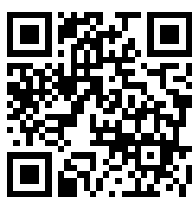
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TECHNICAL REGULATIONS
No. 1405–75B

WAR DEPARTMENT,
WASHINGTON, *January 2, 1940.*

ORDNANCE MAINTENANCE—MOBILE ARTILLERY

GUN AND CARRIAGE, 75-MM, M1916A1 AND M1916MIA1

Prepared under direction of the
Chief of Ordnance

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SECTION I

GENERAL

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1. Purpose.—The purpose of these regulations is to furnish suitable instructions for maintenance and shop repair of the 75-mm gun, M1916, M1916MI, M1916MIA1, M1916MII, M1916MII½, M1916MIII, M1916MIIIA1, M1916MIII½, and M1916MIII½A1, and 75-mm gun carriage, M1916A1 and M1916MIA1. They are for use of ordnance maintenance companies, civilian employees of the Ordnance Department, Reserve Officers' Training Corps students, National Guard, and Reserve officers charged with the maintenance and repair of this matériel.

2. Scope.—In addition to descriptions and figures of the special repair tools, instructions for inspection, assembly and disassembly, and maintenance and repair of the matériel are contained herein.

3. References.—*a.* Personnel charged with the maintenance and repair of this matériel are required to be familiar with the regulations listed below:

TR 1305–75B, information relative to description, operation, and functioning of the matériel.

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TR 1495–A (published as Supplement to SNL N–9), instructions for star gaging, and complete method with illustrations for taking gutta-percha impressions of the bore of cannon.

TR 1395–A, instructions covering the characteristics, purpose, handling, etc., of cleaning and preserving materials, tools and materials for use therewith, and special oils, greases, and cutting oils issued by the Ordnance Department.

Ordnance Proof Manual, instructions for proof of guns and carriages.

TR 1495–C (published as Supplement to SNL N–9), pressure gage outfits for cannon and the uses thereof.

TR 1420–C, fire control and sighting equipment.

SNL C–30, complete list of parts and equipment and basic spare parts.

OFSB 5–2, instructions for electric and oxyacetylene welding.

b. Drawings covering this matériel are listed below:

Class 52, division 76, 75-mm gun, M1916, and modifications.
Class 2, division 283, 75-mm gun carriage, M1916A1.
Class 2, division 284, 75-mm gun carriage, M1916MIA1.
Class 2, division 105, recoil mechanism, M1916MI.

SECTION II
TOOLS FOR INSPECTION

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4. General.—The tools for inspection and those pertaining to maintenance and repair are issued as a set of special repair tools, and are so listed in section IV, Standard Nomenclature List No. C–18.

5. Tools for inspection.—The following tools are used in the inspection of the gun and carriage by the ordnance maintenance companies:

a. Sights, bore.—The bore sights are used in the verification and adjustment of the panoramic telescope described in TR 1305–75B.

b. Jack, screw, recoil piston.—The recoil piston screw jack is used to force the recoil piston rod of the M1916MIA1 carriage to the rear when testing the recoil mechanism for pressure.

c. Tester, pressure gage.—(1) The pressure gage tester (1, fig. 19) is used in testing the accuracy of the service pressure gage with the master pressure gage. It is filled with liquid subjected to pressure which is transmitted equally to both pressure gages.

(2) To use the pressure gage tester, clamp it in a vise. The tester arms should stand level, the screw withdrawn, and the apparatus

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filled with recoil liquid before assembling the pressure gage in order that it may be tested to eliminate possible air bubbles in the connections. The master gage is screwed in one arm and the service gage to be tested in the other arm. Apply pressure by means of the operating screw. If the gages are not in agreement, proceed as outlined in paragraph 29.

(3) Figure 19 shows the pressure gage tester and the following equipment for use therewith:

(*a*) *Adapters.*—The adapters (9) are used to connect the pressure gages to the tester. The adapter (8) is issued with all outfits but is used only with the 155- and 240-mm howitzer matériel.

(*b*) *Gage, pressure, master.*—The master pressure gage (5) is used to check the accuracy of the service pressure gage. It is graduated in pounds per square inch, as well as kilograms per square centimeter. The master gage should be calibrated annually before the regular inspection period, and at any time there is doubt of its accuracy.

(*c*) *Gaskets and glasses.*—The gaskets (6, 7, and 10) and the glasses (11) are spare parts.

(*d*) *Jack, gage hand.*—The gage hand jack (3) is used in removing the pressure gage indicator hand when it is not in agreement with the master pressure gage.

(*e*) *Set, gage hand.*—The gage hand set (4) is used when replacing the pressure gage indicator hand in agreement with the master pressure gage.

d. Thermometer, Fahrenheit, graduated 10° to 220°.—The thermometer is used in taking the temperature of the oil drained from the recoil mechanism of the 75-mm gun carriage, M1916MIA1, when making manometer tests.

Section III

INSTRUCTIONS FOR INSPECTION

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6. General.—*a.* Inspection is for the purpose of determining the condition of the matériel, whether repairs or adjustments are required, and the remedies necessary to insure that the matériel is in such serviceable condition that it will function properly.

b. The use of the artillery gun book, O. O. Form 5825, is outlined therein. See also OFSB 4–1.

c. (1) The estimated average accuracy life in full service rounds of the 75-mm gun, M1916, and modifications, is approximately 10,000

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rounds. The guns in service will be star gaged at approximately 10 percent and 90 percent of their estimated average accuracy life in rounds fired, and thereafter at each 10 percent during the remainder of their service. Also they should be star gaged at any time an inspector may deem it necessary on account of doubtful condition, or when the bores show signs of unusual wear or other irregularities. Decoppering of the bores of cannon before star gaging is prohibited. When star gaging these 75-mm guns the greatest distance from the muzzle at which star gage measurement is to be made is 69.5 inches.

(2) For pastilles or other defects of the bore of the gun which require plaster of Paris or gutta-percha impressions for measuring purposes, plaster of Paris should be used if practicable, as it gives a harder surface than gutta-percha and a more accurate measurement is obtained.

7. Inspection of gun and carriage.—The inspection of the gun and carriage as outlined in TR 1305–75B will be followed. Instructions for inspection and verification and adjustment of the sights are also outlined therein. The following additional inspection of the carriages and recoil mechanisms will be observed:

a. The recoil mechanism of the 75-mm gun carriage, M1916A1, will be inspected as outlined in TR 1305–75B.

b. The recoil mechanism of the 75-mm gun carriage, M1916MIA1, will be inspected for oil leakage, pressure of compressed nitrogen, friction of the various packings, serviceability of the oil gage rack (17B, fig. 13), and condition of the cradle ways.

c. To test the reliability of the oil gage rack (17B, fig. 13), insert the drain valve release in the drain hole located on the left rear side of the cradle (using a screw driver) and drain the reserve oil. There are two drain valve releases, one for carriages with American threads and one for carriages with French threads. The oil gage rack should start to move in before the oil ceases to flow, and should recede ¼ inch below the face of the follower (18E). Refill the mechanism as outlined in paragraph 30*a* (2), TR 1305–75B.

d. Examine the guides of the cradle for burs or scoring.

e. Elevate and depress the gun through its arc to see that the operation is smooth and that the variable recoil mechanism is functioning properly.

f. Traverse the gun to the right and left to see that operation is smooth, and that the backlash at the traversing handwheel does not exceed one-eighth of a turn. Examine the traversing rack for burs and scored teeth.

g. Examine all trail fastenings and traveling lock connections and drawbar brackets for broken welds.

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8. Manometer test.—*a. General.*—In order that an intelligent and consistent inspection may be made of the recoil mechanism of the 75-mm gun carriage, M1916MIA1, it is essential that the inspector be informed not only as to its action but also with regard to certain of its technical peculiarities with which he will come in contact. There is a slight difference in the threads and also in design of the recoil cylinder front head on mechanisms manufactured by the French and those of American manufacture. While the procedure for making the manometer test is the same, special tools are required as follows:

	For mechanism of French manufacture use	For mechanism of American manufacture use
Release, drain valve	B155631	HB129G.
Jack, recoil piston	C67280	24–13–41.
Wrench, recoil cylinder head, front	A166721	TKAX1C.

Extreme care must be used at all times to prevent any foreign matter entering the mechanism. Therefore, clean all sand and dirt from the mechanism, tools, and oil containers before starting the test.

b. Oil reservoir.—The oil reservoir (fig. 13) contains 1 quart 11 ounces of heavy, low pour point recoil oil, and is used to reestablish the oil reserve by means of the pump assembled in the reservoir.

c. Reserve oil.—The terms "oil reserve" or "reserve oil" are applied to that portion of the oil which normally separates the floating piston from the regulator. Referring to figure 13 it will be apparent that the compressed nitrogen acts to put a pressure on the oil only so long as there is oil between the regulator and the floating piston. After these components come in contact, further movement of the floating piston is prevented, and consequently the pressure of the oil will drop to zero. In amount, the reserve oil represents a volume corresponding to a movement of the floating piston of about ¼ inch, or exactly the same as the travel of the oil gage rack (17B) between its extremes of movement.

d. In determining the nitrogen pressure, the inspector is actually measuring the pressure on the oil transmitted to it by the compressed gas through the medium of the floating piston.

e. The oil, in passing from the vicinity of the pressure gage to the vicinity of the floating piston, or vice versa, must pass through very small orifices. Because of the resistance offered in these orifices, if the recoil piston screw jack is operated rapidly in either direction, misleading pressures will be generated in the vicinity of the gage and

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be registered thereon. For this reason the recoil piston screw jack must be operated *at not over four turns per minute.*

f. The oil within the mechanism becomes sluggish at a low temperature. Its action through the small orifices is therefore erratic, and the reliability of the gas pressure measurements under such conditions is always doubtful. Therefore, if pressure must be taken in cold weather, it is necessary that the recoil mechanism and extra oil be in a room warmed to at least *50° F. for 24 hours* preceding the test.

g. Since the amount of nitrogen originally placed in the mechanism cannot increase, the pressure at any given temperature cannot become higher except by moving the floating piston so as to reduce the volume of the gas chamber. This can be accomplished if an excess of oil is introduced, as may be the case if the oil gage rack is stuck and the sticking is not noticed. *Make sure the oil gage rack (17B, fig. 13) is registering properly* by draining off some of the reserve oil and then restoring it. The oil gage rack will move in when the oil is drained and should move out as the reserve is reestablished. Failure of the oil gage rack is almost invariably on the outward movement.

h. If gas leaks past the floating piston, it may be detected by the *foamy appearance* and the sputtering of the oil when draining off the reserve oil.

i. Place the gun in a horizontal position. Remove the recuperator cylinder head plug (22C, fig. 13) located on the left rear side of cradle with screw driver (TGBX1A). The leather gasket (SB58B) should remain in the recess of the filling valve housing (22A).

(1) Insert the proper drain valve release firmly against the leather gasket (SB58B), and catch the reserve oil in a clean receptacle as it escapes from the mechanism.

(2) Place the thermometer in the reserve oil and note the temperature. Keep the thermometer out of the sun. This should represent, as accurately as possible, the temperature inside the recoil mechanism.

(3) Attach the adapter of the pressure gage to the drain valve release, face of the gage turned to a convenient position for reading. Purge the line by forcing the piston to the rear by means of the recoil jack (about two turns of the handle), and tighten the adapter so that it will be oiltight.

j. To determine the nitrogen pressure of the mechanism and the friction of the floating piston.—(1) Remove the piston rod lock nut, piston rod nut key screw, piston rod nut key, and piston rod nut, using screw driver (TGAX2B) and wrench (B155703). Push the gun to the rear until the muzzle is flush with the front end of the cradle.

NOTE.—In order to disconnect the gun from the piston rod, it will be necessary to disassemble the breechblock.

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(2) Remove the recoil cylinder front head (fig. 13), using wrench (TKAX1C), and assemble the nut of the recoil piston screw jack (24–13–41) firmly against the recoil cylinder.

(3) Pump oil into the mechanism until the end of the oil gage rack is about halfway between the bottom of the recess and face of the follower (18E, fig. 13). This represents one-half of an oil reserve. Move the recoil piston to the rear by means of the recoil piston screw jack until a pressure of approximately 1,000 pounds per square inch is registered on the pressure gage.

(4) Turn the screw of the jack ten complete revolutions and, while slowly making the tenth revolution, read the pressure gage, tapping the gage lightly to overcome the effect of friction in the gage itself. This gage reading represents the nitrogen pressure plus the friction of the floating piston ($AP+F$). Make a note of the gage reading.

(5) Continue turning the jackscrew five more revolutions, then reverse the direction of the jackscrew, unscrewing for five revolutions, moving slowly on the fifth revolution, and read the gage the second time. This reading represents the nitrogen pressure minus the friction of the floating piston ($AP-F$). Make a note of the reading.

(6) The nitrogen pressure in the mechanism is one-half the sum of the high and low readings.

$$AP=\frac{(AP+F)+(AP-F)}{2}$$

Example:

Atmospheric temperature, 70° F.

Gage reading as found in (4) above, 1,210 pounds per square inch.

Gage reading as found in (5) above, 840 pounds per square inch.

Add these gage readings together, 2,050.

Then divide the answer by two, 1,025.

1,025 pounds per square inch is the gas pressure of the mechanism.

(7) In determining the friction of the floating piston it must be remembered that it is the sliding and not the standing friction that is to be determined. Therefore, *the floating piston must be in motion when a reading is taken* on the pressure gage.

k. To correct pressure for temperature variation.—(Volume of air chamber remains constant. With the gun in battery the pressure varies directly as the "absolute" temperature.) Recoil mechanisms are charged with nitrogen gas at pressure of 1,000 to 1,050 pounds per square inch at a temperature of 70° F. (reserve oil off). In both the formula and the table following, it is assumed that the mechanism is charged at 1,000 pounds per square inch at 70° F. To make correc-

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tions in pressure, due to changes in temperature, the following formula may be used:

Formula:

$$P_t = \frac{(460+t)\times 1{,}000}{530}$$

Where P_t = pressure in pounds per square inch at $t°$ F.
t = temperature, degrees F., of the recoil mechanism (and the oil).

Example:

What is the pressure at 85° F. when the mechanism was originally charged at 1,000 pounds per square inch at 70° F.?

$$P_t = \frac{(460+85)\times 1{,}000}{530} = 1{,}028 \text{ pounds per square inch.}$$

The correct pressure at various temperatures may be found by referring to the following table. It will be noted that for each degree F. change in temperature there is a corresponding change of approximately 1.9 pounds per square inch in pressure.

Temperature (°F.)	Pressure (pounds per square inch)	Temperature (°F.)	Pressure (pounds per square inch)	Temperature (°F.)	Pressure (pounds per square inch)
0	868	50	962	100	1,057
5	877	55	972	105	1,066
10	887	60	981	110	1,076
15	896	65	991	115	1,085
20	906	70	1,000	120	1,094
25	915	75	1,009	125	1,104
30	925	80	1,019	130	1,113
35	934	85	1,028	135	1,122
40	943	90	1,038	140	1,131
45	953	95	1,047		

NOTE.—The recoil mechanism is considered serviceable with a variation of plus or minus 52.4 pounds per square inch. If not within these limits, the condition of the recoil mechanism must be reported to the Chief of Ordnance.

l. To determine the friction of the floating piston.—(1) The difference between the first reading ($AP+F$), *j* (4) above, and the second reading ($AP-F$), *j* (5) above, represents double the friction of the floating piston.

$$(AP+F)-(AP-F)=2F$$

Example:

Gage reading as found in *j* (4) above, 1,210 pounds per square inch.

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Gage reading as found in *j* (5) above, 840 pounds per square inch.

Subtract the second gage reading from the first gage reading. The result is 370 pounds per square inch or double the friction of the floating piston. Divide 370 by 2 and the result is 185 pounds per square inch, which is the friction of the floating piston.

NOTE.—The operation of determining the friction of the floating piston should be repeated until uniform results are obtained.

(2) The friction of the floating piston and the friction of the recoil piston and the recoil piston rod stuffing box in mechanisms that have been assembled for a considerable period of time will increase, owing to the absorption of oil by the packing. The normal pressure to overcome the friction of the floating piston may vary between 150 and 200 pounds per square inch. If not within these limits, the condition of the recoil mechanism must be reported to the Chief of Ordnance.

m. To determine the friction of the recoil piston and recoil piston rod stuffing box.—(1) Withdraw reserve oil as outlined in *i* (1) above.

(2) Assemble screw jack (24–13–41, fig. 20) to the mechanism as outlined in *j* (1) and (2) above.

(3) Force the recoil piston to the rear (about 2 inches) by means of the screw jack, permitting the oil to escape through the drain valve release. *Do not remove jack.*

(4) Attach the pressure gage to the release as outlined in *i* (3) above.

(5) Force the recoil piston to the rear by means of the screw jack until the gage reads between 1,000 and 1,300 pounds per square inch pressure.

(6) Reverse the motion of the jackscrew until the jack head leaves the piston. The piston follows the jack until the friction developed by the recoil piston and stuffing box packing equals the pressure in the cylinder. Since the oil pressure in the cylinder is greater than that required to overcome the friction, until equalized, the gage hand drops without fluctuating and remains stationary when the piston rod stops moving.

(7) Read the gage. The gage reading at this point represents the sum of the friction of the recoil piston and the friction in the recoil piston rod stuffing box.

(8) Obtain three uniform gage readings.

NOTE.—Exercise the piston by repeating operations (5), (6), and (7) above a sufficient number of times until the three gage readings are practically uniform. This is important since true friction readings cannot be obtained until the packings are well lubricated.

(9) The normal pressure necessary to overcome the combined friction of the recoil piston and the recoil piston rod stuffing box is

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150 to 300 pounds per square inch. Recoil mechanisms having excessively low or high frictions should be reported to the Chief of Ordnance.

SECTION IV

TOOLS FOR MAINTENANCE AND REPAIR

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9. Tools for maintenance and repair.—The tools provided in Standard Nomenclature List No. C–18 for the maintenance and repair of this matériel are such that their names or general characteristics indicate their uses and application. Therefore, detailed description and method of use thereof are not outlined herein.

SECTION V

INSTRUCTIONS FOR MAINTENANCE AND REPAIR

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10. General.—When the model of carriage is not assigned to the instructions in the following paragraphs, it indicates that the procedure is the same for either the M1916A1 or M1916MIA1.

11. Removing recoil mechanism, M1916A1, from gun.—*a.* Remove the valve turning gear cover by taking out the four cap screws attaching it to the piston rod bracket.

b. Remove the valve turning gear, valve turning arm, and the valve turning connecting rod as a unit by removing the cotter pins and nuts

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and connecting rod pin (KB27E) from the right trunnion cap. Remove the piston rod nut, piston rod gear, and piston rod gland lock. Loosen the piston rod gland. Remove the piston rod sleeve locking screw from top of piston rod bracket. Remove the recoil cylinder retainer screw and loosen the recoil cylinder retainer, but do not remove.

c. Remove the spring rod plugs (KB5R fig. 8), from the end of both spring rods. Screw the spring compressor stud into the left spring rod, and with the aid of a tackle block attach the double sheave block to the spring compressor close to the cradle and attach the single sheave block to the lunette. Elevate the gun so that the center line of the bore will be parallel with the ropes of the tackle block. Have from four to six men pull on the tackle block rope and retract the gun 10 or more inches and then secure the rope to the lunette.

d. Tap on the end of the recoil piston rod until it is free of the piston rod bracket. Remove the recoil cylinder retainer and tap the recoil cylinder to free it from its seat in the breech ring. Slide the recoil cylinder forward until free of the groove in the gun, and remove the recoil cylinder. Ease the gun into battery by slowly slacking off on the tackle block rope.

12. Disassembly of recoil mechanism, M1916A1.—The recoil mechanism having been removed from the gun as described in paragraph 11, proceed to disassemble the mechanism.

a. Rest the recoil mechanism on blocks, front and rear, at such an angle that the oil will drain through the drain plug hole. Remove the two filling plugs and the drain plug and allow the oil to drain into a clean receptacle.

b. Unscrew the counterrecoil buffer rod nut from the piston rod and carefully remove it from the piston rod.

c. Remove the piston rod gland and packing.

d. Remove the front cylinder head with the proper wrench. (See par. 8*a*.) The threads may be started by striking the handle of the wrench with a soft hammer. Do not hold the cylinder in a vise.

e. Draw out the piston rod slowly, supporting it at both ends as it leaves the cylinder. Hold the recoil valve in the cylinder with the fingers.

f. Remove the recoil valve from the cylinder carefully and place it in a safe place.

13. Assembly of recoil mechanism, M1916A1.—*a.* Reverse the order of procedure given in paragraph 12.

b. Wash all parts of the mechanism with dry cleaning solvent and wipe dry.

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c. Do not set up the piston rod gland too tight. Tighten with the hand, and screw up with the wrench one additional notch to lock the gland. Fill the recoil cylinder with recoil oil before replacing the mechanism on the gun, as follows:

(1) With the drain plug in place and filling plug holes open, pour the oil into the filling hole slowly to avoid the formation of air pockets.

(2) When the oil is level with the top of the filling plug openings, tilt the mechanism slightly to allow trapped air to escape, and replenish the oil.

(3) Loosen the filling plug in the front end of the piston rod just enough to allow the oil to drip, and then tighten the plug.

d. Replace the rear filling plug, raise the front of the mechanism about six inches, and tap the cylinder lightly with a wood block or lead hammer to expel trapped air. Level the mechanism and again fill with oil. Replace the front filling plug. Be sure that all gaskets are in place and properly centered.

14. Dismounting gun from carriage.—*a.* Remove the breechblock (see TR 1305–75B).

b. Remove the recoil mechanism as outlined in paragraph 11.

c. Raise and block up the trails in a horizontal position. Elevate the gun until the axis of the bore is parallel with the trails. Attach the spring compressor to the left spring rod, the other end to the tackle block fastened either to the lunette or to a deadman. Retract the gun about six inches. Remove the cotter pin in the left spring rod key and drive out the key with a bronze drift. Ease the gun into battery and permit the spring rod to move forward against the spring cylinder cover.

d. Transfer the spring compressor to the right spring rod and retract the gun about ½ inch. Remove the cotter pin and spring rod key. Ease the gun into battery until the right spring rod rests against the spring cylinder cover.

NOTE.—Personnel should keep away from the front of the spring cylinder when performing the operations described in *c* and *d* above. Care must also be taken to prevent tipping the cradle to the rear.

e. Depress the gun to its maximum.

f. Lower the trails to the ground and spread them until against their stops. Set the brakes. Elevate the gun to zero elevation.

g. Seven men and four pick handles, or similar devices of about the same length and strength, are required to remove the gun from the cradle. Slide the gun about 36 inches to the rear. Place a pick handle in the breech of the gun and assign a man to this position. Place a pick handle, with a man at each end, under the gun slides at

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front of cradle, and four men, with two pick handles under the gun, as it is moved from the cradle. Do not place the pick handles under the dust guards. Care must be taken to keep the gun properly balanced and supported at the same angle as the cradle guides until free of the guides.

15. Mounting gun on carriage.—*a.* All bearing and sliding surfaces must be clean and well lubricated before attempting to mount the gun on the cradle.

b. Mount the gun in the reverse order outlined in paragraph 14*g*.

16. Removing counterrecoil springs.—See paragraph 18, TR 1305–75B.

17. Assembling counterrecoil springs.—See paragraph 19, TR 1305–75B.

18. Removing cradle from carriage.—*a.* Remove the recoil cylinder. Dismount the gun.

b. Remove the left and right trunnion caps by taking out the four cotter pins. Loosen the swing bolt nuts and withdraw the trunnion cap pins.

c. Remove the rocker left and right stops by removing four cotter pins and the rocker stop bolts.

d. Unlock and spread the trails.—(1) Post two men with one pick handle at the rear of the cradle, two men with one pick handle immediately in front of the elevating arc, and two men with one pick handle at the front end of the cradle.

(2) Raise the rear of the cradle slowly until the rockers clear the top carriage. Carry it to the rear sufficiently to rest the middle pick handle in the trunnions, and transfer two men with a pick handle to the rear of the carriage. Remove the cradle.

19. Mounting cradle on carriage.—Mount the cradle in the reverse order of removal.

20. Disassembly of rocker and rocker arms.—*a.* With the cradle removed from the carriage, remove the cotter pins, nuts, cap screws, lock washers, and four machine screws and rocker keys from the left and right rocker arms.

b. Remove the left rocker arm by sliding it up and out of the rocker.

c. Remove the cross shaft bearing cover by removing the cotter pins and three nuts.

d. Drive out the ⅛-inch pin from the intermediate shaft pinion, remove the two ⅛-inch cotter pins and two ½-inch nuts, and the one ⅛-inch cotter pin and ½-inch cap screw from the rocker arm cap, and remove the rocker arm cap.

e. Lift out the elevating handwheel and handwheel shaft as a unit.

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f. Draw the intermediate shaft up and out of the rocker arm brace, and draw the rocker down from the trunnion (keeping in line with rocker arm bearings) and remove. Swing the right rocker arm up and around the trunnion until free of the range scale bracket, and remove.

21. Assembly of rocker and rocker arms.—Assemble in the reverse order of disassembling outlined in paragraph 20.

22. Removing top carriage.—*a.* The cradle, rocker, and rocker arms are removed as described in paragraphs 18 and 20.

b. Remove the left angle of site bracket by disassembling the three cotter pins, nuts, and cap screws in angle of site bracket cover. Take off the cover. Remove the cotter pin and nut from the traversing handwheel shaft. Remove the handwheel and draw shaft out to the left.

(1) Remove two cotter pins and nuts from the left angle of site cross shaft gear cover.

(2) Remove the right angle of site cross shaft gear cover in the same manner as described in (1) above.

(3) Remove the cotter pins and nuts from the left and right angle of site cross shaft.

(4) Remove the cotter pins and nuts from the four ½-inch studs securing the left angle of site bracket and remove the bracket with attached parts as a unit. Remove the right angle of site bracket in the same manner.

(5) Draw out the left and right angle of site cross shafts, and remove the angle of site cross shaft pinions.

(6) Traverse the top carriage to the right by turning the traversing intermediate shaft gear by hand sufficiently to allow the rear traversing stop to be removed. Extract the cotter pin and remove the nut and take off the rear traversing stop.

(7) Traverse the top carriage to the left until the traversing worm is disengaged from the traversing rack. Remove the cotter pins and nuts from the four studs securing the traversing worm shaft bearing to the top carriage and then remove the bearing and attached parts as a unit.

(8) Lift out the traversing worm with its attached parts as a unit.

(9) Traverse the top carriage to the right 90° from zero azimuth. Remove the three screws that attach the traversing rack to the pintle bearing and then remove the traversing rack. Remove the four screws holding the dust guard to the pintle bearing and remove the dust guard.

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(10) Remove the two screws that hold the clip to the pintle bearing and remove the clip. Raise the top carriage and remove it from the pintle bearing.

23. Mounting top carriage.—Assemble and mount in the reverse order of that outlined in paragraph 22.

24. Removing equalizing gear and pinion.—With the top carriage, wheels, and brake mechanism removed from the carriage, proceed as follows:

a. Turn the pintle bearing bottom side up and remove the 29 screws and washers which hold the equalizing gear cover. Remove the cover.

b. Remove the cotter pins and nuts from the axle arm locking ring bolts. Unscrew and remove the left and right axle arm locking rings.

c. Slide the equalizing pinion off the axle arms.

d. Extract the cotter pins from the equalizing gear studs and remove the nuts, washers, and studs.

e. Remove the equalizing gear support locking screws (using special wrench). Lift up and remove the equalizing gear.

25. Assembly of equalizing gear and pinion.—Assemble in the reverse order of removal outlined in paragraph 24.

26. Removal of brake mechanism.—*a.* Extract the cotter pins and remove the nut and screw (BCBX7CF) from the hand brake.

b. Extract the cotter pins (BFAX2AC), and remove the nuts from the wheel spindle. Remove the disk and rim wheel group assembly from the wheel spindle.

27. Assembly of brake mechanism.—Assemble in the reverse order of removal outlined in paragraph 26.

28. Repair of oil gage rack of 75-mm gun carriage, M1916-MIA1.—*a.* To replace the Belleville spring or the oil gage rack packing (47D, fig. 13), unscrew the oil gage follower (18E) with care. Remove the oil gage gland (18F) and Belleville spring (52F).

b. After damaged parts have been replaced, assemble the parts removed in the reverse order of disassembly as outlined in *a* above.

29. Special repair tools.—Pressure gages become inaccurate through the accidental movement of the hand upon the spindle and from wear or distortion of the linkage. In using the pressure gage, if pressure is applied or released too suddenly, the hand may strike the stop pin and be moved on the spindle. Repairs consist in pulling off the hand with the gage hand jack (3, fig. 19), and resetting it with the gage hand set (4), in agreement with the master gage when the gages are being tested by the pressure gage tester. Master gages should be returned to an arsenal periodically for verification of their accuracy.

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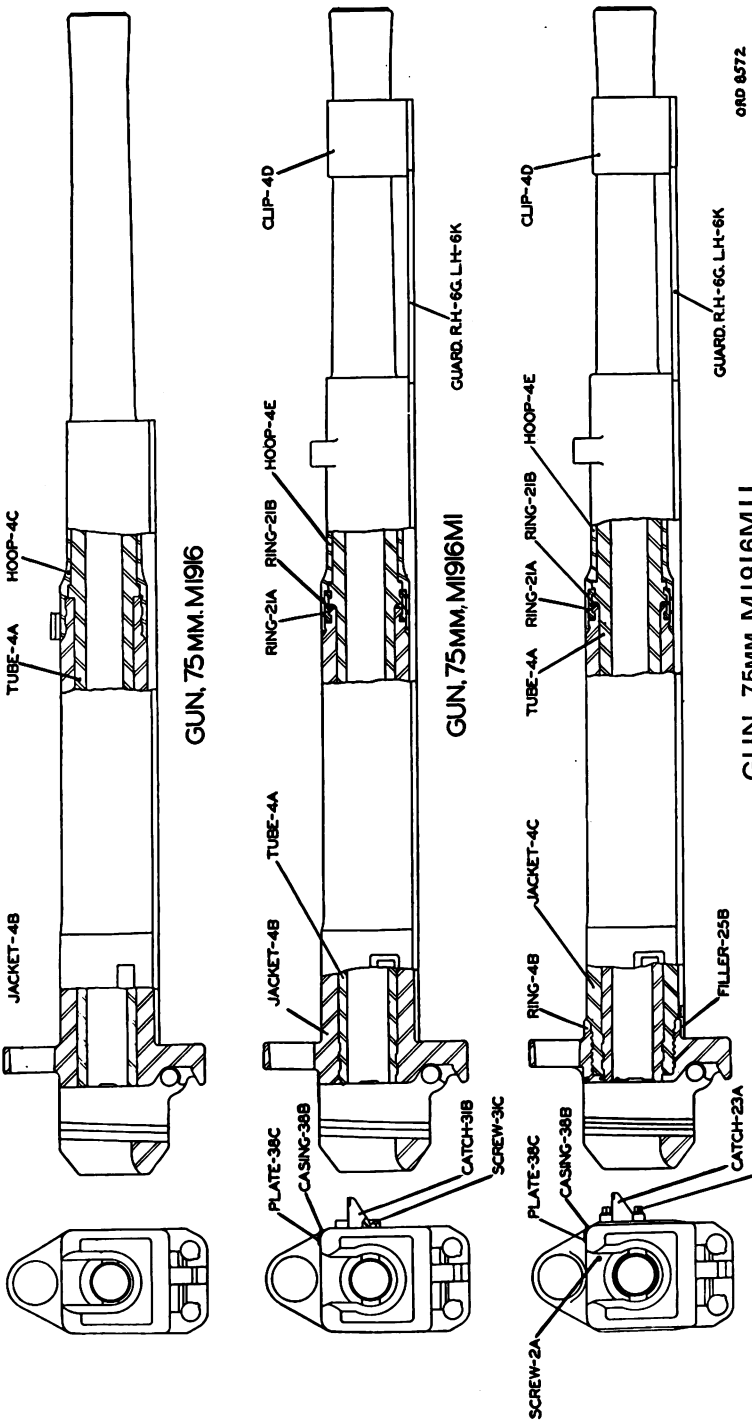


FIGURE 1.—75-mm gun, M1916, M1916MI, and M1916MII (sectioned views).

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Reference	Item
38B	Casing, leveling plate (for M1916MI and M1916MII).
31B	Catch, latch (for M1916MI).
23A	Catch, latch (for M1916MII).
4D	Clip (for M1916MI and M1916MII).
25B	Filler (for M1916MII).
6K	Guard, L. H. (for M1916MI and M1916-MII).
6G	Guard, R. H. (for M1916MI and M1916-MII).
4E	Hoop, locking (for M1916MI and M1916-MII).
4B	Jacket (for M1916 and M1916MI).
4C	Jacket (for M1916MII).
38C	Plate, leveling (for M1916MI and M1916-MII).
4B	Ring, breech (for M1916MII).
21B	Ring, filling (for M1916MI and M1916MII).
21A	Ring, locking (for M1916MI and M1916-MII).
31C	Screw, latch catch (for M1916MI).
23B	Screw, latch catch (for M1916MII).
2A	Screw, securing (for M1916MII).
4A	Tube (for M1916, M1916MI, and M1916-MII).

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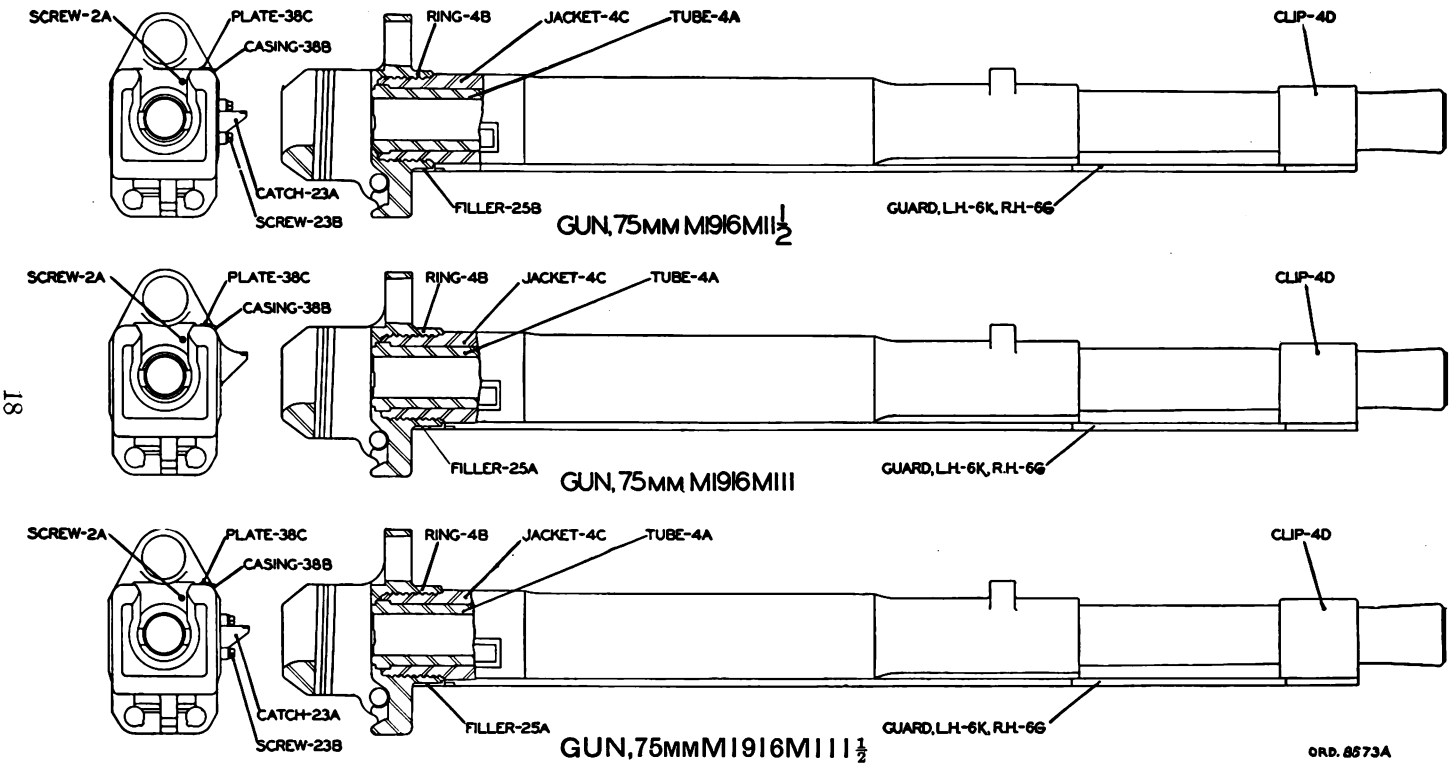


FIGURE 2.—75-mm gun, M1916MII½, M1916MIII, and M1916MIII½ (sectioned views).

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Reference	Item	Reference	Item
38B	Casing, leveling plate (for M1916MII½, M1916MIII, and M1916MIII½).	4C	Jacket (for M1916MII½, M1916MIII, and M1916MIII½).
23A	Catch, latch (for M1916MII½ and M1916MIII½).	38C	Plate, leveling (for M1916MII½, M1916MIII, and M1916MIII½).
4D	Clip (for M1916MII½, M1916MIII, and M1916MIII½).	4B	Ring, breech (for M1916MII½, M1916MIII, and M1916MIII½).
25B	Filler (for M1916MII½).	23B	Screw, latch catch (for M1916MII½ and M1916MIII½).
25A	Filler (for M1916MIII and M1916MIII½).	2A	Screw, securing (for M1916MII½, M1916MIII, and M1916MIII½).
6K	Guard, L. H. (for M1916MII½, M1916MIII, and M1916MIII½).	4A	Tube (for M1916MII½, M1916MIII, and M1916MIII½).
6G	Guard, R. H. (for M1916MII½, M1916MIII, and M1916MIII½).		

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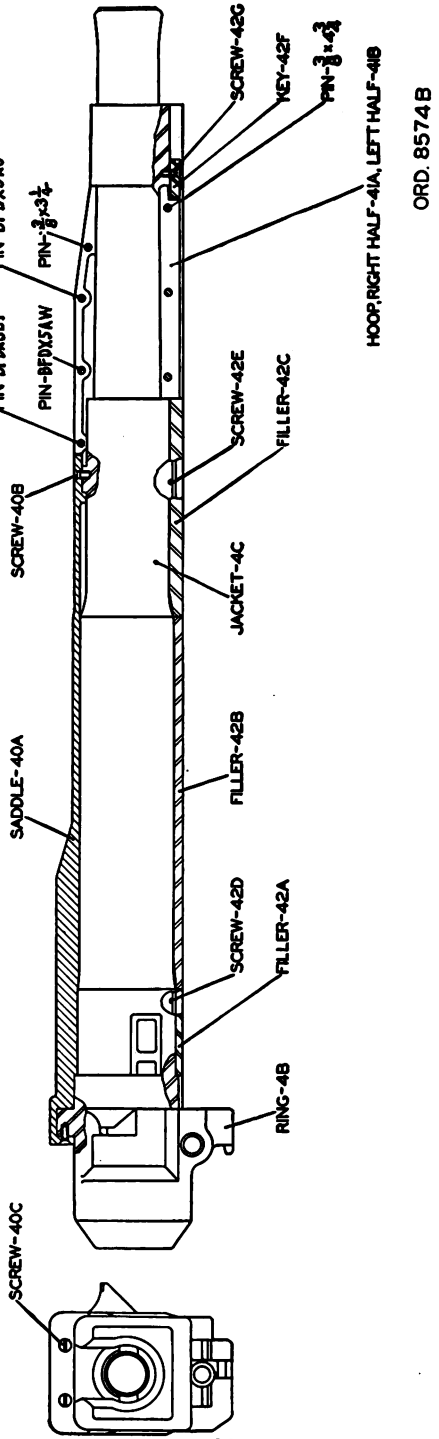


FIGURE 3.—75-mm gun, M1916M1IIIA1 (sectioned view).

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Reference	Item	Reference	Item
42C	Filler, front.	BFDX5BT	Pin, stght., S., ⅜ by 4½.
42B	Filler, middle.		Pin, stght., S., ⅜ by 4¾.
42A	Filler, rear.	4B	Ring, breech.
41B	Hoop, left half.	40A	Saddle.
41A	Hoop, right half.	42E	Screw, filler, middle and front.
4C	Jacket.	42D	Screw, filler, rear.
42F	Key, hoop.	42G	Screw, hoop key.
	Pin, stght., S., ⅜ by 3¼.	40B	Screw, saddle, front.
BFDX5AU	Pin, stght., S., ⅜ by 3¾.	40C	Screw, saddle, rear.
BFDX5AW	Pin, stght., S., ⅜ by 4¼.		

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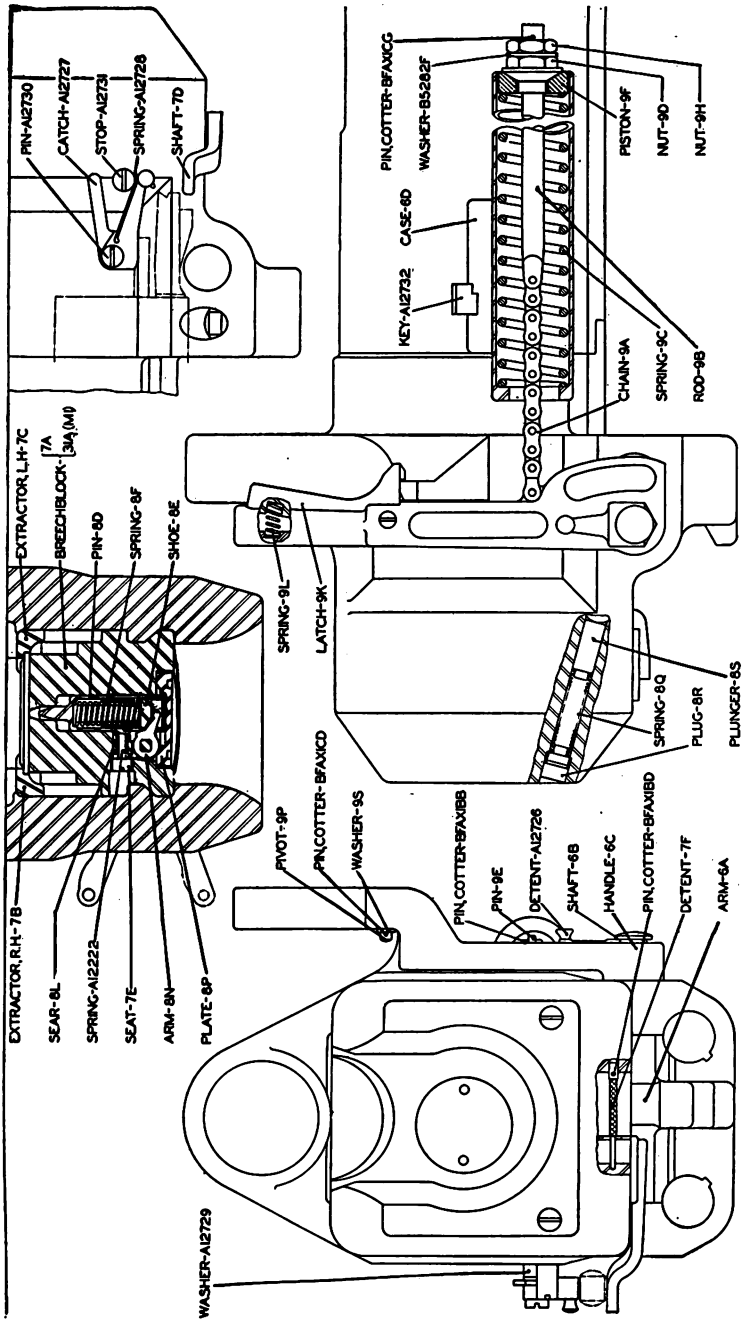


FIGURE 4.—75-mm gun, M1916MIII breech mechanism (sectioned view).

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Reference	Item	Reference	Item
8N	Arm, firing.	9E	Pin, stud link.
6A	Arm, operating.	9F	Piston, spring.
31A	Breechblock (for M1916MI).	9P	Pivot, operating handle latch.
7A	Breechblock (for M1916MII, M1916MII½, M1916MIII, and M1916MIII½).	8R	Plate, face, breechblock.
		8S	Plug, plunger.
6D	Case, closing spring.	9B	Plunger, extractor.
A12727	Catch, return.	8L	Rod, spring piston.
9A	Chain.	7E	Sear.
A12726	Detent, operating shaft, assembly.	6B	Seat, sear spring.
7F	Detent, trigger shaft.	7D	Shaft, operating.
7C	Extractor, L. H.	8E	Shaft, trigger.
7B	Extractor, R. H.	A12728	Shoe, firing spring.
6C	Handle, operating.	9C	Spring, catch.
A12732	Key, spring case.	8Q	Spring, closing.
9K	Latch, operating handle.	8F	Spring, extractor plunger.
9H	Nut, lock.	9L	Spring, firing.
9D	Nut, spring piston rod.	A12222	Spring, operating handle latch.
A12730	Pin, catch.	A12731	Spring, sear.
BFAX1BB	Pin, cotter, split, S., 1/16 by 7/16.	A12729	Stop, return catch.
BFAX1BD	Pin, cotter, split, S., 1/16 by 5/8.	BECX1P	Washer, lock, reg., 5/8 by 13/64 by 5/32.
BFAX1CD	Pin, cotter, split, S., 3/32 by 5/8.	9S	Washer, operating handle latch pivot.
BFAX1CG	Pin, cotter, split, S., 3/32 by 1.		
8D	Pin, firing.		

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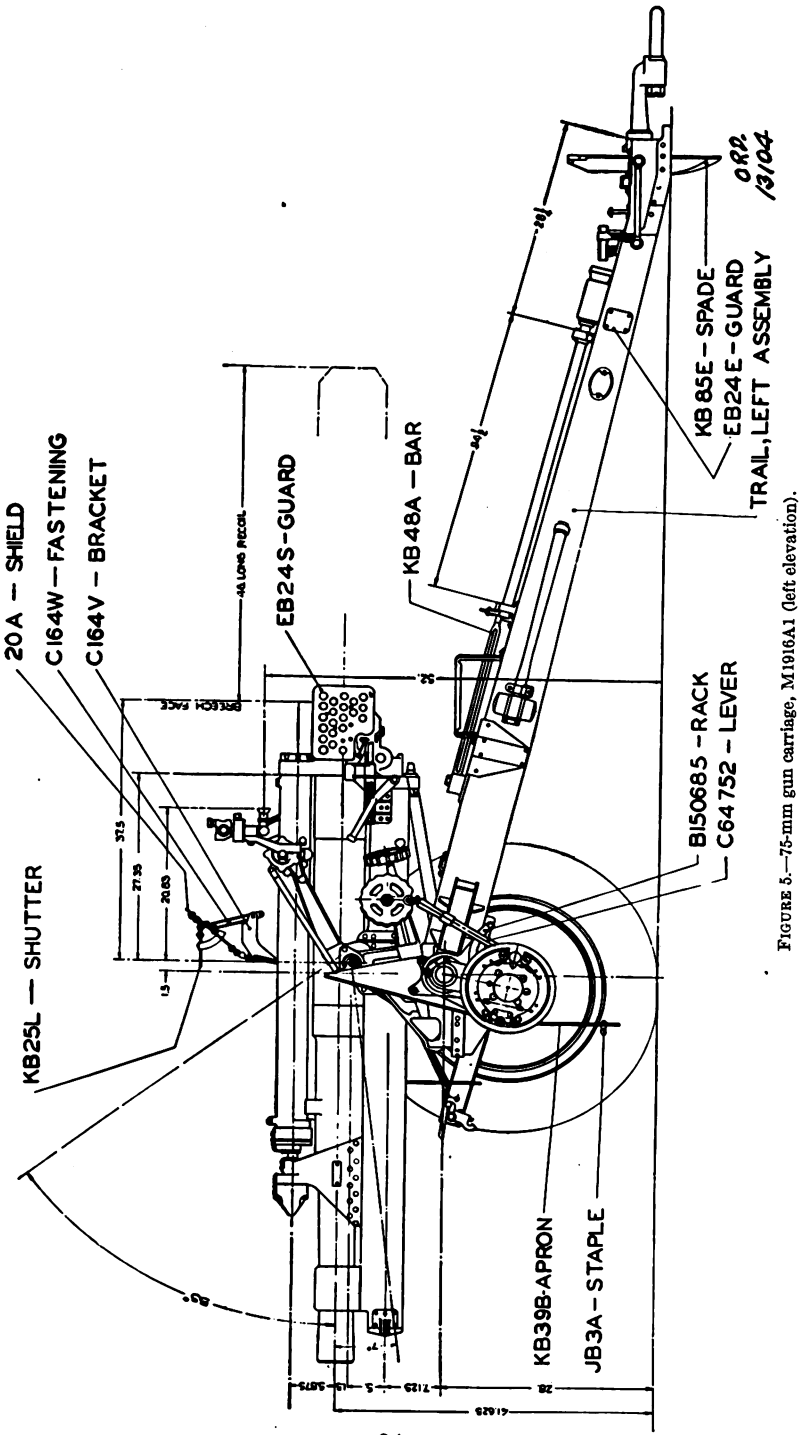


FIGURE 5.—75-mm gun carriage, M1916A1 (left elevation).

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Reference	Item	Reference	Item
KB39B	Apron.	B150685	Rack, brake ratchet.
KB48A	Bar, traveling lock.	20A	Shield, top.
C164V	Bracket, top shield.	KB25L	Shutter, telescope port.
C164W	Fastening, top shield.	KB85E	Spade.
EB24S	Guard, shoulder, left.	JB3A	Staple, apron latch.
EB24E	Guard, wheel, rear.	----------	Trail, left, assembly.
C64752	Lever, hand brake, assembly.		

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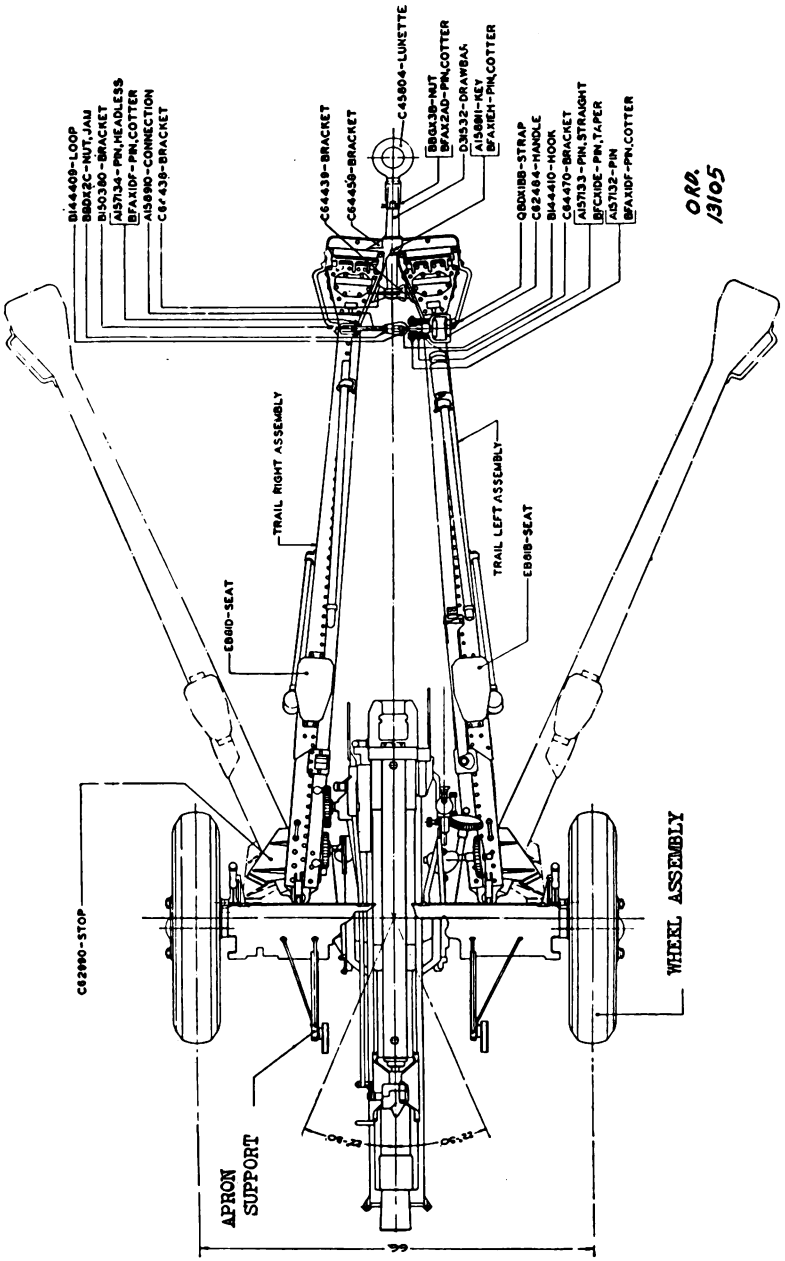


FIGURE 6.—75-mm gun carriage, M1916A1 (plan view).

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Reference	Item	Reference	Item
B159380	Bracket.	BFAX2AD	Pin, cotter, split, S., 3/16 by 2½.
C64470	Bracket.	A157134	Pin, hdls., S., .560 diam. by 2 3/16 clear.
C64439	Bracket, ball.	A157132	Pin, rod end, .560.
C64458	Bracket, drawbar.	A157133	Pin, stght., S., .560 by 2 7/16.
C64438	Bracket, socket.	BFCX1DE	Pin, taper, No. 2 (.193) by 1½.
A158910	Connection, trail lock.	EB81B	Seat, trail, left.
D31532	Drawbar.	EB81D	Seat, trail, right.
C62485	Handle, trail lock.	C62990	Stop, trail, right, assembly.
B144410	Hook, trail connection.	QBDX1BB	Strap, lea., type B, 13 in.
A158911	Key, drawbar.	.....	Support, apron latch base, right, assembly.
B144409	Loop, trail connection.	.....	Trail, left, assembly.
C45804	Lunette, M6.	.....	Trail, right, assembly.
BBDX2C	Nut, jam, hex., s-fin., ¾-16NF-2.	.....	Wheel, assembly.
BBGX3B	Nut, slotted, s-fin., 1¼-7NC-2.		
BFAX1DF	Pin, cotter, split, S., ⅛ by ⅞.		
BFAX1EH	Pin, cotter, split, S., 5/32 by 1¼.		

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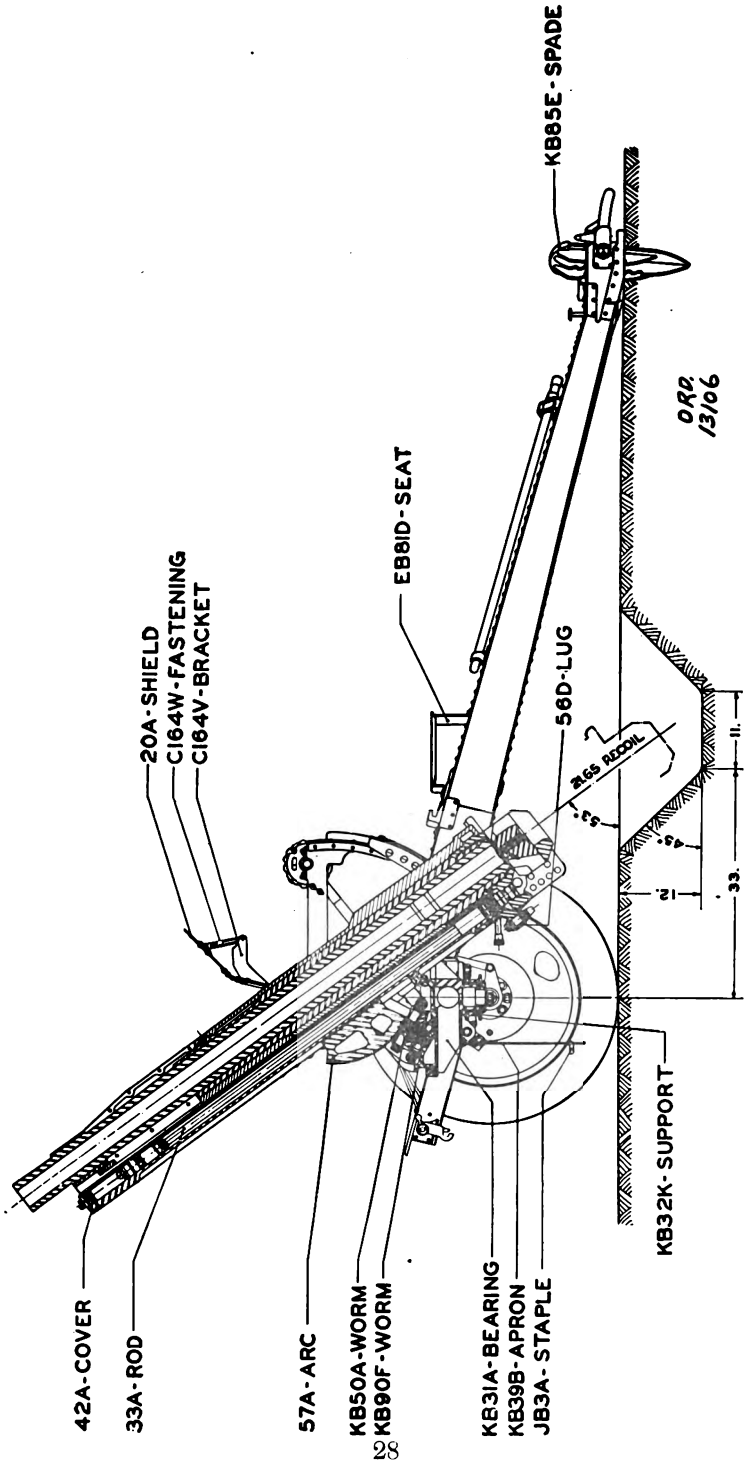


FIGURE 7.—75-mm gun carriage, M1916MIA1 (longitudinal section).

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Reference	Item	Reference	Item
KB39B	Apron.	EB81D	Seat, trail, right.
57A	Arc, elevating.	20A	Shield, top.
KB31A	Bearing, pintle.	KB85E	Spade.
C164V	Bracket, top shield.	JB3A	Staple, apron latch.
42A	Cover, cradle, front.	KB32K	Support, equalizing gear.
C164W	Fastening, top shield.	KB90F	Worm, angle of site.
56D	Lug, traveling lock.	KB50A	Worm, elevating.
33A	Rod, recoil.		

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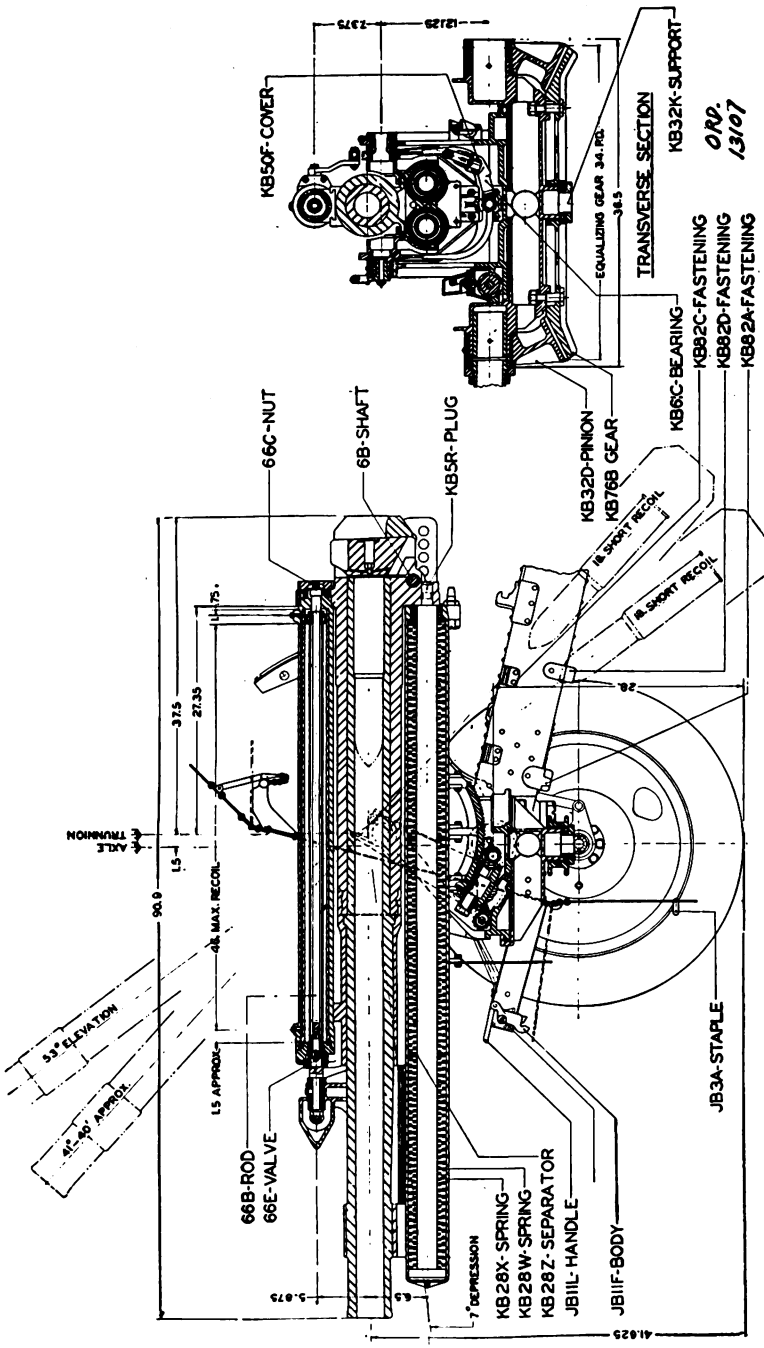


FIGURE 8.—75-mm gun carriage, M1916A1 (longitudinal section).

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Reference	Item	Reference	Item
KB61C	Bearing, elevating cross shaft.	KB32D	Pinion, equalizing, left.
JB11F	Body, apron latch.	KB5R	Plug, spring rod.
KB50F	Cover, elevating cross shaft gear.	66B	Rod, counterrecoil buffer.
KB82A	Fastening, spade, lower, front, right.	KB28Z	Separator, counterrecoil spring.
KB82D	Fastening, spade, lower, rear.	KB28X	Spring, counterrecoil, inner.
KB82C	Fastening, spade, upper.	KB28W	Spring, counterrecoil, outer.
KB76B	Gear, equalizing.	JB3A	Staple, apron latch.
JB11L	Handle, apron latch.	KB32K	Support, equalizing gear.
66C	Nut, counterrecoil buffer rod.	66E	Valve, counterrecoil buffer.

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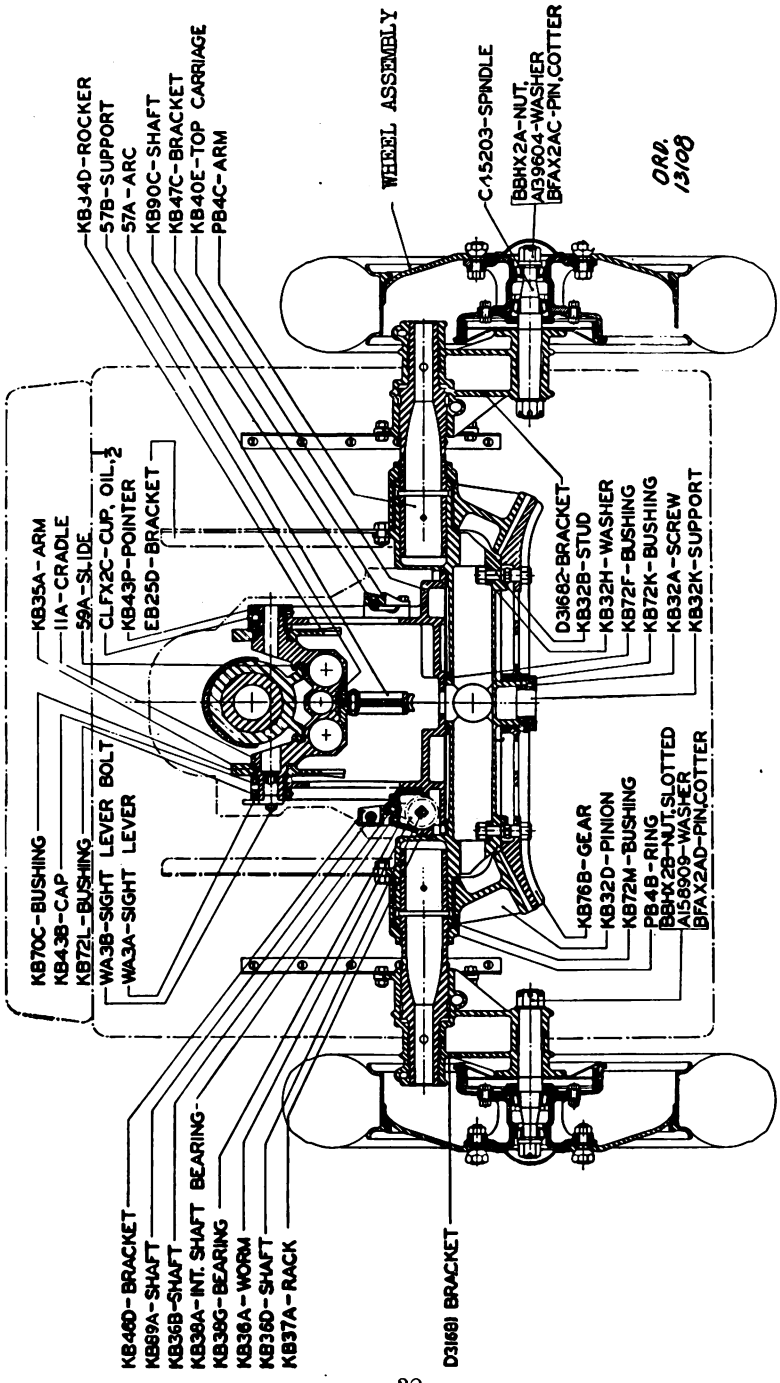


FIGURE 9.—75-mm gun carriage, M1916M1A1 (transverse section).

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Reference	Item	Reference	Item
57A	Arc, elevating.	BFAX2AD	Pin, cotter, split, S., 3/16 by 2½.
PB4C	Arm, axle, right.	KB32D	Pinion, equalizing, left.
KB35A	Arm, rocker, left.	KB43P	Pointer, traveling lock.
KB38A	Bearing, intermediate traversing shaft.	KB37A	Rack, traversing.
		PB4B	Ring, axle arm locking.
KB38G	Bearing, traversing worm shaft.	KB34D	Rocker.
WA3B	Bolt, sight lever.	KB32A	Screw, equalizing gear support locking.
KB46D	Bracket, angle of site, left.		
KB47C	Bracket, angle of site, right.	KB89A	Shaft, angle of site handwheel, w/bevel pinion.
D31681	Bracket, left.		
D31682	Bracket, right.	KB90C	Shaft, angle of site intermediate.
EB25D	Bracket, shield, inner, right.	KB36B	Shaft, traversing intermediate, w/bevel pinion.
KB72K	Bushing, equalizing gear.		
KB72M	Bushing, equalizing pinion.	KB36D	Shaft, traversing worm.
KB72L	Bushing, half, left trunnion cap.	59A	Slide, gun, left.
KB70C	Bushing, half, rocker trunnion.	C45203	Spindle, wheel.
KB72F	Bushing, top carriage pintle.	KB32B	Stud, equalizing gear.
KB43B	Cap, trunnion, left.	57B	Support, elevating arc.
KB40E	Carriage, top.	KB32K	Support, equalizing gear.
11A	Cradle.	A158909	Washer, disk and rim wheel spindle, inner.
CLFX2C	Cup, oil, drive type, ½ in. diam.		
KB76B	Gear, equalizing.	A139604	Washer, disk and rim wheel spindle, outer.
WA3A	Lever, sight.		
BBHX2A	Nut, slotted, s-fin., 1¼–12NF-2.	KB32H	Washer, equalizing gear stud.
BBHX2B	Nut, slotted, s-fin., 1¼–12NF-2.		Wheel, assembly.
BFAX2AC	Pin, cotter, split, S., 3/16 by 2¼.	KB36A	Worm, traversing.

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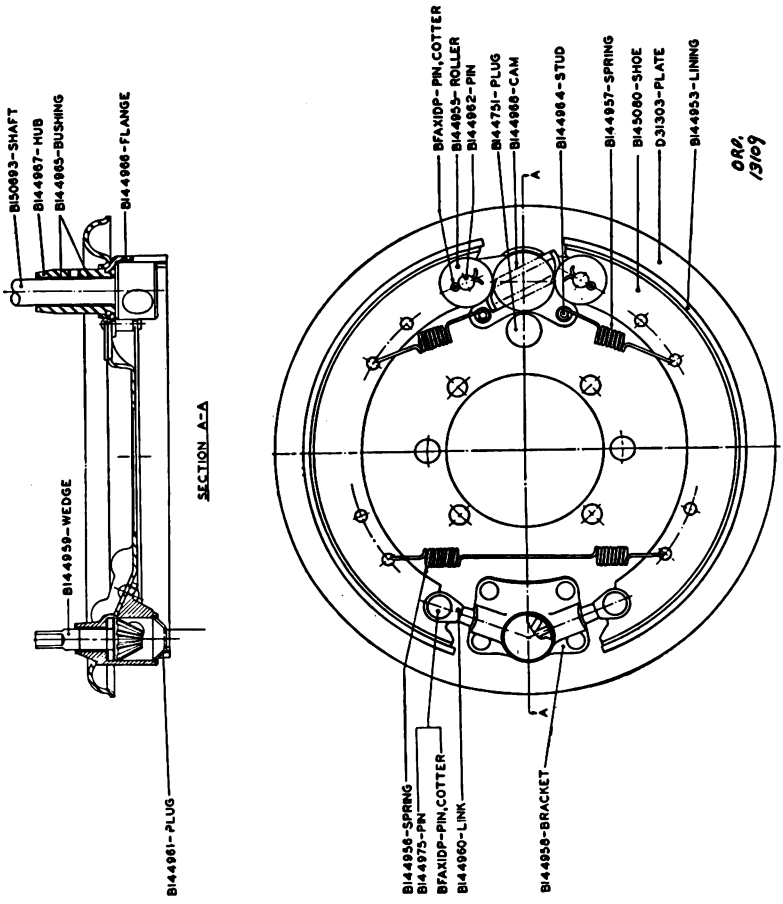


FIGURE 10.—Brake, left hand (sectioned view).

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Reference	Item	Reference	Item
B144958	Bracket, brake adjusting wedge.	B144751	Plug, brake housing plate.
B144965	Bushing, brake cam hub.	B144961	Plug, brake shoe adjusting wedge.
B144968	Cam, brake.	B144955	Roller, brake cam.
B144966	Flange, brake cam hub.	B150693	Shaft, brake cam.
B144967	Hub.	B145080	Shoe.
B144953	Lining, brake shoe.	B144956	Spring, retracting, brake shoe, long.
B144960	Link, brake shoe.	B144957	Spring, retracting, brake shoe, short.
B144962	Pin, brake cam roller.		
B144975	Pin, brake shoe link.	B144964	Stud, brake shoe retracting spring.
BFAX1DP	Pin, cotter, split, S., ⅛ by ¾.	B144959	Wedge, brake shoe adjusting.
D31303	Plate.		

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Reference	Item	Reference	Item
B144454	Cap, hub.	A157237	Retainer, oil.
A157218	Cone and roller, taper roller bearing, 1.1562 I. D. by 1.0013 width.	C62653	Ring, locking, tire.
		BCBX1DD	Screw, cap, hex-hd., 7/16-20NF-2 by 1¼.
A157221	Cone and roller, taper roller bearing, 1.6250 I. D. by 1.1965 width.	BCNX2CE	Screw, mach., rd-hd., S., ¼-20NC-2 by ½.
A157219	Cup, taper roller bearing, 2.615 O. D. by .750 width.	B144357	Stud, disk and rim wheel.
A157222	Cup, taper roller bearing, 3.1562 O. D. by .9375 width.	A137854A	Tire, automobile, pneumatic, truck and bus balloon, 7.50–24 (type B).
C62525	Drum, brake.		
B144356	Gasket, hub cap.	A137854B	Tube, inner, automobile, puncture sealing, 7.50–24, assembly.
C62505	Hub.		
A157225	Nut, disk and rim wheel, 1⅛-16NS-2.	BECX1G	Washer, lock, reg., ¼ by 9/32 by 1/16.
		BECX1L	Washer, lock, reg., 7/16 by 9/32 by ⅛.
BBBX1D	Nut, reg., hex., s-fin., 7/16-20NF-2.	C62593	Wheel, automobile, disk and rim, assembly.
BBBX2C	Nut, reg., hex., s-fin., ¾-16NF-2.		

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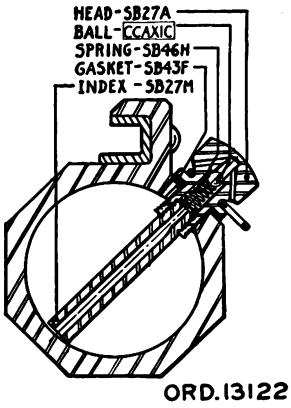


FIGURE 12.—Oil index head, assembly (sectioned view).

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Reference	Item
CCAX1C	Ball, chr-alloy-S., grade 2, ¼ in.
SB43F	Gasket, oil index head.
SB27A	Head.
SB27M	Index, oil.
SB46H	Spring, oil index.

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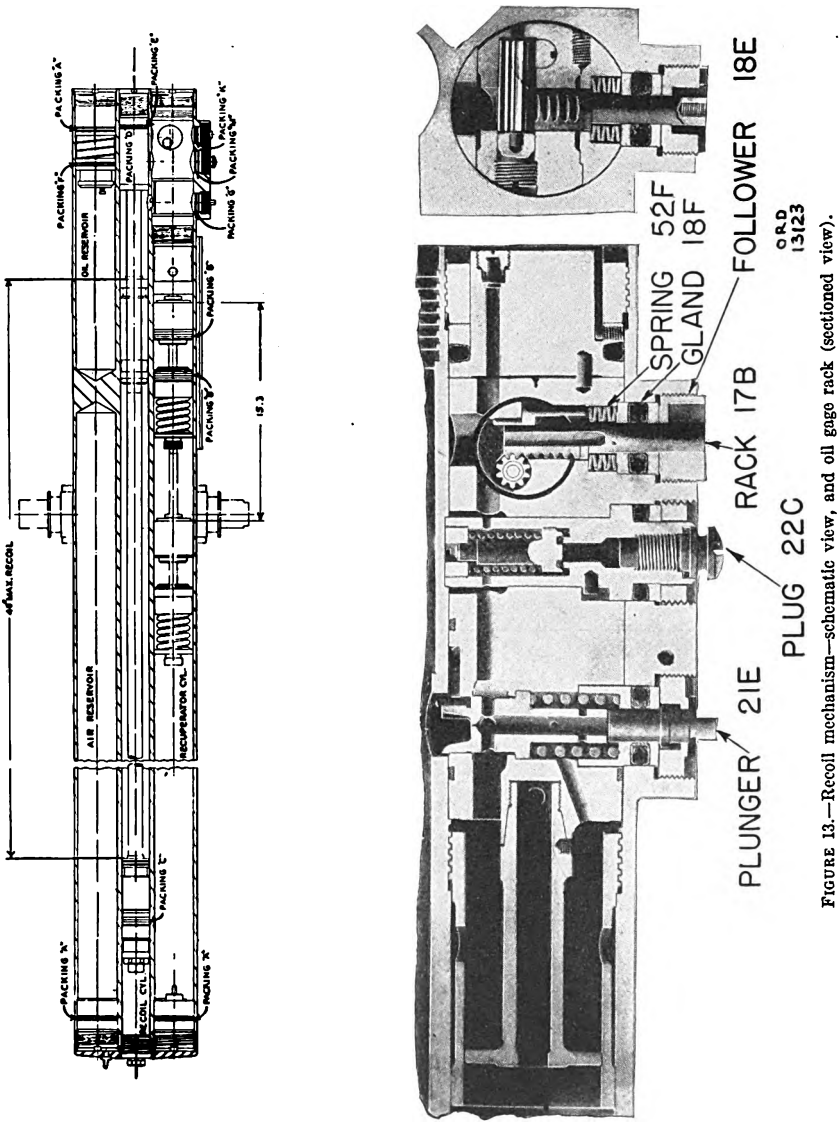


FIGURE 13.—Recoil mechanism—schematic view, and oil gage rack (sectioned view).

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Reference	Item	Reference	Item
18E	Follower, oil gage.	17B	Rack, oil gage.
18F	Gland, oil gage.	52F	Spring, oil gage packing compression Belleville.
22C	Plug, recuperator cylinder head.		
21E	Plunger, throttling valve control.		

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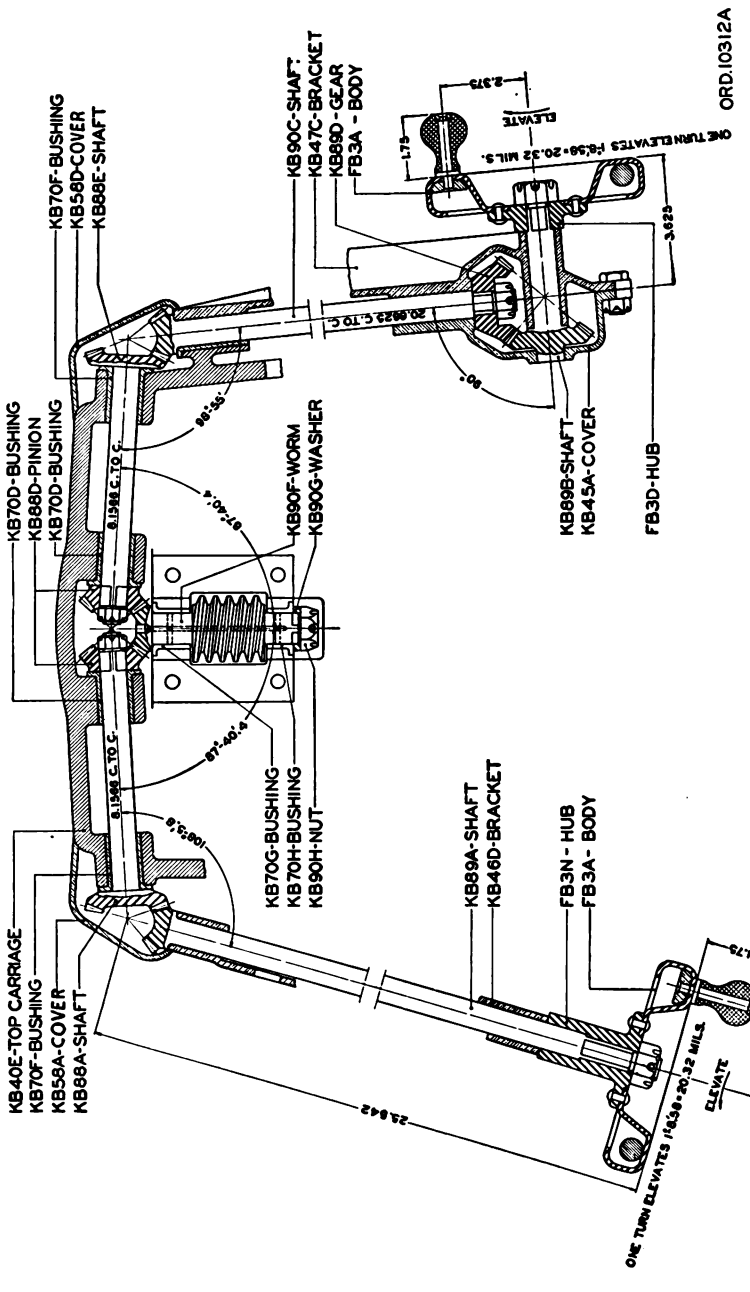


FIGURE 14.—Angle of site mechanism, assembly.

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Reference	Item	Reference	Item
FB3A	Body, handwheel, 6 in.	FB3N	Hub.
KB46D	Bracket, angle of site, left.	FB3D	Hub.
KB47C	Bracket, angle of site, right.	KB90H	Nut, angle of site worm.
KB70D	Bushing, angle of site cross shaft, inner.	KB88D	Pinion, angle of site cross shaft.
KB70F	Bushing, angle of site cross shaft, outer	KB88A	Shaft, angle of site cross, left.
KB70G	Bushing, half, angle of site worm, front.	KB88E	Shaft, angle of site cross, right.
KB70H	Bushing, half, elevating worm, rear.	KB89A	Shaft, angle of site handwheel, w/bevel pinion, left.
KB40E	Carriage, top.	KB89B	Shaft, angle of site handwheel, w/bevel pinion, right.
KB45A	Cover, angle of site bracket, right.	KB90C	Shaft, angle of site intermediate.
KB58A	Cover, angle of site cross shaft gear, left.	KB90G	Washer, angle of site worm.
KB58D	Cover, angle of site cross shaft gear, right.	KB90F	Worm, angle of site.
KB89D	Gear, angle of site intermediate shaft.		

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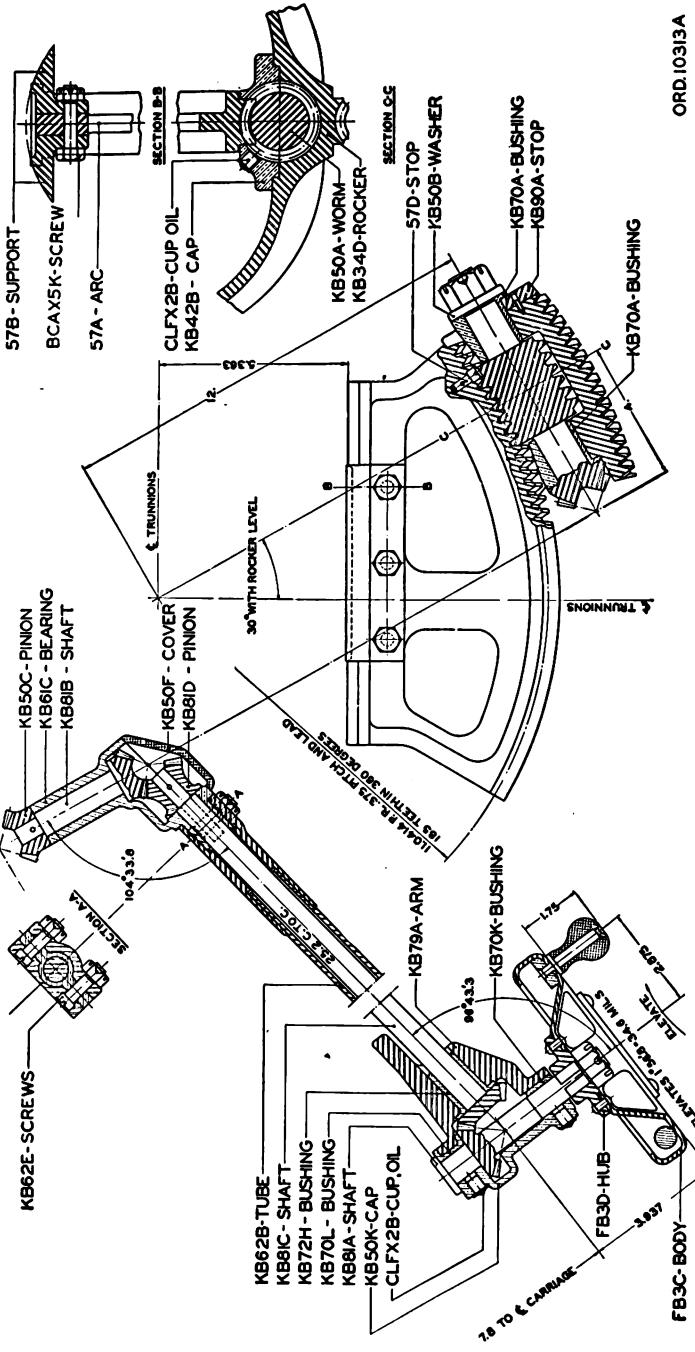


FIGURE 15.—Elevating mechanism, assembly.

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Reference	Item	Reference	Item
57A	Arc, elevating.	KB50C	Pinion, elevating cross shaft.
KB79A	Arm, rocker, right.	KB81D	Pinion, elevating intermediate shaft.
KB61C	Bearing, elevating cross shaft.	KB34D	Rocker.
FB3C	Body, handwheel, 7 in.	BCAX5K	Screw, cap, hex.-hd., ⅜-16NC-2 by 1¾.
KB70A	Bushing, half, elevating worm.	KB62E	Screw, rocker arm brace, lower end.
KB70L	Bushing, half, right rocker arm, top, left.	KB81B	Shaft, elevating cross.
		KB81A	Shaft, elevating handwheel.
KB70K	Bushing, half, right rocker arm, top, right.	KB81C	Shaft, elevating intermediate handwheel.
KB72H	Bushing, rocker arm angle of site intermediate shaft.	KB90A	Stop, angle of site worm.
		57D	Stop, depression.
KB42B	Cap, elevating worm.	57B	Support, elevating arc.
KB50K	Cap, rocker arm.	KB62B	Tube, rocker arm brace.
KB50F	Cover, elevating cross shaft gear.	KB50B	Washer, elevating worm.
CLFX2B	Cup, oil, drive type, ⅜ in. diam.	KB50A	Worm, elevating.
FB3D	Hub.		

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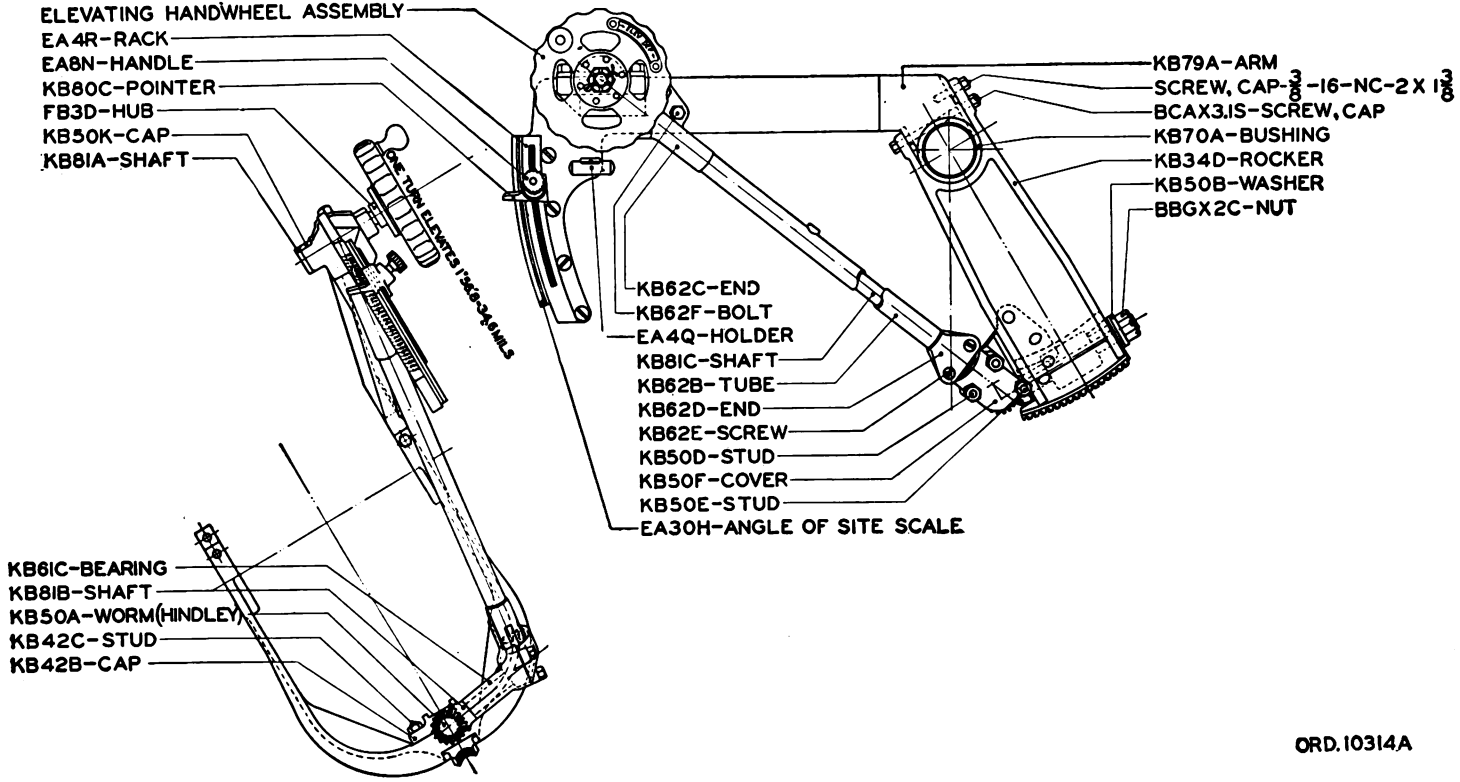


FIGURE 16.—Rocker, assembly.

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Reference	Item	Reference	Item
KB79A	Arm, rocker, right.	EA30H	Scale, angle of site.
KB61C	Bearing, elevating cross shaft.	----------	Screw, cap, hex.-hd., ⅜-16NC-2 by 1⅜.
KB62F	Bolt, rocker arm brace end, upper.	BCAX3.1S	Screw, cap, hex.-hd., ⅜-16NC-2 by 4¾.
KB70A	Bushing, half, elevating worm.	KB62E	Screw, rocker arm brace lower end.
KB42B	Cap, elevating worm.	KB81B	Shaft, elevating cross.
KB50K	Cap, rocker arm.	KB81A	Shaft, elevating handwheel.
KB50F	Cover, elevating cross shaft gear.	KB81C	Shaft, elevating intermediate handwheel.
KB62D	End, rocker arm brace, lower.	KB50E	Stud, elevating cross shaft gear cover.
KB62C	End, rocker arm brace, upper.	KB50D	Stud, elevating cross shaft gear cover, long.
EA8N	Handle, scroll gear.	KB42C	Stud, elevating worm cap.
----------	Handwheel, elevating, assembly.	KB62B	Tube, rocker arm brace.
EA4Q	Holder, level.	KB50B	Washer, elevating worm.
FB3D	Hub.	KB50A	Worm, elevating.
BBGX2C	Nut, slotted, s-fin., ¾-10NC-2.		
KB80C	Pointer, range scale.		
EA4R	Rack, rocker arm range scale pointer.		
KB34D	Rocker.		

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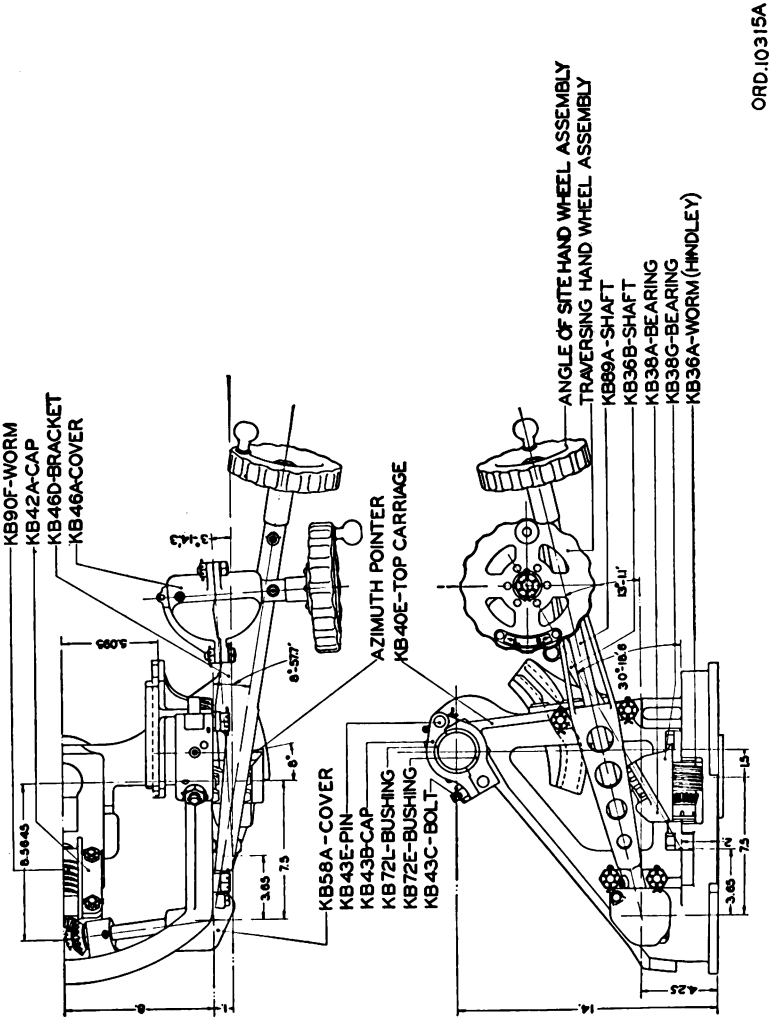


FIGURE 17.—Top carriage, assembly, left side.

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Reference	Item	Reference	Item
KB38A	Bearing, intermediate traversing shaft.	KB58A	Cover, angle of site cross shaft gear, left.
KB38G	Bearing, traversing worm shaft.	.....	Handwheel, angle of site, assembly.
KB43C	Bolt, trunnion cap swing.	.....	Handwheel, traversing, assembly.
KB46D	Bracket, angle of site, left.	KB43E	Pin, trunnion cap and swing bolt.
KB72L	Bushing, half, left trunnion cap.	KB89A	Shaft, angle of site handwheel, w/bevel pinion, left.
KB72E	Bushing, half, trunnion, left.		
KB42A	Cap, angle of site worm.	KB36B	Shaft, traversing intermediate, w/bevel pinion.
KB43B	Cap, trunnion.		
KB40E	Carriage, top.	KB90F	Worm, angle of site.
KB46A	Cover, angle of site bracket, left.	KB36A	Worm, traversing (Hindley).

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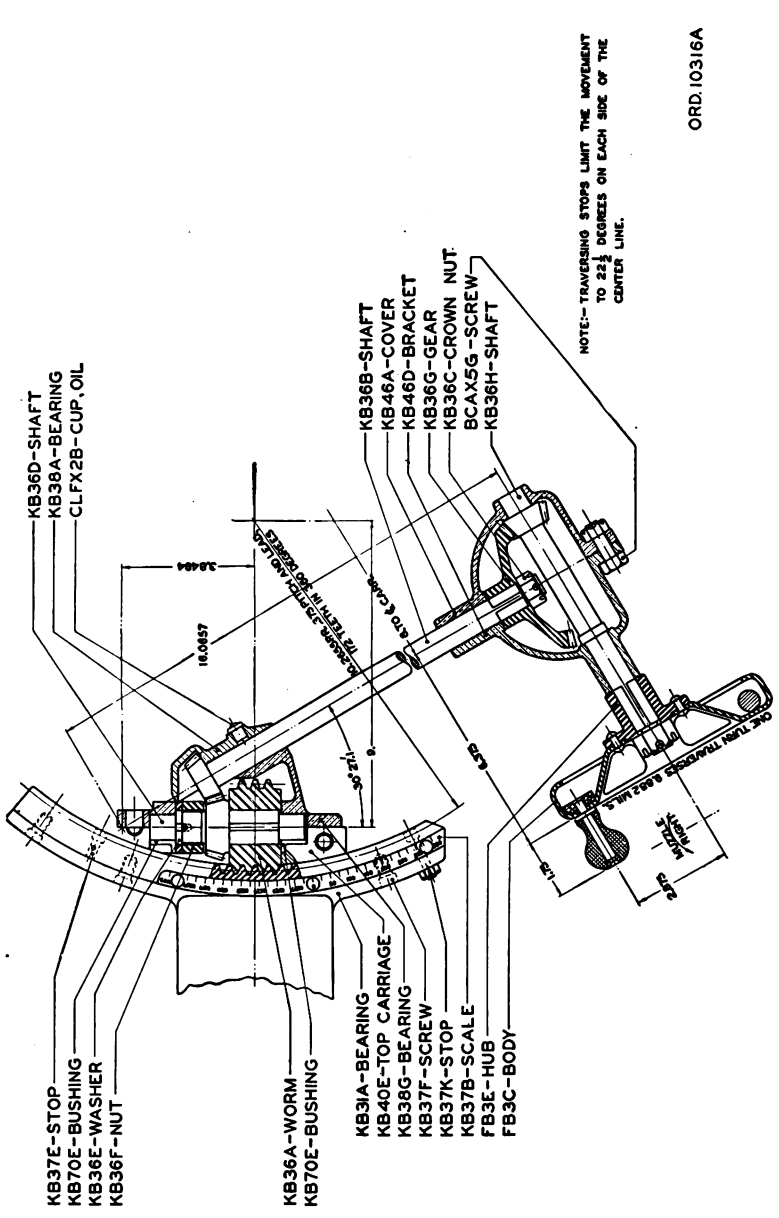


FIGURE 18.—Traversing mechanism, assembly.

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Reference	Item	Reference	Item
KB38A	Bearing, intermediate traversing shaft.	KB37B	Scale, azimuth.
KB31A	Bearing, pintle.	KB37F	Screw, azimuth scale.
KB38G	Bearing, traversing worm shaft.	BCAX5G	Screw (for replacement see screw BCAX1CD).
FB3C	Body, handwheel, 7 in.	BCAX1CD	Screw, cap, hex-hd., ⅜-16NC-2 by 1¼.
KB46D	Bracket, angle of site.	KB36H	Shaft, traversing handwheel, w/bevel pinion.
KB70E	Bushing, half, traversing worm.	KB36B	Shaft, traversing intermediate, w/bevel pinion.
KB40E	Carriage, top.	KB36D	Shaft, traversing worm.
KB46A	Cover, angle of site bracket, left.	KB37E	Stop, traversing and elevating.
CLFX2B	Cup, oil, drive type, ⅜ in. diam.	KB37K	Stop, traversing, rear.
KB36G	Gear, traversing intermediate shaft.	KB36E	Washer, traversing worm-shaft adjusting nut.
FB3E	Hub.	KB36A	Worm, traversing (Hindley).
KB36C	Nut, angle of site intermediate shaft, right and traversing intermediate shaft.		
KB36F	Nut, traversing worm-shaft adjusting.		

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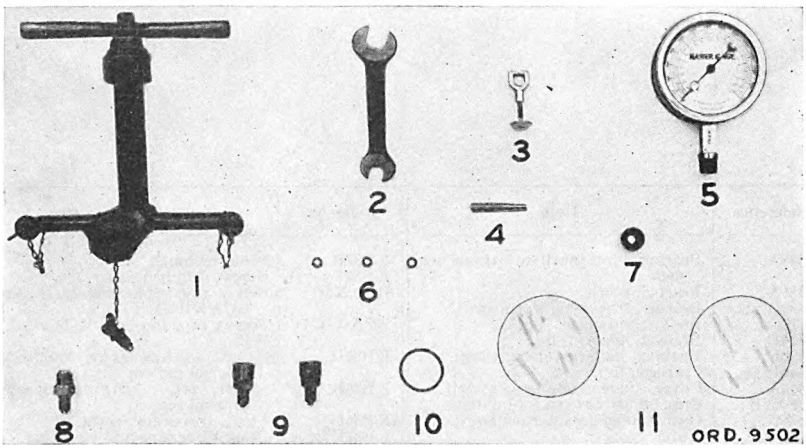


FIGURE 19.—Tools used for testing and repairing pressure gages.

Reference	Item	Reference	Item
1. 24–15–7	Tester, pressure gage.	7. 24–15–9D	Gasket, piston (spare).
2. D66FA	Wrench, 5/8 and 7/8 in. opngs.	8. 24–15–10D	Adapter.[1]
3. A442	Jack, gage hand.	9. 24–15–10Q	Adapters.
4. 15–5–511P	Set, gage hand.	10. 24–15–10L	Gasket, reservoir cap (spare).
5. B748	Gage, pressure, master.	11. A1715	Glasses, pressure gage (spare).
6. 24–15–10F	Gaskets (gage, reservoir, and adapter) (spare).		

[1] Furnished with all pressure gage tester outfits but used with the 155-mm and 240-mm howitzer matériel only.

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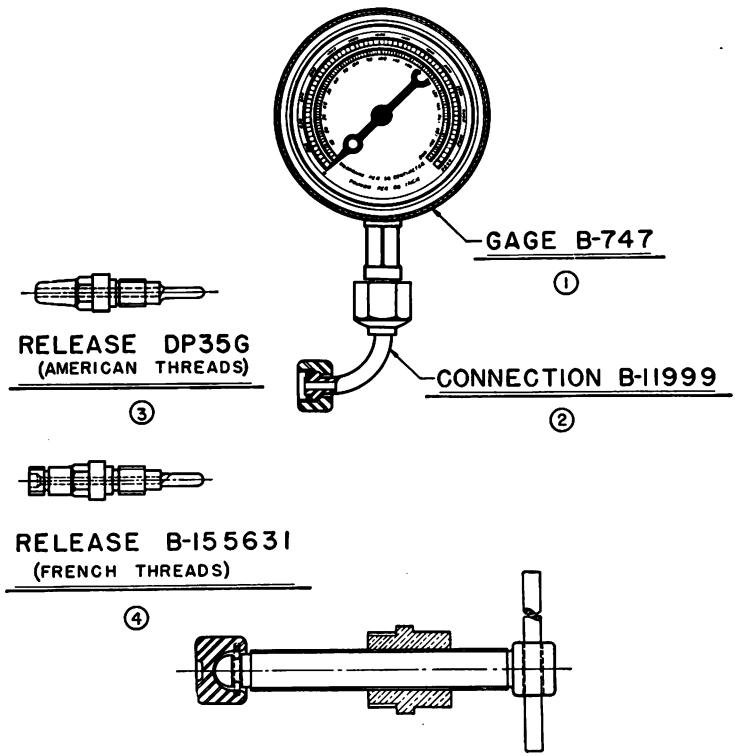


FIGURE 20.—Special tools and accessories.

Reference	Item
1. B747	Gage, pressure.
2. B11999	Connection, pressure gage.
3. DP 35G	Release, drain valve (American threads).
4. B155631	Release, drain valve (French threads).
5. 24-13-41	Jack, screw, recoil piston (w/handle).

[A. G. 062.12 (10-31-39).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

E. S. ADAMS,
Major General,
The Adjutant General.

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TECHNICAL REGULATIONS
No. 1405-155A

WAR DEPARTMENT,
WASHINGTON, *January 2, 1940.*

ORDNANCE MAINTENANCE—MOBILE ARTILLERY

155-MM HOWITZER MATÉRIEL, M1917A1, M1917A2, M1917A3, M1918 AND M1918A1

Prepared under direction of the Chief of Ordnance

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SECTION I

GENERAL

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Purpose	1
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1. Purpose.—The purpose of these regulations is to furnish suitable instructions for maintenance and shop repair of the 155-mm howitzer matériel, M1917 modified and M1918 patterns. They are for use of ordnance maintenance companies, civilian employees of the Ordnance Department, Reserve Officers' Training Corps students, National Guard, and Reserve officers charged with the maintenance and repair of this matériel.

2. Scope.—These regulations contain instructions for inspection, assembly and disassembly, maintenance and repair not covered in TR 1305–155A; they describe the special repair tools required and prescribe their use.

3. References.—*a.* All pertinent information relative to description, operation, and functioning of the M1917 modified and M1918 pattern matériel may be found in TR 1305–155A; instructions for star gaging and complete method, with illustrations, for taking

*This pamphlet supersedes TR 1405-155A, September 23, 1931.

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gutta-percha impressions of the bore of cannon, in TR 1495–A; instructions covering the characteristics, purpose, handling, etc., of cleaning and preserving materials, tools and materials for use therewith, and special oils, greases, and cutting oils issued by the Ordnance Department, in TR 1395–A; instructions for proof of guns and carriages in Ordnance Proof Manual; pressure gage outfits for cannon and the uses thereof, in TR 1495–C; fire-control and sighting equipment, in TR 1320–BF; complete list of parts, spare parts and equipment, and basic spare parts, in Standard Nomenclature Lists C–3, C–28, and C–31. Personnel charged with the maintenance and repair of this matériel are required to be familiar with these publications.

b. As there are no ordnance drawings covering the original 155-mm howitzer and carriage, M1917 (Schneider), and as practically all removable parts are interchangeable with the 155-mm howitzer and carriage, M1918, the drawings listed below will serve for the 155-mm howitzer and carriage, M1917A1, M1917A2, M1917A3, M1918, and M1918A1:

Class 53, division 18, 155-mm howitzer, M1917A1 and M1918.

Class 3, division 41, 155-mm howitzer carriage, M1918.

Class 3, division 182, 155-mm howitzer carriage, M1917A1, M1917A2, M1917A3, and M1918A1.

c. Drawings covering lists of equipment and special repair tools for M1918 and M1918A1 are B103418, B103418A, B103418B, B103418C, B103424, B103424A, B103424B. Drawing B142188 covers additional accessories required for the M1918A1 type carriage.

Section II

TOOLS FOR INSPECTION

Paragraph
Tools for inspection 4

4. Tools for inspection.—The following tools are issued to ordnance maintenance companies for use in the inspection of 155-mm howitzer matériel:

a. Adapter, pressure gage.—See paragraph 56, TR 1305–155A.

b. Hydrometer, 6-inch, 10° to 30° B.—This is a floating instrument for determining specific gravities, especially of liquids, saline solutions, etc. It is usually a hollow glass or metal instrument weighted at one end so as to float upright. Some forms have only one mark on the stem, the specific gravity being calculated from the weights necessary to make the hydrometer sink to this mark.

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c. Paper, litmus (vial).—This paper is for testing the acidity of the glycerin-water liquid in the recoil mechanism. (For additional information see TR 1395–A.)

d. Sight, bore.—See paragraph 83, TR 1305–155A.

e. Target, testing.—See paragraph 84, TR 1305–155A.

f. Tester, pressure gage, complete.—(1) The pressure gage tester is used in testing the accuracy of the service pressure gage with the master pressure gage. It is filled with liquid which is subjected to pressure by a screw at the will of the operator, pressure being transmitted equally to both pressure gages. Figure 21 shows the tester reservoir in assembled position; figure 20 shows the tester reservoir disassembled and packed in the chest.

(2) To use the pressure gage tester, clamp it securely in a vise by means of a lug on the underside, the screw withdrawn, and the apparatus filled with recoil liquid before assembling the pressure gages in order to eliminate possible air bubbles in the connections. The master gage is screwed in one arm and the gage to be tested in the other arm. Apply pressure by means of the operating screw. If the gages are not in agreement, proceed as outlined in paragraph 39 *a*.

(3) Figure 21 shows the pressure gage tester and the following equipment for use therewith:

(*a*) *Adapters.*

1. The adapters (9) are used to connect the pressure gages to the tester.

2. The adapter (8) is issued with all outfits but is used only with the 155- and 240–mm howitzer matériel.

(*b*) *Gage, pressure, master.*—The master pressure gage (5) is used to check the accuracy of the service pressure gage. It is graduated in pounds per square inch as well as kilograms per square centimeter.

(*c*) *Gaskets and glasses.*—The gaskets (6), (7), and (10), and the glasses (11) are spare parts.

(*d*) *Jack, gage hand.*—The gage hand jack (3) is used in removing the pressure gage indicator hand when it is not in agreement with the master gage.

(*e*) *Set, gage hand.*—The gage hand set (4) is used when replacing the pressure gage indicator hand in agreement with the master pressure gage.

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SECTION III

INSTRUCTIONS FOR INSPECTION

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Inspection of howitzer carriage, M1917A1, M1917A2, and M1918	7
Inspection of howitzer carriage, M1917A3 and M1918A1	8

5. General.—*a.* Inspection is for the purpose of determining the condition of the matériel, whether repairs or adjustments are required, and the remedies necessary to insure that the matériel is in such serviceable condition that it will function properly.

b. Complete instructions for use of the artillery gun book (O. O. Form 5825) are given in paragraph 12 *b*, OFSB, 4–1.

c. The average life of the 155-mm howitzer is 7,500 rounds. The howitzers in service should be star gaged at approximately 10 percent and 90 percent of their estimated average accuracy life in rounds fired, and after the latter at each 10 percent during the remainder of their service. Also they should be star gaged at any time an inspector may deem it necessary on account of doubtful condition or where the bores show signs of unusual wear or other irregularities. When star gaging the 155-mm howitzers, the last measurement will be made 67.5 inches from the muzzle.

d. For pastilles or other defects of the bores of howitzers which require plaster of paris or gutta-percha impressions for measuring purposes, plaster of paris should be used if practicable as it gives a harder surface than gutta-percha and a more accurate measurement is obtained.

6. Inspection of howitzer.—See paragraph 39, TR 1305–155A.

7. Inspection of howitzer carriage, M1917A1, M1917A2, and M1918.—See paragraph 40, TR 1305–155A.

8. Inspection of howitzer carriage, M1917A3 and M1918A1.—See paragraph 40, TR 1305–155A.

SECTION IV

TOOLS FOR MAINTENANCE AND REPAIR

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	Paragraph
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Sleeve, assembling (counterrecoil piston)	18
Sleeve, assembling (counterrecoil piston rod)	19
Sleeve, assembling (recoil piston rod)	20
Tool, spring assembling	21
Improvised tools and equipment	22
Wrenches, special	23
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9. Chest, special repair tool.—*a.* The special repair tools pertaining to 155-mm howitzer matériel are listed in Standard Nomenclature List C–18. They are carried in the special repair tool chest (fig. 1). The space occupied by the chest is 40 inches long, 21¾ inches wide, and 16 inches deep. Its weight with tools is approximately 310 pounds.

b. The tools contained in this chest which are of special design or not in common use are described and their uses explained in the paragraphs below. The chest also contains an assortment of common hand tools.

10. Extractor, complete (air tank head).—The extractor ((13), fig. 6) consists of a yoke-shaped plate and two screw-threaded studs. The purpose of the extractor is to withdraw the right air tank head and gasket from the air tank cylinder of the sleigh.

11. Extractor, gasket follower.—The extractors ((4), fig. 7) are screwed into the tapped holes of the counterrecoil rod rubber follower for the purpose of removing the follower without difficulty from the stuffing box. If the follower sticks, tap its face with a hardwood drift in order to break the contact with the rubber gasket.

12. File, breech thread.—The breech thread file ((11), fig. 5) is a special curved, smooth file for dressing the threads of the breech recess.

13. Fixture, hold-back, complete.—The hold-back fixture ((15), fig. 6) consists of a yoke-shaped plate into which are assembled two sliding wedges operated by wing nuts. The purpose of this fixture is to prevent the rotation of the left air tank head when assembling the air tank head follower.

14. Gage, setting, gage cock pointer.—The gage cock pointer setting gage ((12), fig. 6) is for the purpose of locating the position of the set screw holes of the gage cock body which holds the gage cock pointer in proper relation with the gage cock body orifice when the gage cock pointer is at zero on the scale of the left air tank head.

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15. Gun, grease, ¾-pound (with nozzle).—The grease gun ((1), fig. 8) is of the alemite type and is equipped with a nozzle. The purpose of the grease gun is to force grease into bearings by pressure.

16. Roll, tool, M4.—The tool roll, M4, is for the purpose of housing and protecting the tools from becoming lost and to provide ease of transportation.

17. Sleeve, assembling (air pump piston).—The assembling sleeve ((12) fig. 8) is for the purpose of protecting the air pump piston gasket when the air pump piston is being assembled in the pump.

18. Sleeve, assembling (counterrecoil piston).—The assembling sleeve ((6), fig. 7) is for the purpose of protecting the packings of the counterrecoil piston when the counterrecoil piston is being assembled into its cylinder in the sleigh.

19. Sleeve, assembling (counterrecoil piston rod).—The assembling sleeve ((5), fig. 7) is for the purpose of guiding the counterrecoil piston rod through the stuffing box and thereby protecting the packings therein. A piece of drill rod, 18 inches long and ⅜ inch in diameter, inserted through the stuffing box and into the 10-mm hole of the assembling sleeve should facilitate the assembling of the counterrecoil piston rod.

20. Sleeve, assembling (recoil piston rod).—The assembling sleeve ((7), fig. 7) is for the purpose of guiding the recoil piston rod through the stuffing box and thereby protecting the packings of the stuffing box. A piece of drill rod, 18 inches long and ⅜ inch in diameter, inserted into the 10-mm hole of the assembling sleeve should facilitate the assembling of the recoil piston rod.

21. Tool, spring assembling.—The spring assembling tool (fig. 9) is for the purpose of compressing the recoil mechanism packing springs when disassembling or assembling the packing spring within its case.

22. Improvised tools and equipment.—*a. Shears for dismounting the howitzer.*—(1) When it is necessary to dismount the howitzer from its carriage and there is no available tree or structure from which to suspend a 2-ton chain block, shears should be improvised.

(2) A pair of shear legs may be made of 6-inch by 6-inch by 16-foot sound timbers chained together at their upper ends as shown in figure 10, the lower end of the legs resting on a firm foundation and properly braced and stayed in order that no movement will occur when the weight of the howitzer is brought upon it.

b. Assembling stand for supporting sleigh.—The assembling stand for supporting the sleigh, as shown in figure 11, is for the purpose of facilitating the disassembling and the assembling of the recoil mechanism housed within the sleigh. It may not be possible to make a

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duplicate of this stand in the field, but one might be improvised to answer the same purpose. Note that in the stand illustrated the sleigh is maintained in the horizontal position by bars passed underneath at each end of the stand, and that when the mechanism is vertical the bars are passed through notches in one of the lower members.

c. Holding block.—A holding block may be improvised as shown in figure 12 to hold the piston rods when clamping the rods in a vise to prevent them from being deformed. Bucking bars should also be made for the proper replacement of rivets. These bars will be shaped to suit circumstances.

d. Breech key drift.—A breech key drift may be improvised from a bar of machine steel, the general shape of the drift to be patterned after the breech key. The width and thickness of the drift should be at least 1/16 inch smaller than the breech key.

23. Wrenches, special.—*a. Wrench, 40.5-mm (gage cock pointer and gage cock body nut).*—This wrench ((3), fig. 6) is for the purpose of disassembling or assembling the gage cock pointer and the gage cock body nut.

b. Wrench, box (counterrecoil piston nut).—This wrench ((3), fig. 7) is used in the disassembly and assembly of the counterrecoil piston nut.

c. Wrench, box spanner.—This wrench ((2), fig. 7) is used when disassembling or assembling the counterrecoil stuffing box in the cylinder of the sleigh.

d. Wrench, box spanner.—This wrench ((11), fig. 7) is used when disassembling or assembling the recoil stuffing box in the cylinder of the sleigh.

e. Wrench, box (cylinder head).—This wrench ((1), fig. 7) is used when disassembling and assembling the counterrecoil cylinder head and the recoil cylinder head.

f. Wrench, face spanner, adjustable (long teats).—This wrench ((8), fig. 8) is used when disassembling and assembling the throttling ring assembled in the recoil piston rod. It is also used to turn the disks of the spring assembling tool (fig. 9).

g. Wrench, face spanner, adjustable (short teats).—This wrench ((8), fig. 7) is used when disassembling and assembling the counterrecoil rod packing spring compressor ((140L), fig. 13), the recoil piston rod packing spring compressor (139G), and the lubricating glands (136K), (139H), and (137E).

h. Wrench, air pump piston nut (face spanner).—This wrench ((5), fig. 8) is used when disassembling or assembling the piston gasket nut.

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i. Wrench, face spanner (air tank head follower).—This wrench ((8), fig. 6) is used when disassembling or assembling the air tank head follower into the cylinder.

j. Wrench, face spanner (liquid and air pumps).—This wrench ((11), fig. 8) is used when disassembling and assembling the piston valve seat and similar parts of the pumps.

k. Wrench, hook spanner (filling valve follower).—This wrench ((9), fig. 7) is used when disassembling or assembling the filling valve body to the sleigh.

l. Wrench, hook spanner (gasket ring).—This wrench ((4), fig. 8) is used when disassembling and assembling the axle dust gasket ring.

24. Battery tools and accessories.—In addition to the special repair tools described herein the following battery tools and accessories are listed, the description and uses of which will be found in TR 1305–155A.

Adapter, pressure gage.
Bit, vent cleaning.
Funnel (with strainer).
Gage, pressure, 60-kg (recoil mechanism).
Gage, pressure, 150-kg (compressed gas cylinder).
Gun, oil, ¼ pound, M1.
Measure, 1 liter (graduated in half decaliters).
Pipe, filling.
Pump, air.
Pump, liquid.
Roll, tool, M1915.
Wrench, percussion hammer operating shaft nut and operating lever handle nut (face spanner, 11- and 16-mm).
Wrench, filling pipe swivel nut and filling needle valve follower.
Wrench, firing mechanism.
Wrench, obturator spindle.
Wrench, filling needle valve (socket, 8-mm square).
Wrench, filling plug (socket, 9-mm square).
Wrench, filling valve cap (socket, 13.6-mm hexagonal).

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SECTION V

INSTRUCTIONS FOR DISMOUNTING, MOUNTING, DISASSEMBLING, AND ASSEMBLING

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Sleigh, dismounting	26
Cradle, dismounting	27
Shield, dismounting	28
Mechanism, recoil, disassembly	29
Mechanism, recoil, assembly	30
Cradle, mounting	31
Sleigh, mounting	32
Howitzer, mounting	33
Shield, mounting	34

25. Howitzer, dismounting.—*a.* To dismount the howitzer, select a level spot under some support capable of withstanding a load of 2 tons, from which suspend a 2-ton chain block. There should be a clearance of at least 13½ feet from the support to the ground. If there is no tree or structure of sufficient strength to bear a weight of 2 tons, a pair of shears should be improvised as shown in figure 10.

b. (1) Move the matériel under the support until the hook of the chain block hangs directly over the rear cradle band. Depress the howitzer until the cradle is in a horizontal position. Insert wood blocking between the rear end of the cradle and the trail to support the weight of the howitzer when placed in its retracted position.

(2) Remove the sleigh traveling locks by removing the cotter pins from the sleigh traveling lock bearing and the sleigh traveling lock cam screw.

(3) Slide the howitzer and sleigh to the rear until the breech key is exposed. Remove the breech key set screw located in the under face of the bridle. Drive out the breech key; using a steel drift about the same thickness and width as the breech key. (See par. 22 *d*.)

(4) Loosen the nuts of the front band keys about two turns and strike the nuts with a copper hammer to start the keys from their tapered seat. Mark each key with an assembling mark in order to insure correct assembly of the keys to the sides to which they pertain.

(5) Pass a rope sling between the howitzer and sleigh just forward of the jacket. Pass a bar through the lifting eyes on the front face of the counterweight of the howitzer so that it will project a few inches on each side of the lifting eyes. Loop the ends of the rope sling over each end of the bar, then place the sling on the hook of the chain block. Place a strain on the sling just enough to take the weight of the howitzer. Press down on one end of the howitzer and see whether

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the sling is in a correct position to balance the howitzer. If in balance, lash the sling to the hook, lift the howitzer clear of the sleigh, and roll the carriage from under. Lower the howitzer on a suitable runway and move to a safe distance from the support.

26. Sleigh, dismounting.—Move the carriage again under the chain block. Slide the sleigh to the rear until it may be held in balance with a rope sling attached around the sleigh and over the chain block hook. Place a slight strain on the rope sling until the sleigh may be moved back and forth in the cradle with ease. Roll the carriage forward, carefully guiding the sleigh from the cradle by adjusting the chain block for height in order to avoid clamping the sleigh guides in the cradle clips. Lower the sleigh and move to a safe distance.

27. Cradle, dismounting.—*a.* Return the carriage beneath the chain block. Remove the wood blocking from under the rear end of the cradle and elevate the cradle until the depression stop bolts may be reached. Remove the depression stop which is a small plate on the trail front angle. Depress the cradle until the elevating segments are free of the elevating pinion. Remove the cotter pins from the trunnion latch pins and turn the levers of the pins up and back as far as they will go. Lift the front ends of the trunnion caps and swing them open.

b. Place a rope sling around the cradle in rear and front of the trunnions and lift the cradle free of its trunnion bearings. Roll the carriage from under and lower the cradle, moving it to a safe distance.

28. Shield, dismounting.—Take off the brake handle and remove the four bolts which support the shield to the shield support. The upper bolts may be left in their holes until ready to lift the shield off. Four men are required to remove the shield.

29. Mechanism, recoil, disassembly.—*a.* The disassembly and assembly of the recoil and counterrecoil mechanisms should be performed in a clean inclosed space free from drafts or dust-laden air. Before any attempt is made to disassemble the mechanisms, proper facilities should be on hand to support the sleigh and its recoil and counterrecoil mechanism when disassembled from the sleigh. (See par. 22 *b.*)

b. Great care must be exercised to see that all compressed nitrogen has been removed before any attempt is made to disassemble the mechanism. To release the gas pressure—

(1) Place the sleigh on the assembling stand in the position as shown in figure 16 or upon wooden horses.

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(2) Remove the caps from the filling valve body, using wrench ((1), fig. 6). Open the filling needle valve with wrench (11). Allow all the compressed nitrogen to escape and then close the valve.

c. The procedure for disassembly is as follows:

(1) *Gage cock body from left air tank head.*—Remove set screws from the gage cock pointer ((147F), fig. 15, TR 1305–155A). Remove the set screw from the gage cock body nut and back off nut, unscrew the gage cock body (146A) through the gage cock pointer until the pointer moves out far enough to clear the set-in depression in the cylinder head. Then unscrew the pointer.

(2) *Left air tank head from left air tank.*—Remove the locking screw (140C). Unscrew the follower (140B) from the cylinder using wrench ((8), fig. 6) until the face of the follower contacts gage cock body nut (147D). Tap the gage cock body (146A) with a lead hammer to break the gasket joint. Continue to unscrew the follower until the keys (141B) of the head (141C) are withdrawn from the key slots of the cylinder. Unscrew the follower and head from the cylinder as a unit and drain the liquid from the cylinder into a clean 10-gallon receptacle.

(3) *Right air tank head from right air tank.*—Remove the locking screw from the right air tank head follower (A140A) and unscrew the follower, using wrench ((8), fig. 6). Remove the right air tank head from the cylinder by means of the air tank head extractor (13).

(4) *Recoil piston rod from its cylinder.*—Drive the retaining pin from the recoil piston rod nut ((136D), fig. 13). Remove also the pin retaining the counterrecoil rod nut (136B), using a steel punch. Remove the nuts from the rods using wrench ((10), fig. 7). Remove the piston rod yoke (141D). Remove the locking screw from the recoil piston rod lubricator gland (139H) and remove the gland, using wrench ((8), fig. 7). Remove the lubricator ((B106279), fig. 13) from the recoil stuffing box (134B). Remove the cylinder head lock which is located between the recoil and counterrecoil cylinder heads just above the thumb of the operator as shown in figure 19. Remove the recoil cylinder head ((134E), fig. 13), using wrench ((1), fig. 7). Pull out the counterrecoil buffer rod ((138A), fig. 13) about 2 feet and allow the liquid housed in the recoil cylinder to drain off. Remove the retaining screws from the throttling ring and unscrew the ring, using wrench ((8), fig. 8). Withdraw the counterrecoil buffer rod assembly from the recoil rod. With a hardwood block, drive the recoil piston rod ((135A), fig. 13) through the recoil stuffing box (134B), supporting the piston end of the rod to avoid dropping. Withdraw the recoil rod from the cylinder.

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(5) *Counterrecoil piston and rod from its cylinder.*—(*a*) Assuming that the retaining pins, recoil and counterrecoil rod nuts, and the piston rod yoke have been removed as prescribed in *b* above, proceed as follows: Remove the counterrecoil rod lubricator gland ((136K), fig. 13) and lubricator (B106279) from the counterrecoil stuffing box (134G). Remove the counterrecoil cylinder head (134H), using wrench ((1), fig. 7).

(*b*) Assemble the assembling sleeve (6) into the counterrecoil cylinder.

(*c*) With a hardwood block, drive the counterrecoil piston and rod through the counterrecoil stuffing box. Withdraw the counterrecoil piston and rod from the cylinder.

(6) *Counterrecoil piston packings.*—(*a*) Clamp the counterrecoil rod near the piston in a vise, protecting it by means of wood blocks or lead shields padded with sheets of paper to avoid scratching the rod. Block up the opposite end of the rod to relieve it from bending stresses.

(*b*) Remove the screw from the counterrecoil piston lubricator gland ((137E), fig. 13). Remove the gland, using the adjustable spanner wrench ((8), fig. 7). Remove the counterrecoil piston lubricator ((B106280), fig. 13).

(*c*) Drive out the retaining pin from the counterrecoil piston nut (137D) and remove the counterrecoil piston nut and liner (137C), using wrench ((3), fig. 7). Remove the counterrecoil piston rubber pad ((143H), fig. 13) and gasket (143K). Remove the counterrecoil piston rubber follower (137K). Remove gasket (143G). Remove the counterrecoil piston spring.

(7) *Counterrecoil stuffing box from its cylinder.*—Place the wrench ((2), fig. 7) at a convenient angle and strike the end of the wrench with a hardwood block to break the joint between the stuffing box and the copper gasket. Remove the stuffing box from the cylinder.

(8) *Counterrecoil stuffing box packings.*—(*a*) Hold wrench (2) in a vise in such a position that it will retain the stuffing box in an upright position.

(*b*) Remove the retaining screw from the counterrecoil rod gasket follower ((140F), fig. 13). With the adjustable face spanner wrench ((8), fig. 7), unscrew the counterrecoil rod packing spring compressor ((140L), fig. 13). Remove the counterrecoil rod gasket follower (140F). Pull out the counterrecoil rod spring case. Insert the extractors ((4), fig. 7) into the tapped holes in the counterrecoil rod rubber follower ((140E), fig. 13) and pull it from the counterrecoil stuffing box (134G), thereby removing with it gasket (143C). Remove the counterrecoil rod rubber pad (134B) and gasket (143A),

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noting the position of the inner and outer counterrecoil rod rubber pad cup rings in order that they may be reassembled in the same position. Remove the counterrecoil rod packing seat (136L).

(9) *Counterrecoil rod spring case.*—(*a*) Hold the mandrel ((1), fig. 9A) in a vertical position clamping the rectangular base in a vise. Place the counterrecoil rod spring case over the mandrel with the lugs of the counterrecoil rod spring inner case inserted into slots of the mandrel.

(*b*) Assemble disk (3) on top of the case. Assemble handle (2) on the mandrel unit until it is in firm contact with disk (3).

(*c*) Remove screw (6) from the counterrecoil rod spring inner case and then compress the counterrecoil rod packing spring by screwing down on handle (2).

(*d*) Turn the counterrecoil rod spring outer case one-eighth of a turn which will disengage the lugs of the case. Unscrew handle (2) and remove the parts from the mandrel.

(10) *Recoil stuffing box from its cylinder.*—The removal of the recoil stuffing box ((134B), fig. 13) is accomplished in the same manner as outlined for the removal of the counterrecoil stuffing box, using wrench ((11), fig. 7).

(11) *Recoil stuffing-box packings.*—The same procedure of operations should be followed as outlined for the disassembly of the counterrecoil stuffing box.

(12) *Recoil piston rod spring case.*—(*a*) Hold the mandrel ((1), fig. 9B) in a vertical position and clamp the base in a vise.

(*b*) Assemble disk (9) over the mandrel and follow with the recoil piston rod spring case, the lugs of the inner case (12) pointing down. Assemble disk (8) over the mandrel and on top of case (10).

(*c*) Screw handle (2) on mandrel (1) and compress the recoil piston packing spring (11) which will force the inner and outer case retaining lugs apart. With the teats of the spanner wrench ((8), fig. 8) inserted into the holes of disk ((8), fig. 9B), turn the recoil piston rod outer case until the slots match up with the lugs of the inner case (12). Unscrew the handle (2) and remove the disassembled parts of the case.

(13) *Filling valve body from sleigh.*—(*a*) The filling valve body is located in the front of the sleigh between the air tanks and the recoil and counterrecoil cylinders.

(*b*) Remove the set screw from the filling valve follower and remove the follower with wrench ((9), fig. 7). Withdraw the filling valve body from its cylinder.

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30. Mechanism, recoil, assembly.—*a.* When ready to reassemble, force dry-cleaning solvent through all communicating passages, swab the cylinders thoroughly with dry-cleaning solvent and brush the threads clean. Wipe the cylinders dry and coat the interior of cylinders that are to be filled with glycerin-water liquid with a light film of castor oil. Do not touch the bright surface with the hands at assembly as this may cause rust spots to form.

b. The procedure for assemby is as follows:

(1) *Filling valve body to sleigh.*—Insert the filling valve body into its cylinder and with wrench ((9), fig. 7) screw the filling valve follower tight against the filling valve gland which will compress the filling valve gland gasket, thereby making a tight joint. Assemble the set screw to retain the filling valve follower in position.

(2) *Counterrecoil rod spring case.*—(*a*) Place the mandrel ((1), fig. 9A) in a vise as described for disassembling. Place the counterrecoil rod inner case (7) over the mandrel followed by the spring (5). Place the counterrecoil rod outer case (4) on top of the spring.

(*b*) Place disk (3) on top of the case. Screw handle (2) on the mandrel and compress the counterrecoil rod packing spring (5) slightly. Line up the slots and lugs of the spring cases and compress the spring (5) until the slots and lugs have passed each other. Give the counterrecoil spring outer case one-eighth of a turn. Assemble screw (6). Remove the handle (2).

(3) *Counterrecoil stuffing box packings.*—(*a*) Hold the counterrecoil stuffing box as described for disassembling. Insert the counterrecoil rod packing seat ((136L) fig. 13) with the flange face up in the stuffing box. Place gasket (143A) on the assembling sleeve ((7), fig. 7) and insert the assembling sleeve part way through the counterrecoil rod packing seat.

(*b*) Assemble the counterrecoil rod rubber pad cup ring ((144A), fig. 13) on the counterrecoil rod rubber pad (143B). Place the counterrecoil rod rubber pad over gasket (143A). When assembling the rubber packings soften the rubber by applying castor oil and rubbing into the packings by hand.

(*c*) Insert the counterrecoil rod rubber follower (140E) followed by gasket (143C) in the stuffing box.

(*d*) Place the counterrecoil rod spring case with the lugs of the outer case down.

(*e*) Assemble the counterrecoil rod gasket follower (140F) into the stuffing box.

(*f*) Screw the counterrecoil rod packing spring compressor (140L) into the counterrecoil rod gasket follower. Assemble the retaining screw.

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(4) *Counterrecoil stuffing box in its cylinder.*—(*a*) Place the copper gasket into the recess of the cylinder.

(*b*) Coat the threads of the stuffing box with castor oil. Screw the stuffing box into the cylinder and set it up tight against the copper gasket using wrench ((2), fig. 7). New copper gaskets should be used on the recoil and counterrecoil rod stuffing boxes and recoil cylinder head. If new gaskets are not available, the ones in use should be annealed.

(5) *Recoil stuffing box packings.*—(*a*) First assemble the recoil piston rod spring case. Hold the mandrel ((1), fig. 9B) in a vise and place disk (9) over the mandrel followed by the recoil piston rod inner case, lugs down. Assemble the recoil piston packing spring (11). Place the recoil piston rod outer spring case (10) over the spring followed by disk (8). Screw handle (2) on the mandrel and compress the packing spring. Line up the slots and lugs of the cases and compress the spring. Turn the outer case one-eighth of a turn which will lock it in position. Remove the handle (2) and disk (8).

(*b*) The same procedure should be followed as outlined for the assembly of the counterrecoil stuffing box packings, except that the assembling sleeve ((5), fig. 7) is used to support gasket ((143F), fig. 13) and the recoil piston rod gasket follower (139A) is locked in the recoil stuffing box with a headless screw, which must not be omitted.

(6) *Recoil stuffing box in its cylinder.*—The same procedure should be followed as outlined for the assembly of the counterrecoil stuffing box.

(7) *Counterrecoil piston packings.*—First assemble the counterrecoil piston spring case. Follow the same procedure as outlined for the assembly of other spring cases.

(*a*) Place the counterrecoil piston spring case over the counterrecoil rod extension, with the outer spring case bearing against the flange of the counterrecoil rod.

(*b*) Insert next the gasket ((143G), fig. 13).

(*c*) Slide the counterrecoil piston rubber follower (137K) over the counterrecoil rod extension.

(*d*) Assemble the counterrecoil piston rubber pad cup rings, inner and outer, to the counterrecoil piston rubber pad (143H) and slip this assembly over the counterrecoil piston rubber follower (137K).

(*e*) Assemble the assembling sleeve ((6), fig. 7) partly over liner ((137A), fig. 13).

(*f*) Assemble the gasket (143K) over the counterrecoil piston rubber pad.

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(*g*) Screw the counterrecoil piston nut and liner (137C) on the counterrecoil rod extension. Place just enough strain on the nut to push the assembling sleeve from the assembly.

(*h*) Wet the counterrecoil piston lubricator (B106280) with castor oil in cases where recuperators are filled with the glycerin-water mixture, and with low pour point heavy recoil oil when filled with this oil. Assemble and retain it in position by the counterrecoil piston nut and lubricator gland (137D) and (137E). Assemble the counterrecoil piston lubricator gland locking screw.

(*i*) Drive the retaining pin through the hole of the counterrecoil piston nut and the counterrecoil rod extension.

(8) *Counterrecoil piston and rod in its cylinder.*—(*a*) Assemble the assembling sleeve ((6), fig. 7) by screwing it into the rear end of the counterrecoil cylinder.

(*b*) Place assembling sleeve (7) over the threads of the counterrecoil rod.

(*c*) Cover the counterrecoil rod piston with a coating of castor oil or low pour point heavy recoil oil as described in *g* (8) above. Insert the sleeved end of the rod into the counterrecoil cylinder, guiding the sleeved end through the counterrecoil stuffing box by means of a piece of ⅜-inch drill rod 18 inches long inserted into the 10-mm hole in the front end of the assembling sleeve. Push the counterrecoil rod through the counterrecoil stuffing box about 3 inches. Remove both assembling sleeves.

(*d*) Wet with castor oil or low pour point heavy recoil oil as described in *g* (8) above and assemble the counterrecoil rod lubricator ((B106278), fig. 13) into the stuffing box and assemble the counterrecoil rod lubricator gland (136K).

(*e*) Assemble the counterrecoil cylinder head (134H) into the cylinder, using wrench ((1), fig. 7).

(9) *Recoil piston rod in its cylinder.*—(*a*) Place the assembling sleeve (5), over the threads of the recoil piston rod.

(*b*) Insert the threaded end of the recoil piston rod into the recoil cylinder and guide the sleeved end of the rod through the recoil stuffing box by means of a piece of ⅜-inch drill rod, 18 inches long, inserted into the 10-mm hole in the front of the assembling sleeve. Push the recoil piston rod through the stuffing box about 3 inches.

(*c*) Assemble the recoil piston rod lubricator ((B106279), fig. 13) and screw the recoil piston rod lubricator gland in place, using wrench ((8), fig. 7), until the gland is flush with the end of the stuffing box.

(*d*) Lash the recoil piston rod and counterrecoil rod in this position so that they will not move when the position of the sleigh is changed.

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(10) *Gage cock body to left air tank head.*—(*a*) Insert into the recess in the left air tank head the gage cock body gasket followed by the gage cock body gland and assemble the set screw to retain the gland.

(*b*) Insert the gage cock body through the opening of the left air tank head and assemble the gage cock body nut. Set up the gage cock body nut until it requires a pressure of 15 pounds on the end of wrench ((9), fig. 6) to turn the gage cock body.

(*c*) Assemble the gage cock pointer to the gage cock body and retain the gage cock pointer and gage cock body nut in position with set screws.

(*d*) Set the gage cock pointer at zero graduation on the scale of the left air tank head. Test the relation of the gage cock pointer with reference to the boss of the gage cock body using gage (12) set against the keys of the left air tank head. If the surface of the gage cock body boss corresponds to the knife edge of gage (12), mark the end of the gage cock body and put a corresponding mark on the gage cock pointer. These marks should be so placed that they may be readily seen in order that no mistake will be made when assembling the gage cock pointer in its proper position with reference to the gage cock body boss.

(*e*) Remove the gage cock pointer and the gage cock body nut and lash the gage cock body in some manner that it will not slip through the left air tank head.

(11) *Left air tank head in left air tank.*—(*a*) Line up the keys of the left air tank head with the keyways of the left air tank. Press the left air tank head into place. Assemble the air tank rubber gasket followed by the air tank gland. Screw the left air tank head follower until it is in contact with the air tank gland. Assemble the hold-back fixture (15) as shown in figure 16, and then set up tight in the air tank head follower, with wrench (8). Assemble the copper retaining screws.

(*b*) Assemble the gage cock body nut and retain it in position with its set screw.

(*c*) Assemble the gage cock pointer and retain it in position with its set screw.

(12) *Filling recoil and counterrecoil cylinders with liquid.*—(*a*) The procedure and the quantity of liquid specified are for the standard glycerin-water mixture, and also for the low pour point heavy recoil oil now experimentally in use in a limited number of recoil mechanisms.

(*b*) Swing the sleigh into the vertical position as shown in figure 17.

(*c*) Mix about 10 gallons of the glycerin-water recoil liquid in accordance with TR 1395–A and strain it through a clean cloth into a clean receptacle.

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(*d*) Pour about 8 quarts of this liquid into the recoil cylinder with both filling plugs ((134D), fig. 13), in the filling holes.

(*e*) Assemble the recoil cylinder head copper gasket (144M) into the recess of the recoil cylinder.

(*f*) Insert the counterrecoil buffer rod assembly into the bore of the recoil piston rod. Let the buffer rod slide gradually down into the recoil piston rod until about 10 inches of the buffer rod extends outside of the cylinder.

(*g*) Prop with a stick between the recoil cylinder head and the sleigh to prevent further downward movement of the buffer rod. (See fig. 18.)

(*h*) Assemble the throttling ring ((135E), fig. 13), into its seat in the recoil piston rod and lock in position with the counterrecoil throttling ring screw.

(*i*) Pour about 5 quarts more of liquid, or until the recoil cylinder is filled within 1 inch of the top.

(*j*) Loosen the filling plug (134D). Remove the prop and lower the buffer rod into place. Assemble the recoil cylinder head, setting it up tight against its gasket with wrench ((1), fig. 7).

(*k*) Pour about 23½ quarts of liquid into the opening of the right air tank. This amount of liquid should completely fill the counterrecoil cylinder and partially fill the air tanks.

(*l*) Assemble the right air tank head into its cylinder. Slip the rubber gasket and the metal gasket over the right air tank head until they bear against the shoulder of the head. Assemble the right air tank follower, setting it up tight and retain it in position with the copper retaining screw.

(13) *Creating a void in recoil cylinder.*—(*a*) Place the sleigh in the position shown in figure 19, or on the cradle of the carriage.

(*b*) Place the sleigh at an angle of approximately 5°.

(*c*) Remove the front filling plug ((134D), fig. 13) and assemble vent plug (B141687) (vent closed).

(*d*) Remove the rear filling plug (134D) and assemble filling plug (B141095).

(*e*) Assemble funnel pipe ((C62260), fig. 6) and funnel (U316B) to filling plug (B141095).

(*f*) Open vent in vent plug (B141687) and pour liquid in funnel until liquid runs out of vent plug. Close vent in plug (B141687).

(*g*) Remove funnel and funnel pipe. Open vent and allow 100 cubic centimeters of liquid to flow out (of filling plug). Use measure ((U316A), fig. 6). Close vent.

NOTE.—Mechanisms filled with low pour point heavy recoil oil will have 400 cubic centimeters drained off.

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(*h*) Remove filling plug (B141095) and assemble rear filling plug ((134D), fig. 13). Remove vent plug (B141687) and assemble front filling plug ((134D), fig. 13).

(*i*) These voids are required for proper functioning of the mechanism with the different recoil liquids and to allow for expansion of the liquids under abnormal conditions.

(14) *Charging counterrecoil system with compressed nitrogen.*—(*a*) The pressure gage adapter will be mounted as for the introduction of liquid (fig. 23).

(*b*) Open the cradle bottom cover ((C62940), fig. 22), remove the filling valve and filling needle valve caps (148F), and screw on the long swivel nut (U312A) as before.

(*c*) Attach the longer coupling of the filling pipe ((U320A), fig. 22) (for reservoir, approximately 7 feet long) marked "Sleigh" to the long swivel, since it contains a check valve which will not work if reversed. Attach the other coupling of the filling pipe to the cylinder of compressed nitrogen.

(*d*) Open the gage cock valve ((147B), fig. 23) by screwing in the pressure gage adapter stem (U313A). Be sure the gage is registering the pressure before opening the valves in the filling line so that the gage will show the rise in pressure. Then open the filling needle valve stem ((U604B), fig. 22) of the sleigh fully, and slowly turn the handwheel of the compressed gas cylinder valve, very gradually opening that valve until the desired pressure is shown on the pressure gage (U314L). Then tightly close the valve of the compressed gas cylinder.

(*e*) Check the pressure gage reading using the figures and temperature readings as shown on the correction pressure plate attached to cradle head cap, and if it is too high, see that the gage cock pointer ((147F), fig. 23) stands at "1" and open the adapter needle valve (U313C). Get the pressure in exact accord with the correction pressure plate (A158914), then close the filling needle valve stem ((U604B), fig. 22) and gage cock valve. Put on the gage cock body head, the filling valve and filling needle valve caps, and close the cradle bottom cover.

(*f*) The recoil mechanism will be charged with nitrogen to maximum pressure at corresponding temperature as shown on correction pressure plate. The temperature should be taken at the time of charging. A correction pressure plate giving pressure-temperature in metric and English equivalents is published in TR 1305–155A.

31. Cradle, mounting.—*a.* Clean the trunnions, trunnion bearings, and caps. Smooth off any roughness or burrs with a smooth file. Lightly coat the bearings with graphite lubricating grease.

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b. Lift the cradle by means of the chain block high enough to clear the carriage when it is moved under it. Move the carriage until the trunnions of the cradle are directly over the trunnion bearings of the carriage. Lower the cradle and set the elevating segments into mesh with the elevating pinions. Continue to lower the cradle until it seats in the trunnion bearings.

c. Close and lock the trunnion caps. Replace the depression stop. Lower the cradle to zero elevation and block under its rear end.

32. Sleigh, mounting.—*a.* Smooth off all burrs from bearing surfaces. See that the firing safety shaft is in position and working properly. Clean and grease the cradle clips. Force class A lubricating oil through all oil cups and holes. Spread oil evenly over the sleigh guides.

b. Raise the sleigh with the chain block and suspend it directly in rear of the cradle. Roll the carriage back a few inches and enter the front end of the sleigh upon the cradle clips. Continue to roll the carriage toward the sleigh and adjust the height of the sleigh by the chain block until it is in full battery position. Disconnect the chain block and move the sleigh back and forth to test ease of operation.

33. Howitzer, mounting.—*a.* Slide the sleigh to the rear until it is possible to assemble the breech key.

b. Sling the howitzer until it is in perfect balance and suspend it directly over the locking grooves of the sleigh. Lower the howitzer onto its seat.

c. Assemble the breech key and secure it in place with the breech key screw.

d. Assemble the front band keys.

e. Slide the howitzer into battery. Close the piston rod lock so that it will engage with the piston rod nuts. Lash the locking lever handle with copper wire and tie the ends by twisting.

f. Clean and lubricate the traveling locks and assemble them to the carriage.

34. Shield, mounting.—Guide the shield over the howitzer and attach it to the shield brackets by its bolts.

SECTION VI

INSTRUCTIONS FOR MAINTENANCE AND REPAIR

	Paragraph
Mechanism, breech	35
Mechanism, firing, M1918	36
Carriage, howitzer, M1917A1 and M1918	37
Carriage, howitzer, M1917A3 and M1918A1	38
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35. Mechanism, breech.— *a. To remove a seized breechblock.*—(1) The breechblock may be locked by expansion of the obturator, or seizing may be in the major threads, in the threads of the breechblock carrier, or on the bearing surfaces of the rack or operating lever.

(2) Unscrew the firing mechanism. Place a piece of hardwood or a bar of copper against the left end of the rack and tap lightly with a hammer, at the same time pulling down and back on the operating lever handle. Care should be taken not to use sufficient force to damage the teeth of the breechblock or rack. If the major threads prove to be seized, hit the face of the breechblock carrier with a heavy block of wood a number of times and then apply pressure to the operating lever and force the breechblock open by steady pressure rather than by jerky blows of the operating lever. If it still cannot be opened, try a clean 4-inch by 4-inch by 20-foot timber through the bore as a rammer to shock the obturator. When the breechblock has been opened, examine the threads on the block carrier as well as those of the breech recess and make necessary repairs.

b. Damaged parts and repairs.—(1) *Breech recess threads scored or bruised.*—If the threads of the breech recess have become scored or bruised, smooth them by filing and polishing. Scores and bruises on the pressure side of the threads can never be entirely removed due to the danger of destroying the relation of the surface. The removal of metal by filing and polishing must be very sparing and just sufficient to remove the raised metal and restore the original contour of the threads.

(2) *Breechblock threads scored or bruised.*—Take the same action as for above condition.

(3) *Breechblock carrier threads scored.*—Smooth by filing and polishing.

(4) *Gas check seat bruised.*—Smooth by filing and polishing, using the same care in removing metal as when correcting the same condition in the breech recess.

(5) *Leveling plates damaged.*—Correct by filing or scraping in accordance with the following procedure: Place the howitzer in the horizontal position. Place a parallel straightedge in the muzzle end on the lower surface of the bore. If a parallel straightedge is not available, a single-sided straightedge may be wedged against the top of the bore with wooden wedges. The straightedge must be exactly in the middle of the bore and not sprung or distorted by the wooden wedges. Place a level or gunner's quadrant on the protruding end of the straightedge and bring the howitzer exactly level. Transfer the level or gunner's quadrant to the leveling plates and remove metal

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from the plate toward which the bubble moves until the bubble is exactly centered. Maintain the original level at right angles to the line of correction. A flat, true surface plate large enough to cover both leveling plates, coated with blue marking paint (Prussian blue) or red lead, should be used to detect high spots and insure the entire surface of each plate to be true one with the other.

(6) *Operating lever catch worn or broken.*—Remove the screw holding the operating lever catch ((16F), fig. 2, TR 1305–155A) by drilling a small hole in the center of the screw and removing the same by means of an Ezy-Out or by driving a square tang into the hole and turning on the tang to the left with a wrench. Remove the operating lever catch and replace with new parts. The screw which holds the catch in place is designed with a special head which is twisted off after assembly.

(7) *Breechblock carrier lever catch worn or broken.*—Drill a small hole in the center of each screw which retains the breechblock carrier lever catch in position and remove the screw with an Ezy-Out. Drive out the catch and replace. The new parts are furnished undrilled. The new part will be fitted in place and the location of the half screw hole marked with a scriber. The catch is then removed and a half screw hole is filed and the hole countersunk. Use a round file in this operation. The catch is then assembled, inserting the special head screw to hold it in position, the surplus stock twisted off from the screw and filed flush with the catch.

(8) *Obturator spindle vent bushing, excessive erosion.*—Remove the obturator spindle vent bushing by means of an Ezy-Out. Before screwing in the obturator spindle vent bushing the vent in the obturator spindle should be examined to determine whether it can be used as a guide for drilling the bushing. If a drill will not pass through the vent without binding, the obturator spindle vent bushing will have to be drilled before assembly. If a drill can be used, screw in a new bushing as tight as possible and cut off the surplus stock of the bushing and finish flush with the obturator spindle. Drill and ream the venthole from the rear end of the obturator spindle.

(9) *Obturator spindle plug.*—(*a*) Obturator spindle plugs of new design (B241) have been manufactured to replace old type plugs. When in doubt as to type of spindle plugs on hand, procure a primer used for service practice, clean the seat of the spindle plug with the reamer for that purpose. Insert the service primer into the spindle plug; it should extend about 0.15 inch out of the seat of a new-design spindle plug. After replacement, all old plugs will be disposed of in accordance with existing regulations.

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(*b*) An eroded primer seat in obturator spindle plug causes a portion of the fired primer to burn out. In some cases, pieces of the primer remain in the primer seat after ejection of the primer, and in extreme cases blowback occurs. When this occurs, the plug should be removed and a new obturator spindle plug inserted. The damaged obturator spindle plug is removed by unscrewing the plug by means of an Ezy-Out and removing the obturator spindle plug gasket. Assemble a new gasket and plug. The gasket must be of the correct thickness to permit the shoulder on the plug to just touch the end of the obturator spindle when the gasket is firmly compressed.

(10) *Seats for rack and rack lock in breechblock carrier roughened.*—Smooth by filing and scraping.

36. Mechanism, firing, M1918.—*a. Assembly of firing pin guide.*—Remove the primer holder set screw from the firing mechanism block and screw the primer holder in by hand until its bottom face comes in contact with the firing mechanism block. By looking through the set screw hole, the nearest serration on the primer holder may be located. With the wrench provided for the purpose, the primer holder is finally seated, and the serration on the primer holder should be in the center of the set screw hole. The set screw is then assembled. It may be necessary to tighten or loosen the primer holder slightly in order that the set screw may be properly seated. When the set screw is seated, it must be flush or below the outside face of the firing mechanism block.

b. Protrusion of firing pin.—When the firing mechanism is correctly assembled and the firing pin guide is pressed completely down, the end of the firing pin should be flush or below the front face of the guide. With the firing pin guide pressed completely down and the firing pin pushed forward as far as possible, the front end of the firing pin should protrude from 0.025 to 0.035 inch beyond the front face of the guide.

c. Primer failures.—Many primer failures are attributed to faulty primers but really occur from causes in the firing mechanism such as dirty firing mechanism, blunted or deformed firing pin, fouling of firing pin, or method of production of primers.

(1) *Dirty firing mechanism.*—Disassemble the mechanism, clean thoroughly with dry-cleaning solvent, wipe dry, and oil with light class A lubricating oil, and reassemble.

(2) *Blunted or deformed firing pin.*—Blunted or deformed firing pins should be dressed with a smooth file or oilstone. If, after assembly, the protrusion of the firing pin is not within the limits prescribed in *b* above, it should be replaced by a new firing pin.

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(3) *Fouling of firing pin.*—This may be due to the use of heavier than light class A lubricating oil, and may result in misfires. This is especially true in cold weather, as the oil may congeal and become gummy.

(4) *Method of production of primers.*—Primers produced under wartime methods have been found to be less accurate in their dimensions than those produced under peacetime methods. Primers to be used for service practice should be tested for seating in a new obturator spindle plug. No trouble has been experienced in inserting and removing primers that have extended from their seat as much as 0.05 inch. If primers are tested as outlined, it will materially reduce complaints concerning faulty primers.

d. Primer holders.—Primer holders (51B), the cavities of which have flat bottoms, are an obsolete type. Those of new design (B8058) have tapered bottoms and are approximately 0.016 inch thicker. All primer holders with flat bottoms will be disposed of under existing regulations.

37. Carriage, howitzer, M1917A1 and M1918 (par. 38).—

Condition	*Cause*	*Correction*
a. Rear end of cradle flared.	*a.* Spreading of the rear end of cradle may result from opening the piston rod lock with cradle elevated or from firing with the sleigh traveling locks protruding into the cradle ("travel" position). It may be the reason for the howitzer striking the rivets of the right trail flask in recoil as the piece is insufficiently guided. The sleigh traveling locks will be out of line and enter their seats	*a.* With calipers, determine how far forward the spreading extends. If the cradle rear band is spread, put a heavy bolt through the sleigh traveling lock bearings and draw the cradle in with it, striking the bottom of the cradle rear band and the inside of the cradle plate at the bottom several sharp blows with a hand hammer until the cradle clips stay in proper alinement when the bolt is loose. If the spreading is all in rear of the cradle rear band, put a jack inside at the band and draw the cradle in with a bolt through heavy washers at the extreme rear end. The cradle clips will be more or less kinked at the band and will require careful filing and test-

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Condition	Cause	Correction
	in the sleigh with difficulty.	ing with a straightedge to insure alinement with the forward part of the clips.
b. A bent sleigh traveling lock.	*b.* Improper assembly or bent when cradle rear end is flared.	*b.* Heat and straighten. Should the lock be burred or upset at the end entering the sleigh, give it a slight taper of ⅛ inch in length.
c. Sleigh traveling lock bearing jammed and hole elliptical.	*c.* Improper assembly. Worn or jammed when cradle rear end is flared.	*c.* Build up by welding sufficient metal in the bearing and rebore to size, or replace the sleigh traveling lock bearing.
d. Worn cradle front cover hasp.	*d.* Slamming the cover into place.	*d.* Cradle front cover hasps which have a considerable radius at the upper or inside of the point should be removed and a new lip welded and fitted, or the hasp should be replaced.
e. Lost motion in traversing handwheel in excess of 60° movement or one-sixth of a turn.	*e.* Slack adjustment of traversing screw thrust-bearing adjusters. Worn traversing bearing. Worn traversing nut. Intermediate shaft bearing may be worn or not fully screwed home. Traversing gears not properly meshed.	*e.* Replace adjusters. Replace the traversing screw bearing. Replace the traversing nut. Screw the intermediate shaft bearing down and place a thin washer under the traversing intermediate gear. Shim the traversing screw stop collar until the traversing gears are properly in mesh.
f. Worn handwheel shaft bushing.	*f.* May be caused by lack of lubricating oil.	*f.* Replace.
g. Lost motion of the elevating handwheel in ex-	*g.* End play of elevating worm. Loose fit of elevat-	*g.* Replace the upper elevating worm shaft bushing. Replace the elevating worm

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Condition	*Cause*	*Correction*
cess of 60° movement or one-sixth of a turn.	ing worm on the elevating pinion shaft.	wheel on the elevating pinion shaft.
h. Rivet heads broken.	*h.* Strain.	*h.* Before starting to heat the rivets, the pieces to be riveted should be carefully fitted and bolted together. If the holes are not in alinement, the cause should be determined and rectified. If necessary, the holes should be reamed or filed. In no case should the holes be reamed or filed larger than 1/32 inch in excess of the diameter of the rivet.
i. Damaged oil cups.	*i.* Clogged with dirt or grease. Trouble is usually caused by painting.	*i.* Remove by inserting a stiff hooked wire in the oil cup and pull out. Replace by entering the oil cup in the oilhole, and with a hardwood block on the cup, tap into place with a hammer.
j. Hub and tire bolts loose or broken.	*j.* Strain.	*j.* Hub and tire bolts should be kept tight at all times. After tightening, the nuts should be lightly peened over to prevent their movement or loss.
k. Worn hub liners.	*k.* Fair wear and tear.	*k.* The hub liners, inner and outer, for the 1,350-mm (rubber-tired) wheel are secured in the hub box by two 10-mm screws, the heads of which are finished off flush with the outside of the hub box after assembly. These screws must be drilled out. They will be found about 2 inches from the large end of the hub and about 1¾ inches from the small end. Take

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Condition	*Cause*	*Correction*
		out the old screws, drive out the unserviceable liners, clean the hub box, lightly oil the interior, and drive in the replacement liners. Be sure that there is no dirt under the flange of the inner liner to prevent it from seating. Drill the holes for the liner screws 8.2-mm (about 21/64 inch) diameter and tap with a 10–1.5-mm tap. The bronze liner screws should fit tight in the threads and be finished flush with the liner.
l. Broken or split spokes.	*l.* Loose hub and tire bolts, spokes dried out.	*l.* To replace a spoke, take out the hub ring carriage bolts which hold the particular spoke to be replaced. Saw the old spoke into two or three pieces and remove from the wheel. Detach the spoke shoe and the spoke shoe plate. Make the new spoke about 3/32 inch longer than the old one and bevel the hub end on the inside so that it can be driven in and tightly wedged to match the other spokes when it strikes the barrel of the hub box. Slip the spoke shoe over the outer end of the spoke; give the inner end a coat of white lead. See that the opening in the hub box is clean. Enter and drive home the spoke. Drive in the spoke shoe. Cover the surface of the spoke housed by the spoke shoe with white lead. When the spoke shoe is in place

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Condition	*Cause*	*Correction*
		set the rivet. Cut the hole for the hub box carriage bolt so that the bolt will bear against the wood and force the spoke toward the wheel center.
m. Rubber tires worn out.	*m.* Fair wear and tear.	*m.* The usual cuts and abrasions of solid rubber tires detract from appearance but do not seem to appreciably shorten the life of the tire. However, if the tire is cut all the way across the tread so as to give the effect of a flat wheel and severely jars the mount at every revolution, or if the rubber is loose upon the base band the tire is unserviceable and must be replaced. If the rubber has worn down so that its total thickness is less than 1 inch and has little cushioning effect, it should be replaced.
n. Stuffing boxes frozen in sleigh.	*n.* Lack of lubrication on threads when boxes were assembled in sleigh.	*n.* When it is found that considerable force is required to turn the box after breaking the joint, a mild heat should be applied to the outside of the cylinder housing the box, care being taken not to apply enough heat to burn the packing or distort the cylinder. Have the wrench in position for removing the box when the desired expansion has been reached. If there is indication of the threads galling, no effort should be made to remove the box. The stuffing box must be cut out to save the sleigh. This work will be

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Condition	*Cause*	*Correction*
		done with an acetylene torch, cutting the stuffing box off about ¼ inch forward of the sleigh, and with a round nose chisel, cut two grooves about 1 inch apart in the stuffing box, taking great care not to cut into the threads of the cylinder. Break out this section and remove the stuffing box with a drift and hammer, striking on the end of the stuffing box exposed.
o. Gage cock pointer out of adjustment.	*o*. Broken or lost gage cock pointer set screws.	*o*. The howitzer and sleigh must be dismounted and all air pressure withdrawn. Loosen the left air tank head follower and swing the sleigh in the vertical position. Lash the gage cock body so that it will not slip into the cylinder when the gage cock pointer and the gage cock body nut are removed. Remove the left air tank head follower and pull out the left air tank head. Make the necessary repairs and reset the gage cock body as outlined in paragraph 30 *b* (10)(*d*).
p. Bent piston rod yoke.	*p*. Lack of liquid or air pressure in the counterrecoil cylinder.	*p*. Dismount the howitzer and sleigh. Remove the counterrecoil rod nut and the recoil piston nut. Remove the piston rod yoke and straighten.
q. Counterrecoil valve knocking.	*q*. Worn, or scratches in the buffer chamber.	*q*. The howitzer and sleigh will be dismounted. Drain the liquid from the recoil cylinder. Disassemble the mechanism as described in paragraph 29 *c* (4) and disassemble the counterrecoil buf-

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Condition	*Cause*	*Correction*
		fer rod. The clearance between the counterrecoil valve and its seat in the recoil piston rod must be exact and each valve individually fitted to its particular rod. Recoil rods are given a serial number and the exact size of the buffer chamber is recorded with the serial number on a small brass plate fixed to the right side of the rear end of the sleigh. Each recoil mechanism is supplied with a spare counterrecoil valve of proper size and bearing the same serial number as the rod. It may be found that in some recoil mechanisms the actual diameter of the buffer chamber is greater than the recorded diameter and therefore the clearance may exceed 0.0043–0.0004 inch between the diameter of valve and the buffer chamber. A slight knock in counterrecoil may develop from a scratch in the buffer chamber but this does not constitute a dangerous condition. If this knock is severe when the piece is fired at considerable elevation, the buffer valve and chamber should be examined and the perfect seating of the valve against the buffer guide checked by putting marking paint on the valve and spotting the contact surfaces. If the rod is not bent and the assembly is found correct, it

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Condition	*Cause*	*Correction*
		is safe to assume that the clearance exceeds the specified amount and a valve having a slightly greater diameter should be put on for trial. If this does not overcome the knock, the recoil rod and buffer rod should be replaced.
r. Gasket ((143K), fig. 13) passing air and oil.	*r.* This condition is caused by the counterrecoil piston being inactive for a long time and the sudden movement of the piston in recoil has torn the rubber away from its seat in the cylinder.	*r.* Replacement of gasket. Dismount the howitzer and sleigh. Release all air in the counterrecoil cylinder and proceed to disassemble the counterrecoil piston and rod as described in paragraph 29*c* (5).

38. Carriage, howitzer, M1917A3 and M1918A1 (par. 37).—The 155-mm howitzer carriages, M1917A3 and M1918A1, are the 155-mm howitzer carriages, M1917A1, M1917A2, and M1918, modified for high speed transport and equipped with air brakes. These modifications consist of the removal of parts enumerated in FSMWO C3–W12 and C17–W3, and equipping the carriages with air brake mechanisms, drawbars, and disk and rim wheels with pneumatic tires. The provisions of paragraph 37, except as modified by this paragraph with reference to elimination, substitution, and addition of parts for high speed transport and air brakes, apply equally to the 155-mm howitzer carriages, M1917A3 and M1918A1.

a. Brake mechanism.—(1) *Air hose.*—Compressed air for operating the power brakes is generated by an air compressor unit on the prime mover and is led to the carriage by means of two air hose. One air hose, labeled "Service," is connected with the coupling on the rear of the prime mover on the *same* side as attached to the trail. The other air hose, labeled "Emergency," is attached to the coupling on the prime mover on the opposite side.

Caution.—When connected, the ends of the two air hose should in no case cross each other as this will prevent functioning of the brakes.

(2) *Relay emergency valve.*—The function of this valve is to relay and speed up the brake action from the prime mover and provide an

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automatic brake application in case of a break-in-two between the prime mover and carriage.

(*a*) *Emergency portion.*

1. With both air hose connected, the compressed air from the prime mover passes through the emergency (charging) line, connected to emergency line outlet of the relay emergency valve (fig. 24) into the chamber below diaphragm (13), deflecting the latter, breaking seal (2), and flowing through passage (3) and opening (4) into the carriage reservoir which is located near the relay emergency valve.
2. With the pressure on both sides of diaphragm ((13), fig. 24) thus equalized, spring (14) holds diaphragm (13) sealed at (5) and the emergency valve (6) (attached to diaphragm) away from its seat.
3. The emergency line thus keeps the carriage reservoir charged at all times.
4. Should the carriage break away from the prime mover or the emergency line hose burst, the sudden removal thus brought about in the emergency line removes the pressure from below diaphragm (13) so that the reservoir pressure acting on the upper side deflects diaphragm (13) downward, breaking seal (5), and flows upward around the emergency valve stem to the brake chambers, thereby producing an emergency application of the brakes.
5. At the same time, emergency valve (6) is seated by the downward movement of diaphragm (13), thereby cutting off the brake chamber from cavity (11) which at this time is opened to exhaust past seal (16). Also diaphragm (13) seals at (2) so that the brakes are held applied without leakage through the ruptured emergency line.
6. After a break-in-two has occurred, the carriage brakes may be released by draining the air from the carriage reservoir or by building up the emergency line pressure equal to that in the carriage reservoir.

(*b*) *Relay portion.*—The relay portion of the valve functions as follows:

1. With the brakes released, supply valve spring (15) holds supply valve (10) seated, cutting off communication between the reservoir and the brake chamber. Also seal (16) is broken, opening the brake chamber cavity (17) which leads to the atmosphere through exhaust connection (19).

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2. When the brakes are applied, air pressure from the service (application) line enters at (8), depresses diaphragm (9), sealing at (16) to close off the exhaust, and depresses guide (18) which in turn unseats supply valve (10) allowing the reservoir pressure to pass around its stem through passage (11), past valve (6) through opening (7) to the brake chambers, thereby applying the brakes.
3. When the brake chamber pressure has built up equal to that on top of diaphragm (9), supply valve spring (15) forces valve (10) to its seat to close off further supply from the reservoir. This movement leaves guide (18) balanced with diaphragm (9) (still sealed at (16)) closing off the exhaust.
4. If a greater application is made at the service line, the relay valve repeats the movement to increase the pressure accordingly.
5. If the brake is partially released, the drop in pressure above diaphragm (9) allows the greater brake chamber pressure beneath to lift the diaphragm, breaking seal (16), and passing sufficient brake chamber pressure through the exhaust until it equals service line pressure, when diaphragm (9) is again deflected downward, making seal at (16) to prevent further exhaust.
6. Complete release of the brake allows all the brake chamber pressure to escape, leaving the relay portion in the released position.

b. Adjustment of brakes.—(1) *Power brakes.*—(*a*) Adjustment of power brakes is made by means of the slack adjuster ((10), fig. 25) which consists of a worm gear splined to cam shaft (6) and rotates with it. The worm gear meshes into a worm (indicated at (7)) which is assembled in the arm of the slack adjuster. The latter is connected with brake chamber push rod (8). Worm (7) locks arm (10) to cam shaft (6) and controls the relative position of the cam shaft and arm.

(*b*) To adjust the brakes for the power brake system, rotate worm (7) until arm (10) is in proper position to set the brakes when a slight foot pressure is applied to the brake pedal on the prime mover with the air system fully charged.

(2) *Hand brakes.*—To adjust the brake for hand brake system, adjust the length of the connecting cable (3) at one or both of the connections (9) until the brakes are set with the brake levers (2) located approximately half way on segment (11).

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(3) *Power brake mechanism.*—(*a*) The power brake mechanism should be inspected periodically for air leaks.

(*b*) When replacing any part of the air line be sure that all burrs are removed from ends of grease and oil fittings and that all dirt and foreign matter are removed.

(4) *Relay-emergency valve.*—(*a*) To test the application, release portion of this valve for leakage without removing the complete valve, charge the carriage air reservoir and with the brakes in released position apply soap suds to the exhaust port. If air leaks through this port it indicates that the intake valve is not seating properly. Notify the ordnance maintenance company.

(*b*) If air leaks through the exhaust port when the brakes are applied, it indicates that the relay valve diaphragm is not seating properly. Notify the ordnance maintenance company.

(*c*) To test the emergency portion of this valve for leakage, disconnect the emergency hose between prime mover and gun carriage. With air pressure in the carriage air reservoir, the brake should act automatically. Apply soap suds to emergency hose or coupling at the carriage to determine if the emergency diaphragm is leaking. Then apply soap suds to the exhaust port to determine if the emergency valve is seating properly.

(*d*) If the leakage on any of the above tests is more than a two-inch diameter bubble in five seconds, or if the brakes fail to apply when the emergency hose is disconnected, the complete valve should be replaced.

(*e*) The carriage air reservoir should be drained once a month and at approximately every 500 miles in order to expel the accumulated water.

(*f*) The slack adjusters should be taken apart once a year, thoroughly cleaned and filled with medium mineral lubricating grease.

(*g*) When the carriage is coupled to the prime mover and the air pressure registers forty pounds per square inch, the brake mechanism should be tested to determine whether or not all parts function properly when a slight pressure is applied to the brake pedal of the prime mover.

(*h*) At six-month periods, the relay emergency valve should be disassembled and diaphragms replaced. When assembling diaphragms, care must be taken to have them lay smooth in order that they may not have a tendency to form a ridge and crack when vibrating.

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39. Tools, special.

Condition	*Cause*	*Correction*
a. Pressure gage inaccurate.	*a.* Accidental movement of the hand upon the spindle. Wear or distortion of the linkage. Applying pressure suddenly, causing the hand to strike the stop pin.	*a.* Repair consists of pulling the hand off the spindle and resetting it in agreement with the master gage, utilizing the pressure gage tester. The most efficacious settings are 400 to 571 pounds per square inch for recoil mechanism gage end, and 40 to 100 kilograms per square centimeter for the gas cylinder gage. The master gage should be returned to an arsenal periodically for the verification of its accuracy.
b. Filling pipe cracked or broken.	*b.* Improper storage.	*b.* Close the crack by peening with a block of wood. Clean the surface and solder. If broken near one end, reset the coupling.
c. Filling pipe clogged.	*c.* Dirty recoil oil.	*c.* Clean the pipe by passing a wire through it.
d. Air pump exhaust check valve leaking.	*d.* Scratched seat.	*d.* Refit and seat the valve.
e. Air pump intake valve stuck.	*e.* Seat has become gummed.	*e.* Disassemble the intake valve seat, clean, and refit.
f. Air pump piston valve not seating properly.	*f.* Seat has become gummed or dirty.	*f.* Remove the yoke pin. Unscrew the piston gland and remove the piston from the body. Unscrew the piston valve seat from the bottom of the piston using the liquid and air pump face spanner wrench and refit or replace the valve. See that there is no closed air pocket at the top of the piston

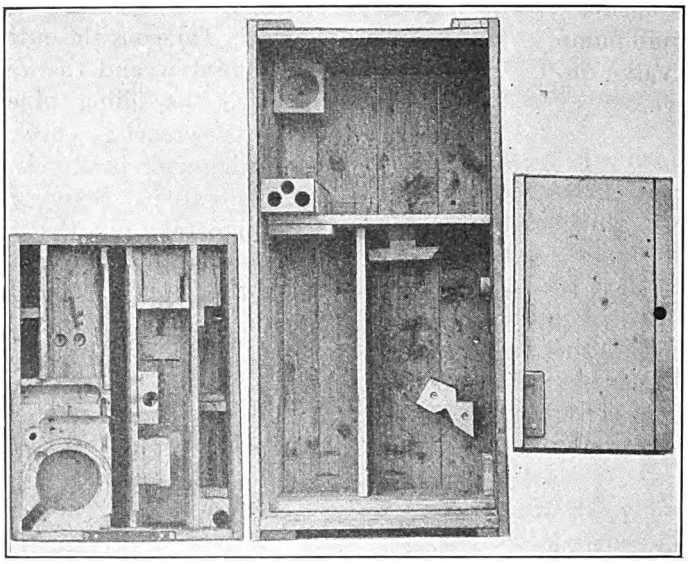
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Condition	*Cause*	*Correction*
		valve stem. A deep longitudinal scratch on the stem of the valve will relieve any such pocket.
g. Air pump piston gasket dry, worn, or burned.	*g.* Working the pump too fast.	*g.* Soak the gasket in neat's-foot oil or replace. See that the piston packing springs which expand the piston gaskets against the wall of the pump body are free in their grooves. Use air pump piston face spanner wrench to unscrew the piston gasket nut and the air pump piston assembling sleeve.
h. Liquid pump packing leaks.		*h.* Take out the yoke pin. Unscrew the plunger packing gland spring follower. Take out the plunger, plunger packing gland spring, plunger packing gland and, plunger packing. Soak the new plunger packing in neat's-foot oil. See that the plunger is clean and free from scores and roughness. Unscrew and remove the body connection with filling pipe swivel nut wrench and assemble the plunger in its bore from the top. Put on it the new plunger packing gland and, with a piece of tubing, set the packing well down into its seat. Withdraw the plunger, put on it the follower and gland spring, and assemble them in the body from the proper end. Reassemble the body connection.

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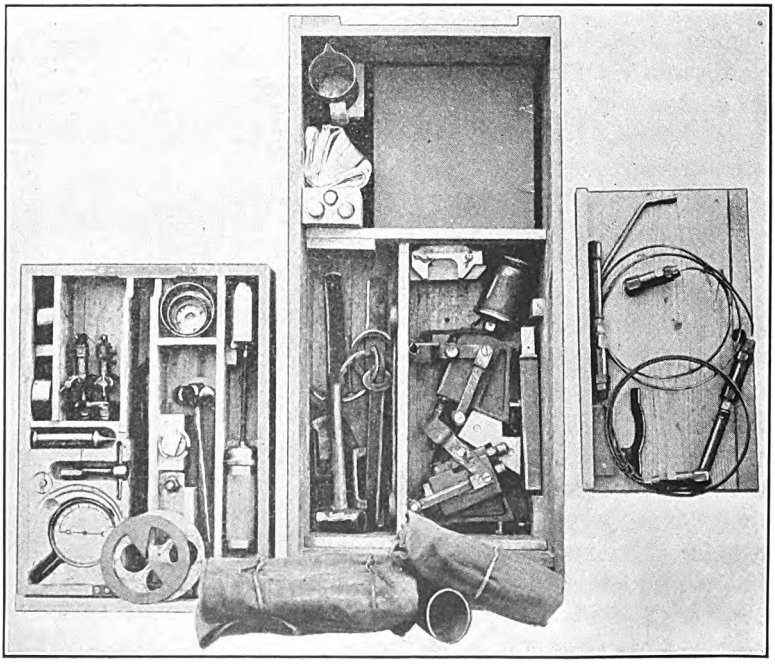
Condition	*Cause*	*Correction*
i. Liquid pump outlet valve inoperative.		*i.* Take out the outlet valve nut screw and the valve nut with the filling pipe swivel nut wrench; check valve spring and check valve. Refit the valve. Before reassembling, take out the pipe connection and thoroughly clean the passage in the pump body.

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Ord. 12308

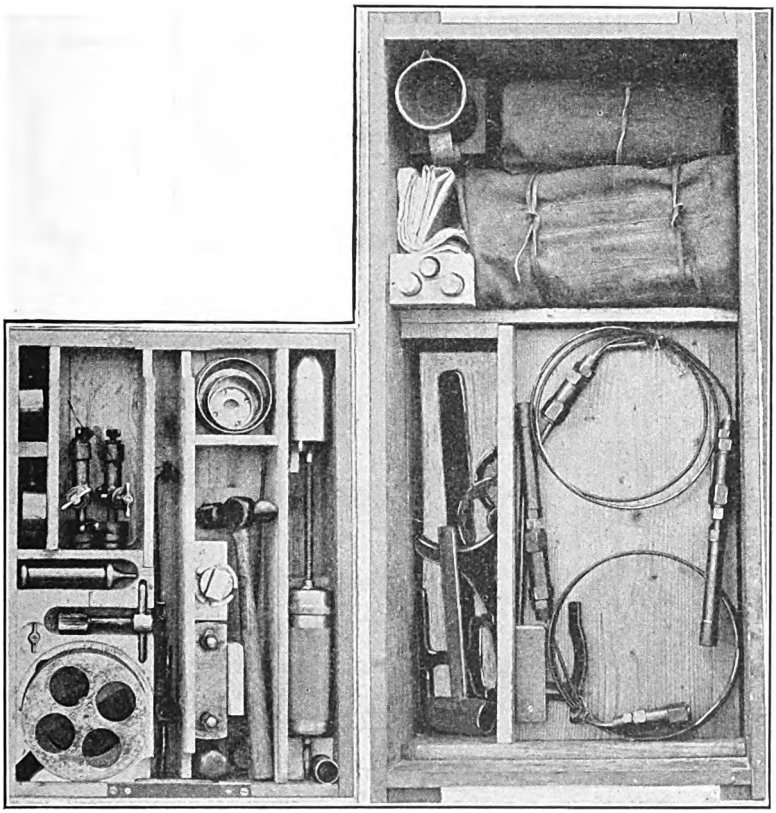
FIGURE 1.—Special repair tool chest (empty).



Ord. 12309

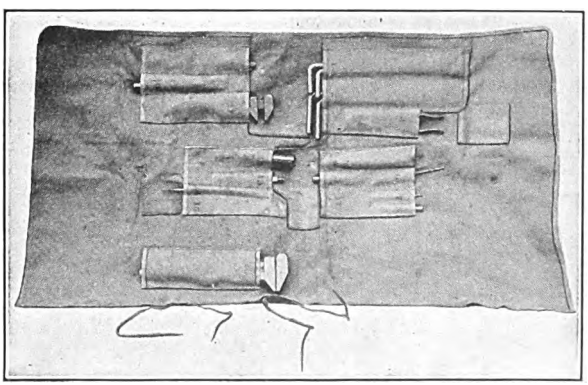
FIGURE 2.—Special repair tool chest (partially packed).

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Ord. 12311

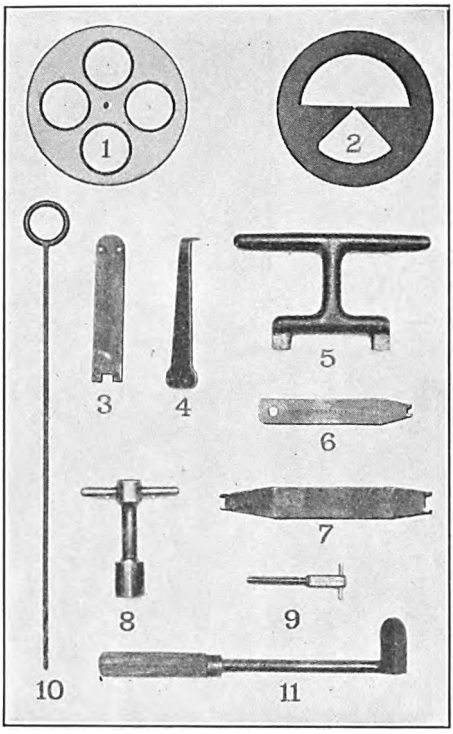
FIGURE 3.—Special repair tool chest (packed).



Ord. 12302

FIGURE 4.—Tool roll, M1915 (with contents).

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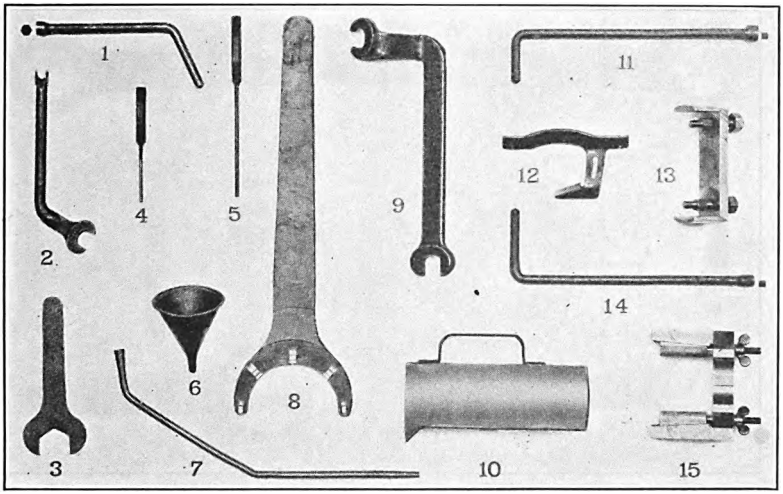


Ord. 12301

FIGURE 5.—Special repair tools for howitzer.

Reference	Item
1. RF12B	Sight, bore, breech.
2. RF12A	Sight, bore, muzzle.
3. U336C	Wrench, firing pin housing.
4. U332B	Wrench, firing mechanism.
5. U332L	Wrench, obturator spindle.
6. U336E	Wrench, primer seat pivot nut.
7. B141009	Wrench, percussion hammer operating shaft nut and operating lever handle nut.
8. U345F	Tap, vent bushing.
9. U595A	Reamer, primer seat resizing.
10. B19667	Bit, vent cleaning.
11. B141012	File, breech thread.

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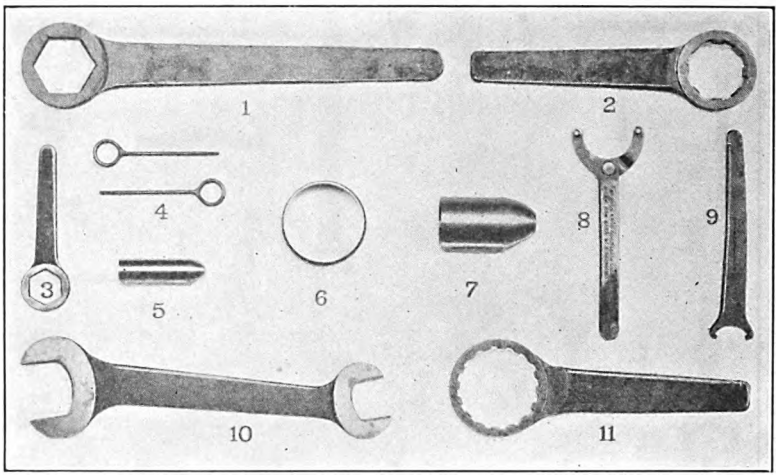


Ord. 12307

FIGURE 6.—Tools for air tank heads and cylinder filling.

Reference	Item
1. U329B	Wrench, filling valve cap.
2. U329C	Wrench, filling pipe swivel nut and filling needle valve follower.
3. B6228	Wrench, gage cock pointer and body nut (40.5-mm. hexagonal opening).
4. A3651	Punch, drive pin, 0.18-inch point, 5¾ inches long.
5. A3656	Punch, drive pin, 0.22-inch point, 9 inches long.
6. U316B	Funnel, copper (with strainer), ¼ pint.
7. C62260	Pipe, funnel.
8. U817C	Wrench, air reservoir head nut.
9. U330A	Wrench, gage cock and filling pipe coupling.
10. U316A	Measure, galvanized, 1 liter (graduated to ½ decaliters).
11. U329E	Wrench, filling needle valve.
12. D42	Gage, gage cock pointer setting.
13. C1724	Extractor, air tank head.
14. B109057	Wrench, filling plug.
15. C1734	Fixture, hold-back, air tank.

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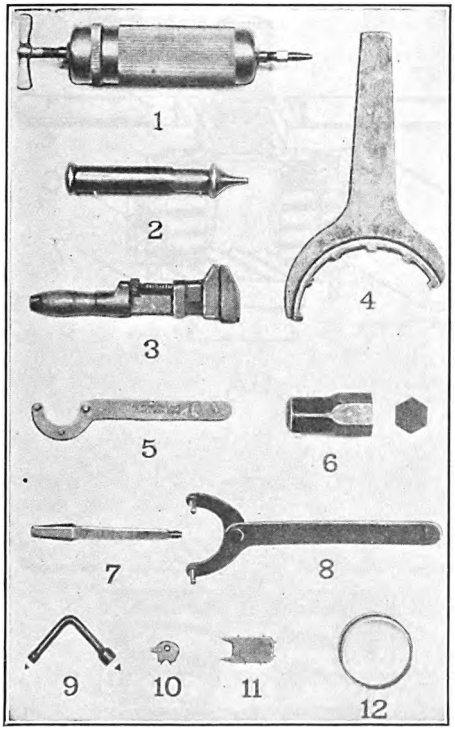


Ord. 12304

FIGURE 7.—Special repair tools for stuffing boxes.

Reference	Item
1. U817A	Wrench, cylinder head and counterrecoil throttling ring.
2. U817E	Wrench, counterrecoil stuffing box.
3. U331D	Wrench, counterrecoil piston.
4. U317K	Extractor, gasket ring follower.
5. A3636	Sleeve, assembling, recoil piston rod.
6. U317B	Sleeve, assembling, counterrecoil piston.
7. A3635	Sleeve, assembling, counterrecoil piston rod.
8. U330B	Wrench, adjustable, pin-spanner (short teats).
9. U345E	Wrench, filling valve follower.
10. U328B	Wrench, piston rod nut.
11. U817B	Wrench, recoil stuffing box.

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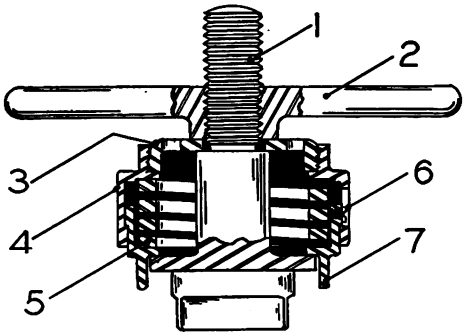
Ord. 12305

FIGURE 8.—Special repair tools (miscellaneous).

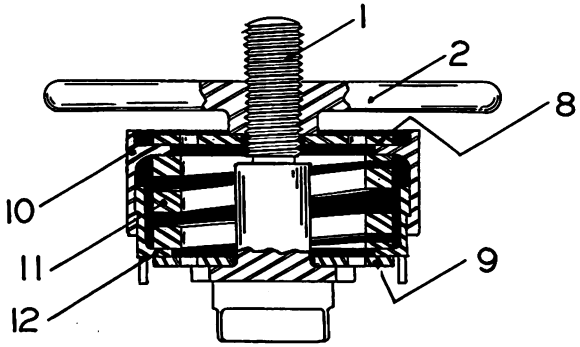
Reference	Item
1. CLAX2E	Gun, lubricating, pressure, screw-handle type, 8-ounce (with nozzle A355).
2.	Gun, oil, 1-ounce.[1]
3. TKAX1B	Wrench, screw, monkey, knife handle, 8-inch.
4. B6452	Wrench, axle dust gasket nut (71.5-mm radius).
5. U345A	Wrench, air pump piston nut.
6. U345C	Wrench, socket, 32-mm hexagonal.
7. A17717	Screwdriver, oiler nozzle.
8. C1818	Wrench, adjustable, pin spanner (long teats).
9. U329D	Wrench, quadrant sight.
10. A31973	Wrench, wing, teat, pin-face, 3⅛-inch span, with screwdriver blade.
11. U345B	Wrench, pump, liquid and air.
12. U317L	Sleeve, assembling, air pump.

[1] Issued until supply is exhausted. Oil or grease gun with type S nozzle. CLBX1B is standard.

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9A



9B ORD. 3197

FIGURE 9.—Special tools for assembling packing springs.

A.—Method of compressing counterrecoil stuffing box (or piston packing springs to assemble spring cases).

Reference	Item
1. U317C	Mandrel, spring assembling tool.
2. U317A	Handle, spring assembling tool.
3. U317E	Disk, spring assembling, No. 1.
4. 140G	Case, counterrecoil rod spring, outer.
5. 140M	Spring, packing, counterrecoil rod.
6. 139E	Screw, inner spring case.
7. 140K	Case, counterrecoil rod spring, inner.

B.—Method of compressing recoil rod packing springs.

Reference	Item
1. U317C	Mandrel, spring assembling tool.
2. U317A	Handle, spring assembling tool.
8. U317F	Disk, spring assembling, No. 2.
9. U317D	Disk, spring assembling, No. 3.
10. 139D	Case, recoil piston rod spring, outer.
11. 134K	Spring, recoil piston rod packing.
12. 139F	Case, recoil piston rod spring, inner.

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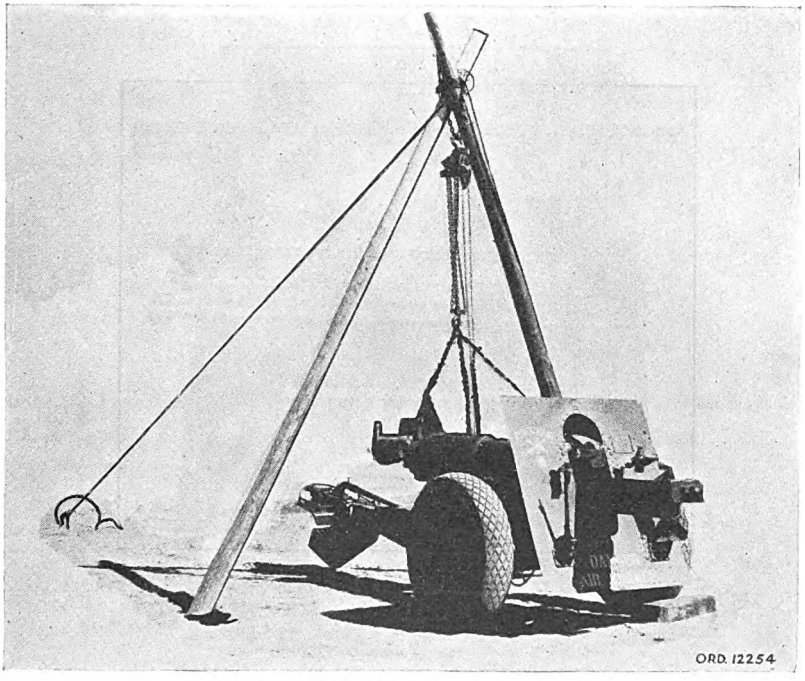
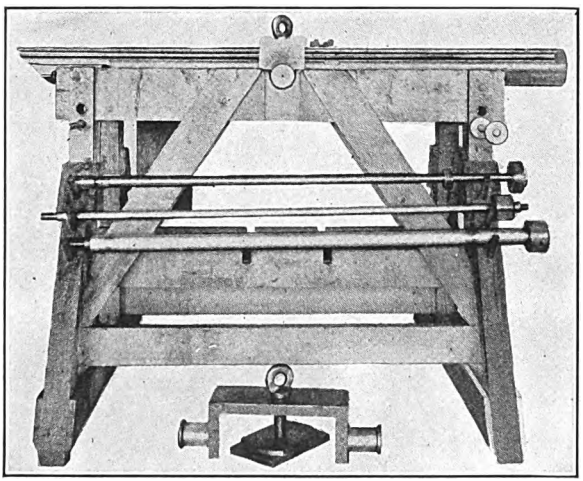


FIGURE 10.—Shears for dismounting the howitzer.

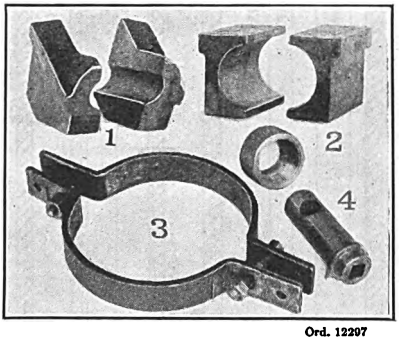
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Ord. 12296

FIGURE 11.—Assembling stand for recoil mechanism.

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Ord. 12297

FIGURE 12.—Improvised equipment (for assembling and disassembling recoil mechanism (1, 2, and 4); quadrant sight (3)).

Reference	Item
1	Holding block for counterrecoil piston rod.
2	Holding block for recoil rod.
3	Clamp for quadrant sight range drum cover.
4	Socket wrench and retaining nut for recoil piston rod plug.

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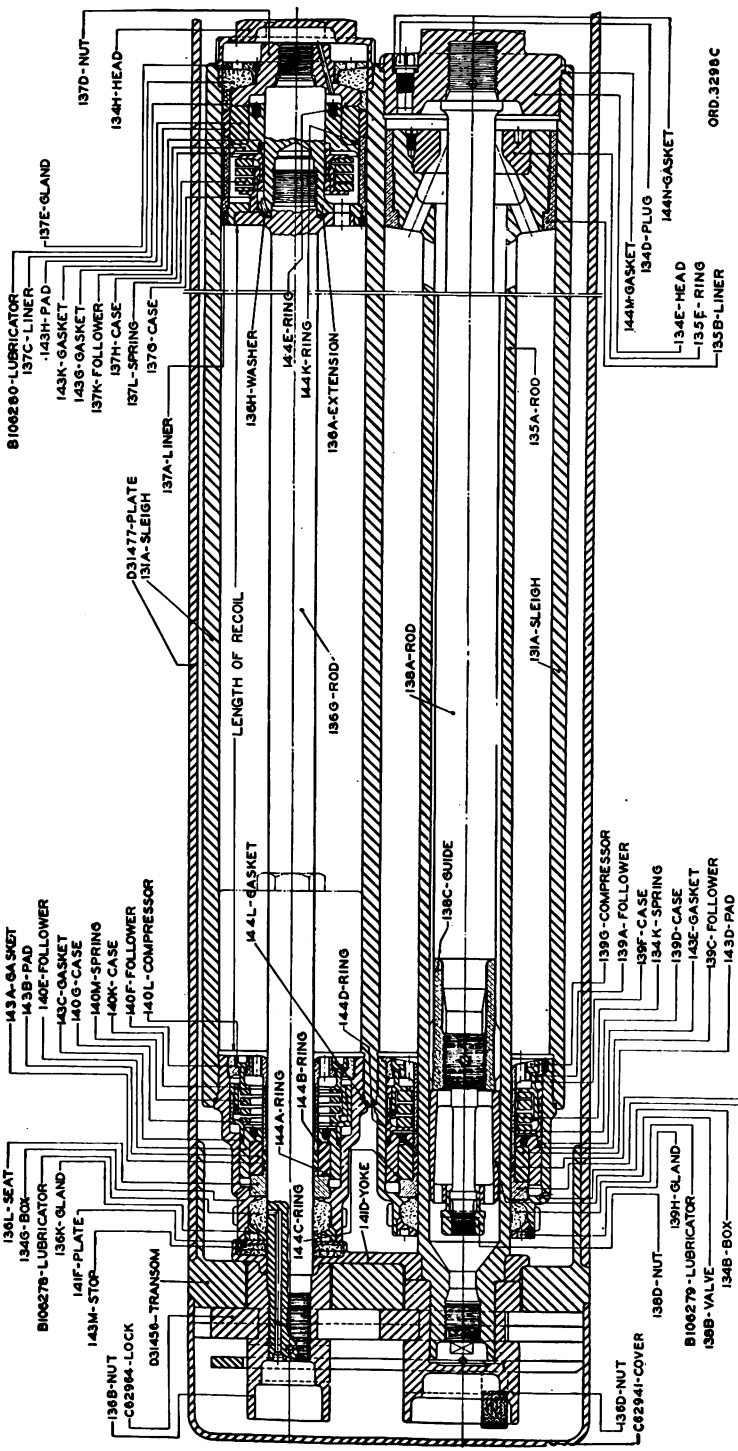
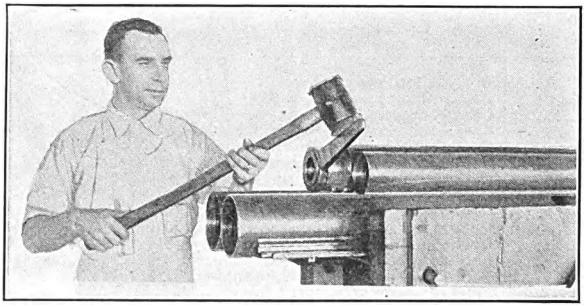


FIGURE 13.—Recoil and counterrecoil mechanism.

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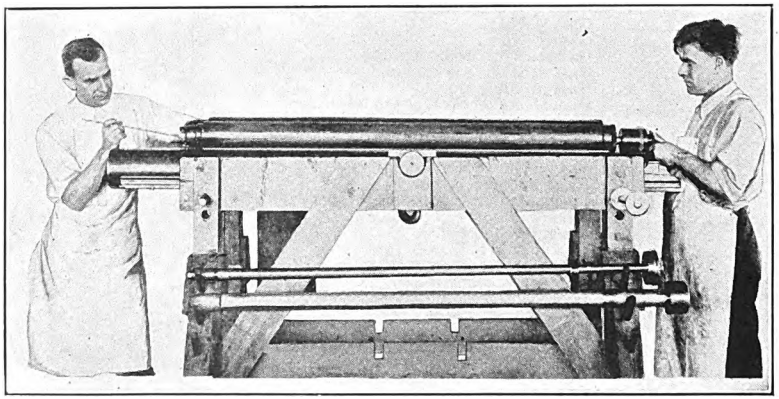
Reference	Item
134G	Box, stuffing, counterrecoil.
134B	Box, stuffing, recoil.
137H	Case, counterrecoil piston spring, inner.
137G	Case, counterrecoil piston spring, outer.
140K	Case, counterrecoil rod spring, inner.
140G	Case, counterrecoil rod spring, outer.
139F	Case, recoil piston rod spring, inner.
139D	Case, recoil piston rod spring, outer.
140L	Compressor, counterrecoil rod packing spring.
139G	Compressor, recoil piston rod packing spring.
C62941	Cover, cradle, front.
136A	Extension, counterrecoil rod.
137K	Follower, counterrecoil piston rubber.
140F	Follower, counterrecoil rod gasket.
140E	Follower, counterrecoil rod rubber.
139A	Follower, recoil piston rod gasket.
139C	Follower, recoil piston rod rubber.
143A	Gasket, No. 1.
143C	Gasket, No. 2.
143G	Gasket, No. 3.
143K	Gasket, No. 4.
143E	Gasket, No. 5.
143F	Gasket, No. 6.
144L	Gasket, 96 by 100 by 2-mm.
144M	Gasket, 114 by 118 by 2-mm.
144N	Gasket, filling plug.
137E	Gland, counterrecoil piston lubricator.
136K	Gland, counterrecoil rod lubricator.
139H	Gland, recoil piston rod lubricator.
138C	Guide, counterrecoil buffer.
134H	Head, cylinder, counterrecoil.
134E	Head, cylinder, recoil.
137A	Liner, counterrecoil piston.
137C	Liner, counterrecoil piston nut.
135B	Liner, recoil piston.
C62964	Lock, piston rod.
B106280	Lubricator, counterrecoil piston.
B106278	Lubricator, counterrecoil rod.
B106279	Lubricator, recoil piston rod.
138D	Nut, counterrecoil buffer rod.
137D	Nut, counterrecoil piston.
136B	Nut, counterrecoil rod.
136D	Nut, recoil piston rod.
143H	Pad, counterrecoil piston rubber.
143B	Pad, counterrecoil rod rubber.
143D	Pad, recoil piston rod rubber.
141F	Plate, counterrecoil stop.
D31477	Plate, cradle.
134D	Plug, filling.
144E	Ring, cup, counterrecoil piston rubber pad, inner.
144K	Ring, cup, counterrecoil piston rubber pad, outer.
144B	Ring, cup, counterrecoil rod rubber pad, inner.
144A	Ring, cup, counterrecoil rod rubber pad, outer.
144D	Ring, cup, recoil piston rod rubber pad, inner.
144C	Ring, cup, recoil piston rod rubber pad, outer.
135E	Ring, throttling, counterrecoil.
138A	Rod, counterrecoil buffer.
136G	Rod, counterrecoil.
135A	Rod, piston, recoil.
136L	Seat, counterrecoil rod packing.
139B	Seat, recoil piston rod packing.
131A	Sleigh.
137L	Spring, packing, counterrecoil piston.
140M	Spring, packing, counterrecoil rod.
134K	Spring, packing, recoil piston rod.
143M	Stop, counterrecoil.
D31456	Transom, cradle.
138B	Valve, counterrecoil.
136H	Washer, lock, counterrecoil rod extension.
141D	Yoke, piston rod.

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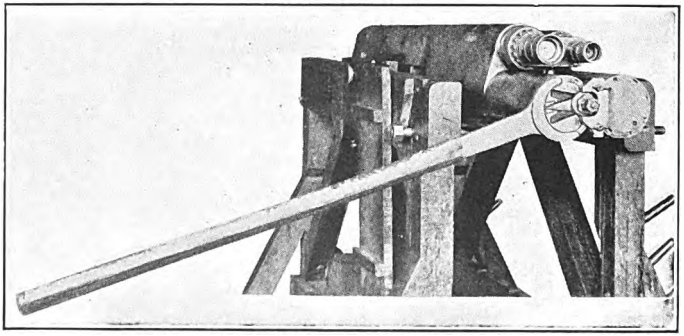
Ord. 12300

FIGURE 14.—Assembling the recoil stuffing box.



Ord. 12299

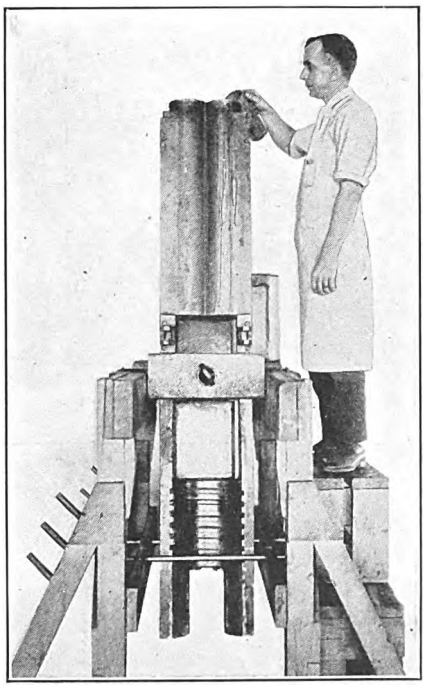
FIGURE 15.—Assembling the counterrecoil rod.



Ord. 12303

FIGURE 16.—Assembly of the left air tank head.

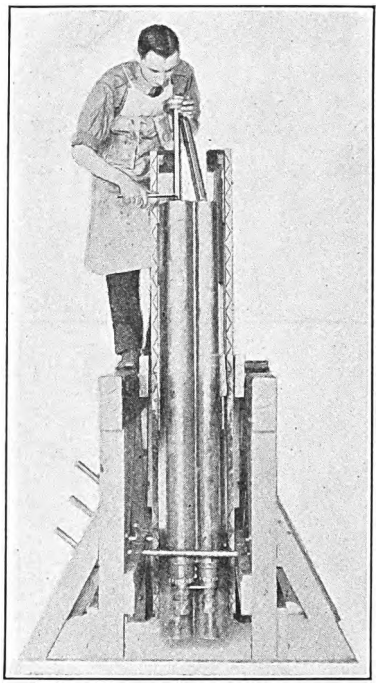
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Ord. 12306

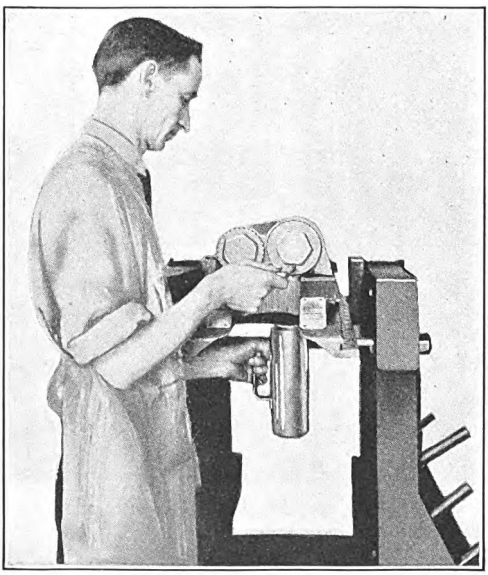
FIGURE 17.—Filling the counterrecoil cylinders.

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Ord. 12312

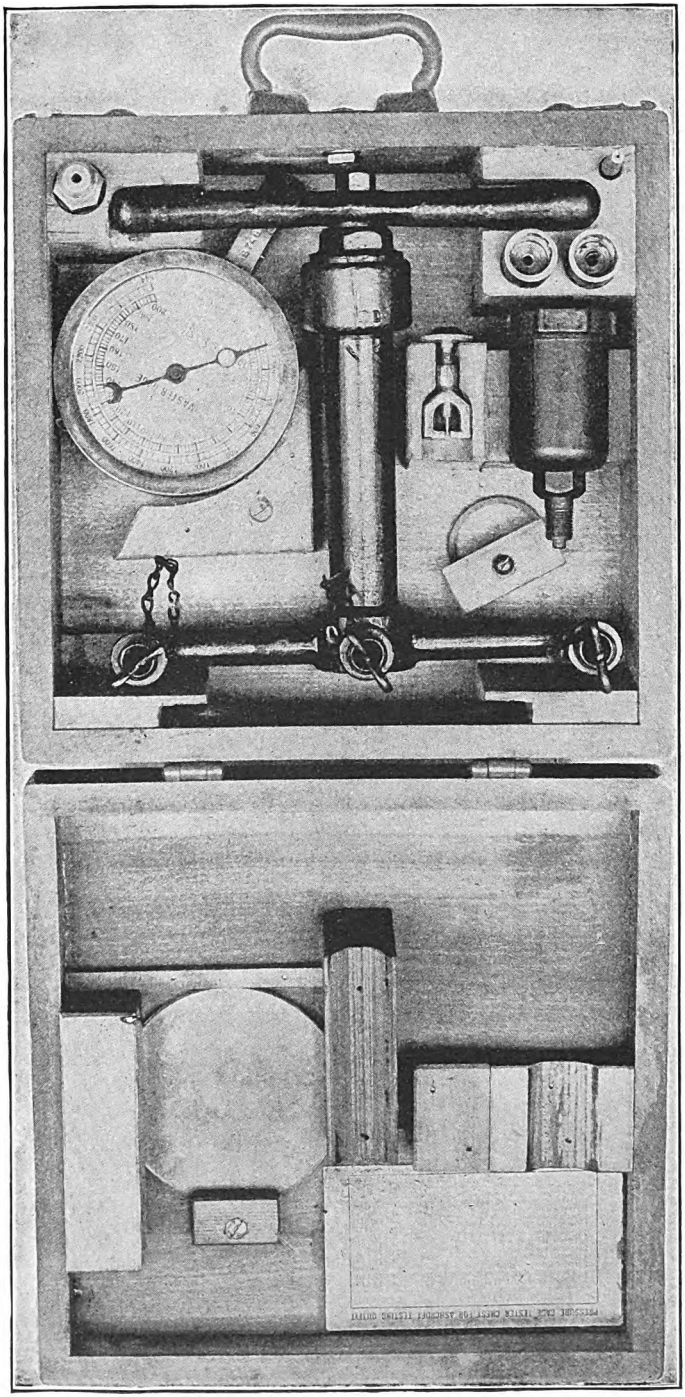
FIGURE 18.—Assembling buffer rod to sleigh.



Ord 12310

FIGURE 19.—Establishing the void in recoil cylinder.

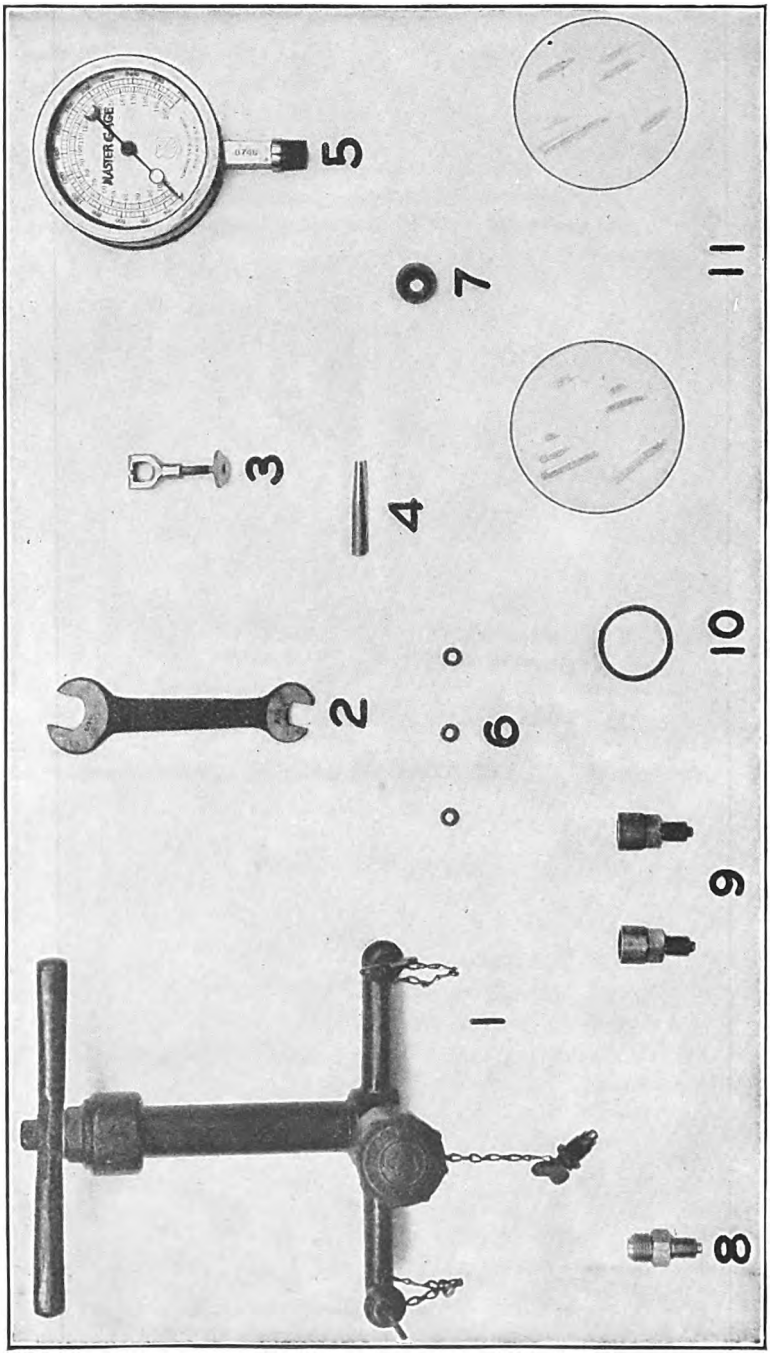
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Ord. 12298

FIGURE 20.—Pressure gage tester chest and contents.

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Ord. 0602

FIGURE 21.—Tools for repairing pressure gages.

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Reference	Item
1. 24–15–7	Tester, pressure gage.
2. TKKX2H	Wrench, engineers, double-head, 5/8 and 7/8 openings (alloy–S).
3. A442	Jack, gage hand.
4. U511P	Set, gage hand.
5. B748	Gage, pressure, master.
6. 24–15–10F	Gaskets, adapter (gage, reservoir and adapter) (spare).
7. 24–15–9D	Gasket, piston suction (spare).
8. 24–15–10D	Adapter, pressure gage tester.[1]
9. 24–15–10Q	Adapters, pressure gage tester.
10. 24–15–10L	Gasket, oil reservoir (spare).
11. A1715	Glasses, pressure gage (spare).

[1] Furnished with all pressure gage tester outfits but used with the 155-mm and 240-mm howitzer matériel only.

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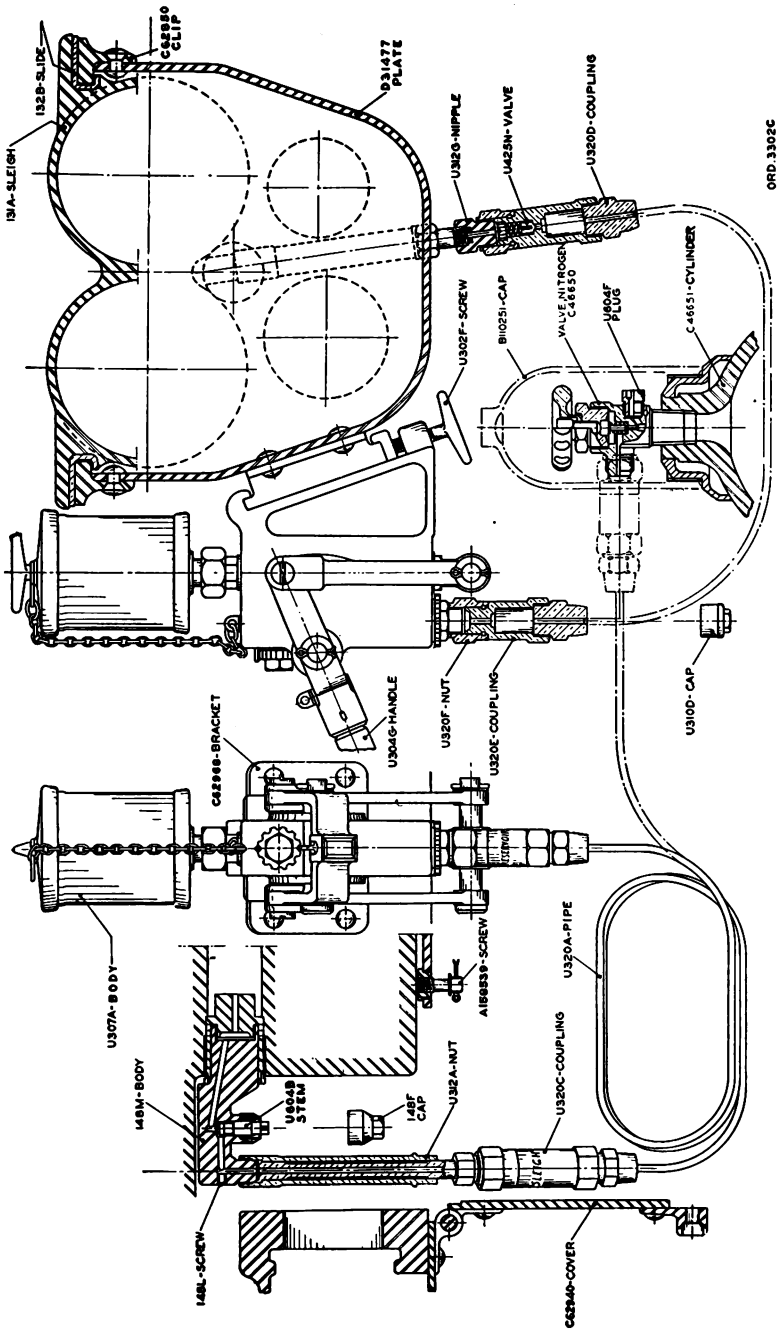


FIGURE 22.—Attachment of liquid pump and compressed nitrogen tank.

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Reference	Item
148M	Body, filling valve body.
U307A	Body, reservoir.
C62968	Bracket, pump.
U310D	Cap, connection.
B110251	Cap, cylinder.
148F	Cap, filling needle valve.
C62850	Clip, cradle, right.
U320D	Coupling, hose, inner.
U320E	Coupling, hose, outer, "Reservoir."
U320C	Coupling, hose, outer, "Sleigh."
C62940	Cover, cradle, bottom.
C46651	Cylinder, compressed gas.
U304G	Handle, lever.
U312G	Nipple.
U312A	Nut, swivel, long.
U320F	Nut, swivel, short.
U320A	Pipe (seamless copper tubing, annealed, 70⅞ inches long).
D31477	Plate, cradle.
U604F	Plug, safety.
U302F	Screw, bracket grip.
A158539	Screw, cradle bottom cover fastening.
148L	Screw, filling valve body screw.
131A	Sleigh.
132B	Slide, sleigh, front, right.
U604B	Stem, filling needle valve.
U425N	Valve, check.
C46650	Valve, nitrogen.

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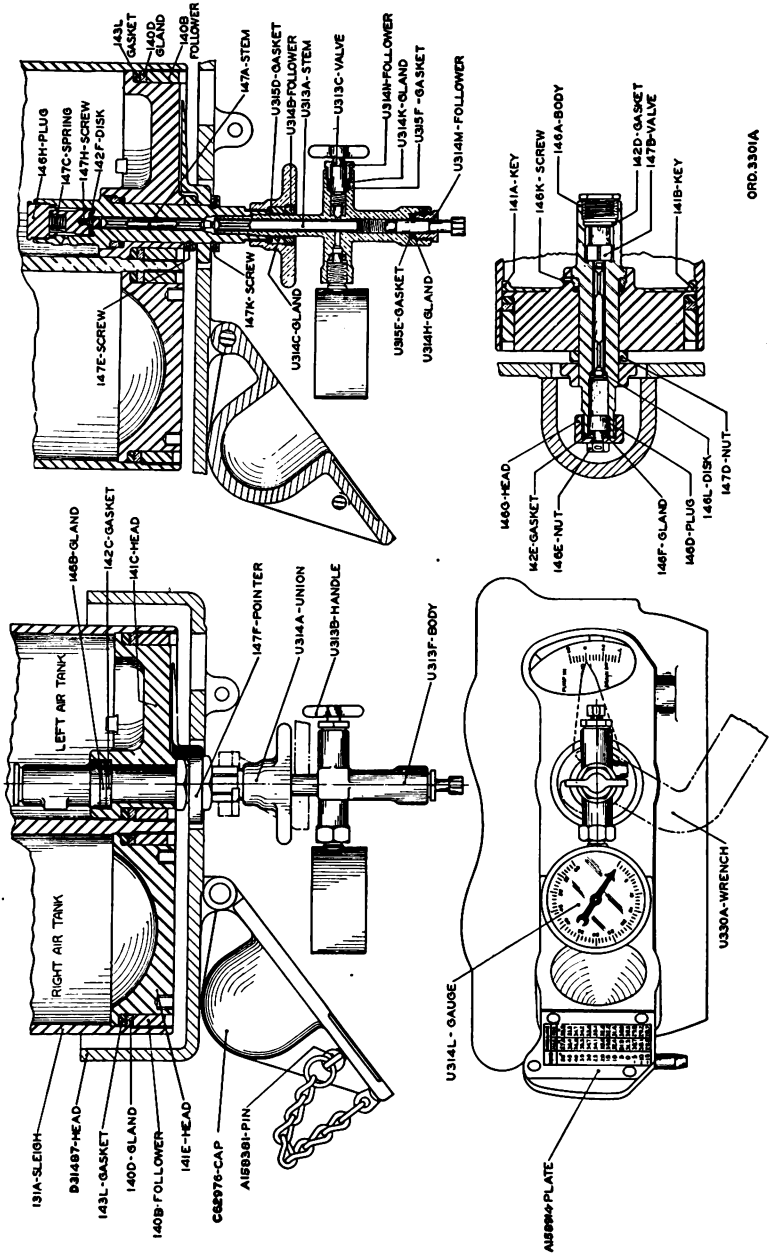


FIGURE 23.—Gage cock, with pressure gage and adapter.

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Reference	Item
U313F	Body.
146A	Body.
C62976	Cap, cradle head.
146L	Disk, gage cock body.
142F	Disk, gage cock valve.
U314N	Follower, adapter needle valve.
U314M	Follower, adapter stem.
140B	Follower, air tank head.
U314B	Follower, union gland.
U314L	Gage, pressure, 60 kg.
143L	Gasket, No. 7 (air tank head—dermatine, 122 I. D. by 137.5 O. D. by 5-mm thick).
142C	Gasket, No. 8 (gage cock body—dermatine, 28 I. D. by 35.9 O. D. by 3-mm thick).
142D	Gasket, No. 9 (gage cock plug—dermatine, 20.1 I. D. by 23.9 O. D. by 2-mm thick).
142E	Gasket, No. 10 (gage cock body head—dermatine, 6.1 I. D. by 14 O. D. by 2-mm thick).
U315D	Gasket, adapter, No. 1 (union—dermatine, 14 I. D. by 23 O. D. by 2-mm thick).
U315E	Gasket, adapter, No. 2 (stem—dermatine, 10 I. D. by 17.9 O. D. by 3-mm thick).
U315F	Gasket, adapter, No. 4 (needle valve—dermatine, 11.1 I. D. by 16.9 O. D. by 7-mm thick).
U314C	Gland, adapter.
U314K	Gland, adapter needle valve.
U314H	Gland, adapter stem.
140D	Gland, air tank head (122 I. D. by 137.43 O. D. by 5-mm thick).
146F	Gland, gage cock body plug.
U146B	Gland, gasket No. 8 (gage cock body).
U313B	Handle, adapter.
D31487	Head.
141C	Head, air tank, left.
141E	Head, air tank, right.
146G	Head, gage cock body.
141B	Key, air tank head, lower.
141A	Key, air tank head, upper.
147D	Nut, gage cock body.
146E	Nut, gage cock body plug.
A158381	Pin, cradle head cap latch.
A158914	Plate, correction pressure.
146D	Plug, gage cock body, front.
146H	Plug, gage cock body, rear.
147F	Pointer, gage cock.
147K	Screw, gage cock pointer.
147H	Screw, gage cock valve.
147E	Screw, hdls., pointed, 5 by 7.5-mm.
146K	Screw, locking, gland.
131A	Sleigh.
147C	Spring, gage cock valve.
U313A	Stem, adapter.
147A	Stem, gage cock valve.
U314A	Union, pressure gage adapter.
U313C	Valve, adapter needle.
147B	Valve, gage cock.
U330A	Wrench, gage cock and filling pipe coupling.

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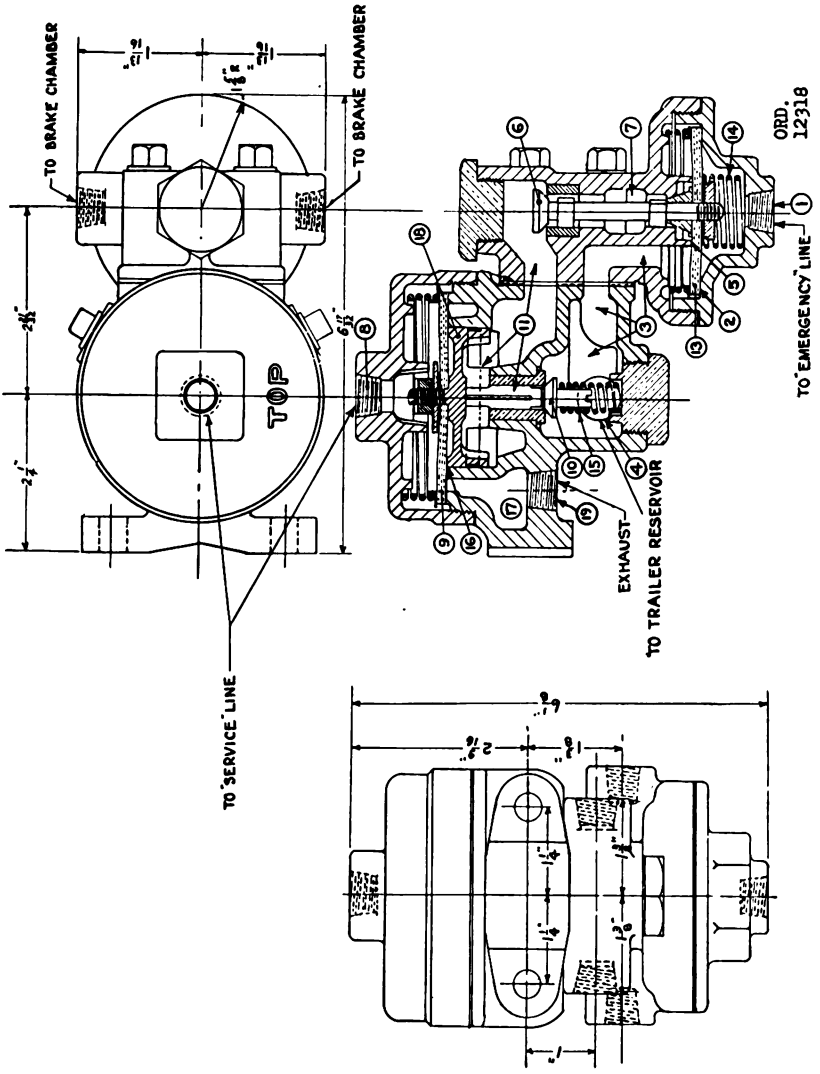


FIGURE 24.—Relay emergency valve power brake mechanism.

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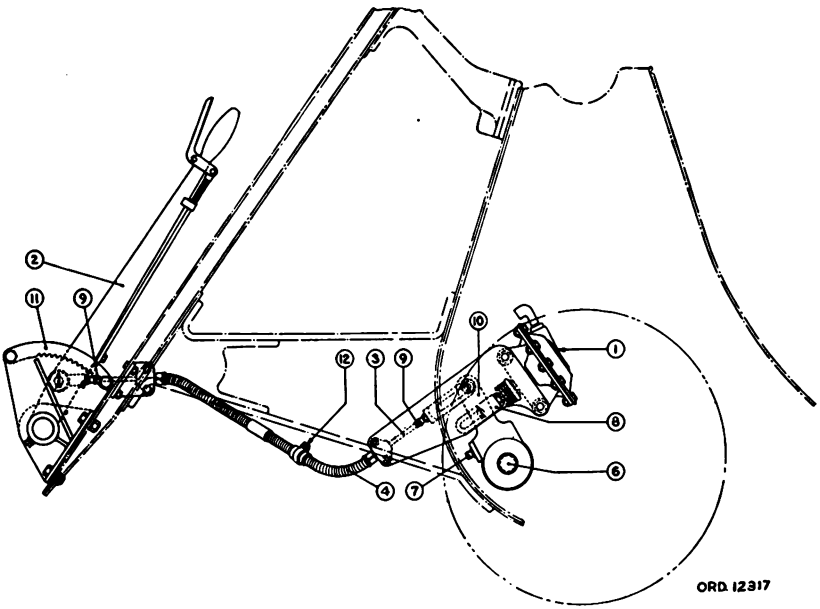


FIGURE 25.—Brake mechanism.

[A. G. 062.12 (11-27-39).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

E. S. ADAMS,
Major General,
The Adjutant General.

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ANTIAIRCRAFT AMMUNITION

AMMUNITION FOR 3-INCH AND 105-MM ANTIAIRCRAFT GUNS

CHANGES No. 2

WAR DEPARTMENT,
WASHINGTON, *January 2, 1940.*

TR 1360-3A, July 31, 1936, is changed as follows:

24. General.

* * * * * * *

b. Permissible fuzes.—* * *

Projectile	Permissible fuzes				
	Mk. III	Mk. IIIA1	Mk. IIIA2	M43	M2
3-inch antiaircraft					
Shell, high-explosive, Mk. IX	(1)	(1)	Yes	(2)	No.
Shell, high-explosive, M42	No	No	Yes	Yes	No.
Shrapnel, Mk. I	Yes	Yes	No	No	No.
105-mm antiaircraft					
Shell, high-explosive, M38	No	No	No	No	Yes.
Shell, practice, M38	No	No	No	No	Yes.

[1] Fuzes, Mk. III and Mk. IIIA1 may be used with high-explosive shell, Mk. IX, when that shell is assembled with Mk. X boosters. This shell and fuze will not be used with any booster other than Mk. X except in an emergency and when directed by the Chief of Ordnance.

(2) Indicates that the fuze is not prescribed but there is no reason against its use from a standpoint of safety and functioning.

* * * * * * *

[A. G. 062.12 (12-26-39).] (1940.)

BY ORDER OF THE SECRETARY OF WAR:

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Chief of Staff.

OFFICIAL:

E. S. ADAMS,
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JAN 29 1940

MISCELLANEOUS AMMUNITION

AMMUNITION, GENERAL

CHANGES No. 7

WAR DEPARTMENT,
WASHINGTON, *January 2, 1940.*

TR 1370–A, March 24, 1930, is changed as follows:

40. Ball ammunition.—*a.* * * *

(1) The **caliber .30,** M1906, **ball** ammunition has a bullet weighing 150 grains with a cupronickel jacket and a lead-antimony core, the base of the bullet being flat in contradistinction to a boat-tail base.

(2) The caliber .30, M1, ball ammunition has a bullet weighing 172 grains with a gilding metal jacket and a lead-antimony core, the base of the bullet having a 9° boat-tail.

(3) The caliber .30, M2, ball ammunition has a bullet weighing approximately 152 grains with a tin coated gilding metal jacket to distinguish it from caliber .30, M1, ball ammunition. The bullet has a lead-antimony core, a flat base, and a 7 caliber radius ogive.

* * * * * * *

[A. G. 062.12 (6–30–39).] (1939.)

43. Blank ammunition.—The service blank cartridge, M1909, is used in the caliber .30 rifles in maneuvers, for signaling purposes, and for firing salutes. It is used in machine guns equipped with blank firing attachments in order to function these weapons for instructional purposes. **(For precautions in firing blank ammunition, see par. 19, TR 1350–A.)** Corresponding to this is the blank cartridge for the caliber .45 revolver. The case of this cartridge, however, differs from the caliber .45 ball **cartridge** in that it has an extracting rim in place of the groove or cannelure. **Other blank cartridges of obsolete models may be found in service. However, no blank cartridges except those authorized in TR 1350–A will be fired.**

[A. G. 062.12 (6–30–39).] (1939.)

50. Characteristics and marks of identification.—Lines Nos. 8 and 9 of the table are rescinded.

[A. G. 062.12 (6–30–39).] (1939.)

59. Rifle grenades.—Rescinded.

[A. G. 062.12 (6–30–39).] (1939.)

62. Storage caution.—Due to the fact that white phosphorus ignites spontaneously when exposed to the air and that grenade

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bodies may develop leaks through corrosion, phosphorus filled grenades have been found dangerous for indefinite continuous storage. It has been found necessary to prescribe a limiting time within which such grenades must either be expended or destroyed. The limiting date within which white phosphorus grenades should be expended will be stenciled on the boxes by the issuing depot at the time of issue to a tactical unit. This limiting date has been set at 12 months from date of issue by the depot, and the tactical unit receiving the grenades will take steps to expend or destroy the grenades before the expiration of this period.

[A. G. 062.12 (6-30-39).] (1939.)

BY ORDER OF THE SECRETARY OF WAR:

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TOPOGRAPHY AND SURVEYING

MECHANICAL DRAFTING

CHANGES
No. 1

WAR DEPARTMENT,
WASHINGTON, *April 15, 1939.*

Technical Regulations 1190–26, September 8, 1925, is rescinded.

[A. G. 062.12 (2–1–39).]

BY ORDER OF THE SECRETARY OF WAR:

MALIN CRAIG,
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INFANTRY AND AIRCRAFT ARMAMENT

BROWNING MACHINE GUN, CALIBER .50, M1921, WATER-COOLED

CHANGES No. 3

WAR DEPARTMENT,
WASHINGTON, *January 3, 1939.*

TR 1300–50A, June 4, 1932, is changed as follows:

30. Points to be observed before, during, and after firing.—* * *

Points to be observed before, during, and after firing

	Before	During	During temporary cessation	After
*	* *		* *	* *
Miscellaneous precautions.	Examine all parts of gun as thoroughly as time permits. See that oil buffer tube is filled with oil.		Make all necessary preparations to resume an effective fire.	Unload. Inspect gun each day for several succeeding days and clean until all signs of fouling have been eliminated. Fill oil buffer tube with oil, if necessary.

[A. G. 062.12 (11-4-38).] (1938.)

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115889°—39

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WEAPONS

BROWNING TANK MACHINE GUN, CALIBER .30, MODEL OF 1919

CHANGES No. 4

WAR DEPARTMENT,
WASHINGTON, *January 3, 1939.*

TR 1320–39, May 1, 1926, is changed as follows:

24. Points to be observed before, during, and after firing.

* * * * * * *

c. Points to be observed during firing.— * * *

* * * * * * *

(3) Rescinded.

* * * * * * *

[A. G. 062.12 (11–4–38).] (1938.)

BY ORDER OF THE SECRETARY OF WAR:

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INFANTRY AND AIRCRAFT AMMUNITION

AMMUNITION FOR SMALL ARMS AND AUTOMATIC GUNS

CHANGES No. 4

WAR DEPARTMENT,
WASHINGTON, *January 3, 1939.*

TR 1350–A, May 18, 1934, is changed as follows:

14. Defects found after firing.

* * * * * * *

d. Hangfire (delayed ignition of the powder in the cartridge).—This can be caused by a small **or decomposed** primer pellet, damp powder, **or a light blow of the firing pin caused by dirt or a defect in the weapon. While a hangfire is a serious defect if the delay is long enough to permit the bolt to be opened before the powder burns, such delay is rarely found in practice. Should a hangfire of several seconds delay occur and the bolt be opened before the powder burns, injury to the firer or damage to the weapon, or both, may result. Such injury or damage is less likely to occur with a machine gun than a rifle.**

* * * * * * *

[A. G. 062.12 (11–4–38).] (1938.)

20. General rules.— * * *

* * * * * * *

e. **Because a misfire cannot be immediately distinguished from a hangfire, it is unsafe to open immediately the bolt of the rifle should a misfire occur (par. 14). In such cases the rifle should be recocked by drawing back the cocking piece and refired before opening the bolt.**

* * * * * * *

[A. G. 062.12 (11–4–38).] (1938.)

53. Grades and uses.—*a.* Caliber .45 ball cartridges, M1911, are classified in three grades, that is, 1, 2, and 3, **and as RT.**

(1) Grade 1 ammunition consists of those lots which are likely to retain the best stability over long periods of storage. **Grade 1 ammunition will be issued for use in the caliber .45 Colt and Smith and Wesson revolvers; and may be issued for use in the caliber .45 automatic pistol, M1911 and M1911A1, and Thompson submachine gun, when Grade 2 ammunition is not available.**

(2) **Grade 2 ammunition will be issued wherever available for use in the caliber .45 automatic pistol, M1911 and**

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INFANTRY AND AIRCRAFT AMMUNITION

AMMUNITION FOR SMALL ARMS AND AUTOMATIC GUNS

CHANGES No. 5

WAR DEPARTMENT,
WASHINGTON, *October 20, 1939.*

TR 1350–A, May 18, 1934, is changed as follows:

4. Type.—* * *

a. Caliber .30.

(1) Cartridge, ball, M1906 and M1.
(2) Cartridge, armor piercing, M1918 and M1922.
(3) Cartridge, tracer, M1917, M1923, M1924, and M1.
(4) Cartridge, high-pressure test.
(5) Cartridge, dummy, M1906 (corrugated).
(6) Cartridge, dummy, range, M1921 and M1 (slotted).
(7) Cartridge, blank, M1909.
(8) Cartridge, gallery practice, M1919 (present standard for guard purposes).
(9) Cartridge, guard, M1906 and M1.

* * * * * * *

[A. G. 062.12 (9–11–39).]

7. Clips, bandoleers, and cartons.

* * * * * * *

b. Bandoleers.—The purpose of the * * * ammunition is loaded. The packed or loaded bandoleer weighs approximately 3.91 pounds with M1906 **or M2** ammunition and 4.08 pounds with M1 ammunition.

* * * * * * *

[A. G. 062.12 (9–11–39).]

10. Ammunition lots.

* * * * * * *

c. The ammunition lot number is the means by which all service ammunition is identified and its importance is paramount. The incorrect reporting of an ammunition lot might result in the condemning of large quantities of serviceable ammunition or the issue of condemned ammunition to the service. The only letters used in connection with lots of M1 **or M2** ammunition are the initials of the manufacturer. In reporting ammunition, the following is the correct way to describe a particular lot: "Cartridge, ball cal. .30, M1, Lot F. A. 900" or "Cartridge, tracer, cal. .50, M1, Lot F. A. 28," etc.

* * * * * * *

[A. G. 062.12 (9–11–39).]

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19. Precautions in firing blank ammunition.—*a.* (1) It is dangerous to fire a rifle loaded with a blank cartridge at a representative enemy at distances of less than 20 yards, as the wad or paper cup may fail to break up. **No blank cartridges, other than those authorized below, will be used for blank firing.**

(2) All cartons are plainly marked and markings should be strictly checked before the ammunition is issued. The M1909 caliber .30 blank cartridge is similar in appearance to some of the M1909 caliber .30 high-pressure blank cartridges **formerly used for firing rifle grenades.** The carton markings, **however,** show the difference.

* * * * * * *

[A. G. 062.12 (9–11–39).]

21. General description.—*a.* The cartridge, ball, caliber .30, M1, was adopted in the early part of 1926, after a series of experiments with various types of bullets. The development work was undertaken primarily to gain increased range and superior accuracy over the wartime M1906 cartridge. **The cartridge, ball, caliber .30, M1, is now the standard type for belt-fed weapons.**

* * * * * * *

[A. G. 062.12 (9–11–39).]

26. General description.—*a.* While the caliber .30, M1, **and caliber .30, M2,** ball ammunition **have** superseded the M1906 as standard for manufacture, the description of the latter is given in this section in view of the considerable stock of M1906 ammunition that remains on hand. The M1906 cartridge was the standard service ball ammunition from 1906 until 1926 and will be continued in use until the present stocks become exhausted. **It is used in all caliber .30 nonbelt-fed weapons (rifles, automatic rifles, and semiautomatic rifles), and in all caliber .30 belt-fed weapons (machine guns), when used for training purposes on ranges which are unsafe or unsuitable for use of the M1 ball ammunition.**

* * * * * * *

[A. G. 062.12 (9–11–39).]

27. Identification.—*a.* The cartridge, ball, caliber .30, M1906, has a contour similar to the cartridge, ball, caliber .30, M1. It is distinguished from M2 ammunition only by the markings on the packing box, or carton, or the ammunition data card packed therewith.

* * * * * * *

[A. G. 062.12 (9–11–39).]

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76. Cartridge, rifle grenade, caliber .30, M1.—Rescinded.

[A. G. 062.12 (9–11–39).]

87. Shotgun shells.

* * * * * * *

b. The shell consists of a brass head, a paper case or shell body, a primer, cardboard and felt wads, a smokeless powder charge, and a load of lead shot. Some paper shot shell have a steel reinforcement under the brass head, sometimes referred to as the lining.

* * * * * * *

(2) The brass head is reinforced inside by a base of compressed paper in which the primer pocket is formed. It is attached to the paper shell body by crimping. On shotgun shells for guard and combat use the brass heads extend for a distance of 1 inch up the side of the shell body to a point opposite the lower over-powder wad. On shells for trapshooting or hawk load the brass heads extend only half this distance.

* * * * * * *

[A. G. 062.12 (9–11–39).]

Section XX

CARTRIDGE, BALL, CALIBER .30, M2

	Paragraph
General description	91
Identification	92
Grades and uses	93
Packing	94
Exterior ballistics	95

91. General description.—*a.* Cartridge, ball, caliber .30, M2, was adopted as a standard type in August 1938. This cartridge has adequate power and range to satisfy the requirements of nonbelt-fed weapons. It has less recoil and therefore is less fatiguing than the cartridge, ball, caliber .30, M1, when used in shoulder weapons. It also has the advantage of causing less erosion.

b. The cartridge consists of a case, primer, charge of smokeless powder, and bullet. The primer is secured in the case by crimping. A waterproofing substance placed inside the neck of the case at the time of assembly and a drop of shellac on the joint between the primer and the primer pocket in the case make the cartridge waterproof. The components are described as follows:

(1) Cartridge case (par. 5*a*).

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(2) Primer (par. 5*b*).

(3) Propelling charge. The propelling charge is a "progressive burning" nitrocellulose powder (par 5*d*).

(4) The bullet, weighing approximately 150 grains, has a tin-coated gilding metal jacket over a lead antimony core. It is approximately 1.145 inches long, has a flat base and a 7 caliber radius ogive. The mouth of the cartridge case is crimped into the cannelure of the bullet thereby securing the bullet to the cartridge case. The minimum pull required to extract the bullet from the case is 45 pounds.

c. Weights; cartridge and components.

Item	*Weight in grains**
Cartridge, complete	391.
Cartridge case (unprimed)	195.−20
Primer (loaded)	5.594−.224
Bullet	152.−3
Lead core	97.5−1.5
Jacket	54.5−1.5
Powder charge (approximate)	50.

*7,000 grains=1 pound avoirdupois.

92. Identification.—Although the cartridge, ball, caliber .30, M2, has a contour similar to that of the cartridge, ball, caliber .30, M1, these cartridges may be distinguished by their bullets. The tin-coated jacket of the M2 bullet has a silvery appearance whereas the gilding metal jacket of the M1 bullet is copper colored. The M2 ball ammunition can be distinguished from the M1906 ball ammunition only by the marking on the container and the numerals 38 or higher stamped on the head of the cartridge case. The numerals 21 or lower are stamped on the head of the cartridge case of M1906 ball ammunition. The ammunition lot number, manufacturer's name, caliber and type, constitute a reference by which any information regarding the cartridges can be obtained. The marking on the outside of the sealed packing box will positively identify the ammunition. In examining a box of ammunition for identification, proceed as follows: Examine the outside of the packing box, the carton, or bandoleer card. If the ammunition lot number on the packing box agrees with the ammunition lot number stamped or printed on the carton or bandoleer card, the lot is positively identified by that number. With the exception of the contained number of car-

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tridges and the caliber, no number appears on the packing box except the ammunition lot number. This change in the marking on the packing box was made in 1934 and was for the purpose of preventing confusion between the ammunition lot number and the powder lot number. Prior to the official adoption of cartridge, ball, caliber .30, M2, some lots similar in all respects to it were made at Frankford Arsenal and the ammunition was designated CARTRIDGE, ball, cal. .30, M1906, ammunition lots being numbered Frankford Arsenal 1976 to 1984, inclusive. More of this ammunition was manufactured at Frankford Arsenal in the period between November 1937 and May 1938 and the covering lot numbers were Frankford Arsenal 2030 to 2041, inclusive. After the adoption of the ammunition as M2, ammunition lot numbers 3000 to 3999, inclusive, were assigned as lot numbers for future procurement of M2 ammunition.

93. Grades and uses.—*a.* Cartridge, ball, caliber .30, M2, is graded "R" and "MG." Grade "R" covers ammunition primarily intended for use in rifles, semiautomatic, and automatic rifles. Grade "MG" covers ammunition primarily intended for use in ground machine guns. For the grade of particular lots see OFSB 3–5.

b. Grade 3 ammunition is unserviceable and will not be used for any purpose. (See par. 11*f*.)

94. Packing.—*a.* Cartridge, ball, caliber .30, M2, is packed in cartons, in clips in bandoleers, in clips in cartons, and in machine-gun belts.

b. The methods of marking the packing boxes for this ammunition as shown on the applicable ordnance drawings are as follows:

(1) *Ammunition for ground machine-gun use (in cartons).*

Marking on one side of box		*Marking on ends of box*	
Line	*Marking*	*Line*	*Marking*
1	1,500 cartridges	1	1,500 cartridges
2	Ball	2	Ball
3	Cal. .30, M2	3	Cal. .30, M2
4	In cartons	4	In cartons
5	For ground machine-gun use	5	(Shell and flame)
6	Ammunition Lot No.	6	Lot (manufacturer's initials, number of lot)
7	(Name of manufacturer)		

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(2) *Ammunition for ground machine-gun use (in belts).*

Marking on one side of box		*Marking on ends of box*	
Line	*Marking*	*Line*	*Marking*
1	1,250 cartridges	1	1,250 cartridges
2	Ball	2	Ball
3	Cal. .30, M2	3	Cal. .30, M2
4	In machine-gun belts	4	In belts
5	For ground machine-gun use	5	(Shell and flame)
6	Ammunition Lot No.	6	Lot (manufacturer's initials, number of lot)
7	(Name of manufacturer)		

(3) *Ammunition for rifle use (in clips in bandoleers).*

Marking on one side of box		*Marking on ends of box*	
Line	*Marking*	*Line*	*Marking*
1	1,200 cartridges	1	1,200 cartridges
2	Ball	2	Ball
3	Cal. .30, M2	3	Cal. .30, M2
4	In clips in bandoleers	4	In bandoleers
5	Ammunition Lot No.	5	(Shell and flame)
6	(Name of manufacturer)	6	Lot (manufacturer's initials, number of lot)

(4) *Ammunition for rifle use (clips and cartons).*

Marking on one side of box		*Marking on ends of box*	
Line	*Marking*	*Line*	*Marking*
1	1,500 cartridges	1	1,500 cartridges
2	Ball	2	Ball
3	Cal. .30, M2	3	Cal. .30, M2
4	In clips in cartons	4	In clips
5	Ammunition Lot No.	5	In cartons
6	(Name of manufacturer)	6	(Shell and flame)
		7	Lot (manufacturer's initials, number of lot)

c. The wooden packing box is painted brown. A red band 4 inches wide is painted on the center of each side from top to bottom and continued across the top of the box. Across each end of the box above the handle cut is a red band 2 inches wide. The ammunition lot number is stamped on

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the top, both sides, and the ends of the packing box. The marking is in yellow.

d. The packing box with lid and metal liner weighs approximately 20 pounds. Exclusive of box and liner, 1,200 rounds in clips in bandoleers weigh approximately 76 pounds; 1,500 rounds in clips in cartons weigh approximately 94 pounds; 1,500 rounds in cartons weigh approximately 89 pounds.

95. Exterior ballistics.—The exterior ballistics for the cartridge, ball, caliber .30, M1906, shown in paragraph 30 are applicable to cartridge, ball, caliber .30, M2.

[A. G. 062.12 (9-11-39).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:
E. S. ADAMS,
Major General,
The Adjutant General.

U. S. GOVERNMENT PRINTING OFFICE: 1939

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ANTIAIRCRAFT AMMUNITION

AMMUNITION FOR 3-INCH AND 105-MM ANTIAIRCRAFT GUNS

CHANGES No. 1

WAR DEPARTMENT,
WASHINGTON, *January 3, 1939.*

TR 1360–3A, July 31, 1936, is changed as follows:

28. Fuzes, obsolete.—Rescinded.

[A. G. 062.12 (8–12–38).] (1938.)

BY ORDER OF THE SECRETARY OF WAR:

MALIN CRAIG,
Chief of Staff.

OFFICIAL:

E. S. ADAMS,
Major General,
The Adjutant General.

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MISCELLANEOUS AMMUNITION

AMMUNITION, GENERAL

CHANGES No. 6

WAR DEPARTMENT,
WASHINGTON, *January 3, 1939.*

TR 1370–A, March 24, 1930, is changed as follows:

141. Small-arms ammunition.

* * * * * * *

d. **Accidents, as the result of hangfires, have been reported with rifles when using ammunition of wartime manufacture. These were due to opening the bolt too soon after what was thought to be a misfire. If a misfire occurs in a rifle, the rifle should be recocked by drawing back the cocking piece and refired before opening the bolt.** When **a hangfire occurs** in any lot, its use should be suspended and a report made to the post ordnance officer, giving the number of the lot involved. The ammunition thus affected will be replaced by serviceable ammunition.

* * * * * * *

[A. G. 062.12 (11–4–38).] (1938.)

BY ORDER OF THE SECRETARY OF WAR:

MALIN CRAIG,
Chief of Staff.

OFFICIAL:

E. S. ADAMS,
Major General,
The Adjutant General.

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TECHNICAL REGULATIONS
No. 1320–DO

WAR DEPARTMENT,
WASHINGTON, *March 14, 1939.*

FIRE CONTROL AND SIGHTING MATÉRIEL FOR ANTIAIRCRAFT ARTILLERY

ANTIAIRCRAFT BATTERY COMMANDER'S OBSERVATION INSTRUMENT, M1

Prepared under direction of the Chief of Ordnance

	Paragraph
General	1
Description	2
Operation	3
Disassembly and assembly	4
Tests and adjustments	5
Care and preservation	6
Equipment	7
Data	8

1. General.—*a. Purpose.*—These regulations are published for the information and guidance of the using arms, Reserve Officers' Training Corps students, Reserve officers, and all personnel charged with the maintenance of antiaircraft battery commander's observation instrument, M1.

b. Scope.—In addition to descriptive matter and illustrations, instructions are contained herein for the operation, assembly and disassembly, tests and adjustments, and care and preservation of this instrument.

c. References.—For nomenclature and lists of equipment for the instrument, refer to Standard Nomenclature List (SNL) No. F–58. Tripods are covered in Standard Nomenclature List (SNL) No. F–101.

2. Description.—The antiaircraft artillery battery commander's observation instrument, M1 is designed for use in identifying possible aerial targets and as a spotting instrument. It may also be used in lieu of a surveyor's transit for orienting the entire battery. The instrument comprises two separate optical systems: the observer's telescope, by means of which the observer follows the target, and the battery commander's telescope, available to the battery commander at all times. The instrument complete (figs. 1, 2, and 3) includes a mount, a telescope, M3, an elbow telescope, M2, and a type A tripod. Instruments for the National Guard are provided with an elbow telescope, M2A1 in addition to the elbow telescope, M2. The elbow telescope, M2 is for use by the observer; the telescope, M3 is for use by the battery commander and is supplemented by the elbow telescope, M2A1 when provided.

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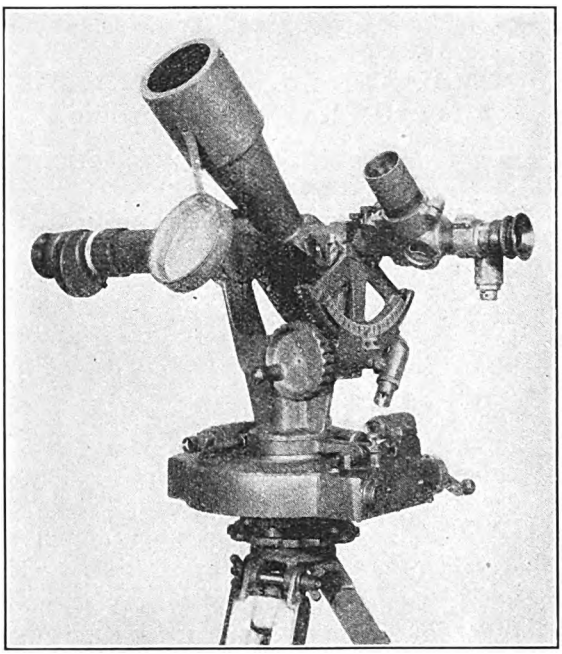


FIGURE 1.—Antiaircraft battery commander's observation instrument, M1 (front view).

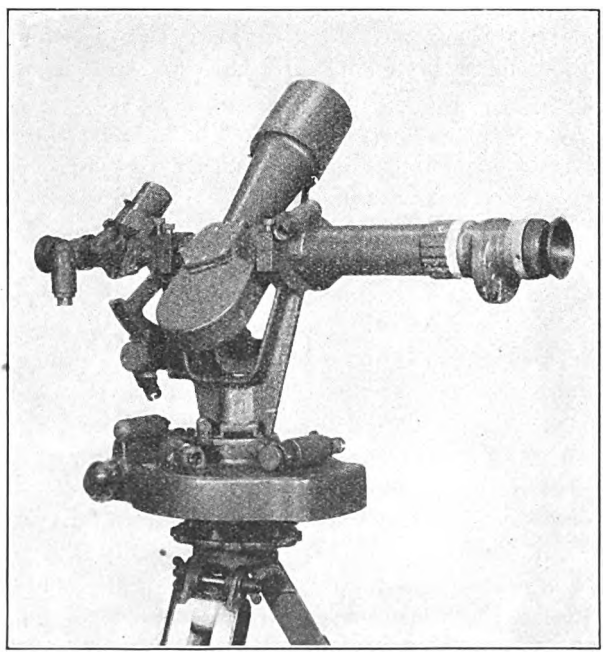


FIGURE 2.—Antiaircraft battery commander's observation instrument, M1 (rear view).

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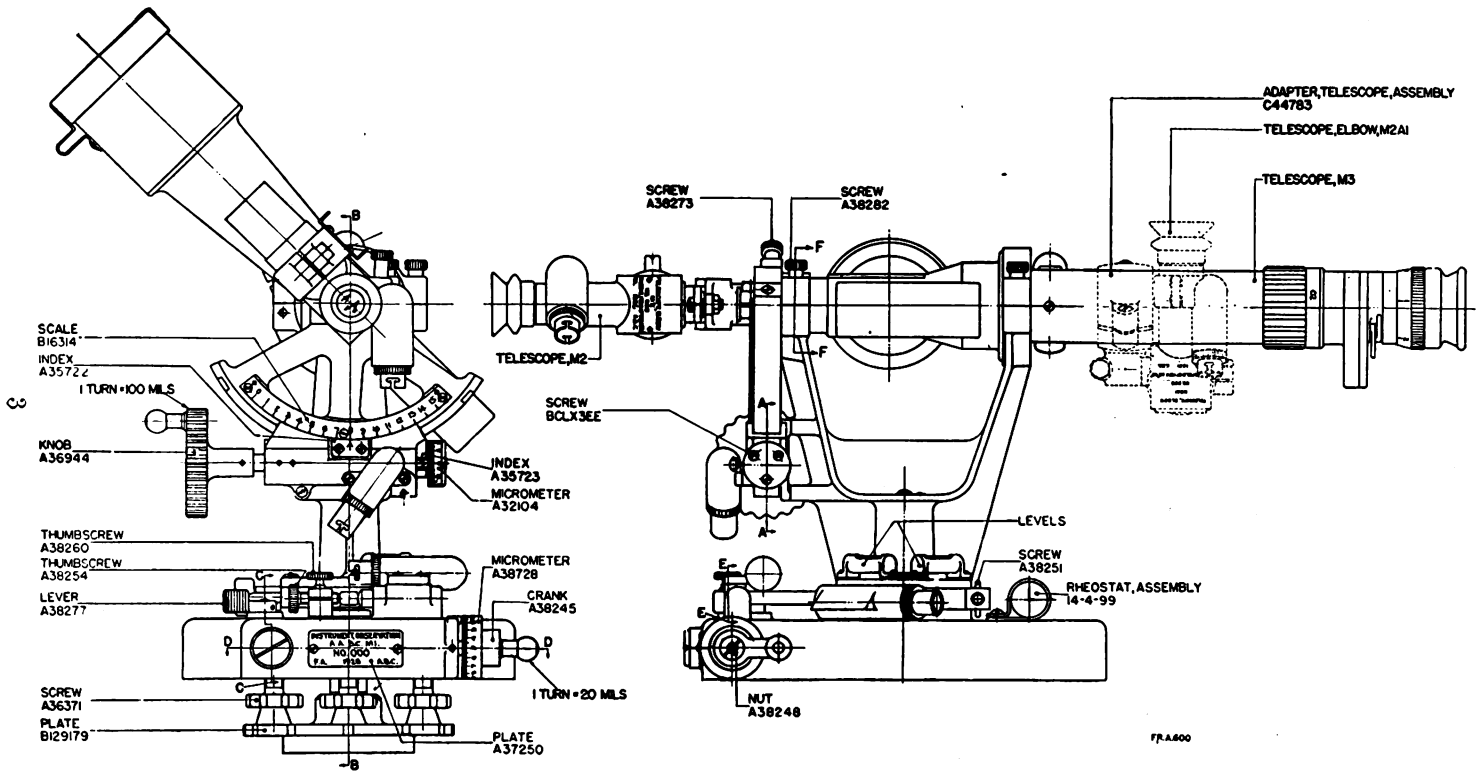


FIGURE 3.—Antiaircraft battery commander's observation instrument, M1, assembled view, without tripod.

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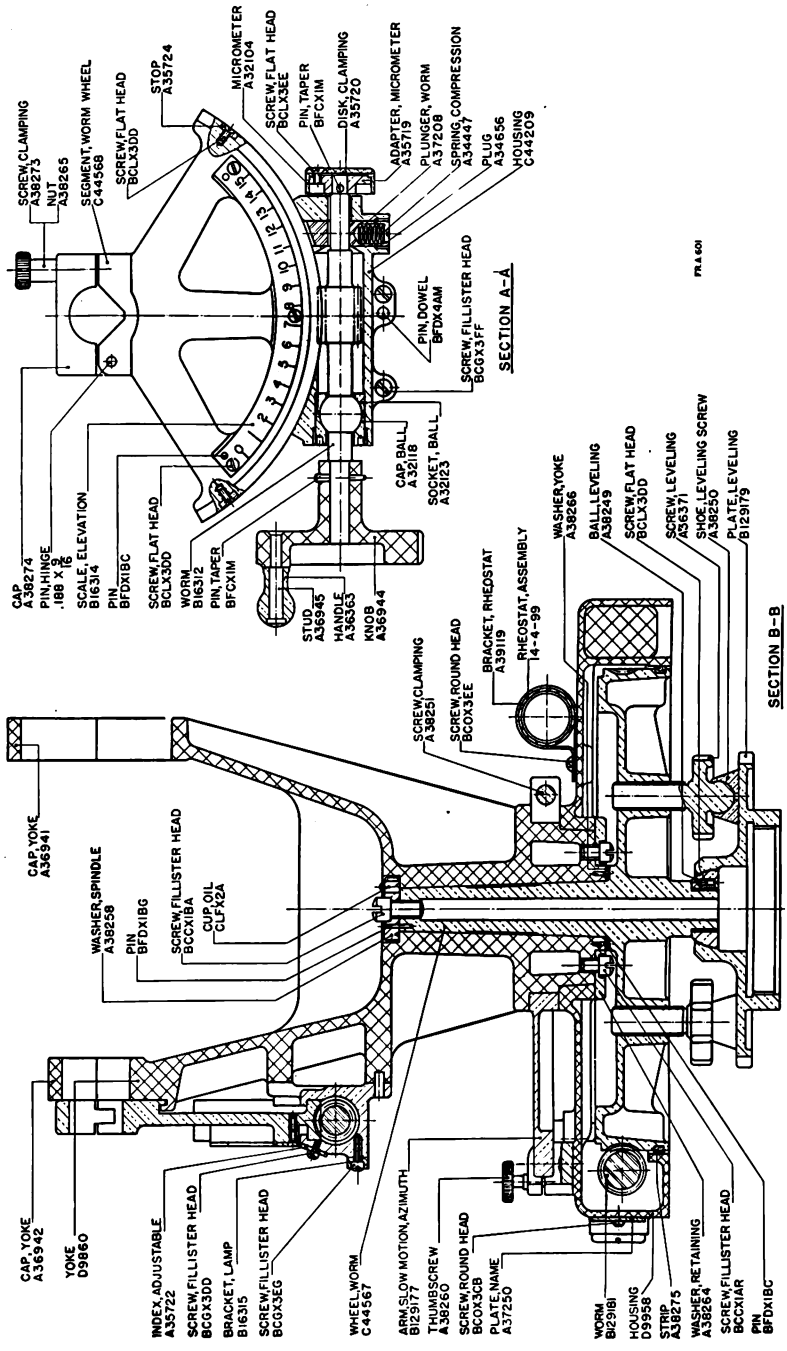


FIGURE 4.—Antiaircraft battery commander's observation instrument, M1, sectioned views of mount (secs. A–A and B–B in fig. 3).

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a. Mount.—The mount (fig. 4) positions the telescopes in azimuth and elevation and includes the necessary scales, micrometers, leveling devices, and lighting equipment to provide indications of elevation and azimuth angles under operating conditions.

(1) The vertical axis for the instrument is provided by the long vertical spindle, integral with the worm wheel (C44567).

(2) The leveling ball (A38249), assembled to the lower extremity of the above spindle, is seated in a spherical socket in the leveling plate (B129179), which screws on the tripod head.

(3) Two levels, at right angles, are provided for use in conjunction with the four leveling screws (A36371) in leveling the worm wheel and hence rendering the spindle vertical.

(4) Construction of the levels is shown in figure 5. Initial adjustment is obtained by the screws (BCGX3DD and BCGX3CE) shown at the right-hand side.

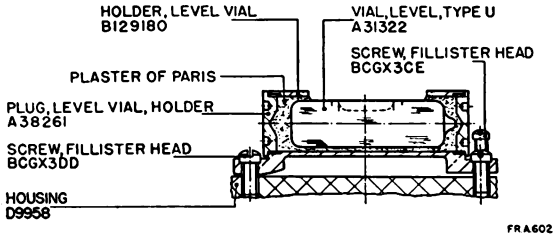


FIGURE 5.—Section through level.

(5) The housing (D9958) is positioned in azimuth about the worm wheel (C44567) by means of the worm (B129181) as described in (8) below.

(6) Motion of the housing (D9958) in azimuth is transmitted to the yoke (D9860) by the slow motion azimuth arm (B129177). This arm is clamped to the yoke by the clamping screw (A38251), which may be released for orientation purposes. A fine adjustment with the same effect is provided by a tangent screw arrangement by which this arm is positioned with respect to the housing. This arrangement is shown in detail in figure 6.

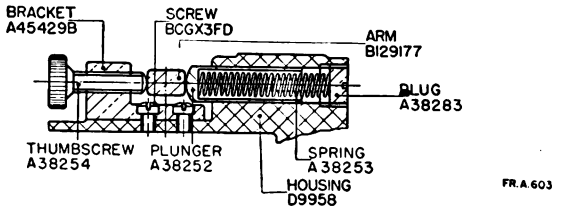


FIGURE 6.—Tangent screw arrangement (sec. E–E in fig. 3).

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(7) The threaded portion of the housing in which the thumbscrew (A38254) is screwed, is split to permit clamping it by the thumbscrew (A38260) shown in figure 4.

(8) Details of the azimuth drive are shown in figure 7. The azimuth worm (B129181) is provided with a ball-and-socket mounting at one bearing and with a compression spring and plunger at the other end to eliminate backlash at this point. In this motion a cam (A38276) is provided, operated by the lever (A38277) (fig. 3), which functions to disengage the worm and permit rapid traversing of the instrument when required. The nut (A38248) retains the crank (A38245), which is keyed on the worm.

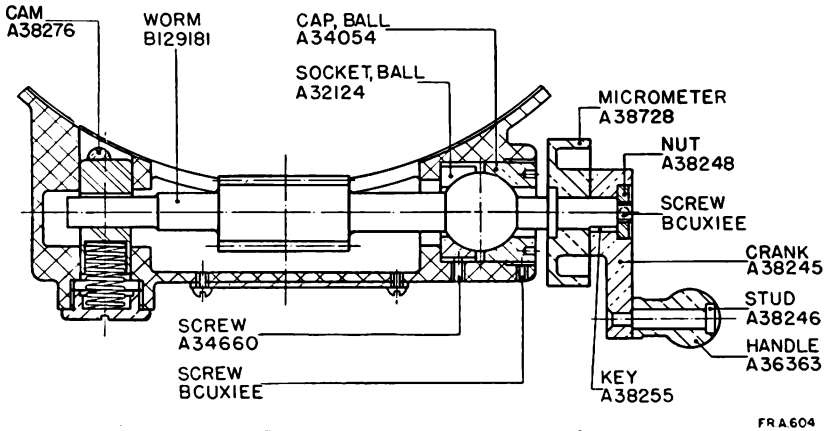


FIGURE 7.—Azimuth drive (sec. D–D in fig. 3).

(9) Coarse indications of azimuth are obtained from a scale engraved on the upper flat surface of the worm wheel (C44567). This scale is graduated at 10-mil intervals, numbered every 100 mils, and is read opposite an index mounted below the reading window which is located in the top of the housing (D9958) near the crank (A38245). Fine indications are obtained from the micrometer (A38728), read opposite an index engraved on the housing (D9958). This micrometer is graduated at intervals corresponding to $\frac{1}{10}$-mil motion of the telescopes in azimuth and is rendered adjustable by the nut (A38248) on the end of the worm.

(10) Motion of the telescopes in elevation is obtained by means of the elevating worm (B16312) driven by the knob (A36944) and engaging with the worm wheel segment (C44568) (fig. 4).

(11) The telescope, M3 is mounted to rotate in the bearings of the yoke (D9860) and is retained by the caps (A36941 and A36942), secured by clamping screws (A38282) (fig. 3). The worm wheel segment (C44568) has a V-shaped locating surface to correctly position

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the telescopes in elevation. The telescope is clamped against this surface by the cap (A38274) and clamping screw (A38273).

(12) The elevating worm (B16312), like the azimuth drive, is provided with a ball-and-socket mounting at one bearing and with a compression spring and plunger at the other to eliminate backlash at this point. No means, however, are provided for disengaging this worm.

(13) Coarse indications of elevation (angular height) are obtained from the elevation scale (B16314), read opposite the adjustable index (A35722). The above scale is graduated at 100-mil intervals. Fine indications are obtained from the micrometer (A32104), read opposite its index (A35723). This micrometer is graduated at intervals corresponding to 1-mil motion of the telescopes in elevation and is rendered adjustable by the clamping disk (A35720) and three flathead screws (BCLX3EE), so that a zero indication may be obtained with the mount and telescope axis level. The index (A35722) of the coarse motion is adjustable for the same purpose.

(14) The instrument is arranged for illumination of the telescope reticles and of the azimuth and elevation scales and micrometers.

(*a*) A rheostat of the carbonized compression disk type is provided to adjust the illumination of the reticle of the telescope, M3 to fit the existing conditions. With this type of rheostat, smooth and uniform adjustment of the illumination is possible.

(*b*) One lamp bracket for illuminating purposes is provided in each location listed below:

1. On the elbow telescope, M2, of which it forms a part.
2. On the elbow telescope, M2A1, when furnished, of which it forms a part.
3. On the telescope, M3, of which it forms a part.
4. Between the coarse and fine elevation indexes (A35722 and A35723).
5. Above the azimuth micrometer (A38728).
6. Above the azimuth reading window in the housing (D9958).

(*c*) Lamps used in these brackets are all 3–cp, 6–8 volt, miniature lamps with G–6 bulb and double contact base.

(*d*) Plugs fitting these various receptacles are color coded as described in paragraph 3 *a* (8).

b. Telescope, M3.—(1) The telescope, M3 is shown in figures 8 and 9. This telescope is arranged to be set for a magnification of either 10 or 20 power. It has the following general characteristics:

Magnification	10×	20×
Objective aperture	2.5″	2.5″
Exit pupil	0.25″	0.125″
Field of view	6°9′	3°5′

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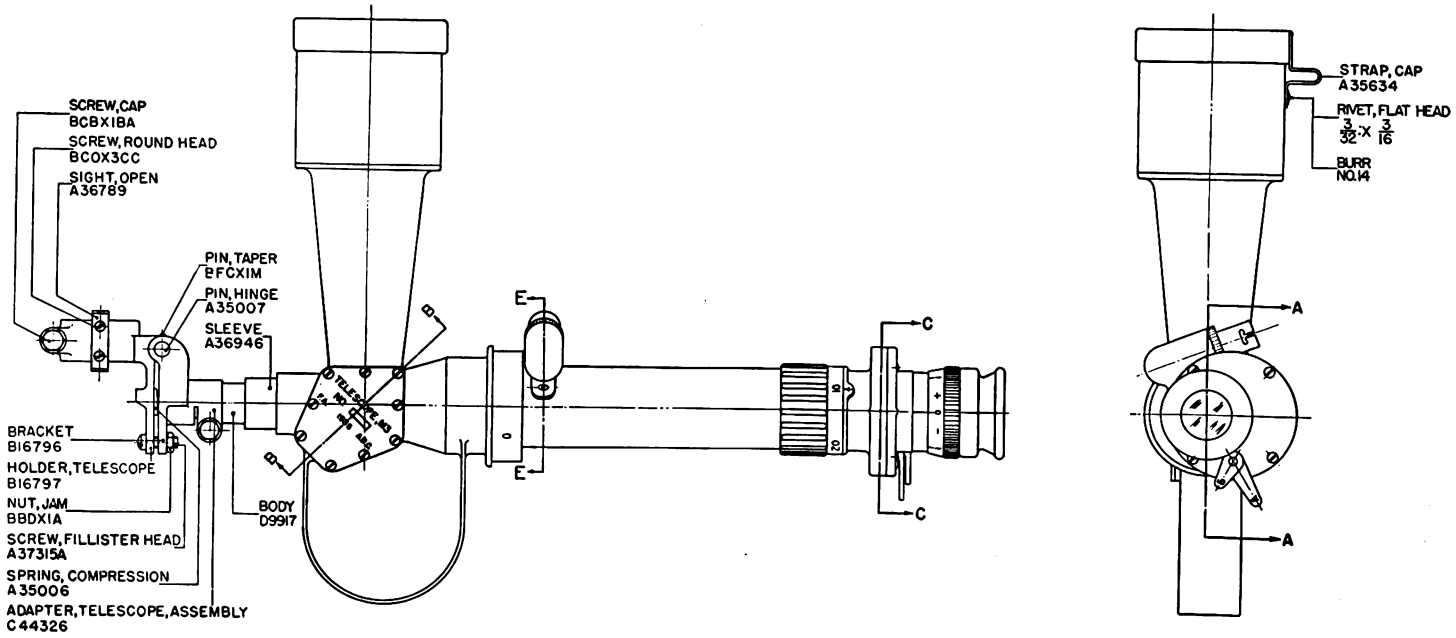


FIGURE 8.—Telescope, M3, assembled views.

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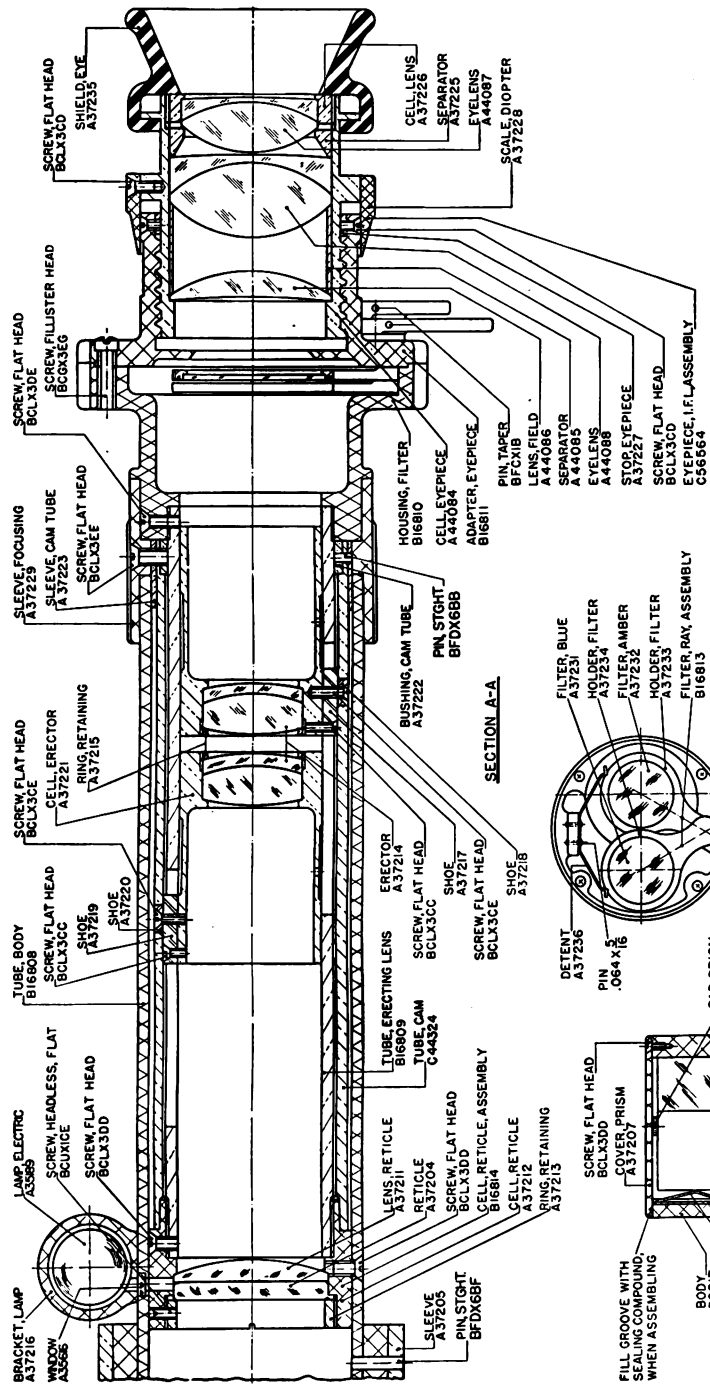


FIGURE 9.—Telescope, M3, sectioned views (secs. A–A, B–B, and C–C in fig. 8).

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(2) For illumination of the reticle, a 3–cp, 6–8 volt, miniature lamp with G–6 bulb and double contact base is provided.

(3) The optical system includes an objecti e, a penta prism, a reticle (electrically illuminated) with lens, a two-cell erector, a blue and amber ray filter assembly, and an eyepiece. The image produced is erect.

(4) Changing the magnification is accomplished by rotating the focusing sleeve (A37229). This sleeve rotates the cam tube (C44324) which has two helical slots of different pitch. These slots engage the shoes (A37218 and A37220) and thereby properly position both erector cells. Graduations are provided on the focusing sleeve (A37229) which indicate, opposite an index on the housing (B16810), the magnification for which the telescope is set.

(5) Focusing of the eyepiece assembly (C56564) is accomplished by rotating the diopter scale (A37228), by means of the knurled periphery thereof, thus screwing the assembly into or out of the adapter (B16811). Graduations are provided on this scale, read opposite a fixed index directly in diopters so that, if the observer knows the value of this quantity for his own eye, he may focus the eyepiece immediately by this means. Focusing the objective, that is, causing the plane of the image of a distant object to lie on or very close to the plane of the reticle, is a factory operation performed when the instrument is assembled. There is no provision for further adjustment by the using arms.

(6) Two internal filters are provided in these telescopes (sec. C–C, fig. 9), one amber and the other blue. Each is controlled by a lever extending outside the housing. The blue filter is controlled by the shorter lever labeled "B"; the amber filter is controlled by the longer lever labeled "A." Rotation of either lever to its extreme counterclockwise position causes the associated filter to be introduced.

(7) The reticle (A37204) of this telescope is graduated as shown in figure 10. The smallest divisions thereon correspond to 1 mil.

(8) The telescope is mounted with the axis of the eyepiece along the horizontal axis of rotation of the instrument. For this reason, inclination of the telescope in elevation above the horizontal results in a rotation of the reticle through the same angle. The cross line which indicates a horizontal direction in the field of view remains parallel to the objective axis of the telescope; the cross line which indicates a vertical direction remains perpendicular thereto, at all elevations.

(9) The body (D9917), in which the prism is housed, is provided with an integral shaft extension, a portion of which has flat machined

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surfaces, to insure positioning at the correct angle of elevation when clamped to the worm wheel segment (C44568) of the mount (*a* (11) above).

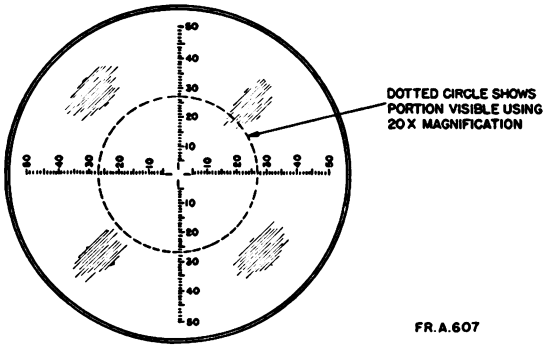


FIGURE 10.—Telescope, M3, reticle.

(10) The shaft extension of the body (D9917) also mounts the adapter (C44326) which supports the elbow telescope, M2 described in *c* below. This adapter includes an open sight (A36789) to aid the observer in initially locating the target in his field. This adapter provides for three possible adjustments of the elbow telescope, M2:

(*a*) By loosening the outer cap screw (BCBX1BA), the elbow telescope may be rotated about its objective axis so that the axis of the eyepiece is parallel to the main horizontal axis of the instrument. When this is the case, the lines on the reticle indicate true vertical and horizontal directions.

(*b*) By loosening the inner cap screw (BCBX1BA), this adapter may be rotated about the horizontal shaft extension so that the objective axis of the elbow telescope, M2 attains the same elevation as that of the telescope, M3.

(*c*) By means of the screw (A37315A) and jam nut (BBDX1A), operating against the pressure of the spring (A35006), the objective axis of the elbow telescope may be made to occupy a vertical plane parallel to that of the telescope, M3.

(11) On instruments furnished with the elbow telescope, M2A1, the adapter (C44783) (fig. 11) is provided to mount it. The larger (2-inch) opening is clamped on the body tube (B16808) of the telescope, M3 of which this adapter, when furnished, is a part. The smaller ($1\frac{9}{16}$-inch) opening is clamped about the body of the elbow telescope, M2A1. This adapter also provides for three possible adjustments of the elbow telescope:

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(*a*) By loosening the cap screw (BCBX1BA) which clamps the elbow telescope, the latter may be rotated about its objective axis so that the axis of the eyepiece is in a plane perpendicular to the main horizontal axis of the instrument. When this is the case, the lines on the reticle indicate true vertical and horizontal directions.

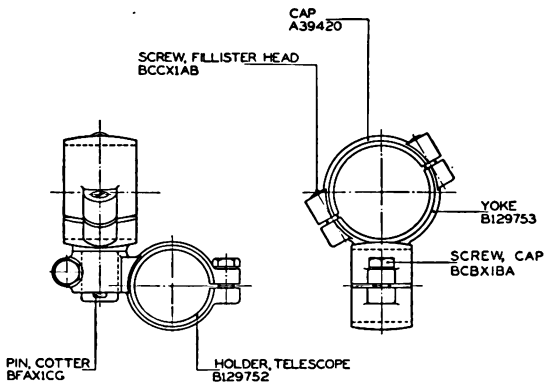


FIGURE 11.—Adapter (C44783).

(*b*) By loosening the fillister-head screws (BCCX1AB), the adapter may be rotated about the horizontal tube (B16808) so that the objective axis of the elbow telescope attains the same elevation as that of the telescope, M3.

(*c*) By loosening the cap screw (BCBX1BA), which clamps the telescope holder (B129752) on the shaft extension of the yoke (B129753), the objective axis of the elbow telescope may be made to occupy a vertical plane parallel to that of the telescope, M3.

(12) A leather objective cap is provided to protect the forward end of the telescope. This cap is attached by a strap to the sunshade which extends over the objective.

c. Elbow telescopes, M2 and M2A1.—(1) The elbow telescopes, M2 and M2A1, used on this instrument are shown in figures 12 and 13. These two telescopes differ only as to details of reticles and lamp brackets. All of these instruments have the elbow telescope, M2 arranged for left-hand mounting. The elbow telescope, M2A1 is provided in addition only when furnished for the National Guard.

(2) Both these telescopes have the following general characteristics:

(*a*) Objective aperture, 1.15″.

(*b*) Exit pupil, 0.144″.

(*c*) Light transmission power (relative), 13.4.

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(*d*) Magnification, 8 ×.

(*e*) Field of view, 8°45′.

(*f*) Lamp, 3–cp, 6–8 volt miniature lamp with G–6 bulb and double contact base.

(3) Two removable filters, one blue and one amber, are included with each telescope. Each filter is provided with a holder (A37318) arranged to slip over the eyelens retaining ring (A33912).

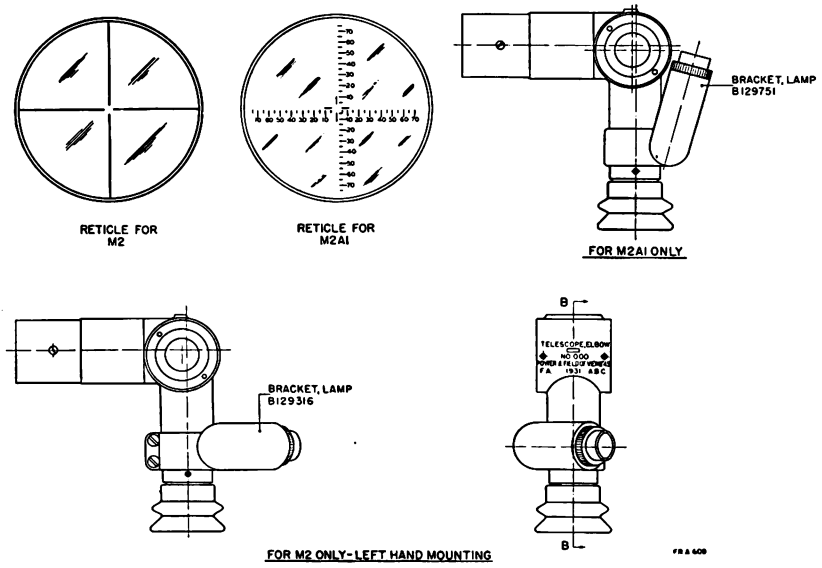


FIGURE 12.—Elbow telescopes, M2 and M2A1, assembled views.

(4) The optical system includes an objective cell, an Amici prism, and an eyepiece assembly. There is no provision for focusing either the eypiece or the objective. The telescope produces an erect image brought about by the use of the Amici prism.

(5) The elbow telescope, M2, like the telescope, M3, is mounted with the axis of the eyepiece along the horizontal axis of the instrument. For this reason, inclination of the telescope in elevation above the horizontal results in a rotation of the reticle through the same angle. The cross line which indicates a horizontal direction in the field of view remains parallel to the objective axis of the telescope and the cross line, which indicates a vertical direction, remains perpendicular thereto, at all elevations.

(6) The elbow telescope, M2A1, when furnished, is mounted with the axis of the eyepiece in a plane perpendicular to the horizontal

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axis of the instrument and the reticle is therefore not rotated as the instrument moves in elevation.

(7) The mounting devices for these telescopes are part of the telescope, M3 and are covered in *b* above.

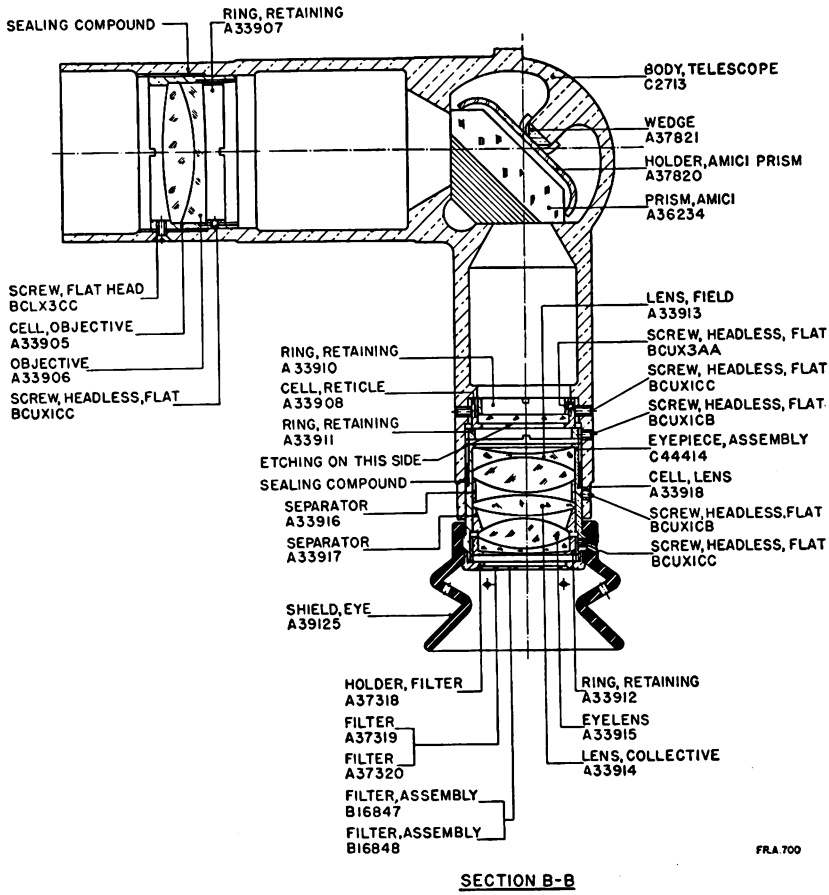


FIGURE 13.—Elbow telescopes, M2 and M2A1, sectioned view.

d. Type A tripod.—(1) The type A tripod (fig. 14) consists essentially of a metal head and three telescoping wood legs with adjustable braces.

(2) The tripod head (X99B) is provided with male threads to engage the leveling plate (B12979) of the mount. A cap is provided to protect these threads when the tripod is not in use.

(3) A circular level (B129517) is mounted in the tripod head.

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(4) The legs are hinged to the tripod head by hinge pins (X99L) and clamped thereto by wing nuts (X99M).

(5) The tripod legs are extensible, being secured in the desired position by the clamps (X136C) and wing nuts (A38269).

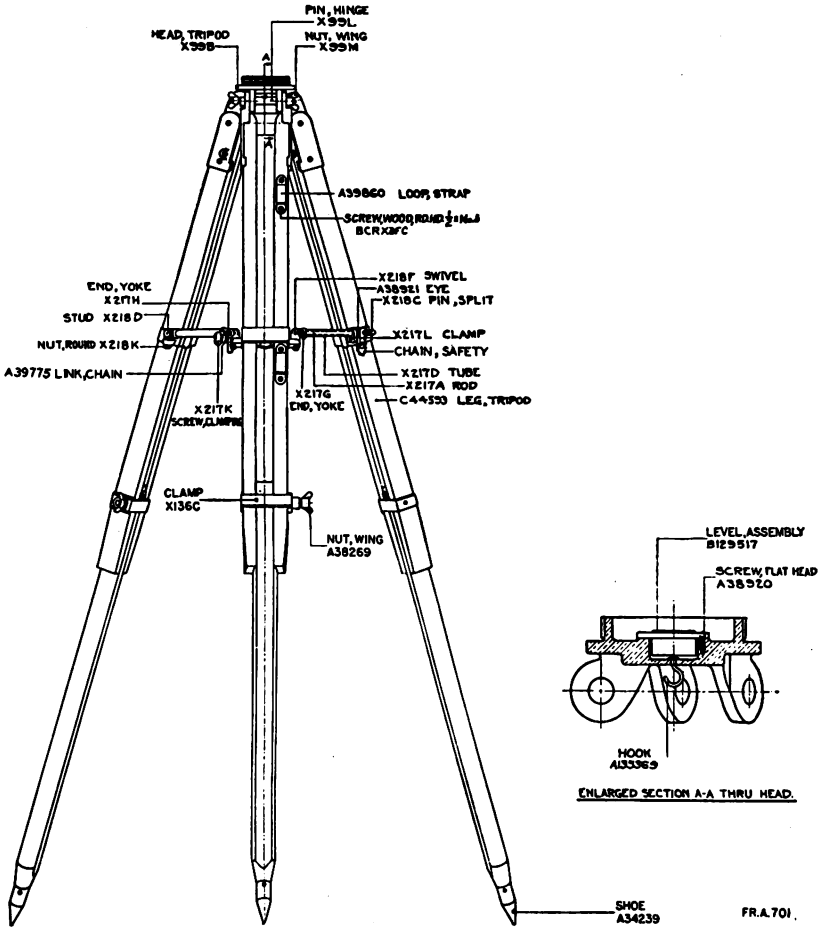


FIGURE 14.—Type A tripod.

(6) Metal braces are provided to secure the legs of the tripod. These braces are particularly useful on terrain which will not permit penetration of the tripod leg shoes.

(7) The metal braces are each constructed of a telescoping rod (X217A) and tube (X217D) with a clamp (X217L) and clamping screw (X217K) for adjusting the length. A removable pin (X218C)

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is provided for rapid engagement or disengagement of the brace to or from the right-hand swivel (X218F).

3. Operation.—In connection with the operating procedure, reference should be made to figures 3, 9, and 14, which show all of the parts referred to.

a. To set up the instrument.—(1) Extend the tripod legs to the desired height, tighten the leg clamps (X136C), and embed the legs firmly in the ground. The legs should be spaced at least 2½ feet apart at the ground to insure stability. The tripod head (X99B) is provided with a circular level (B129517), which should then be centered by readjusting the lengths of the legs as required.

(2) Pin the telescoping tube braces in place by the pins (X218C), adjusting their lengths as necessary by means of the clamping screws (X217K). Remove the cap from the tripod head.

(3) Remove the mount from its packing chest and screw the leveling plate (B129179) carefully on the tripod head. Extreme care must be exercised at this point to insure that the threads engage properly. Approximately four turns are required to securely mount this leveling plate, which should be rotated using only the serrations on the periphery thereof, not by turning other parts of the mount.

(4) Remove the telescope, M3 from its packing chest and place on the mount, securing it in place with the clamping screws (A38282) and (A38273). Be sure the telescope shaft extension is seated squarely in the V-shaped slot provided. Remove the leather cap from the objective of the telescope.

(5) Apply the amber or blue filters to the telescopes if required. Filters for the elbow telescopes, M2 and M2A1 (if furnished), are removable and are kept in the telescope packing chest when not used. Filters for the telescope, M3 are internal and are applied when needed by rotating the levers (A35667 and A35666), labeled "A" (amber) and "B" (blue), respectively, to their extreme counterclockwise positions.

(6) Set the magnification of the telescope, M3 to the desired power, using the focusing sleeve (A37229). Operation at the lower power is accompanied by a wider field of view and a brighter, steadier image.

(7) Focus the eyepiece using the knurled portion of the diopter scale (A37228). The correct diopter setting for the observer, if known, may be set in directly; if not, the setting should be used which gives the clearest definition of the reticle and target or an equally distant object. There is no provision for focusing the objective, this being a factory or shop operation. A small amount of parallax,

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that is, apparent relative motion of image and reticle as the observer's eye is shifted, may therefore be encountered when observing targets at distances other than that for which the factory adjustment was made; the angular errors so introduced, however, are not ordinarily sufficiently large to cause serious consequences in normal use (*c* (7) below).

(8) Make the necessary electrical connections if illumination is required. The plug attached to each of the various leads has a painted band ¼ inch wide which serves to identify the plug for its particular use. The explanation of the colors is as follows:

White	Azimuth scale lamp bracket.
Green	Elevation scale lamp bracket.
Yellow	Azimuth micrometer lamp bracket.
Red	Rheostat bracket.
Blue	Telescope, M3, reticle lamp bracket.
Not painted	Elbow telescopes, M2 and M2A1.
Not painted	Plug to battery box.

When connecting the lead wires, to avoid shorting the battery, connect first to the lamps, then to the battery. Adjust the illumination by means of the rheostat (14–4–99) to a level such that both the target and the reticle graduations of the telescope, M3 may be seen satisfactorily.

(9) Level the mount, using the levels and the leveling screws (A36371). Best results in performing this operation will be had with the mount oriented so that each level is parallel to a pair of diametrically opposite leveling screws; each level is then affected only by the corresponding pair of leveling screws. Tighten the leveling screws only until a snug contact is made.

(10) Make such of the tests outlined in paragraph 5 as conditions permit.

b. Orientation.—(1) Set the thumbscrew (A38254) so that the slow motion azimuth arm (B129177) is approximately in midposition. This thumbscrew is clamped and unclamped by the thumbscrew (A38260).

(2) If necessary, loosen the clamping screw (A38251) and rotate the yoke relative to the housing so that the azimuth and elevation worms are approximately parallel on the same side of the instrument. This is the position shown in figure 3 and renders the crank (A38245) convenient to the right hand of the operator at the elbow telescope, M2. Tighten the clamping screw (A38251).

(3) Select a datum point of known azimuth and, by means of the crank (A38245), set the mount to indicate that azimuth on the scale

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seen through the reading window (coarse) and on the micrometer (A38278) (fine).

(4) Release the leveling screws (A36371) and rotate the entire upper part of the mount so that the datum point appears approximately at the center of the reticle of the telescope, M3, elevating it as required by the knob (A36944). Exercise care not to unscrew the leveling plate (B129179) from the tripod head. Level the instrument again (*a* (9) above) and return to the azimuth setting of the datum point.

(5) By means of the thumbscrew (A38254), unclamped by the thumbscrew (A38260), refine the setting described in (4) above so that the datum point appears exactly at the center of the reticle of the telescope, M3. If additional travel is required, the clamping screw (A38251) may be loosened temporarily to permit moving the slow motion azimuth arm (B129177) a small distance. It should be noted, however, that a large amount of motion at this point will result in a position of the crank (A38245) inconvenient to the right hand of the operator. Were it not for this difficulty, this motion alone could be used for orientation purposes instead of loosening the leveling screws.

(6) Ascertain that the clamping screw (A38251), thumbscrew (A38260), and leveling screws (A36371) are properly tightened. Once the instrument is properly oriented, these screws must not be disturbed. Verify the azimuth indication and the centering of the datum point on the reticle.

c. Observations.—(1) It should be noted that, in the case of the telescope, M3 and the elbow telescope, M2 on this instrument, as the telescope is elevated the reticles are inclined correspondingly. Unless understood, this may cause confusion, particularly at elevations above 800 mils. It should be remembered that the axis of the reticle, which corresponds to the horizontal direction in the field of view, always remains parallel to the objective axis of the telescope (i. e., to the line of position). The axis corresponding to the vertical direction remains perpendicular thereto. The elbow telescope, M2A1, when provided, is so mounted that the axes of the reticle retain their verticality and horizontality.

(2) Motion of the instrument in azimuth is obtained by means of the crank (A38245) and the indications are viewed on the scale below the reading window (coarse, 10-mil divisions) and on the micrometer (A38728) (fine, $\frac{1}{10}$-mil divisions). The crank (A38245) may be disengaged, if desired, by pressing the lever (A38277) to its limit of travel, permitting rapid rotation of the instrument in azimuth.

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(3) Motion of the instrument in elevation (angular height) is obtained by means of the knob (A36944) and the indications are viewed on the scale (B16314) (coarse, 100-mil divisions) and on the micrometer (A32104) (fine, 1-mil divisions).

(4) To observe deviations of trial shots, either at the battery or at the distant station position, having made the preparations described above, carefully set the instrument to the azimuth and elevation (angular height) of the trial shot point. As each trial shot is fired, observe through the telescope, M3 the position of the bursts with respect to the mil graduations on the reticle. Announce the lateral and vertical deviations in mils from the center of the reticle as observed thereon.

(5) To follow the course of firing on a target, an observer in addition to the battery commander is required. The observer uses the elbow telescope, M2 and operates the azimuth and elevation motions of the mount so that the target continuously appears at or close to the center of the reticle. The battery commander uses the telescope, M3 (or the elbow telescope, M2A1, when furnished), and observes the lateral and vertical deviations of the burst from the target.

(6) If desired, this instrument may be used to furnish indications of elevation and azimuth for orienting the entire battery in lieu of a surveyor's transit.

(7) The telescope, M3 is so designed that parallax between image and reticle is negligible for distances ordinarily encountered. However, for objects closer than 500 yards, parallax will exist. Sighting on such objects may be accomplished by placing before the objective a diaphragm of opaque material with a comparatively small circular opening.

d. Removal from service.—To remove the instrument from service, disconnect the electrical connections (removing at battery first), place lead wire in compartment of battery box, place cover on the objective, remove the telescope and place in the chest provided, remove the mount from the tripod and place in the chest provided, screw cap on tripod head, fold tripod, and attach carrying strap.

4. Disassembly and assembly.—*a.* Disassembly and assembly of the major components of the instrument incident to normal operating procedure are covered in paragraph 3.

b. For replacement of lamps, each socket assembly may be unscrewed from its bracket after the lead wire plug has been disconnected (first removing plug from battery receptacle). Use only 3–cp, 6–8 volt miniature lamps with G–6 bulb and double contact bayonet base for replacement.

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c. Removal and replacement by the using arms of externally accessible small parts, where the alinement of the instrument will not thereby be disturbed, is permitted when performed by competent personnel thoroughly familiar with the instrument. Refer to the standard nomenclature lists of this matériel, wherein parts denoted by the "%" note symbol are the only parts which the using arms are authorized to draw for replacement purposes. Removal of optical parts for cleaning is specifically prohibited.

d. No disassembling or assembling operation by the using arms not specifically included above is permitted.

5. Tests and adjustments.—*a.* The levels are in correct adjustment when the bubbles are midway between the lines on the vials with the azimuth axis of the instrument vertical.

(1) This condition may be verified readily when the instrument is set up and leveled as described in paragraph 3, by observing the level bubbles as the instrument is rotated slowly in azimuth. If they remain central, no adjustment is required.

(2) If the bubble of one or both levels does not remain central, adjustment is performed as follows:

(*a*) Level the instrument so that the bubble is midway between the lines.

(*b*) Turn the instrument 3,200 mils (180°) in azimuth.

(*c*) Return the bubble *halfway* to its original central position using the screws (BCGX3CE and BCGX3DD), shown on the right-hand side of figure 5, for this adjustment. Each of these screws locks the other, and it is essential that both are tight when the adjustment is complete.

(*d*) Level the instrument again and repeat the above procedure if necessary.

b. With the instrument level and the objective axis (line of position) of the telescope horizontal, the elevation scale (B16314) and micrometer (A32104) should indicate zero.

(1) The index (A35722) may be adjusted after loosening the two screws therein and the micrometer (A32104) may be adjusted after loosening the three flathead screws (BCLX3EE). These screws must be tightened securely after their adjustment is made.

(2) The horizontal position of the telescope for this setting may be determined by sighting on a distant point at the same height, as determined by using a level or other instrument of known accuracy.

(3) If more convenient, this adjustment may be performed using a datum point of known elevation (angular height), making the elevation scale and micrometer read accordingly.

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c. Tests for verticality and horizontality of the cross lines of the reticle of the telescope, M3 may be performed by sighting on a vertical line, such as a plumb line, with the instrument level. No adjustment by the using arms is permitted.

d. The elbow telescope, M2 must be adjusted so that the objective axis is alined parallel with that of the telescope, M3 and the lines on the reticle must indicate true vertical and horizontal directions.

(1) Tests for verticality and horizontality of the cross lines of the reticle may be performed by sighting on a vertical line, such as a plumb line, with the instrument level. Adjust, if necessary, by rotating the telescope in its mounting about its objective axis, loosening the outer cap screw (BCBX1BA) (fig. 8) temporarily for this purpose.

(2) Parallelism of the objective axes may be verified by sighting on a distant (preferably a celestial) body. Vertical adjustment is made by rotating the adapter about the horizontal axis, temporarily loosening the inner cap screw (BCBX1BA) for this purpose. Lateral adjustment is made using the screw (A37315A) locked by the jam nut (BBDX1A).

e. The elbow telescope, M2A1, on instruments where furnished, must similarly be adjusted. (See fig. 11 for the adapter on which these adjustments are made.) Adjustments of the cross lines of the reticle and of the lateral motion of the objective axis are performed by temporarily loosening the corresponding cap screws (BCBX1BA). The vertical motion of the objective axis is adjusted after temporarily loosening the fillister-head screws (BCCX1AB) in the cap (A39420).

f. The telescopes should be frequently given a visual check to insure that no dust or moisture has collected on the reticles or other optical parts. Instruments showing evidence of such a condition should be turned in.

g. No adjustments by the using arms other than authorized above are permitted.

6. Care and preservation.—These instruments contain delicate and highly accurate mechanisms and the telescopes contain precisely positioned optical parts. It is therefore imperative that the instruments be handled carefully, avoiding unnecessary shocks, etc., which will eventually render the instrument unserviceable. When placing instruments in or removing them from the chests, proceed gently and avoid the use of undue force. These instruments must not be exposed unnecessarily to the weather. When not in use the telescope and mount should be placed in the chests provided and stored in a clean, dry place; they must not be placed in their chests when wet.

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a. Optical parts.—(1) To obtain satisfactory vision, it is necessary that the exposed surfaces of the lenses and other parts be kept clean and dry. Corrosion and etching of the surface of the glass, which greatly interferes with the good optical qualities of the instrument, can be prevented or greatly retarded by keeping the glass clean and dry.

(2) Under no conditions will polishing liquids or pastes be used for polishing lenses and windows.

(3) For dusting optical parts, use only a clean camel's hair brush. For wiping, use only paper specially intended for cleaning optical glass (U. S. A. Spec. 19–40). Use of cleaning cloths in the field is not permitted.

(4) To remove oil or grease from optical surfaces, apply ethyl alcohol (U. S. A. Spec. 4–1018) with a clean camel's hair brush and rub gently with clean lens paper. If alcohol is not available, breathe heavily on the glass and wipe off with clean lens paper; repeat this operation several times until clean.

(5) To remove dust, brush the glass lightly with a clean camel's hair brush and rap the brush against a hard body in order to knock out the small particles of dust that cling to the hairs. Repeat this operation until all dust is removed.

(6) Do not wipe the lenses or windows with the fingers.

(7) Keep the objective of the telescope, M3 covered by the cap provided when not in use.

b. Mechanical parts.—(1) When leveling and orienting the instrument, exercise extreme care to see that the various screws used for leveling, adjusting, and clamping are tightened only until snug contact is made. If too much force is used in this operation, a screw may be permanently damaged and the instrument thereby rendered unserviceable.

(2) When disengaging the azimuth drive for rapidly traversing the instrument, be sure to press the lever (A38277) to the extreme limit of its travel to prevent the worm from scraping over the teeth on the worm wheel.

(3) Exercise care that the bearings and locating surfaces of the telescope M3 and the corresponding surfaces of the mount do not become burred or dented. Inaccuracies at these surfaces may result in erroneous indications.

c. Lubrication.—(1) The main vertical bearing should be oiled occasionally with neutral oil, placing a few drops only in the oil cup (CLFX2A) (fig. 4) at the top of the bearing and in the other

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oil cup (not shown) located in the base of the yoke (D9860) on the side opposite the levels.

(2) The threads of the leveling screws (A36371) should be oiled occasionally with the same oil.

(3) At occasional intervals, lubricate the teeth of the segment (C44568) with a light coating of lubricant composed of equal parts of refined petrolatum (U. S. A. Spec. 2–67) and anhydrous lanolin (U. S. A. Spec. 50–11–72).

(4) In manufacture, the housing about the worm (B129181) is packed with the same lubricant. At intervals of six months, or whenever binding of the azimuth motion is experienced, the instrument should be disassembled and lubricated at this point by competent ordnance personnel. This operation is not to be performed by the using arms.

(5) Keep the instrument clean from any excess lubricant and exercise extreme care that none is allowed to come into contact with the optical surfaces.

d. Tripod.—(1) When setting up the tripod, exercise particular care that the wing nuts clamping the legs are tight to avoid collapse when the instrument is mounted.

(2) Care must be taken to avoid denting the legs, as they will not telescope properly if dented.

(3) When the instrument is not mounted on the tripod head, protect the threads of the latter by means of the cap provided.

e. Battery.—Instructions concerning the care and preservation of alkaline type storage batteries are given in the instruction book issued with each battery. These instructions should be followed closely. Do not use acid intended for lead batteries in alkaline type batteries and avoid the use of any utensils which have been used with acid in connection therewith.

7. Equipment.—*a. Accessories.*—(1) Separate packing chests are provided for the mount and for the telescope. The chest for the former is somewhat heavier in construction and contains a compartment for the tools furnished with the instrument. Both packing chests have internal blocking to prevent shifting of the parts when packed therein. Each chest is furnished with a lock and two keys.

(2) The tools furnished are two screw drivers, one open-end wrench, and two brushes, one with camel's hair bristles and one with Chinese bristles. These tools are not to be used for performing operations other than authorized herein. The brush with Chinese bristles is not to be used on optical parts.

(3) A cap and carrying strap are provided for the tripod.

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b. Electrical equipment.—(1) Electrical equipment furnished with this instrument includes a battery box, battery, book of instructions for battery, wrench and jack for terminals thereof, and a lead wire for connection to instrument.

(2) The battery box (Edison B–4 type) is a metal box which houses the battery and is provided with two receptacles connected thereto. Either of these receptacles may be used to plug in the lead wire (C44605). A pocket for spare lamps is provided and three spare lamps are included.

(3) The battery is a 6–volt alkaline storage battery, M1 (Edison B–2 type), consisting of five separate cells connected in series by connectors and supported in a wooden tray. The characteristics of the battery are listed below:

Rated capacity, ampere-hours	37.5
Number of cells, in series	5
Discharge rate (8 hours), amperes	4.7
Discharge rate (5 hours), amperes	7.5
Average discharge voltage (8 hours)	1.24 (per cell)
Average discharge voltage (5 hours)	1.2 (per cell)
Normal charging rate (7 hours), amperes	7.5
Quantity of electrolyte, pounds	1.1 (per cell)
Total weight, pounds	29

(4) The book of instructions which accompanies each battery covers the care and preservation of the battery. The socket wrench and disconnecting jack are for removing the terminals from the terminal posts when necessary.

(5) The lead wire assembly (C44605) is provided to connect the various receptacles of the instrument. It consists of several sections of twisted lamp cord properly connected together, each section terminating in a double contact plug. In addition to the plug for each lighting receptacle of the instrument, one plug is provided for connection to the battery and one for connection to the rheostat. The connections are so arranged that the latter is placed in series only with the lamp illuminating the reticle of the telescope, M3. For instruments having elbow telescope, M2A1, this wire has eight plugs; for instruments with which that telescope is not furnished, the wire has but seven plugs. All plugs, except those connecting to the battery and to the elbow telescopes, M2 and M2A1 (if furnished), are color coded by ¼-inch painted bands to insure insertion in the proper receptacle. The colors corresponding to the various receptacles are listed in paragraph 3 *a* (8).

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8. Data.—*a. Weight, volume, and method of packing.*—Data for the various components of the instrument are given in the following table:

Unit	Mount	Telescopes	Tripod	Electrical equipment
Weight, pounds	27.5	18	10	46
Weight of packing chest, pounds	16.5	15.5	20	22
Kind of shipping container	(1)	(1)	(2)	(2)
Dimensions (approximate), feet:				
Length	1.25	1.58	3.00	2.50
Width	1.33	2.5	.83	.83
Height	1.58	.83	.83	1.00
Quantity packed in container	1	1	1	1
Cubic feet (approximate)	2.6	3.3	3	2
Square feet (approximate)	1.7	3.9	2.5	2.1
Weight of packed container, pounds	55	46	40.5	72
Weight per square foot of floor space	32	12	16	34

[1] Crate.
[2] Wooden box.

b. Serial numbers.—Data including serial number and date and place of manufacture are located as follows:

(1) On the name plate (A37250) located on the mount (fig. 3).

(2) On the prism cover (A37207) of the telescope, M3 (sec. B–B, fig. 9).

(3) On the body of the elbow telescope, M2 and on the body of the elbow telescope, M2A1, when furnished, as shown in figure 3.

[A. G. 062.12 (10–27–38).]

BY ORDER OF THE SECRETARY OF WAR:

MALIN CRAIG,
Chief of Staff.

OFFICIAL:

E. S. ADAMS,
Major General,
The Adjutant General.

U. S. GOVERNMENT PRINTING OFFICE: 1939

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TECHNICAL REGULATIONS
No. 1305–75B

WAR DEPARTMENT,
WASHINGTON, *January 2, 1940.*

MOBILE ARTILLERY MATÉRIEL

GUN AND CARRIAGE, 75-MM, M1916A1 AND M1916MIA1

Prepared under direction of the
Chief of Ordnance

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SECTION I

GENERAL

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1. Purpose.—These regulations are published for the information and guidance of the using arms, Reserve Officers' Training Corps students, Reserve officers, and all personnel charged with the maintenance of this matériel.

2. Scope.—*a.* In addition to description and figures, these regulations contain instructions for the operation, inspection, disassembly and assembly, repair, and care and preservation of the matériel.

b. Disassembly and assembly and such repairs as may be handled by the battery personnel will be undertaken only under the supervision of an officer or the chief mechanic.

c. In all cases where the nature of the repair, modification, or adjustment is beyond the scope of the battery personnel, the corps area or department ordnance officer upon request will provide trained men to perform the work.

*This pamphlet supersedes W. D. Doc. 1035 (Handbook of the 75-mm Gun Matériel, Model of 1916—With Instructions for its Care).

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3. References.

Nomenclature, list of spare parts and equipment, and basic spare parts for gun and carriage, SNL C–30, or ordnance drawings.

Description and information on sighting and fire-control equipment, TR 1320–A and 1320–C (now TR 310–20).

Ammunition, TR 1350–A.

Drill ammunition, TR 1370–D.

Targets and accessories therefor, TR 1340–C.

Instructions covering the characteristics, purpose, handling, etc., of cleaning and preserving materials, tools, and equipment for use therewith, and special oils, greases, and cutting oils issued by the Ordnance Department, TR 1395–A.

Ammunition for subcaliber guns, TR 1370–C.

Instructions for service of the piece, pertinent FM 6-series.

SECTION II

DESCRIPTION AND OPERATION

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4. Description of 75-mm gun, M1916, and modifications.— *a.* The 75-mm gun, M1916, is the basic weapon of its type. However, eight modifications have been applied to the original gun so that at present the 75-mm guns, M1916, M1916MI, M1916MIA1, M1916MII, M1916MII½, M1916MIII, M1916MIIIA1, M1916MIII½, and M1916MIII½A1 are the models in existence.

b. The M1916, M1916MI, M1916MII, M1916MII½, M1916MIII, and M1916MIII½ guns may be mounted on either the 75-mm gun carriage, M1916 or M1916A1, while the M1916MIA1, M1916MIIIA1, and M1916MIII½A1 guns are mounted on 75-mm gun carriage, M1916MI or M1916MIA1. The latter two carriages are equipped with hydropneumatic recoil mechanisms of the St. Chamond type.

c. The guns are of the built-up type of alloy-steel forgings, consisting of a tube, jacket, breech ring, and clip. All of the parts are assembled by shrinkage.

d. The breech mechanism is of the vertical sliding type having a rectangular breechblock which slides up and down in its recess in the breech ring, and which is operated manually in opening but auto-

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matically closes when a round of ammunition is inserted in the breech chamber.

e. The firing mechanism housed within the breechblock is of the continuous pull type. It is cocked and the gun fired by one continuous motion of the trigger shaft. The mechanism is designed to function either by the firing shaft and handle on the cradle of the carriage or by means of a lanyard.

5. Operation of breech mechanism (fig. 4).—*a.* The operating handle (6C) is grasped around the grip, and pressure of the fingers is applied which releases the latch (9K). The handle is rotated to the rear and down approximately 90°, lowering the breechblock. During the downward movement of the breechblock the inclined grooves on its sides force the outer extractor trunnions forward and rotate the lips on the extractor away from the end of the tube, thus forcing the cartridge case out of the breech. When the breechblock reaches the limit of its downward movement, the inner extractor trunnions are forced over the horizontal shoulders at the top of the lugs by the extractor plunger (8S), and lock the breechblock in the open position.

b. To close the breech, a round of ammunition is inserted *smartly* into the chamber which causes the flange on the cartridge case to catch on the lips of the extractors (7C and 7B), thereby rotating them so that the trunnions are forced to the rear and off the locking shoulders. As the breechblock is released from its locked position it is subjected to the pull of the closing spring (9C), causing the operating handle (6C) to rotate upward where it is locked in the closed position by the operating handle latch (9K).

6. Operation of firing mechanism (fig. 4).—*a.* When the trigger shaft (7D) is forced to the rear either by operating the firing shaft (KB67A) on the cradle or pulling the lanyard, it causes the firing spring shoe (8E) to move forward, compressing the firing spring (8F) until the projecting shoulder on the firing arm (8N) engages a corresponding shoulder on the sear (8L) which disengages the latter from the firing pin (8D). The firing pin (8D) is thrown forward under the compression of the firing spring (8F), firing the piece. After the firing pin (8D) has gone forward the firing spring (8F) is still under its initial compression. The pressure of the firing spring is conveyed to the front side of the firing arm (8N) by the firing spring shoe (8E), and the same pressure is conveyed to the rear of the firing arm by the rear edge of the slot in the pin through which the firing arm projects.

b. These two pressures are equal and opposite and would ordinarily tend to rotate the firing arm about a point halfway between their

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points of application, but the firing arm is pivoted on the trigger shaft and can rotate about the center of the shaft only. Therefore, as the pressure applied by the firing spring shoe has the greater arm surface, the firing arm is rotated about the center of the trigger shaft and carries the firing pin back until the sear engages in its slot and the mechanism is ready to be fired again.

7. Description of 75-mm gun carriage, M1916A1 and M1916-MIA1.—*a.* The 75-mm gun carriages, M1916A1 and M1916MIA1, are modified M1916 and M1916MI carriages. This modification consists of the removal of the brake mechanism, axle seat, foot rest, and steel tired wheels, and the application of new parts to provide for high speed transport.

b. These carriages are of the split trail type, which permits high elevation and wide traverse without changing the positions of the trails.

c. The recoil mechanism of the 75-mm gun carriage, M1916A1, is of the hydrospring, variable recoil type, automatically adjusted to different elevations. In counterrecoil the gun is controlled by springs housed within the spring cylinders and a counterrecoil buffer housed in the recoil cylinder.

d. The recoil mechanism of the 75-mm gun carriage, M1916MIA1, is hydropneumatic, known as the St. Chamond type. This mechanism consists of three cylinders. The middle one is the recoil cylinder. The right has an air reservoir at the forward end and an oil reservoir at the rear end. The left cylinder is the recuperator cylinder, having at its forward end an air space and at its rear end a regulator for controlling the length of recoil. The floating piston in this cylinder separates the air from the oil.

8. Operation of 75-mm gun carriage, M1916A1 and M1916-MIA1.—*a. Elevating mechanism.*—The elevating mechanism is designed to allow elevation of the gun to 42° independent of the angle of site mechanism. The mechanism is operated by the elevating handwheel on the right side of the carriage, which is turned in a clockwise direction for elevating and counterclockwise for depressing.

b. Angle of site mechanism.—The angle of site handwheel is located on the left side of the carriage. The movement of this handwheel transmits power through the rocker to the elevating arc. The angle of site mechanism thus operates the elevating mechanism, gun, cradle, rocker, and sights.

c. Traversing mechanism.—The total traverse of the gun on carriage is 800 mils, 400 mils each left and right of center. The traversing handwheel is located on the left side of the carriage and turns in a

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clockwise direction for left traverse and counterclockwise for right traverse.

d. Brakes.—The brakes of the carriage are of the internal expanding type (Ford). They are operated by hand brake levers, one on each side of the carriage to the rear of the shield. The hand brakes are not for use in traveling but only for immobilizing the carriage in firing.

9. Tabulated data.

a. Gun.

Weight of gun with breech mechanism	pounds	749
Caliber	inches	2. 95
Muzzle velocity (see FT 75–E–2).		
Length of bore	inches	84
Length of gun	do	90. 9
Twist of rifling, right hand, one turn in 119 calibers at beginning of rifling to one turn in 25.4 calibers at 9.72 inches from muzzle, thence uniform.		
Weight of shell, HE, Mk. IV	pounds	13. 44
Weight of shrapnel, Mk. I	do	15. 95
Weight of charge	do	1. 50

b. Carriage.

Weight of carriage, complete	do	2, 461
Weight of gun and carriage, complete	do	3, 210
Diameter of wheels	inches	40
Width of tread	do	66
Length of recoil on 75-mm gun carriage, M1916A1 (at 0°)	do	46
Length of recoil on 75-mm gun carriage, M1916MIA1 (at 0°)	do	46
Height of axis of gun	do	41⅝
Height of panoramic telescope	do	52
Maximum angle of elevation	degrees	53
Maximum angle of depression	do	−7
Traverse of gun on carriage	mils	800

SECTION III

DESCRIPTION OF GROUPS

	Paragraph
Gun	10
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Firing mechanism	12
Gun carriage, M1916A1	13
Gun carriage, M1916MIA1	14

10. Gun.—*a.* The variations in these models of guns are such that recognition is difficult from their outside appearance, except in the cases of the M1916MIA1, M1916MIIIA1, and M1916MIII½A1, which have the top portion of the breech ring cut away and a steel casting, known as the saddle, on the upper surface for use with the St. Chamond recuperator.

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b. Except for the differences outlined in *a* above, the guns have the same characteristics.

(1) The tube extends from the muzzle of the gun to the rear end of the powder chamber, and two recesses are cut in its rear face to form seats for the lips on the extractor.

(2) The jacket is assembled over the breech end of the tube. The jacket carries two flanges on its lower side which form guides for the gun in the slide ways of the cradle of the carriage. A lug on top of the jacket of all guns, except the M1916MIA1, M1916MIIIA1, and M1916MIII½A1, contains a T-slot for the recoil cylinder of the 75-mm gun carriage, M1916A1.

(3) The breech ring is threaded internally at its forward end and screws on to the rear of the jacket.

(4) Where applicable, the upper hole in the breech ring is for the recoil cylinder, and the two holes in the bottom of the breech ring are for the attachment of the counterrecoil spring piston rods.

(5) The breech ring of the guns modified for mounting on the St. Chamond recuperator does not have the upper hole, and the lower portion has only one hole for the recoil rod.

(6) The rear part of the breech ring is cut away to form the breech recess. A vertical rectangular slot extending through the rectangular section of the breech ring forms a seat for the sliding breechblock. The upper part of the breech ring in rear of this slot is cut away, having a U-shaped opening which permits the passage of the cartridge case. Recesses cut in both of the side faces of the breech recess form seats for trunnions on the two extractors. Holes bored into these recesses from the rear face form seats for the extractor plungers, springs, and plugs.

(7) The clip is shrunk on the tube near the muzzle. Two lugs on the underside of the clip form the muzzle guide of the gun. The rear ends of the guides on the jacket are extended to the face of the recoil lugs by short extensions riveted in place to prevent entrance of dust between the surface of the guides and their bearing surfaces on the cradle. For the same purpose, the forward ends of the guides on the jacket are connected by steel plate dust guards with the rear ends of the guides on the clip.

11. Breech mechanism (fig. 4).—*a*. *Breechblock*.—(1) The breechblock is rectangular, of forged steel, and has two flanges on either side which engage with corresponding grooves in the breech recess. These flanges and grooves are inclined at a slight angle to the vertical so that the breechblock moves forward slightly in closing and forces the cartridge case into its seat. The upper part of the breechblock is

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so cut as to form a semicircular opening to permit the passage of the cartridge case when the breech is open. The front of this opening is beveled so that when the breechblock is closed this beveled portion will strike the edge of the case and push it home. A slot inclined at an angle to the front face of the breechblock and having a T-shaped cross section is contained in the lower part of the breechblock. Slots in the side faces of the breechblock form guides for the inside trunnions of the extractors. The lower parts of these slots are inclined slightly forward and the upper parts curve sharply to the front, thus increasing the speed of the extractors during the final part of the downward motion of the breechblock. The lugs at the front of these slots are cut away at their upper ends to form horizontal shoulders, the inner trunnions of the extractors being forced over these shoulders by the extractor plungers so as to lock the breechblock in its open position.

(2) The breechblock under the action of the operating arm (6A), slides up and down in the breech recess. The operating arm is pivoted to the operating shaft (6B) and acts as an oscillating crank in opening and closing the breechblock. The operating shaft (6B) which rotates the operating arm (6A) is operated by the operating handle (6C). The operating handle (6C) is provided with a latch to keep it in closed position, and is connected by a chain (9A), spring piston (9F), and spring piston rod (9B) to the closing spring (9C), which is housed in the closing spring case (6D) attached to the right side of the jacket by means of the spring case key (A12732). The closing spring (9C) is under compression and tends to keep the breechblock closed, or to close the breechblock when released from its locked open position.

b. Operating arm.—The operating arm (6A) carries a cylindrical hub at one end which is fitted to the operating shaft (6B)and at the other end a T-shaped head which operates in the corresponding slot of the breechblock. The operating arm oscillates about the axis of the operating shaft and acts as a crank in raising and lowering the breechblock.

c. Operating shaft.—The operating shaft (6B) is seated in a cylindrical recess in the upper part of the lower lug of the breech ring. The center of the shaft supports the hub on the operating arm (6A) and the right end supports the operating handle into which it fits.

d. Operating handle.—The operating handle (6C) carries a grip at the upper end. Fitted into this grip is the lever of the handle latch which is pivoted at the bottom of the grip by the operating handle latch pivot (9P). The operating handle latch spring (9L) is located at the upper end of the slot in the grip and keeps the latch lever

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projecting beyond the surface of the grip. When the handle is grasped the lever is forced into the slot in the grip, rotating the latch and releasing the handle.

e. Extractor.—(1) The extractors (7C and 7B) are flat oblong steel forgings, each having three projections as follows:

(*a*) Lips at the front parts of the upper ends of the extractors fit into the recesses in the tube and bear against the front face of the rim on the cartridge case.

(*b*) Trunnions on the outside of the lower portions of the extractors move in recesses in the wall of the breech recess and against which the extractor plungers bear. These plungers, which together with the plunger springs and plunger plugs are housed in cylindrical holes in the breech ring, tend to push the lower parts of the extractors forward, and have for their principal purpose the forcing of the inside trunnions on the extractors over the horizontal shoulders on the breechblock, in order to lock the breechblock in the open position.

(*c*) Trunnions on the inside of the lower portions of the extractors operate in the cam slots in the side face of the breechblock and impart the rolling motion to the extractors which extract the cartridge case. Flat surfaces are cut on these trunnions to engage with the corresponding horizontal shoulders on the breechblock in locking the breechblock when open.

(2) The front surfaces of the extractors are curved in vertical directions, and as the breechblock is opened the lower ends of the extractors are forced forward by the trunnions which fit in the inclined grooves in the breechblock. The extractors roll on the surfaces which bear against the vertical surface on the gun at the rear of the tube.

f. Closing spring case.—The closing spring case (6D) is a cylindrical, hollow steel casting with a lug on one side. This lug contains a dovetailed slot to fit over a corresponding lug on the right side of the gun. A rectangular slot at right angles to the dovetail, passing through the case and lug in the gun, is provided for the insertion of a rectangular key (A12732) having a taper on one side, the insertion of which forces the case into position and locks it there. The case incloses the closing spring (9C). A shoulder is left at the rear end of the case against which one end of the closing spring bears.

g. Spring piston rod.—The spring piston rod (9B) passes through the center of the closing spring (9C) and through the spring piston (9F) and closing spring case (6D). The spring piston rod nut (9D) is held in place by a lock nut (9H) and cotter pin. Attached to the

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opposite end of the rod is the chain (9A) which is also attached to the operating handle (6C) and operates in closing the breechblock.

h. Closing spring.—The closing spring (9C) is a spiral spring. It is normally compressed to a height of 14 inches when the breechblock is in the closed position. This pressure may be increased by *screwing* up on the spring piston rod nut (9D) the necessary amount to allow the breechblock to close without excessive shock which might cause the operating handle to become battered.

12. Firing mechanism (fig. 4). —*a. Firing pin.*—The firing pin (8D) is a hollow cylinder terminating into a smaller solid conical point which protrudes through the front face of the breechblock when firing the gun.

b. Firing spring shoe.—The shoe (8E) is a hollow cylinder which fits over the rear of the firing spring (8F) and slides inside the firing pin (8D).

c. Firing arm.—The arm (8N) is a steel forging consisting of a cylindrical hub with a square shoulder for engaging the sear (8L) and a projecting arm carrying a small knob at its outer end. The hub is provided with a square hole which fits over a corresponding square on the trigger shaft.

d. Sear.—The sear (8L) is a small steel cylinder open at one end to receive the sear spring. It carries a projecting shoulder which engages in a notch in the firing pin and a second shoulder on which the shoulder of the firing arm (8N) operates in releasing the sear.

e. Trigger shaft.—The trigger shaft (7D) is cylindrical in form with a square on one end which fits into the firing arm (8N) and a flat arm projecting at right angles from the other end. The latter serves as a lever to rotate the shaft. It is held in position in the breechblock by the trigger shaft detent (7F).

f. Return catch.—The return catch (A12727) is pivoted on the left side of the breech end of the gun, and when the gun is out of battery it is held down by its weight and the action of the catch spring (A12728) which bears against the underside of the return catch stop (A12731). When the return catch is in the downward position, the hook on its end is in line with a notch in the end of the firing shaft (KB67A) on the carriage. If the firing shaft is moved to the rear when the gun is out of battery, it will be caught by this catch which prevents firing of the piece. When the gun is in battery, the hook on the catch is lifted out of line with the notch in the firing shaft by a cam mounted on the firing shaft bracket.

13. Gun Carriage, M1916A1.—*a. General.*—(1) The carriage is of the split trail, variable long recoil type. The length of recoil is regu-

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lated automatically so that the breech of the gun will not strike the ground on recoil when elevated at an angle of less than 47°. At elevations greater than 47°, a hole must be dug for the breech in recoil.

(2) The gun is mounted in slides on the cradle. The slides are attached to the spring cylinder. The spring cylinder is suspended by trunnions mounted in bearings on the top carriage. The top carriage (fig. 17) is supported by the pintle bearing (KB31A, fig. 7). Axle arms are attached to the pintle bearing. On each axle arm a wheel spindle bracket is mounted to which the wheels and braking mechanism are assembled.

(3) The carriage has an independent line of site through the angle of site mechanism by means of which maximum depression of −7° and elevation of +11° may be obtained. Additional elevation is obtained through the elevating mechanism.

b. Principal parts.—The principal parts of the carriage are the trail, cradle, recoil mechanism, top carriage, pintle bearing, equalizing gear, angle of site mechanism, elevating mechanism, traversing mechanism, firing mechanism, shield, brake mechanism, shoulder guards, and wheels.

(1) *Trail.*—(*a*) The trails, left and right, are hinged to the left and right equalizing pinions. Stops are provided to control maximum trail spread. A trail lock is provided to secure the trails in travel position and is composed of a ball on the left trail seated in a cup on the right trail. This seat is locked by a toggle joint actuated by a handle which in turn is secured in travel position by a strap.

(*b*) To the right trail is welded a drawbar (C64458, fig. 6) which forms a bearing for the drawbar (D31532). The latter is held in place by the drawbar key (A158911). The lunette is secured to the drawbar by a nut and cotter pin.

(*c*) Floats consisting of flanged steel plates are attached to the bottom of both trails at their rear for the purpose of increasing area of the trails on soft ground.

(*d*) Spade bearings are riveted on the rear of the trails for the removable spades. The removable spades (KB85E, figs. 5 and 7) are secured in position by the spade latch plungers. When in position the spades are driven into the ground at which time the spade latch plungers are forced into notches in the spades by means of the spade latch spring. The slopes on the faces of the plungers allow downward movement of the spades but prevent upward movement. To release a spade, the foot pedal on the spade latch handle is pressed

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down. This disengages the plunger from the spade and allows the spade to be removed.

(*e*) A trail handle is riveted to the outside of each trail for lifting purposes. Trail guards are riveted to the top of the trails to prevent battering by sledges used for driving the spades.

(*f*) Sponge staff fastenings are riveted to the top of each trail. Sponge staffs are inserted in upper rings of staff fastenings and the lower ends are clamped in place. The smaller section of the sponge staffs fits in the sponge fastening.

(*g*) Sledge fastenings are similar to sponge staff fastenings and are riveted to the outside of each trail.

(*h*) Trail seats are made of formed plates and are riveted to the top of the trails near the breech of gun. The oiler support with springs is under the right-hand trail seat. The oiler rests on this support and is held in place by springs.

(*i*) The traveling lock bar (KB48A, fig. 5) consists of a steel bar pinned to the lock bar bearing on the left trail. It is made to swing across the trails in traveling position and along the left trail in firing position. In traveling position the socket in the middle of the lock bar engages with the traveling lock stud in the bottom of the cradle. The right end of the lock bar is held in the lock bar clip on the right trail by the traveling lock bar latch plunger. To disengage the latch plunger for firing, the latch lever is lifted and the traveling lock bar swung to fastening in the left trail where it is secured by the traveling lock bar latch plunger.

(2) *Cradle.*—The cradle of the 75-mm gun carriage, M1916A1, is in the form of two cylinders joined at the center with axes in the same horizontal plane. Above the cylinders are the gun ways parallel with the cylinders and opening toward the center line of the cylinders. The traveling lock stud is bolted through a lug at the rear and below the cylinders. The firing shaft bracket is riveted to the left side, and the range scale bracket to the right side of the cylinders at their rear end. Shoulder guards are pinned in sockets in both the firing shaft and range scale brackets to prevent contact of the cannoneers with the gun during recoil. Trunnions are riveted and keyed to the cylinders near the center. The elevating arc is bolted to lugs on the bottom of the cylinders at the trunnions. The piston rod bracket is riveted to projections on the cylinders above the gun slides and near the front end. The cylinder cover is pinned to the cylinder clips which are riveted to the front of the spring cylinders.

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(3) *Recoil mechanism.*—(*a*) *General.*

1. The recoil mechanism of the 75-mm gun carriage, M1916A1, is of the hydrospring type, with the recoil cylinder mounted above the gun and the counterrecoil cylinders and springs in the cradle below the gun.

2. The recoil cylinder is held by a slot machined in the gun jacket at the front and rests in a cylindrical opening in the lug at the top of the breech ring. It is held in place by the recoil cylinder retainer, which screws into the rear cylinder head and bears against the lug of the breech ring. Three lands are formed inside of the recoil cylinder parallel to the center line.

3. The recoil valve is a cylinder with a collar at the front end and three lands inside and parallel to the bore. Three rows of holes are bored at the lands. The recoil valve fits inside of the recoil cylinder, resting on the lands of the latter. It is held in place by a collar bearing against the edge of a counterbore in the cylinder at the front, while the rear end of the valve bears against the inside rear end of the recoil cylinder.

4. The recoil piston rod assembly is composed of a piston which is screwed and pinned to the piston rod. The piston is of bronze and is slotted to fit the lands of the recoil valve. The piston rod is hollow for almost its entire length. The front end passes through the gland in the cylinder head and piston rod sleeve in the piston rod bracket. The valve turning gear fits over the front end of the piston rod, the rod being held by the piston rod nut, which causes the shoulder on the rod to bear against the piston rod sleeve. The front end of recoil cylinder is closed by means of a gasket and the front cylinder head, the latter being screwed in place. A bronze gland and four rings of $\frac{5}{16}$-inch Garlock hydraulic packing prevent leakage around the piston rod.

5. The counterrecoil buffer assembly consists of a buffer rod (66B, fig. 8) screwed into the buffer rod nut at the rear end of the recoil cylinder, and extends through the buffer bushing into the interior of the piston rod. A buffer head is screwed and pinned to the front end of the buffer rod. The buffer head is of two diameters connected by a short cone. The rear end is the smaller diameter which is threaded inside to screw over the buffer rod. The

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coned surface contains slots leading to a hollow chamber in front. The front end of the head is faced and provided with a central bearing for the valve stem. The bearing is supported by webs in the main body of the guide. The valve stem at its rear end acts as a stop. To the threaded portion of the stem a valve is screwed and pinned.

6. The counterrecoil springs (KB28X and W, fig. 8) are assembled around spring rods in the spring cylinders. The spring rods are attached to the lower portion of the breech ring and are retained by taper keys driven diagonally through the lug of the breech ring and spring rods. Three coils of inner counterrecoil springs are assembled over the spring rods, surrounded by three coils of outer springs. The inner and outer springs are coiled in opposite directions to prevent nesting. The sets of coils are separated by bronze separators. The rear ends of the spring cylinders are bushed for the spring rods.

(*b*) *Operation of the recoil and counterrecoil system.*

1. When the gun is fired it moves back in slides on the cradle, carrying with it the spring rods, buffer rod, recoil cylinder, and recoil valve. The recoil piston rod assembly and the spring cylinders remain stationary, being fixed to the carriage.

2. The recoil cylinder being full of oil, the oil is forced by the piston through holes in the recoil valve in front of the piston up into an annular space between the valve and cylinder and into space behind which has been vacated by the piston. The hydraulic resistance caused by forcing the oil through the holes in the valve absorbs most of the recoil energy of the gun, and the remaining energy is taken up by compression of the counterrecoil springs and friction.

3. When the gun reaches the end of recoil all of the recoil energy has been absorbed, and the counterrecoil springs acting against the spring rod pistons force the gun back to battery position. The purpose of the counterrecoil buffer is to overcome the tendency of the gun to return to battery too rapidly, although at the same time allowing sufficient speed of counterrecoil to permit maximum rapidity of fire. Buffer action is necessary, as the strength of the counterrecoil springs required to return the gun to battery at high elevation is greater than is required at lower elevations.

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4. As the buffer rod moves backward in the recoil piston rod, the valve in the buffer rod head is opened by the pressure of oil in back of the valve and the vacuum in front, which forces oil into the buffer chamber in front of the buffer rod head. At full recoil the buffer chamber is full of oil and the buffer rod head is inside the rear end of the recoil piston rod. When the counterrecoil springs force the gun back in counterrecoil, the buffer rod moves forward, compressing oil in the buffer chamber and forcing the counterrecoil buffer valve closed. This prevents escape of oil through the counterrecoil buffer valve and forces oil to throttle between the outside surface of buffer rod head and the inside surface of the recoil piston rod, offering resistance to the counterrecoil spring action. The inside bore of the recoil piston rod is tapered at the front end to increase resistance and obtain desired decrease in counterrecoil velocity.

(c) *Variable recoil mechanism.*—Variable recoil is obtained by varying areas of effective throttling holes in the recoil valve. An arm on the trunnion cap is connected by means of a valve turning connecting rod, valve turning arm, valve turning gear, and piston rod gear to the recoil piston rod. As the gun is elevated the relation of the cylinder to the trunnions changes, causing the recoil piston rod to turn by means of the valve turning mechanism. Slots in the recoil piston engage lands in the recoil valve, causing the recoil valve to turn with the recoil piston. As the recoil cylinder remains stationary the location of the lands inside of the recoil cylinder changes with relation to the three rows of holes in the recoil valve, and these rows of holes are covered to produce variations in length of recoil. At long recoil all rows of holes are uncovered, at intermediate recoil one row is covered, and at short recoil two rows are covered. The setting of the recoil valve in degrees elevation is shown by a scale on the piston rod sleeve and index mark on the edge of the piston rod bracket bushing at the top of the piston rod.

(4) *Top carriage.*—The top carriage carries the trunnions of the cradle and rests on the pintle bearing. It bears on circular bronze slides in the upper part of the pintle bearing and is centered on a bronze pintle collar of the pintle bearing.

(5) *Pintle bearing.*—The pintle bearing supports the top carriage, equalizing pinions and equalizing gears, and axle arms, the latter being shrunk and pinned to the pintle bearing.

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(6) *Equalizing gear.*—(*a*) The object of the equalizing gear (KB76B, figs. 8 and 9) is to increase the stability of the carriage on the wheels in firing at different elevations. The equalization gear is an H-section with a bevel-toothed sector on each end and a bronze bushed bearing in the center.

(*b*) It bears over the vertical journal below the pintle bearing and is held in place by the equalizing gear support (KB32K) screwed inside the journal.

(*c*) Vertical deflection is prevented by the equalizing gear studs (KB32B, fig. 9) which are fixed to the pintle bearing by hexagon shoulders and nuts passing through slots in the equalizing gear. The gear is supported on the shoulders of the studs.

(*d*) Equalizing pinions (KB32D, figs. 8 and 9) are bevel pinion sectors, bronze bushed, bearing over arms of the pintle bearing. They have lugs for trail connection bolts. The pinions are held in place by locking rings screwed over the axle arms and are free to revolve about the pintle bearing arms. The equalizing pinions mesh with the equalizing gear.

(*e*) When the carriage is laid at a cant it is more unstable than when the wheels are level. If fired under this condition, the force of recoil tends to overturn the carriage. The function of the equalizing gear is to overcome this tendency. In firing, stresses are transmitted to the trails, and the side on which the lesser stress is exerted tends to rise. This motion is transmitted through the equalizing pinion and equalizing gear to the equalizing pinion on the other side, applying downward force on this trail and preserving the stability of the carriage.

(7) (*a*) *Angle of site mechanism.*

1. The angle of site mechanism is designed to give the gun a maximum depression of about −7° and a maximum elevation of +11°, independent of the elevating mechanism. The mechanism is operated by two handwheels, one on either side of the carriage.

2. The handwheel on the right side operates through the bevel gear on the handwheel shaft and an intermediate shaft, both mounted in the angle of site bracket, right, and angle of site cross shaft, right, mounted in bronze bushings in the top carriage. The handwheel on the left side operates through bevel gears on handwheel shaft mounted in angle of site bracket, left, and angle of site cross shaft, left, mounted in bronze bushings in the top carriage. Bevel gears on ends of both angle of site cross shafts mesh

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with bevel gears on angle of site worm, which is mounted in bushings in top carriage and held in place by angle of site worm caps. This worm meshes with teeth cut in the rocker.

3. The rocker (KB34D, figs. 9, 15, and 16) is a U-shaped piece with bearings at the top of both arms and teeth cut in bottom of U. The bearings bear over and are free to revolve about trunnions on the cradle independent of the trunnion bearing in the top carriage. The top half of the right bearing is formed by the right rocker arm which extends back and carries the angle of site scale (EA30H, fig. 16), range scale pointer (KB80C), rocker arm range scale pointer rack (EA4R), and level, and forms a bearing for the elevating handwheel shaft (KB81A, figs. 15 and 16). Rear of the right rocker arm (KB79A) is the rocker arm brace which is attached to the rocker arm and rocker (KB34D). The top half of the left bearing is formed by the left rocker arm, a diagonal arm extending upward to the rear to form a support for the sight. Movement of the angle of site mechanism is limited in elevation by the rocker stop bolt to the side of the rocker and in depression by a screw in the arc.

(*b*) *Elevating mechanism.*

1. The elevating mechanism (fig. 15) is designed to allow an elevation of the gun 42° independent of the angle of site mechanism. The mechanism is operated by one handwheel on the right side of carriage which is turned in a clockwise direction to elevate the gun.

2. The elevating mechanism is operated through bevel gears on the elevating handwheel shaft (KB81A, figs. 15 and 16) mounted on the right rocker arm (KB79A), elevating intermediate handwheel shaft (KB81C) inside the rocker arm brace, elevating cross shaft (KB81B) mounted in the elevating cross shaft bearing (KB61C, figs. 8, 15, and 16) bolted to the rocker, and the elevating worm (KB50A, figs. 7, 15, and 16) which meshes with the elevating arc bolted to the bottom of the cradle.

(*c*) *Operation of angle of site and elevating mechanisms.*

1. Angle of site mechanism (fig. 14) is operated by turning the handwheel, the movement of which is transmitted through shafts and gears to the angle of site worm (KB90F, figs. 7, 14, and 17) meshing with the rocker (KB34D, figs. 9,

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15, and 16). Movement of the rocker is transmitted directly through the elevating worm (KB50A, figs. 7, 15, and 16), elevating arc (57A) and cradle to the gun, and through rocker arms to the elevating mechanism and sight support. The angle of site mechanism thus moves the elevating mechanism rocker, cradle, gun, and sights.

2. The elevating mechanism through movement of the handwheel moves only the gun and cradle, shaft, and elevating worm inside the rocker which meshes with the elevating arc.

3. The angle of site scale (EA30H, fig. 16) is graduated in mils from 170 to 500. The range scale is graduated in meters. The zero setting of the gun is with 0 on the range scale opposite 300 on the angle of site scale and level bubble on the right rocker arm. This allows the maximum depression of −7° (about 130 mils) or maximum elevation of +11° (about 200 mils) of angle of site mechanism to be read on angle of site scale against zero on the range scale.

4. The sight, M1916, which acts as a support for the panoramic telescope, is attached to the left rocker arm.

5. In direct fire the axis of the bore is brought on the line of site by operating the angle of site handwheel until the cross hairs of the panoramic telescope are on the target, and the range is laid off independently by bringing the desired range graduation opposite 300 on the angle of site scale. The line of site may be set independently of range as there are two angle of site handwheels.

6. In indirect fire the angle of site in mils is laid off on the angle of site scale with the pointer, and the desired range graduation brought opposite the pointer by means of the elevating handwheel.

(8) *Traversing mechanism.*—(*a*) The total traverse of the gun on the carriage is 800 mils, or 400 mils each side of center. The traversing handwheel is located on left side of the carriage and turns in a clockwise direction for left traverse or in the opposite direction for right traverse.

(*b*) The traversing handwheel shaft (KB36H, fig. 18) is mounted in the angle of site shaft left bracket (KB46D, figs. 14, 17, and 18) and angle of site bracket left cover (KB46A, figs. 17 and 18). A bevel pinion on the upper end of the shaft meshes with a bevel gear on the traversing intermediate shaft (KB36B, figs. 9, 17, and 18) which

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bears in the angle of site cross shaft gear left cover and intermediate traversing shaft bearing (KB38A) bolted to the top carriage. A bevel pinion at the lower end of the traversing intermediate shaft (KB36B) meshes with the bevel gear on the end of the traversing worm shaft (KB36D, figs. 9 and 18) which is mounted in the bearing in the top carriage. The traversing worm (KB36A, figs. 9, 17, and 18) meshes with the traversing rack which is screwed to the pintle bearing. Traversing and elevating stops (KB37E, fig. 18) which are fillister-head screws between the end teeth of the traversing rack limit movement of the worm meshed in the rack.

(*c*) The movement of the handwheel is transmitted through shafts and bevel gears to the worm and rack. The rack is mounted in the pintle bearing which remains stationary, and the top carriage revolves about its bearing in the center of the pintle bearing and bronze-lined slides around the outside of pintle bearing. The azimuth scale (KB37B, fig. 18) is screwed to the pintle bearing above the rack, and the pointer is formed on the traversing worm shaft bearing.

(9) *Brake mechanism* (fig. 10).—(*a*) The brakes are of the internal expanding type. The brake shoes (B145080) are connected to cam shafts and are actuated by the hand brake levers.

(*b*) The movement of the brake levers is controlled by the brake lever catch engaging the teeth of the brake segment rack assembled to the wheel spindle bracket.

(*c*) The brake shoe is a flanged segment, the outer diameter of which is covered with a brake lining secured by rivets. When the brake shoes are secured to the brake housing plate assembly by the brake cam roller pin (B144962) and brake shoe link pin (B144975), and connected with the brake shoe adjusting wedge (B144959) by the brake shoe links (B144960) and brake cam roller (B144955), they are held in contact with the brake cam (B144968) by the three brake shoe retracting springs. The assembly is designated as the brake.

(*d*) When engaging the brake the movement of the hand brake levers rotates the brake cam, causing the brake cam rollers (B144955) to ride toward the high point of the brake cam, and thereby forces the brake shoe against the brake drum secured to the hub of the wheel.

(*e*) When the hand brake levers are released, the tension on the brake shoe retracting spring is likewise released. This action forces the brake cam rollers to the low point of the brake cams and thereby releases the pressure of the brake shoes against the brake drums.

(10) *Disk and rim wheel.*—The wheel assembly consists of a 24 by 6 automobile disk and rim wheel, with locking ring, mounting a 7.50–24

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truck and bus balloon type B pneumatic automobile tire, with a puncture sealing truck and bus balloon compression type I, 7.50–24 automobile inner tube. The tire is secured to the rim by the tire locking ring. The rated capacity of the tire as given in Federal Specification No. ZZ–T–381a is 2,400 pounds tire load at 55 pounds air pressure. As used on these carriages the tire load is approximately 1,500 pounds but is all unsprung weight. Therefore, for carriage stability and to reduce wear and tear in the carriage, the air pressure is fixed at 35 pounds cold pressure. The air pressure should be checked and recorded at each inspection.

(11) *High-speed adapter.*—(*a*) The high-speed adapter consists of the left- and right-wheel spindle bracket assembly, disk and rim wheel group assembly, brake mechanism assembly, hand brake lever, and ratchet racks.

(*b*) The left- and right-wheel spindle brackets are mounted on the axle arms attached to the pintle bearing and are clamped to the axle arm by cap screws and bolts.

(12) *Shoulder guards.*—Shoulder guards are small shields pinned into sockets in the firing shaft bracket and the range scale bracket to protect cannoneers from the recoiling gun.

(13) *Shields.*—(*a*) Shields are designed to provide protection for the cannoneers when under fire.

(*b*) The main shield is divided into two parts which are attached to shield brackets bolted to the pintle bearing.

(*c*) The top shield is hinged to the top of the main shield and may be raised or lowered as required.

(*d*) An apron is hinged to the bottom of the main shield and may be lowered when in firing position or raised when traveling.

(14) *Exterior firing mechanism.*—(*a*) The exterior firing mechanism is secured to the left side of the cradle by the firing shaft bracket.

(*b*) When the firing handle is pulled the motion is transmitted through the firing link to the firing shaft, which moves to the rear, and the firing shaft pawl engages the trigger shaft (7D, fig. 4) so that a slight additional pull fires the gun. When the gun is more than an inch out of battery the sloping face of the return catch (A12727) is not engaged with the slope on the firing shaft bracket, but is forced down by its spring and engages the undercut groove in the end of the firing shaft and stops further movement of the firing shaft in that direction.

14. Gun carriage, M1916MIA1.—*a.* As the gun carriage, M1916MIA1, is similar to the carriage, M1916A1, their main differences

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being in the type of recoil and counterrecoil systems, description only of the recoil mechanism is given below.

b. (1) The recoil mechanism is hydropneumatic, known as the St. Chamond type. The use of small forgings was made possible by introducing high pressure in the recuperator and recoil cylinders.

(2) The mechanism consists of three cylinders. The middle one is the recoil cylinder. The right cylinder has an air reservoir at its forward end and an oil reservoir at its rear end. The left cylinder is the recuperator cylinder, having at its forward end an air space and at its rear end a regulator for controlling the length of recoil. A floating piston in this cylinder separates the air from the oil.

(3) In recoil the gun moves to the rear, carrying with it the recoil piston. The recoiling parts are held in battery by the reaction of the air on the floating piston which is transmitted through the liquid against the leak-tight recoil piston. The energy of recoil is absorbed by the throttling of the oil through a spring-controlled orifice in the regulator valve.

(4) An opening is provided between the recoil and the recuperator cylinders to house the regulator valve. During recoil the pressure in the recoil cylinder opens the regulator valve, the movement of which is controlled by a helical spring and a number of Belleville springs. The oil passing through the orifice controlled by this valve moves the floating piston forward against the air pressure, thereby storing up energy to return the gun from the recoiled position to its position in battery. The valve in the counterrecoil orifice remains closed during recoil.

(5) Throttling during recoil is controlled by the regulator valve consisting of an upper and lower valve stem. The lower valve stem is sealed in a circular seat at the entrance channel to the valve. As the valve lifts, the throttling area becomes the vertical circumferential area between the valve and its seat. In long recoil the movement of the valve is controlled by a spiral spring which rests on the lower valve stem. The upper stem rests in a valve housing and has Belleville springs reacting on the stem only. To move the upper valve stem, the whole housing is lowered automatically by a cam operated when elevating the cradle. At short recoil the upper stem of the regulator is brought down by the cam until its lower surface is in contact with the top surface of the lower valve stem, thus controlling the throttling of the valve.

(6) The regulator valve is closed during the counterrecoil movement, except for a very small constant opening. During counterrecoil there is also a second path for the flow of oil through a small

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channel beginning at the inside of the buffer chamber in the recuperator cylinder, and finally emptying into the recoil cylinder through a bypass around the regulator valve. Near the end of counterrecoil the tapering buffer rod on the floating piston in the recuperator controls the flow through the second path by causing additional throttling through the small annular area between the buffer chamber and buffer rod, thus bringing the recoil parts to rest without any great amount of shock.

SECTION IV

DISASSEMBLING AND ASSEMBLING

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Firing mechanism	15
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Counterrecoil springs	17

15. Firing mechanism (fig. 4).—*a. Disassembling.*—(1) This may be done either when the breechblock is mounted or dismounted. Remove the trigger shaft detent (7F) and trigger shaft (7D), unscrew the breechblock face plate (8P) with the teat wrench provided and pull the firing mechanism out with the fingers. Remove the firing arm (8N), insert the flat end of the trigger shaft (7D) in the slot in the firing spring shoe (8E), push down and turn clockwise to disengage the pin on the shoe from the shoulder in the slot in the firing pin (8D). This releases the shoe from the firing pin and the shoe and firing spring may be removed. The sear and sear spring are removed from their recess.

(2) In order to facilitate assembly and disassembly a small hole has been drilled and tapped in the sear and firing spring shoe into which the end of the trigger shaft detent may be screwed when difficulty is experienced in assembling or disassembling these parts.

b. Assembling.—Place the firing spring (8F) in the firing pin (8D). Place the firing spring shoe (8E) over the end of the firing spring, engage the flat end of the trigger shaft (7D) in slot in the firing spring shoe and turn so that the pin on the shoe is opposite the rear end of the slot in the firing pin. Push down on the firing spring shoe until the pin on the shoe is opposite the shoulder in the slot in the firing pin. Turn the firing spring shoe counterclockwise until the pin engages the forward end of the shoulder in the slot, and lock the parts together. Insert the end of the firing arm (8N) through the slot in the firing pin. Place the sear spring (A12222) in the sear and put the sear (8L) and spring in place either by removing the sear spring seat (7E) which closes the left end of the sear hole or by using a knife or small pair of

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pliers and inserting from the firing pin hole. Insert the assembled firing mechanism in the recess in the breechblock and assemble the breechblock face plate by screwing it home. This completes assembly of the firing mechanism with the exception of the trigger shaft which must be assembled when the breechblock is mounted in the breech recess.

16. Breech mechanism (fig. 4).—*a. Dismounting and disassembling.*—Remove the trigger shaft detent cotter pin and trigger shaft. Remove the operating shaft detent (A12726) by pulling its upper end to the right until the small pin is released from its seat, then rotate it to the rear until it comes clear of the operating shaft (6B). Remove the tension from the closing spring (9C) by unscrewing the lock and spring piston rod nut (9D). Disconnect the closing spring by removing the small connecting pin. Place a block of wood under the breechblock to hold it in position. Remove the operating handle (6C) from the operating shaft (6B). Pull the operating shaft out to the left. Push up on the breechblock until it is ¼ inch above its closed position and remove the operating arm. Allow the breechblock to slide downward until it clears the breech recess and remove the breechblock. Withdraw the taper key (A12732) from the closing spring case (6D) and push the case to the front and off its seat. The closing spring piston rod (9B), spring piston (9F), and chain (9A) can be withdrawn from the closing spring case. The extractor plungers (8S) and springs (8Q) are removed by unscrewing the two extractor plunger plugs (8R) from the breechblock. Care must be used to prevent these plugs from being thrown to the rear when they are removed.

b. Assembling and mounting. The firing mechanism having been assembled in the breechblock, place the trunnions of the extractors (7C and 7B) in their respective recesses, insert the extractor plungers (8S) and plunger springs (8Q) and place the plunger plugs (8R) in the ends of the plunger springs (8Q) in the breechblock. Compress the plunger springs and screw the plunger plugs home. Place the outer end of the operating arm in the slot in the breechblock, insert the breechblock in breech recess from the bottom, and push up until ¼ inch above the closed position, then push the operating arm (6A) into its seat in the breech recess. Insert the operating shaft (6B). Assemble the operating handle (6C) on the end of the operating shaft (6B). Place the fork of the operating shaft detent (A12726) in the groove in the operating shaft and rotate the detent until it locks in place. Assemble the closing spring (9C), spring piston rod (9B), and chain (9A) within the closing spring case (6D), and assemble the spring

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piston rod nut (9D) and lock nut (9H) to the spring piston rod. Assemble the closing spring case in position on its dovetail seat and insert the spring case key. Connect the closing spring chain to the operating handle. Screw up on the spring piston rod nut until the spring is compressed to about 14 pounds pressure. Place the trigger shaft in its hole in the breechblock and into the square hole in the firing arm and then push the trigger shaft detent home.

17. Counterrecoil springs.—*a. Removal.*—Close and lock the trails together. Set brakes and drive one spade into the ground to secure the carriage.

(1) (*a*) Remove the breechblock (see par. 16).

(*b*) Attach the spring compressor to the right spring rod by screwing the stud into the spring rod.

(*c*) Secure the single sheave tackle block issued with battery accessories to a fixed point such as a "dead man" or tree. The holding power of this point must be greater than the power of the compressed counterrecoil springs. The block should be on a plane with the center of the spring rod.

(*d*) Sufficient slack of rope must be allowed to permit the spring compressor to travel the full length of the spring cylinder and be detached from the spring rod at the front end.

(*e*) Open the spring cylinder cover.

(*f*) Retract the spring rod about 6 inches, remove the cotter pin from the spring rod key, and drive out the key with a bronze drift.

(*g*) Slack off on the pull rope until the counterrecoil springs are no longer under compression. Draw the spring rod out of the front end of the spring cylinder, detach the spring compressor, and remove the counterrecoil springs.

(2) Attach the spring compressor to the left spring rod and proceed as with the right.

b. Assembling.—In assembling the counterrecoil springs proceed in the reverse order of removal. The following precautions must be observed:

(1) If the tension of the spring compressor should bring the spring rod up solid against the spring cylinder bushing in rear of spring cylinder, ease off on the pull rope slightly and pry up the rod with bronze drift until the rod will enter the bushing.

(2) Before the key slot enters the breech lug see that keyways in spring rods and keyway in breech lug are in line. If not, turn the spring rod by means of a drift until keyways are in line.

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SECTION V

INSPECTION AND ADJUSTMENT

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Carriage	19
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Recoil mechanism, M1916MIA1 (St. Chamond)	21
Verification and adjustment of the sights	22

18. Gun.—The following instructions with reference to the inspection of the gun carriage and recoil mechanism should be observed scrupulously by all concerned:

Parts to be inspected in order of inspection	Points to observe
a. The gun as a unit.	*a.* Note general appearance; smoothness of operation of the breech mechanism in opening and closing. Note the action of the operating handle latch when pressed by the fingers. Test the action of the firing mechanism with the lanyard. Disassemble the breech mechanism and thoroughly clean it. Notice the condition of the bore for copper deposits on the lands and in the grooves; erosion at rifling. Examine the breech recess and note whether there are scores or burs on the bearing surfaces.
b. Breechblock.	*b.* Note whether there are scores or bruises on bearing surfaces and that the vent hole is clear.
c. Firing mechanism.	*c.* Disassemble the firing mechanism and see that it is thoroughly clean and lubricated and that all parts are free of burs.

19. Carriage.

Parts to be inspected in order of inspection	Points to observe
a. The carriage as a unit.	*a.* Note the general appearance, whether the carriage is painted in accordance with regulations, including grease and oil cups, oil plugs and oil hole covers, and that all moving parts are properly lubricated.
b. Elevating mechanism.	*b.* Elevate and depress the gun through the full extent of its travel. Note

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	whether the mechanism operates without binding or undue backlash.
c. Traversing mechanism.	*c.* Traverse the carriage through the full extent of its travel. Note whether the mechanism operates without binding or undue backlash.
d. Brake mechanism.	*d.* Test the brakes by placing the carriage in firing position, the wheels clear of the ground. Set the hand brake levers. Note position of plunger latch on brake segment rack. If plunger latch is in last tooth of rack the brake shoe should be adjusted. Release the hand brake lever to its off position. Note whether wheel revolves freely without drag.
e. Disk and rim wheels.	*e.* (1) Examine the disk and rim wheel nuts. Note condition, and whether they are set up tight. Note whether the rim of the wheel is deformed. (2) Examine the tire. Note whether the crown of the tire is taking the wear. If worn on either side of the crown, test alinement of wheels.

20. Recoil mechanism, M1916A1.

Parts to be inspected in order of inspection	Points to observe
a. Valve turning mechanism.	*a.* (1) Elevate the gun. Note whether the piston rod turns. (2) Note if oil is leaking at the piston rod gland; if so, tighten slightly on the gland. (3) Note whether oil cup is functioning properly, and whether the bearing surfaces of the piston rod and piston rod sleeve are being lubricated.
b. Recoil oil.	*b.* Elevate the gun to zero elevation, remove the two filling plugs on top of recoil cylinder. Note whether oil is level with top of cylinder. If not, add recoil oil to the mechanism.

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21. Recoil mechanism, M1916MIA1 (St. Chamond).—Points to observe during firing:

a. Watch the length of recoil. The normal recoil at 0° elevation is 45.67 inches, and at 53° elevation, 22 inches. The time of recoil and return to battery under normal conditions is 3 to 5 seconds.

b. Note the action of gun in recoil to see that its movement is uniform. Should the gun jump or jerk in returning to battery, it probably indicates the presence of air in the oil in the recoil and recuperator cylinders.

c. Note the action of the variable recoil mechanism and see that the lug operating in the camshaft slot functions properly.

d. If the gun returns to battery with a decided shock it indicates that there is too much reserve oil and the reserve should be drained gradually until the action is smooth. Continued firing will cause the oil to expand. This condition will have to be taken care of by draining off the excess oil. When firing ceases and the mechanism has cooled, a new reserve of recoil oil must be pumped into the mechanism until the oil gage rack is flush with the face of the oil gage follower.

e. After firing, inspect to see that no clear oil is leaking from the rear end of the recoil or recuperator cylinders. Open the recoil cylinder front head. See if there is clear oil at this point. If clear oil is found at either place notify the ordnance maintenance company.

22. Verification and adjustment of the sights.—*a. General.*—(1) Battery mechanics are forbidden to disassemble any part of the panoramic telescope and will make only such adjustments as are hereinafter prescribed. Adjustments are to be made only with tools provided by the Ordnance Department for that purpose and in the presence of a commissioned officer. Any difficulties which cannot be corrected by the methods herein described should be reported to the ordnance maintenance company.

(2) When out of adjustment the panoramic telescope will cause inaccurate firing and therefore should be verified and adjusted frequently. A testing target is provided for verifying the telescope.

b. Verification.—The procedure of verification is as follows:

(1) Place the carriage in firing position.

(2) Level the carriage transversely with the aid of the gunner's quadrant. With the gunner's quadrant on the leveling plates level the gun in a horizontal plane.

(3) Set the cross level bubble of the M1916 sight.

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(4) Open the breech and insert the bore sight. Place the black cord in the horizontal and vertical lines on the muzzle face, and strap in position.

(5) Place the testing target at a distance of 54 yards in a plane perpendicular to the bore of the gun and at a height where the axis of the bore passes through the center of the target marked "bore". The target should be checked by means of a plumb bob. The target is moved vertically until the vertical line through the target and the vertical cord on the muzzle of the gun coincide.

c. Adjustment.—(1) With the panoramic telescope mounted in the socket of the M1916 sight, set the azimuth scale and elevation micrometer of the panoramic telescope at zero. With the telescope thus arranged, the line of sight should pass through the center line of the target.

(2) If the line of sight pierces the target above or below the horizontal center line, it indicates that the elevating knob of the panoramic telescope is out of adjustment. Operate the elevating knob until the line of sight pierces the target on the horizontal center line. Loosen the elevating knob locking screw and turn the elevating knob without turning the elevating worm until the index on the rotating head points to zero. Tighten the locking screw.

(3) If the line of sight pierces the target to either the right or left of the vertical center line of the target, and the azimuth micrometer index reads zero, elevate and depress the gun, noting the angular differences. Loosen the micrometer locking screw, and with the teat wrench provided for the purpose turn the index one-half the difference of the angular errors, at the same time holding the scale to prevent it from turning. Tighten locking screw.

(4) After the panoramic telescope is adjusted it should be submitted to the following test for accuracy at extreme elevation and azimuth:

(*a*) With the carriage level and the gun and panoramic telescope at zero elevation and deflection, see that the line of sight and axis of the bore prolonged strike the target at the proper point.

(*b*) Elevate the gun to its maximum elevation without altering the elevation of sight. As the elevation of the gun is altered, the line of sight should follow the vertical line of the testing target.

(*c*) With conditions as in (*a*) above, traverse the gun to its extreme position in azimuth. As the deflection is altered the line of sight should follow the horizontal line of the testing target.

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SECTION VI

FUNCTIONING

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Malfunctions of carriage, M1916MIA1	26

23. General.—The functioning of the matériel as a whole and of the groups is so closely allied with description and operation and description of groups that it has been included in sections II and III and is not repeated hereunder.

24. Malfunctions of gun.—Abnormal conditions and their correction.

Malfunction	Cause	Correction
a. Fails to fire.	*a.* (1) Broken or weak firing spring.	*a.* (1) Remove firing mechanism and disassemble, wash parts in dry cleaning solvent, remove all burs with an oilstone or smooth file. Replace broken or damaged parts.
	(2) Broken or deformed point on firing pin.	(2) Replace firing pin.
b. Failure to extract cartridge case.	*b.* (1) Broken extractors.	*b.* (1) Ram the cartridge case gently from the muzzle. Examine edge of chamber for deformation. Disassemble mechanism and replace broken extractors.
	(2) Broken or weakened extractor plunger springs.	(2) Unscrew plunger plugs and replace defective springs.
c. Breechblock fails to rise when extractors are pushed forward.	*c.* Broken closing spring, chain, or stud link pins.	*c.* Unscrew piston rod lock nut and piston rod nut and remove spring piston rod and replace broken parts.

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Malfunction	Cause	Correction
d. Breechblock fails to rise to the fully closed position.	*d.* (1) Lack of compression of closing spring.	*d.* (1) Loosen piston rod lock nut and increase the compression of the closing spring by screwing up on the piston rod nut. Set up on piston rod lock nut.
	(2) Weakened closing spring.	(2) Replace closing spring.
	(3) Lack of lubrication on sides of breechblock.	(3) Clean and lubricate breech recess and breechblock.
	(4) Burs or roughened surfaces on sides of breechblock, breech recess, operating shaft, or operating cam.	(4) Do not operate mechanism. Notify ordnance maintenance company.
e. Operating handle latch fails to operate.	*e.* Broken latch spring, broken operating latch, or bent or broken latch pivot.	*e.* Remove latch pivot and latch and replace broken parts.

25. Malfunctions of carriage, M1916A1.

Malfunction	Cause	Correction
a. Gun fails to return completely into battery.	*a.* (1) Weak or broken counterrecoil springs.	*a.* (1) Disassemble spring cylinder and replace broken springs.
	(2) Expansion of recoil oil.	(2) Open the filling plug and allow excess oil to escape.
	(3) Lack of lubrication on gun slides and cradle ways.	(3) Lubricate all exposed bearing surfaces.
	(4) Piston rod gland too tight.	(4) Loosen piston rod gland.

26. Malfunctions of carriage, M1916MIA1.

Malfunction	Cause	Correction
a. Oil leaking into front of recoil cylinder.	*a.* Failure of piston packing, or wear of cylinder wall.	*a.* Notify the ordnance maintenance company.
b. Oil leaking around oil index.	*b.* Failure of packing.	*b.* Notify the ordnance maintenance company.

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Malfunction	Cause	Correction
c. Oil gage rack not functioning.	*c.* Index stuck.	*c.* Drain off about one-half pint of reserve oil, then pump sufficient oil into the mechanism to move the oil gage rack. If rack does not move notify the ordnance maintenance company.
d. Failure of gun to return to battery.	*d.* Insufficient oil reserve.	*d.* Drain reserve oil until oil gage rack moves to the bottom of its recess, then pump sufficient oil to bring the oil gage rack flush with the face of the oil gage follower.
e. Failure of gun to return into battery (oil gage rack showing sufficient reserve oil).	*e.* (1) Low nitrogen pressure.	*e.* (1) Notify the ordnance maintenance company.
	(2) Excessive friction.	(2) Notify the ordnance maintenance company.
f. Return of gun to battery with a shock.	*f.* Too much reserve oil.	*f.* Drain off reserve oil until oil gage rack moves to the bottom of its recess, then pump sufficient oil into the reservoir to bring the oil gage rack flush with the face of the oil gage follower.

Section VII

CARE AND PRESERVATION

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27. Gun.—*a. General.*—(1) Whenever the rate of fire permits, it is important that the cannoneer look through the bore before loading to ascertain that no particles of the cartridge case, wadding, or unburnt powder remain in the bore. The presence of such particles causes imprints in the bore and sometimes premature explosions. During night firing the sponge should be used between rounds.

(2) When shells burst near the gun, make sure before firing that neither the exterior nor the muzzle face of the bore have been struck by the fragments. Any injuries affecting the bore of the gun are likely to cause the tube to split if the gun is fired. Bulges at any part of the gun or any unusual condition which appears should be reported at once to the ordnance inspector of artillery.

(3) In cleaning after firing, wash the bore with a solution made by dissolving ½ pound of soda ash or 1 pound of sal soda in 1 gallon of water, using the sponge for swabbing purposes. Wipe perfectly dry, using the sponge covered with burlap, and then swab the bore with a light coating of rust preventive compound, applying it with the slush brush.

(4) The surface of the leveling plates should be protected from injury. Do not lay tools or other articles upon their surfaces. In case of injury, repairs must be made by the personnel of the ordnance maintenance company.

(5) If the matériel is to be left unused for any considerable length of time, the bore of the gun, breech mechanism, and all bright and unpainted surfaces should be cleaned thoroughly with dry cleaning solvent so as to be free from rust, water, and lubricating oil before coating the surfaces with rust preventive compound. The various covers must also be placed in position.

(6) Lubrication instructions for the various parts of the gun are given in paragraph 31.

b. Breech mechanism.—(1) The breech mechanism should be kept clean and the parts well lubricated at all times. The mechanism should be disassembled periodically when not in use to discover if any rust is forming. When in use it should be disassembled at frequent intervals, cleaned, and oiled, and should always be so cared for immediately after each firing period.

(2) Do not use a steel hammer directly on any part of the breech mechanism. A copper drift or hardwood block should be interposed or a copper hammer used to prevent deforming the parts.

(3) Vigilance must be exercised to detect any cuts or abrasions forming on the bearing surface of the breech recess and breechblock. If the breechblock does not operate smoothly it should be examined

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and scoring or bruises should be removed by the ordnance maintenance company.

c. Firing mechanism.—(1) The firing mechanism parts require the same careful attention as the breech mechanism, and should be disassembled frequently from the breechblock for cleaning and oiling.

(2) Wear in the firing mechanism is almost negligible except for deformation of the firing pin. Such deformation may become so great as to prevent the firing pin striking the primer. If the firing pin is examined after each firing period it can be anticipated when replacement is necessary.

(3) To remove rust preventive compound from matériel taken from temporary storage, the greater part should be scraped off and the balance removed with a rag or cotton waste dipped in dry cleaning solvent.

28. Carriage.—*a.* The carriage cannot be kept in serviceable condition unless proper attention is given to cleaning, lubrication, and loose or broken parts. The subject of lubrication, together with the method and frequency of application, is covered in detail in paragraph 31.

b. All bearing surfaces, revolving parts, springs, gear teeth, and brake mechanisms must be kept clean and as free from dirt as possible. Special attention should be given to the elevating arc to see that it is clean and free of grit and oil as this condition forms an abrasive causing the teeth to wear and thereby creating excessive backlash.

c. Brake mechanism.—(1) The proper functioning of the brake is of vital importance. A freely operating brake insures a long period of operation before readjustment becomes necessary.

(2) Brake adjustment is accomplished by rotating the brake shoe adjusting wedge (B144959, fig. 10) which extends to the outside of the brake housing plate. The exposed end of the adjusting wedge is machined with a square for turning with a wrench in the direction desired.

(3) The correct procedure for adjusting the brake is as follows:

(*a*) Set the hand brake lever at its full released position.

(*b*) Jack up the wheel.

(*c*) Adjust the brake adjusting wedge until a drag is felt on the wheel. Then back off just enough so that the brake does not drag. Brake must be cold when making this adjustment.

(*d*) The position of the hand brake lever can be adjusted by removing the cotter pin (BFAX1CG) and nut (BBFX1C) on screw (BCBX7CF) in the end (B150585) of the lever (C64752, fig. 5).

d. Wheel bearings should be adjusted to prevent brake drag due to loose bearings.

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e. The brake camshaft is lubricated through a buttonhead fitting. Lubrication must be held to the correct amount to avoid the brake lining becoming saturated with oil or grease. This condition will demand heavy brake handle pressure and the premature replacement of brake linings.

29. Recoil mechanism, M1916A1.—*a. Before and during firing.*—(1) Before firing, the recoil mechanism should be examined for leakage of oil, proper amount of recoil oil (U. S. A. spec. 2–96) in the recoil cylinder, and to see that the valve turning mechanism is performing its function.

(2) During firing, the action of the recoil mechanism should be noted and the following conditions checked:

(*a*) That gun recoils its prescribed distances at all elevations.

(*b*) That gun returns to battery without excessive shock.

(*c*) Leakage of oil from the filling plugs, drain hole, and piston rod gland.

b. Draining.—Elevate the gun to about 5° and remove the forward filling plug. Remove the drain plug and allow the oil in the cylinder to drain into a clean receptacle. Replace drain plug.

c. Filling with recoil oil.—(1) Elevate the gun to about 5°. Remove both filling plugs. Pour in recoil oil slowly with the aid of a funnel until it appears at the rear filling hole. Replace rear filling plug, and continue to fill the cylinder slowly until the oil appears at the top filling hole. Depress gun to zero elevation. Remove the rear filling plug and continue to fill the cylinder, shaking the carriage gently until air ceases to come out of the cylinder. When the oil is level with both filling plug holes replace the filling plugs.

(2) Depress the gun to about −5° and remove the valve turning gear cover. Remove rear filling plug. Loosen filling plug in the end of the piston rod sufficiently to allow oil to drop out. As soon as the oil starts to drip, tighten filling plug. Again level the gun and rock the carriage to permit air to escape and replace rear filling plug. Remove the front plug and add recoil oil if required. Again rock the carriage until all air in the cylinder has escaped. Replace the front filling plug.

(3) Elevate the gun to 5° elevation and allow to stand in this position for about 5 minutes. Remove the front filling plug and again refill the cylinder with recoil oil. Loosen the drain plug and drain out about ¼ gill of oil. Tighten drain plug and replace front filling plug.

(4) About 4 quarts of recoil oil are required to fill the recoil cylinder.

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30. Recoil mechanism, M1916MIA1 (St. Chamond) (fig. 13).—Before firing, the recoil mechanism should be examined for leakage of oil, for proper amount of oil reserve, and for leakage of air past the floating piston.

a. Oil reserve.—The oil gage rack (17B) indicates the "oil reserve," or the amount of reserve oil which keeps the floating piston apart from the regulator.

(1) The movement of the oil gage rack (17B) is at right angles to the floating piston. When the oil gage rack is flush with the end or slightly beyond the face of the cylinder, a full reserve is indicated. Reserve oil must be added when the oil gage rack is ¼ inch below the face of the oil gage follower (18E).

(2) To add reserve oil to the system unlock the handle extension of the pump with wrench (DP33A). Make sure there is sufficient oil in the oil reservoir by removing the oil index head assembly and note the height of oil on the index. If the oil in the reservoir registers less than half full, add recoil oil in order to be sure to cover the intake valve of the pump. Start stroking the pump. Should it require priming, open the air valve located in the end of the pump piston by pressing on the air valve button, while operating the pump handle, until oil flows from the end of the pump piston. Pump oil into the system until the oil gage rack is flush with or slightly beyond the face of the oil gage follower.

(3) When in doubt as to the amount of reserve oil in the system, always draw off the existing reserve by inserting the drain valve release in the drain plug hole on the left rear side of cradle.

NOTE.—The leather gasket should remain in the recess of the drain hole.

(4) The condition of the oil should be noted. Emulsified oil indicates a defective floating piston.

b. To exercise the floating piston.—(1) Draw off the reserve oil with drain valve release. Close the drain valve by unscrewing the drain valve release.

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(2) Move the floating piston forward by pumping excess reserve oil into the mechanism. This will require approximately 150 full strokes of the pump handle.

(3) Drain off the oil. Repeat the operation three times.

(4) Reestablish the proper reserve.

NOTE.—The gun need not be disconnected.

31. Lubrication instructions.—*a. Gun and carriage.*—The life of the matériel depends to a great extent on proper lubrication. Particular attention should be given to the lubrication of sliding surfaces of the breech mechanism and other sliding surfaces that may not contain oil holes, oil cups, or fittings.

(1) Grit must be kept out of lubricating openings and the lubricant. In cleaning oil cups and open oil holes the necessary wiping should be done with a piece of firm cloth, and no lint should be allowed to remain in any orifice. Open oil holes which have become clogged with congealed oil should be cleaned with a piece of wire.

(2) Oil and grease should be applied while the parts are being maneuvered to insure distribution of lubricant to all moving parts.

(3) The teeth of the elevating and traversing arc should be cleaned with dry cleaning solvent before new grease is applied.

(4) Wheel hubs are packed with grease at assembly and should be cleaned and repacked every 6 months of continuous use.

(5) The various lubricants and cleaning and preserving materials issued by the Ordnance Department and their uses are described in TR 1395–A.

b. Chart.—The following chart gives the location, lubricant, amount, frequency, and method of application of lubricants.

c. For oiling gun slides, breechblocks, elevating and traversing mechanisms, etc., when the temperature is 50° F. or above, oil, lubricating, class D, SAE 50, will be used, and SAE 20 when the temperature is below 50° F.

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LUBRICATION CHART

Fig.	Location	Type of oiler	Lubricant	How applied	Remarks
4	Breech mechanism (bearing surfaces).	Brush	Oil, lubr., cl. D, SAE 50 or SAE 20.	Brush	Daily and after firing.
4	Operating handle latch	do	do	Drops on pin	Weekly.
—	Piston rod bracket	Oil cup	do	Oiler	Do.
14	Angle of site worm	do	do	do	Do.
15	Rocker arm brace end, upper	do	do	do	Do.
9, 14	Angle of site bracket, right	do	do	do	Do.
9, 14, 18	Angle of site bracket, left	do	do	do	Do.
9, 14, 18	Angle of site bracket cover, left	do	do	do	Do.
8, 15, 16	Elevating cross shaft bearing	do	do	do	Do.
7, 15, 16	Elevating worm cap	do	do	do	Do.
17	Trunnion cap, right	do	do	do	Do.
17	Trunnion cap, left	do	do	do	Do.
15	Rocker arm cap	do	do	do	Do.
9, 17	Intermediate traversing shaft bearing.	do	do	do	Do.
9, 14, 17, 18	Top carriage	do	do	do	Do.
9, 15, 16	Rocker	do	do	do	Do.
7, 18	Pintle bearing	do	do	do	Do.
8, 9	Equalizing pinion, right	do	do	do	Do.
8, 9	Equalizing pinion, left	do	do	do	Do.
10	Brake cam shaft	B-hd. fitting	Grease, lubricating mineral, medium grade.	Grease gun	Do.
10, 11	Wheel hub (Remove wheel)	Hand pack	Wheel bearing grease	Pack	Every 6 months.

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32. Paint.—For detailed information regarding the removal of old paint, cleaning and preparation for painting, preparing new paint, application and kind of paint for different surfaces, brushes, slushing oils, abrasives, burlap, etc., see TR 1395–A.

33. Protection and cleaning of matériel affected by gas.—*a. Protection against phosgene, chlorine, etc.*—(1) For matériel which is in constant danger of gas attacks, whether from gas clouds or gas shells, care will be taken to keep all bright parts of the guns, carriages, mountings, and accessories well coated with oil.

(2) Sights and all instruments also will be covered with oil and protected with covers when not in actual use, care being taken that the oil does not come in contact with any glass or find its way into the interior of the instruments.

(3) All uncapped fuzes or fuzes which have been removed from their containers will be wiped over with oil as soon as possible and protected with a cover.

b. Protection against mustard gas.—It must be remembered that practically all fabrics and materials such as wool, cotton, rubber, and oilcloth can be penetrated by mustard gas if exposed to it a sufficient length of time. The mustard gas is absorbed by these materials and penetrates them by a slow process of diffusion. In general, it may be said that the greater the length of time allowed for penetration the greater the danger in wearing these articles. For instance, rubber boots which have been worn in an area shelled heavily with mustard gas may be a grave danger to men who wear them several days after the bombardment. Fabrics thoroughly impregnated with boiled linseed oil will resist penetration by mustard gas for over an hour, but after this time these articles are dangerous because the mustard gas dissolves in the linseed oil and they must be destroyed.

c. Cleaning.—All bright parts of gun and carriages, together with all accessories and spare parts exposed to the gas, will be cleaned and wiped dry as soon as possible after the attack, and in any case within 24 hours, after which they will be thoroughly coated afresh with oil. The same applies to the whole of the ammunition still in the battery position. Ammunition which for any reason has not been oiled will be cleaned and oiled. It is desirable to expend it as soon as possible.

d. Disinfection of matériel of all kinds affected with mustard gas.—The following measures will be taken for the removal of mustard gas

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from various materials and equipment (guns, projectiles, cases, wood, metals, rope, etc.) which have come in contact with mustard gas. For all of the operations indicated below, the gas mask and protective clothing, including protective shoes and gloves, must be worn.

(1) Commence by freeing the objects of dirt, lumps of earth, and liquid with wooden spatulas, rags, etc., which will be buried immediately after this operation. They must never be burned.

(2) Sprinkle a continuous layer of calcium hypochlorite, which is preferred if available, or else dry chloride of lime over the parts that lend themselves to this treatment. In the statements hereafter calcium hypochlorite is specified, but dry chloride of lime may be substituted in the event that calcium hypochlorite is not available. After 2 hours, or better after 6 hours, if practicable, wash off the layer of calcium hypochlorite and rinse thoroughly. It is imperative that all the calcium hypochlorite be removed in order to prevent the deterioration resulting from the prolonged action of the calcium hypochlorite. In the case of ammunition it is imperative to prevent particles of calcium hypochlorite from being introduced into the bore of the piece.

(3) Whitewash soiled parts which do not lend themselves to sprinkling with dry powder with a thick paste of calcium hypochlorite made from three volumes of calcium hypochlorite and one volume of water. After 2 hours, or preferably 6 hours, wash off the calcium hypochlorite.

(4) The delicate parts of the apparatus, such as breech mechanism, sighting apparatus, glasses, etc., which would be injured by calcium hypochlorite will be cleaned by dry polishing with rags. After this operation the rags will be buried.

(5) If there are large quantities of water at hand, in the place of calcium hypochlorite use water. The water should be warm, but not boiling, and large quantities should be used. This cannot be done in the case of greasy articles where only calcium hypochlorite should be used.

(6) When it is not necessary to use contaminated matériel immediately, or when one has not the above means at his disposal, it may be considered that the handling of the matériel or apparatus is not dangerous after 6 or 8 days.

e. Transportation of matériel affected by gas.—Removal will be effected by automotive units whenever possible. If horse transport must be used, the route will be reconnoitered carefully in order to avoid infected ground. The matériel will be disinfected as thoroughly as possible before removal.

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SECTION VIII

ACCESSORIES

	Paragraph
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Compressor, spring, No. 5	36
Gage, tire, balloon	37
Gun, lubricating, screw type, 8-ounce	38
Hose, heavy duty, 15-inch, button head fitting	39
Release, drain valve	40
Sights, bore	41
Target, testing	42

34. General.—There are a number of accessories provided with this matériel, such as cold chisels, bronze drifts, files, file handles, machinists' hammers, pliers, steel punches, screwdrivers, wrenches, gun, and sponge covers, the names or general characteristics of which plainly indicate their use and application. Therefore, no detailed description nor method of use is outlined herein. However, the special accessories being of a different nature, their description, purpose, and method of use are outlined below.

35. Book, artillery gun.—The artillery gun book (O. O. Form No. 5825) is issued for the purpose of keeping an accurate record of the matériel. It must always remain with the gun regardless of where the gun may be sent (to the repair shop, to another battery, etc.). The book is divided as follows: Record of assignment of the gun to the various batteries, battery commander's daily gun record, inspector's record of examinations, and forms to be filled out in the case of premature explosions.

36. Compressor, spring, No. 5.—The spring compressor is used when assembling or disassembling the counterrecoil springs from the cradle of the 75-mm gun carriage, M1916A1. In using this compressor a tackle block is also required. The latter is staked to some fixed object of sufficient strength to stand the pressure of the compressed counterrecoil springs.

37. Gage, tire, balloon.—The balloon tire gage is for measuring the air pressure within the tire.

38. Gun, lubricating, screw type, 8-ounce.—With the handle unscrewed to its maximum out position and the screw cover removed, the lubricating gun is filled with grease by hand. The gun holds 8 ounces of grease. The cover is screwed on to the cylinder, and the movement of screwing in on the handle forces the grease through the hose and into the grease receptacles.

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39. Hose, heavy duty, 15-inch, buttonhead fitting.—The steel hose is equipped with an adapter which is screwed into the nozzle of the lubricating gun. The other end of the hose is fitted with a pull-on coupling which fits over the head of the buttonhead type fitting on the carriage.

40. Release, drain valve.—The drain valve release is used to drain the reserve oil from the recoil mechanism of the 75-mm gun carriage, M1916MIA1.

41. Sights, bore.—The breech bore sight is a brass disk which fits into the shell chamber. It has four finger holes for use in inserting and withdrawing it from the chamber, and one small hole in the exact center for sighting. The muzzle bore sight consists of a black cord, which is placed across the muzzle in the bore sight lines cut in the face of the gun, and a web belt for holding the cord in place.

42. Target, testing.—The testing target is used in the verification and adjustment of sights.

Section IX

SUBCALIBER EQUIPMENT

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Description and operation of the mount	44
Disassembling and assembling	45
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43. General.—*a.* The purpose of the subcaliber equipment is to provide for a greater amount of target practice than could be obtained by the use of the regular 75-mm ammunition. Except for the firing of other than the regular ammunition, the handling and loading of which differ, as well as the range, the training is with the 75-mm gun carriage, M1916A1.

b. Subcaliber firing is accomplished by the use of the 37-mm gun, M1916, and recoil mechanism, mounted on the top of the 75-mm gun by means of a specially constructed mount.

44. Description and operation of the mount (fig. 19).—*a.* The 37-mm subcaliber mount, T15, mounted on the 75-mm gun carriage, M1916A1, is composed of a bracket (D33282) to which is bolted a bracket (B19138). The trunnions of the brackets are provided with cap screws and jam nuts which retain the tank cradle in position and provide a means of adjustment for deflection. The front end of bracket (D33282) is equipped with three ⅜-inch cap screws and jam

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nuts, their purpose being that of retaining and providing a means of adjusting the 37-mm subcaliber gun when bore sighting on a testing target.

b. Two supports (B154355 and B154356) attached to the cradle (11A) and the cylinder retainer (B154686) welded to the recoil cylinder retainer (KB51H) provide a seat for the subcaliber mount, T15, which is retained at the front by two cap screws (BCBX2BD) and at the rear by cap screws (BCBX4BB).

45. Disassembling and assembling (fig. 19).—*a.* Clean the seats for bracket (D33282) and mount the bracket, retaining it in position by means of its cap screws, nuts, and lock washers.

b. Remove bracket (B19138) from bracket (D33282) by removing the three cap screws (BCBX1CD), nuts, and lock washers, retaining it in position. Lift the 37-mm gun and recoil mechanism on top of the 75-mm recoil mechanism and insert the front end of the 37-mm gun recoil mechanism through the band on the front end of bracket (D33282) placing the trunnion of the recoil mechanism in the trunnion bearing of bracket (D33282). Assemble bracket (B19138) over the recoil mechanism trunnion and bolt in place. Tighten the cap screws in the trunnion bearing and those at the front end of bracket (D33282) just sufficiently to retain the 37-mm gun in position.

46. Bore sighting.—*a.* As the subcaliber gun is to be laid with the regular sighting and maneuvering mechanism of the 75-mm gun, the bores of the gun and 37-mm subcaliber gun should be parallel. To secure the proper alinement when the 75-mm gun carriage is in firing position, bore sights are set in the subcaliber gun.

b. Verification of the sights having been accomplished as described in paragraph 22, the following procedure should be observed in bore sighting the 37-mm gun:

(1) Make a testing target by wrapping two pieces of black tape of equal width around the aiming post with the lower edge exactly $16\frac{49}{64}$ inches apart. By the use of the aiming post as a testing target, it will not be necessary to level the 75-mm gun carriage, as the aiming post can be canted to conform to the angle of the carriage so that the vertical line of the bore of the 75-mm gun will coincide with the side of the aiming post. Place the target some distance from the gun.

(2) Use the bore sights to line up the bore of the 75-mm gun with the lower edge of the lower tape on the aiming post.

(3) Use the bore sights of the 37-mm subcaliber gun and bore sight it on the testing target. The bore of this gun should be lined up with the lower edge of the upper tape on the aiming post.

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(4) The adjustment of the 37-mm subcaliber gun upon the target is made by the three cap screws in the front of bracket (D33282 fig. 19). When tightening these cap screws great care must be taken not to place a strain upon the recoil cylinder as it will become distorted and may not function properly.

47. Care and preservation.—Repairs to this mount will be minor in nature and will involve only the removal of burs when necessary and the replacement of nuts and cap screws. When the subcaliber mount is dismounted from the 75-mm gun all parts should be assembled in their proper place.

48. Accessories and spare parts.—Accessories and spare parts for the subcaliber equipment are shown in Standard Nomenclature List No. C–30.

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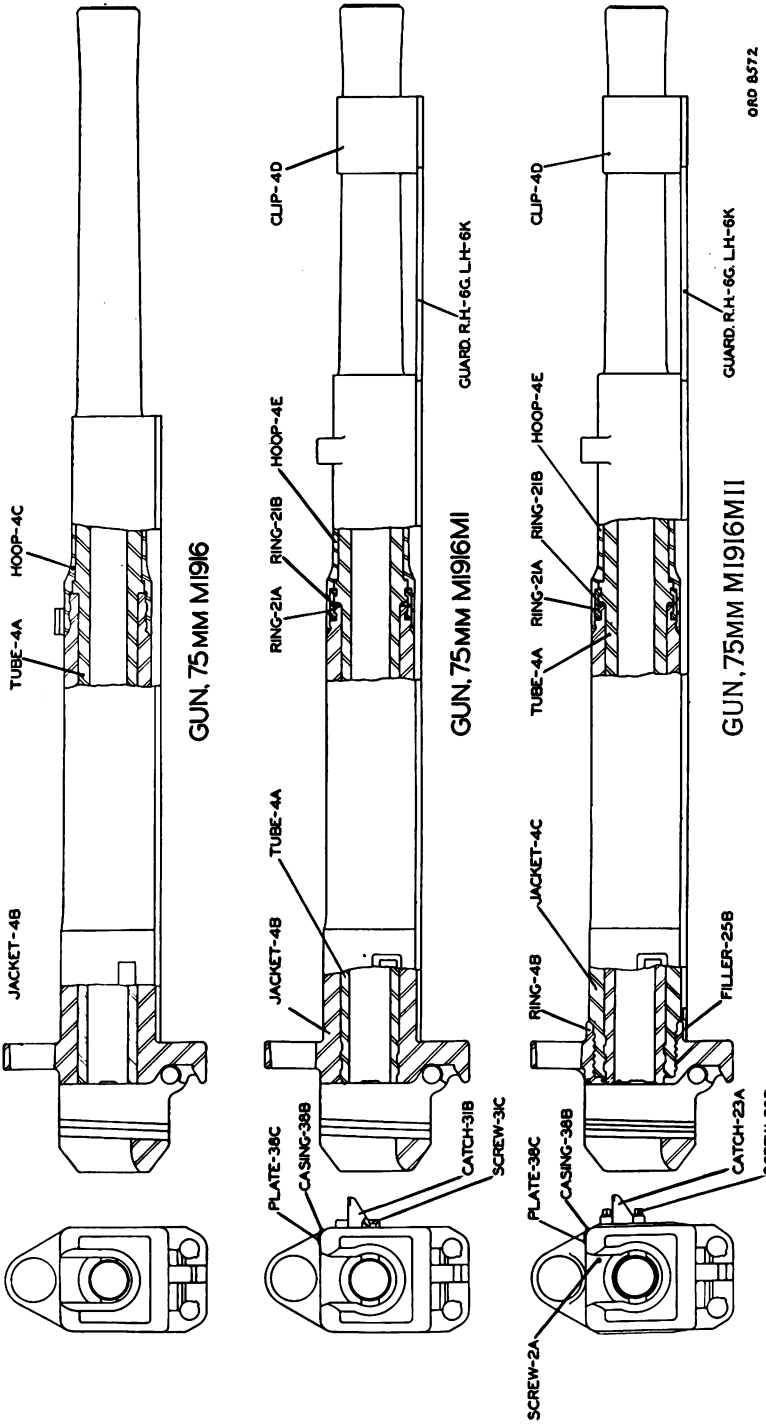


FIGURE 1.—75-mm gun, M1916, M1916MI, and M1916MII (sectioned views).

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Reference	Item	Reference	Item
38B	Casing, leveling plate (for M1916MI and M1916MII).	4C	Jacket (for M1916MII).
31B	Catch, latch (for M1916MI).	38C	Plate, leveling (for M1916MI and M1916MII).
23A	Catch, latch (for M1916MII).	4B	Ring, breech (for M1916MII).
4D	Clip (for M1916MI and M1916MII).	21B	Ring, filling (for M1916MI and M1916MII).
25B	Filler (for M1916MII).	21A	Ring, locking (for M1916MI and M1916MII).
6K	Guard, L. H. (for M1916MI and M1916MII).	31C	Screw, latch catch (for M1916MI).
6G	Guard, R. H. (for M1916MI and M1916MII).	23B	Screw, latch catch (for M1916MII).
4E	Hoop, locking (for M1916MI and M1916MII).	2A	Screw, securing (for M1916MII).
4B	Jacket (for M1916 and M1916MI).	4A	Tube (for M1916, M1916MI, and M1916MII).

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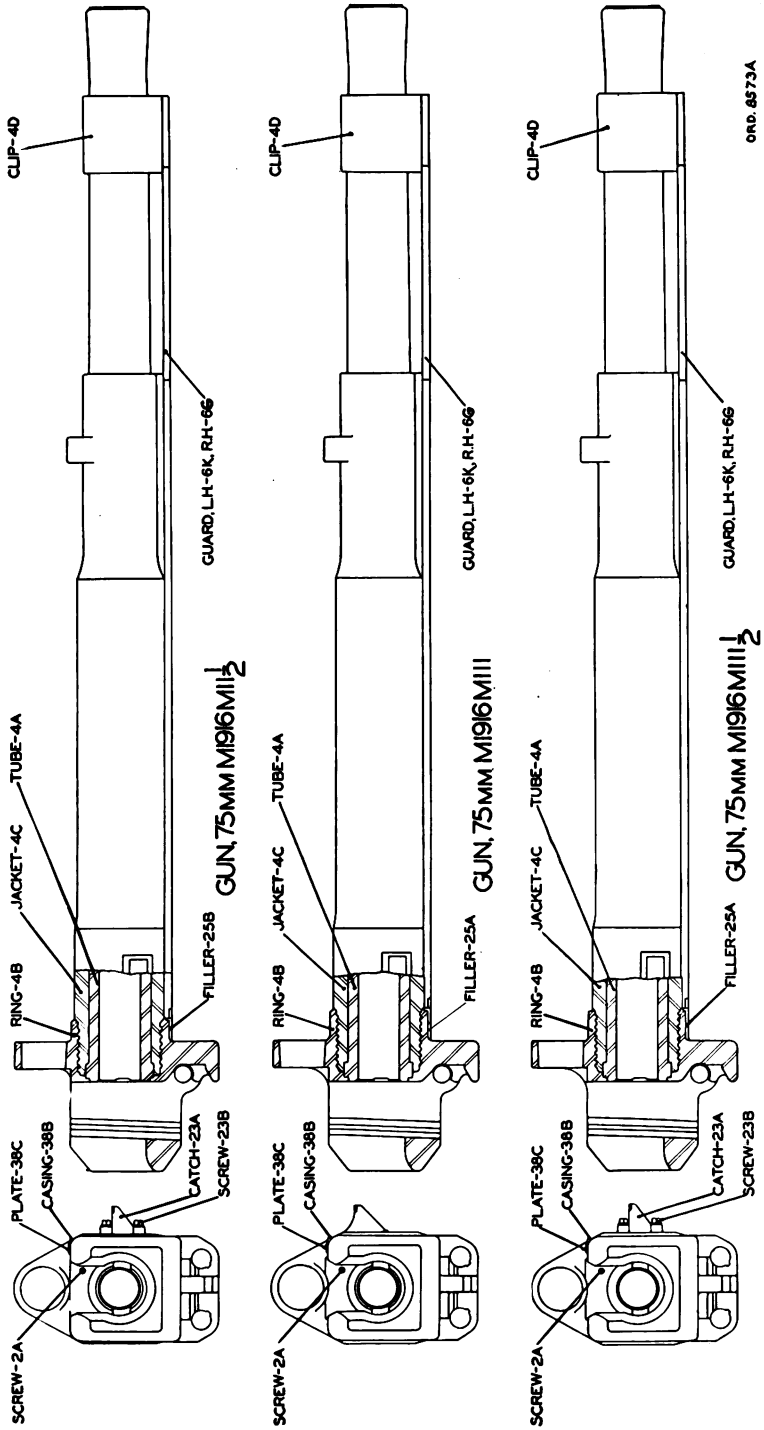


FIGURE 2.—75-mm gun, M1916MIII½, M1916MIII, and M1916MIII½ (sectioned views).

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Reference	Item	Reference	Item
38B	Casing, leveling plate (for M1916MII½, M1916MIII, and M1916MIII½).	4C	Jacket (for M1916MII½, M1916MIII, and M1916MIII½).
23A	Catch, latch (for M1916MII½ and M1916MIII½).	38C	Plate, leveling (for M1916MII½, M1916MIII, and M1916MIII½).
4D	Clip (for M1916MII½, M1916MIII, and M1916MIII½).	4B	Ring, breech (for M1916MII½, M1916MIII, and M1916MIII½).
25B	Filler (for M1916MII½).	23B	Screw, latch catch (for M1916MII½ and M1916MIII½).
25A	Filler (for M1916MIII and M1916MIII½).	2A	Screw, securing (for M1916MII½), M1916MIII, and M1916MIII½).
6K	Guard, L. H. (for M1916MII½, M1916MIII, and M1916MIII½).	4A	Tube (for M1916MII½, M1916MIII, and M1916MIII½).
6G	Guard, R. H. (for M1916MII½), M1916MIII, and M1916MIII½).		

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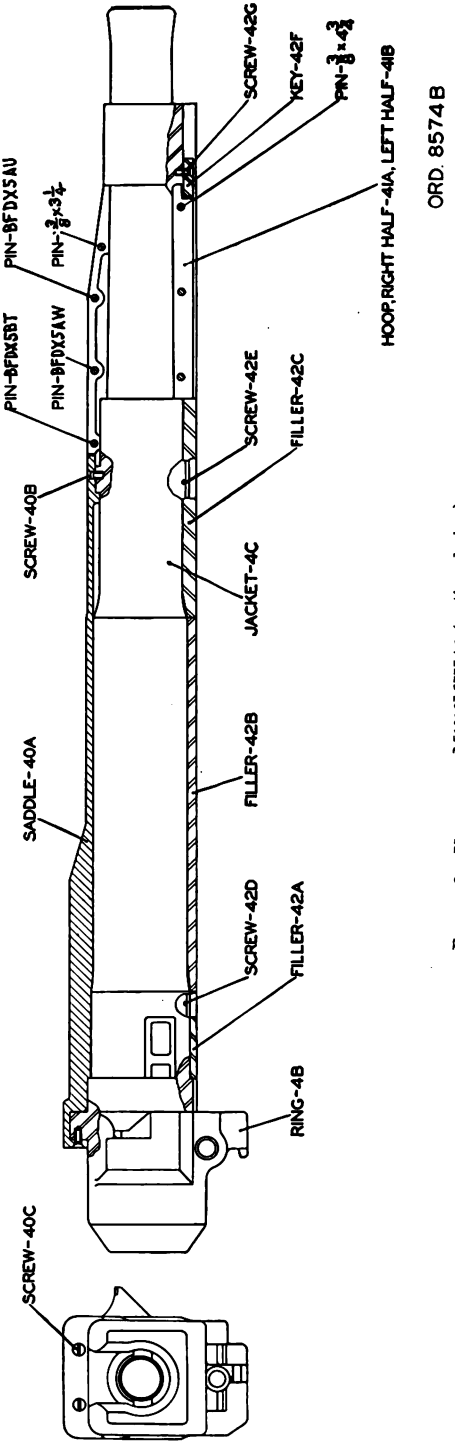


FIGURE 3.—75-mm gun, M1916MIIIA1 (sectioned view).

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Reference	Item	Reference	Item
42C	Filler, front.	BFDX5BT	Pin, stght., S., ⅜ by 4½.
42B	Filler, middle.		Pin, stght., S., ⅜ by 4¾.
42A	Filler, rear.	4B	Ring, breech.
41B	Hoop, left half.	40A	Saddle.
41A	Hoop, right half.	42E	Screw, filler, middle and front.
4C	Jacket.	42D	Screw, filler, rear.
42F	Key, hoop.	42G	Screw, hoop key.
	Pin, stght., S., ⅜ by 3¼.	40B	Screw, saddle, front.
BFDX5AU	Pin, stght., S., ⅜ by 3¾.	40C	Screw, saddle, rear.
BFDX5AW	Pin, stght., S., ⅜ by 4¼.		

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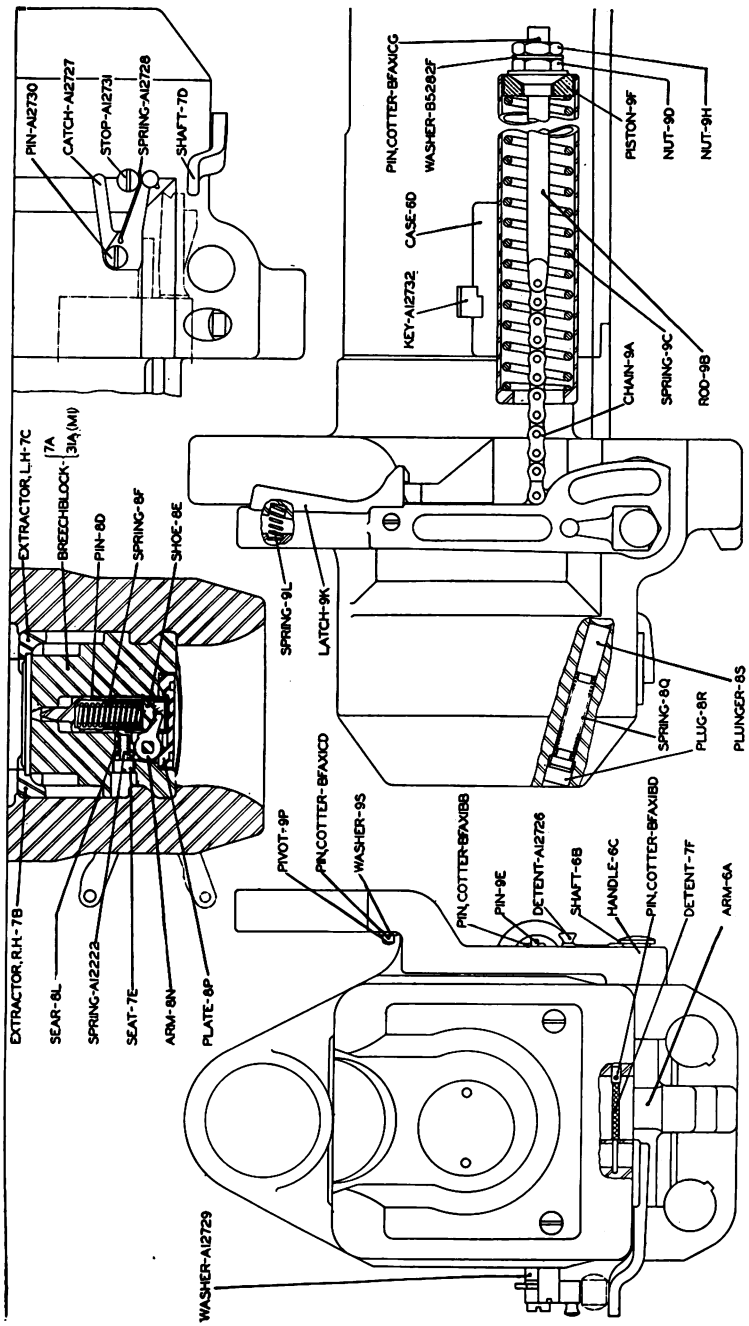


FIGURE 4.—75-mm gun, M1916MIII, breech mechanism (sectioned view).

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Reference	Item	Reference	Item
8N	Arm, firing.	9E	Pin, stud link.
6A	Arm, operating.	9F	Piston, spring.
31A	Breechblock (for M1916MI).		
7A	Breechblock (for M1916MII, M1916MII½, M1916MIII, and M1916MIII½).	9P	Pivot, operating handle latch.
		8P	Plate, face, breechblock.
		8R	Plug, plunger.
6D	Case, closing spring.	8S	Plunger, extractor.
A12727	Catch, return.	9B	Rod, spring piston.
9A	Chain.	8L	Sear.
A12726	Detent, operating shaft, assembly.	7E	Seat, sear spring.
7F	Detent, trigger shaft.	6B	Shaft, operating.
7C	Extractor, L. H.	7D	Shaft, trigger.
7B	Extractor, R. H.	8E	Shoe, firing spring.
6C	Handle, operating.	A12728	Spring, catch.
A12732	Key, spring case.	9C	Spring, closing.
9K	Latch, operating handle.	8Q	Spring, extractor plunger.
9H	Nut, lock.	8F	Spring, firing.
9D	Nut, spring piston rod.	9L	Spring, operating handle latch.
A12730	Pin, catch.	A12222	Spring, sear.
BFAX1BB	Pin, cotter, split, S., 1/16 by 7/16.	A12731	Stop, return catch.
BFAX1BD	Pin, cotter, split, S., 1/16 by 5/8.	A12729	Washer, catch pin.
BFAX1CD	Pin, cotter, split, S., 3/32 by 5/8.	BECX1P	Washer, lock, reg., 5/8 by 13/64 by 5/32
BFAX1CG	Pin, cotter, split, S., 3/32 by 1.	9S	Washer, operating handle latch pivot.
8D	Pin, firing.		

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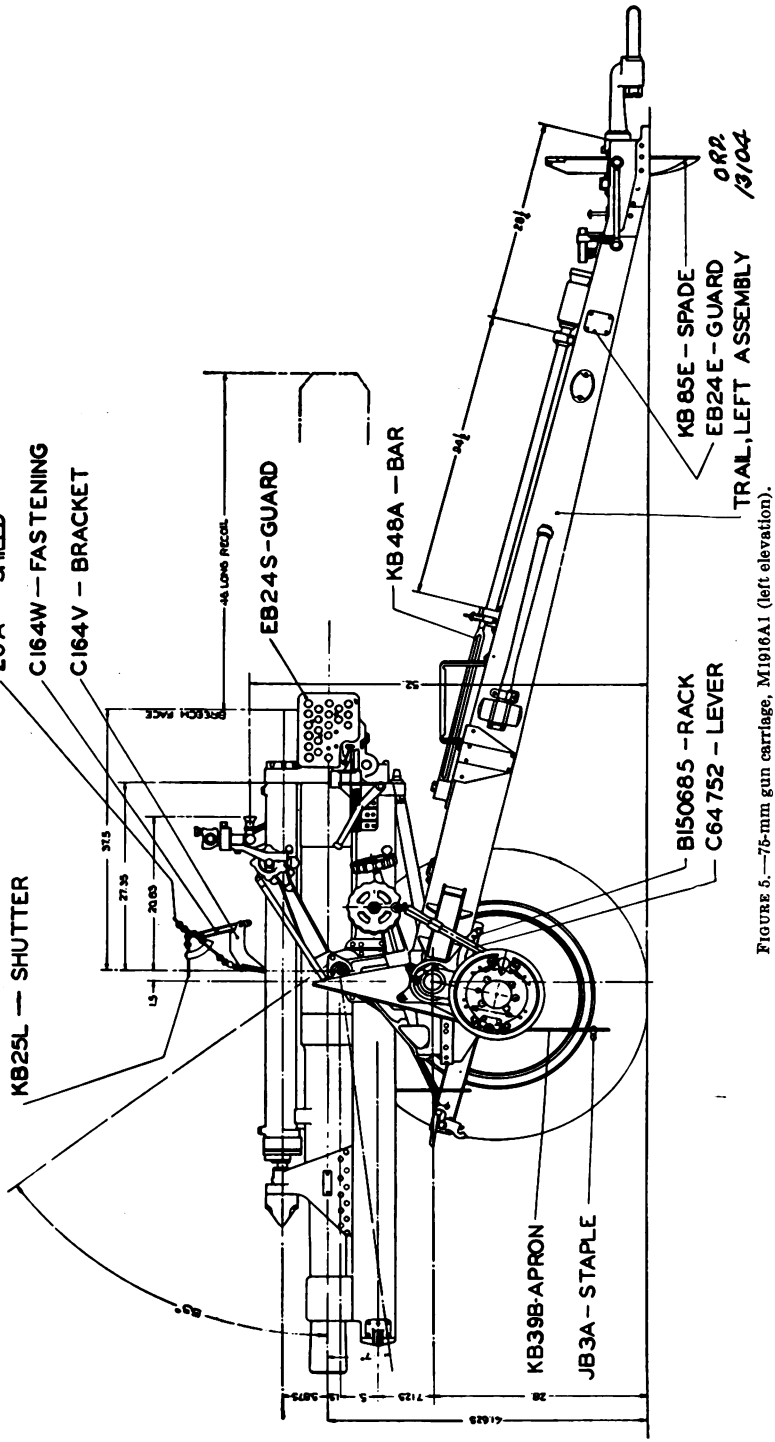


FIGURE 5.—75-mm gun carriage, M1916A1 (left elevation).

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Reference	Item	Reference	Item
KB39B	Apron.	B150685	Rack, brake ratchet.
KB48A	Bar, traveling lock.	20A	Shield, top.
C164V	Bracket, top shield.	KB25L	Shutter, telescope port.
C164W	Fastening, top shield.	KB85E	Spade.
EB24S	Guard, shoulder, left.	JB3A	Staple, apron latch.
EB24E	Guard, wheel, rear.	.....	Trail, left, assembly.
C64752	Lever, hand brake, assembly.		

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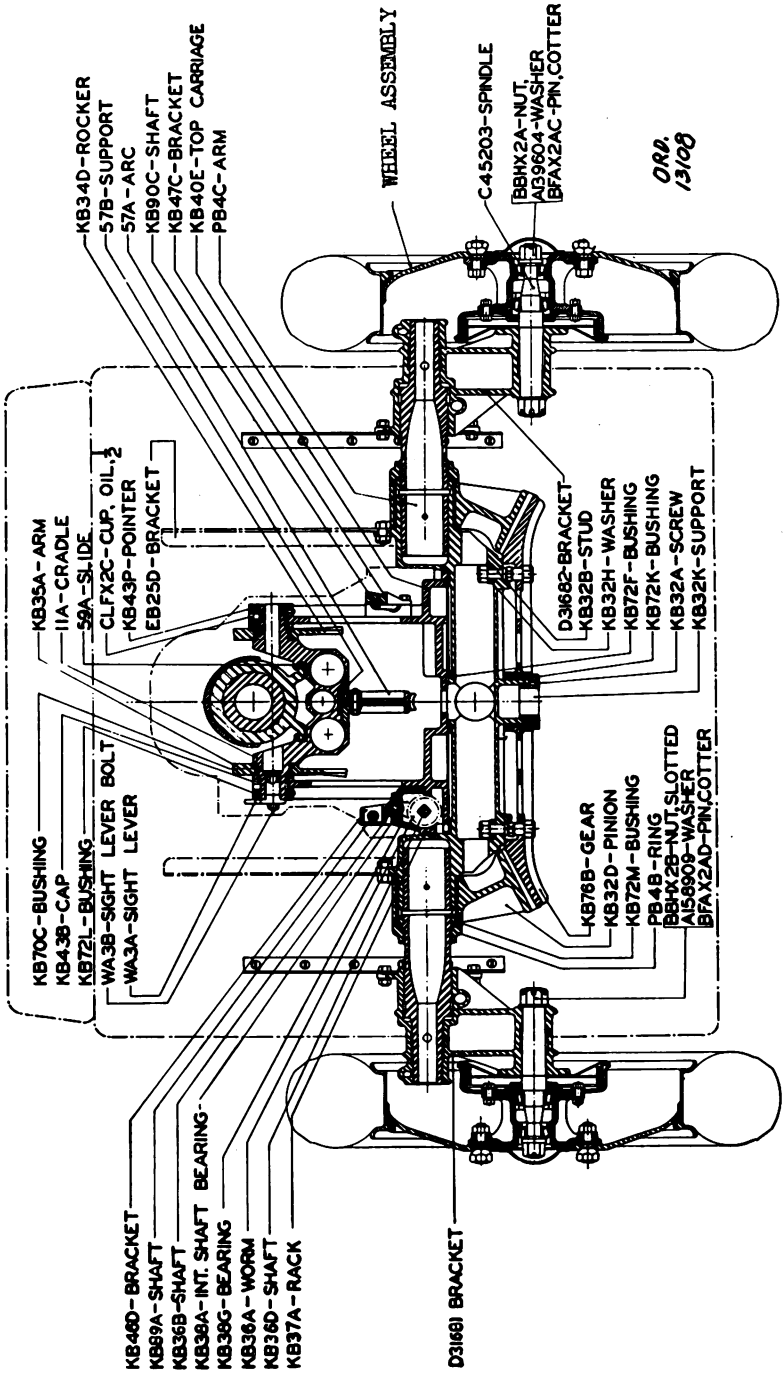


FIGURE 6.—75-mm gun carriage, M1916A1 (plan view).

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Reference	Item	Reference	Item
B150380	Bracket.	BFAX2AD	Pin, cotter, split, S., 3/16 by 2½.
C64470	Bracket.	A157134	Pin, hdls., S., .560 diam. by 2 3/16 clear.
C64439	Bracket, ball.		
C64458	Bracket, drawbar.	A157132	Pin, rod end, .560.
C64438	Bracket, socket.	A157123	Pin, stght., S., .560 by 2 7/16.
A158910	Connection, trail lock.	BFCX1DE	Pin, taper, No. 2 (.193) by 1½.
D31532	Drawbar.	EB81B	Seat, trail, left.
C62484	Handle, trail lock.	EB81D	Seat, trail, right.
B144410	Hook, trail connection.	C62990	Stop, trail, right, assembly.
A158911	Key, drawbar.	QBDX1BB	Strap, lea., type B, 13 in.
B144409	Loop, trail connection.		Support, apron latch base, right, assembly.
C45804	Lunette, M6.		
BBDX2C	Nut, jam, hex., s-fin., ¾-16NF-2.		Trail, left, assembly.
BBGX3B	Nut, slotted, s-fin., 1¼-7NC-2.		Trail, right, assembly.
BFAX1DF	Pin, cotter, split, S., ⅛ by ¾.		Wheel, assembly.
BFAX1EH	Pin, cotter, split, S., 5/32 by 1¼.		

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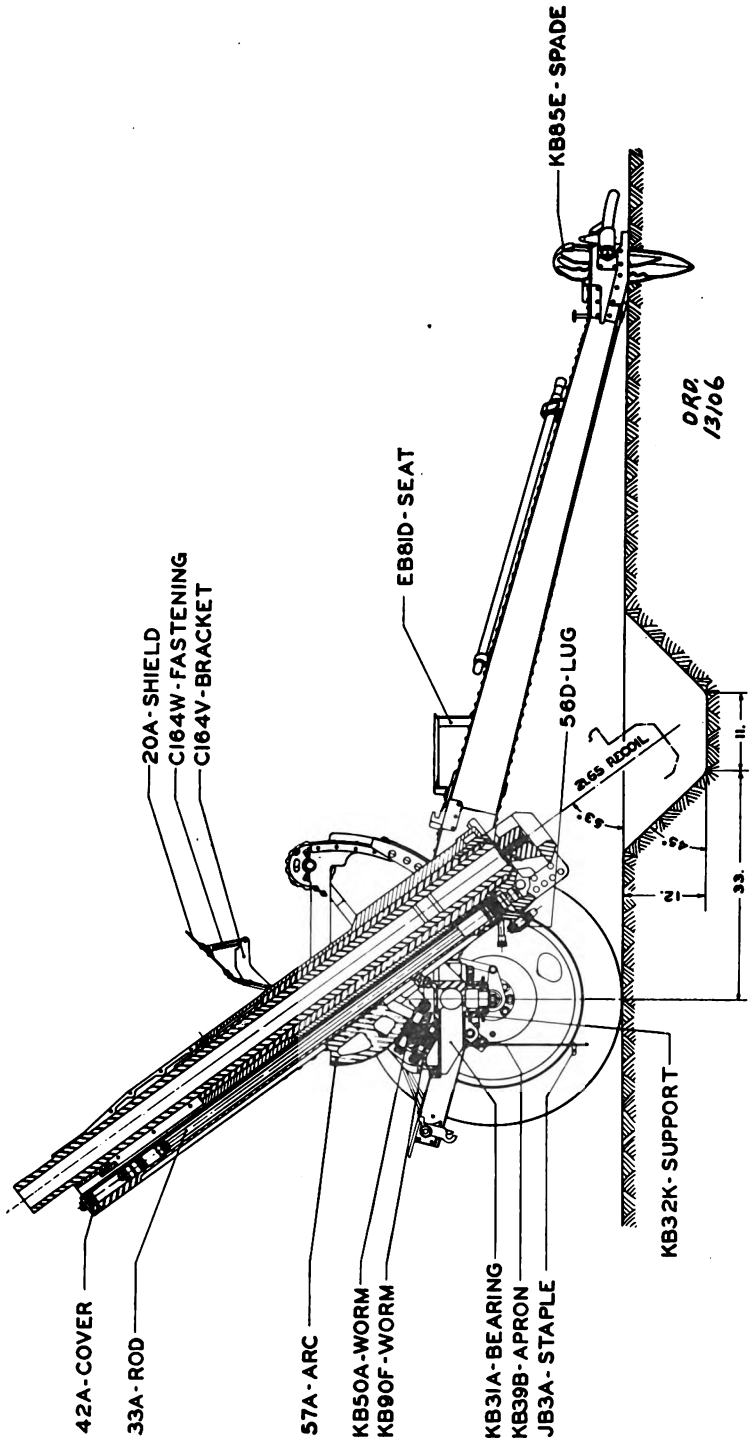


FIGURE 7.—75-mm gun carriage, M1916M1A1 (longitudinal section)

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Reference	Item	Reference	Item
KB39B	Apron.	EB81D	Seat, trail, right.
57A	Arc, elevating.	20A	Shield, top.
KB31A	Bearing, pintle.	KB85E	Spade.
C164V	Bracket, top shield.	JB3A	Staple, apron latch.
42A	Cover, cradle, front.	KB32K	Support, equalizing gear.
C164W	Fastening, top shield.	KB90F	Worm, angle of site.
56D	Lug, traveling lock.	KB50A	Worm, elevating.
33A	Rod, recoil.		

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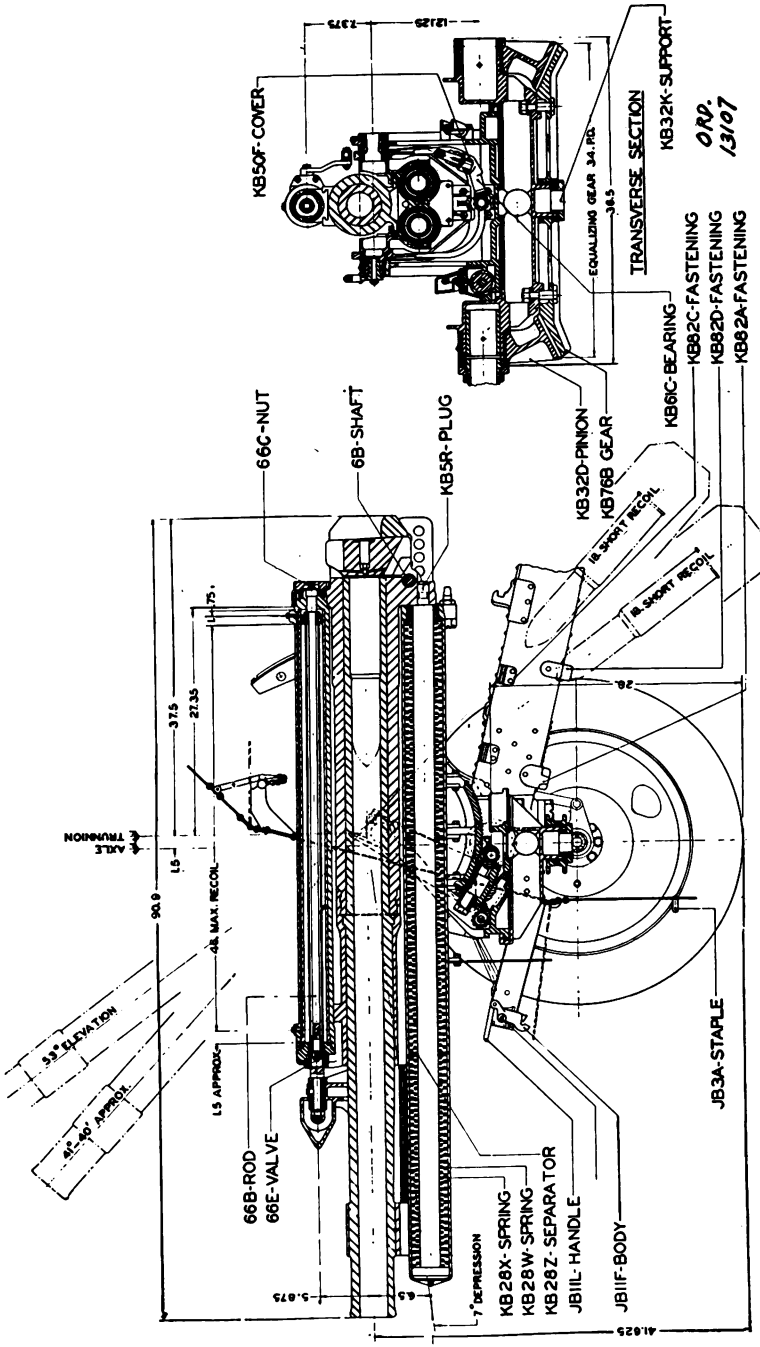


FIGURE 8.—75-mm gun carriage, M1916A1 (longitudinal section).

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Reference	Item	Reference	Item
KB61C	Bearing, elevating cross shaft.	KB32D	Pinion, equalizing, left.
JB11F	Body, apron latch.	KB5R	Plug, spring rod.
KB50F	Cover, elevating cross shaft gear.	66B	Rod, counterrecoil buffer.
KB82A	Fastening, spade, lower, front, right.	KB28Z	Separator, counterrecoil spring.
		6B	Shaft.
KB82D	Fastening, spade, lower, rear.	KB28X	Spring, counterrecoil, inner.
KB82C	Fastening, spade, upper.	KB28W	Spring, counterrecoil, outer.
KB76B	Gear, equalizing.	JB3A	Staple, apron latch.
JB11L	Handle, apron latch.	KB32K	Support, equalizing gear.
66C	Nut, counterrecoil buffer rod.	66E	Valve, counterrecoil buffer.

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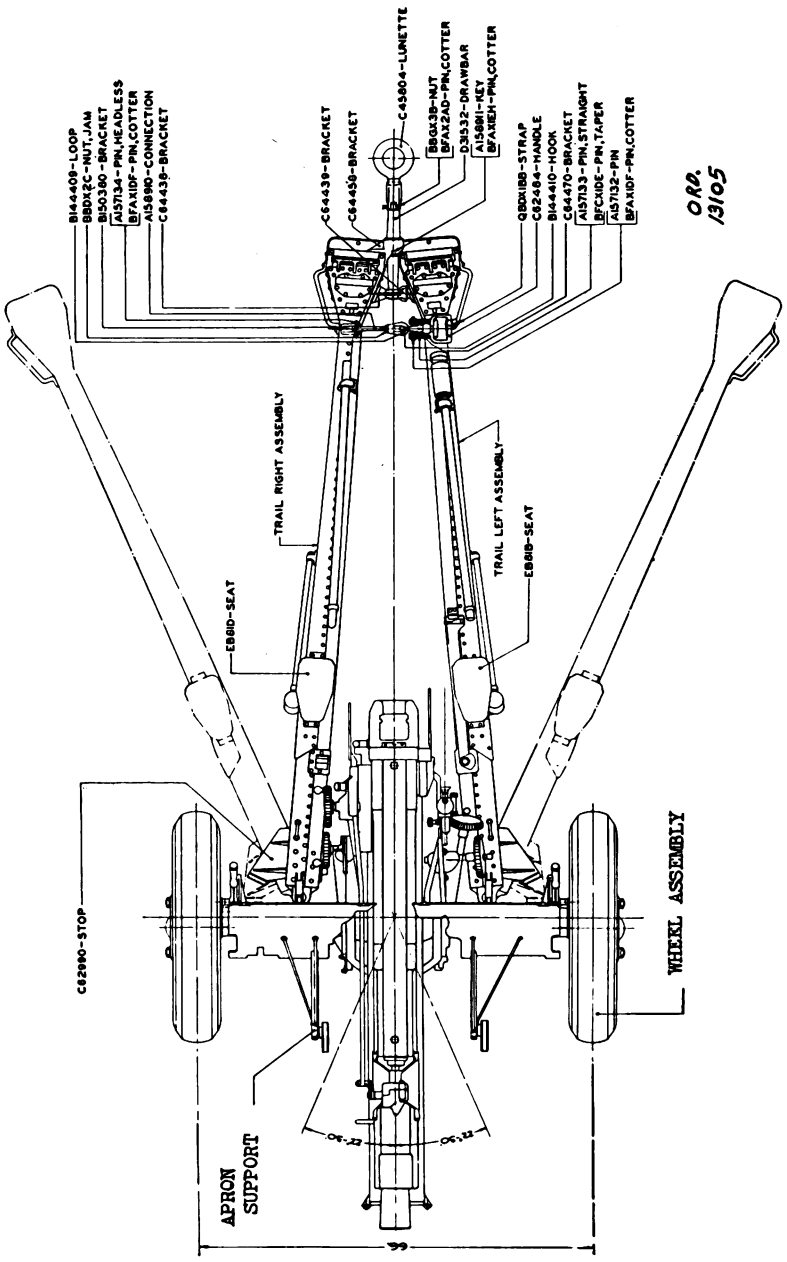


FIGURE 9.—75-mm gun carriage, M1916MIA1 (transverse section).

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Reference	Item	Reference	Item
57A	Arc, elevating.	BFAX2AD	Pin, cotter, split, S., 3/16 by 2½.
PB4C	Arm, axle, right.	KB32D	Pinion, equalizing, left.
KB35A	Arm, rocker, left.	KB43P	Pointer, traveling lock.
KB38A	Bearing, intermediate traversing shaft.	KB37A	Rack, traversing.
		PB4B	Ring, axle arm locking.
KB38G	Bearing, traversing worm shaft.	KB31D	Rocker.
WA3B	Bolt, sight lever.	KB32A	Screw, equalizing gear support locking.
D31681	Bracket, left.		
D31682	Bracket, right.	KB89A	Shaft, angle of site handwheel, w/bevel pinion.
KB46D	Bracket, angle of site, left.		
KB47C	Bracket, angle of site, right.	KB90C	Shaft, angle of site intermediate.
EB25D	Bracket, shield, inner, right.	KB36B	Shaft, traversing intermediate, w/bevel pinion.
KB72K	Bushing, equalizing gear.		
KB72M	Bushing, equalizing pinion.	KB36D	Shaft, traversing worm.
KB72L	Bushing, half, left trunnion cap.	59A	Slide, gun, left.
KB70C	Bushing, half, rocker trunnion.	C45203	Spindle, wheel.
KB72F	Bushing, top carriage pintle.	KB32B	Stud, equalizing gear.
KB43B	Cap, trunnion, left.	57B	Support, elevating arc.
KB40E	Carriage, top.	KB32K	Support, equalizing gear.
11A	Cradle.	A158909	Washer, disk and rim wheel spindle, inner.
CLFX2C	Cup, oil, drive type, ½ in. diam.		
KB76B	Gear, equalizing.	A139604	Washer, disk and rim wheel spindle, outer.
WA3A	Lever, sight.		
BBHX2A	Nut, slotted, s-fin., 1¼-12NF-2.	KB32H	Washer, equalizing gear stud.
BBHX2B	Nut, slotted, s-fin., 1¾-12NF-2.		Wheel, assembly.
BFAX2AC	Pin, cotter, split, S., 5/16 by 2¼.	KB36A	Worm, traversing.

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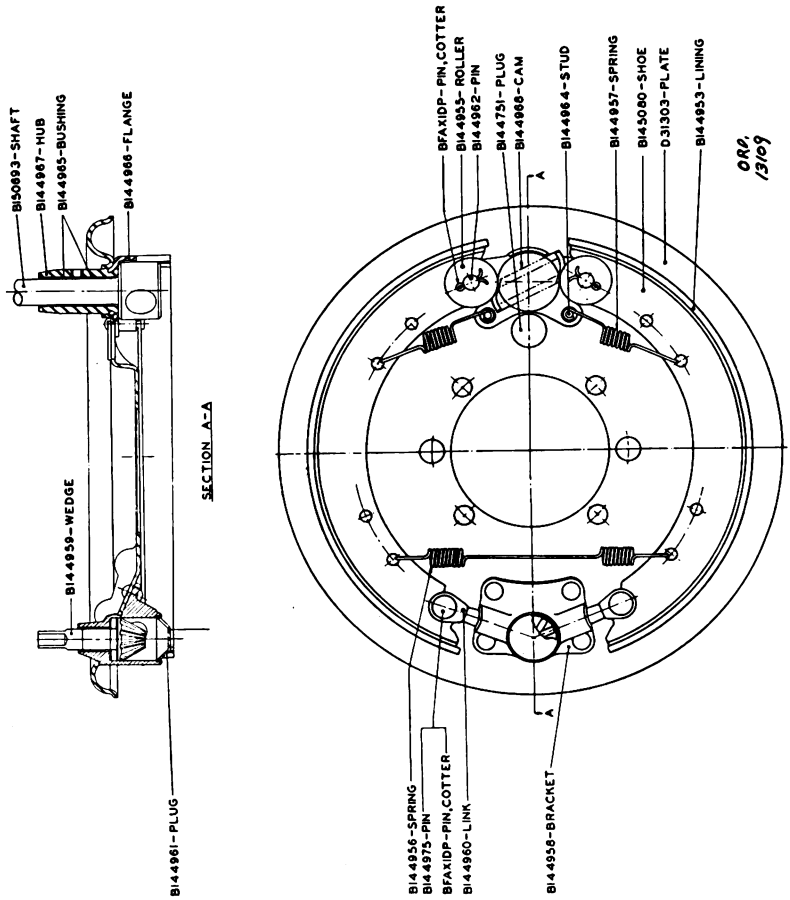


FIGURE 10.—Brake, left hand (sectioned view).

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Reference	Item	Reference	Item
B144958	Bracket, brake adjusting wedge.	B144751	Plug, brake housing plate.
B144965	Bushing, brake cam hub.	B144961	Plug, brake shoe adjusting wedge.
B144968	Cam, brake.	B144955	Roller, brake cam.
B144966	Flange, brake cam hub.	B150693	Shaft, brake cam.
B144967	Hub.	B145080	Shoe.
B144953	Lining, brake shoe.	B144956	Spring, retracting, brake shoe, long.
B144960	Link, brake shoe.	B144957	Spring, retracting, brake shoe, short.
B144962	Pin, brake cam roller.		
B144975	Pin, brake shoe link.	B144964	Stud, brake shoe retracting spring.
BFAX1DP	Pin, cotter, split, S., ¼ by ¾.	B144959	Wedge, brake shoe adjusting.
D31303	Plate.		

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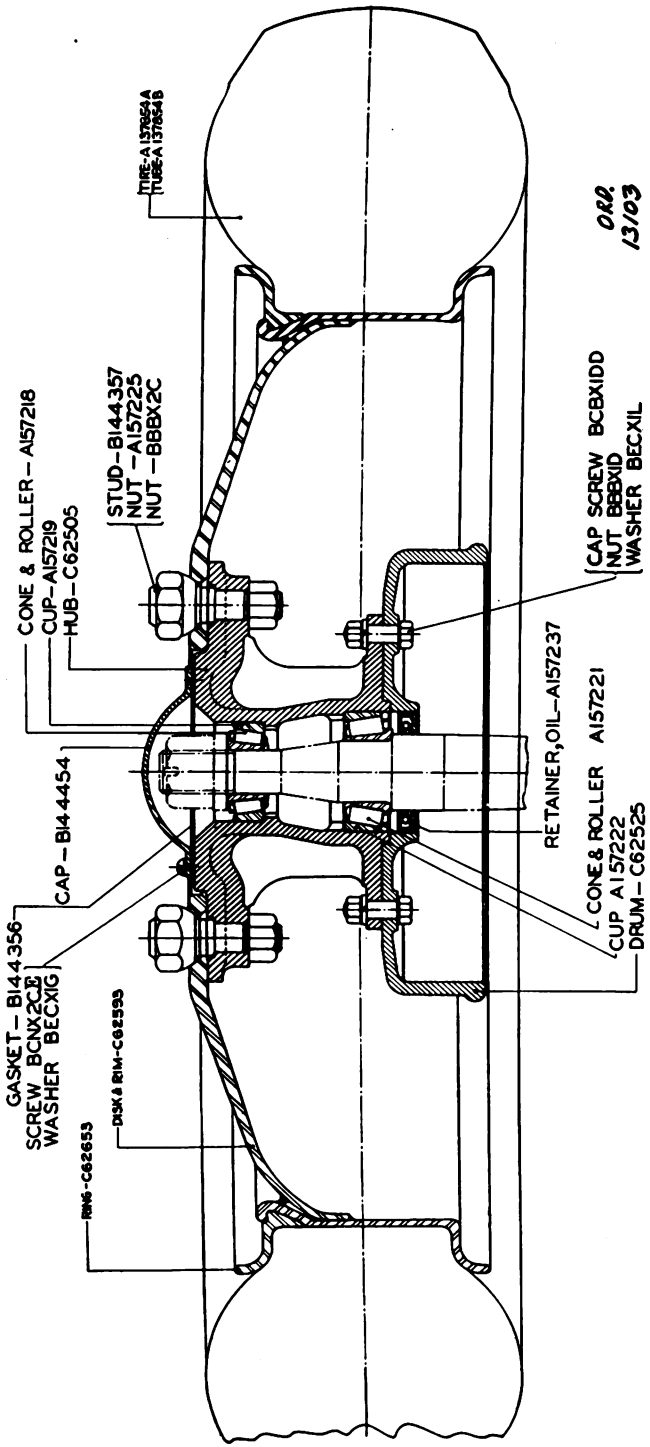


FIGURE 11.—Wheel and hub (sectioned view).

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Reference	Item	Reference	Item
B144454	Cap, hub.	C62653	Ring, locking, tire.
A157218	Cone and roller, taper roller bearing, 1.1562 I. D. by 1.0013 width.	BCBX1DD	Screw, cap, hex-hd., 7/16–20NF–2 by 1¼.
A157221	Cone and roller, taper roller bearing, 1.6250 I. D. by 1.1965 width.	BCNX2CE	Screw, mach., rd-hd., S., ¼–20NC–2 by ½.
A157219	Cup, taper roller bearing, 2.615 O. D. by .750 width.	B144357	Stud, disk and rim wheel.
A157222	Cup, taper roller bearing, 3.1562 O. D. by .9375 width.	A137854A	Tire, automobile, pneumatic, truck and bus balloon, 7.50–24 (type B).
C62525	Drum, brake.	A137854B	Tube, inner, automobile, puncture sealing, 7.50–24, assembly.
B144356	Gasket, hub cap.	BECX1G	Washer, lock, reg., ¼ by 3/32 by 1/16.
C62505	Hub.	BECX1L	Washer, lock, reg., 7/16 by 5/32 by 1/8.
A157225	Nut, disk and rim wheel, 1⅛–16NS–2.	C62593	Wheel, automobile, disk and rim, assembly.
BBBX1D	Nut, reg., hex., s-fin., 7/16–20NF–2.		
BBBX2C	Nut, reg., hex., s-fin., ¾–16NF–2.		
A157237	Retainer, oil.		

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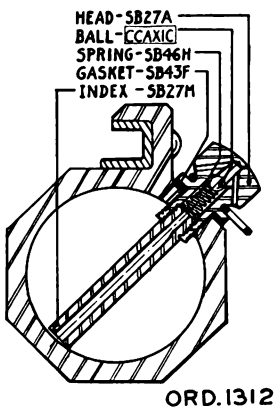
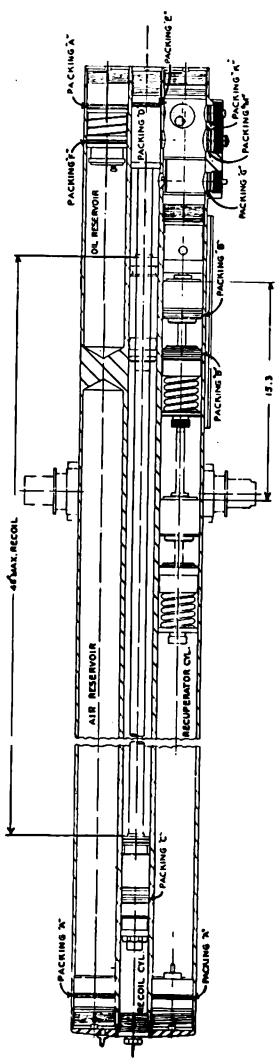


FIGURE 12.—Oil index head, assembly (sectioned view).

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Reference	Item	Reference	Item
CCAX1C	Ball, chr-alloy-S., grade 2, ¼ in.	SB27M	Index, oil.
SB43F	Gasket, oil index head.	SB46H	Spring, oil index.
SB27A	Head.		

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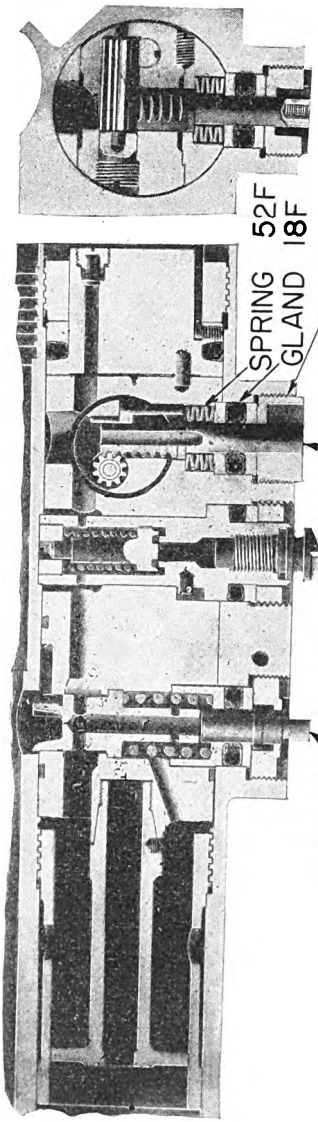


FIGURE 13.—Recoil mechanism (schematic view) and oil gage rack (sectioned view).

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Reference	Item	Reference	Item
18E	Follower, oil gage.	17B	Rack, oil gage.
18F	Gland, oil gage.	52F	Spring, Belleville, oil gage packing compression.
22C	Plug, recuperator cylinder head.		
21E	Plunger, throttling valve control.		

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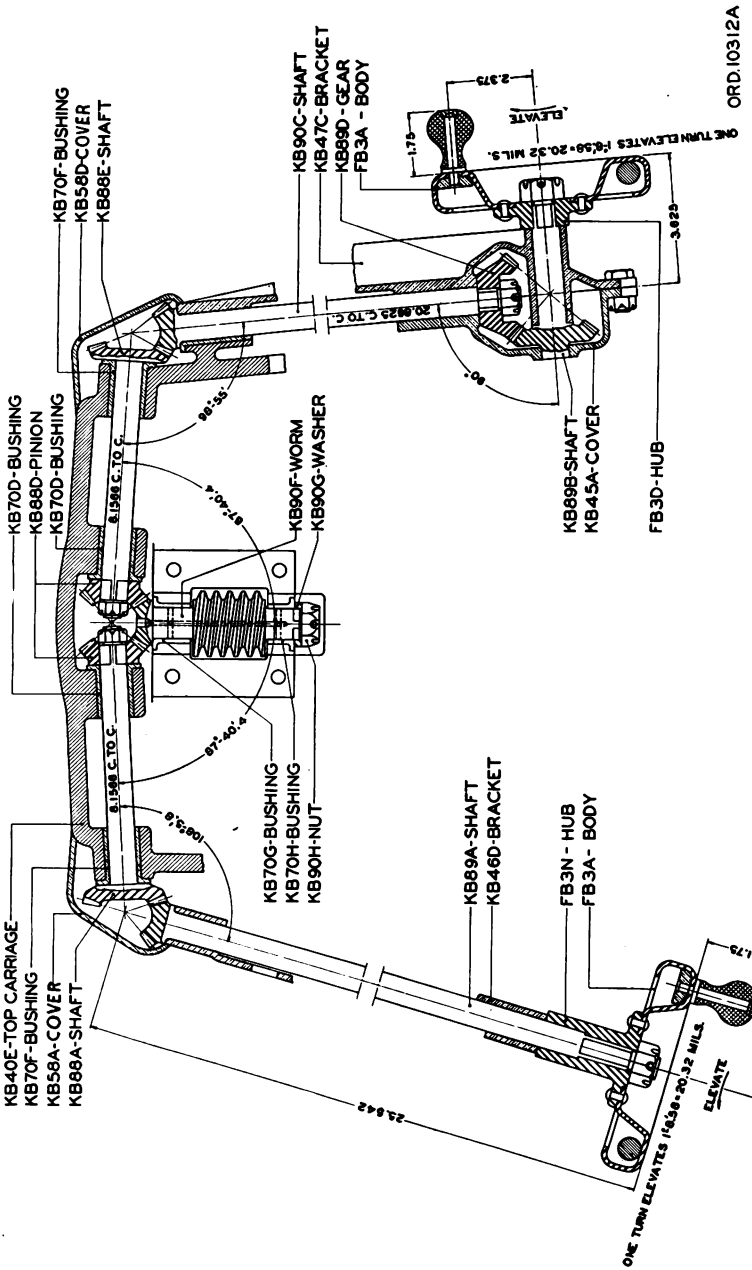


FIGURE 14.—Angle of site mechanism, assembly.

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Reference	Item	Reference	Item
FB3A	Body, handwheel, 6 inch.	KB89D	Gear, angle of site intermediate shaft.
KB46D	Bracket, angle of site, left.	FB3D	Hub.
KB47C	Bracket, angle of site, right.	FB3N	Hub.
KB70D	Bushing, angle of site cross shaft, inner.	KB90H	Nut, angle of site worm.
KB70F	Bushing, angle of site cross shaft, outer.	KB88D	Pinion, angle of site cross shaft.
KB70G	Bushing, half, angle of site worm, front.	KB88A	Shaft, angle of site cross, left.
KB70H	Bushing, half, elevating worm, rear.	KB88E	Shaft, angle of site cross, right.
KB40E	Carriage, top.	KB89A	Shaft, angle of site handwheel, w/bevel pinion, left.
KB45A	Cover, angle of site bracket, right.	KB89B	Shaft, angle of site handwheel, w/bevel pinion, right.
KB58A	Cover, angle of site cross shaft gear, left.	KB90C	Shaft, angle of site intermediate.
KB58D	Cover, angle of site cross shaft gear, right.	KB90G	Washer, angle of site worm.
		KB90F	Worm, angle of site.

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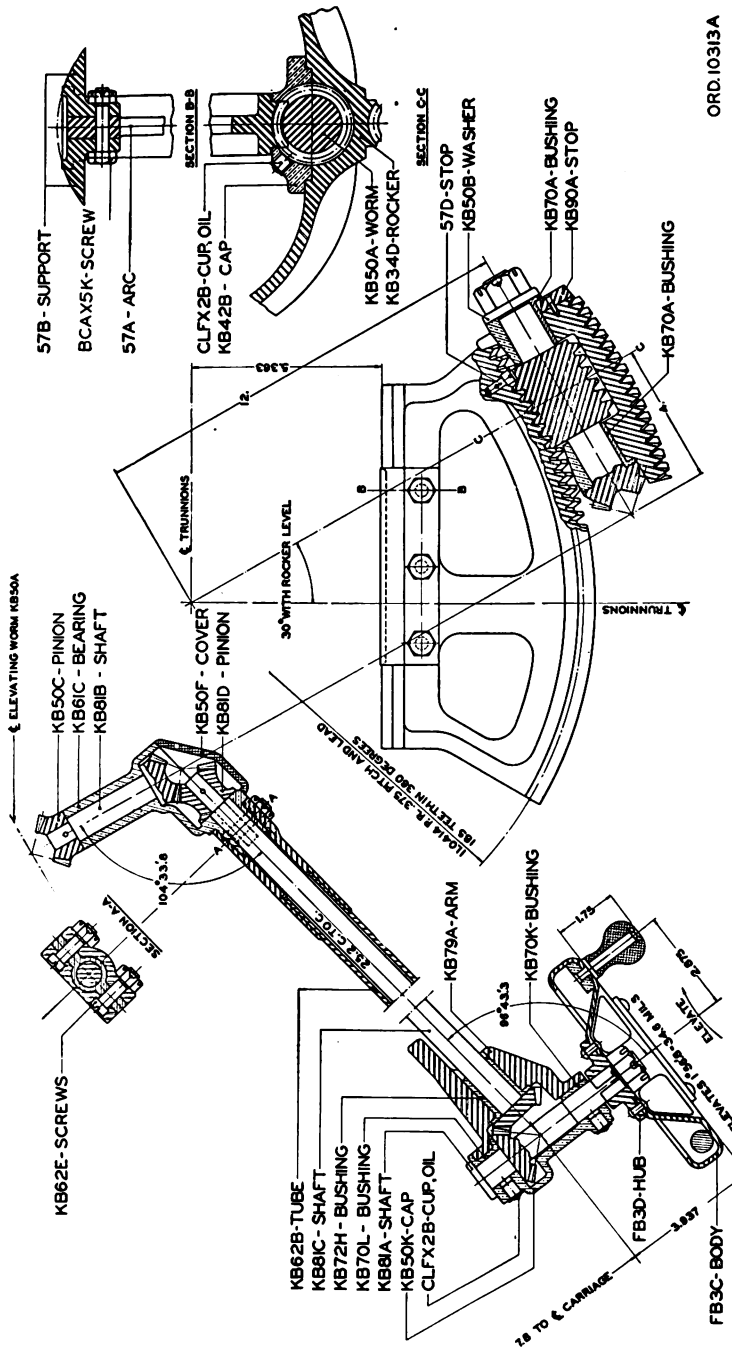


FIGURE 15.—Elevating mechanism, assembly.

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Reference	Item	Reference	Item
57A	Arc, elevating.	KB50C	Pinion, elevating cross shaft.
KB79A	Arm, rocker, right.	KB81D	Pinion, elevating intermediate shaft.
KB61C	Bearing, elevating cross shaft.	KB34D	Rocker.
FB3C	Body, handwheel, 7 inch.	BCAX5K	Screw, cap, hex-hd., ⅝–16NC–2 by 1¾.
KB70A	Bushing, half, elevating worm.	KB62E	Screw, rocker arm brace lower end.
KB70L	Bushing, half, right rocker arm, top, left.	KB81B	Shaft, elevating cross.
KB70K	Bushing, half, right rocker arm, top, right.	KB81A	Shaft, elevating handwheel.
KB72H	Bushing, rocker arm angle of site intermediate shaft.	KB81C	Shaft, elevating intermediate handwheel.
KB42B	Cap, elevating worm.	KB90A	Stop, angle of site worm.
KB50K	Cap, rocker arm.	57D	Stop, depression.
KB50F	Cover, elevating cross shaft gear.	57B	Support, elevating arc.
CLFX2B	Cup, oil, drive type, ⅜ inch diameter.	KB62B	Tube, rocker arm brace.
FB3D	Hub.	KB50B	Washer, elevating worm.
		KB50A	Worm, elevating.

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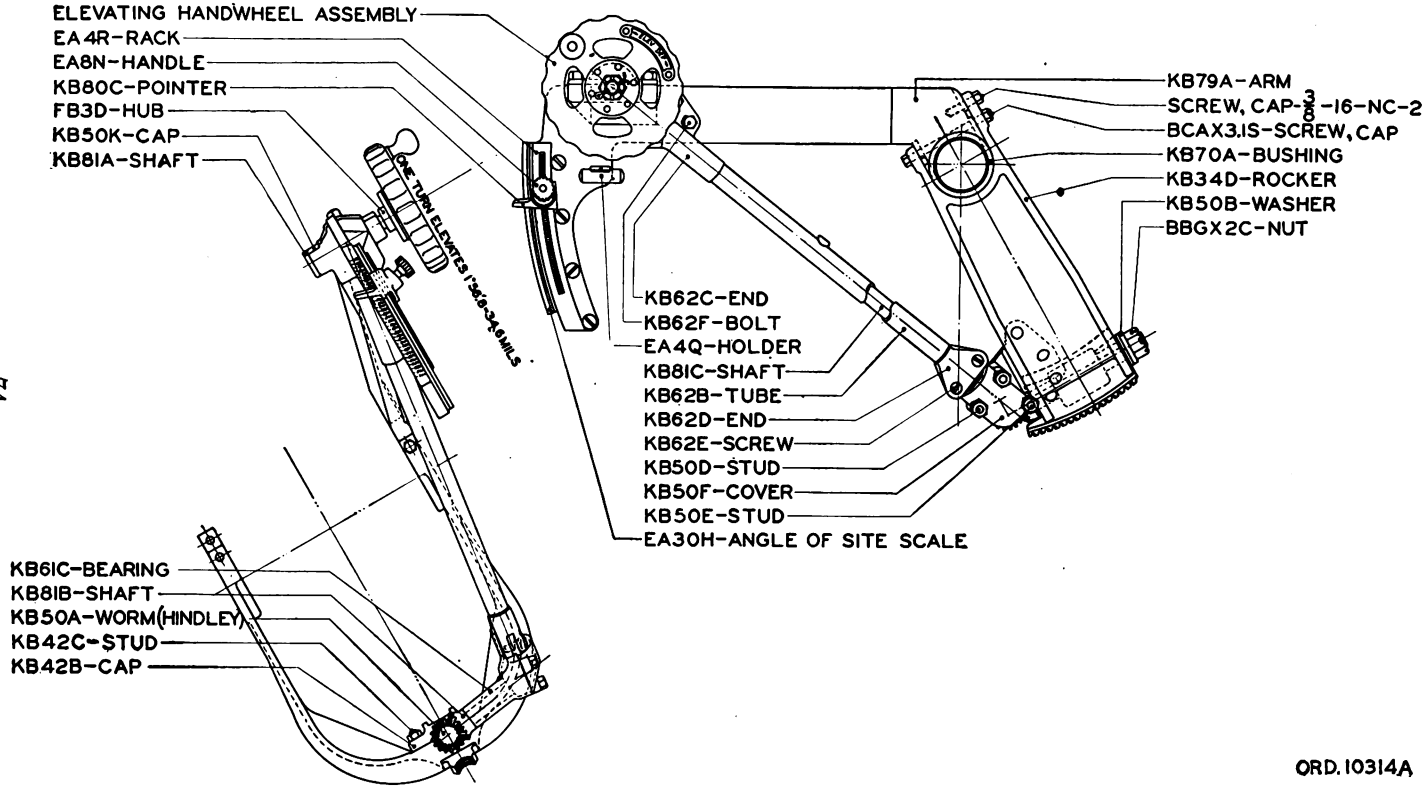


FIGURE 16.—Rocker, assembly.

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Reference	Item	Reference	Item
KB79A	Arm, rocker, right.	EA30H	Scale, angle of site.
KB61C	Bearing, elevating cross shaft.		Screw, cap, hex-hd., ⅜–16NC–2 by 1⅜.
KB62F	Bolt, rocker arm brace end, upper.	BCAX3.1S	Screw, cap, hex-hd., ⅜–16NC–2 by 4¾.
KB70A	Bushing, half, elevating worm.	KB62E	Screw, rocker arm brace lower end.
KB42B	Cap, elevating worm.	KB81B	Shaft, elevating cross.
KB50K	Cap, rocker arm.	KB81A	Shaft, elevating handwheel.
KB50F	Cover, elevating cross shaft gear.	KB81C	Shaft, elevating intermediate handwheel.
KB62D	End, rocker arm brace, lower.	KB50E	Stud, elevating cross shaft gear cover.
KB62C	End, rocker arm brace, upper.	KB50D	Stud, elevating cross shaft gear cover, long.
EA8N	Handle, scroll gear.	KB42C	Stud, elevating worm cap.
	Handwheel, elevating, assembly.	KB62B	Tube, rocker arm brace.
EA4Q	Holder, level.	KB50B	Washer, elevating worm.
FB3D	Hub.	KB50A	Worm, elevating.
BBGX2C	Nut, slotted, s-fin., ¾–10NC–2.		
KB80C	Pointer, range scale.		
EA4R	Rack, rocker arm range scale pointer.		
KB34D	Rocker.		

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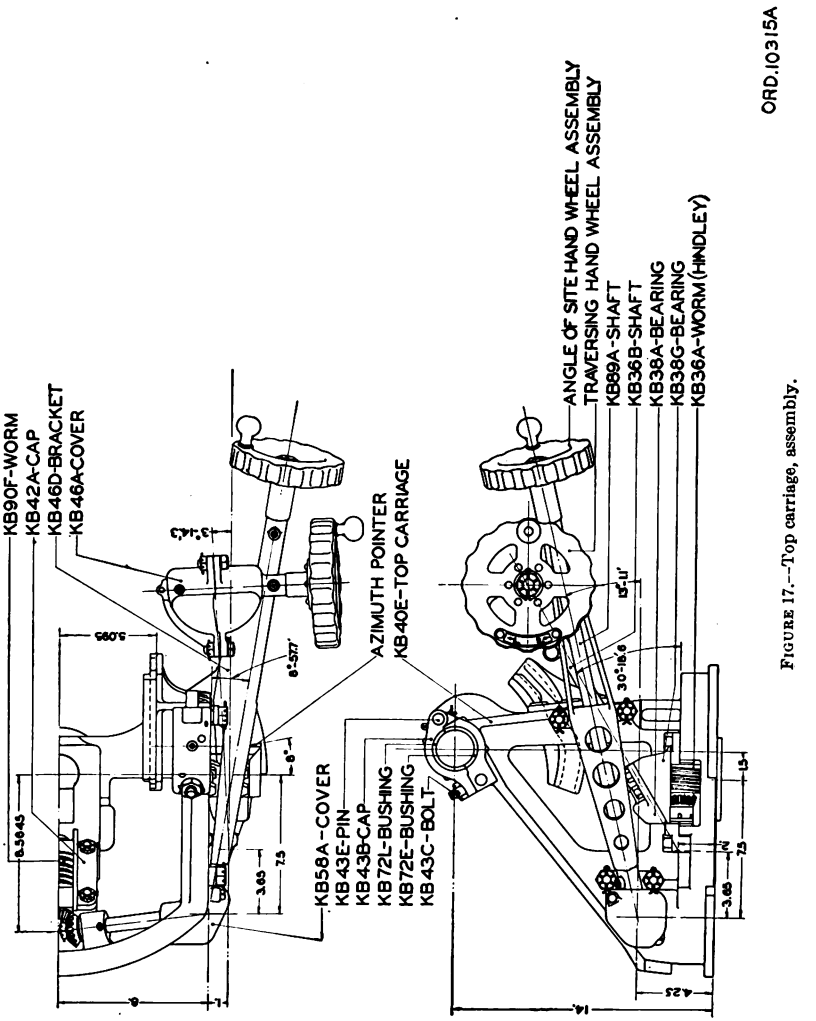


FIGURE 17.—Top carriage, assembly.

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Reference	Item	Reference	Item
KB38A	Bearing, intermediate traversing shaft.	KB58A	Cover, angle of site cross shaft gear, left.
KB38G	Bearing, traversing worm shaft.		Handwheel, angle of site, assembly.
KB43C	Bolt, trunnion cap swing.		Handwheel, traversing, assembly.
KB46D	Bracket, angle of site, left.	KB43E	Pin, trunnion cap and swing bolt.
KB72L	Bushing, half, left trunnion cap.	KB89A	Shaft, angle of site handwheel w/bevel pinion, left.
KB72E	Bushing, half, trunnion, left.		
KB42A	Cap, angle of site worm.	KB36B	Shaft, traversing intermediate, w/bevel pinion.
KB43B	Cap, trunnion.		
KB40E	Carriage, top.	KB90F	Worm, angle of site.
KB46A	Cover, angle of site bracket, left.	KB36A	Worm, traversing (Hindley).

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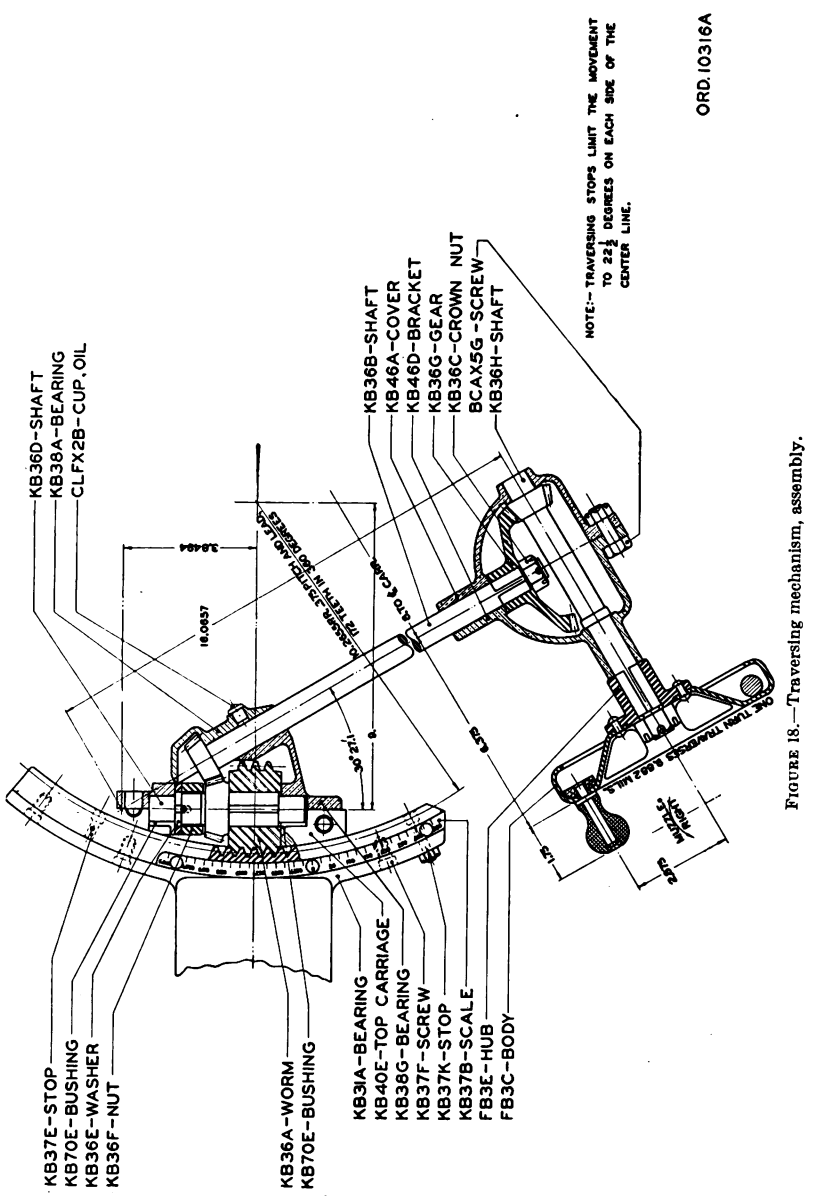


FIGURE 18.—Traversing mechanism, assembly.

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Reference	Item	Reference	Item
KB38A	Bearing, intermediate traversing shaft.	KB36F	Nut, traversing worm shaft adjusting.
KB31A	Bearing, pintle.	KB37B	Scale, azimuth.
KB38G	Bearing, traversing worm shaft.	KB37F	Screw, azimuth scale.
FB3C	Body, handwheel, 7 in.	BCAX5G	Screw, cap, hex-hd., ⅜-16NC-2 by 1¼ (dld. f/c-pin.).
KB46D	Bracket, angle of site, left.	KB36H	Shaft, traversing handwheel, w/bevel pinion.
KB70E	Bushing, half, traversing worm.	KB36B	Shaft, traversing intermediate, w/bevel pinion.
KB40E	Carriage, top.	KB36D	Shaft, traversing worm.
KB46A	Cover, angle of site bracket, left.	KB37E	Stop, traversing and elevating.
CLFX2B	Cup, oil, drive type, ⅜ in. diam.	KB37K	Stop, traversing, rear.
KB36G	Gear traversing intermediate shaft.	KB36E	Washer, traversing worm shaft adjusting nut.
FB3E	Hub.	KB36A	Worm, traversing (Hindley).
KB36C	Nut, angle of site intermediate shaft, right and traversing intermediate shaft.		

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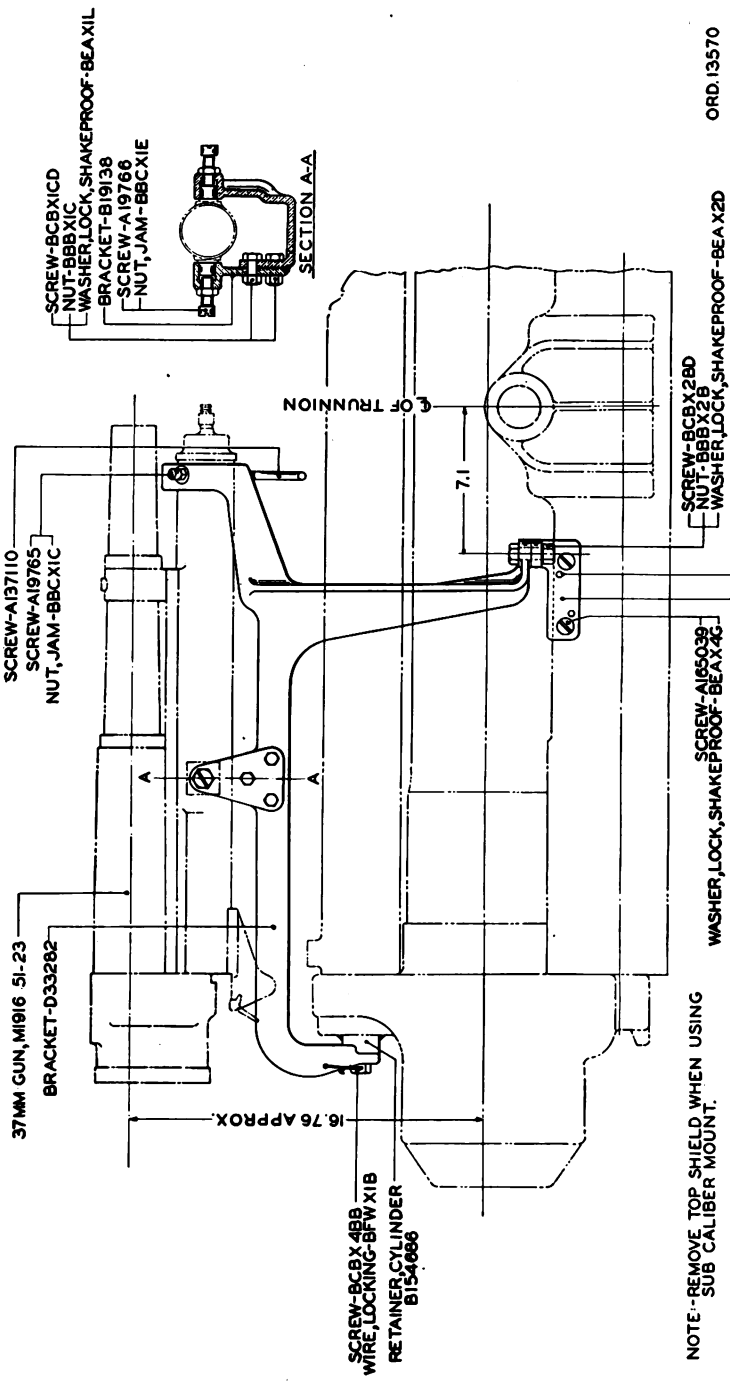


FIGURE 19.—Mount, subcaliber, 37-mm, T15.

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Reference	Item	Reference	Item
D33282	Bracket, cradle mounting.	BCBX4BB	Screw, cap, hex-hd., ⅝–18NF–2 by 1¼ (dld. f/lkg-wire).
B19138	Bracket, cradle trunnion.	BCBX2BD	Screw, cap, hex-hd., ⅝–18NF–2 by 1¾.
BBCX1C	Nut, jam, s-fin., ⅝–16NC–2.	A165039	Screw, subcaliber support.
BBCX1E	Nut, jam, s-fin., ½–13NC–2.	B154356	Support, subcaliber, L. H. (attached to cradle).
BBBX1C	Nut, reg., hex., s-fin., ⅜–24NF–2.	B154355	Support, subcaliber, R. H. (attached to cradle).
BBBX2B	Nut, reg., hex., s-fin., ⅝–11NC–2.	BEAX1L	Washer, lock, "Shakeproof No. 12 type", ⅜ in.
BFDX2AA	Pin, stght., S., ¼ by ¾.	BEAX2D	Washer, lock, "Shakeproof No. 12 type", ⅝ in.
B154686	Retainer, cylinder (welded to KB51H).	BEAX4G	Washer, lock, "Shakeproof No. 15 type", ⅞ in.
A137110	Screw, adjusting.	BFWX1B	Wire, S., low carbon, bright annealed, .0625 in. diam. lb.
A19765	Screw, cap, fl–fil–hd., S., ⅝–16NC–2 by 1¼.		
A19766	Screw, cap, fl–fil–hd., S., ½–13NC–2 by 1½.		
BCBX1CD	Screw, cap, hex-hd., ⅜–24NF–2 by 1¼.		

[A.G.062.12 (10–31–39).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

E. S. ADAMS,
Major General,
The Adjutant General.

U. S. GOVERNMENT PRINTING OFFICE: 1940

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TECHNICAL REGULATIONS
No. 1050–5

WAR DEPARTMENT,
WASHINGTON, *May 10, 1939.*

SYMBOLS FOR SEACOAST DEFENSE FIRE-CONTROL MAPS, DIAGRAMS, AND STRUCTURES

Prepared under direction of the
Chief of Engineers

	Paragraph
General	1
List of symbols	2
Numbers and symbols for harbor defenses	3
Abbreviations	4
Communication symbols for use on harbor defense fire-control charts and diagrams	5

1. General.—*a.* Symbols on existing maps, charts, diagrams, or structures need not be changed to conform to these regulations.

b. When maps, charts, or diagrams are redrawn or new editions thereof are issued and when structures are reassigned, the symbols or abbreviations prescribed herein will be used. Such changes will be made progressively and without expenditure of funds for this special purpose.

c. Additional symbols required will be found in BFM, Vol. I, Ch. 6.

2. List of symbols.

Name	Symbol	Abbreviation
Harbor defense command post	(H)	H D C P
Groupment command post	(C)	Gm C P
Fort command post	(F)	Ft C P
Combined groupment command post and fort command post.	(CF)	Gm Ft C P

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SYMBOLS FOR SEACOAST DEFENSE

Name	Symbol	Abbreviation
Gun group command post		G C P
Mine group command post		M C P
Seacoast battery command post		B C P
Harbor defense observation post		H D O P_3
Groupment observation post		Gm O P_2
Fort observation post		Ft O P_3
Gun group observation post		G_2^1 O P
Gun group double observation post		G_1 G_2 O P
Mine group observation post		M_2^1 O P
Mine group double observation post		M_1^1 M_2^1 O P
Battery observation post		B_1^1 O P
Emergency observation post		E_2^1 O P

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Name	Symbol	Abbreviation
Spotting post		S^{1}_{3} O P
Self-contained base range-finder station.		R F
Plotting room		P
Data booth		Data B
Temporary or improvised fire-control structures.		B^{2}_{3} Imp
60-inch seacoast searchlight; fixed, portable, or mobile. (See page 5 for antiaircraft searchlights.)		SL 2 F (P or M)
Searchlight shelter		S Sh
Searchlight power-house		S P H
Searchlight controller booth		C B
Seacoast searchlight other than 60-inch.		SL^{36}_{3P}
Mine loading room		L R

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SYMBOLS FOR SEACOAST DEFENSE

Name	Symbol	Abbreviation
Mine casemate		M C
Meteorological station		M E T
Tide station		Td
Signal station		S S
Fire-control switchboard room		F S B
Post telephone switchboard room		P S B
Combined fire-control and post telephone switchboard room.		F S B P S B
Cable terminal		C Ter
Power-house		P H
Central power-house		C P H
Pumping plant		P P
Magazine or shell room		Mg 2 or S Rm 2

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Name	Symbol	Abbreviation
Antiaircraft observation post		A A O P 2
Antiaircraft searchlight; fixed, portable, or mobile.		A A S L 3 F (P or M)
Antiaircraft gun battery or composite battery, fixed or mobile.		A A No 2 F or M
Datum point		
Triangulation station		
Intersection point		
Benchmark		B M
Lighthouse		L H
Separate observation post		O P
Operations and plotting room		O P R
Watchers booth		W Bth
Radio power-house		R P H

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3. Numbers and symbols for harbor defenses.—*a.* In a harbor defense command, seacoast installations will be numbered consecutively from right to left, facing the center of the field of fire of the harbor defense; antiaircraft installations pertaining thereto may be numbered in any convenient sequence. The existing numbers of seacoast batteries need not be changed.

b. Groupment stations, gun group stations, and mine group stations will be numbered consecutively and each given a numerical subscript beginning with number 1, as:

$$C_1,\ C_2;\ C_1^1,\ C_1^2;\ C_2^1,\ C_2^2.$$
$$G_1,\ G_2;\ G_1^1,\ G_1^2;\ G_2^1,\ G_2^2.$$
$$M_1,\ M_2;\ M_1^1,\ M_1^2;\ M_2^1,\ M_2^2.$$

c. Groupments may also be given a name in addition to the numbers, as: G_1^1 Funston.

d. Harbor-defense observation posts, seacoast and antiaircraft searchlights, underwater listening posts, and antiaircraft gun batteries, observation posts, machine-gun batteries or platoons, and searchlight platoons, will be numbered consecutively, each in a separate series, beginning with number 1, as:

$$HDOP_1,\ HDOP_2;\ SL_{1F} \text{ or } SL_{2M} \text{ or } AASL_2.$$

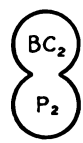
e. Where stations are combined in one room the letters representing each station are inclosed in the symbol, as:



f. Where stations are adjacent in the same structure, the symbols are tangent to each other and are arranged to show the relative location, as:



g. Where communication may be had by voice through a passage, door, window, or voice tube, the symbols are left open at the point of contact, as:



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4. Abbreviations.

Cable gallery	C Gal
Cable tank	C T
Cable hut (commercial cable)	C H
Coast Guard station	C G S
Engineer wharf	Engr Whf
Gasoline tank	G Tk
Guardhouse	G H
Latrine	L
Lighthouse wharf	L H Whf
Mine boathouse	M B H
Mine derrick	M Drk
Mine tramway	M Tmy
Mine wharf	M Whf
Ordnance machine shop	O M S
Private wharf	Pvt Whf
Radio (commercial station)	Rad
Railway wharf	Ry Whf
Saluting battery	Sl B
Service dynamite room	S D R
Steamship wharf	S S Whf
Quartermaster wharf	Q M Whf
s. Superseded (for abandoned buildings, etc.)	24 s
t. Temporary (for all uses except fire-control structures)	19 t
Sunset gun	S G
Tide gage (not a [T])	T G
Torpedo storehouse	T S
Tower	Tw
Water tank	W Tk
Weather Bureau	W B

5. Communication symbols for use on harbor defense fire-control charts and diagrams.

Telephone cable (numerals indicate number of pairs and gage)	26 - 19
Speaking tube	
Mechanical data transmission line	
Electrical data transmission line	
Searchlight controller line	
Zone signal and magazine telephone line	

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Firing signal line ---------- ● ● ● ● ●
Time interval bell line ---------- — · — · —
Submarine cable (numerals indicate number of pairs and gage) ---------- —50–19—

[A. G. 062.12 (12-21-38).]

BY ORDER OF THE SECRETARY OF WAR:

MALIN CRAIG,
Chief of Staff.

OFFICIAL:

E. S. ADAMS,
Major General,
The Adjutant General.

U. S. GOVERNMENT PRINTING OFFICE: 1939

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TECHNICAL REGULATIONS
No. 1120–75

WAR DEPARTMENT,
WASHINGTON, *December 5, 1939.*

CHEMICAL WARFARE SERVICE

4.2-INCH CHEMICAL MORTAR, MIA1

Prepared under direction of the
Chief of the Chemical Warfare Service

	Paragraphs
SECTION I. General	1– 2
II. Description and data	3– 5
III. Ammunition	6–10
IV. Operating instructions	11–16
V. Care and maintenance	17–20
VI. Accessories, spare parts, and fire-control equipment	21–24
VII. Transportation equipment	25–28
VIII. Repairs in the field	29–30

SECTION I

GENERAL

	Paragraph
Purpose and scope	1
References	2

1. Purpose and scope.—These regulations are intended for the using services. They give all necessary information regarding the construction, functioning, and identification of all matériel pertaining to the 4.2-inch chemical mortar, MIA1, (surface set-up assembly), including the mortar, ammunition, and transportation equipment, with directions for the operation, care, and maintenance of such matériel. They also give brief directions for the minor repairs that may be made in the field by a mortar company and the replacement of unserviceable parts by a chemical maintenance company.

2. References.—*a.* Handbook for the 4.2-inch Chemical Mortar, 1932, which covers the MI (dug-in type) mortar.

b. Chemical Warfare Service Field Manual, Volume I.

c. TR 1370–A.

d. AR 750–10.

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e. Chemical Warfare Service Supply Catalog, July 1, 1937.

f. Standard Nomenclature and Price List of Chemical Warfare Matériel. (Issued annually, giving the correct nomenclature, list of expendable articles, and prices of chemical warfare matériel.)

SECTION II

DESCRIPTION AND DATA

	Paragraph
General description	3
Detailed description	4
Weights	5

3. General description.—*a. Mortar.*—(1) The 4.2-inch chemical mortar, MIA1, is a rifled muzzle-loading weapon capable of firing at elevations between 800 mils and 1,066 mils and of being traversed 100 mils right or left of basic.

(2) The mortar (see fig. 1) consists essentially of a barrel, a barrel support (standard), and a baseplate. Practically, it differs from the MI mortar (dug-in type) only in the form of the baseplate which lies flat on the surface of the ground, and in the support for the barrel, designated the "standard". The baseplate does not require the digging of an excavation for its emplacement as does the baseplate of the MI mortar. The standard is shaped like an inverted T. The stem of the T is a hollow shaft housing the elevating mechanism, and the ends of the arms of the T are connected by tie rods, or connectors, to the baseplate so that when the baseplate is forced to the rear by the recoil of the barrel when the mortar is fired, the whole assembly moves back as a unit and the components of the mortar (barrel, baseplate, and standard) remain approximately in the same relation to each other, with a minimum disturbance of the angle of elevation of the barrel. The elevation of the barrel is varied by turning the elevating screw wheel, and lateral displacement is obtained by turning the traversing screw.

(3) A sight is furnished to enable the mortar squad to train the mortar on a given point and to set the barrel at the elevation called for by the range table.

(4) The range may be varied either by changing the elevation of the barrel or by varying the amount of propelling charge, or by a combination of the two.

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(5) The mortar may be fired at a rapid rate of fire of 15 to 20 rounds per minute for short periods, or at a sustained rate of fire of 3 to 5 rounds per minute if emplaced normally.

b. Ammunition.—(1) The shell is streamlined and, being provided with interior vanes, gives true flight with either liquid or solid fillings. A bursting charge of high explosive actuated by a point detonating fuze is used to burst the shell and disperse its contents on impact. The propelling charge is attached to the base of the shell, and the pressure developed by the charge when it is ignited

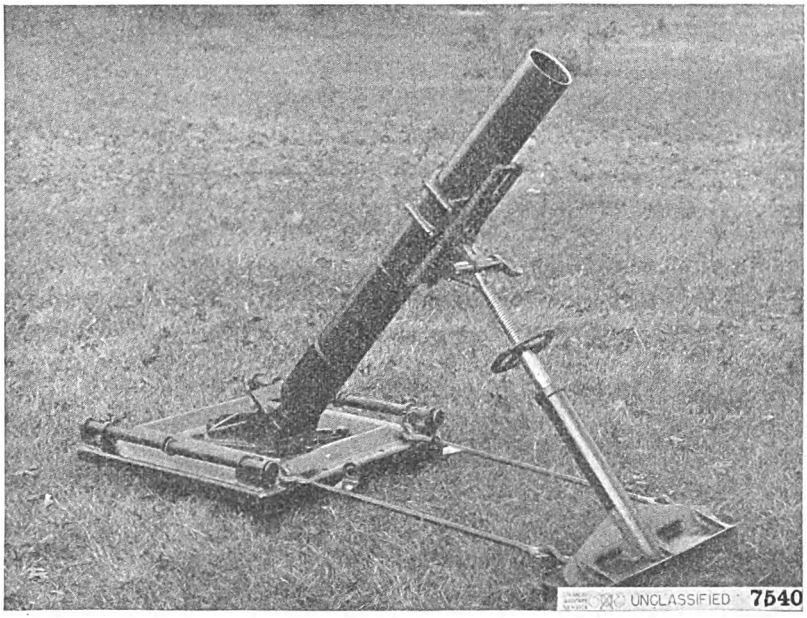


FIGURE 1.—4.2-inch chemical mortar, MIA1.

expands a driving disk of soft brass, also attached to the base of the shell, into the rifling of the barrel. As the shell is forced out of the barrel, rotation is imparted to the shell, resulting in true flight with an increase in range over that obtained with the smooth bore 4-inch chemical mortar, which gives a tumbling shell.

(2) The propelling charge consists of an ignition cartridge and two to eight bundles of powder. The ignition cartridge is a specially loaded 12-gage shotgun shell which fits inside a cartridge container on the base of the shell, while the bundles of powder fit over the outside of the cartridge container and are firmly held over the radial holes in the latter by means of the striker and compression nuts.

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The mortar is fired by dropping the complete round down the mortar barrel. The impact of the shell on the firing pin in the base of the barrel causes the ignition cartridge to function. The flame from the cartridge escapes through the radial holes in the cartridge container and ignites the powder surrounding the cartridge container.

(3) The force of the discharge, or setback, and centrifugal force in the rotating shell after it has left the barrel arm the fuze. When the shell strikes a resisting object, such as the limb of a tree, the roof of a house, or the ground, the fuze functions. Care should therefore be taken, when firing from woods, to avoid striking branches of trees which might cause premature explosion of the shell near friendly troops.

4. Detailed description.—*a. Barrel, M1A1.*—(1) The barrel (see fig. 2) is a steel tube (1) 48 inches long, having an outside diameter varying from 5⅛ inches at the base to 4¾ inches at the muzzle, and an inside diameter of 4.2 inches. At the base or breech end it is swaged in to form a bottleneck approximately 2 inches in diameter which is threaded on the outside to receive the base cap (2). On the inside of the base cap is a ¾-inch hole threaded to receive the striker pin (3) which projects inside the barrel. The copper base-cap washer (4) is placed in the base cap to insure a gas-tight joint between the base cap and the barrel. The base cap has two pins (5) 1 inch in diameter screwed into two holes drilled radially 180° apart in the outer walls at right angles to the center line of the base cap just below the shoulder against which the bottleneck of the barrel seats. When the mortar is assembled, these pins fit into slots in the base-cap cup of the baseplate and prevent rotation of the barrel during firing.

(2) The barrel is rifled with 24 grooves and lands. The depth of the groove is 0.03 inch and the width is 0.486 inch; the width of the land is 0.062 inch. The length of the rifling is 42 inches; the pitch increases from zero at the breech to one turn in 20 calibers at the muzzle.

(3) A leather muzzle cover is placed over the muzzle end of the barrel to protect the interior surfaces from grit and moisture.

(4) *Connection to standard.*—(*a*) The connection between the barrel and the standard is so designed that the shock due to the recoil of the barrel during firing is cushioned by coil springs and is not transmitted to the standard through a rigid connector. This feature decreases the strain on the barrel and standard components and adds to the stability of the mortar while in action. See figure 2, view B—B.

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(*b*) The connection is a large two-piece clamp (6) assembled to the barrel by steel bolts (7), and a steel coupling (8). The lower half of the clamp extends longitudinally underneath the barrel about 5½ inches beyond each pair of bolts. At the ends of this extension the metal is thickened at the corners, which are bent down to form lugs or ears. A T-shaped guide machined on the lower part of the clamp extends about 2 inches beyond the front pair of bolts and 3½ inches beyond the rear pair. A coupling (8) machined to fit the guide is slipped on from the end of the T section of the clamp. Lugs on each side of the coupling are assembled between the ends of two coil springs

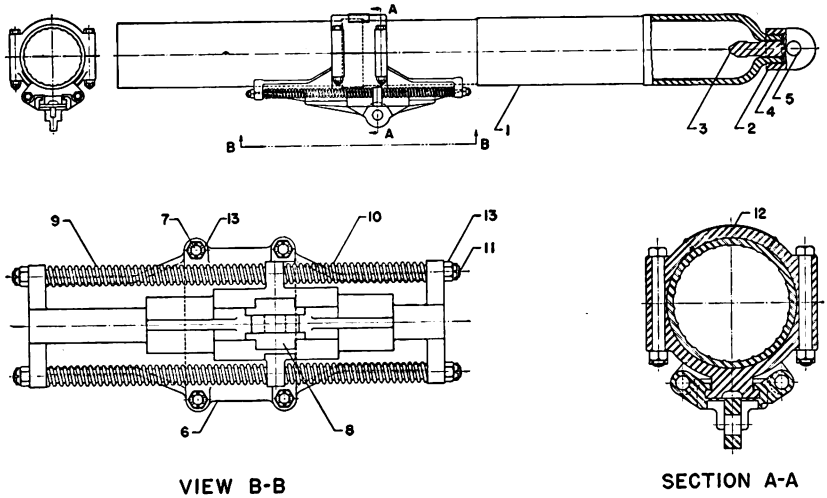


FIGURE 2.—4.2-inch chemical mortar barrel, MIA1.

1. Tube.
2. Cap, base.
3. Pin, striker.
4. Washer, base-cap.
5. Pin, base-cap (2).
6. Slide, shock absorber.
7. Bolt, slide (4).
8. Coupling.
9. Spring, front (2).
10. Spring, rear (2).
11. Guide, spring (2).
12. Plate, name.
13. Nut, castle (8).

(9) and (10). The springs and coupling lugs are held in place by guide rods (11) which in turn are supported by and bolted to the lugs or ears on the ends of the clamps by nuts (13). The underside of the coupling has an ear projecting downward which fits into a slot on top of the traversing nut on the standard (see *b* (4) below) and is held in place by a barrel pin passing through holes in the traversing nut and the ear of the coupling. The diameter of the hole in the coupling

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is sufficiently large to allow the coupling to rotate about the barrel pin as an axis.

b. Standard, MI.—The standard (see fig. 3) consists essentially of a support welded at the lower end to a base, an elevating mechanism which is housed in the support, and, mounted on the upper end of the elevating screw, a traversing mechanism which also serves as the connection between the standard and the barrel.

(1) *Base.*—The base (30) is an oblong plate of alloy steel with the longer sides turned up 5/8 inch and the ends bent down 2 3/8 inches to form a rectangle 6 inches wide and 24 1/4 inches long. The turned-down ends act as spades which cut into the ground and prevent excessive side movement. The spades are reinforced by welded ribs underneath the base. Two eyebolts (33) welded to lug ribs on the base are provided for the tie rods or connectors (27) (28) which are used to connect the standard with the base plate. For carrying purposes there is welded to each tie rod a flange or connection bracket with a hole through it so that the connectors may be brought up and the brackets inserted in the slot in the traversing nut (9) and held in position by the barrel pin (6).

(2) *Support.*—The support (32) is a seamless steel tube welded at the bottom to the base of the standard and provided at the top with a retaining collar (19). The union with the base is reinforced by ribs.

(3) *Elevating mechanism.*—The elevating mechanism consists of an elevating screw (23) made of nickel-chromium steel in a sleeve (18) 15 5/8 inches long, the upper end of which is threaded on the inside for a distance of 2 inches. The sleeve has a shoulder 4 3/4 inches from the top which fits free in the support. The outer diameter of the sleeve below this shoulder is such as to leave room between the sleeve and the support for a compression spring (24), the lower end of which rests on a stop or bearing (25) in the support. The purpose of this spring is to allow downward motion of the barrel in the direction of the axis of the support when the mortar is fired, and thus reduce the stresses on the standard. The elevating screw is raised or lowered by turning the sleeve of the bronze elevating screw wheel (31). To prevent backlash of the spring when the sleeve is turned, small ball bearings (21) between thrust washers (20) (22) are provided at the upper end of the spring. The elevating mechanism allows the mortar barrel to be elevated between 623 mils and 1,256 mils.

(4) *Traversing mechanism.*—The upper end of the elevating screw is flattened and slotted to take the traversing slide (26) on which is mounted the traversing screw (10). The screw passes through the

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traversing nut (9) which rides along the traversing slide when the screw is turned by the crank (14) and crank handle (15). A hole runs through the top of the traversing nut which is slotted at right angles to the hole to take the bottom lug on the barrel coupling when

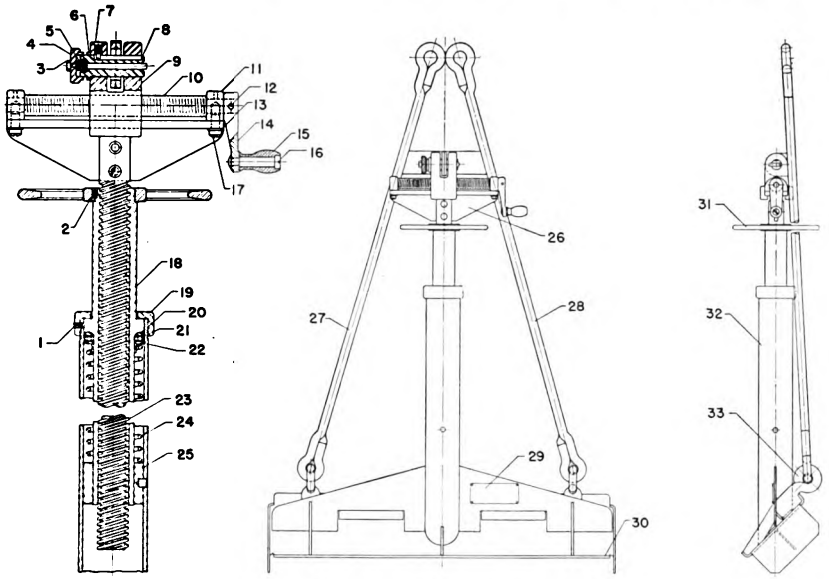


FIGURE 3.—4.2-inch chemical mortar standard, MI.

1. Screw, set.
2. Screw, set.
3. Nut, machine screw.
4. Knob.
5. Spring, latch.
6. Pin, barrel.
7. Pin, stop.
8. Latch.
9. Nut, traversing.
10. Screw, traversing.
11. Bearing, traversing screw (2).
12. Pin, taper.
13. Washer, lock (4).
14. Crank, traversing screw.
15. Handle, crank.
16. Stud, handle.
17. Screw, bearing (4).
18. Sleeve, elevating screw.
19. Collar, retaining.
20. Washer, thrust, upper.
21. Retainer, ball.
22. Washer, thrust, lower.
23. Screw, elevating.
24. Spring.
25. Bearing, sleeve.
26. Slide, traversing.
27. Connector, right.
28. Connector, left.
29. Plate, name.
30. Base.
31. Wheel, elevating screw.
32. Support.
33. Eyebolt (2).

the standard is assembled to the barrel, or the connector brackets when the connectors are folded up for carrying. In either case, the barrel pin (6) is passed through the holes in the traversing nut and the

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barrel coupling or the connector brackets. A stop pin (7) in the upper part of the traversing nut engages in a longitudinal groove in the barrel pin. The barrel pin is reamed eccentrically to take a latch (8) which locks the barrel pin in place. The latch is kept closed by a spring (5) and is released by pushing in on the latch knob (4) and turning it. The traversing mechanism allows 200 mils traverse, 100 mils right and 100 mils left of basic.

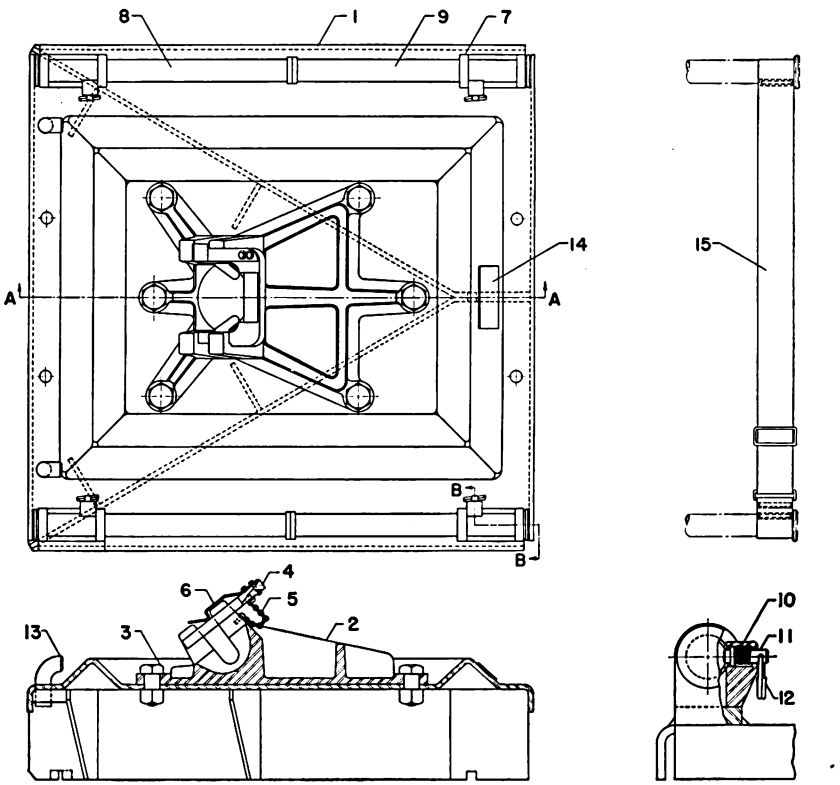


FIGURE 4.—4.2-inch chemical mortar baseplate, MII.

1. Plate.
2. Cup.
3. Bolt (6).
4. Fork, cup.
5. Chain.
6. Retainer, fork.
7. Bracket, handle (2) (right rear and left front).
   Bracket, handle (2) (right front and left rear).
8. Handle, front (2).
9. Handle, rear (2).
10. Spring, catch (4).
11. Catch (4).
12. Ring, pull (4).
13. Hook (2).
14. Plate, name.
15. Sling (2).

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C. Baseplate, MII.—The baseplate (see fig. 4) rests flat upon the surface of the ground. The plate (1) is a ¼-inch nickel-chromium steel plate with the edges turned down at right angles about 1½ inches and forming a rectangle 26 by 28 inches. On the surface, in the form of a rectangle about 16½ by 21 inches, it has a bead 1½ inches high with an inverted V-shaped cross section. A large Y-shaped spade made of two nickel-chromium steel plates 5 inches wide and 31½ inches long welded together at one end, and four gusset spade plates are welded to the underside of the baseplate with the apex of the Y-spade to the rear. This location of the large spade assists in causing the baseplate to move uniformly to the rear, and the small inside spades or gusset plates restrain the rearward displacement. The cast steel base-cap cup (2) is bolted on the upper surface of the baseplate within the rectangle formed by the V-shaped bead. The butt or base-cap end of the barrel rests in the rounded portion of the cup, with the two base-cap pins in the U-shaped slots. These prevent rotation of the barrel when the mortar is fired, and the cup fork or barrel lock (4), the legs of which engage in the square grooves in the slotted uprights of the cup, straddling the base cap above the base-cap pins, prevents the butt end of the barrel from jumping out of the cup. The cup fork is attached to the base-cap cup by a short length of chain (5). One tine of the fork is provided with a flat spring or fork retainer (6) which bulges out slightly and has a hump about 2¼ inches from the end of the tine. This hump fits under the shoulder of the slots for the base-cap pins and prevents the cup fork from jumping out of its own slots during the firing of the mortar. At the corners of the plate handle brackets (7) are welded to hold two-piece retractable handles (8) (9) of seamless steel tubing. Normally, the handles are retracted and held in the position shown in the figure by the spring catches (11), but they may be extended to the front and rear of the baseplate, litter fashion, to facilitate transportation. Slings (15) of heavy cotton webbing are also provided to assist in carrying the baseplate. At the front of the baseplate near the corners two hooks (13) are welded over which the eyes in the ends of the standard connectors are placed when the mortar is assembled for firing.

d. Sight, MII.—The sight (see fig. 5) consists essentially of three major parts (each a bronze casting), body (1), elevation indicator (2), and sighting arm (3). It is used to lay the mortar on the line of sight and to indicate when the barrel has been brought to the desired angle of elevation. The sight fits on the upper end of the muzzle of the mortar when in the firing position and is removed

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from the mortar during firing. The elevation indicator pivots around a sleeve (4) at the front end of the body and may be clamped by a thumb screw (8) in the position corresponding to the desired elevation as indicated by the elevation scale engraved on the side of the body. The elevation indicator is provided with a level glass

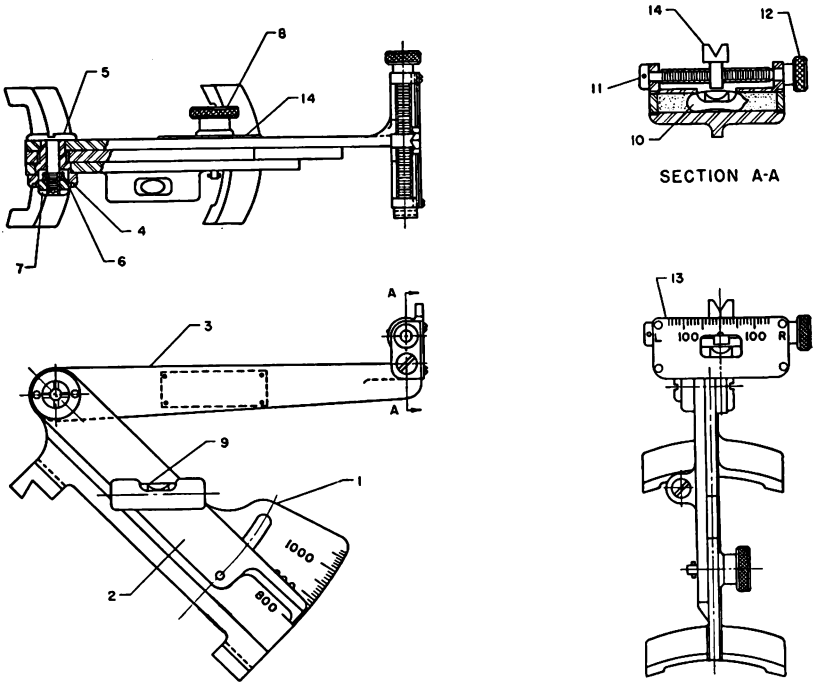


FIGURE 5.—4.2-inch chemical mortar sight, MII.

1. Body.
2. Indicator, elevation.
3. Arm, sighting.
4. Sleeve, arm tightening.
5. Screw, arm tightening.
6. Spring, arm tightening.
7. Nut, arm tightening.
8. Screw, elevation indicator.
9. Level glass.
10. Level glass.
11. Collar, screw.
12. Screw, traversing indicator.
13. Scale, traversing.
14. Indicator, traversing.

(9) so mounted that the bubble occupies the center position when the barrel is elevated or depressed, as the case may be, to the angle at which the indicator has been set. On the sighting arm at the rear end, a cross-level glass (10), the traversing indicator (14) (a movable notch which travels on the traversing indicator screw (12)), and the traversing scale (13) are mounted. Radium luminous material is

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applied to the face of the traversing indicator and of the bead on the front end of the sighting arm. The sight is carried in a leather case with shoulder strap, shown in figure 6.

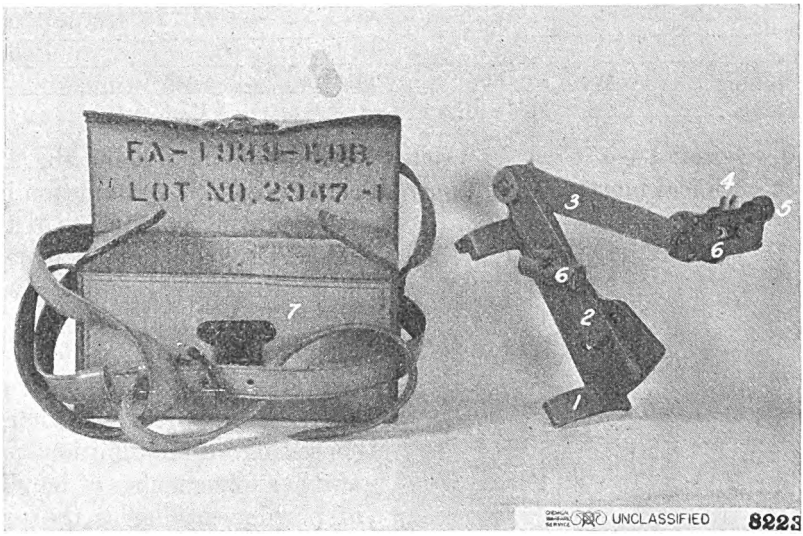


FIGURE 6.—4.2-inch chemical mortar sight, MII, and carrying case.

1. Body.
2. Elevation indicator.
3. Sighting arm.
4. Traversing indicator.
5. Traversing indicator screw.
6. Level glasses.
7. Carrying case.

5. Weights.—*a. Mortar:*

	Pounds
Barrel, MIA1, approximately	91
Baseplate, MII	150
Standard, MI	53
Sight, MII, in case	2
Total	296

b. Ammunition (complete round):

Shell body, approximately	16.1
Chemical filling	5.2–7.7
Fuze and burster tube	1.45
Propelling charge	.25
Total	23.0–25.5

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SECTION III

AMMUNITION

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6. General.—*a. Complete round.*—The ammunition for the 4.2-inch chemical mortar, MIA1, may be classed as fixed ammunition because all the components of the round are loaded in the mortar as a unit and by one operation. A complete round consists of a filled shell, a point detonating fuze with tetryl bursting charge, and a propelling charge consisting of an ignition cartridge and a number of bundles of powder serving as the propellant (see fig. 7). The ignition cartridge is inserted in a cartridge container fastened to the base of the shell, and the bundles of powder are placed on the outside of the container and held in place by an adjustable upper nut and a striker nut which screws onto the open end of the cartridge container, thus affording a support for both the bundles of powder and the ignition cartridge.

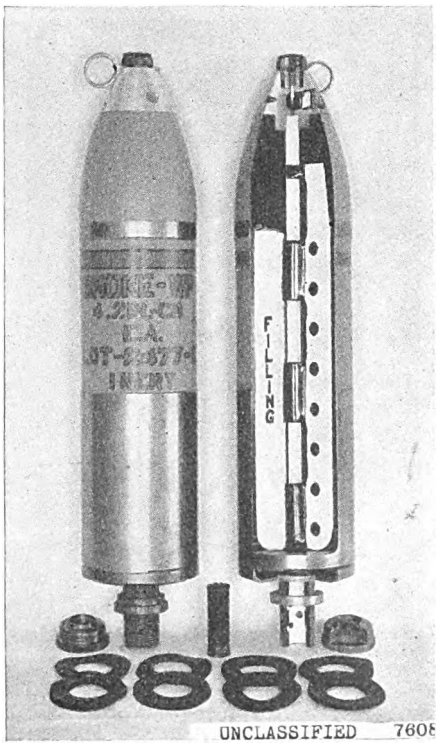


FIGURE 7.—Complete round, 4.2-inch chemical mortar.

NOTE.—The disk propellant powder has been replaced by the powder in square sheets shown in figure 11.

b. Action on firing.—The shell is fired by dropping a complete round down the barrel. As the striker nut hits the top of the firing pin in the base of the barrel, a striker in this nut is driven into the primer in the ignition cartridge. This fires the cartridge which ignites the powder. The pressure of the gases from the burning propellant at

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the same time that it expels the projectile from the mortar is sufficient to actuate the pressure plate, expanding the rim of the rotating disk so that it engages the rifling of the barrel. This imparts rotation to the shell, thus giving stable or true flight and consequently nose impact of the shell. The force of impact causes the fuze to function.

c. Chemical filling.—The following chemical fillings are authorized for use in the shell for the 4.2-inch chemical mortar:

Type	C. W. S. symbol	Name
Gas, persistent	HS	Mustard.
Gas, nonpersistent	CG	Phosgene.
Gas, irritant	CNS	Liquid lacrimator (solution of chloracetophenone).
Gas, irritant	CNB	Liquid lacrimator (solution of chloracetophenone).
Smoke	WP	White phosphorus (yellow phosphorus).
Smoke	FS	Sulfur trioxide-chlorsulfonic acid mixture.
Smoke	FM	Titanium tetrachloride.

d. Weights.—The body of the shell weighs approximately 16.12 pounds. The approximate weights of the chemical filling and of the complete round, including filled body, fuze, and propelling charge, are as follows:

Type of filling	Approximate weight of filling	Approximate weight of complete round	Type of filling	Approximate weight of filling	Approximate weight of complete round
	Pounds	*Pounds*		*Pounds*	*Pounds*
HS	5.44	23.44	WP	7.50	25.50
CG	5.00	23.00	FS	7.50	25.50
CNS	5.75	23.75	FM	7.50	25.50
CNB	5.25	23.25			

e. Dimensions.—The over-all dimensions of the complete round are major diameter, 4.19 inches and length, 20.40 inches, of which the fuze comprises 2.25 inches.

7. Shell.—*a. Description.*—(1) The 4.2-inch chemical mortar shell which has thus far given the best results and is currently being issued is the E38R2 shell shown in figure 7. To simplify manufacturing operations the E50 shell shown in figure 8 has been designed but is still in the experimental stage. Practically, the only difference between the two shells is that the body of the E38R2 shell is made from a steel forging with base and walls integral and the casing is swaged to form the ogive, whereas in the E50 shell (fig. 8) the body (1) is made of seamless steel tubing with the base (2) and ogive welded to the ends of the tubing. Before the ogive is formed

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or welded on, a sheet steel vane (3) is welded inside the body to aid in stabilizing the shell by forcing liquid fillings to rotate with it and thus prevent tumbling during flight. However, as the initial resistance of the liquid filling to take up rotation is so great that a solid vane would be torn loose from its welding, holes are drilled through the body of the vane to allow a certain amount of the liquid to slip by. On the base of the shell is a threaded stud to which the cartridge container (10) is secured. The cartridge container is a tube of machine steel threaded on the inside to screw on the stud on the base of the shell. It is also threaded externally and has two nuts (an upper compression nut (11) and a lower striker nut (12)) to hold the propellant over the vent holes which are drilled radially through the walls of the cartridge container and serve to transmit the flash of the ignition cartridge to the bundles of powder and thus ignite them. The striker nut, in addition to holding the propellant and ignition cartridge in place, also carries a striker plate and point to fire the primer of the ignition cartridge. Moreover, it prevents

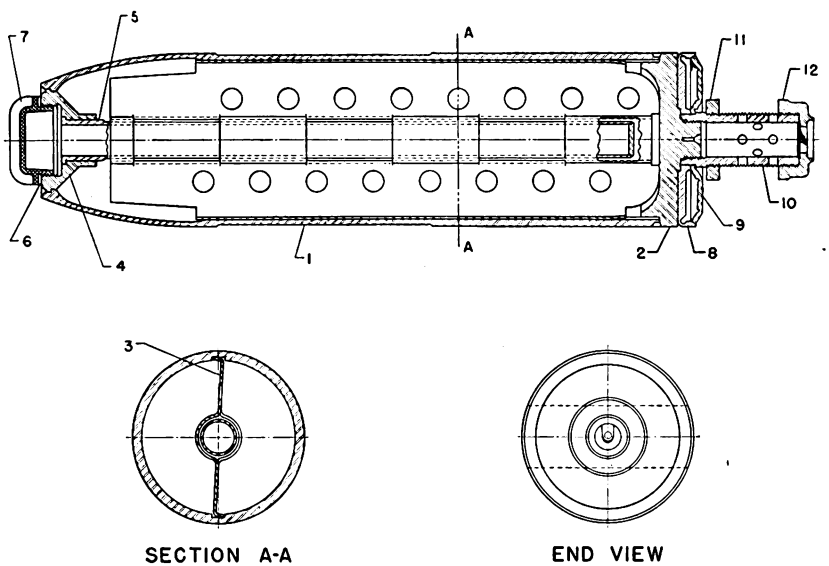


FIGURE 8.—4.2-inch chemical mortar shell.

1. Body.
2. Base.
3. Vane.
4. Adapter.
5. Well, burster tube.
6. Washer.
7. Plug, shipping.
8. Disk, rotating.
9. Plate, pressure.
10. Container, cartridge.
11. Nut, upper.
12. Nut, striker.

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the base of the ignition cartridge from being blown out into the base of the barrel when the mortar is fired, and causes the flash of the ignition cartridge to spread through the radial holes in the cartridge container and into the powder rather than be blown out of the rear end of the cartridge container.

(2) In the nose of the shell a steel adapter (4) is welded with a smooth finished central opening into which the burster tube well (5) is pressed after the shell has been filled, thus forming a gas-tight seal.

(3) The rotation unit consists of a brass rotating disk (8) and a steel pressure plate (9). In the surface of the rotating disk is a groove 1.5 inches wide and 0.062 inch deep which fits over a tongue on the base of the shell and locks the disk to the shell. The diameter of the rotating disk is approximately equal to that of the shell, while the pressure plate is slightly smaller and fits into the rotating disk. When assembled, the disk and plate form a hollow ring which collapses under the pressure of the propellant gases, the brass disk expanding and being forced into the rifling grooves.

b. Painting and marking.—The shell, except the guides, are painted blue gray. The markings differ with the type of filling. (See fig. 7.)

(1) On shell filled with persistent gas (HS), two green bands ½ inch wide and ¼ inch apart are painted around the shell, the top band ⅜ inch below the top grade of the shell. The type and symbol of the agent (GAS–HS) are stenciled in ¾-inch green letters below the lower band, and underneath this the following data in ½-inch green letters and numbers:

4.2 IN–CM.
EA (loader's identification mark).
LOT number.

(2) On shell filled with nonpersistent gas (CG), the markings are the same except that only one band ½ inch wide in green is painted around the shell ¾ inch from the top guide.

(3) Shell filled with irritant gas (CNS, CNB) have one band. The band and all other markings are in red.

(4) Smoke shell (WP, FS, FM) have one band. The band and all other markings are in yellow.

8. Fuze.—*a. General characteristics.*—The fuze (see figs. 9 and 10) is an impact fuze of the point detonating type weighing about 1½ pounds. The complete fuze consists of the fuze proper with aluminum body (1) (fig. 10) and the various components, and the seamless steel burster tube (15). The bursting charge consists

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of about 65 grams pelleted tetryl in the burster tube and the cup (14). After the burster tube has been screwed into the base of the fuze body the entire outside surface of the tube is given a coating of rust-preventive compound.

b. Safety features.—The fuze has four safety features:

(1) The safety pin (13), a cotter pin which, passing through the body of the fuze, the striker (8), and the retainer (6), secures the retainer and striker firmly against the body of the fuze and prevents their movement. Just before firing, the safety pin is pulled from the fuze by the ring attached to the pin.

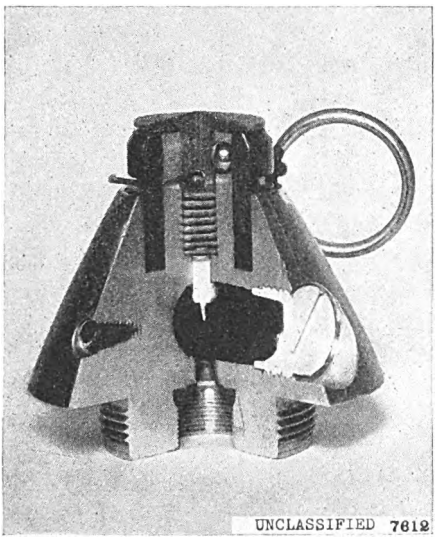


FIGURE 9.—4.2-inch chemical mortar fuze (E15R8).

(2) The shear wire (11), which passes through the retainer and the fuze body and prevents any movement of the retainer, even after the safety pin has been withdrawn, as long as the shear wire itself remains unbroken. The ends of the shear wire are bent into the annular groove around the outer surface of the retainer. This prevents accidental damage to the shear wire from external sources and also enables the fuze to arm itself by cutting the shear wire inside the retainer only.

(3) The retainer (6), a brass ring which holds two steel balls (10) in cylindrical holes 180° apart in the upper part of the fuze body. When the striker (8) is in the unarmed position, two hemispherical recesses 180° apart in the stem are located opposite the two holes in the fuze body. The diameter of the holes is slightly larger but their depth is less than the diameter of the balls. When the retainer is held in the unarmed position by the shear wire its inner surface covers the outer openings of the holes so that approximately one-third of each ball fits into the corresponding hemispherical recess in the striker stem while the other two-thirds remains in the cylindrical hole in the body of the fuze. Immediately below the retainer is a well in the fuze body into which the retainer drops when the shear wire is cut.

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(4) The slider (2), a brass cylinder of two diameters forming a shoulder at their junction. In the slider holes are cut to take the primer detonator (3), the striker point, and the lock pin (4), and a groove for the guide screw (5). In the unarmed position the primer detonator is out of line with the bursting charge and the striker. The point on the end of the striker fits into a hole in the slider, locking it in place as long as the retainer is held in position by the shear wire.

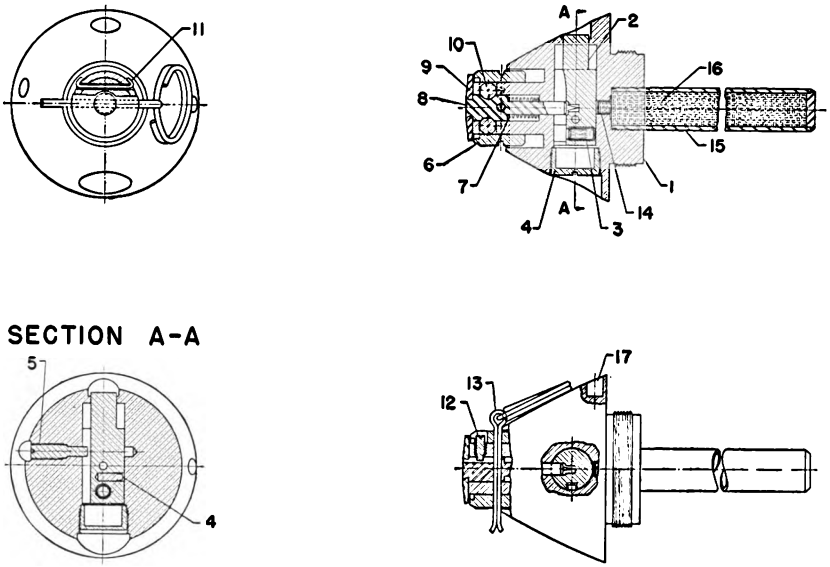


FIGURE 10.—4.2-inch chemical mortar fuze (E15R8).

1. Body.
2. Slider.
3. Primer detonator.
4. Pin, lock.
5. Screw, guide.
6. Retainer.
7. Spring.
8. Striker.
9. Head, striker.
10. Ball, steel (2).
11. Wire, shear.
12. Screw, set.
13. Pin, safety.
14. Cup.
15. Tube, burster.
16. Burster charge.
17. Fuze wrench hole.

c. Functioning.—(1) Just before the shell is inserted in the barrel, the safety pin is pulled out of the fuze. As the shell, after striking the firing pin at the base of the barrel and igniting the propellant, is forced up the barrel by the pressure of the powder gases, the retainer, being a movable part, moves down into the well below it, cutting the shear wire. The inside of the retainer is recessed at the

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top so that when the retainer drops into the well below it the recessed portion comes opposite the holes in the fuze body containing the steel balls. The combination of centrifugal force due to the rotating shell and the pressure of the striker caused by the striker spring (7) on the balls forces them out into the additional space in the recessed portion of the retainer. The striker is thus released and the spring forces it up into the armed position with the striker head (9) projecting 0.25 inch above the fuze body.

(2) The striker is prevented from being forced entirely out of the fuze by the set screw (12) which passes through the upper part of the fuze body at the same level as the steel balls and 90° from each ball. A vertical slot is cut in the striker from the bottom of the striker head to the safety pin hole. The point of the set screw extends into this slot and thus controls the movement of the striker. A U-shaped slot in the wall of the retainer at the point where the head of the set screw projects from the fuze body permits the retainer to fit around the head of the set screw without interference with the downward movement of the retainer.

(3) When the striker is free to move, the spring lifts the point of the striker and centrifugal force caused by the rotating shell moves the slider (2) outward until its shoulder meets a shoulder in the fuze body. On completion of this movement, the slider is held fast in the armed position by the lock pin (4), which also functions by centrifugal force and prevents backward movement of the slider. The guide screw (5) in the fuze body fits into a groove in the slider and prevents rotation of the slider until the lock pin functions, thus assuring vertical alinement of the detonator when coming into the armed position. During the flight of the shell, the tension of the striker spring holds the striker up in the armed position. Upon impact, the spring is compressed and the pin of the striker is driven into the detonator, thereby setting off the primer detonator which, in turn, detonates the bursting charge of the shell.

9. Propelling charge, MV.—*a. General.*—The propelling charge (see fig. 11) consists of an ignition cartridge and eight full bundles and one-half bundle of powder. Two to eight bundles are used, which allows seven zones of fire with approximate ranges of from 600 to 2400 yards. Intermediate ranges are obtained by the use of the half bundle. The number of bundles of powder to be used is determined by the range desired, as given in the range tables. Just prior to firing, the cartridge is placed in the cartridge container of the shell and the bundles of powder are placed over the cartridge container. The upper compression nut is not brought down against

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the powder until after the lower striker nut has been screwed on flush with the end of the cartridge container.

b. Ignition cartridge.—The ignition cartridge (see fig. 12) is the same as that used with the infantry 3-inch trench mortar Mk. I.

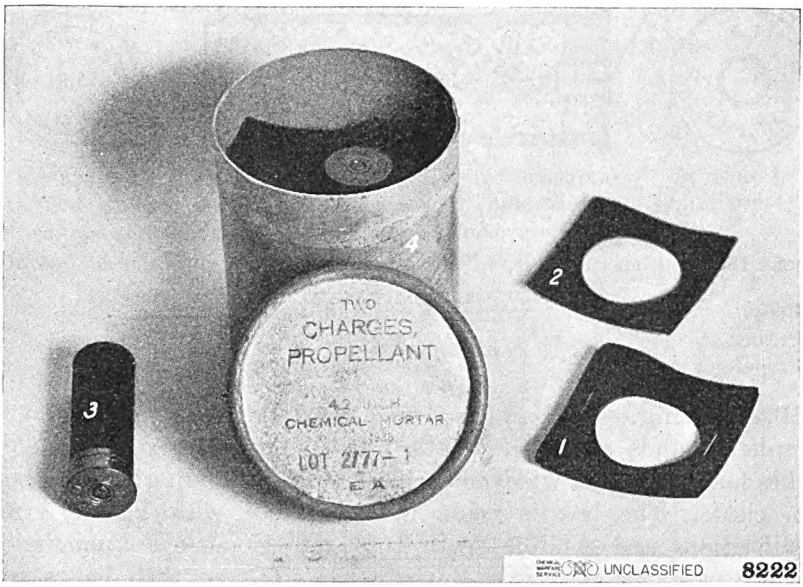


FIGURE 11.—4.2-inch chemical mortar propelling charge, MV, and container for two charges.

1. Full bundle (150 grains) of powder.
2. Half bundle (75 grains) of powder.
3. Ignition cartridge.
4. Fiber container for two complete propelling charges, each consisting of eight full bundles and one-half bundle of powder and one ignition cartridge.

It is designated cartridge 12-gage, green, Mk. I, and is procured under U. S. Army Specification Number 50–63–5 as Type I, Class A. It is similar in appearance to a commercial 12-gage shotgun shell.

c. Propellant powder.—The propellant powder is practically nonhygroscopic and smokeless, but not flashless. The individual grains are thin square sheets, 2.18 by 2.18 inches and 0.0125 inch thick, with a circular hole 1.35 inches in diameter in the center of each square. The squares are bound by clips of bookbinding wire into bundles of 150±5 grains and half bundles of 75±2.5 grains. (Until recently, powder in the form of circular grains (disk propellant) as

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shown in fig. 7 was used.) The powder is supplied in the proportion of eight full bundles to one half hundle.

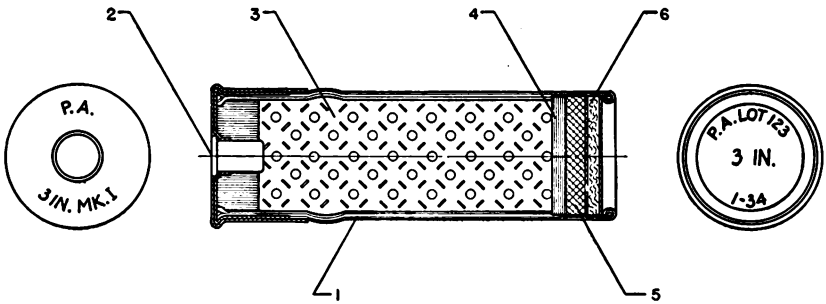


FIGURE 12.—Ignition cartridge, 4.2-inch chemical mortar propelling charge, MV.

1. Body.
2. Primer.
3. Propellant powder.
4. Wad, inner.
5. Wad, intermediate.
6. Wad, outer.

10. Packing.—*a. Complete round.*—All the components of two complete rounds are packed in a wooden box approximately 25⅛ inches long, 11 inches wide, and 7 inches high, including top and bottom cleats. The box is made in accordance with U. S. Army specifications and complies with Interstate Commerce Commission regulations. The box lid is hinged and is closed with hasps and latches. The box contains two filled shell with fuzes assembled and one propelling charge container with two complete propelling charges (see *c* (1) below). A data card properly filled out is placed in each box. The weight of the box packed with two complete rounds varies with the type of chemical filling of the shell as follows:

Shell	*Pounds (approximate)*
Gas, HS	62.88
Gas, CG	62
Gas, CNS	62.5
Gas, CNB	62.5
Smoke, WP	66
Smoke, FS	67
Smoke, FM	67

The displacement of the box is approximately 1.12 cubic feet. The markings on the box are shown in figures 13 and 14.

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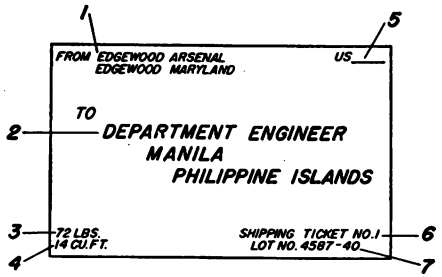


FIG. 13.—Marking, address, side, for all packing boxes.

1. Consignor.
2. Designation and address of consignee (as shown on shipping instructions).
3. Gross weight (in pounds).
4. Cubic displacement (in cubic feet)
5. To indicate United States property.
6. Number of shipping ticket.
7. Lot number.

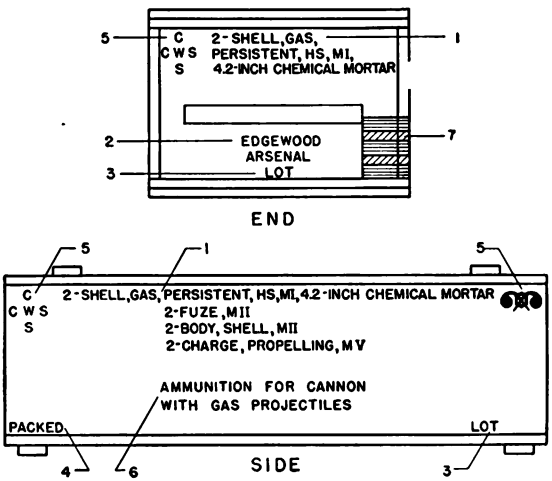


FIGURE 14.—Marking of packing box for two complete rounds for 4.2-inch chemical mortar.

1. Quantity and kind of complete round.
2. Name of place where packed.
3. Lot number.
4. Month and year of packing.
5. C. W. S. insignia.
6. To comply with I. C. C. regulations.
7. Colored stripes on blue gray background. Color and number of stripes as specified for kind of filling:

Persistent gas (HS)	2 green stripes.
Nonpersistent gas (CG)	1 green stripe.
Irritant gas (CNB, CNS)	1 red stripe.
Smoke (WP, FS, FM)	1 yellow stripe.

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side), see figure 13.

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b. Fuze.—When the fuze assemblies are shipped in bulk, they are packed 50 to the box. The box is made of wood in accordance with U. S. Army specifications and complies with Interstate Commerce Commission regulations. The fuzes are packed in 5 horizontal rows of 10 fuzes each, being held in position by means of wooden retainers about 2 inches from the front and rear sides of the box. A data card properly filled out is placed in each box. The lid is secured with 14 screws. The dimensions of the box are approximately 22¼ inches long by 18 inches wide by 17$^{9}/_{16}$ inches high, including the top and end cleats, with a displacement of 4.07 cubic feet. The shipping weight of the box, with 50 fuzes, is approximately 109 pounds. The markings on the box are shown in figures 13 and 15.

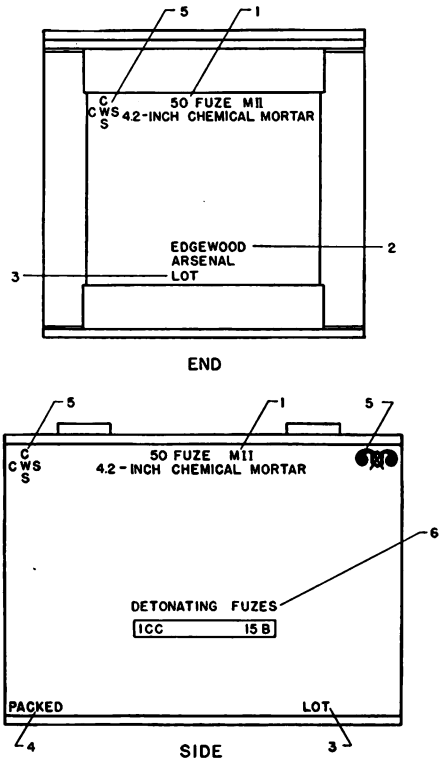


FIGURE 15.—Marking of packing box for fifty fuzes for 4.2-inch chemical mortar.

1. Quantity and kind of fuze.
2. Name of place where packed.
3. Lot number.
4. Month and year of packing.
5. C. W. S. insignia.
6. To comply with I. C. C. regulations.

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side), see figure 13.

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c. Propelling charge, MV.—(1) *Container.*—Sixteen 150-grain bundles and two 75-grain bundles of powder are packed in a fiber container (see fig. 11), approximately 3⅞ inches high and 3$^{3}/_{16}$ inches in diameter, together with two or with three ignition cartridges. The container is closed with a light friction fit slip cover and the cover seam is sealed with adhesive plaster. Containers in which two ignition cartridges have been packed are stamped in black indelible ink on the top as follows:

TWO
CHARGES
PROPELLING
MV
4.2 INCH
CHEMICAL MORTAR
Date of packing (month and year)
Packer's identification mark
Lot

Containers in which three ignition cartridges have been packed are stamped in red indelible ink as above, with the additional line, EXTRA CARTRIDGE, under MV.

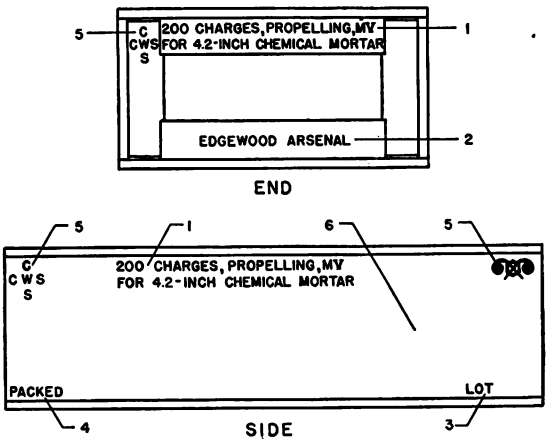


FIGURE 16.—Marking of packing box for 200 propelling charges for 4.2-inch chemical mortar.

1. Quantity and kind of propelling charges.
2. Name and place where packed.
3. Lot number.
4. Month and year of packing.
5. C. W. S. insignia.
6. To comply with I. C. C. regulations.

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side), see figure 13.

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(2) *Packing box.*—One hundred propelling charge containers (80 with 2 ignition cartridges and 20 with 3 ignition cartridges) are packed in 2 layers of 50 containers each in a wooden box made in accordance with U. S. Army specifications and complying with Interstate Commerce Commission regulations. An ammunition data card properly filled out is placed in each box. The lid is held securely in place with 16 screws, and the box is bound at each end with nailless strapping. The dimensions of the box are approximately 34⅞ by 17½ by 9$^{9}/_{16}$ inches, with a displacement of 3.38 cubic feet. The approximate weight of the box with 200 propelling charges is 96 pounds. The markings of the box are shown in figures 13 and 16.

SECTION IV

OPERATING INSTRUCTIONS

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Misfires	15
Going out of action	16

11. Installation of mortar.—*a.* The location for emplacing the mortar should be selected with care. It should be as level and firm as practicable. If the ground is comparatively level no excavation will be required. A space approximately 3 feet wide and 7 feet long, in line with the aiming stakes, should be cleared of underbrush, stones, and roots. If the topsoil is loose or sandy it should be removed from the cleared space. If the ground is very uneven a space, as above, should be leveled off for the baseplate and the base of the standard. The baseplate is then placed on the cleared space with a line through the aiming stakes bisecting the baseplate cup, and a man standing on the baseplate rocks it from side to side until an impression of the Y-shaped spade is made on the ground. The baseplate is then moved to one side and with the pick end of the pick mattock a crevice is dug to a depth of approximately 5 inches along the Y-shaped impression. The spade of the baseplate is now placed in the crevice and the baseplate is dropped into position. Several men should then stand on the baseplate and force it down until the bottom surface rests firmly on the ground.

b. The upper ends of the tie rods on the standard are released and hooked onto the baseplate and the base of the standard is lowered to

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the ground. The base-cap end of the barrel is assembled into the cup on the baseplate and locked in place with the barrel lock (cup fork). The support of the standard is raised and connected to the barrel coupling. The barrel and standard are approximately alined on the aiming stakes and the spades on the base of the standard are forced into the ground.

c. Four sandbags are filled with loose earth or sand for use in holding the baseplate and standard firmly in position during firing. One of these bags is placed on each side of the base of the standard and two near the baseplate to be used when necessary.

12. Laying the mortar.—*a.* For the computation of firing data, see paragraphs 122–128, Chemical Warfare Service Field Manual, Volume I.

b. The aiming stakes having been alined to indicate the direction of fire, the sight is set for the desired elevation, placed on the barrel, and rotated slowly around the barrel until the cross bubble indicates the level position. The barrel is then elevated until the elevation bubble also comes to the level position (desired elevation). Using the sight for alinement and keeping the cross-level bubble centered, the mortar is alined approximately on the aiming stakes by slight movements of the baseplate and standard, and the final exact alinement is made by the traversing screw.

c. During action, if the mortar should shift from its original setting, it can be corrected only between rounds. The sight is not allowed to remain on the barrel when the mortar is fired.

13. Loading and firing.—*a.* The shell, as delivered to the mortar, are packed in boxes containing two complete rounds as described in paragraph 10*a*. To provide replacements for defective cartridges, one of the propelling charge containers with an extra cartridge is packed in every fifth box of shells.

b. Preparation of ammunition.—For purposes of safety as well as economy of effort, the preparation of ammunition should be conducted under competent supervision in an orderly sequence of operations, which should be strictly adhered to, as follows:

(1) Open boxes.

(2) Remove striker nut assembly from cartridge container. Clean the shell by removing all rust-preventive compound and dirt from guides, body, cartridge container, and flash outlet holes. Remove rust or paint from guides by means of emery cloth.

(3) Examine fuze. See that the shear wire on the fuze is in place and bent over at both ends.

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(4) Examine guides for burrs which might cause the shell to stick in the barrel. Burrs should be filed down.

(5) Open propellant containers as needed.

(6) Place the necessary number of bundles of powder on the cartridge container.

(7) Insert cartridge in the cartridge container, taking care that the base flange of the cartridge is firmly seated against the cartridge container.

(8) Replace the striker nut assembly on the cartridge container and screw it down tight.

(9) When necessary, the safety pin in the fuze may be straightened with a pair of pliers to facilitate rapid removal by the mortar squad.

c. Firing.—(1) *Immediately before firing, and at no other time, remove the safety pin from the fuze.*

(2) Drop the assembled round into the barrel, fuze end up.

(3) Remove the hand quickly from the muzzle of the mortar after dropping in the shell.

14. Precautions.—For safe and proper operation of the mortar, the following precautions should be observed at all times:

a. Before firing, make sure that all excess oil is removed from the bore of the barrel. If the bore is oily, smoke will be given off and the position disclosed.

b. Cartridges and powder bundles should be kept dry.

c. Guides should be clean and free from burrs.

d. The powder bundles must be secure on the cartridge container.

e. The striker nut must be screwed tightly on the cartridge container.

f. A shell must not be inserted in the barrel if the base cap is not seated in the baseplate cup and held in place by the barrel lock.

g. Do not try to force the shell down the barrel.

h. Be sure that the shell is dropped into the mortar cartridge end first.

i. Pull the safety pin before firing.

j. Drop the hands quickly and lower the head behind the muzzle immediately upon release of the shell.

k. In case of misfire, allow one minute interval to elapse before investigating. See paragraph 15 *b* below and paragraph 14 *d* (3), AR 750–10.

l. The position of the mortar should be checked after the first round as the initial charge always tends to seat the baseplate in the ground, thus causing a change in the setting of the mortar.

m. For detailed safety precautions to be observed in firing ammunition in time of peace, see AR 750–10.

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15. Misfires.—*a.* A misfire is the failure of an assembled round to leave the mortar after release into the barrel. Misfires may be due to any of the following causes:

(1) Defective primer or cartridge.

(2) Defective propellant.

(3) Parts of striker nut assemblies or other debris covering the point of the striker pin.

(4) Loose, bent, or defective firing pin or cartridge container.

(5) Burrs, rust, paint, or dirt on guides, or dirty bore, preventing the shell from reaching the striker or from reaching it with sufficient force to detonate the primer.

(6) Striker nut assembly not screwed down tight against the primer.

b. (1) In case of a misfire the gunner (No. 2) will call out "Misfire," and the mortar will not be touched for at least one minute. To remove the shell, the base of the barrel is raised so that the misfired shell will slide out easily into the hands of the firer (No. 1). The safety pin is immediately replaced in the fuze and the defect corrected, or the round is placed on the ammunition dump. While the shell is being removed, no member of the mortar crew should stand directly in front or directly in the rear of the mortar.

(2) If for any reason the shell should stick in the barrel on its way down, extreme care must be exercised. Any movement of the barrel may cause the shell to slide down the rest of the way and be discharged. In such a situation efforts should be made to dislodge and fire the shell by rocking or pounding the mortar without raising the base end of the barrel, and care should be taken that the barrel is not pointed toward any person or solid object while this is being done.

16. Going out of action.—*a.* Remove the sandbags.

b. Dismount the barrel from the standard.

(1) Depress the barrel to the minimum elevation.

(2) Withdraw the coupling pin which connects the standard to the barrel.

(3) Lift the barrel from the standard.

c. Dismount the barrel from the base-cap cup.

(1) Remove the cup fork or barrel lock from the base-cap cup.

(2) Lift the barrel out from the base-cap cup.

d. Disconnect the connecting rods from the baseplate.

(1) Raise the standard in a rotary motion toward the baseplate until the eyelets of the connecting rods are free.

(2) Bring the free ends of the connecting rods together at the standard head.

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(3) Secure the connecting rods in the slot provided at the head of the standard by replacing the coupling pin.

e. Raise the baseplate from the firing position.

(1) Extend the handles on the baseplate. A small amount of dirt may have to be cleared away to allow extension of the handles.

(2) Lift up the baseplate by the handles.

Section V

CARE AND MAINTENANCE

	Paragraph
General care	17
Disassembly and assembly	18
Cleaning before, during, and after firing	19
Painting	20

17. General care.—*a.* The bore of the barrel and all unpainted surfaces should be kept clean and free from rust. The bore should always be kept lightly oiled with a light oil when not in actual use and the muzzle covered with the muzzle cover. The use of the muzzle cover is especially important in rainy weather, as water, in addition to causing rust, may seriously affect the range of the mortar. The muzzle cover should be held in place by the cord.

b. If the mortar is to remain unused for some time, all bright and unpainted parts such as the bore, the guides, the striker pin, screws, gears, threads, etc., after being first thoroughly cleaned, should be protected by a light coat of rust-preventive compound as issued. The rust-preventive compound is easily removed by the use of burlap or waste dipped in gasoline.

c. The striker pin should be examined from time to time and if found so worn, bent, or defective as to be liable to cause misfires, it should be replaced, care being taken that the new striker pin is screwed tightly into the base cap.

d. The springs should be examined occasionally for defects, and screws and nuts tightened.

18. Disassembly and assembly.—In assembling and disassembling the mortar, no other tools than those issued with the outfit will be used.

a. To remove the barrel base cap.—Use the special wrench provided for this purpose, applying the wrench to the radial pins on the base cap. Light blows with a hammer on the handle of the wrench may be necessary to start the threads.

b. To replace the base cap.—Use the special wrench for replacing the base cap. See that the base-cap washer is in place. Care should

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be taken to insure a tight fit between the base cap and the barrel to avoid gas leaks.

c. To remove the striker pin.—Remove the base cap from the barrel and apply the combination wrench to the flat milled section of the striker pin. The base cap may be held against rotation during the operation by the base-cap wrench.

d. To replace the striker pin.—Proceed in reverse order to that prescribed in *c* above. Put a drop of oil on the threads before screwing the striker pin firmly into the base cap.

e. The personnel will have no difficulty in dismounting parts of the remaining mechanism. Care should be taken in dismounting bolts, etc., not to batter them by driving them out with a hammer. A piece of hardwood or a copper drift should be interposed.

19. Cleaning before, during, and after firing.—It is important that proper attention be given to the cleaning and inspection of the mortar before and after firing periods.

a. Before firing.—(1) Remove all oil from the bore and any excess oil on the outside of the barrel and on the standard.

(2) See that the striker pin is screwed firmly home in the base cap and that the base cap is screwed tightly on the barrel, insuring a gas-tight fit. Use the base-cap wrench for tightening the base cap.

(3) See that all nuts, bolts, and screws are in position and securely tightened.

b. During firing.—(1) The barrel should be swabbed out after every five rounds, except in rapid fire.

(2) The base cap and firing pin should be examined at every opportunity and cleaned and tightened.

c. After firing.—(1) Unscrew the base cap and clean and sponge out the barrel, removing all residue. Lightly oil the bore.

(2) Clean the striker pin and then oil lightly.

(3) Clean and oil the base cap.

(4) Examine, clean, and oil all working parts of the standard and barrel. Replace the muzzle cover.

(5) Clean the baseplate.

(6) Tighten all nuts and screws.

20. Painting.—*a.* All parts of the matériel, with the exception of the bore and bearing surfaces, should be kept well painted as a protection against rust. Clean and wash the matériel thoroughly to remove all dirt and grease, and allow to dry before applying the paint.

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b. The following parts will be painted with one coat of primer and one coat of olive-drab lacquer enamel:

(1) The barrel, complete with clamps and springs, except the bore and the slide.

(2) The standard, except the elevating and traversing screws and the bearing surfaces.

(3) The baseplate.

SECTION VI

ACCESSORIES, SPARE PARTS, AND FIRE-CONTROL EQUIPMENT

	Paragraph
Accessories and spare parts set	21
Mil rule and range indicator	22
Packing chest	23
Standard packing box	24

21. Accessories and spare parts set.—The accessories and spare parts set for the 4.2-inch chemical mortar, M1A1, consists of the following items:

Quantity	*Name of part*
12	Bag, sand.
1	Bag, wiping cloth.
1	Chest, packing.
6	Cloth, emery, no. 00 sheets.
1 lb.	Cloth, wiping.
1	Cover, muzzle, MI.
1	Lanyard.
1	Mattock, pick.
1	Oil, 1-quart can.
1	Oiler, ½-pint.
1	Rod, cleaning, consisting of—
1	Claw.
1	Handle.
1	Roll, tool, ammunition, containing—
6	Cloth, emery, no. 00 sheets.
½ lb.	Cloth, wiping.
2	File, flat, second-cut, 8-inch.
1	Hatchet, broad.
1	Wrench, fuze.
1	Roll, tool, gunner's, containing—

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½ lb.	Cloth, wiping.
2	Bolt, slide.
1	Handle, traversing-screw.
1	Pin, striker.
1	Pliers, combination, 8-inch.
1	Screwdriver, 4-inch blade.
2	Spring, front.
2	Spring, rear.
1	Wrench, base-cap.
2	Wrench, engineer's single head, ⅝-inch milled opening.
1	Wrench, engineer's, single head, 15/16-inch opening.
1	Spade.
3	Stake, aiming.

22. Mil rule and range indicator.—*a. Mil rule, MI.*—The rule (see fig. 17) consists of—

(1) The rule proper, graduated in units of 10 mils up to 100 mils on both sides of the zero graduation at the center of the scale. The

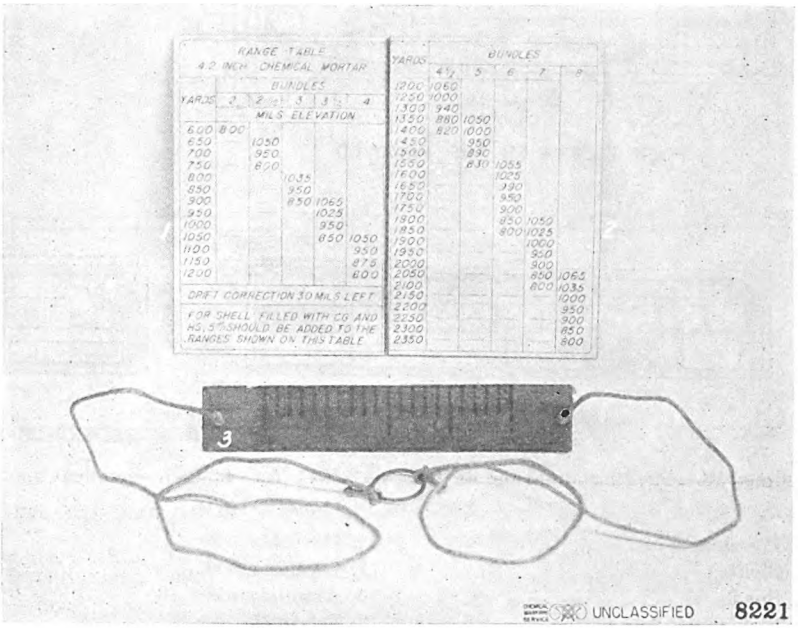


FIGURE 17.—Chemical mortar mil rule, MI, and 4.2-inch chemical mortar range indicator, MI.
1. Range indicator, MI, front.
2. Range indicator, MI, back.
3. Mil rule, MI.

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rule is made of maple wood, and one coat of spar varnish is applied to all surfaces.

(2) Two shock-absorber cords, each tied to the rule proper, ¼ inch from the ends, by an overhand knot. The other ends of the cords are fastened by slip knots to a brass ring.

(3) A brass ring, ¾ inch inside diameter, to which the two cords are attached.

b. Range indicator, MI.—The range indicator, MI (see fig. 17) is a tablet of plastic material, 5¼ by 3½ by 1/16 inches, on each side of which is printed the range table for the chemical mortar.

23. Packing chest.—When in actual use, the mortar and the various accessories, spare parts, and fire-control equipment are carried on the carts described in section VIII. For purposes of storage and shipment, the components of the accessories and spare parts set

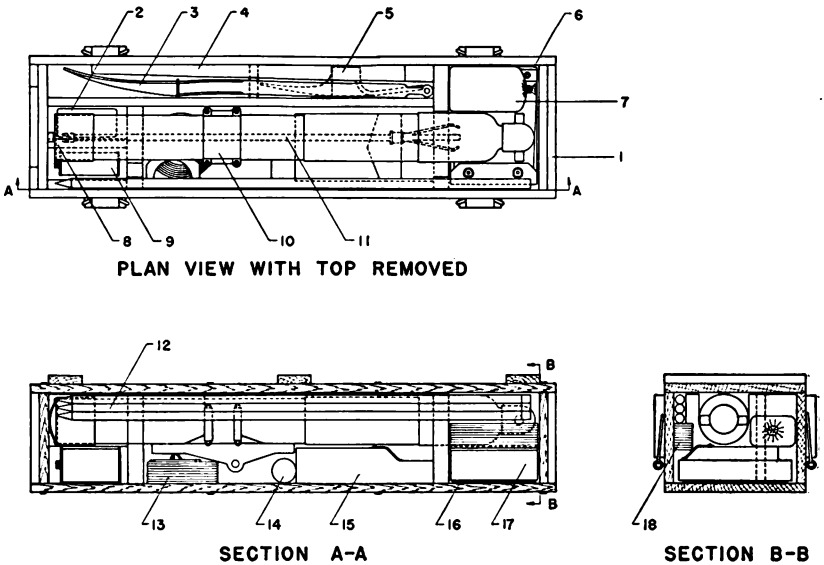


FIGURE 18.—Packing diagram of packing chest for 4.2-inch chemical mortar barrel, accessories, and spare parts.

1. Packing chest.
2. Sight.
3. Spade.
4. Pick mattock handle.
5. Pick mattock head.
6. Packing chest contents card.
7. Wiping cloths, 1-pound bag.
8. Muzzle cover.
9. Oil can, 1-quart.
10. Barrel.
11. Cleaning rod.
12. Aiming stakes (3).
13. Lanyard.
14. Oiler, ½-pint.
15. Ammunition tool roll.
16. Emery cloth, 6 sheets.
17. Gunner's tool roll.
18. Baseplate sling.

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enumerated in paragraph 21 and, in addition, the barrel, the baseplate slings, the sight, the mil rule, and the range indicator are packed with a packing chest contents card in a packing chest in accordance with the packing diagram shown in figure 18. The packing chest is a strongly braced wooden box secured with nailless metal strapping after the lid has been screwed on. Partitions and cross members on the inside of the box hold the various items in position. Four handles (two at the front and two at the back) are provided to facilitate handling. The outside dimensions of the chest, including the handles at the sides and the cleats at the top, are approximately 55⅜ by 16¾ by 12¼ inches, and the displacement is approximately 6.57 cubic feet. The packed chest weighs approximately 220 pounds. For technical markings on the packing chest see figures 13 and 19.

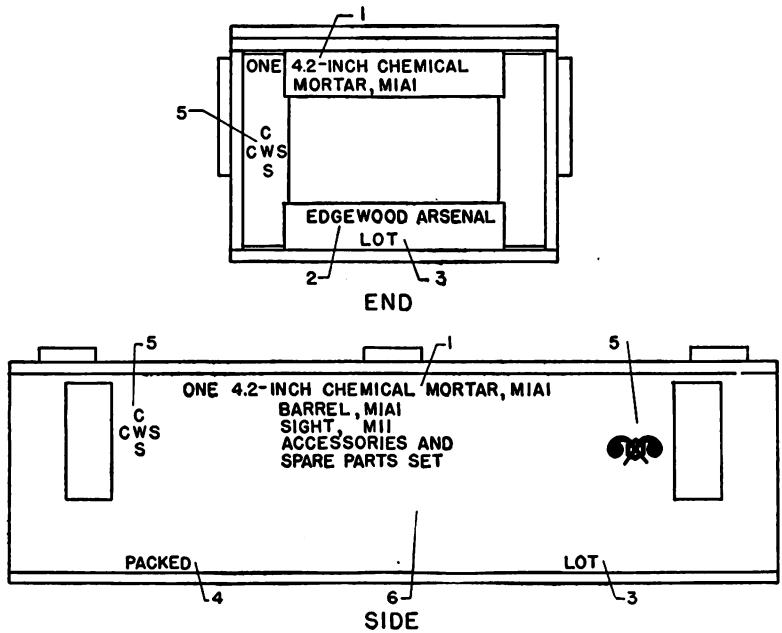


FIGURE 19.—Marking of packing chest for 4.2-inch chemical mortar barrel, accessories, and spare parts.

1. Quantity and kind of chemical mortar.
2. Name of place where packed.
3. Lot number.
4. Month and year of packing.
5. C. W. S. insignia.
6. To comply with I. C. C. regulations.

NOTE.—Both ends of chest are marked alike. For marking on side not shown (address side), see figure 13.

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24. Standard packing box.—When the standard is to be stored or shipped separately, it is packed in a wooden box approximately 40¼ by 26⅝ by 10 inches (including end, top, and bottom cleats), with a saddle of 2-inch lumber in the center and supports at both ends. The lid is fastened on with screws. The displacement of the box is approximately 6.2 cubic feet and the weight of the packed box is about 110 pounds. For technical markings on the box see figures 13 and 20.

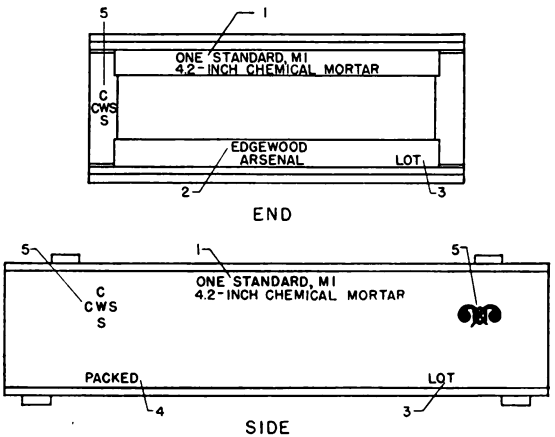


FIGURE 20.—Marking of packing box for 4.2-inch chemical mortar standard, MI.

1. Quantity and kind of standard.
2. Name of place where packed.
3. Lot number.
4. Month and year of packing.
5. C. W. S. insignia.
6. To comply with I. C.C. regulations.

NOTE.—Both ends of box are marked alike. For marking on side not shown (address side), see figure 13.

SECTION VII

TRANSPORTATION EQUIPMENT

	Paragraph
Shell carrier, MI	25
Chemical mortar cart, MIA1	26
Chemical mortar ammunition cart, MIA1	27
Weights of carts and loads	28

25. Shell carrier, MI.—The shell carrier, MI (see fig. 21), which is used to carry two chemical mortar shell, is made of paraffined olive-drab cotton duck and consists essentially of two pockets, two shoulder straps, a belt assembly, and a left and a right suspender. It weighs approximately 2⅛ pounds.

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26. Chemical mortar cart, MIA1.—The chemical mortar cart, MIA1, which is used for the transportation of the 4.2-inch chemical mortar, MIA1, and accessories, spare parts, and ammunition, is a two-wheel, man-drawn cart and consists of a chassis and a mortar cart rack (see fig. 22).

a. Chassis.—(1) The frame of the chassis is constructed from 2- by 2- by $\frac{3}{16}$-inch structural steel angle, and is $26\frac{1}{8}$ inches wide and 37 inches long. The axle is welded near the center and carries motorcycle wheels, the tires of which are approximately 27 inches outside diameter. The width of the tread is $33\frac{3}{4}$ inches and



FIGURE 21.—Chemical mortar shell carrier, MI.

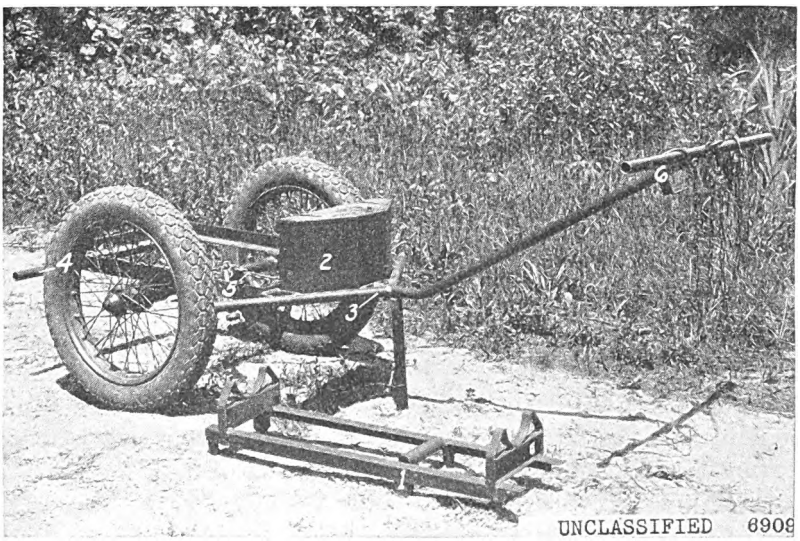


FIGURE 22.—Hand-drawn 4.2-inch chemical mortar cart, MIA1.

1. Mortar rack.
2. Tool box.
3. Pole braces.
4. Rear handle.
5. Adjustable chain coupling.
6. Lead chains and handles.

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the over-all length of the cart, including the pole, is 7 feet 3 9/16 inches.

(2) At the front end of the frame are welded U-shaped brackets to which are welded the pole braces (3) which carry the detachable pole and handle at their junction. These items are of 1¼-inch tubing. The pole braces are at an angle so that besides strengthening the structure they act as wheel guards, deflecting any brush with which they may come in contact in the field. They also serve as handles in lifting the cart on or off trucks.

(3) In the center of the pole handle is a ring to which are attached by round eye snaps two lead chains with handles (6).

(4) A tool box (2) is located between the pole braces and the front angle of the chassis. Clips for the spade and the pick mattock handle are welded to this angle. On the rear angle of the chassis frame are locating clips for the spade, standard, baseplate, and pick mattock handle. Under it a seamless steel tube (4), 1¼ inches in diameter, extends the entire width of the chassis frame and projects at each end to form guards for the wheels and to serve as handles when the cart is lifted on or off trucks.

(5) Near each corner of the chassis frame tightening chains are attached for retaining the load. These chains are pulled taut by a chain coupling (5) operated by a screw.

b. Mortar cart rack.—The mortar cart rack (1) is 40⅜ inches long, 10⅛ inches wide, and 9⅛ inches high. The longitudinal members are constructed from 1½- by 1½- by ⅛-inch structural steel angle. Of the three cross members, those at the front and rear are channel-shaped, of ⅛-inch steel plate, and the middle one is of 1½-inch steel tubing. Above the channels is a steel strap 1 inch wide and 3/16 inch thick bent into such a shape as to form a support for the mortar barrel. At each end of the channels are notches that retain the aiming stakes. The rear channel is provided with locking pins that enter holes drilled in the aiming stakes, thus securely locking the stakes to the mortar cart rack. The rack is supported on four brackets made of 1½- by 1½- by ⅛-inch structural steel. At the lower end of each and projecting down from it, a ½-inch pin is welded. These pins enter drilled holes in the baseplate, when the mortar cart is loaded, locating the rack and preventing any movement of it.

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c. Mortar cart accessories set, MIA1.—The mortar cart accessories set, MIA1, consists of the following equipment:

Quantity	*Name of part*
1	Bag, tool, containing—
1	Kit, repair, rubber tube, consisting of—
1	Cement, rubber, 1-ounce tube.
1	Patch, rubber, 27-square-inch sheet.
1	Roughener.
5	Valve cores (in box).
1	Wrench, automotive, adjustable, 9-inch.
1	Iron, tire, flat type, 15-inch maximum length.
1	Pump, motorcycle tire, hand.

One of these accessories sets is issued per mortar squad (two carts).

d. Load.—The cart is designed to carry the mortar accessories and spare parts set (par. 21), except the ammunition tool roll and contents, the barrel, the standard, the baseplate, and the mortar cart accessories set, MIA1 (*c* above). The load is placed on the cart in the following order (see figs. 23 and 24):

(1) The pick mattock head, gunner's tool roll, mortar cart accessories set, ½-pint oiler, and baseplate slings are put in the tool box.

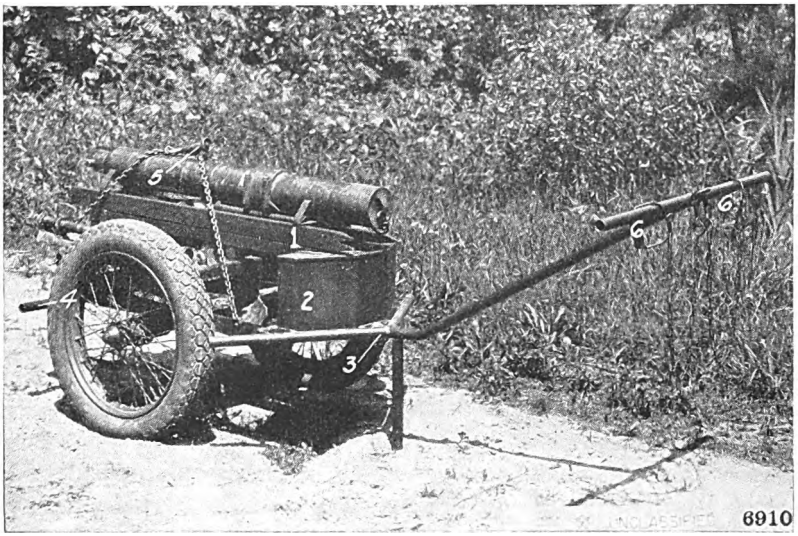


FIGURE 23.—Loaded hand-drawn 4.2-inch chemical mortar cart, MIA1 (front view).

1. Mortar rack.
2. Tool box.
3. Pole braces.
4. Rear handle.
5. Adjustable chain coupling.
6. Lead chains and handles.

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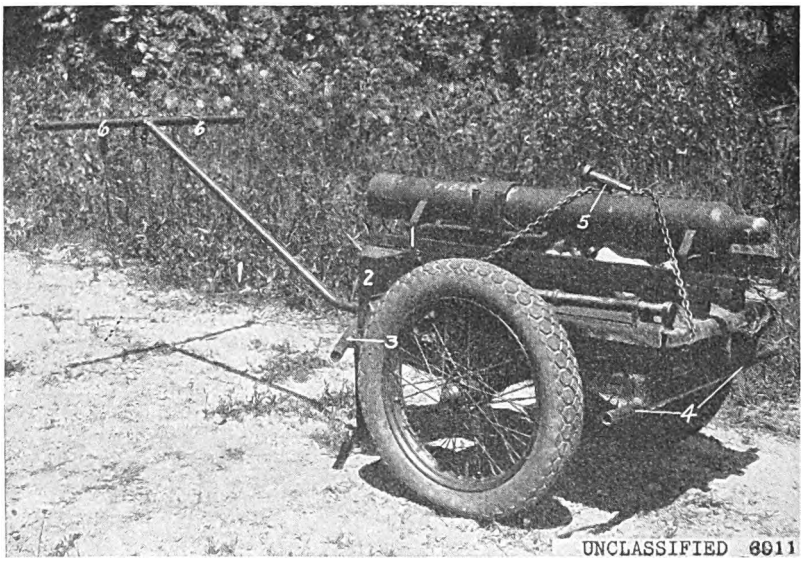


FIGURE 24.—Loaded hand-drawn 4.2-inch chemical mortar cart, M1A1 (rear view).

1. Mortar rack.
2. Tool box.
3. Pole braces.
4. Rear handle.
5. Adjustable chain coupling.
6. Lead chains and handles.

(2) The spade is placed in the spade support under the front frame angle on the left-hand side of the cart, the handle extending to the rear where it is held by the spade clip. The large end of the pick mattock handle is inserted in the pick mattock clip located under the front frame angle on the right-hand side of the cart, and the hole drilled in the small end of the pick mattock handle is fitted over the pin on the rear angle of the cart chassis.

(3) The standard is next laid in the chassis frame front side up with the connector rods between the standard clips on the rear frame angle.

(4) The baseplate is then loaded with the front of the plate facing the front of the cart and the rear notch in the baseplate spade entering the baseplate guide on the rear angle of the cart frame. The notches in each side of the baseplate are supported by the side angles of the cart frame. These notches prevent any lateral movement of the baseplate, and in turn the baseplate prevents any movement of the spade, pick mattock handle, and standard.

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(5) The mortar rack is now placed on the baseplate, the four pins in the feet or supporting brackets entering the drilled holes in the baseplate.

(6) The aiming stakes, two on the right and one on the left side, are put in the mortar rack with the points forward, and are retained in place by the lock pins passing through the holes drilled in the stakes.

(7) Eight sandbags are folded and stowed between the side angles of the rack at the rear of the baseplate cup. The other four sandbags are folded and put in front of the cup.



FIGURE 25.—Hand-drawn 4.2-inch chemical mortar ammunition cart, MIA1.

2. Tool box.
3. Pole braces.
4. Rear handle.
5. Adjustable chain coupling.
6. Lead chains and handles.

(8) The mortar barrel, with the cleaning rod inside the barrel and the muzzle cover in position, is placed in the barrel support with the muzzle toward the front end of the cart, and is moved forward until the shock-absorber slide is against the front barrel support.

(9) The chain is now put over the mortar barrel and the chain coupling is tightened, thus holding the entire load securely.

27. Chemical mortar ammunition cart, MIA1.—The ammunition cart, MIA1 (fig. 25), is identical with chassis of the mortar cart, MIA1 (par. 26*a*), except that no clips are welded to the front and rear angles of the chassis frame to retain the mortar load. It is

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designed to carry 5 shell boxes (10 complete rounds) and the ammunition tool roll which is a part of the accessories and spare parts set (par. 21). The shell boxes are placed on the cart with the side up, the rear box against the rear frame angle. The chains are put over the boxes and the chain coupling tightened, thus holding the load securely (see fig. 26). The ammunition tool roll is carried in the tool box. One mortar cart accessories set, MIA1, is issued per ammunition squad (2 carts) and is also carried in the tool box of one of the carts. In an emergency the ammunition cart may be used to carry the mortar cart load (par. 26*d*), except the spade and mattock handle. There are no locating clips for the standard and the notch in the base plate spade, but their absence does not interfere with the load being held securely by the chains.

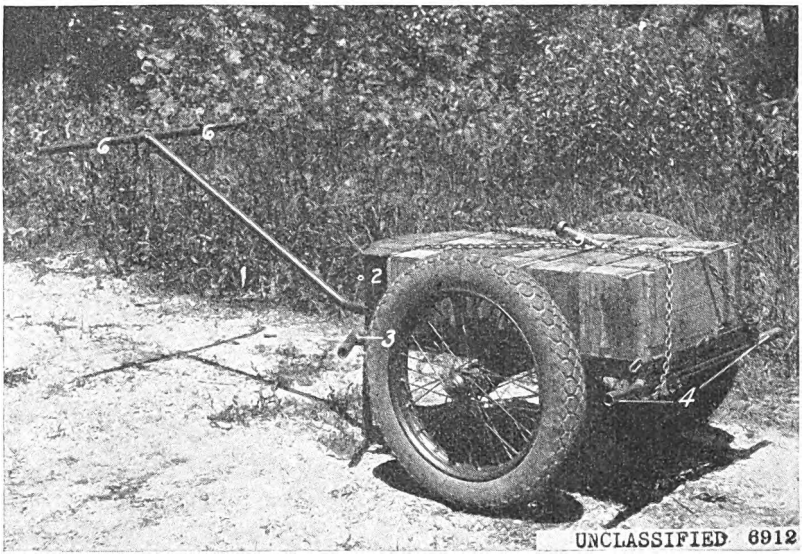


FIGURE 26.—Loaded hand-drawn 4.2-inch chemical mortar ammunition cart MIA1.

2. Tool box.
3. Pole braces.
4. Rear handle.
5. Adjustable chain coupling.
6. Lead chains and handles.

28. Weights of carts and loads.—The weights of the carts and their loads are approximately as follows:

	Mortar cart, MIA1 *Pounds*	*Ammunition cart, MIA1* *Pounds*
Chassis	149	146
Rack	16	---
Load	326	330
Cart, loaded	491	476

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SECTION VIII

REPAIRS IN THE FIELD

Paragraph
By mortar company 29
By chemical maintenance company 30

29. By mortar company.—The chemical mortar, MIA1, accessories and spare parts set (see par. 21), which is carried on the mortar cart, contains two spare slide bolts, a traversing screw handle, a striker pin and two front and two rear springs for the shock-absorber slide. If any of these parts of the mortar should be broken or damaged they may be replaced readily by the mortar company with the tools furnished in the accessories and spare parts set. The procedure used in replacing the striker pin is the same as that given in paragraph 18*d*.

30. By chemical maintenance company.—Since the chemical mortar does not have a breech lock, recoil device, or any fine mechanisms that are apt to get out of adjustment, there are few things that can break or get out of repair, and in general it is more expeditious to replace the damaged part with a new one than to attempt to make repairs in the forward areas. The parts most frequently needing replacement and repair are the slide springs and the tie rods or connectors between the baseplate and the standard. When a detached chemical unit is at some distance from the depot or there is a shortage of parts in stock at the depot, it may be desirable to send forward an element of the weapon section of the chemical maintenance company to make repairs on a damaged mortar while the weapon continues in the possession of the chemical unit. These detachments are furnished with a chest of such tools as chisels, clamps, drills, files, grinders, hacksaws, hammer, hatchet, pliers, screw drivers, sledge, vise, wrenches, etc., and all such basic spare parts of the barrel, baseplate, standard, and mortar and ammunition carts as may be replaced without welding or blacksmithing operations.

[A. G. 062.12 (6–30–39).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:
E. S. ADAMS,
Major General,
The Adjutant General.

U. S. GOVERNMENT PRINTING OFFICE: 1939

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TECHNICAL REGULATIONS
No. 1300–30E

WAR DEPARTMENT,
WASHINGTON, *October 12, 1939.*

INFANTRY AND AIRCRAFT ARMAMENT

BROWNING AUTOMATIC RIFLE, CALIBER .30, M1918 AND M1918A1

Prepared under direction of the Chief of Ordnance

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SECTION I

GENERAL

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Purpose and scope	1
References	2

1. Purpose and scope.—These regulations are published for the information and guidance of the using arms and all personnel charged with the maintenance of this matériel. They contain descriptions and figures, and instructions in the proper methods of adjustment, disassembling, assembling, and care and preservation of the matériel.

2. References.—*a.* Nomenclature, list of spare parts and equipment and basic spare parts for the Browning automatic rifle, caliber .30, M1918 and M1918A1, are contained in SNL A–4.

b. Description and characteristics of the several types of ammunition used in the rifles described herein are given in TR 1350–A.

c. Information concerning inspection, repairs, and maintenance to be performed by ordnance maintenance personnel is given in TR 1400–30E.

*This pamphlet supersedes TR 320–25, March 25, 1925.

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d. Complete instructions for cleaning the bore and chamber of the rifle, cleaning and preserving material in general, and materials for use therewith are given in TR 1395–A.

e. Marksmanship (automatic rifle, caliber .30, M1918A1) is outlined in chapter 2A, part 1, Basic Field Manual, volume III.

f. Antiaircraft marksmanship (automatic rifle, caliber .30, M1918) is outlined in chapter 2, part six, Basic Field Manual, volume III.

Section II

GENERAL DESCRIPTION AND TABULATED DATA

Paragraph
General description 3
Tabulated data 4

3. General description.—*a.* The Browning automatic rifles, caliber .30, M1918 and M1918A1, shown in figures 1 and 2, are air-cooled, gas-operated, magazine-fed weapons. The operation of both models is exactly the same. The rifle has no special cooling system, the barrel being exposed to the air and the hand of the firer being protected on the underside of the barrel by a wooden forearm. Care must be taken to avoid touching the barrel during firing. The rifle is operated by the power furnished by expanding powder gases following ignition of the cartridge. The powder gases enter the gas cylinder through a port in the forward part of the barrel and impinge upon the head of a piston. The expanding gas drives the piston to the rear. During the rearward movement the bolt is unlocked, the cartridge case extracted and ejected, and the recoil spring compressed. The forward movement, actuated by the recoil spring, feeds a cartridge into the chamber, closes and locks the bolt, and ignites the cartridge. The rifle is fed from a magazine having a capacity of 20 cartridges. The cyclic rate of fire is approximately 500 rounds per minute. Firing semiautomatically, it is possible to fire 150 rounds per minute. However, in normal fire, best results are obtained between 40 and 60 aimed shots per minute.

b. The automatic rifle as initially designed is designated Browning automatic rifle, caliber .30, M1918. It was originally intended as a supplementary assault weapon in infantry rifle squads. In recent years it has also come into use as a "train defense" weapon.

(1) To improve the rifle for use as a supplementary assault weapon, it was modified by mounting a spike-footed bipod assembly on the gas cylinder and by replacing the rifle butt plate with a hinged butt plate with the necessary changes in the butt stock. Mod-

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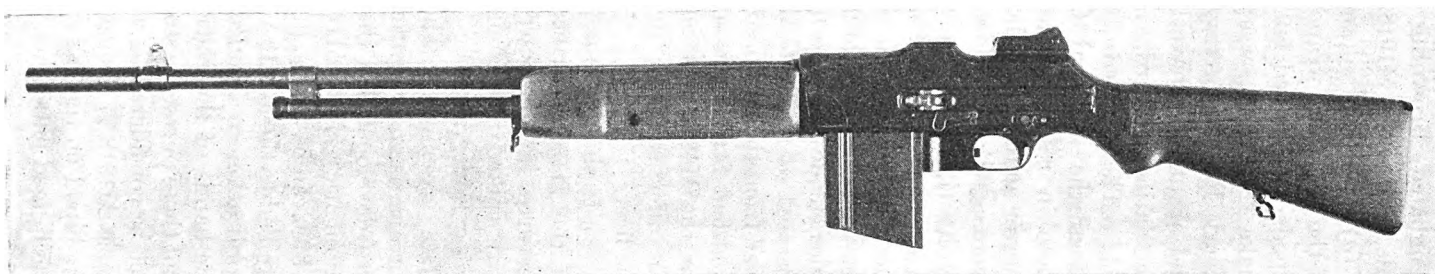


FIGURE 1.—Browning automatic rifle, caliber .30, M1918.

Weight	pounds	16.
Diameter of bore	inches	0.300–0.302.
Number of grooves		4.
Depth of grooves	inches	0.004.
Twist, one turn in	do	10.
Length of bore	do	21.533.
Headspace, overhauled	do	1.940–1.946.
Pin, protrusion	do	.040–.050.
Trigger pull	pounds	6–10.
Front sight, height (increments 0.015)	inches	1.177 to 1.327, inclusive.
Sight radius (leaf up)	do	30.79–30.85.
Aimed shots per minute, semiautomatic		60.
Ammunition	caliber	.30 M1 ball.
Ammunition	do	.30 M1906 and M2.
Ammunition, tracer	do	.30 M1.
Classification		Standard.

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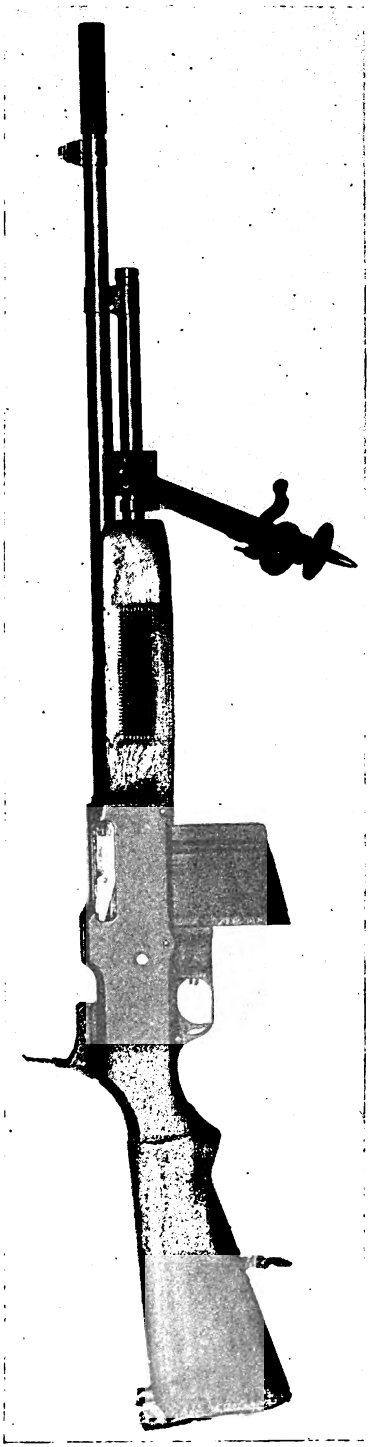


FIGURE 2.—Browning automatic rifle, caliber .30, M1918A1.

ified in this manner the rifle is designated Browning automatic rifle, caliber .30, M1918A1.

(*a*) Two hundred and fifty-five of the M1918A1 weapons and 249 bipods and hinged butt plates to make M1918A1 weapons were issued Regular Army Infantry and about 3,700 have been issued the National Guard.

(*b*) The hinged butt plates issued the National Guard and those in reserve storage have a shorter outer butt plate body to overcome the interference caused by its tip when the rifleman is in a prone position. Furthermore, these rifles have a shortened forearm with the projections on the sides cut down and a metal shield inserted to facilitate radiation of heat from the recoil spring. This modified forearm is not desirable for the M1918 weapon as it does not offer sufficient protection to the firer.

(2) It should be noted that all of the M1918A1 rifles have two features in common; the bipod with spiked feet mounted on the gas cylinder and the hinged butt plate assembly. The modified forearm is an improvement which was developed for the Browning automatic rifle, M1918A2, but which can be and is, in some cases, applied to the M1918A1 rifles. Its application to M1918A1 rifles in the hands of the National Guard and those in reserve storage should not be considered as affecting the basic M1918A1 features; that is, the bipod on the gas cylinder and the hinged butt plate.

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(3) To adapt the weapon for use as a light machine gun in rifle company light machine-gun sections, it has been further modified and designated as Browning automatic rifle, caliber .30, M1918A2. These modifications include a bipod assembly with skid-type feet mounted on the flash hider; a new trigger-guard assembly which has a pistol grip and guiding surfaces for the magazine and which contains a rate-reducing mechanism; a butt stock having a recess for a stock rest and a cheek rest on its left side; and a rear sight as used on the Browning machine gun, caliber .30, M1919A4. No provision is made for semiautomatic fire when the rate-reducing mechanism is used.

(*a*) Incident to these changes, the magazine opening will be beveled to facilitate insertion of the magazine.

(*b*) Prior to this weapon going into production, the weight of the barrel will be determined.

(4) The Browning automatic rifle, M1918A2, will be described in detail by changes in these regulations, or by the publication of a separate pamphlet when the necessary details become available.

4. Tabulated data.

Weight of automatic rifle, M1918 (magazine empty)	pounds	15.88
Weight of automatic rifle, M1918A1 (magazine empty)	do	18.50
Weight of magazine, empty	do	0.44
Weight of magazine, filled (20 cartridges):		
Ball M1906 and M2 ammunition	do	1.57
Ball M1 ammunition	do	1.63
Overall length of rifle, including flash hider:		
M1918	inches	47.59
M1918A1	do	47.81
Length of barrel	do	24.08
Length of barrel with flash hider	do	27.30
Free length of recoil spring, minimum	do	15.00
Gas port from muzzle	do	6.00
Muzzle velocity, M1 ammunition	feet per second	2,632
Muzzle velocity, M2 ammunition	do	2,685
Mean chamber pressure, M1 ammunition	pounds per square inch	46,000–48,000
Mean chamber pressure, M2 ammunition	do	40,000–42,000
Caliber of bore	inches	0.30
Number of grooves in barrel		4
Twist in rifling, uniform R. H., one turn in	inches	10.00
Sight graduated to	yards	1,600

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SECTION III

DETAILED DESCRIPTION

Paragraph
Detailed description of automatic rifle 5

5. Detailed description of automatic rifle.—As the distinctive difference in the M1918 and M1918A1 automatic rifles is the addition of a bipod and a hinged butt plate, the M1918A1 automatic rifle is described below.

a. The automatic rifle is best described under two headings; the stationary portions and the moving portions.

(1) The stationary portions consist of the receiver and parts directly or indirectly attached thereto.

(*a*) The receiver (fig. 29) is made of a single piece of steel formed at the rear end to receive the butt stock and the buffer tube, the latter part being threaded into the receiver. The butt stock is held in place by the butt stock bolt which threads into the rear end of the buffer. The buffer tube contains, from front to rear, the buffer, four sets of buffer friction cups and cones, the buffer spring, and the buffer nut. The bronze buffer friction cups fit over the steel cones and are split to allow expansion when under pressure. The butt plate assembly is attached to the butt stock by means of screws. The M1918 butt stock is shown in figure 30. The M1918A1 butt stock is shown in figure 29.

(*b*) The M1918 butt plate assembly consists of the butt plate, butt plate trap, and the trap spring, screw, and axis pin. The components are shown in figure 30. The trap is hinged between the ears of the butt plate on the trap axis pin and is retained either closed or open by the free end of the trap spring. When trap is open, the butt stock bolt may be removed.

(*c*) The M1918A1 automatic rifle has a hinged butt plate assembly which provides a means of assisting the firer in maintaining controlled fire, as the natural tendency of the butt plate to creep down off the shoulder during periods of sustained fire is eliminated. The hinged butt plate group assembly is a modification of the M1918 butt plate assembly and consists of the hinged butt plate assembly (outer butt plate body, the inner butt plate body and lug, and the hinge pin), butt plate trap, trap spring, trap spring screw, trap axis pin, lock spring, set screw, and a ¼ inch steel ball. The components are shown in figure 29. The outer butt plate body hinges on the hinge pin located in the lug which is welded on the top of the inner butt plate body. The outer butt plate body may be raised to a position in prolongation of the top of the stock, thus forming an angle of ap-

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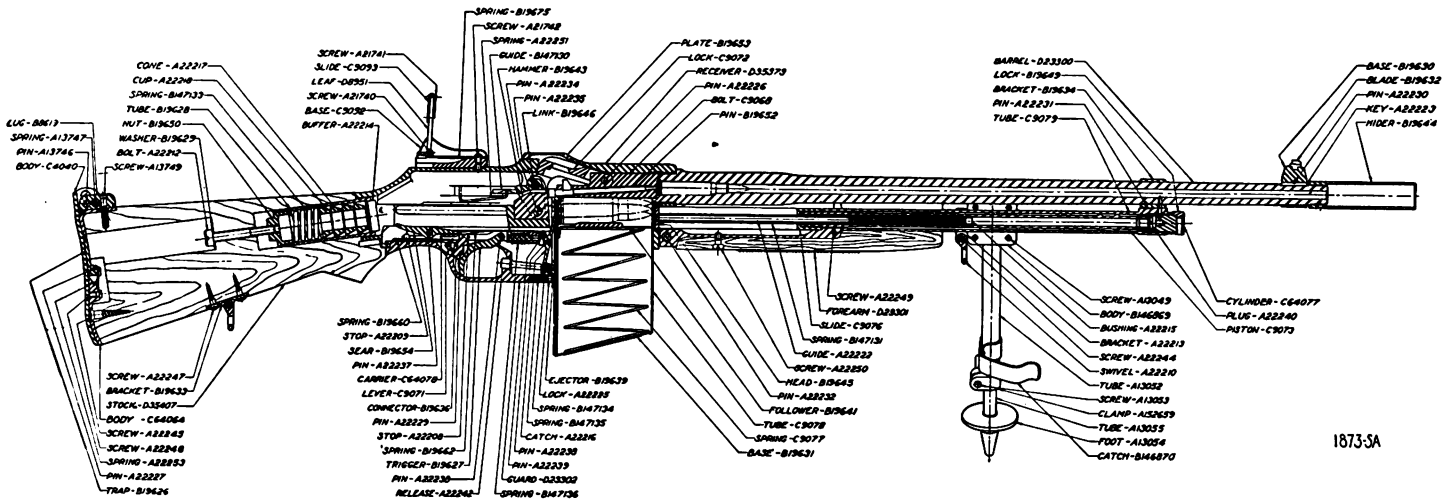


FIGURE 3.—Browning automatic rifle, caliber .30, M1918A1 (sectional view).

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proximately 90° with the face of the inner butt plate body. It is held in this position by means of the ball, lock spring, and set screw. When not in use, the outer butt plate body is swung down against the inner butt plate body.

NOTE.—The hinged butt plates issued the National Guard and those in reserve storage have a shorter outer butt plate body to overcome the interference caused by its tip when the rifleman is in a prone position.

(*d*) The butt swivel bracket is fastened to the bottom of the butt stock by means of the butt swivel bracket screws. To this bracket is attached the bracket swivel by means of the bracket swivel screw.

(*e*) The marking for the rifle is on the top of the receiver at the front end. The M1918 and M1918A1 automatic rifles use the same receiver, also the M1922 machine rifle, therefore the receivers of the automatic rifles are marked in various ways, such as: Browning machine rifle, U. S. model of 1918; Browning automatic rifle, U. S., caliber .30, model 1918; and Browning automatic rifle, U. S., model 1918. In the rear of the marking, the top plate is fitted into dovetail guides in the receiver. The rear sight base is driven into dovetail grooves at the rear end of the top of the receiver. The rear sight base is further positioned by the rear sight base spring screw. The rear sight leaf is pivoted at the rear of the rear sight base, its operation being controlled by the rear sight base spring. The rear sight slide and rear sight slide catch operate up and down on the rear sight leaf in such a way as to give a range adjustment up to 1,600 yards. The leaf is also provided with a battle sight. The components of the rear sight are shown in figure 33.

(*f*) The ejection opening is located on the right side of the receiver, as is the hammer pinhole. The hammer pinhole is located so as to allow the disassembling of the hammer pin and subsequent parts.

(*g*) The left side of the receiver is provided with a guide for the operating handle. The operating handle is fitted with the operating handle plunger which is held in place by the operating handle plunger pin and which is operated by the operating handle plunger spring in such a way as to retain the operating handle in the forward position unless force is applied to move it toward the rear. The bolt guide is held in the side of the receiver above the operating handle by the bolt guide spring which is attached to the inside of the receiver. The edge of the bolt guide projects inside the receiver forming a support for the bolt when it is in the rear position. The change lever stop is also assembled to the left side of the receiver, this part being held in place by the change lever stop spring which is pinned to the inside of the receiver.

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(*h*) The bolt support, right, and bolt support, left, are riveted to the inside of the receiver by means of three bolt support rivets each, in such a way as to support the bolt when it is in its forward position. The rear corners of the bolt supports are rounded so as to aid by their camming action the raising of the bolt lock. The inner edges of the bolt supports are formed to guide the cartridge into the chamber as it is stripped from the magazine. The locking shoulder of the receiver is located just in rear of the top plate. This shoulder supports the bolt lock and bolt when the cartridge is fired.

(*i*) The bottom of the receiver is left open to receive the magazine at the front end. The rear portion of the opening is closed by the trigger guard (fig. 31) which fits up between the sides of the receiver. The rear end of the trigger guard is supported by a tongue in the receiver which fits into a corresponding groove in the trigger guard. The forward end of the trigger guard is held in place by the trigger guard retaining pin. The trigger guard retaining pin spring locks in an indentation in the receiver, thus holding the pin in place.

(*j*) The ejector is retained in a T-cut at the front end of the trigger guard by means of the ejector lock and spring. The top of the ejector extends upward in such a way as to operate in the ejector cut in the bolt. The magazine catch is pinned to the trigger guard. The upper end projects through the ejector and provides a catch which holds the magazine in place. The magazine catch spring is positioned between the ejector and the magazine catch below the pivot point of the latter. This holds the upper end of the magazine catch in the forward position. The magazine release extends forward from the trigger guard and operates against the lower end of the magazine catch, thus moving the upper end of the catch rearward when the release is pushed forward.

(*k*) The trigger is pivoted to the trigger guard by the trigger pin. The connector fits loosely in the trigger, the lower notch riding on the connector pin. The upper edge of the connector comes in contact with the front end of the sear when the trigger is raised. The cam surface in rear of this edge engages the corresponding surface of the sear carrier if the change lever has been set at "F." The sear is pivoted near the rear end of the trigger guard by the sear pin which passes through the trigger guard and the sear carrier, the holes in the trigger guard being slotted. The rear end of the sear is provided with a nose which engages the sear notch in the slide. The under surface of the front end of the sear engages the connector when it is raised by the action of the trigger. The sear spring is held in grooves in the trigger guard. This spring is of

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the leaf type, the middle tongue bearing against the connector holding this latter part in position. The two outside tongues of the sear spring bear downward against the forward end of the sear.

(*l*) The change lever extends laterally through the trigger guard, being held in place by the front tongue of the change lever spring. This tongue also engages in notches around the shaft of the change lever, thus holding the change lever in the various positions. The handle of the change lever extends upward along the left side of the receiver on which is marked the positions "F" for semiautomatic fire, "A" for full automatic fire, and "S" for safety. The cuts and lugs on the under side of the change lever shaft control the action of the trigger and connector, thus giving the classes of fire mentioned. The change lever stop in the receiver prevents the change lever from being set at safety without intention. The change lever spring is held in the trigger guard by means of grooves. The sear stop is assembled to the rear tongue of this spring. The sear carrier is held in place at the rear end by the sear pin and at the front end by the trigger pin, the holes in the sear carrier for the trigger pin being slotted so as to allow a certain amount of movement of the sear carrier in a forward direction. This movement is arrested by the counterrecoil spring which surrounds the spindle at the front end of the sear carrier, bearing against the front shoulder of the sear carrier and the opposite shoulder of the trigger guard. Thus when a shock is imposed upon the sear, it is transmitted to the sear carrier through the sear pin which operates in slotted holes in the trigger guard. The trigger operates between the side walls of the sear carrier. The connector stop is in the form of a pin passing between these side walls and forming a stop which prevents excessive forward movement of the connector.

(*m*) The forward end of the receiver near the top is threaded to receive the barrel which is screwed in tightly to the draw marks. The barrel (fig. 28) is of plain, light construction, the large diameter at the breech end being carried well forward of the chamber. The gas port is provided on the under side of the barrel about 6 inches from the muzzle end. This port corresponds to a similar port in the gas cylinder-tube bracket which surrounds the barrel at this point, being held in place by the gas cylinder tube bracket pin. The gas port extends through this bracket, which is provided with a T-cut which retains the front end of the gas cylinder tube. The front sight base surrounds the muzzle end of the barrel. This carrier is held in place by the front sight key and the front sight key pin. The front sight blade, which is of the usual construction, dovetails transversely

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into the top of the front sight base. The front sight blades vary in height in accordance with the requirements of targeting the rifle at the factory. After targeting, the blade is staked in place with a prick punch. The muzzle end of the barrel is threaded to receive the flash hider, which is of plain, tubular construction, provided with a hole at the rear end, which takes the combination tool.

(*n*) The rear end of the gas cylinder tube is held up into the receiver by the gas cylinder-tube retaining pin, the spring of which locks in an indentation in the left side of the receiver. The tube provides a guideway for the gas piston and is threaded at the front end to receive the gas cylinder. This end is notched to engage the gas cylinder lock. The ribs at the top engage the T-cut in the bracket of the barrel holding the gas ports in close contact. The shoulder at the rear end of the tube provides a stop for the front end of the slide. The lugs above this bear against the barrel. The rear portion of the barrel and gas cylinder tube are protected on the bottom and sides by a wooden forearm which is attached to the gas cylinder tube by means of the forearm screws, long and short. The forearm escutcheon is permanently seated in the forearm and acts as a nut for the forearm screw, long. The outside of the forearm is cut to provide a good gripping surface for the hand.

NOTE.—The M1918A1 rifles issued the National Guard and those in reserve storage have a shortened forearm with the projections on the sides cut down and a metal shield inserted to facilitate radiation of heat from the recoil spring.

(*o*) The recoil spring guide head engages retaining shoulders in the front end of the receiver. The rear surface of this head is checkered to facilitate disassembling and assembling. The recoil spring guide is riveted into the head which forms the rear seat for the recoil spring. The rear portion of this spring is guided by the recoil spring guide, the front portion being retained in the hollow gas piston.

(*p*) The front swivel bracket clamps around the gas cylinder tube in front of the forearm. The bracket swivel is attached to the front swivel bracket by the bracket swivel screw.

(*q*) The gas cylinder lock fits in the transverse hole through the head of the gas cylinder. The cylinder is provided with three gas ports of varying size. These are located around the circumference of the cylinder wall, the position and size of each being indicated by circles marked on the cylinder head. The notches for the head of the gas cylinder lock are located so as to register the gas port in the cylinder, indicated by the circle marking nearest the barrel. The

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inside of the gas cylinder is recessed at the forward end to provide clearance for dirt and powder fouling.

(*r*) The bipod assembly (fig. 34) is attached to the gas cylinder tube at any point between the front swivel bracket and the vents in the forward end of the gas cylinder tube. It has telescoping legs, with a minimum length of about 9 inches measured from pivot to point, and a maximum length of about 14 inches from pivot to point. When not in use, the bipod legs may be folded forward parallel with the barrel where they are held in place by the leg catch. The body of the bipod is made in two sections, right and left, which are held together by four screws when assembled to the gas cylinder tube. The legs of the bipod are attached to the body by means of the rod end pins which are held in place by cotter pins. The legs, right and left, are made in two sections, upper and lower. The lower end of the upper section is provided with a slot, clamp, and clamp thumbscrew, the combination of which provides an adjustment in elevation and a means of clamping the legs to the desired height by sliding the lower section of the legs in or out of the upper section and clamping in place with the clamp thumbscrew. Each leg is equipped with a disk shoe 2 inches in diameter, 1½ inches from the point which prevents the legs sinking into the ground during firing. The left leg is equipped with a spring leg catch by means of which the legs are clamped and held in position parallel with the barrel when not in use.

(2) The moving portions consist of the operating, breech, and firing mechanisms.

(*a*) The rings at the front of the gas piston (fig. 32) operate in the gas cylinder. The rear end of the piston threads loosely into the front end of the slide and is held from rotation by the gas piston retaining pin. The piston is of hollow construction, the front end being closed by the gas piston plug and a bearing for the forward end of the recoil spring being provided by the gas piston bushing.

(*b*) The slide extends rearward in longitudinal grooves in the receiver, clearance for the magazine being provided between the sides of the slide. The rear end of the slide is beveled slightly to form a parallel line of contact against the buffer. A sear notch is cut in the underside of the slide. The hammer is held in the guides in the slide by the hammer pin which also acts as the lower pivot for the bolt link. After the breech has locked, the front face of the hammer strikes the firing pin. The bolt link is pinned to the bolt lock by the bolt link pin. The upper and rearward projection of

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the bolt link forms a bearing surface against which the bolt lock rests during the recoiling movement. This holds the rear end of the bolt lock up.

(*c*) The rear locking surface of the bolt lock bears against the corresponding surface of the receiver as the cartridge is ignited. The underside of the bolt lock is slotted and a cam surface provided which engages the retracting cam of the firing pin. The front end of the bolt lock bears against the bolt with which it is permanently hinged by means of the bolt lock pin. The bolt carries the firing pin, the retracting cam of the latter operating in the slot in the rear tail, or firing pin guide, of the bolt. The head of the firing pin extends rearward from this guide, and when struck by the hammer causes the firing pin point to project through the hole in the front face of the bolt, thus igniting the cartridge, the base of which is supported by the face of the bolt. The extractor and extractor spring are positioned in a recess at the front end of the bolt so that the extractor will engage the rim of the cartridge as it is driven forward into the chamber. A lug on the extractor engages a groove in the recess in the bolt and prevents the extractor from pulling out to the front.

b. The magazine assembly consists of the magazine tube, base, follower, and spring (fig. 32). The magazine tube is formed to receive a staggered double row of cartridges and has a capacity of 20 rounds. A notch is formed in the rear edge of the tube which engages the magazine catch. The upper lips of the tube are formed to facilitate feeding. The magazine follower operates upward against the cartridges under the action of the magazine spring which is supported at the bottom by the magazine base.

SECTION IV

FUNCTIONING

	Paragraph
General	6
Detailed functioning	7
First phase	8
Second phase	9
Functioning of buffer	10
Functioning of trigger mechanism	11
Setting change lever	12

6. General.—All automatic weapons must have mechanical means for performing the following functions: extraction, ejection, feeding, locking the breech while there is a high pressure in the bore, and igniting the cartridge. Operations such as extraction and ejection

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are performed by various cams, lugs, and springs, and the energy necessary to perform this work and to overcome friction in the rifle is derived from the explosion of the powder in the chamber.

7. Detailed functioning.—The functioning of the Browning automatic rifle is divided into two phases based on the natural oper-

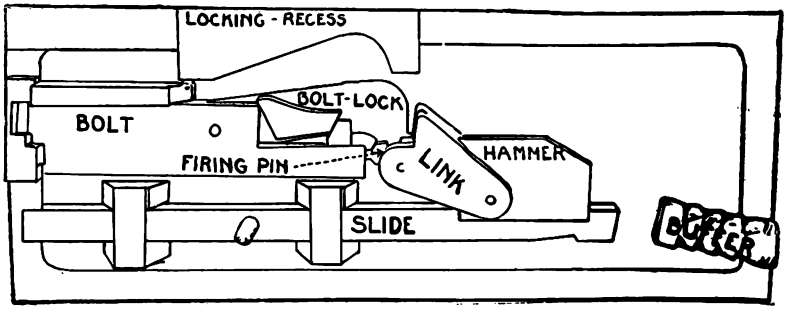


FIGURE 4.—Bolt action.

ations of the mechanism when a shot is fired. These two phases are the backward action (first phase) and the forward action (second phase). In making the division, the igniting of the cartridge in the chamber is the dividing point.

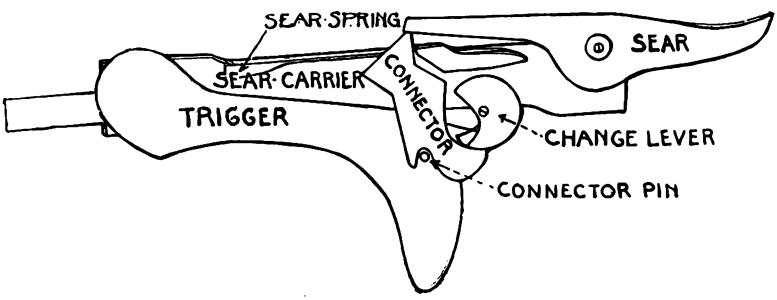


FIGURE 5.—Trigger mechanism.

a. The operations which take place in the first phase of functioning are:

(1) Action of gas.
(2) Movement of slide to rear.
(3) Unlocking.
(4) Withdrawal of firing pin.
(5) Extraction.
(6) Ejection.
(7) Termination of first phase.

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b. The operations which take place in the second phase of functioning are:

(1) Action of recoil spring.
(2) Feeding.
(3) Locking.
(4) Ignition.
(5) Termination of second phase.

8. First phase.—*a. Action of gas.*—A cartridge having been ignited, the bullet under the pressure of the expanding powder gases travels through the barrel and when it reaches a point 6 inches from the muzzle it passes a port in the bottom of the barrel. The barrel pressure, which at this instant is still very high, seeks this first natural vent. Registered with the barrel port are other similar ports in the gas cylinder tube bracket, gas cylinder tube, and gas cylinder. The port in the gas cylinder is the smallest and serves to throttle the barrel pressure. The port in the gas cylinder leads radially into a well about ⅛ inch in diameter in the head of the gas cylinder. The throttled barrel pressure is conducted through this well to the gas piston plug. This pressure acts on the piston a very short time, that is, the time it takes the bullet to travel the 6-inch distance from the barrel port to the muzzle. Its effect is that of a sudden severe blow on the piston plug. Under the influence of this blow, the gas piston is driven to the rear and carries with it the slide to which it is assembled. When the piston has traveled about $\frac{9}{10}$ inch backward, the bearing rings on its head, also the gas piston plug, pass out of the cylinder. The gas expands around the piston head and into the gas cylinder tube and is exhausted through six portholes in the tube just in rear of the gas cylinder tube bracket. The gas is prevented in a large measure from traveling back through the gas cylinder tube by two rings on the piston, about ⅝ inch apart and 1¼ inches from the piston head. These rings also serve as bearings to hold the front end of the piston in the center of the gas cylinder tube after the piston head has passed out of the gas cylinder.

b. The slide.—As the piston is forced back as described in *a* above, it carries with it the slide. The first and immediate result of the backward movement of the slide is the beginning of the compression of the recoil spring, thereby storing energy for the forward action.

c. Unlocking.—The hammer pin is slightly in advance of the bolt link pin, about 0.19 inch. The center rib of the hammer is very slightly in rear of the head of the firing pin. When the slide begins its motion to the rear, it imparts no motion whatever to the bolt and bolt lock. The slide moves back 0.19 inch, and its only effect

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during this travel is to carry the hammer from the firing pin and the hammer pin directly under the bolt link pin. At this point the unlocking begins, the bolt link revolves forward about the hammer pin, drawing the bolt lock down and to the rear. The motion of the lock and bolt, which is zero at the instant the hammer pin passes under the bolt link pin, accelerates from this point until the slide has traveled about 1.2 inches, at which point the bolt lock is drawn completely down out of the locking recess and away from the locking shoulder of the receiver. It is now supported in front on the bolt supports, and the front upper shoulder of the bolt link has revolved

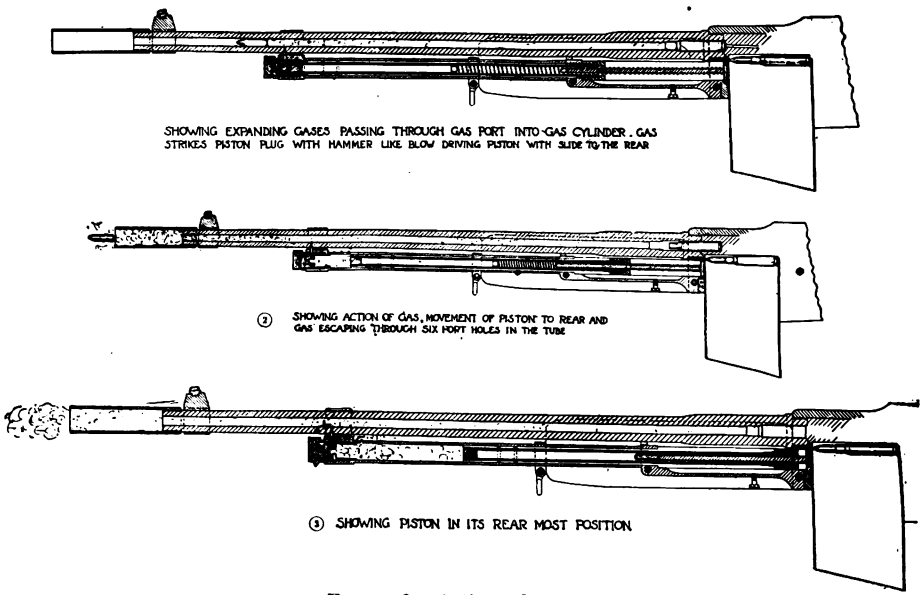


FIGURE 6.—Action of gases.

forward and bears upon the locking shoulder of the bolt lock. These two influences prevent the bolt lock from revolving down below the line of backward travel of the bolt.

d. Withdrawal of firing pin.—As the bolt lock revolves down from its locked position, a cam surface in a slot in the rear bottom side of the bolt lock comes in contact with a similar cam surface on the firing pin lug and cams the firing pin from the face of the bolt.

e. Extraction.—The backward motion of the bolt begins when the bolt lock has been drawn down so that the circular cam surface on its underside is operating on the rear shoulders of the bolt supports. This produces a strong lever action which slowly loosens the cartridge case. The backward travel of the bolt has been slight, only about $\frac{5}{32}$ inch.

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when the firing pin is withdrawn; its travel is about $\frac{11}{32}$ inch when the bolt lock is completely drawn down. From this point the bolt moves to the rear, drawn by the bolt lock and bolt link, with the same speed as the slide and carries with it the empty cartridge case which is held firmly in its seat on the face of the bolt by the extractor. The extractor is on the upper right-hand side of the bolt next to the ejection opening in the receiver. A slot cut in the left side of the bolt lock near the back end passes over the bolt guide, which supports the bolt lock and bolt when they are in the rear position.

f. Ejection.—When the slide reaches a point about ¼ inch from the end of its travel, the base of the cartridge case strikes the ejector which is on the left side of the feed rib of the bolt and opposite the extractor. This action causes the cartridge case to be pivoted with considerable force about the extractor and through the ejection opening in the receiver. The front end of the cartridge case passes first out of the receiver and is pivoted so that it strikes the outside of the receiver at a point about 1 inch in rear of the ejection opening. It rebounds from the receiver toward the right front.

g. Termination of first phase.—The backward motion is terminated when the rear end of the slide strikes the buffer. The slide moves forward $\frac{1}{10}$ inch after striking the buffer under the action of the recoil spring, but if the sear nose is not depressed it engages the sear notch on the slide and the piece is cocked for the next shot.

NOTE.—It is to be noted that the motion of the bolt, bolt lock, and bolt link mechanism began slowly at first and did not attain the speed of the slide until the latter had traveled about 1¼ inches backward. This is a very important characteristic of the rifle, since on this account the mechanism is not subjected to an excess strain due to a sudden start at the instant the gas impinges upon the piston. This slow start delays the opening of the chamber sufficiently to allow the high barrel pressure to decrease.

9. Second phase.—*a. Action of recoil spring.*—The sear nose is depressed, disengaging the sear, and the slide moves forward under the action of the recoil spring. The position of the bolt link pin is slightly below a line joining the bolt lock pin and the hammer pin; therefore as the slide starts forward the joint at the bolt link pin has a tendency to buckle downward. It is prevented from doing this by the tail of the feed rib on the bolt which extends backward under the bolt lock, also by the upper front shoulder of the bolt link being in contact with the locking surface of the bolt lock. Since the joint cannot buckle, the entire mechanism moves forward with the slide. When it has traveled about ¼ inch, the front end of the feed rib impinges on the base of the top cartridge which the magazine spring and lips are holding up in its path.

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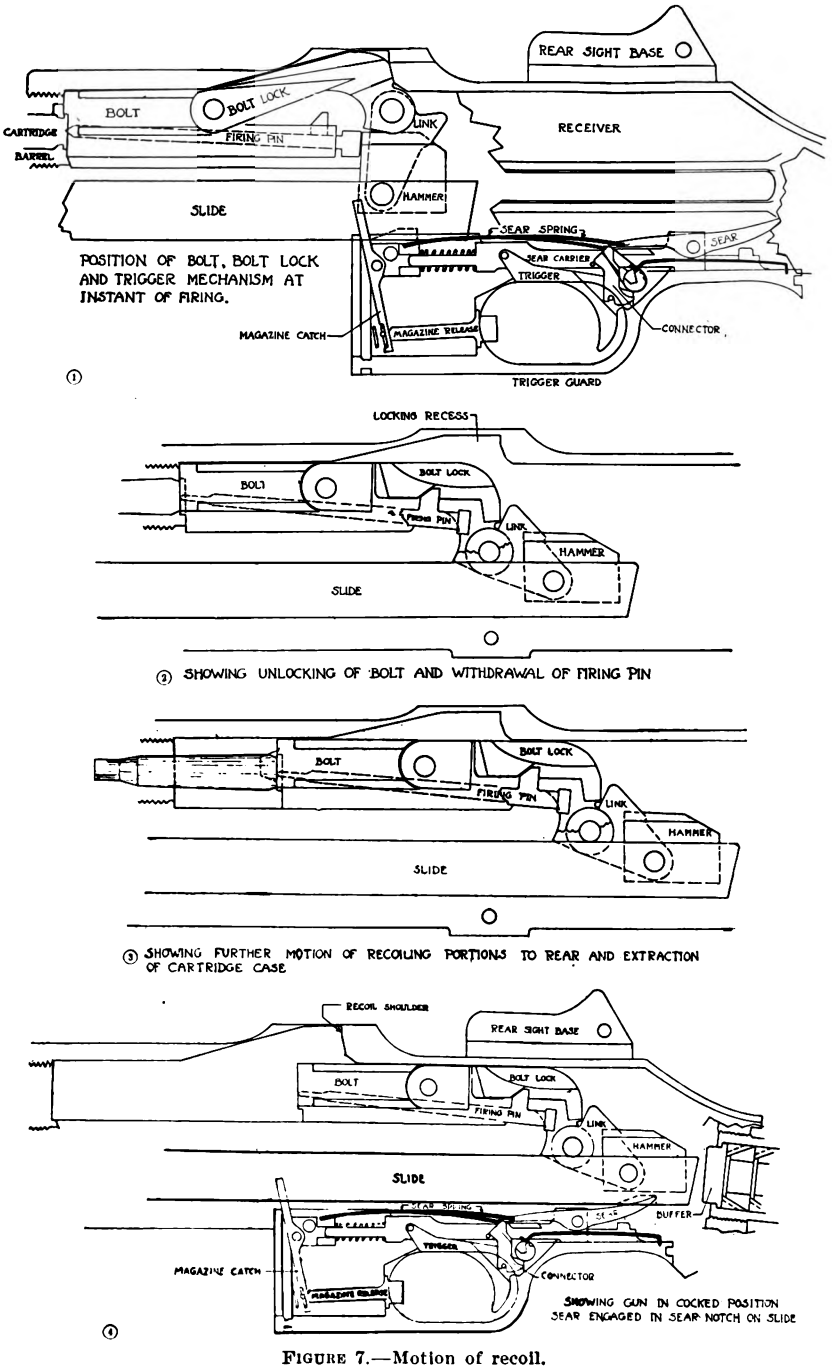


FIGURE 7.—Motion of recoil.

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b. Feeding.—The cartridge is carried forward about ¼ inch, when the nose of the bullet strikes the bullet ramp or guide on the breech of barrel and is deflected upward toward the chamber. This action also guides the front end of the cartridge from under the magazine lips. The base of the cartridge approaches the center of the magazine where the lips are cut away and the opening enlarged, and at this point is forced out of the magazine by the magazine spring. The base of the cartridge slides across the face of the bolt and under the extractor. Should the cartridge fail to slide under the extractor, the extractor will snap over its head as the bolt reaches the forward position. When the cartridge is released by the magazine, the nose of the bullet is so far in the chamber that it is guided by the chamber from this point on.

c. Locking.—When the slide is about 2 inches from its forward position, the circular cam surface on the underside of the bolt lock begins to ride over the rear shoulders of the bolt supports and the rear end of the bolt lock is cammed upward. The bolt link pin passes up above the line joining the bolt lock pin and hammer pin. The joint at the bolt link pin now has a tendency to buckle upward and the bolt lock being opposite the locking recess in the receiver is free to, and does, pivot upward about the bolt lock pin. The bolt link revolves upward about the hammer pin forcing the bolt lock up, and a rounded surface on the bolt lock just above the locking face slips over the locking shoulder in the receiver giving the lock a lever action which forces the bolt home to its final position. The two locking surfaces on the bolt lock and the receiver register as the hammer pin passes under the bolt link pin.

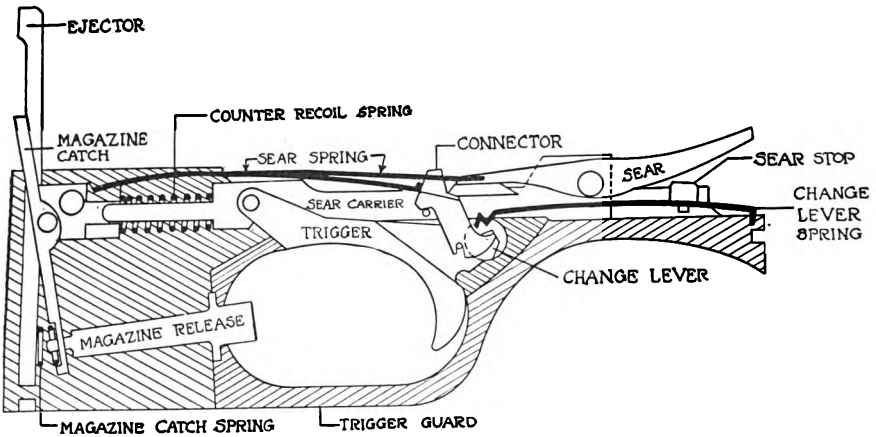
d. Igniting the cartridge.—The lug on the firing pin is buried in the slot on the underside of the bolt lock at all times except when the bolt is locked in the forward position. Therefore, the firing pin is locked away from the face of the bolt during all the backward and forward motion of the bolt. When the hammer pin passes under the bolt link pin, the firing pin has been released by the bolt lock. The slide and hammer move forward about ⅛ inch farther and the center rib of the hammer strikes the head of the firing pin, driving it forward and igniting the cartridge.

e. Termination of second phase.—The forward end of the slide strikes a shoulder at the rear end of the gas cylinder tube which terminates the forward motion. The forward motion is not terminated by the hammer on the firing pin. This may be seen by examining the head of the firing pin when the gas cylinder tube is assembled to the receiver and the bolt mechanism is in the forward position. The

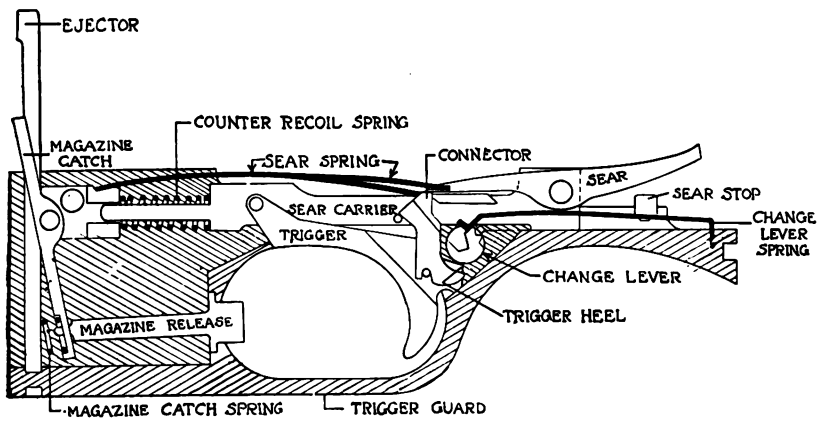
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firing pin has still about $\frac{1}{16}$-inch clearance from its extreme forward position.

NOTE.—The locking shoulder of the receiver is inclined forward. Its surface is perpendicular to the line through the bolt lock which the shock of the explosion follows; therefore, the force of this shock is exerted normal to this surface. It should be noted that the speed of the bolt mechanism is slowed down gradually from the instant that the bolt lock starts to rise until the hammer pin passes under the bolt link pin when its speed is zero.



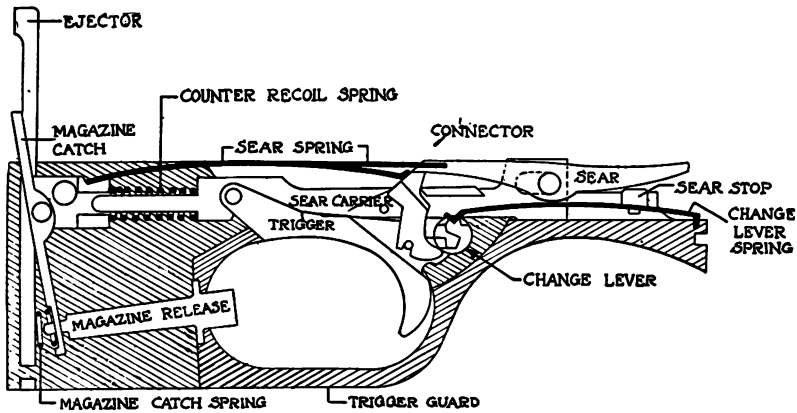
① Showing trigger mechanism single shot firing. The connector cammed forward from under the forward end of the sear by the under cam surface of the sear carrier permits the forward end of the sear to return to position under tension of sear spring, causing the rear end of the sear to engage in the sear notch of the slide.



② Showing trigger mechanism set on safe. Cylindrical portion of the change lever resting over the heel of the trigger prevents the upward movement of the trigger and the releasing of the sear.

FIGURE 8.—Trigger mechanism in single shot and automatic firing and set at safe.

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⊛ Showing trigger mechanism automatic firing. Toe of the connector engages under the connector stud on the change lever, preventing the connector from rising sufficiently high to be cammed forward from under the fore end of the sear; head of the connector holding up fore end of sear, depressing rear, preventing the rear end of sear from engaging in the sear notch of the slide.

FIGURE 8 (Continued)

10. Functioning of buffer.—*a. General.*—The buffer system consists of a tube in which are placed successively from front to rear the buffer head, a brass friction cup with concave interior which is split to allow for expansion, and a steel cone to fit into the cup. Four of these cups and cones are placed one after the other in series. In rear of these are the buffer spring and finally the buffer nut which is screwed into the end of the tube and forms a seat for the spring.

b. The action.—The buffer head, struck by the rear end of the slide, moves to the rear, forcing the cups over the cones and causing them to expand tightly against the tube, consequently producing considerable friction as the cups move back and compress the buffer spring. Thus the rearward motion of slide is checked gradually and there is practically no rebound. The spring returns the buffer head and friction cups and cones to their original positions.

11. Functioning of trigger mechanism.—*a.* The trigger mechanism has three settings:

(1) *Automatic* (A).—When so set, the sear is depressed as long as the trigger is held back and the piece will continue firing until the magazine is emptied.

(2) *Semiautomatic* (F).—When so set, the sear is depressed, thereby disengaging the sear and sear notch when the trigger is pulled, but the mechanism is so constructed that the sear rises and engages in the sear notch when the slide comes back again, and the sear and sear notch will not disengage until the trigger is fully released and then pulled.

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With this setting, the piece fires one shot for each pull and release of the trigger.

(3) *Safe* (S).—When so set, the sear cannot be released from the sear notch by pulling the trigger.

b. The action of the trigger mechanism is taken up in phases and should be followed on the mechanism itself as the explanation proceeds. Have the trigger guard disassembled completely. Study the shape of the change lever and note the following:

(1) It is a bar about ¼ inch in diameter.

(2) It has three shallow longitudinal slots cut on top of the bar, as the handle is held vertically.

(3) The side of the bar is slotted in such a way as to leave a little tongue of metal in the center and at the lower edge of the slot.

12. Setting change lever.—*a.* Assemble the change lever and spring to the trigger guard. Note that the toe of the change lever spring is seated in one of the longitudinal slots on the change lever, and that as the lever is turned from one position to another, it seats in the other slots. The only function of the spring and the longitudinal slots is to hold the change lever in the position in which it is set.

b. Assemble the trigger and pin to the guard.

c. The change lever controls the rate of fire.

(1) To set the rifle at safe, depress the change lever stop and pull the change lever rearward until it covers the change lever stop. This position is marked "S." It will be noticed that the change lever stop prevents the accidental setting of the change lever at safe, and at the same time allows a quick change from safe to either full automatic or semiautomatic fire.

(2) For full automatic fire or continuous fire to the capacity of the magazine, set the change lever in the vertical position against the change lever stop marked "A."

(3) For semiautomatic fire or single shot, push the change lever to the forward position marked "F."

d. Turn the change lever to rear or safe position. Note that in this position the slot is turned slightly upward and that the full surface of the bar is on the bottom. Pull the trigger. Note that the rear top end of the trigger is slotted longitudinally and that the metal on each side of the slot forms two shoulders which rise against the bottom of the change lever bar.

e. Push the change lever over to the vertical position, which is the automatic setting. Pull the trigger as before and note that the slot in the change lever is turned to the front and that the two shoulders of the trigger, which before engaged the full surface of the change

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lever bar, now are free to pass up into the slot of the change lever; also that the tongue of metal on the bottom of the change lever slot passes through the longitudinal slot in the end of the trigger.

f. Now push the change lever forward to single shot position.

g. Note that now the slot is turned partially down and that, when the trigger is pulled, the rear end of the trigger passes up into the change lever slot; also that the tongue of metal in the bottom of the change lever slot is now turned back and does not pass through the slot in the end of the trigger as it did in the automatic position.

h. Now observe the shape of the connector. It is shaped like a boot with a toe and heel. It has a flat surface that slopes down and toward the front from the head (sear spring ramp). In rear of the head the profile extends straight downward for about ⅛ inch, then slopes slightly to the rear for 0.12 inch (sear carrier ramp). This last slope is used in a cam action to be explained later. Note the narrow, flat top surface of connector. Its function is to raise the forward end of sear until cammed out from under the latter.

i. Place the connector on the connector pin and set change lever to safe, pull the trigger and note that the connector is not raised for the obvious reason that the trigger itself cannot be raised because the change lever bar is in its way.

j. Turn change lever to automatic position, pull the trigger, and note that the head of the connector is raised and held in a vertical position and cannot be tipped forward. The tongue on the change lever engages the toe of the connector as the trigger is pulled and holds the connector upright.

k. Turn the change lever to single shot position, pull the trigger, and note that the tongue on the change lever does not now engage the toe of the connector and that the head of the connector can now be tipped forward.

l. Observe now the cross pin on the sear carrier called the connector stop, also that just in rear of the connector stop and on the underside of the sear carrier is an inclined surface sloping upward in the metal which joins the two sides of the sear carrier. This surface has a cam action with the above-mentioned surface on the connector.

m. Completely assemble the trigger mechanism.

n. Note that the center leaf of the sear spring presses on the front sloping surface of the connector and tends to press the head of the connector backward. Set change lever on safe and pull trigger. Note the head of connector is not raised above the sear carrier for reasons given previously. Therefore the sear nose is not de-

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pressed, hence the safe position. Change over to the automatic position and pull the trigger; the head of the connector is raised and held in the vertical position, thus depressing the sear nose and holding it in this position which obviously gives automatic fire as long as there are cartridges in the magazine. The tongue on change lever tends to hold connector vertically and the ramp on sear carrier tends to cam connector forward. The forces exerted by these two parts on connector are opposed; hence trigger mechanism is locked when trigger has been pulled enough to release slide.

o. Set change lever for single shot; pull trigger slowly. Note that at first the head of the connector rises and thereby depresses the sear nose, which allows the slide to go forward. If the squeeze of the trigger is continued, the previously mentioned cam surface on the connector comes in contact with the cam surface of the sear carrier and the head of the connector is cammed forward against the pressure of the center leaf of the sear spring. The connector disengages the front arm of the sear and the two outside leaves of the sear spring depress it, and the sear nose is thereby raised up in the path of the slide and engages the sear notch when the slide moves back, thus allowing only one shot to be fired. When the trigger is released, the center of leaf of the sear spring presses the head of the connector downward and back under the forward end of the sear so that when the trigger is pulled again the action is repeated and a single shot is fired.

p. In the semiautomatic position, the connector stop prevents the head of the connector being tipped so far forward that the sear spring cannot push it back in place when the trigger is released. The only function of the change lever in the semiautomatic position is the limiting of the upward travel of the trigger when its upper rear shoulders strike the top of the slot in the change lever, which in this position is turned down.

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SECTION V

PARTIAL DISASSEMBLING AND ASSEMBLING

	Paragraph
Sequence and method of disassembling	13
Detailed explanation of disassembling	14
Sequence and method of assembling	15
Detailed explanation of assembling	16
Disassembling and assembling trigger mechanism	17
Disassembling and assembling magazine	18
To remove firing pin without disassembling	19
To remove extractor without disassembling	20

13. Sequence and method of disassembling.—Steps in disassembling will be taken in the following sequence:

a. Remove bipod.
b. Cock the piece.
c. Remove gas cylinder tube retaining pin.
d. Remove gas cylinder tube and forearm (let mechanism easily forward).
e. Remove trigger guard retaining pin.
f. Remove trigger guard.
g. Remove recoil spring guide and recoil spring.
h. Push hammer pin through hammer pinhole in receiver.
i. Remove operating handle.
j. Remove hammer pin.
k. Remove hammer.
l. Remove slide.
m. Push bolt guide out.
n. Remove bolt, bolt lock, and bolt link.
o. Remove bolt link pin and bolt link.
p. Remove firing pin.
q. Remove extractor and spring.

14. Detailed explanation of disassembling.—Remove bipod by unscrewing the four bipod body screws. Lay the rifle on a bench, barrel down, pointing to the left. Cock the piece. This must be done in order that the gas cylinder tube may clear the gas piston and gas cylinder tube bracket. Turn the gas cylinder tube retaining pin spring 90° in a clockwise direction and lift out gas cylinder tube retaining pin. Remove gas cylinder tube and forearm. Let the slide forward *very easily* in order to release the tension of the recoil spring and avoid any damage to the rifle. Care must be taken during disassembling and assembling to avoid working against tension of any springs. Turn the trigger guard retaining pin spring 90° in a clock-

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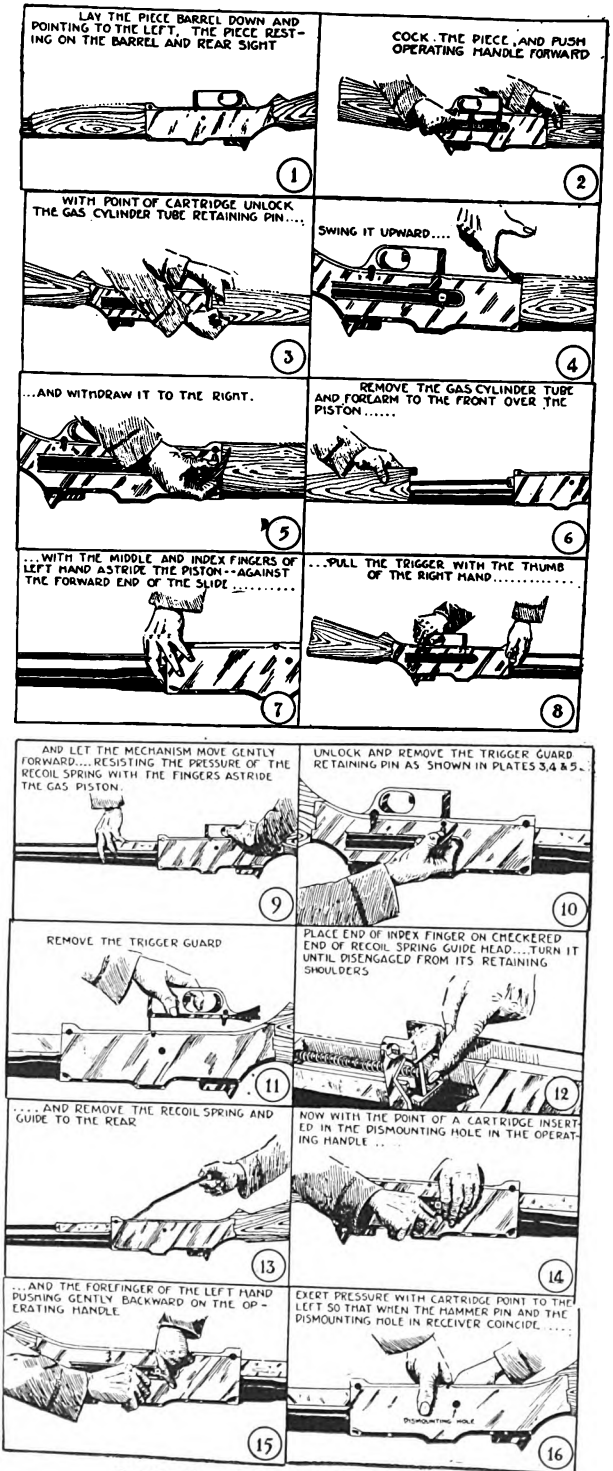


FIGURE 9.—Method of disassembling.

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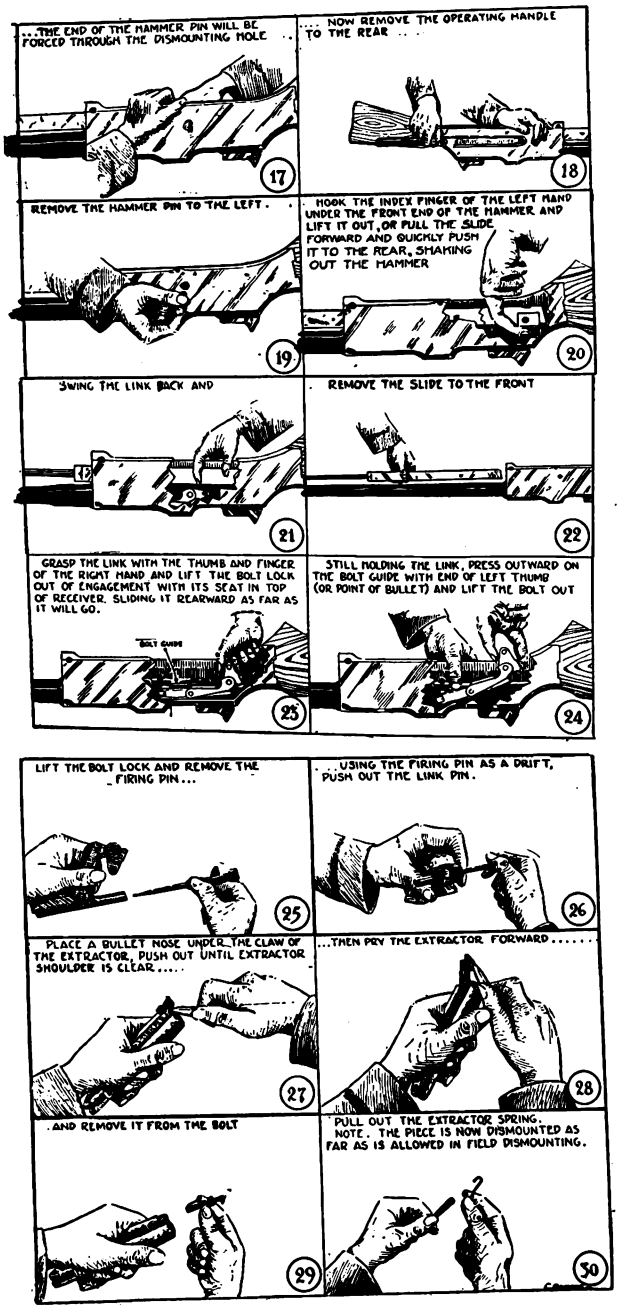


FIGURE 9 (Continued)

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wise direction and lift out pin. Lift out the trigger guard group. Remove the recoil spring guide by pressing the right index finger on the checkered surface of its head and turning it until the ends are clear of the retaining shoulders. This may also be done by using the index finger of the left hand and the middle finger of the right hand. Line up the hammer pinholes on the receiver and the operating handle by inserting the point of the recoil spring guide or dummy cartridge in the hole on the operating handle with the right hand, press against the hammer pin, and push the slide backward with the left hand. The recoil spring guide will push the hammer pin through its hole in the receiver as the hammer pin registers with the latter. Remove the operating handle by pulling straight to the rear. Push the hammer forward out of its seat in the slide and lift out of the receiver. Remove the slide by pulling forward out of the receiver, being careful that the bolt link is pushed well down, thus allowing the slide to clear. In removing the slide, take care to avoid striking the gas piston or rings against the gas cylinder tube bracket. Force the bolt guide out with the left thumb or point of bullet. Lift out the bolt, bolt lock, and bolt link by pulling slowly to the rear end of receiver and up. Pull out the firing pin from its way in the bolt. Using firing pin as drift, push out bolt link pin and remove bolt link. Remove the extractor by pressing the small end of a dummy cartridge against the claw and exerting pressure upward and to the front.

15. Sequence and method of assembling.

a. Extractor and spring.
b. Firing pin.
c. Bolt link and bolt link pin.
d. Bolt, bolt lock, and bolt link.
e. Slide.
f. Hammer.
g. Hammer pin (far enough to register all holes).
h. Operating handle.
i. Hammer pin fully seated.
j. Recoil spring and guide.
k. Trigger guard.
l. Trigger guard retaining pin.
m. Cock the piece.
n. Gas cylinder tube.
o. Gas cylinder tube retaining pin.
p. Let slide forward easily.
q. Bipod.

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16. Detailed explanation of assembling.—Replace extractor spring. Replace extractor into its seat in the bolt. Replace the bolt link and bolt link pin with the shoulder of the link against the flat surface of the bolt lock. Lift the bolt lock and replace the firing pin. Lay the piece, barrel down and pointing to the left, so that the piece is resting on the barrel and rear sight. With the bolt mechanism held in a perpendicular position, insert it in the receiver, forcing the end of the bolt under the ends of the bolt supports, then press the bolt mechanism down so it lies flat in its place. Push the bolt mechanism forward, swing the bolt link down, then replace the slide and push it all the way back. With the hammer resting between the thumb and the forefinger, lower and seat it properly in the receiver and push the slide forward. With the thumb and forefinger of the right hand, aline the hammer pinholes of the bolt link, hammer, and slide with the hammer pinhole in the side of the receiver. Insert hammer pin to the right until only ¼ inch of the hammer pin protrudes from the receiver. Replace the operating handle. Tap the end of the protruding hammer pin with sufficient force to drive it home. Replace recoil spring and guide. With the end of the index finger on the checkered end of the recoil spring guide head, turn it until it is properly seated. Replace the trigger guard and the trigger guard retaining pin. Cock the piece. Slide the gas cylinder tube and forearm to the rear of the gas piston. Replace the gas cylinder tube retaining pin. Replace bipod.

17. Disassembling and assembling trigger mechanism.—*a. Sequence of disassembling.*

(1) Ejector.
(2) Magazine catch spring.
(3) Magazine catch pin.
(4) Magazine catch.
(5) Magazine release.
(6) Sear spring.
(7) Trigger pin.
(8) Trigger and connector.
(9) Sear pin.
(10) Sear.
(11) Sear carrier and counterrecoil spring.
(12) Change lever spring.
(13) Change lever.

b. Complete disassembling.—Depress the ejector lock with the point of a dummy cartridge. Hold the thumb in front of the magazine catch spring to prevent it flying out and slide the ejector out

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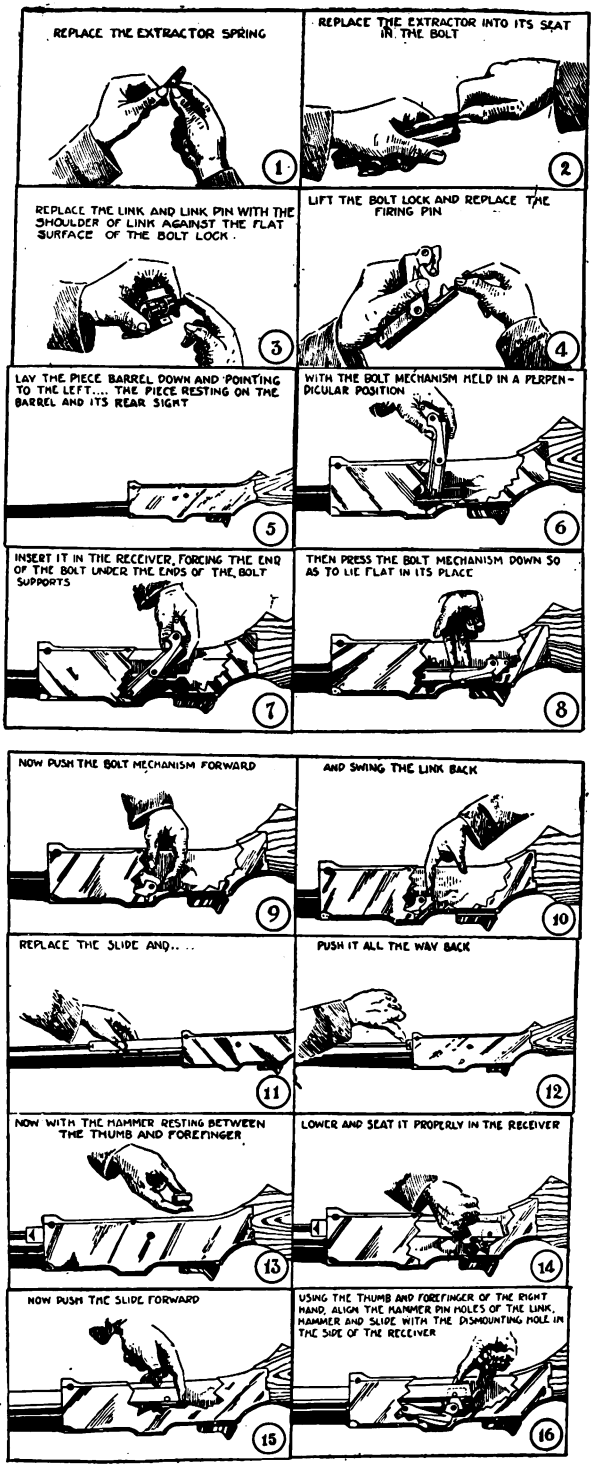


FIGURE 10.—Method of assembling.

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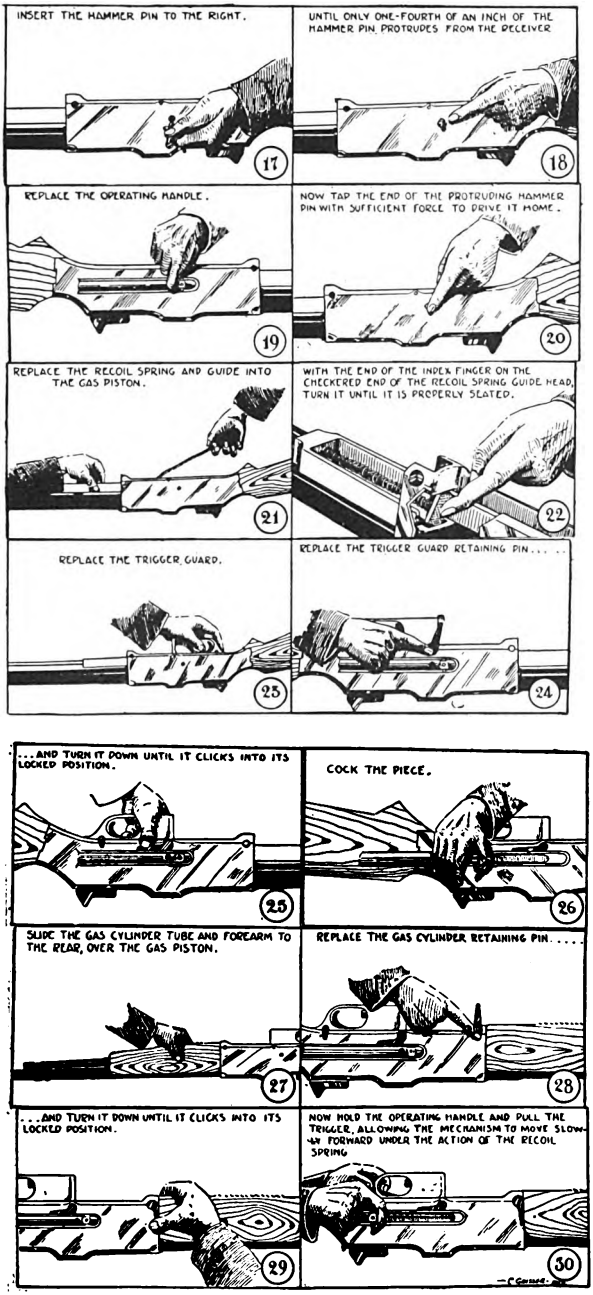


FIGURE 10 (Continued)

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of its seat (fig. 11). Remove the magazine catch spring. Remove the magazine catch pin then the magazine catch (fig. 12) and the

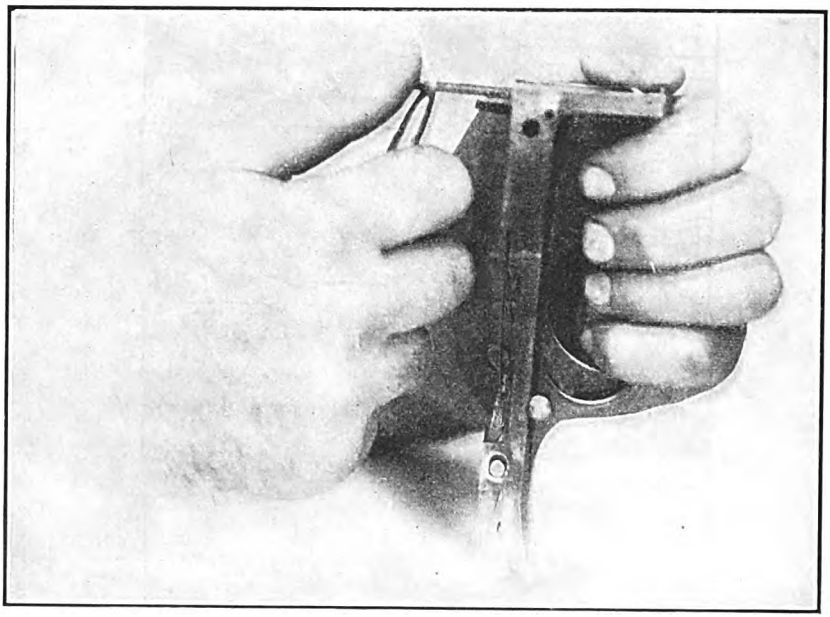


FIGURE 11.—Removing ejector.

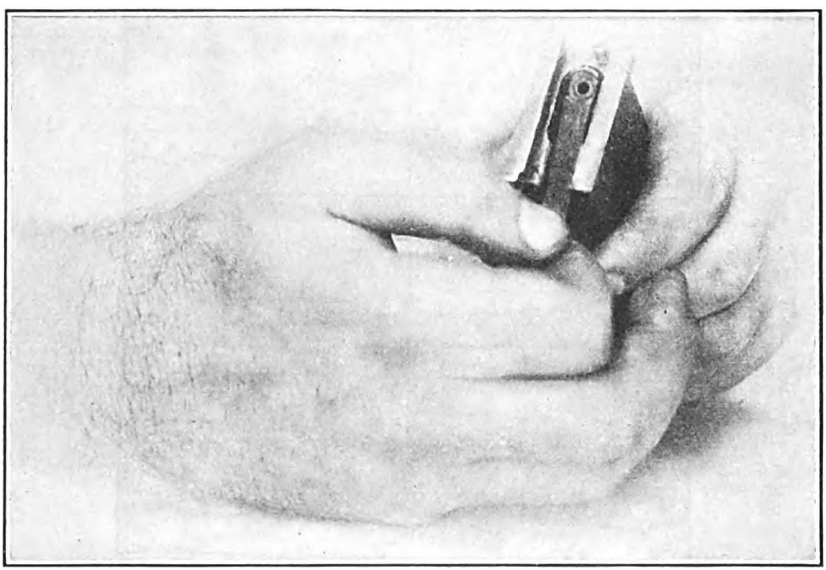


FIGURE 12.—Removing magazine catch.

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magazine release may be lifted out (fig. 13). To remove the sear spring, insert the trigger guard retaining pin spring under the sear

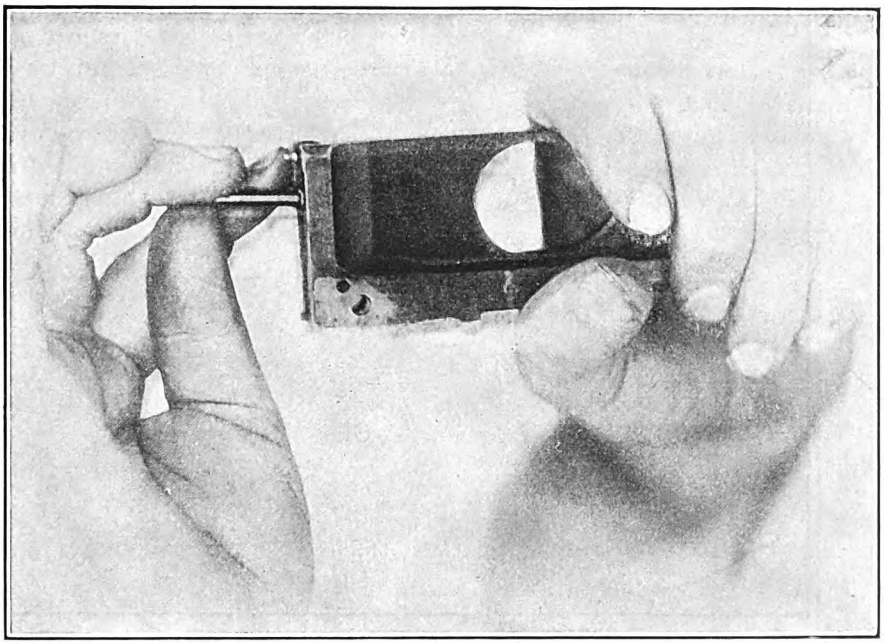


FIGURE 13.—Removing magazine release.

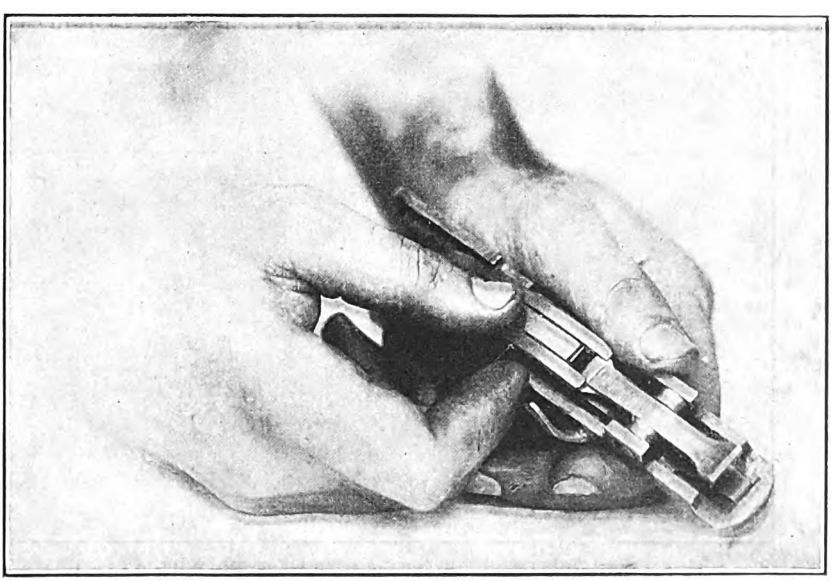


FIGURE 14.—Removing sear spring.

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spring above the connector stop. Pry up, pressing against sear spring with thumb and pulling it out to the rear (fig. 14). Push

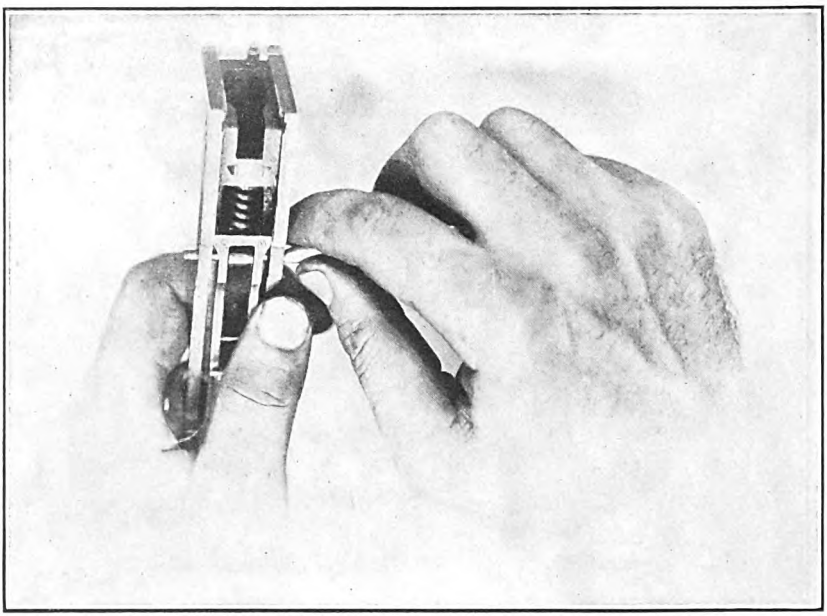


FIGURE 15.—Removing trigger pin.

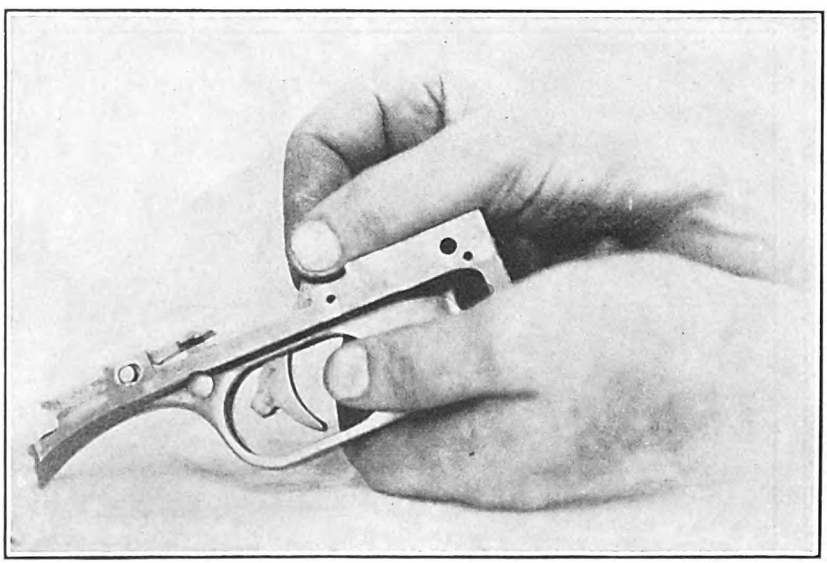


FIGURE 16.—Removing trigger and connector.

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out the trigger pin (fig. 15) and then the trigger and connector may be removed through top of trigger guard (fig. 16). Push out sear pin with recoil spring guide. Remove sear (fig. 17). Pry up on sear carrier (fig. 18) and lift out. Remove the change lever spring by prying the bent end out of its seat with the rounded end of the sear spring and moving the change lever from front to rear. When clear of the change lever, push it out the rest of the way by pressing with the thumb against the sear stop. Pull out the change lever.

c. Detailed assembling.—Assembling is in reverse order of disassembling. The following points should be observed in assembling:

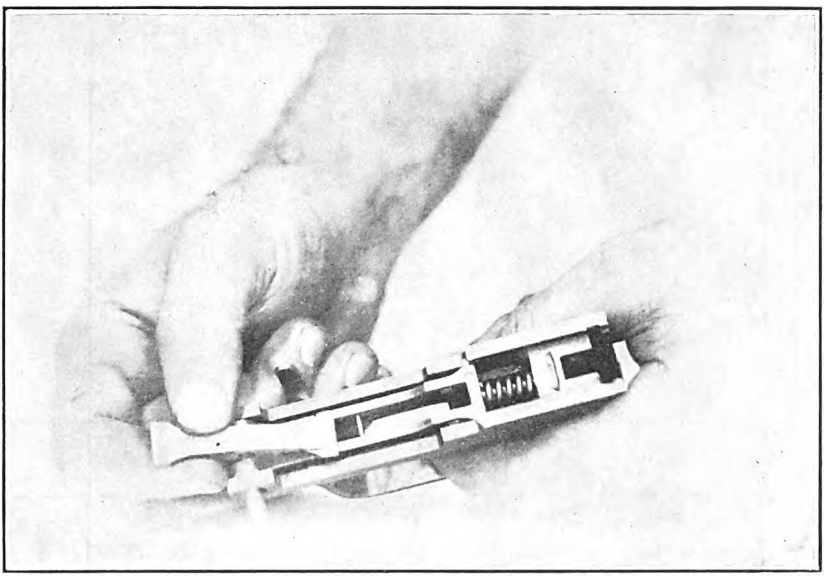


FIGURE 17.—Removing sear.

(1) It is easy to seat the magazine catch spring if the ejector is moved down until it is flush with the magazine catch spring before attempting to compress the latter (fig. 19).

(2) In assembling the change lever spring, first insert the ears in the slots in the trigger guard and push spring forward a slight distance, then insert the rounded end of the sear spring between the rear end of the trigger guard and the change lever spring. By prying up with the sear spring and at the same time pressing forward against the sear stop, and rotating the change lever from the rear to front, the change lever spring is easily seated. Assemble sear carrier and counterrecoil spring to trigger mechanism by inserting the counterrecoil guide (front of sear carrier) in the seat. Then, using the recoil

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spring guide as a lever in the sear pinhole, pry the sear carrier forward until its rear end is held by the ears of the change lever spring. Insert the sear and force the recoil spring guide through so as to register the holes in the sear, sear carrier, and trigger guard for the sear pin. By a slight pressure on the recoil spring guide, push the

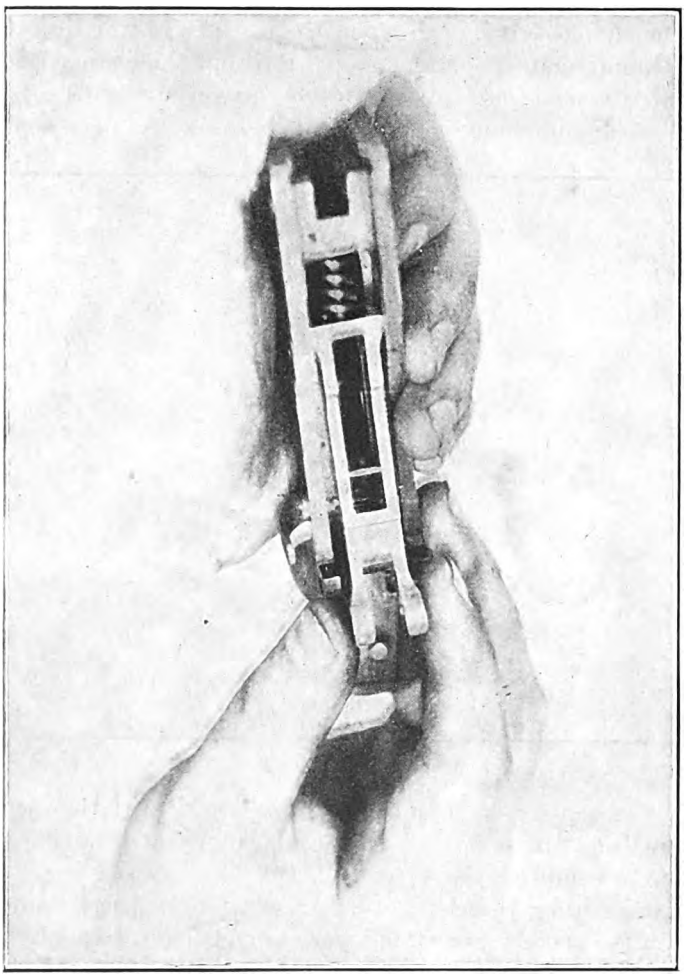


FIGURE 18.—Removing sear carrier.

sear carrier forward against the counterrecoil spring, thus permitting the sear pin to be easily seated in the sear pinhole. The trigger pin must always be removed before the sear pin and the sear pin replaced before the trigger pin, in order that the tension of the counterrecoil spring will always be on the sear pin.

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(3) In assembling the connector, note that its head is in rear of the connector stop (fig. 20) and the toe of the connector is down and

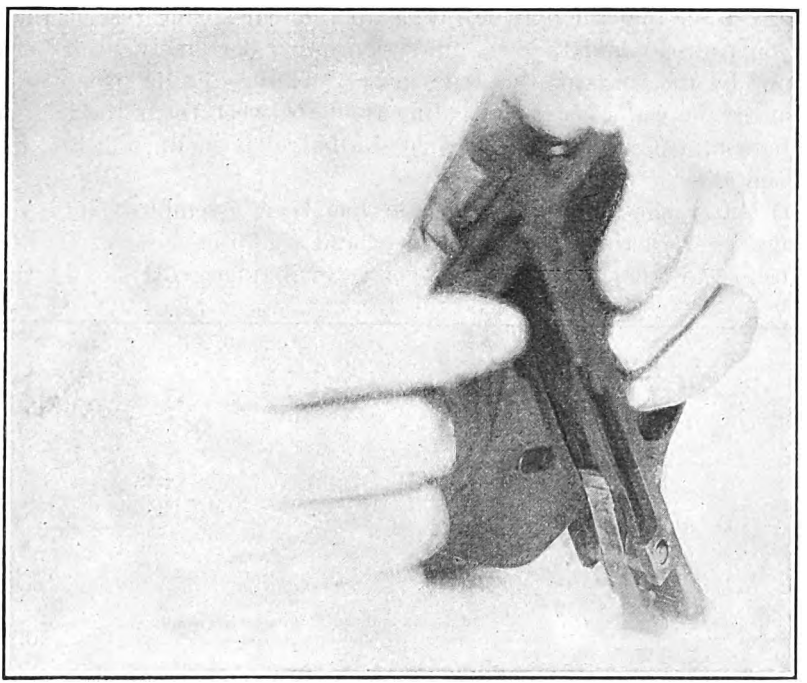


FIGURE 19.—Assembling magazine catch spring.

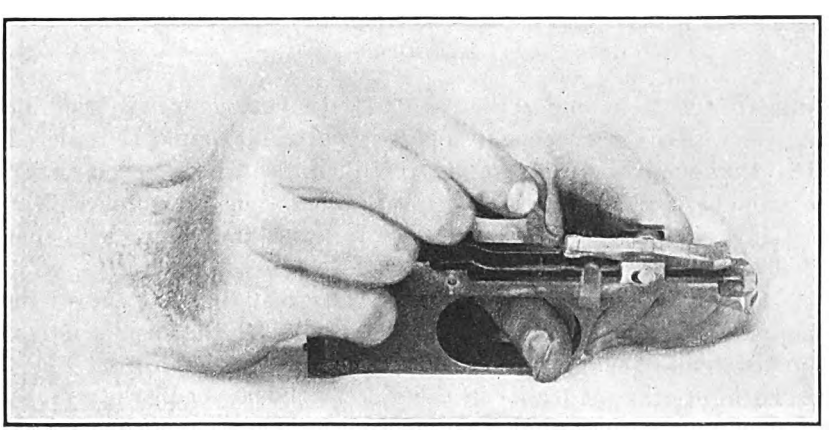


FIGURE 20.—Assembling connector.

to the rear. The connector will ordinarily drop into place resting on the connector pin in the trigger.

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(4) To replace sear spring, press down and forward with the thumb of the right hand, engaging sides of the spring, in the recesses, until front end of spring rests in depression stop (fig. 21). Be especially careful to see that the outside prongs of the sear spring rest on their seat on the sear and that the middle prong rides freely in the slot formed by the walls of the sear carrier. If the middle prong rests on one of the walls instead of riding freely between them, the trigger mechanism will not function when the barrel is inclined below the horizontal.

(5) After the trigger mechanism has been assembled, turn the change lever to the forward position and pull the trigger. If the connector will not rise, it is not correctly in place. It should rise

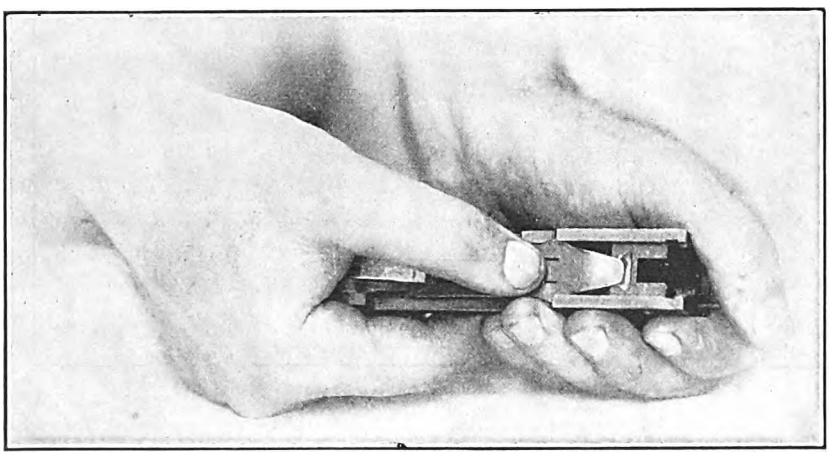


FIGURE 21.—Assembling sear spring.

and snap out from under the sear. If the connector will rise but does not raise the sear, the sear spring is weak and should be replaced.

18. Disassembling and assembling magazine.—*a.* To remove magazine base, raise the rear end until indentations thereon are clear, then slide to the rear. The magazine follower and spring will then fall out.

b. It is assembled in reverse order. Note that the bent end of the follower and the eye of the spring work against the inside of rear (notched) end of magazine. (See figs. 22, 23, 24, and 25.)

c. To insert the magazine in the rifle, withdraw the empty magazine after pressing the magazine release. Hold the magazine (loaded) with the base in the palm of the right hand, cartridges pointing to the front. Insert the magazine between the sides of the receiver in front of the trigger guard and push it home with the right hand.

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The magazine may be inserted with the mechanism in either the cocked or forward position. It is, however, ordinarily inserted after the rifle has been cocked.

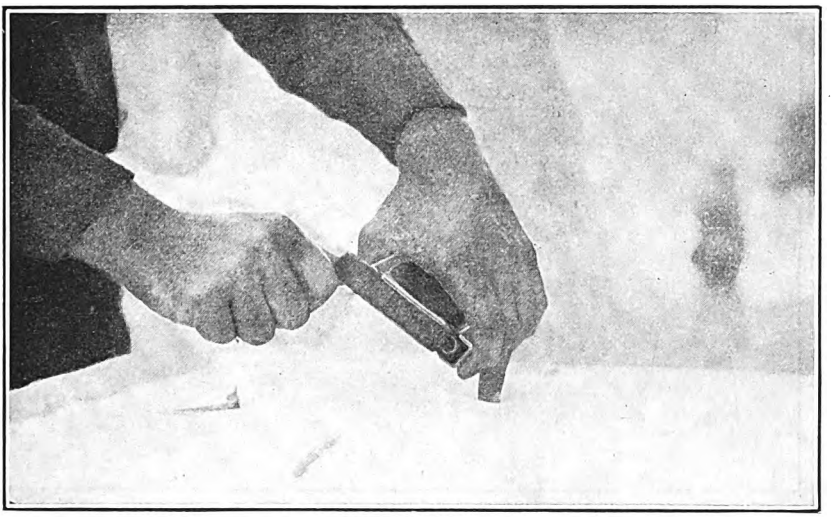


FIGURE 22.—Disassembling magazine, first operation. (With point of a cartridge raise rear end of magazine base until indentations are clear to permit withdrawal. Then slide the base to the rear.)

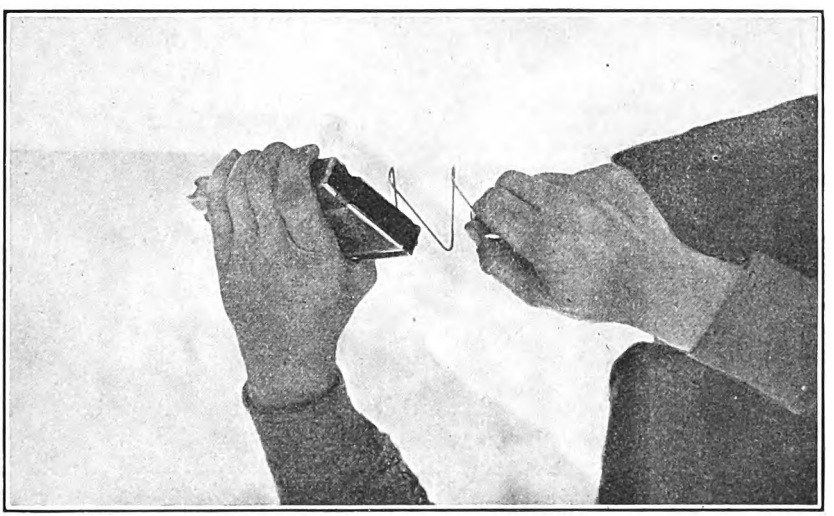


FIGURE 23.—Disassembling magazine, second operation. (Pull out magazine spring and shake out the follower.)

19. To remove firing pin without disassembling.—Lay the rifle on the table, barrel down, muzzle to the front. Remove trigger

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mechanism. Place rim of cartridge under bolt guide (fig. 26 A). Pull operating handle to rear and hold mechanism back. Steady the cartridge with the thumb and forefinger of the right hand (fig.

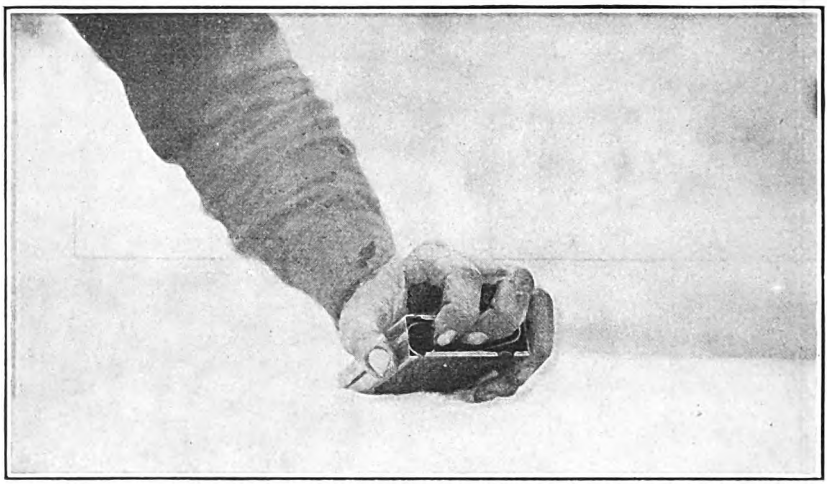


FIGURE 24.—Assembling magazine, first operation. (Insert follower and magazine spring, then compress magazine spring into position.)



FIGURE 25.—Assembling magazine, second operation. (With the left hand hold the magazine spring in position. Slide the magazine base fully home.)

26 B). It may be necessary to exert a slight downward pressure on the nose of the cartridge in order to pull the bolt guide out far enough to free the bolt. Push down on bolt link, causing bolt to

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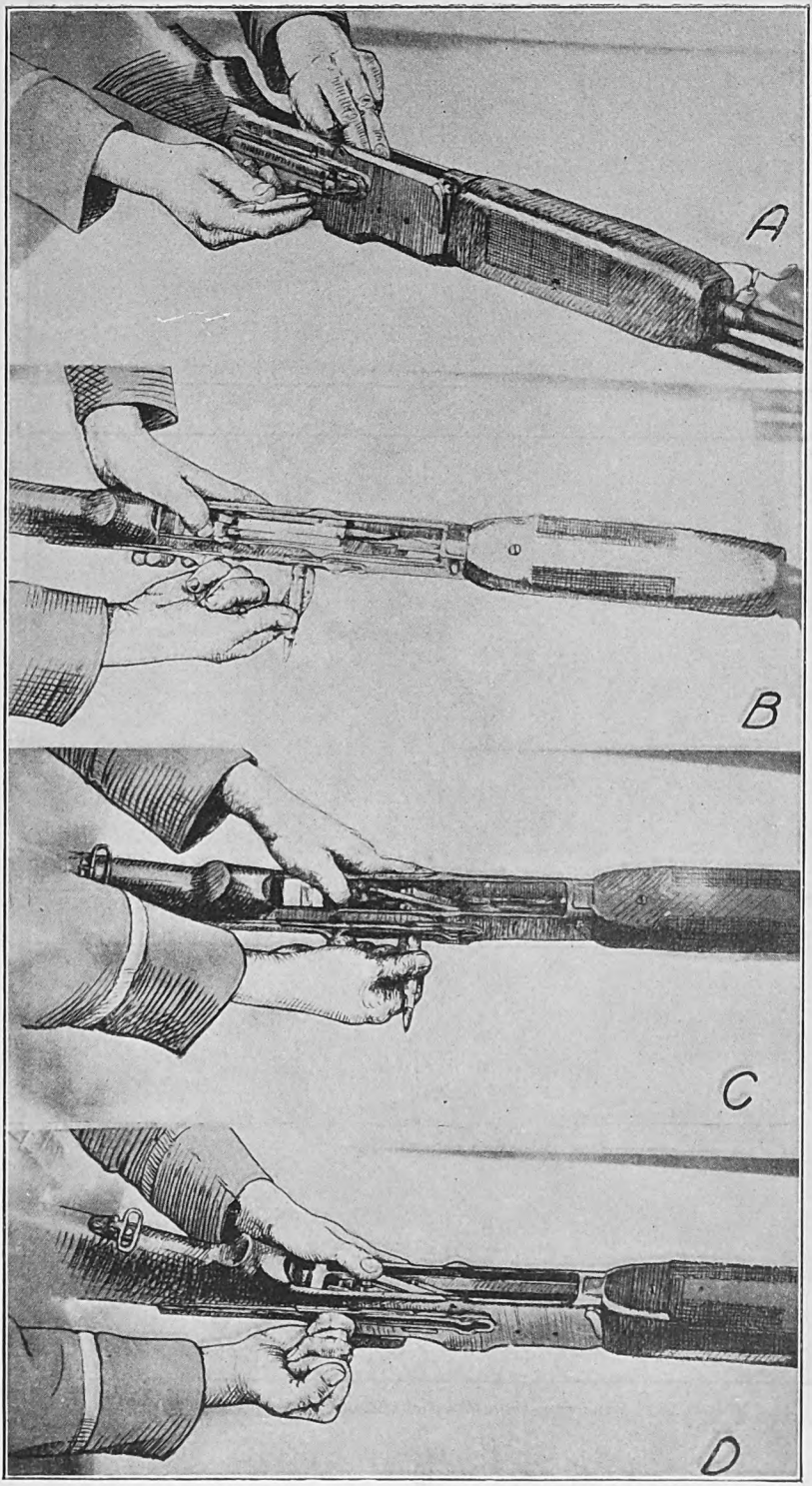


FIGURE 26.—Removing firing pin without disassembling the rifle.

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break at bolt lock pin (fig. 26 C). Allow mechanism to go forward until it stops. Replace firing pin. Then pull operating handle to rear again and push bolt into position (fig. 26 D).

20. To remove extractor without disassembling.—Draw back mechanism and insert empty cartridge case between bolt and chamber exposing the extractor (fig. 27 ①). With the forefinger of the left hand, force out the claw of the extractor then place point of cartridge behind the extractor shoulder and pry forward until extractor is free of recess (fig. 27②). Remove extractor spring. To assemble extractor, insert short end of extractor spring in hole in the shank of extractor, having the long end of spring along the slot in the extractor. Insert extractor and spring in end of bolt and push into position (fig. 27 ③).

SECTION VI

COMPLETE DISASSEMBLING AND ASSEMBLING

(Not done in field)

	Paragraph
Forearm group	21
Barrel group	22
Butt stock and buffer group	23
Rear sight group	24
Receiver group	25

21. Forearm group.—*a.* To disassemble the forearm group, unscrew the forearm screws, long and short, and remove the wood forearm from the gas cylinder tube. The forearm escutcheon should never be removed from the forearm. Unscrew the bracket swivel screw which allows the removal of the bracket swivel. Spring the front swivel bracket off over the gas cylinder tube.

b. Before removing the gas cylinder, note its setting carefully so that it may be reassembled to the same position. Then force out the gas cylinder lock until its head clears the notch in the gas cylinder, which may then be unscrewed from the gas cylinder tube. The gas cylinder lock may be completely removed from the cylinder with a suitable drift or by prying under the head with the combination tool.

c. To assemble the forearm group, replace the forearm on the gas cylinder tube and insert the forearm screws, long and short. Spring the front swivel bracket over the gas cylinder tube and replace the bracket swivel, fastening it in place by means of the bracket swivel screw. All screws should be drawn up tight. Screw the gas cylinder in the gas cylinder tube to its proper setting and push in the gas cylinder lock so that its head engages the notch in the gas cylinder.

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The registration of gas port is indicated by the circle marking on the front of the cylinder. When on the small port the smallest circle is toward the barrel, and in this position the cylinder should be about one turn from the shoulder. Unscrew one-third of a turn successively to register the larger ports.

22. Barrel group.—*a.* The barrel should never be removed until replacement is necessary and then only in a shop equipped with a suitable vise having leather vise jaws for holding the barrel and a special wrench and filler block for removing the receiver. The special wrench and the filler block for the Browning automatic rifle are provided for use in ordnance repair shops. Before removing the barrel, remove from the receiver the gas-operating, firing, and trigger mechanism.

b. The components attached to the barrel should never be removed except when replacements are necessary or for purposes of salvaging. Unscrew the flash hider with the combination tool. Drive out the front sight key pin, drive the front sight base off to the front, and remove the front sight key. The gas cylinder tube bracket may then be driven off to the front after the pin has been driven out. These parts should be replaced in the reverse order.

c. When replacing a barrel, always be sure that it is tight enough in the receiver never to work loose. Screw the barrel into the receiver until the draw line matches that of the receiver. Then assemble the gas cylinder tube to see if the gas cylinder tube bracket on the barrel lines up properly. If it does not, the barrel should be turned very slightly until the alinement is correct.

23. Butt stock and buffer group.—*a.* The butt stock bolt may be unscrewed by inserting a long screw driver through the hole in inner butt plate body after the outer butt plate body has been raised and the butt plate trap has been opened. To remove the bolt with the combination tool, the butt plate assembly must first be removed by unscrewing the butt plate screws. As soon as the butt stock bolt has been loosened, the butt stock may be withdrawn to the rear. To disassemble the butt plate assembly, unscrew setscrew and remove lock spring and steel ball. The outer butt plate body must not be removed unless necessary for replacement as the hinge pin is staked in place. Unscrew and remove the butt plate trap spring screw and spring. Then drive out the butt plate trap axis pin and remove the butt plate trap.

b. The removal of the butt stock allows the disassembling of the buffer mechanism. Unscrew the buffer nut and remove to the rear in the order mentioned, the buffer spring, the four sets of buffer

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friction cups and cones, and the buffer. The buffer tube is threaded into the receiver and should never be removed except for replacement. In order to assemble the butt stock and buffer mechanism, reverse the method given above. Special attention should be given

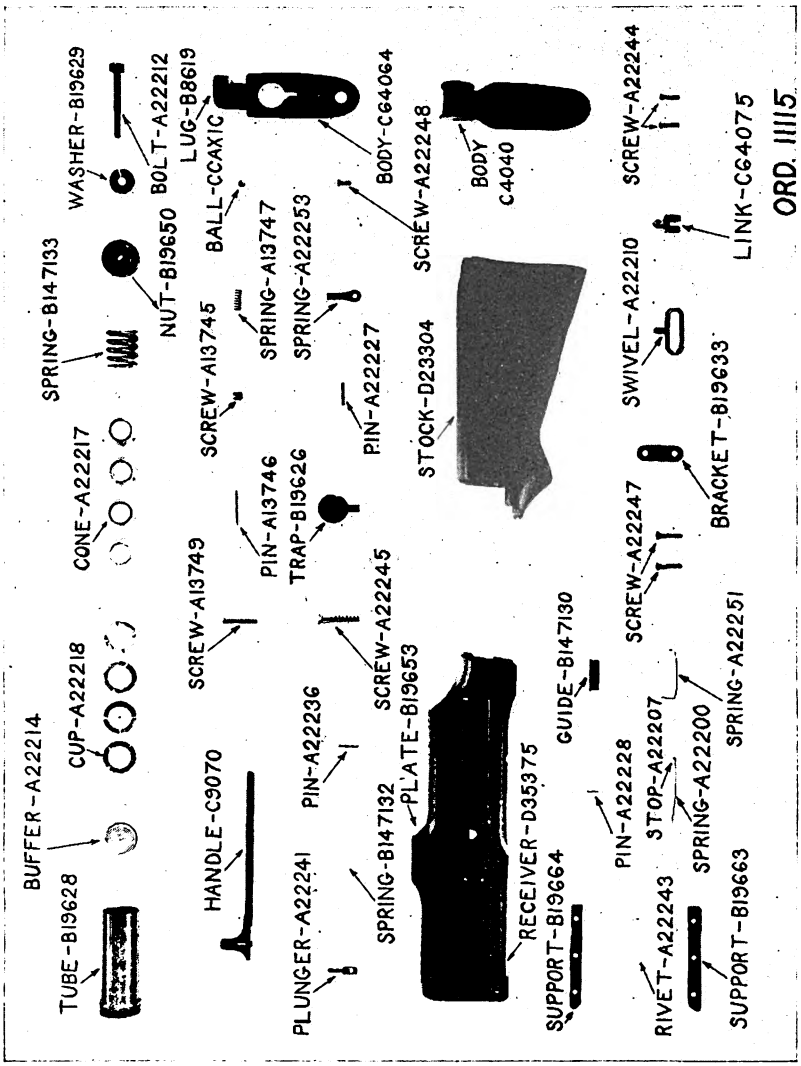


FIGURE 29.—Browning automatic rifle, caliber .30, M1918A1 (receiver and butt stock group parts).

to see that the buffer spring is always assembled behind the buffer friction cups and cones. There being no adjustment of the buffer mechanism, the buffer nut should always be screwed up tight when assembling.

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24. **Rear sight group.**—The rear sight is to be removed or disassembled only when a replacement of a certain part or parts is neces-

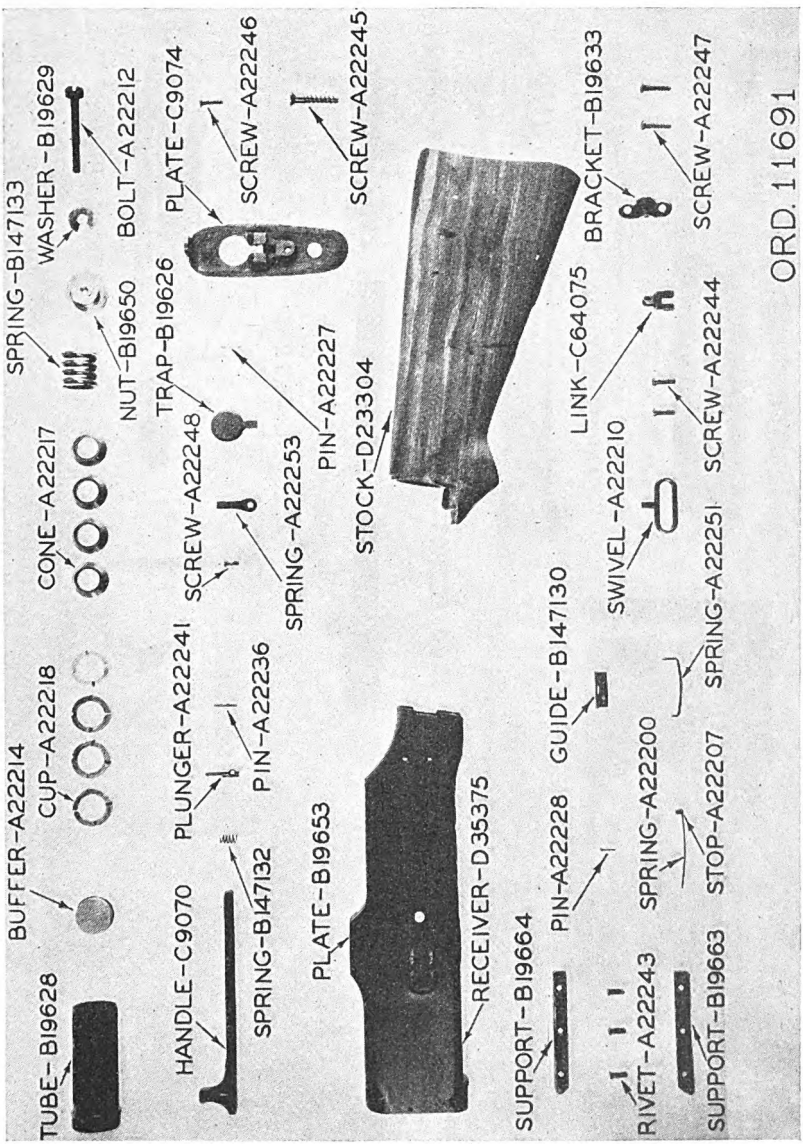


FIGURE 30.—Browning automatic rifle, caliber .30, M1918 (receiver and butt stock group parts).

sary. Remove the rear sight base spring screw and drive the rear sight base out to the rear. Unscrew the rear sight axis screw and nut and take out the rear sight leaf. The rear sight base spring may

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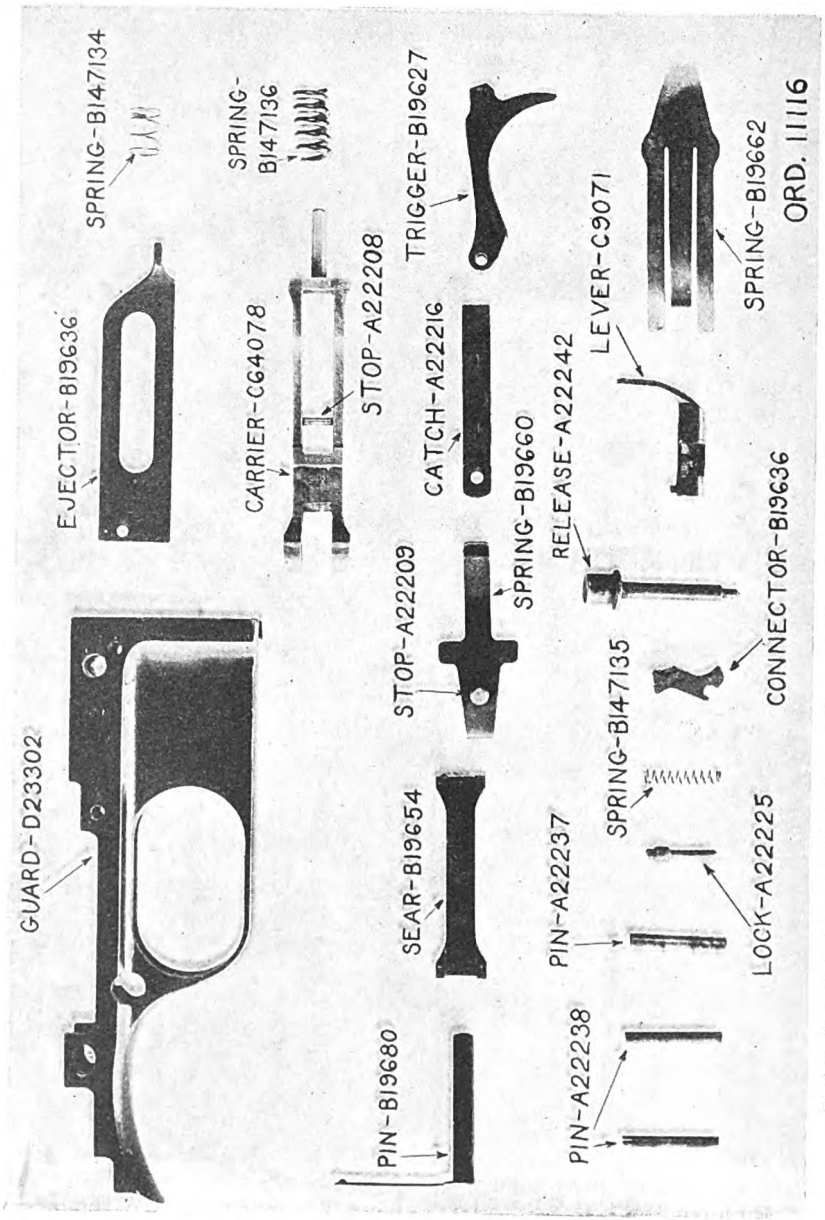


FIGURE 31.—Browning automatic rifle, caliber .30, M1918 and M1918A1 (trigger guard group parts).

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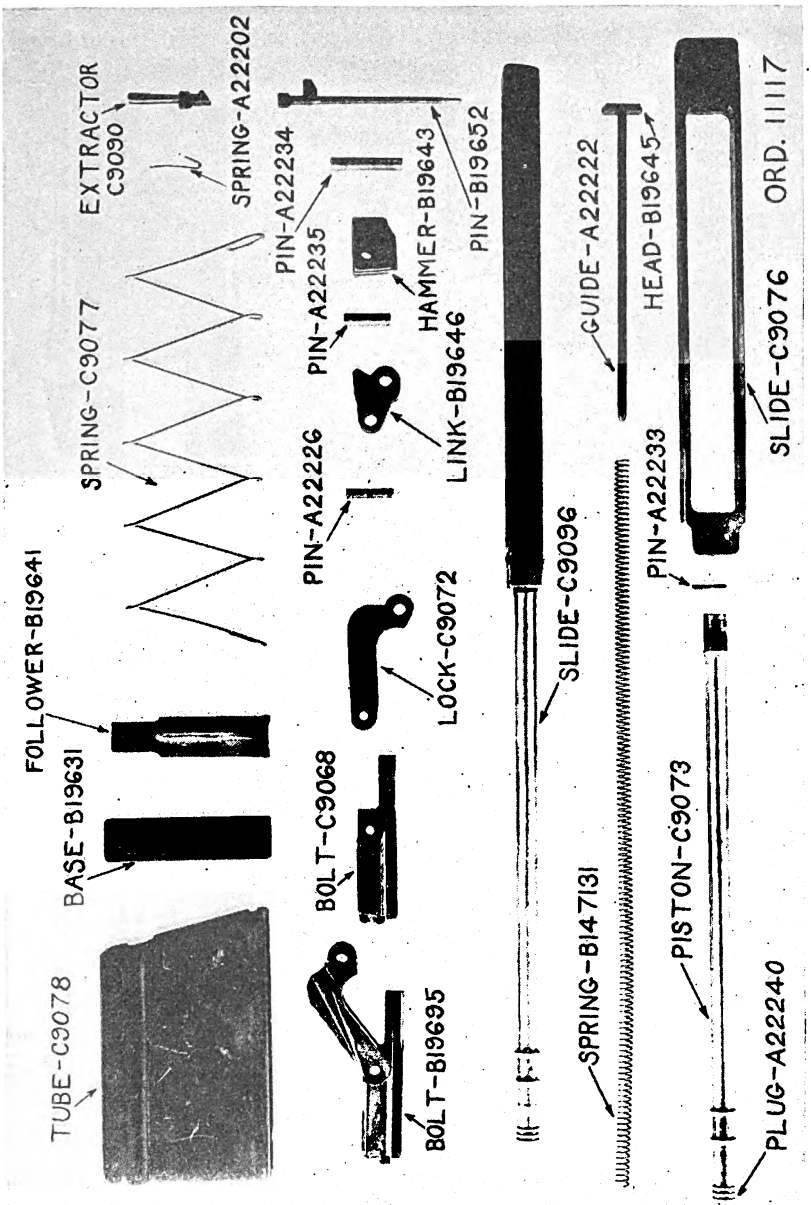


FIGURE 32.—Browning automatic rifle, caliber .30, M1918 and M1918A1 (gas piston and bolt group parts).

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then be removed from the base. Unscrew the rear sight slide stop screw which will allow the slide to be withdrawn from the leaf.

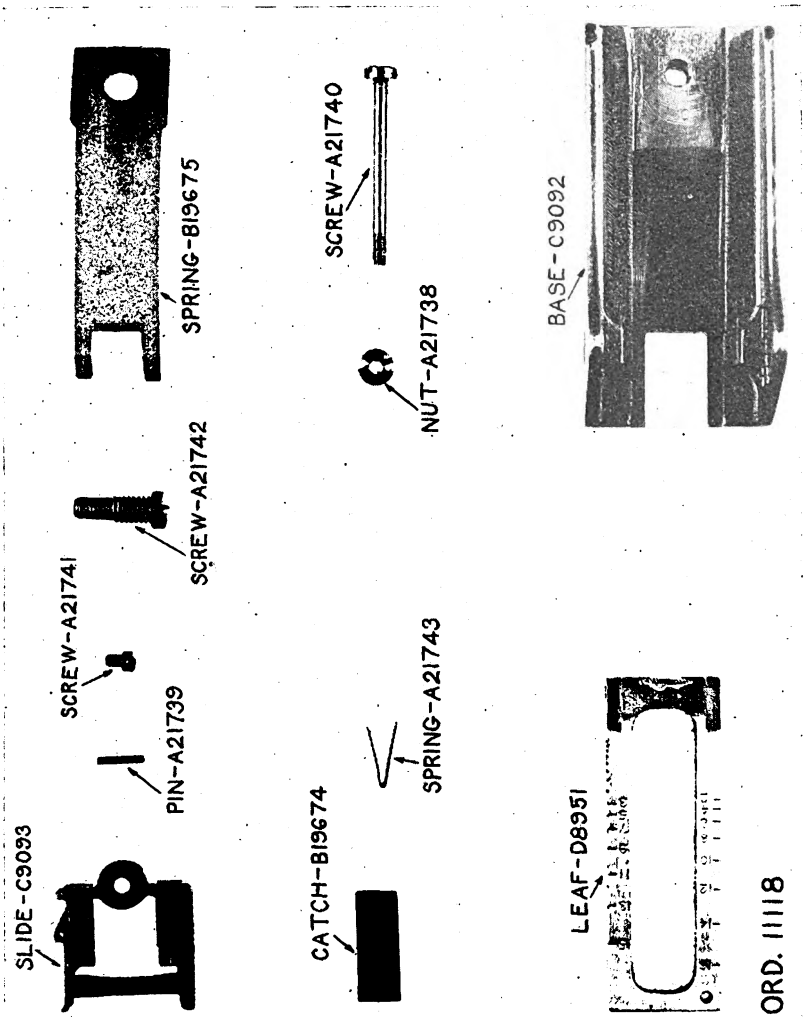


FIGURE 33.—Browning automatic rifle, caliber .30, M1918 and M1918A1 (rear sight group parts).

With a small drift, drive out the rear sight slide catch axis pin and take off the rear sight slide catch and spring. To reassemble the above components, reverse the order given for disassembling.

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25. Receiver group.—*a.* To disassemble the operating handle, press in on the operating handle plunger and push out the operating handle plunger pin toward the countersunk side of the plunger. The plunger and spring may then be removed. Reverse the above method in reassembling.

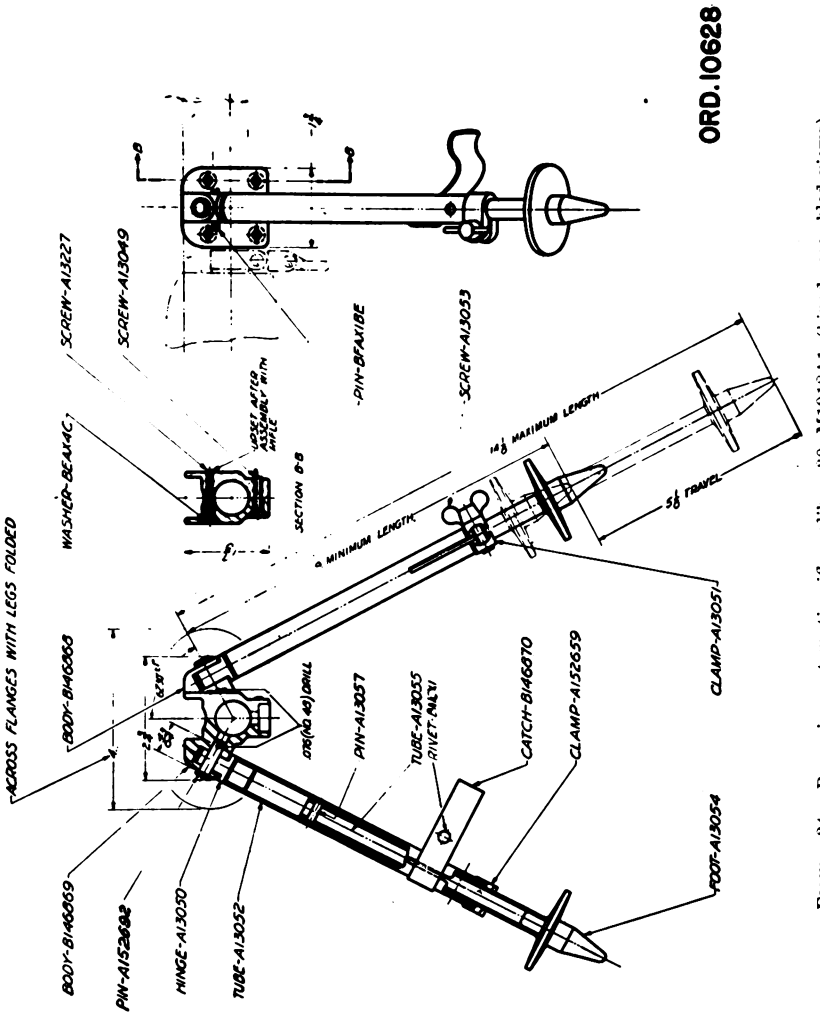


Figure 34.—Browning automatic rifle, caliber .30, M1918A1 (bipod assembled views).

b. The bolt guide spring may be lifted out of its seat in the bolt guide with the rim of a cartridge. The guide and spring may then be removed from the receiver. To reassemble these parts, insert the longer turned-over end of the bolt guide spring in its hole on the inside of the receiver. Then replace the bolt guide and hold it

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while the spring is pushed over until the shorter turned-over end engages the groove in the bolt guide. The change lever stop and spring may be removed after the change lever stop spring pin has been driven out. This should never be done except when necessary.

SECTION VII

CARE AND PRESERVATION

	Paragraph
Power developed in automatic rifle	26
General care	27
Cleaning and cleaning materials	28
Preparation of rifles for long-term storage	29
Cleaning of rifles as received from long-term storage	30
Lubrication and lubricants	31
Preserving rifles after rust-preventive compound has been removed	32
Points to be observed before, during, and after firing	33
Protection of rifles against gas	34

26. Power developed in automatic rifle.—An automatic rifle of the Browning type has approximately one-half pound of weight per horsepower developed. The great amount of work required of the weapon would necessarily indicate the necessity for careful care and manipulation of this type of gun. The following points should be carefully observed and adhered to in order to secure the continued successful mechanical operation of the Browning automatic rifle or any other similar type of automatic weapon.

27. General care.—The importance of a thorough knowledge of how to care for and clean the automatic rifle cannot be overemphasized. The kind of attention given to a weapon of this type determines largely whether or not it will shoot accurately and function successfully when needed. The automatic rifle is not only a firearm for the accurate projection of bullets to considerable range, but is also a gas engine. The bore and chamber must be kept in perfect condition for accurate shooting. Also it is just as important that the gas system and operating mechanism be kept in perfect condition for efficient functioning. The first step in cleaning an automatic rifle is to disassemble it as explained in paragraph 14, and in addition remove the gas cylinder from the gas cylinder tube. It should be noted that the action of primer and powder fouling extends to all parts with which the gas comes in contact, that is, the bore, chamber, piston, gas cylinder, gas cylinder tube, and the included gas ports.

28. Cleaning and cleaning materials.—*a. Cleaning the bore.*—As the receiver of the automatic rifle is of such construction that

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the bore cannot be cleaned from the breech, it is necessary to clean it from the muzzle. Care should be taken that the cleaning rod does not rub or wear the muzzle. It is not necessary or desirable to plug the gas port. Using a cleaning rod having a slotted end, swab the bore thoroughly with three or four cut flannel patches saturated with hot water and issue soap, sal soda solution, hot water alone, or in the absence of these, cold water. While the bore is wet, a brass or bronze wire brush, if available, should be run all the way through the bore and back three or four times. The bore should then again be swabbed with several cut flannel patches wet as above. Then wipe the cleaning rod dry and, using dry, clean flannel patches, thoroughly swab the bore until it is perfectly dry and clean. Finally wipe the cleaning rod dry, saturate a clean flannel patch in sperm oil (Spec. U. S. A. 2–45A) or its substitutes dependent on climatic conditions as outlined in paragraphs 31 and 32, and swab the bore and chamber with the patch, finally drawing the patch smoothly through the bore and out of the muzzle, allowing the cleaning rod to turn with the rifling. Complete instructions for cleaning the bore and materials for use therewith are given in TR 1395–A.

b. Cleaning the chamber.—During the firing, a certain amount of oil and dirt accumulates in the chamber where the heat forms it into a hard coating akin to carbon on the walls of the chamber. This coating is easily removed with the chamber-cleaning brush while the chamber is hot, but is difficult to remove after it hardens upon cooling. If not removed, cartridges stick in the chamber, resulting in failure to extract. The rifleman should be trained to use the cleaning brush immediately upon cessation of firing, even if this cessation is only for a few minutes. The cleaning brush is introduced through the ejection opening in the receiver and should be used vigorously. Upon completion of firing, the brush having been used, the chamber is further cleaned in the process of cleaning the bore, care being taken that water does not remain in the chamber, that the chamber is wiped dry with a patch wrapped around the forward portion of the cleaning brush, and finally lightly oiled in the same manner.

c. Cleaning the gas system.—The gas system consists of the gas cylinder, gas cylinder tube, piston, and the included gas ports. All of these are subjected to primer and powder fouling to the same extent as the bore, and also receive carbon deposits from the burning of oil. To clean these parts of powder and primer fouling, wipe and scour them thoroughly with rags or patches wet with soap and hot water or with hot water only, with the aid of the gas cylinder cleaning tool. Then, using dry rags or patches, thoroughly dry the parts. Scrape

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off any carbon deposits remaining with the gas cylinder cleaning tool and wipe clean and dry again. Oil the parts with a thin film of aircraft instrument and machine gun lubricating oil (Spec. U. S. A. 2–27D) applied with a clean rag or patch. Do not use an oilcan or lubricate excessively. This is sufficient lubrication for these parts. Excessive oil produces excessive carbon and dirt that cause friction.

d. Cleaning the breech mechanism.—This refers to the receiver and all parts contained therein. These parts should be wiped with oily rags, then with a clean dry rag so as to render them thoroughly clean and dry. They should then be wiped with a clean rag slightly saturated with aircraft instrument and machine gun lubricating oil (Spec. U. S. A. 2–27D) so as to give each part a thin film of light oil. This is sufficient for perfect lubrication. Excessive oiling, as with an oilcan, is a waste of oil and results in a collection of dirt which causes friction.

e. Cleaning the magazine.—It is imperative that magazines be given the best of care and kept in perfect condition. They should be disassembled, wiped clean and dry, and thinly coated with oil as described for the breech mechanism. Much dirt gets into them through careless handling on the ground during range or other firing. They must be kept free from dirt and rust which hinder their operation by making the spring and follower stick. Care must be exercised in the handling of magazines to avoid denting or bending them. The greatest possible care should be taken to prevent any damage to the lips of the magazine or to the notch for the magazine catch.

f. Cleaning the exterior, forearm, and stock.—Clean, dry, and lightly oil all metal parts. Wipe all dirt out of screwheads and crevices with small brush or matchstick. If the rifle is to be placed in the arms rack after cleaning, avoid touching the oiled metal parts with the hand, as perspiration is a great promoter of rust. The forearm should never be artificially cooled (with water) when hot, nor artificially dried (with excessive heat) when wet. Such artificial means check and crack the wood. Ordinarily the stock and forearm need only to be wiped dry and then wiped with an oily rag. About once a month or oftener, and always after the stock and forearm have become wet with water or perspiration, they should be thoroughly rubbed with a little linseed oil in the palm of the hand. Rub the oil well in until dry. An old toothbrush may be used on the checked portion of the forearm. Care must be exercised at all times to protect the forearm from sudden blows which cause cracks and breaks. Before firing, all oil should be

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removed from the exterior of the barrel in order to prevent smoking when the barrel becomes hot.

g. Cleaning the bipod.—Remove all dirt, sand, and mud by wiping or, if necessary, by washing and drying. Threads and moving parts should be kept lightly oiled but care should be taken to prevent excess oil from getting on the parts as it will cause dirt and sand to collect and prevent proper operation.

29. Preparation of rifles for long-term storage.—The automatic rifles should be cleaned and prepared with particular care. The bore, all parts of the mechanism, and the exterior of the rifles should be thoroughly cleaned and then perfectly dried with rags. In damp climates particular care must be taken to see that the rags are dry. After drying a part, the bare hands should not touch that part. Special care should be taken to insure that the gas system is thoroughly cleaned and that the gas ports are free from fouling. All metal parts should then be heavily coated with rust-preventive compound. Then handling the rifle by the stock and forearm only, it should be placed in the packing chest, the wooden supports at the butt and muzzle having previously been painted with rust-preventive compound. Under no circumstances should a rifle be placed in storage contained in a cloth or other cover, or with a plug in the bore. Such articles collect moisture which causes the weapon to rust.

30. Cleaning of rifles as received from long-term storage.—Rifles received from storage are completely coated with rust-preventive compound. Use dry-cleaning solvent to remove all traces of this compound, particular care being taken that the gas system, gas ports, firing pin, and all recesses in which springs or plungers operate are cleaned thoroughly. After using the dry-cleaning solvent, make sure it is completely removed from all parts by wiping with light-colored cloths until no staining of the cloth occurs. The bore and chamber of the barrel must be thoroughly cleaned. All surfaces having been thoroughly cleaned, they should then be protected with a thin film of lubricating oil applied with a rag.

NOTE.—Failure to clean the gas system, the firing pin, and the recess in the bolt in which it operates, may result in gun failure at normal temperatures and will most certainly result in serious malfunctions if the rifles are operated in low-temperature areas, as rust-preventive compound and other foreign matter will cause the lubricating oil to congeal or frost on the mechanism.

31. Lubrication and lubricants.—*a.* Proper oiling is second in importance only to intelligent cleaning. It is a vital necessity for the working parts but the oil should be used sparingly; wiping with a

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well-oiled rag is the best method. Oil all bearing surfaces of the rifle before firing.

b. If the rifle is to be fired in areas where the temperature is 45° F. or above, sperm oil (Spec. U. S. A. 2–45A) should be used when available. When not available, motor oil, weight 20, or any light-grade machine oil, may be used in an emergency.

c. If the rifle is to be fired in areas where the temperature is below 45° F., aircraft instrument and machine-gun lubricating oil (Spec. U. S. A. 2–27D) should be used.

32. Preserving rifles after rust-preventive compound has been removed.—Sperm oil (Spec. U. S. A. 2–45A) is the most suitable oil for preserving the mechanism when in regular or intermittent use. This oil is satisfactory for preserving the polished surfaces, the bore, and the chamber for a period of from 2 to 6 weeks, dependent on the climatic and storage conditions. Aircraft instrument and machine-gun lubricating oil (Spec. U. S. A. 2–27D) should not be considered as a suitable preservative; however, for rifles fired regularly in cold areas it should be used and application made more often, as the use of sperm oil or other heavy-bodied oils is a material disadvantage, as it is absolutely essential that such oils be removed with cleaning fluid and aircraft instrument and machine-gun lubricating oil applied before an attempt is made to fire the rifle in such areas.

33. Points to be observed before, during, and after firing.—When the automatic rifle is to be fired, it must be cleaned, properly assembled, and lubricated. While in use, it must be kept as nearly as possible in the same condition. After firing, it must again be put in readiness for later use. Certain rules, the observance of which will aid fulfillment of these conditions, are called points to be observed before, during, and after firing.

a. Before firing.—The automatic rifleman must be thoroughly impressed with the value of observing these points and testing his rifle by their observance each time it is to be fired, doing it, furthermore, before the moment for firing has actually arrived. They are not intended as a guide for a detailed inspection of the rifle, nor should points to be observed before firing be so considered. They are intended to constitute a procedure that can be carried out quickly as a preliminary to going into action with the rifle or firing a score at target practice with it.

(1) Test trigger mechanism at "S," "A," and "F."

(2) See that the bore is clear and clean.

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(3) Work slide back and forth rapidly several times to see that it moves freely and does not stick.

(4) Test ejector and extractor with dummy cartridge or empty case.

(5) Verify proper setting of gas port.

(6) See that bipod and hinged butt plate are in good workable condition.

(7) Examine magazines and eliminate faulty ones.

(8) Verify cleaning.

(9) Verify oiling.

(10) Verify presence of tools and spare parts and that the oilcan is full of oil.

b. During firing.—(1) Keep magazine and chamber protected from dirt.

(2) Clean bore and gas system as frequently as opportunity during cessation of fire permits.

c. After firing.—(1) Remove loaded magazine.

(2) Let bolt forward.

(3) Wipe out bore and oil rifle.

(4) Clean rifle thoroughly at first opportunity.

(5) Replenish spare parts.

(6) Reload magazines as soon as possible.

34. Protection of rifles against gas.—*a. When rifle cannot be disassembled.*—(1) Wipe over with a well-oiled rag all surfaces exposed to gas except the bore.

(2) Fire occasional shots and between these, work operating handle back and forth.

(3) Wipe magazines and spare parts with oiled rag.

b. When rifle can be disassembled.—Proceed as in *a* above, except that the bore should be plugged at each end with an oiled rag and the rifle disassembled, wiped with oil, assembled, and wrapped in a waterproof sheet if one is available.

c. After the gas attack.—(1) Clean all parts in boiling water containing a little sal soda.

(2) Clean bore and chamber thoroughly.

(3) Wipe all trace of gas from contents of the spare parts case.

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SECTION VIII

STOPPAGES

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35. Classes.—Stoppages are divided into two general classes, temporary and prolonged:

a. Temporary.—Temporary stoppages are due to—

(1) Failure of some part of the rifle of which a duplicate is carried.

(2) Faulty ammunition.

(3) Improper care of the rifle.

(4) Lack of knowledge of operating and functioning of the rifle.

b. Prolonged.—Prolonged stoppages are due to a failure of some part that cannot be replaced or to a failure which cannot be remedied in the field under fire or without skilled assistance or machine-shop facilities.

36. Causes.—*a. Dirt.*—Natural fouling incident to firing and also to careless cleaning.

b. Insufficient oil.—From failure to oil and because of oil burning up during firing.

c. Extraneous matter in working parts.—Due to poor cleaning, brass chipped from cartridges, breakages, and blown primer.

d. Improper assembly of rifle.—Gas ports not registered, middle prong of sear spring riding on one wall of sear carrier, etc.

e. Breakages.—Due to improper assembly, oversize or undersize parts, burrs, incorrect heat treatment, overheating of parts incident to firing.

f. Burred parts.—Due to improper assembly, use of force, dirt, grit, and foreign matter in mechanism.

g. Magazine troubles.—Due to bent or dented magazines, worn magazine catch notch, foreign matter, as blown primer between lips of magazine and top carriage.

h. Faulty ammunition.—Failure of primer of charge, dented cartridges.

i. Excessive play in parts.—Due to wear in disassembling parts not supposed to be disassembled, such as removing barrel from receiver.

j. Ruptured cartridges.—Due to excessive head space. Head space is the distance between the face of the bolt and the shoulder of a standard steel test cartridge. If excessive head space exists when

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the cartridge is chambered properly, the cartridge case will be forced against the walls of the chamber at the instant of explosion. The cartridge case base will be driven to the rear, as it is not supported by the bolt. This results in rupture about ½ inch from the base of the cartridge. In effect, the action during the period of gas pressure within the cartridge case is the same as if the chamber gripped all the outer surface of the cartridge case except the part about ½ inch from the head. The pressure within the cartridge case being approximately 50,000 pounds per square inch, the ungripped portion of the case is torn from the gripped part and forced back against the face of the bolt. The case is never pulled apart by the extractor.

37. Method of reducing.—Temporary stoppages have been divided into four positions, dependent upon the position where the bolt stops. The position of the stoppage is determined by pulling the operating handle to the rear until it strikes the hammer pin. Boundaries of the positions are:

a. First position, mechanism and operating handle fully closed.

b. Second position, operating handle strikes hammer pin anywhere from fully closed to a point where operating handle plunger pin rides over raised shoulders on ribs of operating handle guideway.

c. Third position, operating handle strikes hammer pin anywhere from second position to a point directly over "F" of change lever setting.

d. Fourth position, operating handle strikes hammer pin anywhere between third position and rear.

Classified table of stoppages

FIRST POSITION

(Operating handle fully home)

Stoppage	Cause	Remedy in field
1. Failure to feed	1. Magazine trouble—	
	a. Magazine not fully home.	1. *a.* Push magazine fully home.
	b. Obstruction between lips of magazine and top cartridge.	*b.* Change magazine.
	c. Weak magazine spring.	*c.* Change magazine.
	d. Magazine dirty.	*d.* Change magazine, clean later.
	e. Magazine tube or lips dented or bent.	*e.* Change magazine.
	f. Magazine catch notch worn.	*f.* Change magazine.

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Classified table of stoppages—Continued

FIRST POSITION—Continued

Stoppage	Cause	Remedy in field
2. Failure to fire----	2. *a.* Broken or short firing pin.	2. *a.* Change firing pin.
	b. Weak recoil spring.	*b.* Change recoil spring.
	c. Excessive friction.	*c.* Clean and oil friction surfaces, clean ammunition, clean and lightly oil chamber with a rag.
	d. Faulty ammunition, defective primers or charges.	
3. Insufficient gas	3. *a.* Gas cylinder not properly adjusted.	3. *a.* Correct adjustment of gas cylinder.
	b. Gas ports clogged.	*b.* Turn cylinder to next larger port; clean at first opportunity.
	c. Piston binding, account dirty piston and cylinder.	*c.* Turn cylinder to next larger port; clean and oil at first opportunity.
	d. Dirty chamber.	*d.* Turn cylinder to next larger port; lightly oil chamber with a rag; clean chamber, gas ports, and cylinder at first opportunity.
	e. Lack of oil.	*e.* Oil friction surfaces; lightly oil chamber with a rag.

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Classified table of stoppages—Continued

SECOND POSITION

(Operating handle strikes hammer pin anywhere from fully closed, back to top of raised shoulders on operating handle guideway)

Stoppage	Cause	Remedy in field
1. Obstruction or burred surface.	1. Extraneous matter or burrs— *a.* On face of the bolt. *b.* In breech recess where bolt and receiver join. *c.* On bolt lock. *d.* In bolt-lock recess.	1. Feel on face of bolt, in receiver and chamber, on bolt lock, and in bolt-lock recess, for burrs or extraneous matter. Remove extraneous matter—burrs.
2. Faulty ammunition.	2. Battered round.	

THIRD POSITION

(Operating handle strikes hammer pin between second position and point directly over "F" on receiver)

1. Ruptured cartridge.	1. Excessive head space.	1. Use ruptured cartridge extractor to remove ruptured cartridge case. If recurs, clean and lightly oil chamber with a rag.
2. Failure to feed completely.	2. *a.* Broken firing pin protruding from face of bolt.	2. *a.* Replace firing pin.
	b. Other obstruction that prevents base of cartridge from sliding up across face of bolt.	*b.* Remove obstruction.
3. Mechanism wedged tightly.	3. Obstruction—extraneous matter between bolt support and bolt lock.	3. Remove obstruction.
4. Faulty ammunition.	4. Battered round.	

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Classified table of stoppages—Continued

FOURTH POSITION

(Operating handle strikes hammer pin between third position and all the way to the rear)

Stoppage	Cause	Remedy in field
1. Failure to extract.	1. *a.* Dirty, rusted, or pitted chamber.	1. Use cleaning rod to remove empty cartridge case, then— *a.* Clean and lightly oil chamber with a rag.
	b. Dirt under extractor.	*b.* Clean face of bolt and extractor.
	c. Defective extractor.	*c.* Change extractor.
	d. Defective extractor spring.	*d.* Change extractor spring.
	e. Defective ammunition—soft rims on cartridges.	
2. Trigger will not release slide, the piece being cocked.	2. Trouble in trigger mechanism— *a.* Change lever set on "S."	2. *a.* Set change lever on "F" or "A."
	b. Improper assembly which results in failure of center prong of sear spring to push connector back under front end of sear.	*b.* Take out trigger guard and examine; replace necessary parts and assemble properly.
	c. Defective sear spring.	*c.* Same as *b* above.
	d. Defective or lost connector.	*d.* Same as *b* above.
3. Obstruction	3. Extraneous matter between ejector and bolt.	3. Remove obstruction.

(NOTES)

1. The first thing to do in case of any stoppage is to pull back the operating handle and try to fire again. This will remove the cause of a large percentage of stoppages.

2. If the stoppage recurs, pull back the operating handle slowly to determine position of stoppage. Then apply proper remedy.

3. If no ruptured cartridge extractor is available, oil the nose of a cartridge and cover it with a small amount of dirt or sand; then place it in the chamber

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and let the bolt go forward. Ruptured cases may often be removed in this manner. Clean and oil the chamber and bore very carefully after doing this. (See par. 43 *g* (3).)

38. Explanation of stoppages.—*a. First position.*—(1) *Failure to feed.*—Usually traceable to magazine trouble. An obstruction (usually a blown primer) between lips of magazine and top cartridge prevents the new cartridge from being engaged on the feed rib and causes the bolt to go home on an empty chamber. The same stoppage occurs when the magazine catch notch becomes so worn as to permit the magazine to drop down slightly and also when the magazine catch breaks or when the magazine is not pushed clear up in magazine opening.

(2) *Failure to fire.*—Repeated failure to fire is usually due to a broken or short firing pin. Frequently the beginner will mistake a misfire due to an obstruction between the face of the bolt and the breech for one due to a broken firing pin. He should remember that the latter is a first-position stoppage and the former a second-position stoppage. A misfire due to a broken firing pin will not show any indentation on the primer. The second-position stoppage almost invariably shows a slight indentation.

(3) *Insufficient gas.*—A stoppage in the first position with an empty case in the chamber is due to insufficient gas, which in turn may be due to the gas ports not being properly registered or being partially clogged or to excessive friction because of lack of oil and a dirty chamber.

b. Second position.—A failure to close will usually be caused by an obstruction lodging between the face of bolt and the breech, thus holding firing pin away from primer. The primer will be slightly dented. This stoppage is typical. When the piece stops in the second position, always look for an obstruction either on the face of the bolt or in breech recess where bolt and receiver join; the most frequent obstruction is the blown primer. Often it is difficult to determine. Frequently it drops off as the bolt is drawn back. If the stoppage recurs, it is certain that an obstruction is in the rifle between the face of the bolt and the breech or between the bolt lock and receiver top plate.

c. Third position.—(1) *Ruptured case.*—This stoppage is due to excessive head space. When the immense pressure following the ignition of the charge is taken up by the cartridge case, the latter not being properly supported by the bolt will rupture about ½ inch from the base. The short end at the base must then be extracted and the larger portion of the case will remain in the barrel. A tem-

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porary correction for such a stoppage is to clean the chamber thoroughly and lightly oil it with a rag.

(2) *Broken firing pin.*—This stoppage is caused by the end of a broken firing pin protruding through the firing pinhole in the face of the bolt. The cartridge is then kept from sliding under the extractor as the bolt moves forward and a third-position stoppage will result. The cartridge will show an abrasion near the base. To remedy this stoppage, the firing pin must be replaced.

(3) *Mechanism wedged fast.*—This is a rare stoppage. The slide cannot be moved forward nor backward. It occurs when any obstruction gets between one of the bolt supports and the bolt lock. As the slide is driven to the rear, the bolt lock is wedged fast by the obstruction. The stoppage has been caused by a blown primer or by a piece of metal broken off the rear of firing pin channel wall. It should be reduced in a properly equipped shop.

d. Fourth position.—(1) *Failure to extract.*—This stoppage is generally due to a dirty or pitted chamber. Usually the empty case will have a small part of the rim pulled off by the extractor. This case can be removed only by the use of the cleaning rod. A few drops of oil in the magazine will ordinarily prevent this stoppage temporarily. The only permanent remedy is a thorough cleaning of the chamber. If the gun develops this stoppage before a large number of rounds has been fired, it is not the fault of the gun but is due to improper cleaning after the last firing.

(2) *Failure to release sear.*—Another fourth-position stoppage is that in which the piece is cocked and the trigger mechanism will not release the sear when set at "A" or "F." This stoppage is traceable to trouble in the trigger mechanism and may be due to a broken sear spring, a broken or lost connector, an improper assembling of the sear spring, or to any cause which has the effect of moving the middle prong of the sear spring too far to the front with respect to the connector so that the connector is not cammed under the tail of the sear.

(3) *Blown primer.*—Another fourth-position stoppage occurs when a blown primer wedges itself between the points of the ejector and the face of the bolt, thereby holding the bolt and mechanism back in the fourth position.

39. Causes of failure to function.—*a. Probable causes of failure to extract.*

(1) Defective extractor.
(2) Dirt under extractor.
(3) Dirt in chamber.
(4) Pitted chamber.

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(5) Weak extractor spring.
(6) Defective ammunition.

b. Probable causes of failure to eject.

(1) Insufficient gas.
(2) Defective extractor.
(3) Dirt under extractor.
(4) Ejector does not fit up close to bolt.
(5) Ejector binds on bolt.
(6) Ejector has too much backward play.
(7) Ejector bent backward or otherwise defective.
(8) Weak extractor spring.
(9) Defective ammunition.

c. Probable causes of failure to breech.

(1) Dirt between bolt and rear end of barrel.
(2) Primer in mechanism, generally in front of bolt.
(3) Defective bolt lock or pin.
(4) Defective magazine.
(5) Piston binding.
(6) Excessive friction.
(7) Recoil spring too short.

d. Probable causes of insufficient gas.

(1) Ports clogged.
(2) Poor fit between gas-cylinder tube and bracket.
(3) Gas leakage around piston (worn cylinder).
(4) Piston binding, or cylinder dirty.
(5) Gas cylinder threaded in too far, or vice versa.

e. Probable causes of ruptured cartridges.

(1) Locking surface of bolt lock worn.
(2) Bearing between bolt and bolt lock worn.
(3) Face of bolt worn.
(4) Chamber of barrel worn or pitted.
(5) Locking shoulder of receiver worn.
(6) Bolt support loose or worn.
(7) Defective ammunition.

SECTION IX

ADJUSTMENT AND INSPECTION

Paragraph
Gas adjustment 40
Notes on maintenance and inspection 41

40. Gas adjustment.—The rifle should normally be operated on the smallest port, and this setting will never be varied unless the rifle

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shows signs of insufficient gas. To aline the smallest port, screw in the gas cylinder with the combination tool until the shoulder of the gas cylinder is about one turn from the corresponding shoulder of the gas cylinder tube and the smallest circle on the cylinder head is toward the barrel. Lock the cylinder in position. If, upon firing, the rifle shows signs of insufficient gas, try setting the cylinder one complete turn on each side of the original setting. As soon as the proper setting has been obtained, the rifleman will carefully note the position so that he may quickly assemble the cylinder to the proper point without trial. The larger ports are provided for use in case of emergency, when the action of the rifle has been made sluggish through the collection of dirt and grit or the lack of oil, and the conditions render it impossible for the rifleman to correct these troubles. For this reason the threads should be kept clean and oiled and the cylinder free to turn if necessary. The extractor, ejector, and the chamber of the barrel should be examined and cleaned and defects corrected when possible. Under adverse conditions and when signs of insufficient gas become apparent, the cylinder should be unscrewed one-third of a turn, thus registering the medium circle and alining the medium port with the gas orifice. Repeat this operation in order to connect the largest port with the barrel. Excessive friction or dirt may sometimes result in the failure of the action to complete the forward movement under the action of the recoil spring, which part may also have become permanently set or short from continued use under conditions of excessive heat. In such case, replace the recoil spring.

a. Results of insufficient gas.—(1) Failure to recoil (usually due to a misalined or excessively clogged gas port or extremely dirty mechanism).

(2) Failure to eject.

(3) Weak ejection.

(4) Uncontrolled automatic fire (exceptional).

b. Results of too much gas.—(1) Excessive speed, causing pounding.

(2) Excessive heat in gas-operating mechanism.

41. Notes on maintenance and inspection.—Complete instructions for ordnance maintenance personnel for the shop repair, inspection, and maintenance of the automatic rifle are given in TR 1400–30E. The following notes are for the information of repairmen for the purpose of keeping the rifle in good mechanical condition:

a. Maintenance.—Filing or otherwise altering parts should only be done under the strictest supervision as this often fails to remedy the trouble and results in damage to the rifle. Filing and altering of

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parts are sometimes necessary, but should never be done except by an expert repairman under the direction of a commissioned officer competent to supervise the work. All defective parts should be distinctly marked or tagged to avoid their future use.

(1) *Barrel.*—(*a*) The barrel should not be removed until worn to such an extent as to require replacement. This wear usually occurs in the rifling near the breech or in the chamber. A barrel is usually good for 8,000 rounds, after which time the accuracy depreciates quite rapidly. A worn or pitted chamber may result in ruptured shells or in the shells swelling and sticking in the chamber rendering extraction difficult or uncertain.

(*b*) The gas port through the barrel and gas cylinder tube bracket may become stopped up and allow insufficient gas to pass through to insure positive action. To remedy this difficulty, clear the port with the gas cylinder cleaning tool. The lower surface, especially that portion immediately surrounding the port of the gas cylinder tube bracket, should fit closely to the corresponding surface of the gas cylinder tube. Some wear at this point may be taken up by bending the lips of the bracket down slightly, tapping them lightly with a hammer, or by bending the retaining rib of the tube back at each edge, thus bringing the surfaces into closer contact. A smooth, close fit is desired. If the fit is excessively tight, some metal may be removed from the surface of the gas cylinder tube bracket by use of the special hand scraper provided for this purpose, or with an oilstone or dead smooth file. Care should be exercised not to remove too much metal, especially from that surface near the port.

(2) *Gas-operating mechanism.*—(*a*) The front retaining rib of the gas cylinder tube may become too loose in the gas cylinder tube bracket, resulting in insufficient gas and requiring adjustment, as described above in (1) (*b*), or replacement. The wall of the tube may become dented, thus binding the piston. In some cases it may be possible to straighten this out until the piston works freely. In replacing a gas cylinder tube see that it correctly fits the bracket and that the rear hole lines up properly in the receiver. The tube should never be twisted to secure a fit at this point. In case of necessity, reamer may be run through the rear hole to clean out a small amount of metal.

(*b*) The ports of the gas cylinder may become clogged to such an extent as to render the action uncertain, or burnt powder deposited on the inside of the gas cylinder may cause the piston to stick. The gas cylinder cleaning tool may be used to clean these parts. Failure to operate due to insufficient gas is sometimes the result of wrong

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assembling of the gas cylinder, screwing it in one turn from the shoulder. Unscrew one-third of a turn to change to the medium port, and one-third of a turn farther to the large port. The relative sizes of the ports are indicated by circles on the front end of the cylinder. The threads of the gas cylinder should fit snugly enough to prevent excessive gas leakage. The fit of the gas cylinder and piston, although free, should not be excessively loose, in order that the recoil may be uniform. Extreme wear would necessitate replacement. In replacing a gas cylinder make sure that the piston works freely when the cylinder is set at each port. Test as described in (*c*) below.

(*c*) If the gas piston has become bent, it may bind in the gas cylinder or tube. Slight bends may be straightened and tested in the following manner: remove the trigger guard, bolt, and recoil spring. The piston and slide should work back and forth easily as the muzzle of the rifle is tilted first up and then down. Particular attention should be given at the point where the piston enters the cylinder. In replacing a piston, the new one should be tested in this manner. In the case of the old-type piston, which is threaded rigidly into the slide, slight bending may be necessary in order to secure the proper alinement.

(3) *Receiver.*—Wear in the receiver usually occurs on the locking surface or on the bolt supports. The rear cam surface of the bolt supports must be accurately positioned in order to cam the bolt lock upward at the proper time. The bolt supports must fit tightly in the receiver and be well riveted. The hammer used in riveting should be heavy enough to swell the rivets throughout their entire length. An excessively loaded cartridge may spread the side of the receiver slightly and loosen the bolt supports. In this case, the sides of the receiver should be carefully brought back into position with the aid of a vise, and the bolt supports reriveted.

(4) *Firing mechanism.*—(*a*) The slide should fit freely in the receiver and the sides should be straight. The slide should not be excessively loose in the receiver, as this may cause the hammer pin to batter the top of the front end of the slot in the left side of the receiver, rendering it difficult to pull back the operating handle when cocking the rifle. To remedy this difficulty the slot may be smoothed over and widened slightly by filing. Slight cracks may occur in the slide, extending from the hammer pinhole to the upper surface. This does not in general affect the operation of the rifle.

(*b*) The hammer should have a good bearing against the seat in the rear of the slide, and when assembled should not be loose

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enough to allow any appreciable tilting when pressure is exerted in the upper portion of the front face. In addition to this condition, excessive wear or deformation of the front face may be the cause of misfires. When the parts are in their forward position, the hammer should clear the firing pin, but not by more than $\frac{1}{32}$ of an inch. The hammer should come up against the link when the gas cylinder tube is not in place. The recoil spring should not become set and hence too short for positive operation. In some cases this may be corrected temporarily by pulling out the spring: in some cases replacements will be necessary. The recoil spring should be not less than 15 inches long.

(*c*) In addition to the actual length of the firing pin, the following points determine the distance which the firing pin will protrude through the bolt in the locked position (causing pierced primers at one extreme and misfires at the other): the distance from the face of the hammer to its rear bearing surface against the slide, the distance from this surface to the front stop shoulder of the slide, the distance from the slide stop shoulder of the gas cylinder tube to the gas cylinder tube retaining pinhole, the distance from this hole to the face of the receiver, the distance from the face of the receiver to the locking surface, and the distance from the locking surface of the bolt lock to the front face of the bolt. Firing pin protrusion can only be gaged when the rifle is assembled and the bolt is in the locked position. It will be necessary to use a gage extending from the muzzle of the gun or to take a wax impression of the projection when the bolt is locked.

(*d*) When the bolt is unlocked the bolt link should bear on the locking shoulder of the bolt lock and should hold the bolt lock up so that it just clears the bolt supports and guide as the bolt is moved rearward. Frequent blown or pierced primers may cause the rear head of the firing pin to batter the front of the bolt link. This battered surface should not be allowed to develop a sharp edge which might catch or break off the head of the firing pin.

(*e*) The top rear corner of the firing pin head should be well rounded to avoid the above-mentioned breakage. The shank of the firing pin should be straight and the point not excessively deformed or pitted. The retracting cam should be beveled on each side, and neither this part nor the corresponding slot in the bolt lock should show battering or signs of misalinement.

(*f*) The bolt and bolt lock are an assembled unit and should never be separated. There should be a good bearing between the two so that none of the shock of the recoil is taken on the bolt lock pin.

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The bolt lock pin may become loose with wear until one end projects and catches on the inside of the receiver, resulting in stoppages and mutilation of the receiver. Test by pushing the pin both ways with the finger. It should not be possible to cause it to project on either side. In case of projection, rerivet the pin. Considerable wear on the locking shoulder of the bolt lock, in the joint between the bolt and bolt lock or on the face of the bolt, may result in excessive head space, causing ruptured cartridges and, in some cases, blown primers. During the rearward motion, the bolt lock should never bear to any appreciable extent on the bolt supports or guide. If the firing-pin hole in the face of the bolt is enlarged or off center, the assembly should be replaced, as this is often the cause of breakage of firing-pin points.

(*g*) When the gun is assembled without the recoil spring but with the gas cylinder and gas cylinder tube in place, recoiling parts should slide back and forth freely as the gun is turned muzzle up, and vice versa, unless the breeching is snug. In that case they should move freely when the bolt lock is disengaged from the recoil shoulder of the receiver. On the forward movement the bolt lock should be cammed up by the rounded rear ends of the bolt supports, but there should be sufficient clearance between the bolt support and the locking shoulder of the receiver to prevent excessive binding. When in the locked position the front shoulder of the bolt should just clear the rear shoulder of the barrel. If the bolt comes up against the barrel but does not interfere with the locking of the bolt lock, the operation of the gun will not be affected unless dirt is allowed to accumulate in front of the bolt.

(*h*) Particular attention should be given the extractor to see that it has retained its proper shape and that the cartridge fits the hook correctly. The inner radius of the extractor hook should closely fit the bottom of the cannelure of the cartridge. The extractor notch just back of the hook should be deep enough to allow the extractor to come down into the cannelure, so that minimum cartridge will snap in and be held up firmly in place. Faulty ejection may result if the cartridge is allowed to drop even a short distance. To test this, remove the bolt and firing pin and insert a live cartridge under the extractor. It should be able to withstand considerable shaking without dropping down out of place. Examine to see if the extractor hook bears against the bottom of the cannelure at all points and that the base of the cartridge is held snugly against the face of the bolt. About 0.01-inch clearance between the base of the cartridge and the bolt face will not in general affect the operation of the rifle, but

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more than this may cause weak ejection. The lower corners of the extractor and lips of the bolt should be slightly rounded so as not to chip brass from the cartridges as they slip up into place. The rear face of the notch in the extractor, which bears against the lug of the bolt during extraction, should be slightly undercut, thus tending to prevent the extractor from slipping over the rim of the cartridge or from pulling out. The rear face of the extractor hook should be square and the extracting edges fairly sharp. An excessive amount of dirt under the extractor may result in failure to extract or failure to eject. The extractor should be a snug fit in the bolt. Side play or twisting is especially liable to cause trouble. Worn or defective extractors may often be corrected by proper and careful filing. The extractor spring rarely causes any trouble.

(5) *Trigger guard mechanism.*—(*a*) The fit of the trigger guard in the receiver is not important except that it should be fairly snug sideways. The sear should be a loose fit in the sear carrier. The nose of the sear as well as the sear notch in the slide should be correct in shape in order to maintain positive engagement. The sear pin should carry the tension of the counterrecoil spring, leaving the trigger pin free. The trigger should be a loose fit in the trigger guard and the connector loose in the trigger. The trigger pull should be smooth and from 6 to 10 pounds. The change lever should work smoothly. The ideal condition in semiautomatic fire is for the cam on the connector to engage the sear carrier just at the moment the sear releases the slide. The sear spring should fit in the trigger guard without an excessive amount of side play. The center leaf should have a smooth and continuous bearing against the bevel surface of the connector. The magazine catch should work freely and easily and should hold the magazine up closely to the bolt supports.

(*b*) The ejector should fit fairly close in the trigger guard guides. An excessive amount of play forward and backward may result in weak ejection. This may sometimes be corrected by bending the ejector slightly. The upper end of the ejector should spring slightly when pressed back. The location of the working end of the ejector for height and side position is of primary importance. To examine this, draw back the mechanism until the bolt face is even with the ejector. The ejector should fit up within $\frac{1}{32}$ of an inch of the bolt, but should not bind. A poor-fitting ejector may be corrected by bending until it fits up closely in the notch of the bolt. The upper part of the ejector should not bend rearward. If the ejection is correct, the shells will be given a spinning motion as they leave the

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rifle and will be thrown diagonally forward with considerable force. Test the ejection with a magazine filled with dummies. First operate the rifle slowly by hand, which should result in positive ejection. Then operate rapidly, when the cartridge should be ejected with force.

(6) *Rear sight.*—If the rear sight is properly assembled with a good driving fit it will give little trouble. If the sight works loose from the receiver, it may be necessary to replace the sight base. It may, however, be possible to swell the dovetail of the rear sight base by light and careful peening with a hammer until the necessary drive fit is obtained.

(7) *Buffer assembly.*—If properly assembled the buffer tube assembly will cause little or no difficulty. Special attention should be given to see that the buffer spring is always assembled behind the buffer friction cups and cones. The bronze buffer friction cups sometimes split and in this case should be replaced.

(8) *Magazines.*—Magazines should fit easily in the receiver and should be free enough to drop out under their own weight when the magazine release is compressed. The form of the inturned lips is important. Cartridges should come out smoothly and without excessive friction, which might hold back the bolt to such an extent as to cause failure to breech and misfires. The inside distance between the pressed-in ribs should be maintained within reasonable limits. The magazine follower should work freely. Deformed or battered magazines may be repaired by placing over the salvaging tools and bringing back into shape with a lead hammer.

b. Inspection.—Careful and frequent inspections should be made of the following:

(1) *Receiver and barrel.*
(*a*) Tightness of flash hider and front sight.
(*b*) Condition of bore.
(*c*) Tightness and alinement of barrel.
(*d*) Burs on receiver or any part.
(*e*) Position of bolt guide and spring.
(*f*) Tightness of buffer tube.
(*g*) Tightness of stock.
(2) *Rear sight.*
(*a*) Firmness of rear sight base.
(*b*) Free movement of slide.
(*c*) Condition of slide catch spring.
(3) *Gas cylinder and tube.*
(*a*) Proper alinement of gas ports.

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(*b*) Fouling of gas cylinder.
(*c*) Burs.
(4) *Gas piston and slide.*
(*a*) Fouling of piston.
(*b*) Sear notch for chips and burs.
(*c*) Hammer pin for looseness (should be loose).
(*d*) Length of recoil spring (not less than 15 inches).
(5) *Bolt group.*
(*a*) Proper fitting of extractor.
(*b*) Security of bolt lock pin.
(*c*) Clearance for firing pin in face of bolt.
(*d*) Bolt and bolt lock for wear and burs.
(*e*) Shoulder of firing pin to see that it is cammed easily and in alinement, by cut-out portion on underside of bolt lock.
(6) *Trigger guard group.*
(*a*) Length and strength of sear spring.
(*b*) Wear and burs on all parts.
(*c*) Verify presence of all springs.
(*d*) Worn magazine catch.
(7) *Magazine.*
(*a*) Shape of magazine lips.
(*b*) Dirty or dented parts.
(*c*) Fitting of magazine in receiver.
(*d*) Wear in magazine catch notch.
(8) *Bipod.*
(*a*) Smoothness of operation.
(*b*) Inspect right and left leg assemblies for burred or rough surfaces on leg hinge; bruised or bent leg; bruised or worn threads on the leg clamp thumbscrew.
(*c*) Bruised or bent sliding leg assembly.
(9) *Hinged butt plate.*—Smoothness of operation of the outer butt plate body.
(10) After the rifle is assembled, test for proper assembly and action, especially the trigger mechanism and the piston in gas cylinder.

Section X

SPARE PARTS AND ACCESSORIES

Paragraph
Spare parts 42
Accessories 43

42. Spare parts.—The parts of any rifle will in time become unserviceable through breakage or wear resulting from continuous usage.

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For this reason spare parts are provided for replacement purposes. They should be kept clean and lightly oiled to prevent rust. They are divided into two groups; spare parts and basic spare parts.

a. Spare parts.—These are extra parts provided with the rifle for replacement of the parts most likely to fail; for use in making minor repairs; and in general care of the rifle. Sets of spare parts should be kept complete at all times. Whenever a spare part is taken to replace a defective part in the rifle, the defective part should be repaired or a new one substituted in the spare part set as soon as possible. Parts that are carried complete should at all times be correctly assembled and ready for immediate insertion in the rifle. The allowance of spare parts is prescribed for the rifle in SNL A–4.

b. Basic spare parts.—These are sets of spare parts provided for the use of ordnance maintenance companies and include all parts necessary to repair the rifles. The allowance of basic spare parts is prescribed in the addendum to SNL A–4.

43. Accessories.—Accessories include tools for assembling, disassembling and cleaning the rifle, as well as chests and auxiliary equipment. A complete list of accessories for the rifle is listed in SNL A–4. Accessories must not be used for any purpose other than that for which they are intended and when not in use they should be stored in their proper place or receptacle provided for them. There are a few accessories provided with the rifle, the names or general characteristics of which indicate their use and application, therefore no detailed description nor method of use is outlined herein. The special accessories, however, being of a different nature, the description and purpose of each are outlined as follows:

a. Gun sling (fig. 35).—The gun sling is an adjustable carrying sling made of russet strap leather. One end of the gun sling is attached to the front swivel of the rifle and the other end is attached to the underside of the stock by means of the butt swivel. The gun sling consists of two straps, long and short. Each end of the long strap is provided with a gun sling hook. A series of holes punched in the long strap provides for different locations for the gun sling hook, and thereby enables the loop to be shortened or extended as desired. One end of the short strap is fastened to the long strap by the gun sling loop. The other end passes through the butt swivel and is provided with a hook that may be engaged in any of the holes provided for it in the long strap. The gun sling provides an easy means of carrying an automatic rifle, the sling being extended and slung over the shoulder.

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b. Magazine filler (fig. 35).—The magazine filler is a pressed steel adapter that fits over the top of an empty magazine. A clip of cartridges may be inserted in the top of the magazine filler and the car-

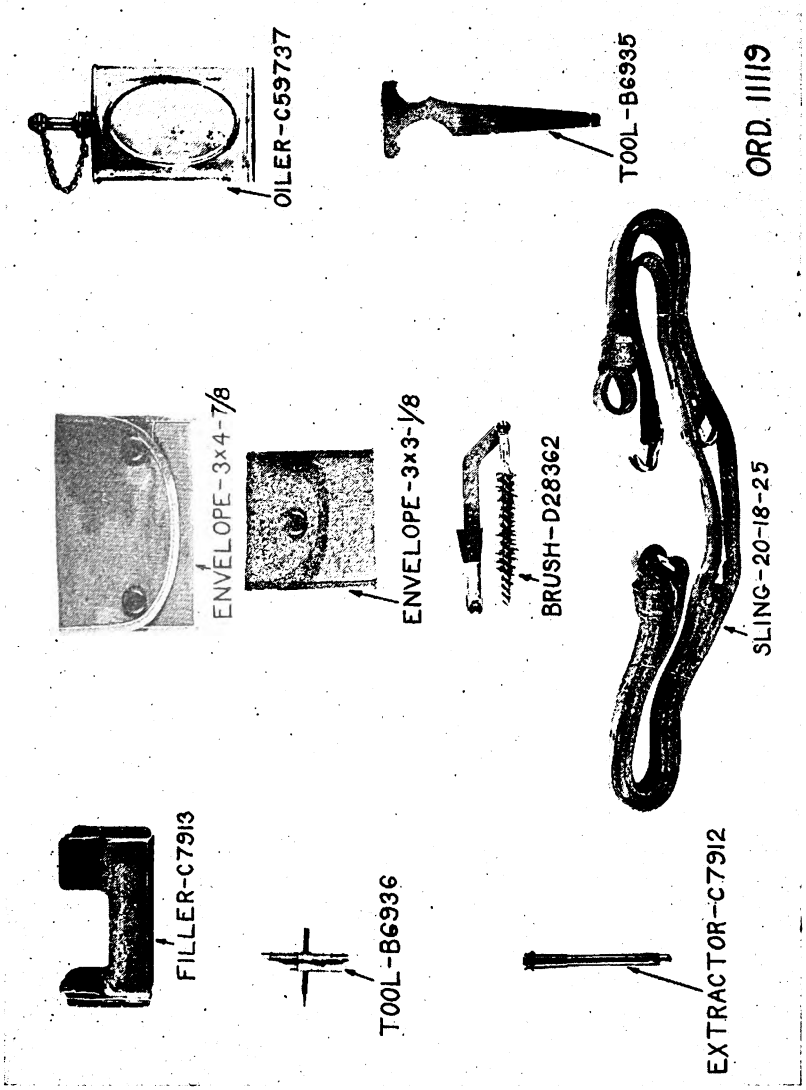


FIGURE 35.—Accessories.

tridges pushed down and into the magazine as shown in figure 36. To fill the magazine, place the wide end of the magazine filler over the top of the magazine so that the groove in the magazine filler fits over the catch rib of the magazine. Hold the magazine in the same rela-

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tive position that it occupies in the rifle; that is, with the catch rib toward the operator. Then insert a clip of cartridges in the guides provided in the filler and with the right thumb near the base, push the cartridges into the magazine. Each magazine will hold four clips of cartridges.

c. Accessory and spare parts case, M1918.—This is a leather box, approximately 2¼ inches wide, 3½ inches high, and 5¼ inches long used to hold the oval oiler, spare parts, etc. The case should be given the same care as other leather equipment. The contents should always be properly packed.

d. Fabric envelopes, small and large (fig. 35).—The small envelope is used to hold the recoil spring after it has been coiled up.

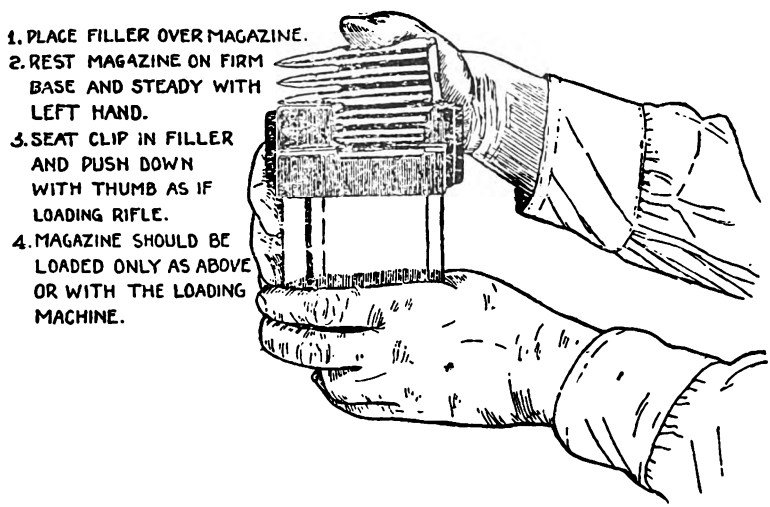


FIGURE 36.—Loading magazine for automatic rifle.

The remaining spare parts are packed in the large envelope. The envelopes, with contents, are carried in the accessory and spare parts case.

e. Gas cylinder cleaning tool (fig. 35).—This tool is provided for the cleaning of the gas-operating mechanism. These parts should habitually be kept clean and lightly oiled. For thorough cleaning, remove the gas cylinder tube, gas cylinder, and slide. Care should be exercised to avoid scoring or damaging the cylinder walls or the rings of the gas piston. Using the tool as a hand reamer, insert the smooth end of the body into the cylinder, turning it to the right as it is advanced toward the cylinder head. As soon as it reaches the head, press down and give the tool a few turns to cut the carbon from

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the inside surface of the head. Then withdraw and reverse the tool, using the recess cutter as a gage to remove the carbon from the recess at the forward end of the interior of the gas cylinder. This part should be thoroughly cleaned, especially that portion near the edge of the operating surface of the cylinder wall. Using the drift point, clean the ports in the barrel, gas cylinder tube, and gas cylinder. Scrape the carbon from the face of the piston with the front cutting edge of the cleaning tool body, and remove the deposit between the piston rings with the drift point.

f. Combination tool (fig. 35).—The small spanner at the head of the combination tool is used to turn the gas cylinder and the flash hider. Barrels which are not excessively tight in the receiver may be removed and replaced by the use of the large spanner, although shop facilities are necessary for the proper accomplishment of this work. The catch end of the large spanner is drawn out to provide a thin screw driver end, used for the removal of the smaller screws on the rifle, such as the butt plate screws, swivel screws, and rear sight screws. The position of this screw driver allows the use of a large amount of leverage, therefore extreme care should be exercised to avoid the breakage of the screw driver point. The regular screw driver end is heavily made and may be used for the removal of the butt stock bolt and the forearm screws.

g. Ruptured cartridge extractor, Mk. II (fig. 35).—(1) The ruptured cartridge extractor, Mk. II, has the general form of a cartridge, is made of steel and consists of three parts; the spindle, the head, and the sleeve. The spindle is shaped like a cartridge case with an extracting groove or cannelure similar to the cartridge case. Just forward of the extracting groove is a shoulder which limits the travel of the extractor into the chamber. The head consists of a long pin threaded at the back end and enlarged and rounded at the front end. In rear of the forward end is a shoulder which limits the forward travel of the sleeve. Back of this shoulder is a cone taper. The sleeve is tapered at its forward end, the taper ending in a square shoulder. Three longitudinal slits 120° apart extend three-fourths of the length of the sleeve to the rear. The sleeve fits loosely over the pin portion of the head, which in turn is screwed into the spindle.

(2) When a cartridge ruptures, it leaves the front end in the chamber, which telescopes over the bullet end of the next cartridge. As the operating handle is pulled back, the live cartridge is extracted and ejected, sometimes withdrawing the ruptured fragment with it. In this case the use of the ruptured cartridge extractor is unnecessary.

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If the ruptured end is not extracted by the following cartridge, cock the rifle and remove the magazine. Then insert the ruptured cartridge extractor through the ejection opening and push it forward into the chamber. Let the bolt forward without excessive shock so that the extractor engages the rim of the ruptured cartridge extractor. Then draw the operating handle back, extracting and ejecting the ruptured cartridge extractor and ruptured fragment of the cartridge case. This fragment can sometimes be removed from the ruptured cartridge extractor by depressing the front catches of the sleeve, but it will usually be necessary to unscrew and remove the spindle and sleeve from the head of the ruptured cartridge extractor. Two and sometimes more ruptures can be extracted before it is necessary to remove the fragments from the extractor sleeve.

(3) Every precaution should be taken to avoid the loss of this very important tool. In case it does become lost, it will sometimes be possible to remove a ruptured cartridge case by the use of a cartridge which has been oiled or moistened and coated lightly at the front end with sand or dirt. Although the rifleman should know of this method, its use should be prohibited except in cases of urgent necessity, as the residue of grit may result in the scoring of the polished surface of the chamber.

h. Oval oiler (fig. 35).—The oval oiler is used to hold the oil for lubricating the rifle. The body of the oiler is made of tin, oval in shape, and holds about 3 ounces of oil. It has a short brass nozzle which screws into a socket located on the top surface of the body. A screw cap, connected to the lower part of the nozzle by means of a loop and chain, is provided to cover the end of the nozzle to prevent the oil from leaking out when the oiler is not in use.

i. Chamber cleaning brush, M1 (fig. 35).—The chamber cleaning brush, M1, consists of a flat curved steel handle, one end of which is hinged to the chamber cleaning brush assembly, the bronze bristles of which are secured in place by twisted wire. To the other end of the handle is hinged a small bristle dusting brush.

j. Cleaning brush, caliber .30, M2 (fig. 37).—The brush consists of the core, bristles, and tip. The core, made of brass wire, is twisted in a spiral and holds the bronze bristles in place. The ends of the core are secured in the brass tip, one end of which has threads formed for attaching the brush to the cleaning rod.

k. Cleaning rod, M2.—This is a steel cleaning rod consisting of two sections fastened together with a swivel joint. The rear end is provided with a tubular steel handle which swivels on the rod. The front end is provided with threads for attaching the cleaning brush,

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caliber .30, M2, and has a slot formed for holding a cloth-cleaning patch.

l. Jointed cleaning rod, M1 (fig. 37).—This is a steel cleaning rod consisting of four sections, each with threaded dowels for joining the sections. The rear section is provided with a tubular steel handle which swivels on the rod. The forward section is made of two pieces fastened together with a swivel joint. The front end is provided with threads for attaching the cleaning brush, caliber .30, M2, and has a slot formed for holding a cloth-cleaning patch.

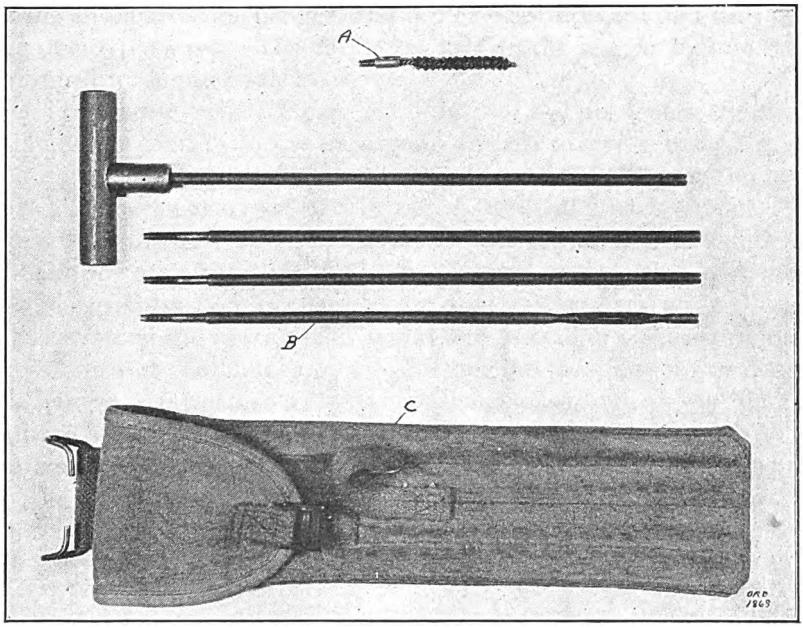


FIGURE 37.—Cleaning brush, caliber .30, M2; jointed cleaning rod, M1; cleaning-rod case, M1.

m. Cleaning-rod case, M1 (fig. 37).—The case is a fabric container sewed to form five pockets, four of which hold the sections of the jointed cleaning rod, M1, and the other pocket holds the cleaning brush, caliber .30, M2. A web billet and chape with buckle are sewed on the front of the case to secure the sections of the cleaning rod. A web hanger with brass double hook is sewed on the back of the case.

n. Carrying case.—The carrying case for the automatic rifle is made of No. 6 olive-drab cotton duck; the muzzle and breech ends are reinforced with No. 1 olive-drab cotton duck. The case has an olive-drab cotton webbing carrying strap which is secured to the case by web chapes.

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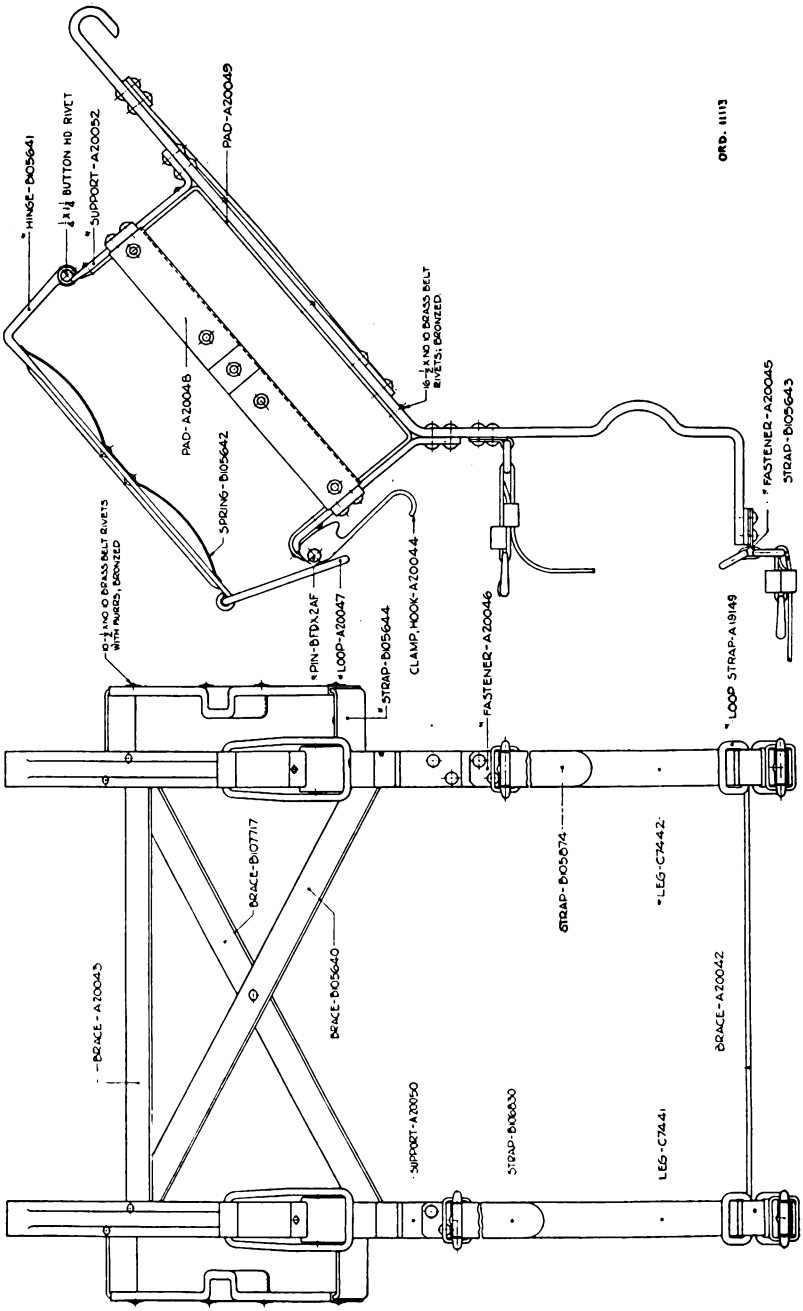


FIGURE 38.—Automatic rifle hanger, M1.

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o. Carrying case, M4.—This carrying case is for the automatic rifle when it is pack transported. It is made of russet harness leather, reinforced to strengthen and stiffen it, and is so designed as to hold the automatic rifle firmly in its carrying position. It is carried in the automatic rifle hanger, M1.

p. Machine-rifle ammunition chest, M1.—The ammunition chest, which is made of pressed steel, is divided into three compartments, each compartment holding 100 rounds in five magazines. The magazines are placed in the compartments with cartridge opening downward and magazines staggered. Two chests are carried in the upper part of the automatic-rifle hanger, M1, top of chest upward and lid-fastening device outward. The chests are held in the hanger by two straps equipped with quick release devices.

q. Automatic rifle hanger, M1 (fig. 38).—This is an aluminum-alloy frame used to secure an automatic rifle carrying case, M4, containing an automatic rifle; two ammunition chests, M1, and an accessory and spare parts case, M1918, to the saddle of a pack animal. The upper part of the hanger hooks over the hanger bars of the saddle and is held down by buckling the leather straps on the lower part of the hanger to corresponding staples on the bottom bars of the saddle. The accessory and spare parts case, M1918, is held in place on the upper cross brace of the hanger by two leather straps. The upper part of the hanger is formed so as to receive two ammunition chests, M1, containing 300 cartridges each. The chests are held in the hanger by two leather straps equipped with quick release devices. The lower part of the hanger is formed so as to receive the leather carrying case, M4, containing one automatic rifle. The rifle is carried muzzle to the front. The carrying case is held in the hanger by two leather straps.

[A. G. 062.12 (8–23–39).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:
E. S. ADAMS,
Major General,
The Adjutant General.

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TECHNICAL REGULATIONS
No. 1300–30A

WAR DEPARTMENT,
WASHINGTON, *November 13, 1939.*

INFANTRY AND AIRCRAFT ARMAMENT

U. S. RIFLE, CALIBER .30, M1903 AND M1903A1

Prepared under direction of the
Chief of Ordnance

		Paragraphs
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SECTION I

GENERAL

	Paragraph
Purpose and scope	1
References	2

1. Purpose and scope.—These regulations are published for the information and guidance of the using arms and all personnel charged with the maintenance of this matériel. They contain description and illustrations, and instructions in the proper methods of disassembling, assembling, care and preservation of the U. S. rifle, caliber .30, M1903 and M1903A1.

2. References.—*a. Nomenclature and list of spare parts and equipment.*—Standard Nomenclature List No. B–3.

b. Description and characteristics of ammunition.—TR 1350–A.

c. Inspection, repairs, and maintenance.—TR 1400–30A.

d. Instructions for cleaning bore and chamber, and cleaning and preserving materials.—TR 1395–A.

e. Marksmanship.—Part one, chapter 1, BFM, volume III.

f. Instruction with bayonet.—Part one, chapter 4, BFM, volume III.

*This pamphlet supersedes TR 320–10, March 12, 1924, including C 1, January 2, 1926, and C 2, January 2, 1937.

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g. Musketry.—Part one, chapter 6, BFM, volume III.

h. Combat practice firing.—Part five, chapter 2, BFM, volume III.

i. Antiaircraft marksmanship.—Part six, chapters 1 and 2, BFM, volume III.

SECTION II

DESCRIPTION AND DATA

Paragraph
Description 3
Data 4

3. Description.—*a. General.*—The caliber .30 pattern of rifle described in these regulations was initially designated as U. S. rifle, caliber .30, M1903 (fig. 1). Subsequently a pistol grip type stock replaced the straight type stock and the designation was changed to U. S. rifle, caliber .30, M1903A1 (figs. 2 and 3). As the only difference between the M1903 rifle and the M1903A1 rifle is in the stock, the M1903A1 rifle only is described herein.

b. U. S. rifle, caliber .30, M1903A1.—This rifle is a breech loading magazine rifle of the bolt type. The magazine of the rifle will hold five cartridges, and one additional cartridge may be inserted in the chamber, thus making the maximum capacity of the rifle, for any one loading, six shots. In order to facilitate the loading of the magazine, cartridges are ordinarily put up in brass clips holding five cartridges each. The magazine, however, may be loaded by inserting single cartridges by hand, one after the other. The total weight of the rifle including oiler and thong case and gun sling, but without bayonet, is 9 pounds 7 ounces. The bayonet weighs 1 pound.

c. U. S. rifle, caliber .30, M1903A1, National Match.—These rifles are especially manufactured for use in the National Matches. The component parts are identical with the same parts of the regular M1903A1 rifle with the following exceptions:

(1) The bolt is polished all over to a bright finish. Since 1928, National Match bolts are numbered to correspond to receiver number.

(2) The extractor cam surface and the runways for the bolt in the receiver are polished after parkerizing.

(3) All working surfaces are polished after hardening.

(4) The bolt sleeve, sear, trigger, follower, and ejector are oil-blacked.

(5) The barrel is especially selected for the finish of the chamber, bore, and rifling, and is stamped with the starproof mark.

(6) The stock is the pistol grip type used on the regular M1903A1 rifle but it is especially selected for workmanship and grain.

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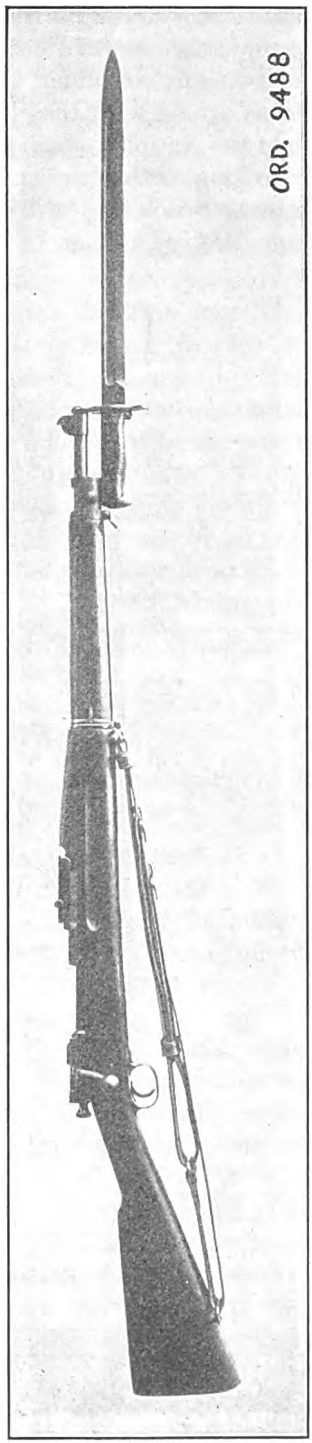


FIGURE 1.—U. S. rifle, caliber .30, M1903, with bayonet, M1905, and gun sling, M1907.

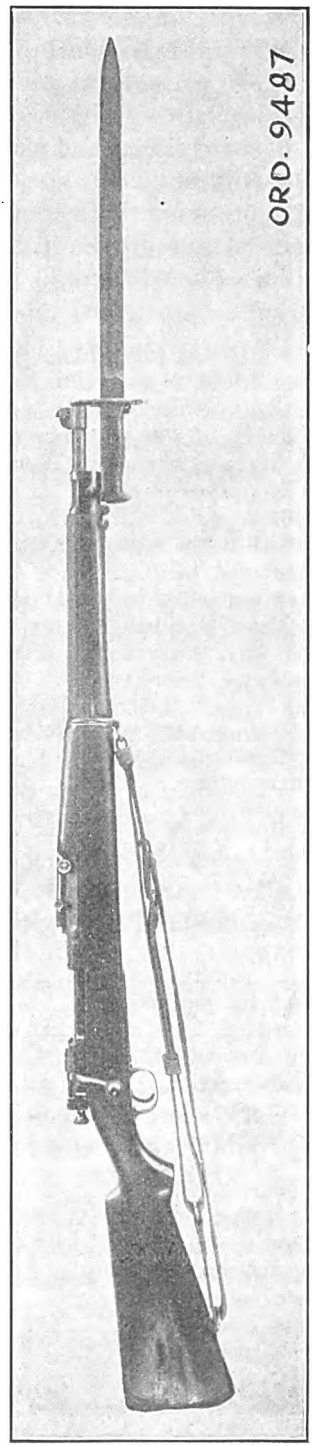


FIGURE 2.—U. S. rifle, caliber .30, M1903A1, with bayonet, M1905, and gun sling, M1907.

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d. U. S. rifle, caliber .30, M1903A1, Special Target.—These rifles are slightly used National Match rifles completely reconditioned. Due to their exceptional accuracy they are designated under the above nomenclature and issued to organizations armed with the rifle for use in competitions and matches other than the National Matches. The rifles will retain this nomenclature only so long as they are sufficiently accurate for this special target work, after which they will be submitted to an ordnance inspector who may classify them as U. S. rifle, caliber .30, M1903A1.

4. Data.

Weight of M1903A1 rifle without bayonet	pounds	9.1
Weight of M1905 bayonet	do	1.00
Over-all length of rifle without bayonet	inches	43.46
Over-all length of rifle with bayonet	do	59.43
Twist in rifling, uniform R. H., one turn in	do	10.00
Number of grooves in barrel		4.00
Sight radius	inches	22.138
Sight radius, battle sight	do	21.563
Sight graduated to	yards	2,850.00
Weight of cartridge, ball, M1 (approximate)	grains	415.00
Weight of cartridge, ball, M2 (approximate)	do	391.00
Muzzle velocity, theoretical, ball, M1	feet per second	2,650.00
Muzzle velocity, theoretical, ball, M2	do	2,700.00
Maximum range, ball, M1 (approximate)	yards	5,500.00
Maximum range, ball, M2 (approximate)	do	3,450.00
Chamber pressure (approximate):		
M1 ammunition	pounds per square inch (mean)	48,000.00
M2 ammunition	pounds per square inch (mean)	40,000.00

SECTION III

GROUPS, ASSEMBLIES, AND PARTS

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Bolt and firing pin group	6
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Bolt stop assembly	8
Cut-off group	9
Floor plate group	10
Magazine spring	11
Follower	12
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Butt swivel assembly	19

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Butt swivel screws 20
Lower band group 21
Upper band group 22
Stock 23
Stock screws and nuts 24
Hand guard 25
Barrel assembly 26
Receiver 27

5. General.—For convenience the parts of the rifle have been arranged in groups and assemblies. A group is a number of parts which function together in the rifle and which are naturally intimately related to each other and should therefore be considered together. An assembly consists of two or more parts which are either permanently or semipermanently assembled and should not ordinarily be taken apart. An assembly is frequently issued as a unit for maintenance purposes. The groups, assemblies, and individual parts are listed in the following paragraphs of this section in the order in which they would be taken from the rifle in case the latter is completely disassembled.

6. Bolt and firing pin group.—The bolt and firing pin group can be removed from the rifle as a unit, and includes the following parts (fig. 4①):

a. Extractor.—At the front end of the extractor is a hook by which the cartridge case is extracted from the chamber. A tongue just rear of the hook rides in its groove at the front end of the bolt. About midway of the extractor is a lug which is undercut to receive the ears on the lugs of the extractor collar. A gas escape hole is provided just in rear of the hook so that gas from the fired cartridge which blows back against the face of the bolt may readily escape. A lug at the rear is known as the back rest and is curved to fit the shape of the bolt upon which it rests.

b. Bolt assembly.—This consists of the bolt and the extractor collar.

(1) The extractor collar is bent into position on the bolt in manufacture, and together with the bolt forms a permanent assembly. The extractor collar should not be removed from the bolt. The top of the extractor collar has two ears which fit in the undercuts on the inside of the extractor, by which means, with the assistance of the extractor tongue and groove, the extractor is held in place on the bolt.

(2) The bolt has two locking lugs formed at the front end which sustain the shock of the discharge, the one on top being slotted to allow the passage of the point of the ejector. A gas escape hole is located between the locking lugs. Two small circular notches are

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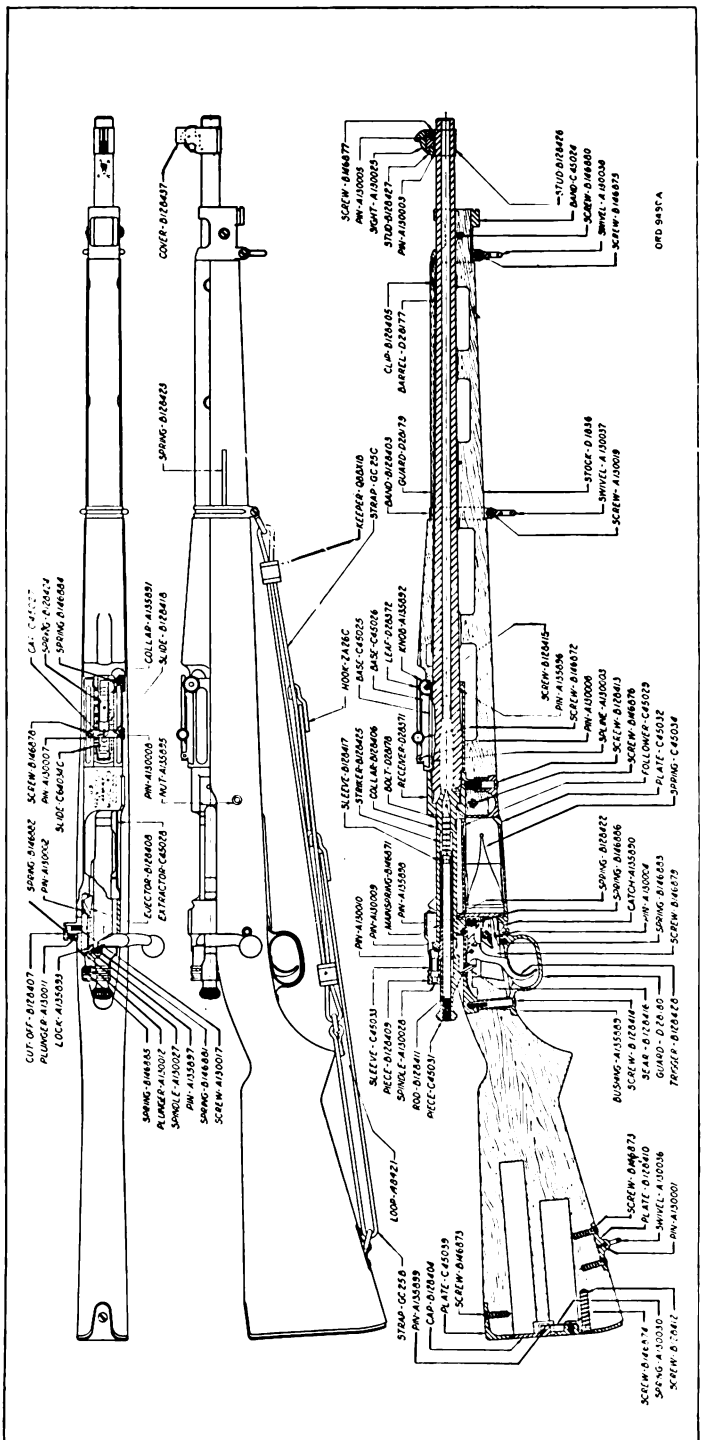


FIGURE 3.—U. S. rifle, caliber .30, M1903A1, with gun sling, M1907 (sectional views).

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located on the left side of the slotted locking lug. This side of the lug rotates 90° when the bolt is drawn back for loading, and one of the notches engages with the bolt stop pin in either single or magazine loading, retaining the bolt in place in the open position. A safety lug is formed midway on the bolt which comes into play only in the event of the locking lugs yielding under powder pressure. On the rear of the bolt are formed the handle, the extracting cam, the safety lock spindle notch, the cocking cam, the cock notch, and the sleeve lock notch.

c. Striker.—The striker has a joint hole formed on its rear end by which it is secured to the firing pin. The annular grooves on the body of the striker retain the lubricating oil and prevent the accumulation of rust thereon.

d. Firing pin sleeve.—The firing pin sleeve fits over the front end of the firing pin and the rear end of the striker, covering the joint hole and preventing accidental separation of the firing pin and striker. Its rear end forms the front bearing for the mainspring.

e. Mainspring.—The mainspring is made of 0.049-inch diameter music wire. It has 30 coils with a pitch of 0.15 inch and an outside diameter of 0.4 inch.

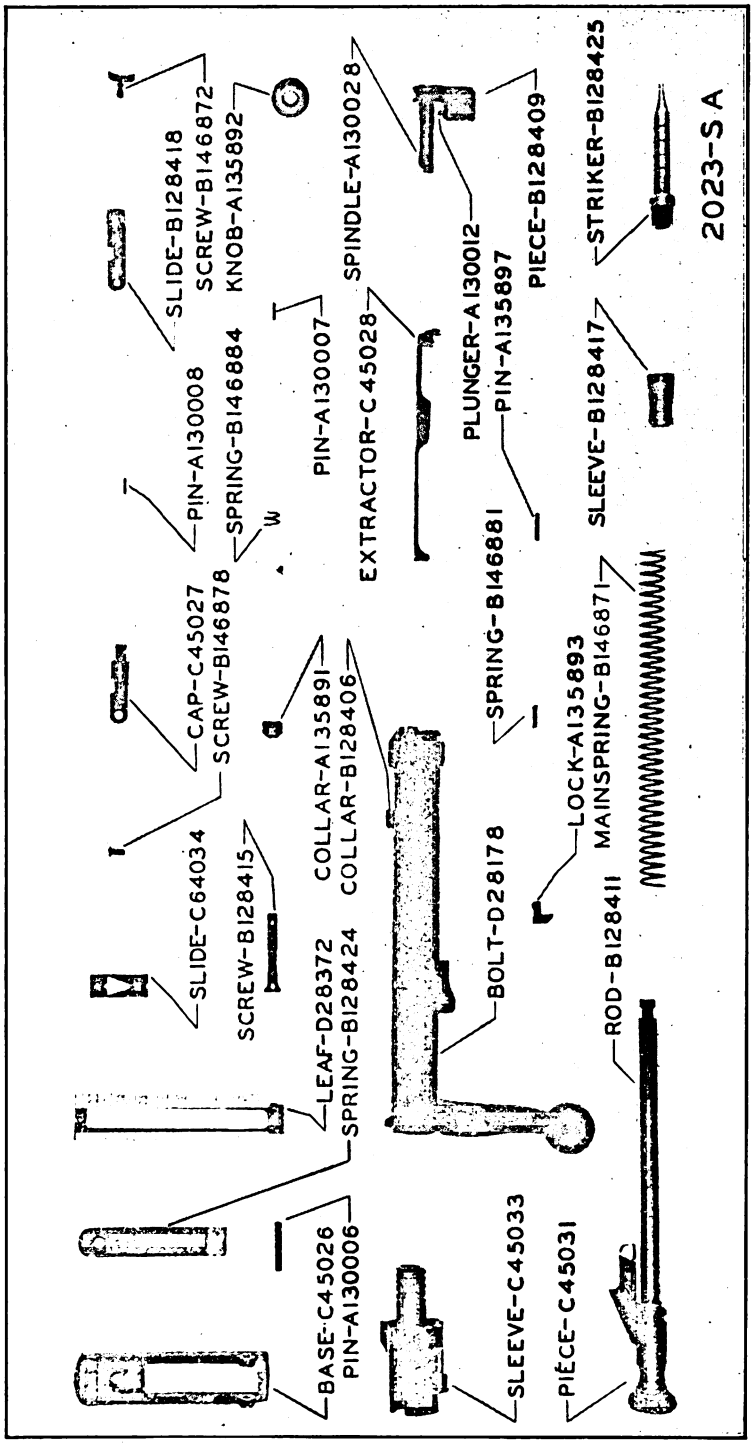
f. Bolt sleeve assembly.—The bolt sleeve assembly consists of the bolt sleeve, the bolt sleeve lock, the bolt sleeve lock pin, and the bolt sleeve lock spring.

(1) The bolt sleeve has a short threaded barrel for the purpose of securing the sleeve to the bolt. Formed on the bolt sleeve are the safety lock seat, the safety lock plunger groove, recesses for retaining the safety lock when turned to the right or left, a recess for retaining the safety lock in dismounting the bolt mechanism, a bevel for dismounting the safety lock from the bolt sleeve, and a recess for the bolt sleeve lock. There are also the cocking piece groove, an undercut for the rear end of the bolt and holes for the firing pin, sleeve lock pin, and safety lock spindle.

(2) The bolt sleeve lock is designed to prevent accidental turning of the bolt sleeve when the bolt is drawn back. It has a spindle which is bored out to receive the sleeve lock spring and a groove for the sleeve lock pin.

g. Safety lock assembly.—This assembly consists of the safety lock thumbpiece, the safety lock spindle, the safety lock plunger, and the safety lock spring. These parts are permanently assembled during manufacture. The safety lock plunger projects into its groove in the bolt sleeve under the action of the safety lock spring and prevents any movement of the safety lock to the rear. When the safety lock

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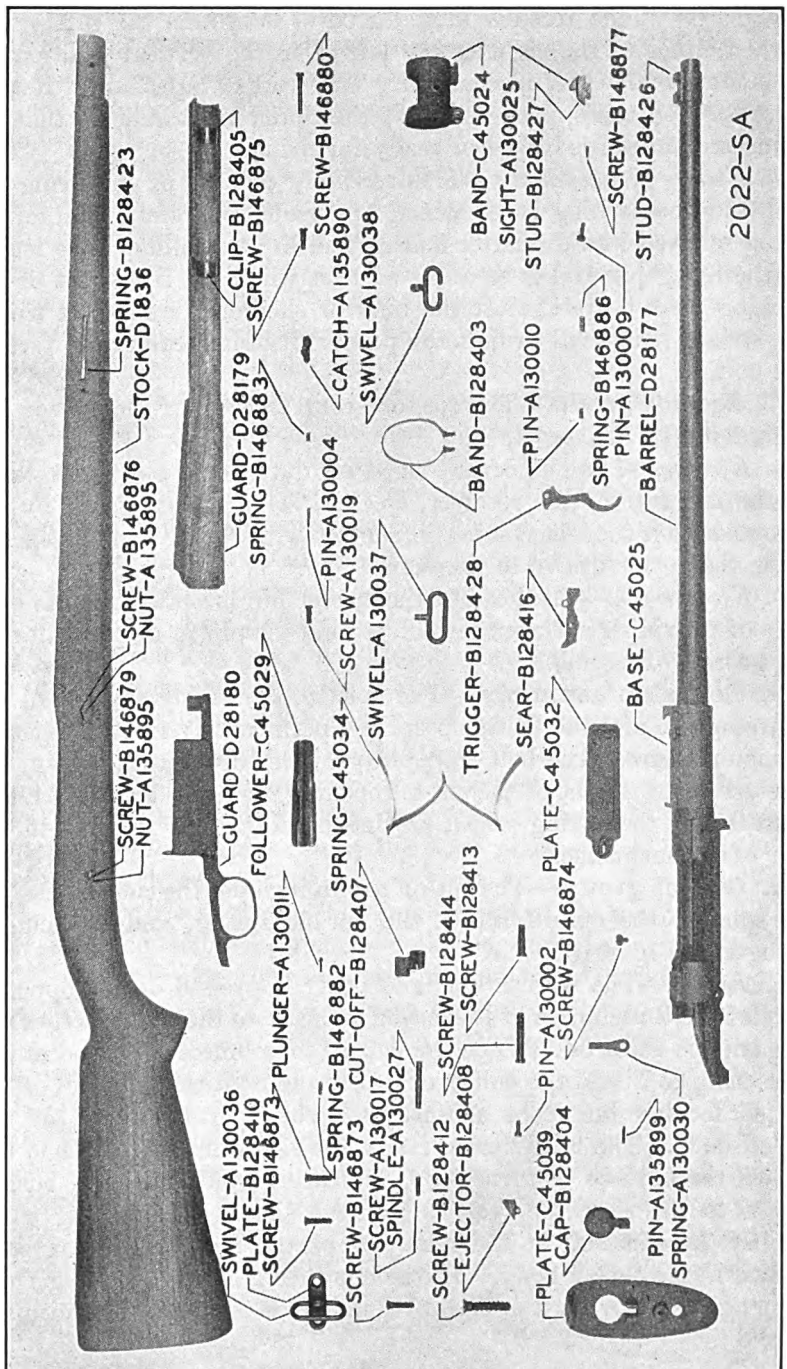


FIGURE 4.—Components of U. S. rifle, caliber, .30, M1903A1.

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plunger is in the recesses in the groove, it retains the safety lock turned either to the right or the left or in the vertical position for dismounting the bolt mechanism. The words "Safe" and "Ready" impressed on the opposite sides of the thumbpiece indicate that the firing mechanism is locked or ready for firing.

h. Firing pin assembly.—This assembly consists of the firing pin rod and the cocking piece which are made separately, the former being screwed into the latter and riveted in assembling. The length of the firing pin rod is so adjusted that when the front end of the cocking piece bears against the interior shoulder of the bolt sleeve, the striker point will project the proper distance beyond the face of the bolt.

7. Ejector group.—The ejector group consists of the ejector and ejector pin. (Fig. 4 ②.)

a. Ejector.—The ejector is hinged on the ejector pin in its recess in the left side of the receiver, ejection being accomplished by the slotted lug on the bolt coming in contact with the heel of the ejector when the bolt is drawn to the rear.

b. Ejector pin.—The head of the ejector pin is slotted for the purpose of providing sufficient tension to hold the pin in its place during the process of assembling.

8. Bolt stop assembly.—The bolt stop assembly consists of the bolt stop pin and the bolt stop spring, permanently riveted together in manufacture. The bolt stop pin projects through its hole in the receiver just in front of the cut-off opening, and is held in place and operated by the spring which fits into a slot in the receiver in the rear of the magazine.

9. Cut-off group.—The cut-off group includes the cut-off, the cut-off spindle, the cut-off screw, the cut-off spring, and the cut-off plunger. (Fig. 4 ②.)

a. Cut-off.—The words "On" and "Off" impressed on the opposite sides of the thumbpiece of the cut-off indicate to the firer whether the magazine is on or off. When the cut-off thumbpiece is turned down, indicating "off" and the bolt is drawn to the rear, the rear end of the slotted locking lug stops against the projecting front end of the cut-off body. The rifle is then ready for single loading. When the cut-off thumbpiece is turned up, indicating "on", and the bolt is drawn to the rear, the rear end of the slotted locking lug stops against the shoulder at the rear end of the magazine fire groove formed in the cut-off body. The rifle is then ready for loading from the magazine. When the cut-off thumbpiece is in the intermediate

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position, the dismounting groove formed in the cut-off body permits the bolt to be drawn entirely out of the receiver.

b. Cut-off screw.—The cut-off screw goes through the cut-off from the outer edge of the thumbpiece, its end fitting into a groove in the cut-off spindle.

c. Cut-off spring and plunger.—The cut-off spring and the cut-off plunger retain the cut-off in its seat in the receiver with the thumbpiece turned up for loading from the magazine, turned down for single loading, or turned to the intermediate position for permitting the removal of the bolt. The spindlehead works in a groove in the left side of the receiver, having three small notches corresponding to the above positions of the cut-off.

10. Floor plate group.—The floor plate group includes the floor plate, the floor plate catch, the floor plate pin, and the floor plate spring. (Fig. 4 ②.)

a. Floor plate.—On the front end of the floor plate a tenon is formed which fits into a groove at the front end of the magazine, and with the assistance of the floor plate catch retains the floor plate securely in its place at the bottom of the magazine. On the rear end of the floor plate is a lug which is slotted to receive the floor plate catch and has a tenon on its front end which fits into a slot in the magazine. Directly back of the lug is a cavity through which the floor plate catch is released by means of the end of a bullet, small screw driver, or similar tool.

b. The floor plate catch retains the floor plate in its seat; the floor plate pin retains the floor plate catch in position and operates as a pivot for the floor plate catch; the floor plate spring operates the floor plate catch.

11. Magazine spring.—The smaller end of the magazine spring slides into the undercuts on the follower, and the larger end fits in the same way into the undercuts in the floor plate. (Fig. 4 ②.)

12. Follower.—A rib is formed on top of the follower which serves to locate the cartridges in the magazine and guides the last cartridge into the chamber. On the bottom are two lugs in which are the undercuts for the magazine spring. (Fig. 4 ②.)

13. Trigger guard group.—The trigger guard group includes the trigger guard (of which the body of the magazine forms a part), the guard screw bushing, the rear guard screw, and the front guard screw. The guard screw bushing fits tightly into the stock between the receiver and the rear tang of the trigger guard, and serves as a stop for the rear guard screw, preventing its being screwed down tight enough to bend the trigger guard. The front and rear guard

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screws are the same except that the rear screw is longer. (Fig. 4 ②.)

14. Sear and trigger group.—The sear and trigger group includes the sear, the sear spring, the sear pin, the trigger, and the trigger pin. (Fig. 4 ②.)

a. The sear has a seat for the sear spring in the upper front end, a slot for the trigger, and two transverse holes, one for the sear pin and one for the trigger pin. The sear pin hinges the sear in the receiver. The sear spring is seated in the sear spring seat of the sear, its upper end bearing against the receiver.

b. The trigger operates in the trigger slot in the sear. The trigger pin hinges the trigger to the sear by passing through the trigger pin holes in the sear and trigger.

15. Front sight group.—The front sight group includes the movable stud assembly and the front sight screw. (Fig. 4 ②.)

a. Movable stud assembly.—This assembly consists of the movable stud, the front sight, and the front sight pin. The rear face of both the fixed stud and the movable stud is serrated to prevent any reflection of light from the surface interfering with aiming the rifle.

(1) The movable stud fits into the undercut slot in the fixed stud. It has a transverse hole for the front sight pin.

(2) The front sight fits in a slot in the movable stud.

(3) The front sight pin holds the front sight in position in the slot in the movable stud. The pin is tapering, and its small end is driven in from the right, and both ends are then upset to prevent accidental removal.

b. Front sight screw.—This screw secures the movable stud to the fixed stud and prevents the movable stud from being moved laterally. The recess for this screw is not drilled in the movable stud until the correct position of the movable stud has been determined by bore sighting.

16. Rear sight assembly.—The rear sight assembly consists of the rear sight movable base, the rear sight windage screw, the rear sight windage screw collar, the rear sight windage screw spring, the rear sight windage screw knob, the rear sight base spring, the rear sight leaf, the rear sight joint pin, the rear sight slide, the rear sight slide cap, the rear sight slide cap screw, the rear sight slide binding screw, the rear sight slide cap pin, the rear sight drift slide, and the rear sight drift slide pin. (Fig. 4 ①.)

a. Rear sight movable base.—On the top surface of the movable base near the end are two ears in which are holes for the joint pin

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which serves as a hinge for the rear sight leaf. Back of the ears are the wind gage graduations, each point of which corresponds to a lateral deviation of 4 inches for each 100 yards. On the lower rear end is a lip which fits in the undercut in the rear end of the fixed base. On the lower front end is a lip in which is a worm gear for the engagement of the windage screw.

b. Rear sight windage screw.—This screw when assembled with other components provides the means of setting the rear sight so that allowance may be made for wind blowing across the line of fire. The taper head of the screw fits into the conical recess in the left side of the fixed base, and the thread on the screw engages the worm gear in the lip of the movable base.

c. Rear sight windage screw collar.—This collar fits over the right end of the windage screw, and the taper on the collar fits into the chamfer on the right side of the fixed base.

d. Rear sight windage screw spring.—This spring fits around the right-hand end of the windage screw and is seated in the cylindrical recess of the windage screw collar.

e. Rear sight windage screw knob.—The windage screw knob is driven over the right-hand end of the windage screw which is knurled in manufacture so as to increase the friction, the projection on the left side fitting into the cylindrical opening in the windage screw collar. The action of the windage screw spring between the windage screw collar and the windage screw knob acts to take up any lost motion which may be due to wear between the windage screw and the movable base and between the windage screw and the front lug of the fixed base.

f. Rear sight base spring.—One end of this spring has a lip which fits in the undercut in its seat in the movable base. A hole is provided by which, with the aid of a drift or small screw driver, the spring is assembled or dismounted by driving it into or out of its seat in the movable base.

g. Rear sight leaf.—The leaf hinges on the joint pin in the movable base. The free end of the base spring bears against the lower end of the leaf and maintains it in either its lowered or raised position. The leaf is graduated from 100 to 2,850 yards. The lines extending across one or both branches of the leaf are 100-yard divisions, the longer of the short lines being 50-yard and the shorter lines 25-yard divisions.

h. Rear sight joint pin.—This pin on which the leaf hinges is cylindrical with rounded ends and fits tightly in the ears of the movable base.

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i. Rear sight slide.—The rear sight slide operates up and down on the rear sight leaf.

j. Rear sight slide cap.—The cap is attached to the rear sight slide by entering the dovetailed groove at the right end of the slide and by the slide cap screw at the left.

k. Rear sight slide binding screw.—This screw is seated in the right end of the rear sight slide and serves to retain the slide in any desired position on the leaf.

l. Rear sight slide cap pin.—This pin is inserted in its hole in the rear sight slide, and fitting into a groove in the rear sight slide binding screw prevents the accidental removal of the latter.

m. Rear sight drift slide.—The drift slide has the drift slide pin riveted to it in manufacture.

(1) The drift slide normally used has a peephole 0.06 inch in diameter. Drift slides having peepholes 0.04, 0.05, 0.07, and 0.08 inch in diameter are also manufactured, and drift slides with 0.07- and 0.08-inch diameter peepholes are carried in the set of spare parts. The numbers 4, 5, 6, 7, and 8 are stamped on the back surface of the respective drift slides as a means of identification.

(2) The index lines on either side of the peephole and lower notch enable the drift slide to be set accurately at any desired graduation on the rear sight leaf.

(3) As the rear sight slide is moved up or down on the rear sight leaf the drift slide moves with it and at the same time has a lateral movement in the undercut between the branches of the leaf, thus automatically correcting for drift. This movement corrects for all drift up to 600 yards, but for only part of the drift beyond that range.

(4) With the rear sight leaf up, ranges from 100 to 2,350 yards can be obtained through the peephole; from 100 to 2,450 yards through the lower notch at the bottom of the triangular opening; and from 1,400 to 2,750 yards through the upper notch in the upper edge of the drift slide.

(5) With the rear sight leaf down and using the battle sight notch in the rear sight slide cap, the sights are set for 547 yards or battle-line firing for the down position of the rear sight slide.

17. Butt plate assembly.—The butt plate assembly consists of the butt plate, the butt plate cap, the butt plate pin, the butt plate spring, and the butt plate spring screw. (Fig. 4 ②.)

a. Butt plate.—The butt plate has the toe, the tang, the cap hole, the cap ears in which are holes for the butt plate pin, the spring lug, and holes for the large and small butt plate screws. A notch is cut

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into the edge of the cap hole to facilitate the opening of the cap. Most rifles are furnished with butt plates which are smooth. On a few, however, the plate has been checked.

b. Butt plate cap.—The cap is hinged between the ears of the butt plate on the butt plate pin and is retained either closed or open by the free end of the butt plate spring. The cap is either smooth or checked to match the butt plate.

c. Butt plate pin.—This pin serves to hinge the butt plate cap between the ears of the butt plate, and after being driven into the holes in the ears of the butt plate and cap has its ends slightly upset.

d. Butt plate spring.—The spring bears on the heel of the butt plate cap and serves to retain the latter either in a closed or an open position.

e. Butt plate spring screw.—This screw secures the butt plate spring to the lug on the butt plate and is firmly screwed against the spring.

18. Butt plate screws.—The butt plate screws, large and small, secure the butt plate to the stock. (Fig. 4 ②.)

19. Butt swivel assembly.—The butt swivel assembly consists of the butt swivel, the butt swivel plate, and the butt swivel pin. The butt swivel plate has holes for the butt swivel screws, butt swivel, and the butt swivel pin. The butt swivel pin retains the butt swivel in the butt swivel plate. (Fig. 4 ②.)

20. Butt swivel screws.—The butt swivel screws are the same as the small butt stock screw and serve to attach the butt swivel plate to the stock.

21. Lower band group.—The lower band group includes the lower band, the lower band screw, the lower band swivel, and the lower band spring. (Fig. 4 ②.)

a. Lower band.—The lower band has two ears with screw holes for the lower band screw. The front or upper end is designated by the letter "U" which should be assembled with open end facing the muzzle. The lower band is split between the ears in order to give better adjustment to the stock and hand guard and permit removal of the lower band without marring the stock.

b. Lower band swivel.—The swivel is a steel loop with a lug which is hinged between the ears of the lower band.

c. Lower band screw.—This screw serves to hinge the lower band swivel between the ears of the lower band. The threaded end of the screw is upset after assembling, in order to prevent it from becoming lost.

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d. Lower band spring.—One end of this spring has a notch which holds the lower band in place. On the other end is a spindle which retains the spring in the stock. This part is shown assembled to the stock in figure 4 ②.

22. Upper band group.—The upper band group includes the upper band, the upper band screw, the stacking swivel, and the stacking swivel screw. (Fig. 4 ②.)

a. Upper band.—On the lower front end of the upper band an undercut lug is formed for attaching the bayonet. On the lower rear end are two ears in which are the holes for the stacking swivel screw. In the center is a transverse hole for the upper band screw. In the upper rear end is an undercut for the front tenon on the hand guard.

b. Upper band screw.—This screw secures the upper band to the stock. The thread under the head engages the hole in right side of the upper band.

c. Stacking swivel.—This swivel is a split loop with a lug which is hinged between the ears of the upper band.

d. Stacking swivel screw.—This screw serves to hinge the stacking swivel between the ears of the upper band. It is similar to the lower band screw but slightly longer. The threaded end of the screw is upset after assembling in order to prevent it from becoming lost.

23. Stock.—The stock is the M1903A1 having a pistol grip. The M1903 stock is identical except it has no pistol grip. Two holes are provided in the butt of the stock; the upper hole is a pocket for the oiler and thong case and the lower hole is for decreasing the weight of the stock. (Fig. 4 ②.)

24. Stock screws and nuts.—The stock screws and nuts, front and rear, are identical except the rear screw is slightly longer. The front stock screw extends transversely through the stock between the mortise for the recoil lug and the magazine well, and the rear stock screw extends transversely through the stock between the magazine well and the slot for the trigger. The nuts and the heads of the screws are countersunk in the stock, and the ends of the screws are slightly upset over the nuts after assembly. These parts are shown assembled to stock in figure 4 ②.

25. Hand guard.—The hand guard is made of wood. It has a tenon at its front end which enters an undercut in the upper band, a shoulder about in the middle for the lower band, a tenon at its rear end which enters an undercut in the rear sight fixed base, and

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two recesses for the hand guard clips. The inside, for nearly its entire length, is hollowed out to form an air chamber. (Fig. 4 ②.)

26. Barrel assembly.—The barrel assembly includes the barrel, the fixed stud, the fixed stud pin, the fixed base, the fixed base spline, and the fixed base pin. (Fig. 4 ②.)

a. Barrel.—The barrel is 24 inches in length, and the rifling consists of four plain grooves 0.004 inch deep. The twist is uniform right hand, one turn in 10 inches. The muzzle is rounded to protect the rifling, and the tenon at the rear is threaded for the purpose of securing the receiver to the barrel. On the top in rear of the fixed stud are stamped the initials of the place of manufacture, the ordnance escutcheon, and the month and year.

b. Fixed stud.—The fixed stud to which is assembled the front sight group has a longitudinal slot in its upper inner surface which fits over the lug on the upper side of the barrel and prevents lateral displacement of the fixed stud.

c. Fixed stud pin.—The fixed stud pin enters a transverse hole near the rear of the fixed stud, and by bearing in a slight recess on the top of the barrel prevents longitudinal displacement of the fixed stud.

d. Fixed base.—The fixed base to which is assembled the rear sight assembly has a transverse hole near its front end for the fixed base pin and a longitudinal hole in its front end for the fixed base spline, by which it is firmly secured to the barrel and lateral and longitudinal movement prevented. On the top of the fixed base is a lug on which pivots the movable base.

e. Fixed base spline.—This is a small pin which locates and prevents the fixed base from turning on the barrel.

f. Fixed base pin.—This pin is identical to the fixed base spline and prevents longitudinal movement of the fixed base on the barrel.

27. Receiver.—The principal parts of the receiver, shown assembled to the barrel in figure 4 ②, are the well which receives the bolt, the magazine opening, the seat for the cut-off, the recess for the cut-off thumbpiece, the groove for the cocking piece, the sear nose slot, the extracting cam, the recoil lug in which is the hole for the front guard screw, the recesses for the bolt locking lugs, the locking cams, the locking shoulders, the safety shoulder, the cartridge ramp, the gas escape hole, the sear pin hole, and the ejector pin hole. On the upper surface of the front end of the receiver are stamped the place of manufacture, the model of the rifle, and the serial number.

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SECTION IV

MECHANICAL OPERATION, DISASSEMBLING, AND ASSEMBLING

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28. Assembled parts, description and operation.—Most of the operating parts may be included under the bolt mechanism and the magazine mechanism.

a. Bolt mechanism.—(1) *Description.*—The bolt mechanism consists of the bolt assembly, bolt sleeve assembly, extractor, safety lock assembly, firing pin assembly, firing pin sleeve, striker, and mainspring. The components of the bolt mechanism are shown in figure 4 ①.

(*a*) The bolt moves backward and forward and rotates in the well of the receiver. It carries a cartridge either from the magazine or one placed by hand in front of it into the chamber and supports its head when fired.

(*b*) The bolt sleeve unites the parts of the bolt mechanism, and its rotation with the bolt is prevented by the lugs on its sides coming in contact with the receiver.

(*c*) The hook of the extractor engages in the grooves of the cartridge case and retains the head of the latter in the countersink of the bolt until the case is ejected.

(*d*) The safety lock when turned to the left is inoperative; when turned to the right (which can only be done when the rifle is cocked) the point of the spindle enters its notch in the bolt and locks the bolt; at the same time its cam forces the cocking piece slightly to the rear out of contact with the sear and locks the firing pin.

(2) *Operation.*—(*a*) *To open bolt.*—Raise the bolt handle until it comes in contact with the left side of the receiver and pull directly to the rear until the top locking lug strikes the cut-off. Raising the bolt handle rotates the bolt and separates the locking lugs from their locking shoulders in the receiver, with which they have been brought into close contact by the powder pressure. This rotation causes the cocking cam of the bolt to force the firing pin to the rear, drawing the point of the striker into the bolt, rotation of the firing pin being prevented by the lug on the cocking piece projecting through the slot

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in the bolt sleeve into its groove in the receiver. As the bolt sleeve remains longitudinally stationary with reference to the bolt, this rearward motion of the firing pin and consequently of the striker will start the compression of the mainspring, since the rear end of the latter bears against the front end of the barrel of the bolt sleeve and its front end against the rear end of the firing pin sleeve. When the bolt handle strikes the receiver, the locking lugs have been disengaged, the firing pin has been forced to the rear until the sear notch of the cocking piece has passed the sear nose, the cocking piece nose has entered the cock notch in the rear end of the bolt, the bolt sleeve lock has engaged its notch in the bolt, and the mainspring has been almost entirely compressed. During the rotation of the bolt a rear motion has been imparted to it by its extracting cam coming in contact with the extracting cam of the receiver so that the cartridge case will be started from the chamber. The bolt is then drawn directly to the rear, the parts being retained in position by the cocking piece nose remaining in the cock notch and locked by the bolt sleeve lock engaging its notch in the bolt. Just before the bolt is drawn fully to the rear, the top locking lug strikes the heel of the ejector, throwing its point suddenly to the right in the lug slot. As the bolt moves fully to the rear, the rear face of the cartridge case strikes against the ejector point and the case is ejected slightly upward and to the right from the receiver.

(*b*) *To close bolt.*—Push the bolt handle forward until the extracting cam on the bolt bears against the extracting cam on the receiver, thereby unlocking the bolt sleeve from the bolt; then turn the bolt handle down. As the bolt handle is turned down the cams of the locking lugs bear against the locking shoulders in the receiver, and the bolt is forced slightly forward into its closed position. As all movement of the firing pin is prevented by the sear nose engaging the sear notch of the cocking piece, this forward movement of the bolt completes the compression of the mainspring, seats the cartridge in the chamber, and in single loading forces the hook of the extractor into the groove of the cartridge case. In loading from the magazine the hook of the extractor, rounded at its lower edge, engages in the groove of the top cartridge as it rises from the magazine under the action of the follower and magazine spring. The rifle is now ready to fire.

(*c*) The opening and closing of the bolt should each be done by one continuous motion.

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(*d*) Double loading from the magazine is prevented by the extractor engaging the cartridge case as soon as it rises from the magazine and holding its head against the face of the bolt until ejected.

(*e*) It will be noted that in this system of bolt mechanism the compression of the mainspring and the seating of the cartridge in and the starting of the empty case from the chamber are entirely done by the action of cams.

(*f*) *To cock rifle.*—The rifle may be cocked either by raising the bolt handle until it strikes the left side of the receiver and then immediately turning it down or by pulling the cocking piece directly to the rear.

(*g*) *To fire rifle.*—To fire the rifle, the finger piece of the trigger must be drawn to the rear until contact with the receiver is transferred from the trigger bearing to the heel, which gives a creep to the trigger, and then until the sear nose is withdrawn from in front of the cocking piece. In firing, unless the bolt handle is turned fully down, the cam on the cocking piece will strike the cocking cam on the bolt, and the energy of the mainspring will be expended in closing the bolt instead of on the primer. This prevents the possibility of a cartridge being fired until the bolt is fully closed.

b. Magazine mechanism.—(1) *Description.*—The magazine mechanism consists of the floor plate, follower, magazine spring, and the cut-off. These components are shown in figure 4②. To charge the magazine, see that the cut-off is turned up showing "On", draw the bolt fully to the rear, insert the cartridges from a clip or from the hand, and close the bolt. To charge the magazine from a clip, place either end of a loaded clip in its seat in the receiver and with the thumb of the right hand press the cartridges down into the magazine until the top cartridge is caught by the right edge of the receiver. Pushing the bolt forward after charging the magazine ejects the clip. The cartridge ramp guides the bullet and cartridge case into the chamber. The magazine can be filled, if partly filled, by inserting cartridges one by one.

(2) *Operation.*—(*a*) When the cut-off is turned down, the magazine is "Off". The bolt cannot be drawn fully back, and its front end projecting over the rear end of the upper cartridge holds it down in the magazine below the action of the bolt. The magazine mechanism then remains inoperative, and the rifle can be used as a single-loader, the cartridges in the magazine being held in reserve. The rifle can readily be used as a single-loader with the magazine empty.

(*b*) When the cut-off is turned up, the magazine is "On". The bolt can be drawn fully to the rear, permitting the top cartridge to rise

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high enough to be caught by the bolt in its forward movement. As the bolt is closed, this cartridge is pushed forward into the chamber, being held up during its passage by the pressure of those below. The last one in the magazine is held up by the follower, the rib on which directs it into the chamber.

(*c*) In magazine fire, after the last cartridge has been fired and the bolt drawn fully to the rear, the follower rises and holds the bolt open to show that the magazine is empty.

29. Precautions.—*a. Carrying the rifle cocked.*—If it is desired to carry the rifle cocked with a cartridge in the chamber, the bolt mechanism should be secured by turning the safety lock to the right. Under no circumstances should the firing pin be let down by hand on a cartridge in the chamber.

b. Ejection.—To obtain positive ejection, and to insure the bolt catching the top cartridge in the magazine when loading from the magazine, the bolt must be drawn fully to the rear in opening it.

c. Magazine to single loading.—When the bolt is closed or slightly forward, the cut-off may be turned up or down as desired. When the bolt is in its rearmost position, to pass from loading from the magazine to single loading it is necessary to force the top cartridge or the follower below the reach of the bolt, to push the bolt slightly forward, and to turn the cut-off down, showing "Off".

d. Misfire.—In case of a misfire it is unsafe to draw back the bolt immediately as it may be a case of hangfire. In such cases the rifle should be recocked by drawing back the cocking piece and fired before opening the bolt.

e. Lubrication.—It is essential for the proper working and preservation of all cams that they be kept lubricated.

f. Use of oil or grease on cartridges prohibited.—Grease or oil on cartridges used in the rifle or on the walls of the rifle chamber creates excessive and hazardous pressure on the rifle bolt. A dry cartridge case when fired in a dry chamber is expanded against the walls of the chamber and thus cushions the blow on the cartridge case head and bolt to a certain extent. When there is oil on the case or on the walls of the chamber there is no adhesion of the case to the chamber, the case slips back, and the case head and bolt receive a greater rearward thrust.

g. Obstructions in barrel.—Never fire the rifle with rust-preventive compound or any obstruction, whether near the breech or the muzzle, in the bore. Practically all cases of burst barrels can be traced to

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some obstruction left in the bore, such as a cleaning patch, mud, or the like.

30. Disassembling and assembling by rifleman.—The bolt and magazine mechanisms can be removed and disassembled without removing the stock. The stock should never be removed except for making repairs and then only under the supervision of ordnance personnel.

a. Bolt mechanism.—(1) *Removing.*—Place the cut-off at the center notch; cock the rifle and turn the safety lock to a vertical position. Raise the bolt handle and draw out the bolt.

(2) *Disassembling.*—(*a*) Hold bolt in left hand, press bolt sleeve lock in with thumb of right hand to unlock bolt sleeve from bolt, and unscrew bolt sleeve by turning to the left.

(*b*) Hold bolt sleeve between forefinger and thumb of the left hand, draw cocking piece back with middle finger and thumb of right hand, and turn safety lock down to the left with the forefinger of the right hand in order to allow the cocking piece to move forward in bolt sleeve, thus partially relieving the tension of mainspring.

(*c*) With the cocking piece against the breast, draw back the firing pin sleeve with the forefinger and thumb of right hand and hold it in this position while removing the striker with the left hand. Remove firing pin sleeve and mainspring; pull firing pin out of sleeve.

(*d*) Turn the extractor to the right, forcing its tongue out of its groove in the front of the bolt, and force the extractor forward and off the bolt.

(3) *Assembling.*—(*a*) With the left hand, grasp the rear of the bolt, handle up, and turn the extractor collar with the thumb and forefinger of the right hand until its lug is on a line with the safety lug on the bolt; take the extractor in the right hand and insert the lug on the collar in the undercuts in the extractor by pushing the extractor to the rear until its tongue comes in contact with the rim on the face of the bolt (a slight pressure with the left thumb on the top of the rear part of the extractor assists in this operation); turn the extractor to the right until it is over the right lug. Take the bolt in the right hand and press the hook of the extractor against the butt plate or some rigid object until the tongue on the extractor enters its groove in the bolt.

(*b*) With the safety lock turned down to the left to permit the firing pin to enter the bolt sleeve as far as possible, assemble the bolt sleeve and firing pin. Place the cocking piece against the breast and put on mainspring, firing pin sleeve, and striker. Hold the cocking

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piece between the thumb and forefinger of the left hand, and by pressing the striker point against some substance, not hard enough to injure it, force the cocking piece back until the safety lock can be turned to the vertical position with the right hand.

(*c*) Insert the firing pin in the bolt and screw up the bolt sleeve (by turning it to the right) until the bolt sleeve lock enters its notch on the bolt.

(*d*) See that the cut-off is at the center notch; hold the rifle under floor plate in the fingers of the left hand, the thumb extending over the left side of the receiver. Take bolt in right hand with safety lock in a vertical position and safety lug up; press rear end of follower down with left thumb and push bolt into the receiver. Lower bolt handle; turn safety lock and cut-off down to the left with right hand.

b. Magazine mechanism.—(1) *Removing.*—With the bullet end of a cartridge, press on the floor plate catch (through the hole in the floor plate), at the same time drawing the bullet to the rear; this releases the floor plate.

(2) *Disassembling.*—Raise the rear end of the first limb of the magazine spring high enough to clear the lug on the floor plate and draw it out of its mortise; proceed in the same manner to remove the follower.

(3) *Assembling.*—(*a*) To assemble the magazine spring and follower to the floor plate, reverse the operations of disassembling.

(*b*) Insert the follower and magazine spring in the magazine, place the tenon on the front end of the floor plate in its recess in the magazine, then place the lug on the rear end of the floor plate in its slot in the trigger guard and press the rear end of the floor plate forward and inward at the same time, forcing the floor plate into its seat in the trigger guard.

31. Complete disassembling of rifle.—Complete disassembling of the rifle will be done only under the supervision of ordnance personnel (not by rifleman). The bolt and magazine mechanisms having been removed and disassembled to the extent described in paragraph 30, proceed as follows:

a. Turn safety lock to a vertical position on the bolt sleeve and remove it by striking the front face of the thumbpiece a light blow.

b. Drive out the bolt sleeve lock pin from the top and remove the bolt sleeve lock and spring, being careful not to lose the spring.

c. Remove front sight pin and remove front sight. Unscrew front sight screw and remove movable stud.

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d. Remove upper band screw and drive upper band forward by a few sharp blows on the lug with a hardwood block. Unscrew stacking swivel screw and remove stacking swivel.

e. Unscrew lower band screw and remove lower band swivel; press in rear end of lower band spring and move lower band forward and off the barrel.

f. Draw hand guard forward until free from fixed base and remove.

g. Remove front and rear guard screws and trigger guard. It may be necessary to tap gently on the front and rear of the trigger guard bow to loosen.

h. Remove floor plate catch and spring from trigger guard by driving out the floor plate catch pin from either side.

i. Remove barrel and receiver assembly from stock.

(1) ***The fixed base and the fixed stud should never be removed from the barrel.***

(2) ***The barrel should never be unscrewed from the receiver. The barrel and receiver may be assembled only at ordnance establishments properly equipped for this work. Requisitions should, therefore, always call for barrels and receivers assembled and not for barrels alone.***

j. To remove the lower band spring, drive its spindle out of its hole in the stock from the left.

k. Unscrew the butt swivel screws and remove the butt swivel assembly from the stock. The butt swivel assembly consisting of the plate, swivel, and pin, permanently assembled, is issued complete.

l. Unscrew butt plate screws and remove butt plate from stock.

m. Unscrew butt plate spring screw and remove the butt plate spring; drive out butt plate pin and remove butt plate cap.

n. Remove cut-off by loosening the screw in the end of the thumbpiece until it disengages the groove in the cut-off spindle; insert the blade of a screw driver in the notch in the rear end of the spindle and force it out. Remove the spring and the plunger, being careful not to lose them.

o. Remove the ejector by driving out the ejector pin from the upper side.

p. Remove the sear and trigger by driving out the sear pin from the right, being careful not to lose the sear spring.

q. Remove trigger from sear by driving out the trigger pin from either side.

r. Remove bolt stop by inserting a small punch or the end of the striker in the hole in the end and forcing it from its pocket.

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s. The rear sight assembly should never be disassembled except for cleaning and for the purpose of making repairs. The rear sight leaf should never be removed from the rear sight movable base except for making repairs.

32. Assembling of rifle.—Follow in reverse order the operations of disassembling.

a. In assembling the bolt sleeve lock to the bolt sleeve, be careful to compress the lock and spring while driving in the pin from the bottom of the bolt sleeve.

b. To assemble the safety lock and bolt sleeve, insert the safety lock spindle in its hole in the bolt sleeve as far as it will go; then, with the thumbpiece vertical and pressed against some rigid object, introduce the point of the safety lock assembling tool, provided for this purpose, between the safety lock spindle and the safety lock plunger, forcing the latter into the thumbpiece until it slips over the edge of the sleeve. Further pressure on the safety lock thumbpiece together with the gradual withdrawal of the tool will complete the assembling.

c. The floor plate catch spring and the cut-off spring are alike except in length; the latter being the longer, care should be taken not to substitute one for the other.

Section V

CARE AND PRESERVATION

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33. General care.—The importance of a thorough knowledge of the care and cleaning of the rifle cannot be overemphasized. The kind of attention given to a weapon of this type determines largely whether or not it will shoot accurately and function successfully when needed. The bore and chamber must be kept in perfect condition for accurate shooting. Also it is important that the receiver and moving parts be kept clean, lubricated, and in perfect condition for efficient functioning. Care and cleaning will not be confined to the rifle alone but will include all accessories and appendages.

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34. Cleaning and cleaning materials.—The first step in cleaning is to remove the bolt mechanism from the rifle.

a. Cleaning the bore.—(1) Rifles should always be cleaned from the breech and should be done as soon as the firing for the day is completed. The fouling is easier to remove then, and if left longer it will corrode the barrel.

(2) Care should be taken to see that the chamber is cleaned as thoroughly as the rest of the bore. A roughened chamber delays the rapidity of fire considerably and often causes cartridges to stick.

(3) Complete instructions for cleaning the bore and materials for use therewith are given in TR 1395-A.

b. Cleaning and care of other than the bore of the rifle.—(1) The receiver should be wiped clean, care being taken to remove all dirt and lint.

(2) If gas escapes at the base of the cartridge it will probably enter the well of the bolt through the striker hole. In this case the bolt mechanism must be disassembled and the components and well of the bolt thoroughly cleaned. Before assembling the bolt mechanism, the firing pin, the barrel of the sleeve, the body of the striker, the well of the bolt, and all cams should be wiped with an oiled rag. Many of the components can generally be cleaned with dry rags. All components after cleaning should be wiped with an oiled rag. The best method of applying oil is to rub with a piece of cotton cloth upon which a few drops of lubricating oil (U. S. A. spec. 2-27D) have been placed. This is sufficient for perfect lubrication. Excessive oiling, as with an oilcan, is a waste of oil and results in a collection of dirt which causes friction.

(3) Ordinarily the stock and forearm need only be wiped with a dry rag and then with an oily one. About once a month or oftener, and always after the stock and forearm have become wet with water or perspiration, they should be thoroughly rubbed with a little linseed oil in the palm of the hand. Rub the oil in until dry.

35. Preparation of rifles for long-term storage.—The rifles should be cleaned and prepared with particular care. The bore, all parts of the mechanism, and the exterior of the rifles should be thoroughly cleaned and then perfectly dried with rags. In damp climates particular care must be taken to see that the rags are dry. After drying a part the bare hands should not touch that part. All metal parts should then be heavily coated with rust-preventive compound. Then handling the rifle by the stock and forearm only, it should be placed in the packing chest, the wooden supports at the

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butt and muzzle having previously been painted with rust-preventive compound. Under no circumstances should a rifle be placed in storage if contained in a cloth or other cover, or with a plug in the bore. Such articles collect moisture which causes the weapon to rust.

a. Rust-preventive compound is a heavy, dark-colored, sticky grease provided to protect metal surfaces of the rifle from corrosion while in storage. It is not a lubricant and should not be used as a lubricant. The compound is of two grades, heavy and medium.

(1) Rust-preventive compound, heavy (U. S. A. spec. 2–82B), is used for long-term or permanent storage and must be made fluid prior to use. It melts at about 131° F. A practical method to obtain fluidity is to place the container in a vessel of water, heating it to a temperature of not over 180° F., the exact temperature being determined by the thickness of the film desired. The higher the temperature of the compound, the thinner is the film applied to the metal. In no case should it be heated above 180° F., at which temperature deterioration of the compound sets in. The compound should be heated to the correct temperature for about half an hour before using. Best results will be obtained if the compound is heated to 180° F. and then allowed to cool to the desired consistency before using. The best method of applying the compound is by dipping as there is much less danger of the inclusion of air bubbles in the grease film by this method.

(2) Rust-preventive compound, medium (U. S. A. spec. 2–84A), is a sluggish liquid which pours at a temperature of 81° F. It is used for short-time protection and should not be used on guns put in permanent storage. It may be applied with a brush or by dipping. In applying, heating is not necessary, except in very cold temperatures. Application of the rust-preventive compound to the bore of the rifle barrel is best done by dipping the cleaning brush in rust-preventive compound and running it through the bore two or three times.

b. Prior to placing the rifle in storage the bolt should be in the forward position with the firing pin released. In fact, it is good practice to relieve the firing pin tension whenever the rifle is not in use.

36. Cleaning of rifles as received from long-term storage.—*a. General.*—Rifles received from storage are completely coated with rust-preventive compound. Use dry cleaning solvent to remove all traces of this compound, particular care being taken that all recesses in which springs or plungers operate are cleaned thoroughly. After using the dry cleaning solvent, make sure it is completely removed from all parts by wiping with light-colored cloths until no staining of the cloth occurs. The bore and chamber of the barrel must be

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thoroughly cleaned. All surfaces having been thoroughly cleaned should then be protected with a thin film of lubricating oil applied with a rag.

NOTE.—Failure to clean the firing pin and the recess in the bolt in which it operates may result in gun failure at normal temperatures, and will most certainly result in serious malfunctions if the rifles are operated in low temperature areas, as rust-preventive compound and other foreign matter will cause the lubricating oil to congeal or frost on the mechanism.

b. Dry cleaning solvent (Fed. spec. P–S–661).—This is a petroleum distillate, noninflammable and noncorrosive, used for removing grease. It is generally applied with rag swabs to large parts and as a bath for small parts. The surfaces must be thoroughly dried immediately after removal of the solvent. To avoid leaving finger marks, which are ordinarily acid and induce corrosion, gloves should be worn by persons handling parts after such cleaning. Dry cleaning solvent will attack and discolor rubber.

37. Lubrication and lubricants.—*a.* Proper oiling is second in importance only to intelligent cleaning. It is a vital necessity to the working parts but the oil should be used sparingly. Wiping with a well-oiled rag is the best method. Oil all bearing surfaces of the rifle before firing, taking particular care to see that the bolt mechanism and the extracting and cocking cams are oiled. Before firing the rifle make sure that the walls of the chamber are clean and free of oil (see par. 29 *f*).

b. If the rifle is to be fired in areas where the temperature is 45° F. or above, sperm oil (U. S. A. spec. 2–45A) should be used when available. When not available, motor oil, weight 20, or any light grade machine oil may be used in an emergency.

c. If the rifle is to be fired in areas where the temperature is below 45° F., aircraft instrument and machine-gun lubricating oil (U. S. A. spec. 2–27D) should be used.

38. Preserving rifles after removal of rust-preventive compound.—Sperm oil (U. S. A. spec. 2–45A) is the most suitable oil for preserving the mechanism when in regular or intermittent use. This oil is efficient for preserving the polished surfaces, the bore, and the chamber for a period of from 2 to 6 weeks, dependent on the climatic and storage conditions. Aircraft instrument and machine-gun lubricating oil (U. S. A. spec. 2–27D) should not be considered as a suitable preservative; however, for rifles fired regularly in cold areas it should be used, and application made more often. It is a material disadvantage to use sperm oil or other heavy-bodied oils, as it is absolutely essential that such oils be removed with cleaning fluid and

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aircraft instrument and machine-gun lubricating oil applied before an attempt is made to fire the rifle in such areas.

39. Improving performance of rifle (not to be done by rifleman).—*a. Working down bolt.*—When the bolts of rifles fail to function smoothly they may be worked down with valve grinding compound, medium grade, under the supervision of division, post, camp, or station ordnance officers, in the following manner:

(1) *First operation—smoothing extracting cam.*—Disassemble rifle down to the receiver, barrel, and bolt. Remove firing pin mechanism from bolt. Place receiver with barrel attached, the muzzle end slightly elevated, in bench vise, using either wood or leather between vise jaws to prevent damage to receiver. Plug the muzzle and chamber of the barrel with small rags. Apply a small quantity of the valve grinding compound with the end of a match or sliver of wood to the primary extracting cam (situated at the left rear end of receiver). Enter bolt in receiver. Apply a small quantity of valve grinding compound to extracting cam of bolt. Grasp handle of bolt in palm of right hand and with a forward pressure upon bolt handle rotate handle of bolt up and down, at the same time maintaining enough forward pressure upon bolt to keep cam surface of receiver and bolt in contact. Continue this operation until a smooth, regular surface is obtained upon both cam surfaces. Wipe dry and thoroughly clean all surfaces of bolt and receiver from all traces of the valve grinding compound.

(2) *Second operation—smoothing cocking cam.*—Assemble firing pin mechanism to bolt. Apply a small quantity of valve grinding compound to cocking cam surfaces of both bolt and cocking piece. Enter bolt in receiver. Close bolt. Be sure that trigger and sear are removed from receiver. Grasp handle of bolt in palm of right hand and with a slight forward pressure upon bolt handle, rapidly cock and release firing pin by rotating bolt handle up and down. Continue this operation until a satisfactory smooth surface is obtained. Wipe dry and thoroughly clean all surfaces from all traces of the valve grinding compound.

(3) *Third operation—freeing extractor collar.*—Disassemble bolt mechanism. Provide a pair of special hardwood jaws with a recess to engage lug of extractor collar and clearance for body of extractor collar. Place jaws in vise, inserting bolt so that lug on extractor collar falls in dogging slot provided. Close vise with jaws encircling body of bolt, allowing bolt to be freely rotated. A ¼-inch hole should be drilled in the hardwood vise jaws to allow for insertion of the penetrating oil. Prepare a soft brass plug, one end turned

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and threaded to screw into rear end of bolt; the other end, either squared or rounded, to be gripped by any suitable rotating member, preferably a bit brace or breast drill. With brass plug screwed into bolt and gripped by jaws of bit brace or breast drill, rapidly rotate bolt, applying penetrating oil, until extractor collar is entirely free. Wipe dry and thoroughly clean the bolt.

(4) A special precaution should obtain to remove entirely all traces of the valve grinding compound and the penetrating oil from the parts to prevent undue wear and injury to the mechanism.

b. Adjustment of trigger action.—(1) Rifles having unsatisfactory trigger actions will be turned in to the ordnance officer for adjustment. Normally this adjustment will be made by the ordnance officer, utilizing therefor ordnance facilities and personnel; but at any post, camp, or station not provided with suitable ordnance personnel it will be done by utilizing such personnel as may be available after having specially trained them for the purpose. Instructions for correcting faulty trigger actions will be found in TR 1400-30A prepared under the direction of the Chief of Ordnance for the use of ordnance personnel engaged in the maintenance of rifles.

(2) There are two distinct phases to the trigger action. The initial movement of the trigger to the rear transfers the contact of the trigger with the receiver from its bearings to the heel and takes up what is referred to as "slack." After the slack has been taken up, any further appreciable movement of the trigger to the rear, prior to the release of the firing pin, is referred to in the service as "creep."

(3) Most of the faulty trigger actions are due to the amount and character of the creep. The amount of creep should be as small as possible so that after the slack has been taken up, the firing pin will be released by continuing the trigger squeeze, as prescribed in part one, chapter 1, BFM, volume III, but without giving the impression that the trigger has been pulled farther to the rear.

40. Repairs.—*a.* With the exception of the improvements enumerated in paragraph 39 and the replacement of parts that are supplied in the spare parts set, no repairs or alterations to the rifle except by the Ordnance Department are authorized.

b. The Ordnance Department is charged with issuing rifles with trigger pulls greater than 3 pounds but not in excess of 5 pounds. All rifles having trigger pulls which do not fall between these limits should be turned in to the Ordnance Department for correction.

41. Protection of rifles against gas.—*a. When rifle cannot be disassembled.*—(1) With a well-oiled rag, wipe over all surfaces exposed to gas except the bore.

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(2) Fire occasional shots and between these open and close the bolt.

(3) Wipe spare parts with oiled rag.

b. When rifle can be disassembled.—Proceed as above, except that the bore should be plugged at each end with oiled rags and the rifle disassembled, wiped with oiled rag, assembled, and wrapped in a waterproof sheet if one is available.

c. After the gas attack.—(1) Clean all parts in water containing a little sal soda. The water should be warm but not boiling, and large quantities should be used.

(2) Clean bore and chamber thoroughly.

(3) Wipe all trace of gas from contents of the arm repair chest.

SECTION VI

SPARE PARTS, APPENDAGES, AND ACCESSORIES

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42. Spare parts for replacement purposes.—The parts of any rifle will in time become unserviceable through breakage or wear resulting from continuous usage. For this reason spare parts are provided for replacement purposes. They should be kept clean and lightly oiled to prevent rust. They are divided into two groups, spare parts and basic spare parts.

a. Spare parts.—These are extra parts provided with the rifle for replacement of the parts most likely to fail; for use in making minor repairs; and in general care of the rifle. Sets of spare parts should be kept complete at all times. Whenever a spare part is taken to replace a defective part in the rifle, the defective part should be repaired or a new one substituted in the spare parts set as soon as possible. Parts that are carried complete should at all times be correctly assembled and ready for immediate insertion in the rifle. The allowance of spare parts is prescribed for the rifle in Standard Nomenclature List No. B–3.

b. Basic spare parts.—These are sets of spare parts provided for the use of ordnance maintenance companies and include all parts necessary to repair the rifles. The allowance of basic spare parts is prescribed in the addendum to Standard Nomenclature List No. B–3.

43. Appendages.—Appendages consist of the bayonet, M1905, and the bayonet scabbard, M1910 (fig. 5).

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a. Bayonet, M1905.—This bayonet has a blade which is sharp on the front or lower edge for a distance of 15 inches and on the back for a distance of 5 inches from the point. The blade is stamped on its left side with the ordnance escutcheon and the initials of the place and year of manufacture, and on the right side with the letters "U. S." and the serial number. The bayonet guard riveted to the blade is provided with a hole for the rifle barrel and a cut for the bayonet scabbard catch and scabbard mouthpiece hook. The tang and pommel end of the blade has an opening for the bayonet catch which connects with a recess in the swell of the tang and allows the front end of the bayonet catch to enter its seat in the bayonet scabbard catch. An undercut groove on the upper end of the tang receives the stud on the upper band of the rifle when the bayonet is fixed, the bayonet being held in place by the bayonet catch. The bayonet scabbard catch which is located in the tang just to the rear of the bayonet guard is provided with a hook which retains the bayonet in the scabbard by engaging the scabbard mouthpiece hook. On the tang are mounted the left and right grip assemblies.

b. Bayonet scabbard, M1910.—This scabbard consists of a wooden body covered with rawhide, over which is fitted a woven fabric cover, olive-drab in color. The lower end of the scabbard is provided with a leather reinforce which extends about 3 inches and has a hole in the bottom fitted with a metal eyelet which serves as a drain hole. The bayonet is held fast in the scabbard by means of two mouthpiece hooks formed on opposite sides of the mouthpiece top. The scabbard is fastened to the belt or pack of the enlisted man by a double hook which is attached to the scabbard by the duck hanger sewed to the cover.

44. Accessories.—Accessories include tools for assembling, disassembling, and cleaning the rifle, as well as chests and auxiliary equipment. A complete list of accessories for the rifle is listed in Standard Nomenclature List No. B–3. Accessories must not be used for any purpose other than that for which they are intended, and when not in use they should be stored in their proper place or receptacle provided for them. A few accessories are provided with the rifle, the names or general characteristics of which indicate their use and application; therefore no detailed description or method of use is outlined herein. The special accessories, however, being of a different nature, are described and their purposes outlined in the following subparagraphs:

a. Gun sling (figs. 1, 2, and 3).—The gun sling is an adjustable carrying sling made of russet strap leather. One end of the gun

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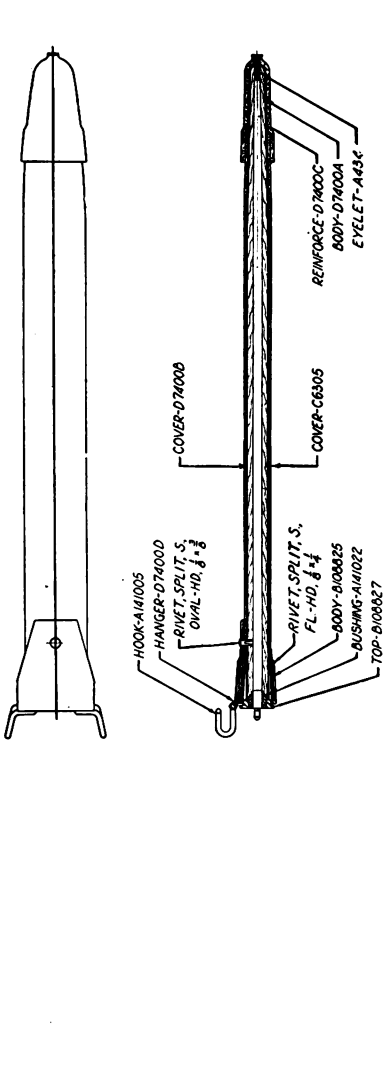


FIGURE 5.—Bayonet, M1905, and bayonet scabbard, M1910 (sectional views).

sling is attached to the lower band swivel of the rifle, and the other end is attached to the underside of the stock by means of the butt swivel. The gun sling consists of two straps, long and short. Each end of the long strap is provided with a gun sling hook. A series of holes punched in the long strap provides for different locations for the gun sling hook, and thereby enables the loop to be shortened or extended as desired. One end of the short strap is fastened to the long strap by the gun sling loop. The other end passes through the butt swivel and is provided with a hook that can be engaged in any of the holes provided for it in the long strap.

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b. Brush and thong, caliber .30, complete (fig. 6).—This consists of the thong brush, the thong tip, the thong weight, and the thong cord. The thong weight and the thong tip are made of brass and are provided with holes in which the thong cord is knotted. The thong cord is made of hemp twine and is about 30 inches long. The thong tip is provided with a cleaning patch slot and has threads provided on the end to receive the thong brush. In cleaning the bore by means of the thong, the brush or cleaning patch should always be drawn from the muzzle toward the breech.

c. Oiler and thong case (fig. 6).—The case is carried in the butt of the rifle stock. It consists of a brass tube about 6 inches long and ¾ inch in diameter, divided transversely near the center by a partition. Both ends are closed by screw caps. In one section is carried a small supply of sperm oil, and in the other the thong and thong brush used for cleaning the bore of the rifle. The cap on the oil section is provided with a wire, flattened at its point, which reaches to the bottom of the section and is used for applying oil, a drop or more at a time. The oil is only for the lubrication of the working parts. The cap is also provided with a leather washer to prevent leakage. The cap on the thong section has a leather pad on its outer surface, which prevents the noise that would result from the case striking the butt plate cap. The case should always be inserted in the rifle stock so that the leather-tipped cap will be next to the butt plate cap.

d. Front sight cover (fig. 6).—This cover is made of sheet steel and pressed into shape. It is then casehardened, giving it sufficient spring to cause it to hug closely the fixed stud, thereby retaining its position on the rifle.

e. Rifle screw driver (fig. 6).—This is a special screw driver used for disassembling and assembling the rifle. It consists of a large and a small blade held together by a hollow rivet. The blades turn readily on the rivet and may be folded when not in use. The large blade is used in removing the large butt plate screw, the butt plate spring screw, and the guard screws. The small blade is used for removing all other screws, except the cut-off screw, for which the spur formed on the opposite end of the small blade is used. A pin fitted in the edge of the large blade serves as a drift in removing the butt plate cap, the ejector, the floor plate catch, sear and trigger pins, and the lower band spring.

f. Safety lock assembling tool.—This tool is used for assembling the safety lock to the bolt sleeve. The tool consists of a blade and a wooden handle. The blade is made of ⅛- by $\frac{3}{16}$-inch tempered steel

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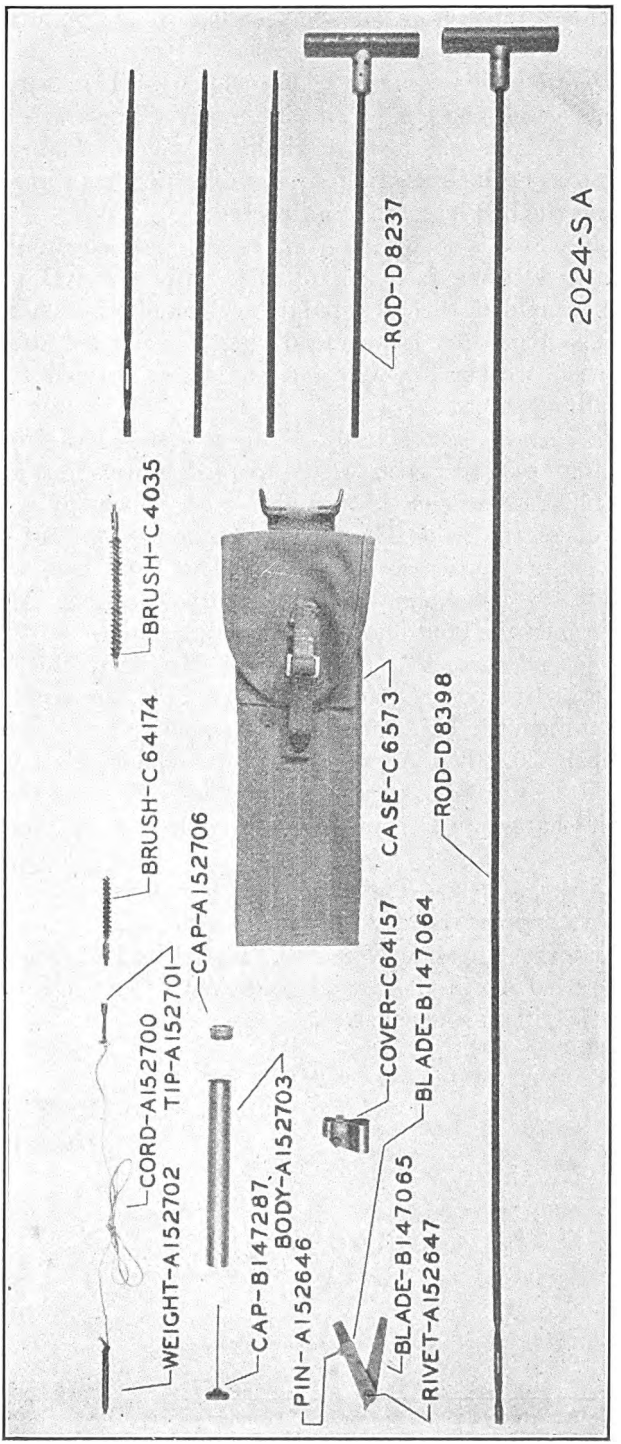


FIGURE 6.—Accessories.

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2¾ inches long, tapered on one side, with a wedge point. The tool is 6½ inches in over-all length.

g. Cleaning brush, caliber .30, M2 (fig. 6).—The brush consists of the core, bristles, and tip. The core, made of brass wire, is twisted in a spiral and holds the bronze bristles in place. The ends of the core are secured in the brass tip, one end of which has threads formed for attaching the brush to the cleaning rod.

h. Cleaning rod, M2 (fig. 6).—This is a steel cleaning rod consisting of two sections fastened together with a swivel joint. The rear end is provided with a tubular steel handle which swivels on the rod. The front end is provided with threads for attaching the cleaning brush, caliber .30, M2, and has a slot formed for holding a cloth cleaning patch.

i. Jointed cleaning rod (fig. 6).—This is a steel cleaning rod consisting of four sections, each with threaded dowels for joining the sections. The rear section is provided with a tubular steel handle which swivels on the rod. The forward section is made of two pieces fastened together with a swivel joint. The front end is provided with threads for attaching the cleaning brush, caliber .30, M2, and has a slot formed for holding a cloth cleaning patch.

j. Cleaning rod case, M1 (fig. 6).—The case is a fabric container sewed to form five pockets, four of which hold the sections of the jointed cleaning rod, M1, and the other pocket holds the cleaning brush, caliber .30, M2. A web billet and chape with buckle are sewed on the front of the case to secure the sections of the cleaning rod. A web hanger with brass double hook is sewed on the back of the case.

k. Rifle cover, M1918.—The cover for the rifle is made of 18-ounce olive-drab waterproof fabric, the muzzle end being reinforced with the same material for about 7 inches. A web billet and chape with buckle are sewed on the body and fold-over flap on the breech end and secure the rifle in the cover.

[A. G. 062.12 (9–5–39).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:
E. S. ADAMS,
Major General,
The Adjutant General.

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TECHNICAL REGULATIONS
No. 1300–30J

WAR DEPARTMENT,
WASHINGTON, *July 15, 1939.*

INFANTRY AND AIRCRAFT ARMAMENT

BROWNING MACHINE GUN, CALIBER .30, M2, AIRCRAFT, FIXED AND FLEXIBLE TYPES

Prepared under direction of the
Chief of Ordnance

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SECTION I

GENERAL

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1. Purpose and scope.—These regulations are intended for the Air Corps and all personnel charged with the maintenance of this matériel. They contain descriptions and figures and instructions in the proper methods of adjustment, disassembling, assembling, and care and preservation of the matériel.

2. References.—*a.* Nomenclature, list of spare parts and equipment, and basic spare parts for the Browning machine gun, caliber .30, M2, aircraft, are contained in Standard Nomenclature List No. A–28.

b. The interchangeability of component parts of the machine gun described herein with component parts of other Browning machine guns is shown in Supplement to Standard Nomenclature List No. A–1.

c. Description and characteristics of the several types of ammunition used in the machine gun described herein may be found in TR 1350–A.

*These regulations supersede TR 1300–30J, 1934.

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d. Complete instructions for cleaning the bore and chamber of the machine gun and cleaning and preserving material in general and materials for use therewith, may be found in TR 1395–A.

e. A complete description and method of installing the type E–4 machine-gun synchronizer are given in Air Corps Order No. 11–20–3.

SECTION II

GENERAL DESCRIPTION

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3. Types.—*a.* The Browning machine gun, caliber .30, M2, aircraft (figs. 1, 2, 3, and 4), is designed for both fixed and flexible use and, by properly repositioning some of the component parts, it may be made to feed from either the right side or the left side as desired.

b. (1) The gun is supplied in two types—

(*a*) The *fixed type gun* may be installed on or within the fuselage, or on or within the wings of the airplane, and is provided with an operating slide which connects with the bolt by means of the operating slide bolt stud. Provision is made for attaching a cable to the operating slide to permit remote control of the "immediate action" on the gun. When hand-operated, the operating slide may be drawn back to its full extent or to a position with the bolt not fully home and the bolt retained there by turning the handle to the right or left. However, the bolt should be fully retracted before releasing the operating handle.

(*b*) The *flexible type gun* is installed in the fuselage and "immediate action" is performed by use of the retracting slide which connects with the bolt by means of the retracting slide bolt stud. The retracting slide handle remains stationary and in a forward position while the gun is firing, thus eliminating all moving parts outside the receiver.

(2) The flexible type gun is provided with a backplate having a horizontal buffer, double spade grips, and a hand trigger, whereas the fixed type gun is provided with a backplate having a vertical buffer and without spade grips.

(3) In both types there is a tubular jacket which envelops the barrel and to which, in the case of the flexible gun, sights may be attached.

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4. Operation.—*a.* (1) The fundamental operating principle of the Browning machine gun, caliber .30, M2, aircraft, is the same as that of Browning machine guns of previous manufacture. The force of recoil is used to perform the various mechanical operations of the gun. The mechanism consists of a barrel attached to a barrel extension and a bolt, which are positively locked together when the mechanism is in the forward position. Upon the discharge of a cartridge, the energy set up in the barrel starts the action of recoil which is transmitted to the bolt and resisted by the barrel extension. When the mechanism has recoiled ⅜ of an inch, the positive lock between the bolt and barrel extension starts to release and the separation occurs in an additional ¼-inch travel. The ⅝ of an inch distance of recoil may be considered as the power stroke. Following this separation of the bolt, a portion of the recoil force in the barrel extension is transmitted to the bolt by an accelerator and the remaining energy to a backplate through a lock frame. The energy of recoil of the gun is finally delivered to the mount.

(2) The functions of the accelerator are to—

(*a*) Act between the rear surface of the barrel extension and the bolt lug as a lever of increasing length in order to relay recoil energy to the bolt. This means of utilization of energy serves to slow up the barrel and barrel extension recoil and to speed up the recoil of the bolt.

(*b*) Boost the recoil energy of the bolt at the period when extraction occurs.

(*c*) Hold the barrel and barrel extension in the recoil position, with the barrel plunger spring compressed, in order to prevent the barrel returning to its forward position before the bolt has completed its recoil.

(*d*) Relay energy from the bolt on its forward movement to the barrel extension in order to insure that the barrel extension and the barrel move forward ahead of the bolt so that when the breech lock in the barrel extension rises, it will be properly timed with the bolt to insure locking without binding or interference. That is, the accelerator serves as both an energy transmitter and as a timing element to insure proper closing and locking as well as unlocking of the breech lock from the bolt.

(3) Through relayed energy of the accelerator, the bolt continues to recoil, compressing its driving spring, and is brought to rest by the backplate buffer. During the recoil of the bolt several functions have occurred, including extraction of the fired cartridge case, and extraction of a live round from the ammunition belt and placing it in position for chambering.

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(4) The counterrecoil of the bolt, due to the energy stored in its driving spring, begins immediately after the recoil of the bolt has been arrested by the backplate buffer. At this time the fired cartridge case is ejected and chambering of the live round begins. This counterrecoil continues until the bolt trips the accelerator. This tripping of the accelerator causes the counterrecoil of the barrel extension and attached barrel to occur ahead of the bolt. The energy used to trip the accelerator momentarily delays the movement of the bolt, assuring the proper timing for completing chambering of the live round and the positive locking of the mechanism.

b. The operation of the flexible gun and the wing mounted fixed gun is fully automatic; that is, it is self-operative within the limit of capacity of the ammunition belt by simply keeping the trigger depressed.

(1) The flexible gun is fired by means of the hand trigger.

(2) The wing mounted fixed gun is fired electrically through the use of a solenoid assembly in combination with a gun control switch attached to the airplane control stick. The solenoid assembly, switches, etc., are supplied by the Air Corps.

c. The operation of the fixed gun when synchronized is semiautomatic; that is, a separate impulse of the firing mechanism is required for each shot. The gun is fired through the agency of the synchronizing mechanism which is supplied by the Air Corps and described in detail in Air Corps Technical Order No. 11-20-3.

5. Feeding.—Feeding is by belt and by proper repositioning of parts from either the right hand or left hand side. The metallic link belt, standard for aircraft use, is used in all firings of the aircraft gun. The ejection of empty cartridge cases is from the bottom of the casing and the empty links from the side opposite to the feeding.

6. Cooling.—Aircraft machine guns are aircooled and, as mounted at present, there is very little difference in the cooling whether the gun is fired on the ground or in the air.

a. With the standard 24-inch caliber .30, M2 barrel weighing 3½ pounds, a maximum burst of 100 rounds may be fired from a flexible or wing gun. Approximately 1 minute after firing a 100-round burst, firing may be resumed and 25 rounds fired and repeated each minute thereafter.

b. For synchronized guns, where the heat from the engine preheats the gun, the burst should be limited to 75 rounds and, after approximately 1 minute, firing may be resumed and 20 to 25 rounds fired and repeated each minute thereafter.

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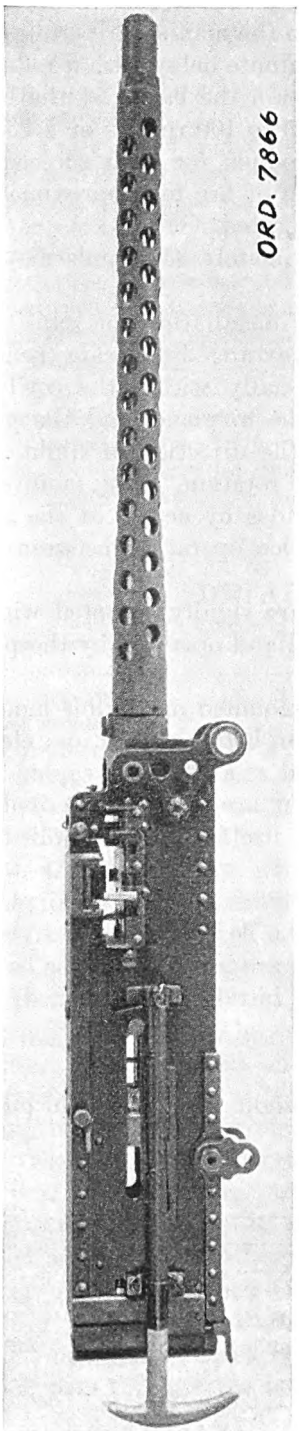


FIGURE 1.—Browning machine gun, caliber .30, M2, aircraft, fixed (right side view).

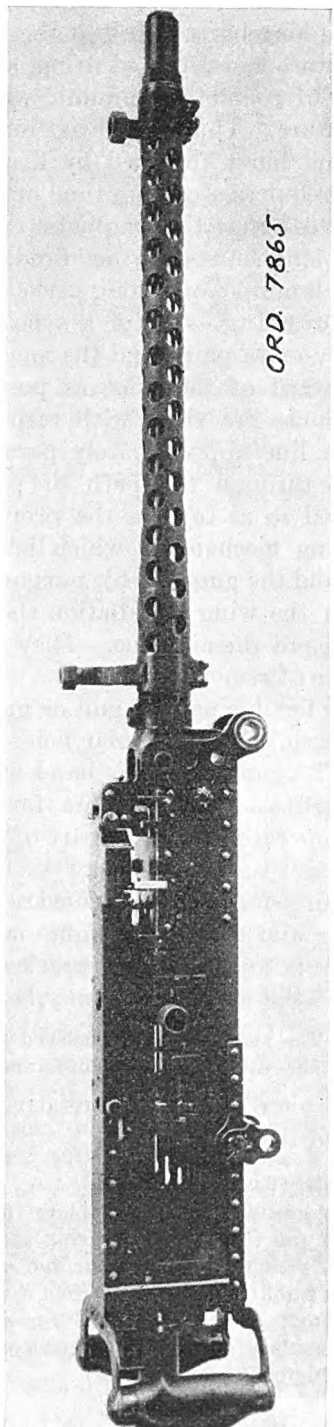


FIGURE 2.—Browning machine gun, caliber .30, M2, aircraft, flexible (right side view).

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c. The long burst will heat the barrel to the maximum permissible temperature and repeated firing, after 1 minute delay with a reduced number of rounds per minute, will maintain the barrel at the high temperature. Thus the initial burst of 75 to 100 rounds or a 75- to 100-round burst followed by firing 25 rounds for each succeeding minute requires a cooling time or cessation of fire for approximately 15 minutes before the long burst can be repeated.

d. If long bursts are not fired, approximately 35 rounds may be fired each minute over long periods.

7. Mounting.—*a.* For a synchronized installation the guns may be singly or in pairs, and the mounts are arranged to locate them as far forward of the pilot as possible, usually within the cowling. The mounts are rigid with respect to the airplane, and the guns fire in a line approximately parallel to the direction of flight and directly through the path of propeller rotation. The gunfire is controlled so as to miss the propeller blades by action of the synchronizing mechanism, which is the device operating between the engine and the gun for this purpose.

b. For the wing installation the guns are rigidly mounted within the wings of the airplane. They are fired and operated by the pilot by means of remote control.

c. For flexible use the gun or guns are mounted on flexible mounts which permit large angular fields of fire in both azimuth and elevation. The gun is fired by hand when used as a flexible weapon.

8. Sights.—*a.* The sights for the gun are carried as airplane equipment rather than as part of the gun itself and are supplied by the Air Corps.

b. Sights for the fixed gun are generally secured to the airplane. The ring and wind vane sights used on the flexible gun are secured in the front and rear sight brackets which are mounted on the barrel jacket of the gun. They may be readily installed or detached.

NOTE.—The machine guns furnished the Navy Department are provided with a rear sight bracket of slightly different design.

c. Complete information relative to the sights is available in publications of the Air Corps.

9. General data.

Weight of gun with mount adapters (fixed)	pounds	20.50
Weight of gun with mount adapters (flexible)	do	20.80
Weight of mount adapters, front and rear	do	.80
Weight of stabilizer (accessory) (not used by the Air Corps)	do	1.75
Overall length of gun (fixed) with operating slide	inches	39.00
Overall length of gun (fixed) without operating slide	do	37.50
Overall length of gun (flexible)	do	39.50

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Overall length of gun (fixed) with operating slide and stabilizer, inches	43.50
Overall length of gun (flexible) with stabilizer, do	44.00
Length of barrel, do	23.90
Space to rear of gun required for removing barrel, do	30.00
Space above gun required to open cover, do	8.75
Caliber of bore, do	.30
Rate of automatic fire, shots per minute	1,000–1,200
Weight of barrel, pounds	3.50
Weight of one metallic belt link, grains	65.00
Weight of 100 cartridges M1, in metallic link belt (approx.), pounds	6.75
Weight of complete round of ammunition:	
M1906, grains	395.00
M1, do	415.00
Maximum chamber pressure, pounds per square inch	48,000.00
Muzzle velocity of bullet (theoretical), feet per second	2,640.00
Weight of arm chest, filled (shipping weight), pounds	40.00
Cubical displacement of arm chest, feet	1.80

SECTION III

DETAILED DESCRIPTION

	Paragraph
Casing group	10
Cover group	11
Back plate group	12
Barrel group	13
Lock frame group	14
Bolt group	15
Operating slide group	16
Retracting slide group	17

10. Casing group (fig. 5).—This group consists of two main parts: the receiver, which encloses the breech mechanism, and the barrel jacket assembly.

a. The complete receiver consists of two side plates, a bottom plate, top plate, trunnion block, and other parts which are assembled permanently to them. The trunnion block forms the basic part of the casing. It is made flat on each side for assembly of the side plates. Two ribs are formed at the bottom running longitudinally for extra strength and for receiving rivets which pass through the side plates. The trunnion block is bored longitudinally through its lower part for the rear barrel bearing. An internally threaded boss is formed concentric with the barrel to receive the threaded rear end of the barrel jacket assembly. The trunnion block is machined transversely in its upper part to form the feedway for the ammunition belt; ears are formed on the upper forward end to hinge the cover and take the cover detent bracket. The cover detent bracket is attached by two rivets which pass through the bracket, trunnion block, and side plates. It

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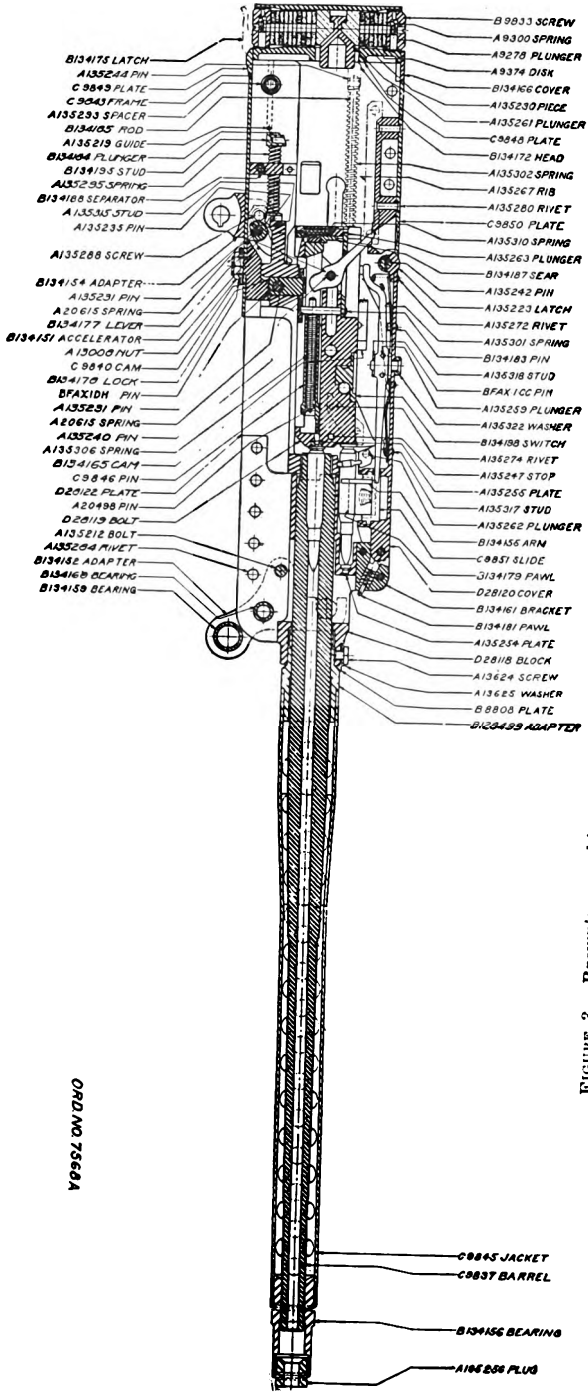


FIGURE 3.—Browning machine gun, caliber .30, M2, aircraft, fixed (sectional view).

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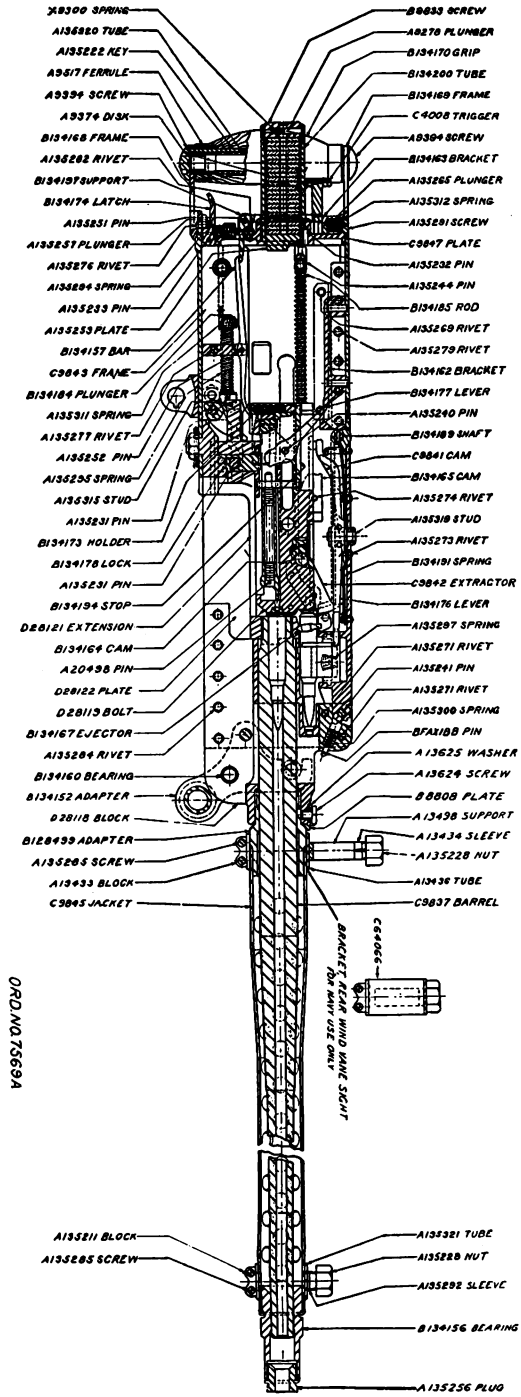


FIGURE 4.—Browning machine gun, caliber .30, M2, aircraft, flexible (sectional view).

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serves as a housing for the cover detent pawl and spring. The pawl is secured by a cotter pin. On each side near the forward end of the trunnion block a boss is formed; these two bosses serve to secure the front mount adapter which has a bearing for the trunnion pin. A rocker shaft bearing is provided as part of the gun. This bearing is provided to permit the use of a synchronizing device containing a rocker shaft. The side plates are two flat steel plates extending backward from the trunnion block and over the top and bottom of these two plates the top and bottom plates are assembled by riveting.

b. The rectangular box thus formed contains the working mechanism of the gun. The rear end of this box is closed by the backplate, and the top front portion is closed by the cover. Both side plates are cut at their upper forward end to conform to the feedway in the trunnion block, and are provided with belt holding pawl brackets which are attached to the side plate by riveting just beneath the feedway. The belt holding pawl brackets are formed so as to guide the ammunition belt properly in feeding and are slotted to take the belt holding pawl and front and rear cartridge stops. Slots are also provided for tying in feed chutes and link ejector chutes. These parts are secured by the belt holding pawl pins. Both side plates are slotted for the operation of the retracting slide bolt stud or operating slide bolt stud, and are provided with mounting blocks for attaching the retracting slide group when used as a flexible type gun and for attaching the operating slide group when used as a fixed type gun. Both side plates are slotted for assembly and operation of the trigger motor used on the fixed synchronized gun and the solenoid assembly used on the fixed wing gun. Two cams which govern the movement of the extractor are fastened with rivets to the interior of the left hand side plate just back of the trunnion block. The forward cam is called the extractor cam; the second cam is called the extractor feed cam. The right hand side plate is fitted with the bolt guiding rib which is attached to the upper rear end of the side plate with rivets; its purpose is to prevent any upward movement of the bolt. An elongated hole is formed in the upper rear end of the right hand side plate to act as a seat for the driving spring rod head. A hole is drilled in the lower rear end to take the lock frame retainer.

c. The bottom plate is made up in the form of a channel section " ⊔ " the flanges of which are riveted to the side plates, the latter fitting snugly inside the channel. The breech lock cam is located on the inner forward end of the bottom plate. This cam is allowed a slight lateral play and is secured on some guns by means of a spring

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tempered cotter pin, while on the newer guns a nut and cotter pin are used. On the under side of the bottom plate, the rear mount adapter

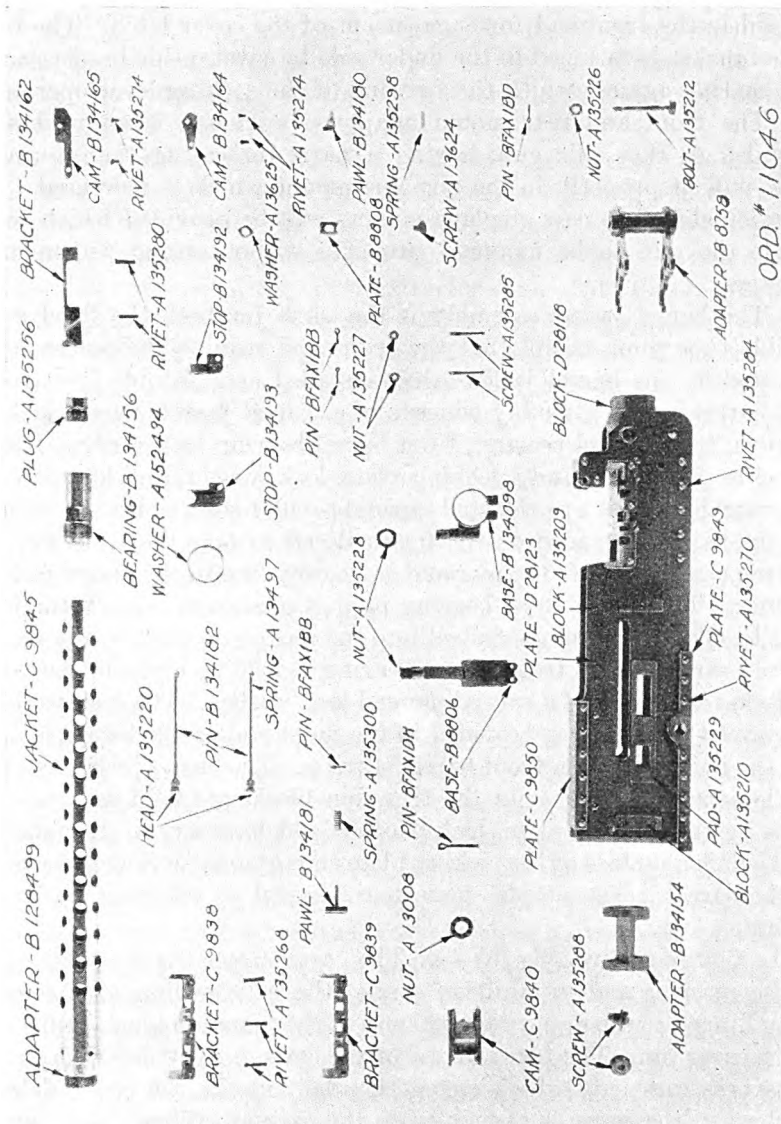


FIGURE 5.—Casing group.

is secured by two special screws. The bottom of the casing between the forward end of the bottom plate and the rear end of the trunnion block is left open for the ejection of the empty cartridge cases.

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d. The top plate is made in the form of a channel section "⊓" the flanges of which fit snugly over the side plate and are riveted to them. It covers the upper rear end of the receiver. A bevel cut is formed in the front end for engagement of the cover latch. The top plate bracket is fastened to the under side by rivets; this bracket acts as a bearing against which the free end of the cocking lever operates.

e. The front and rear mount adapters previously mentioned are provided so that this gun, having a narrower casing than former guns, will fit properly in the airplane mount which is now used. It is anticipated that new airplane mounts will be provided which will enable the gun to be mounted properly without using the mount adapters.

f. The barrel jacket assembly is the same for both the fixed and flexible type guns except that the front and rear sight brackets are mounted on the barrel jacket when installed as a flexible type gun. The barrel jacket assembly consists of a barrel jacket, barrel jacket adapter, front barrel bearing, front barrel bearing lock washer, front barrel bearing plug, and a locking plate, lock washer, and lock screw. The barrel jacket is a perforated tapered tubular steel jacket surrounding the barrel, threaded on the forward end to take the front barrel bearing assembly; into the rear end is securely brazed the barrel jacket adapter. The front barrel bearing plug is prevented from becoming loose by the flange being crimped into the recess provided in the front barrel bearing. The front barrel bearing is held securely in the barrel jacket by means of a special flanged lock washer. The lock washer is crimped into recesses provided in the front end of the barrel jacket and the rear end of the front barrel bearing. The barrel jacket assembly is screwed tightly into the trunnion block and held securely in place by the locking plate, lock washer, and lock screw. Serrations on the under surface of the locking plate engaging in similar serrations on the barrel jacket adapter prevent the barrel jacket assembly from becoming loose.

11. Cover group (fig. 6).—*a.* The cover closes the forward part of the receiver and in addition carries the belt feeding mechanism, being hinged to the upper forward end of the trunnion block by means of the cover pin. The forward end of the cover is provided with three transverse cam cuts which engage similar cuts in the cover detent pawl when the cover is assembled to the casing. When the cover is raised, the detent pawl acts as a cam plunger and holds the cover open in any one of three positions. To close the cover, it is only necessary to exert a quick pull upon it. The cover is held in closed position by the cover latch, the shoulder of which protrudes under the top plate

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and is released by pulling up on the cover latch lever. The cover latch, an eccentric camming device, pivots on the cover latch pin against the action of the cover latch spring. The cover latch spring is a flat spring held in position by the cover latch spring stud and a recess in the cover and secured by a cotter pin. Transverse guides are cut in the interior of the cover over the feedway and in these guides the belt feed slide operates.

b. Near the left hand side and riveted to the cover on the inside, is the cover extractor cam. This cam aids in effecting the downward motion of the extractor on the recoil of the bolt. The cover extractor spring is assembled by means of a stud at the forward end and a recess under the rear end of the cover extractor cam. Into this recess, a lug of the spring projects. The cover extractor spring operates to cause the extractor claw to engage the cannelure in the head of the cartridge in the feeding position by allowing the extractor first to spring over the cartridge head and then causing it to grip under the spring tension.

c. The belt feed slide carries the belt feed pawl, arm, and spring, and operates in the guides previously mentioned. The belt feed pawl is pivoted on the belt feed pawl pin and is held down so as to engage the belt by action of the belt feed pawl spring. The belt feed pawl arm acts to prevent a stoppage by preventing engagement of the pawl with the belt on the feeding stroke in case a cartridge still remains in the feedway.

d. The belt feed lever operates the belt feed slide with a lateral movement. This lever is pivoted near its middle on the belt feed lever pivot stud which is fastened to the cover. The lever extends nearly the entire length of the cover and is operated from the rear end by means of a stud; the stud engages the cam slot cut in the top surface of the bolt. The belt feed lever plunger and its spring are housed in a hole in the side of the belt feed lever and act to keep the lever in the correct position when the cover is open so that, on closing the cover, the stud on the rear of the lever properly engages the cam slot in the bolt. Two holes are provided to take the plunger and its spring as these parts must be transferred from one hole to the other when changing the direction of feeding. For right hand feed, the plunger and its spring must be in the forward hole. The cam slot in the bolt is so cut that the forward and backward movement of the bolt results in a movement from side to side of the stud engaged in it. This causes a corresponding oscillation of the forward end of the belt feed lever which is engaged in a recess cut in the rear side of the belt feed slide with a consequent lateral movement of the belt

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feed slide. The belt feed lever is held in place on the belt feed lever pivot stud by a cotter pin which is inserted in a hole in the stud after assembling the belt feed lever. During the feeding of the belt by the

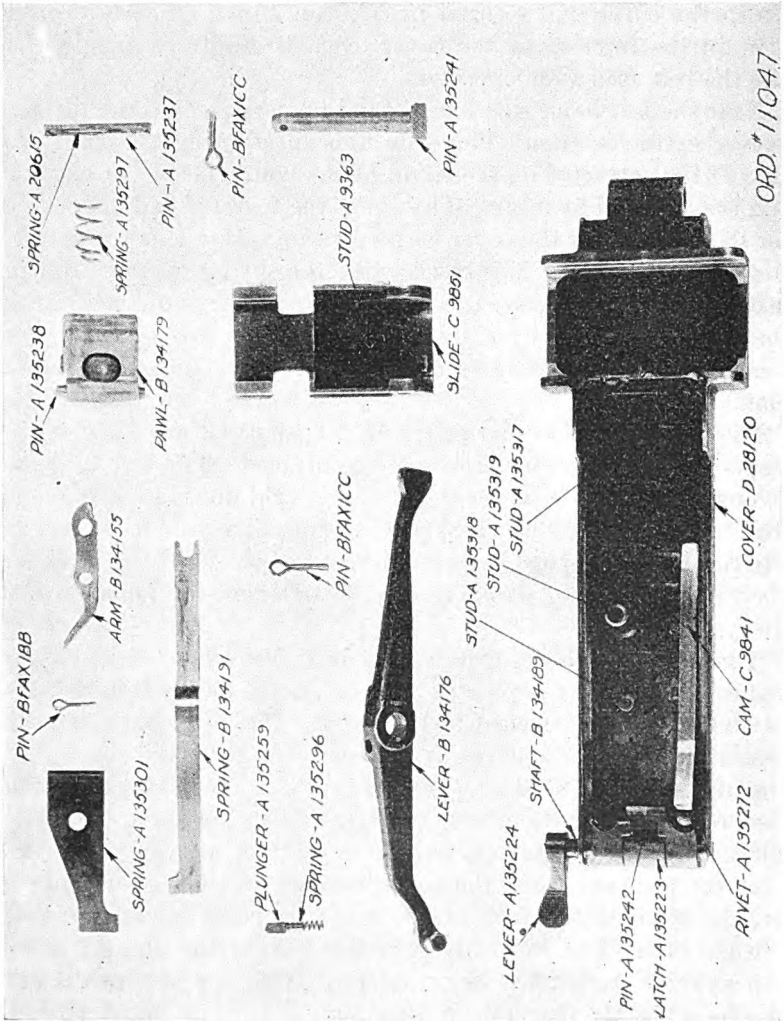


FIGURE 6.—Cover group.

pawl action just described, slipping backward of the belt is prevented by the action of the belt holding pawl previously mentioned in the casing group. Overtravel is prevented by the front and rear cartridge stops which were also previously mentioned in the casing group.

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12. Back plate group.—*a.* The back plate group closes the rear end of the receiver and is held in position by guides on each side which slide over corresponding grooves on the side plate. It rests on the bottom plate and is held in position by the back plate latch. There are two types of back plates used: one for the fixed type gun called the vertical buffer back plate, and one for the flexible type gun called the spade grip back plate.

(1) *Fixed type gun* (fig. 7).—(*a*) The back plate latch is located on the lower right side of the back plate. It pivots on the back plate latch pin and is actuated by the back plate latch spring. When the latch is released, it cams up the back plate latch spring plunger, allowing the sliding out of the back plate without interference. The latch pin is secured by a cotter pin.

(*b*) The forward part of the buffer plunger protrudes through the front face of the back plate and receives the recoil of the bolt. The blow of the bolt forces the buffer plunger to the rear. Two metal plugs called buffer friction pieces are in contact with the buffer plunger through the cam surfaces and when the buffer plunger is driven rearward by the bolt it wedges between the friction pieces, forcing them to move in a direction at right angles to the axis of the gun and causing them to compress the buffer disks, which are made of fiber. This movement against the fiber buffer disks absorbs the shock delivered by the blow of the bolt and thereby reduces its destructive action. The amount of compression of the fiber buffer disks is regulated by the adjusting screws which screw into the top and bottom of the back plate, compressing these disks against the flat face of the buffer friction piece. (See par. 23*g*.) The adjusting screw is held in the desired position by the adjusting screw plunger acting against the adjusting screw plunger spring and seating in a slot cut in the back plate.

(2) *Flexible type gun* (fig. 8).—This back plate is known as the back plate with spade grips so as not to confuse it with the back plate for the fixed type gun. It may be used on the fixed type gun during ground firing by hand but if so used, the trigger bar must be assembled to the lock frame group.

(*a*) Projections are formed on the top and bottom of the rear of the back plate, to which are fastened by means of rivets the upper and lower handle frames. Two hollow wooden grips called handle grips have a tubular steel member called a handle tube running the entire length. These members connect the upper and lower handle frames and are held in place by the handle tube screws. The ends of the wooden grips are protected by metal ferrules.

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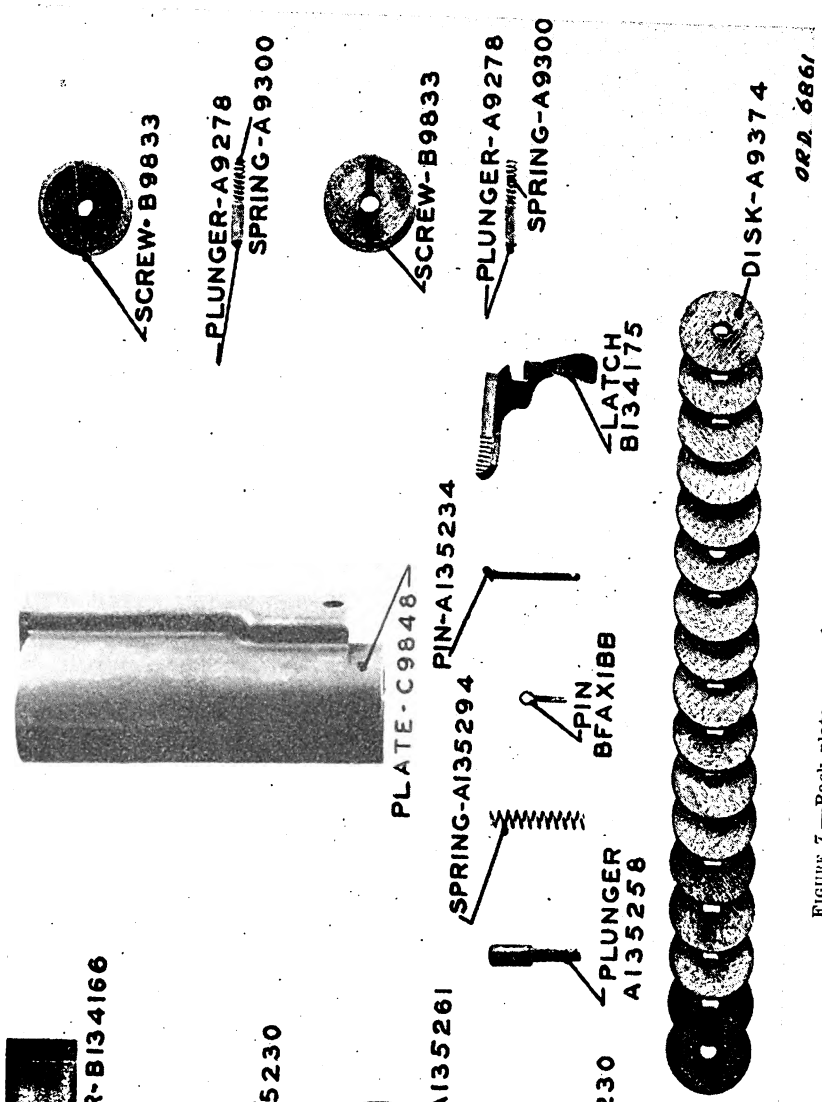


FIGURE 7.—Back plate group for the fixed type gun.

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(*b*) The back plate carries a buffer tube which extends to the rear. The buffer tube contains a series of fiber buffer disks, the front end being closed by the buffer plate and the rear end by the adjusting screw. The buffer plate receives the recoil of the bolt and the fiber disks absorb the blow of the bolt, thereby reducing its destructive action. (See

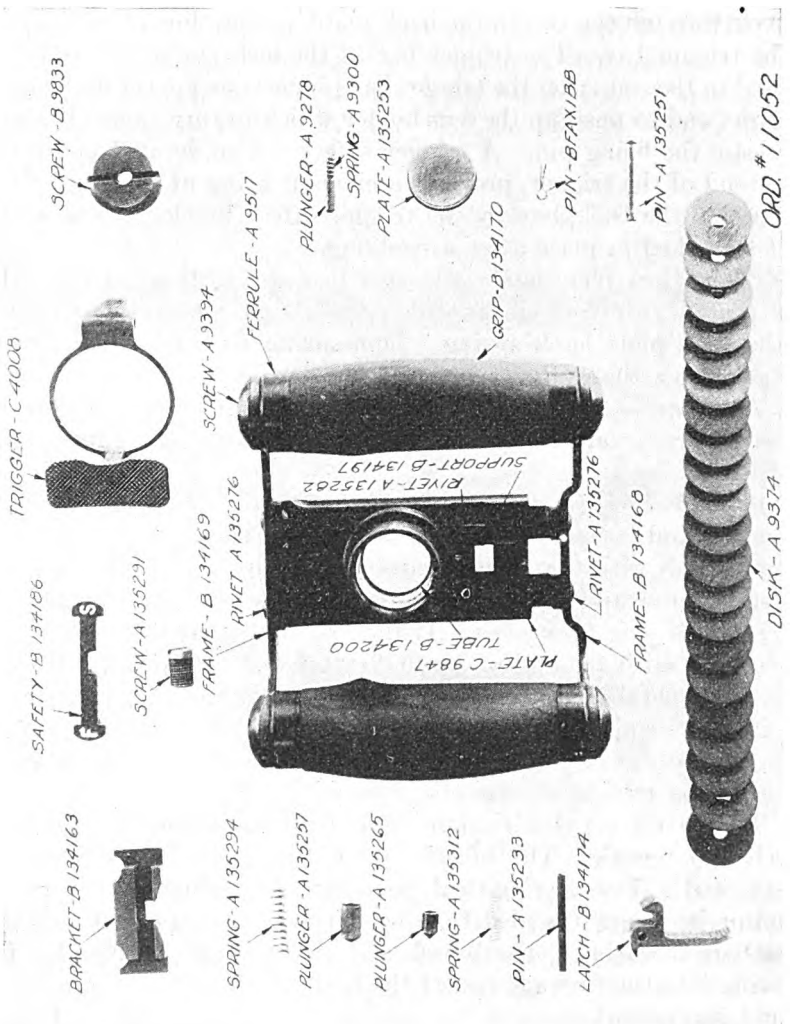


FIGURE 8.—Back plate group for the flexible type gun.

par. 23*g*.) The buffer tube is held from unscrewing from its seat in the back plate by the back plate pin. The adjusting screw serves to regulate the initial pressure between the fiber disks and is held in the desired position by the adjusting screw plunger acting against the

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adjusting screw plunger spring and seating in a longitudinal slot cut in the buffer tube.

(*c*) The back plate is slotted near the bottom to take the trigger which pivots on the trigger pin secured in the trigger support. This trigger support is fastened to the rear face of the back plate by rivets. When the upper end of the trigger is depressed, the lower end, which projects through the slot in the back plate, pushes down the rear end of the trigger bar. The trigger bar of the lock frame group, being pivoted in the center on the trigger bar pin, acts as a lever and causes the front end to push up the sear holder which in turn causes the sear to release the firing pin. A trigger safety device, located above the upper end of the trigger, prevents accidental firing of the gun. It is fastened to the backplate by the trigger safety bracket screw which must be staked in place after assembling.

(*d*) The back plate latch is located in a slot in the bottom of the back plate. It pivots on the back plate latch pin and is actuated by the back plate latch spring. This spring with the latch spring plunger also actuates the trigger.

b. Tightness of adjusting screw.—It is extremely important that the adjusting screws are kept screwed in tight against the buffer disks at all times.

(1) *Vertical buffer back plate.*—If the top of the adjusting screw in the top and bottom of the vertical buffer back plate (fixed type) becomes flush with the top or bottom of the back plate, remove the adjusting screw and add one or more buffer disks. (See par. 23*g*.)

(2) *Spade grip back plate.*—If the top of the adjusting screw becomes flush with the end of the buffer tube of the spade grip back plate (horizontal buffer) (flexible type), remove the adjusting screw, and add one or more buffer disks. (See par. 23*g*.)

13. Barrel group (fig. 9).—This group consists of two main parts: the barrel and the barrel extension.

a. The barrel is cylindrical in form for some distance from both breech and muzzle. The breech end is somewhat larger than the muzzle end. These cylindrical parts are supported in the corresponding bearings provided for them in the trunnion block and the front barrel bearing. The breech end of the barrel is threaded for screwing into the forward end of the barrel extension and is notched around its circumference at the shoulder just forward of the thread to provide for engagement of the barrel locking spring. This spring keeps the barrel in the adjusted position in the barrel extension; it is a positive lock and must be raised slightly and forced to one side before the barrel can be adjusted or unscrewed. The barrel is rifled

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and chambered for the standard caliber .30 cartridge. It is made of steel of great strength and toughness but is not especially hard.

b. The barrel extension is a hardened steel member extending to the rear of the barrel through a little over half the length of the receiver. It consists mainly of two side members joined at the forward end by the lug into which the barrel screws and at the rear by a lug projecting downward and carrying the breech lock. The bolt is supported by the side walls of the barrel extension and slides in grooves cut for it. These side walls act as tension members to hold the breech locked against the chamber pressure due to explosion.

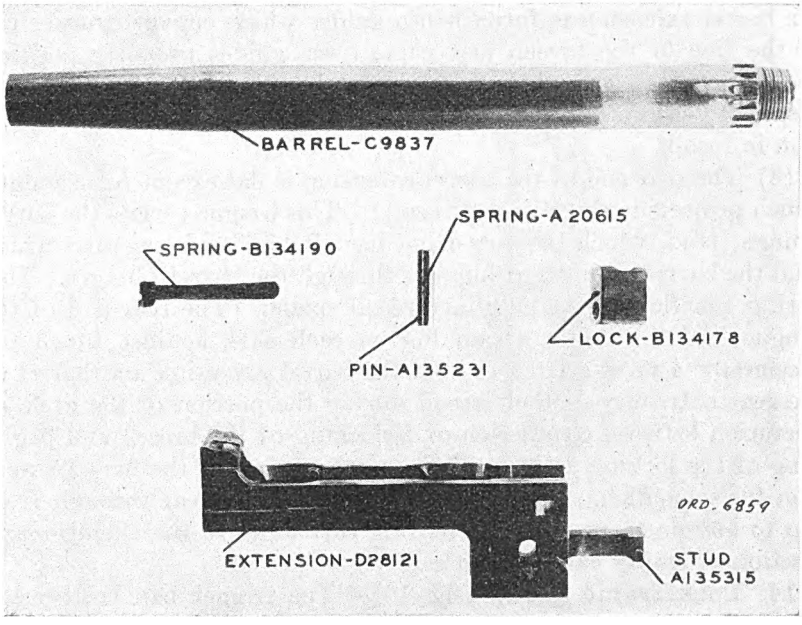


FIGURE 9.—Barrel group.

(1) Locking is effected by action of the breech lock, which is a rectangular block of steel carried in the rear lower part of the barrel extension and has a short vertical sliding movement. When pushed upward, this lock engages a recess in the bottom of the bolt, thus locking it securely to the barrel extension. The breech lock is operated through the agency of the breech lock cam assembled to the interior of the bottom plate and the cams formed on the forward ends of the lock frame. The breech lock cam causes upward or locking movement of the breech lock during forward movement

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of the barrel extension by direct action against the bottom of the breech lock. The lock frame cams cause downward or unlocking movement of the breech lock during backward movement of the barrel extension by their action against the breech lock pin, which extends entirely through the barrel extension and in which it is allowed up and down motion by a corresponding pair of slots.

(2) Recesses are cut in the sides of the barrel extension from the rear to accommodate the lock frame cams. Clearance cuts are provided in the front end of the barrel extension to avoid interference with the extractor cam and extractor feed cam and also with the ejector when it springs past a cartridge in the chamber while gripping a cartridge in the feedway. The rear end of the under side of the barrel extension is formed into guides which engage grooves cut in the side of the breech lock cam; these guides properly position the breech lock cam, barrel extension, breech lock, and bolt with respect to each other and control the movement of the barrel extension in recoil.

(3) The rear end of the barrel extension is flat except for a tongue which projects to the rear at its center. This tongue carries the barrel plunger stud, which projects from its left hand side, against which stud the barrel plunger spring acts through the barrel plunger. This spring functions as an auxiliary recoil spring. The rear end of the tongue is formed into a cam lug on each side, against which the accelerator acts as a latch to hold the barrel extension and barrel at the rear extremity of their recoil during the portion of the cycle of operation between completion of unlocking of the breech and beginning of the locking action. The central portion of the barrel extension for some distance back of the barrel is open clear through from top to bottom to provide for feeding cartridges to the chamber and ejection of empty cartridge cases.

14. Lock frame group (fig. 10).—The trigger bar, trigger bar pin, and trigger bar spring are used only with the flexible type gun.

a. The lock frame group is assembled back of the barrel extension in the space below that required for the recoil of the bolt. It consists mainly of two side plates called the right hand and left hand lock frames assembled by the separator and spacer. The whole unit fits inside the casing of the gun and carries two working parts, the accelerator and the barrel plunger with its spring. The rear of the lock frame bears against the back plate. When the back plate is removed the lock frame is held in place in the casing by the lock frame retainer, a transversely operating plunger which engages a hole in the right side plate. The retainer is held in place by a coiled spring. The for-

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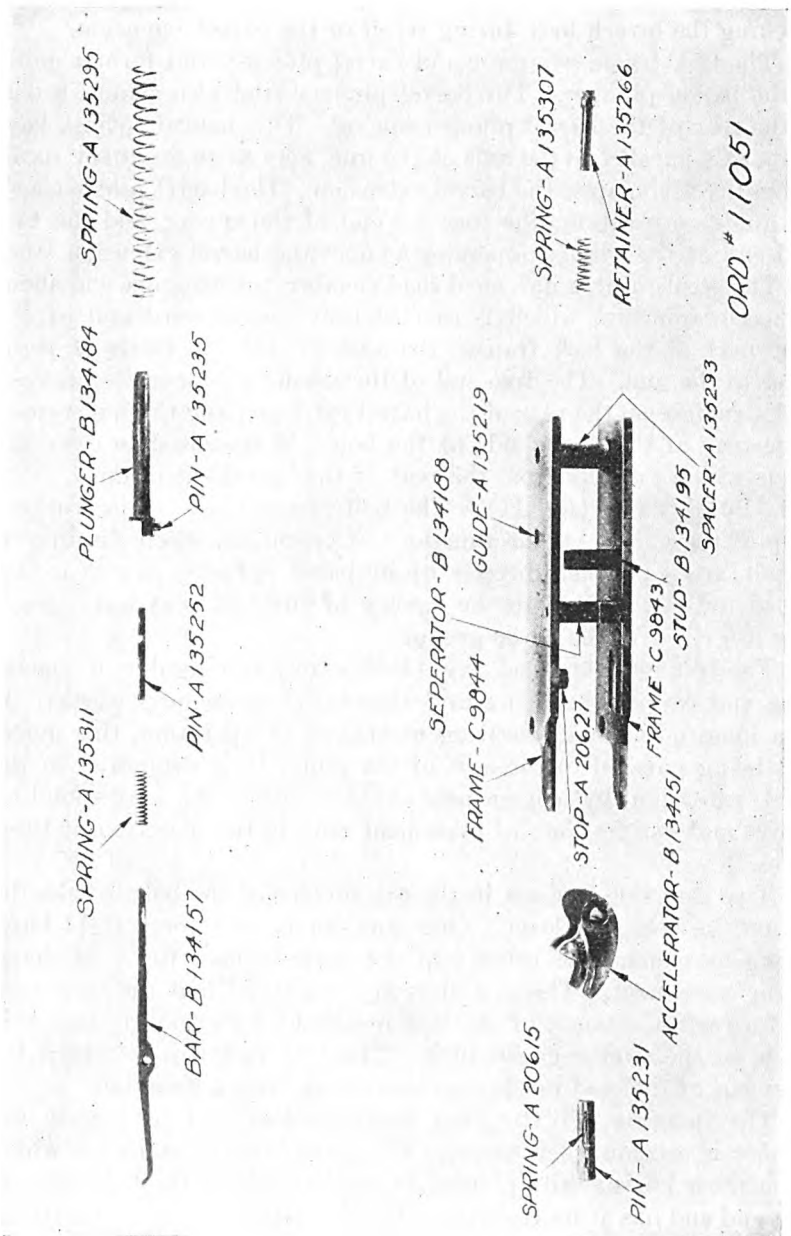


FIGURE 10.—Lock frame group.

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ward ends of the lock frame are carried forward to form two fingers beveled at their ends on the under side. The fingers act as cams in unlocking the breech lock during recoil of the barrel extension.

b. The lock frame separator and barrel plunger stud form a guide for the barrel plunger. The barrel plunger stud also acts as a seat for the rear of the barrel plunger spring. This helical spring, having its axis parallel to the axis of the gun, acts as an auxiliary recoil spring directly against the barrel extension. The barrel plunger acts as a guide and seat for the forward end of the spring, and the forward end of the plunger operates against the barrel extension stud.

c. The accelerator, a hardened steel member, pivots at one end about the accelerator pin, which is carried near the forward end of the lower part of the lock frames, the axis of this pin being at right angles to the gun. The free end of the accelerator operates between the flat surface on the rear of the barrel extension and the lug formed at the rear of the under side of the bolt. It is slotted to clear the tongue which projects from the rear of the barrel extension.

15. Bolt group (fig. 11).—The bolt group is the main working group of the gun. All the functions of operation, except feeding of the belt, are performed directly by its parts and even this is accomplished indirectly through the agency of the belt feed lever previously described in the cover group.

a. The bolt is a hardened steel block nearly rectangular in general shape and carries the firing and chamber feeding mechanisms. It has a longitudinal reciprocating movement of operation, this movement being parallel to the axis of the gun. It is supported in the barrel extension by engagement of its guides in corresponding grooves and has freedom of movement only in the direction of these guides.

b. Two cam slots are cut in the top surface of the bolt to take the stud on the belt feed lever. One cam slot is used for a right hand feeding movement; the other cam slot must be used for a left hand feeding movement. The cam slots are so shaped that the backward and forward movement of the bolt results in a movement from side to side of the stud engaged in it. The bolt switch is provided for movement of the stud in the cam slot in the proper direction.

c. The function of extracting from the belt and feeding to the chamber is accomplished through the agency of the extractor which is a member horizontally pivoted in the left side of the bolt near its front end and has at its free end a claw for extraction of the cartridge from the belt, and a hook called the ejector which grips the body of the cartridge, assists in guiding it into the chamber, and acts as

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the ejector in knocking the empty case out of the opening in the bottom of the casing after extraction from the chamber. The ex-

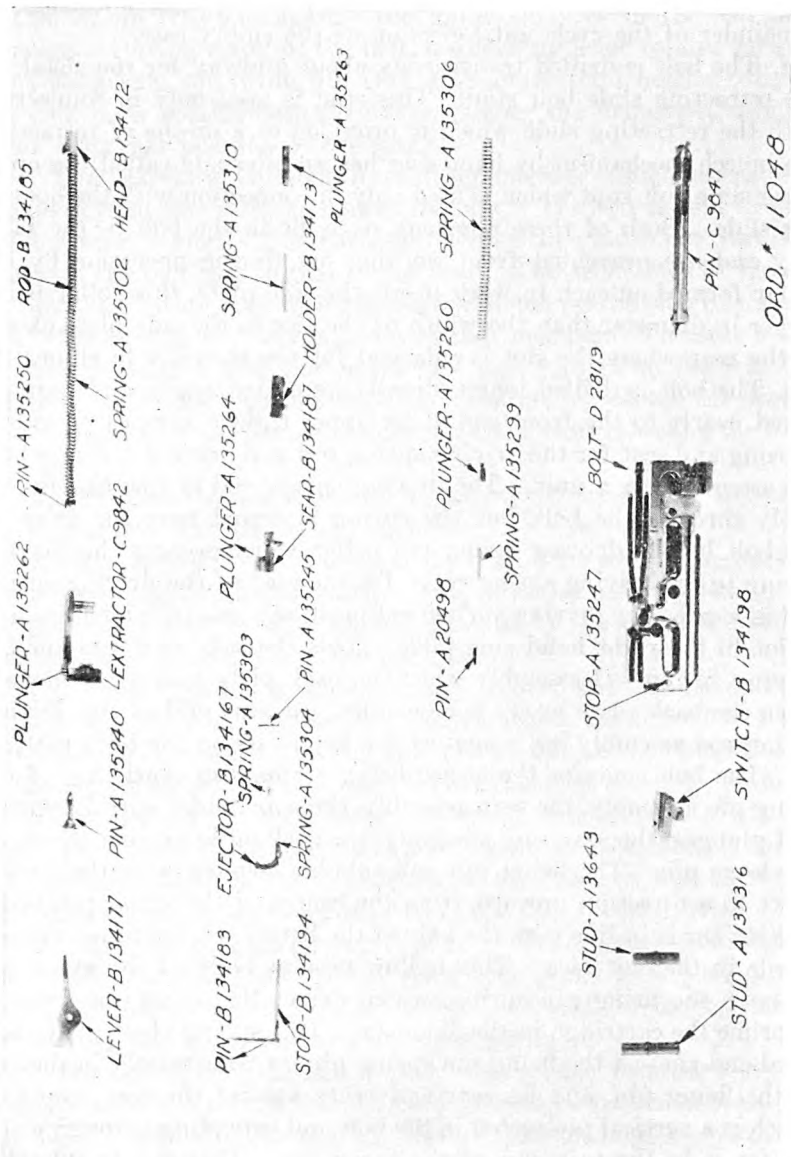


FIGURE 11.—Bolt group.

tractor also secures the bolt switch in its seat in the top surface of the bolt. The operation of the extractor is definitely controlled so as to follow a complete cycle during recoil and counterrecoil of the bolt

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by action of the extractor cam, extractor feed cam, and cover extractor cam. The face of the bolt is formed into a T-slot which embraces the head of the cartridge after extraction from the belt during the remainder of the cycle until ejection of the empty case.

d. The bolt is drilled transversely about midway for the shank of the retracting slide bolt stud. This stud is used only in connection with the retracting slide which is provided as a means of retracting the breech mechanism by hand and has an alternate called the operating slide bolt stud which is used only in connection with the operating slide. Both of these alternate parts fit in the bolt in the same way and are prevented from working out during operation by the collar formed on each to work inside the side plate, this collar being larger in diameter than the width of the slot in the side plate except in the rear where the slot is enlarged for the shoulder to enter.

e. The bolt is drilled longitudinally its entire length and counterbored nearly to the front end at its upper right corner to provide a housing and seat for the driving spring rod and driving spring which are assembled as a unit. The driving spring rod is free to pass entirely through the bolt, but the spring is seated near the front of the bolt by the driving spring rod collar which secures the driving spring to the driving spring rod. On the rear of the driving spring rod is located the driving spring rod head, one side of which fits into a slot in the right hand side plate. This slot acts as a seat for the driving spring rod assembly when the back plate group is removed; when the back plate group is assembled, the rear end of the driving spring rod assembly bears against the front face of the back plate.

f. The bolt contains the entire firing mechanism consisting of the firing pin assembly, the sear assembly, the sear holder with its spring and plunger, the sear stop assembly, the cocking lever, and the cocking lever pin. The firing pin is a tubular member with the striker offset in a direction upward from the center of the firing pin body. The striker is in line with the axis of the barrel and operates through a hole in the bolt face. This hollow tubular body of the firing pin contains the firing pin spring, which drives the firing pin forward to prime the cartridge in the chamber. This spring abuts at its forward end against the firing pin spring pin set transversely in the end of the firing pin, and its rear end bears against the sear stop pin, which is a vertical pin seated in the bolt and extending through a slot cut for it in the rear end of the firing pin. This slot is extended to the rear to provide for operation of the lower end of the cocking lever. The function of the cocking lever is retraction of the firing pin after firing, cocking the firing mechanism, and prevention of

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premature firing. It is pivoted on a horizontal transverse pin in the bolt called the cocking lever pin and oscillates through an angle of about 120° on this pin during recoil and counterrecoil of the bolt by action of its free end against the guide surfaces in the top plate bracket. During recoil of the bolt, the cocking lever rotates forward thus retracting the firing pin and, on counterrecoil of the bolt, the cocking lever rotates backward thus freeing the firing pin which is held in its rear position by the sear.

g. The sear is a horizontally sliding member which operates in guide slots cut for it in the rear of the bolt. The sear is held in place by the sear holder. This member operates in guides cut vertically through the bolt just in rear of the sear. The front face of the sear is provided with a nose which engages a notch on the side of the rear end of the firing pin on retraction of that member. The sear holder is in close contact with the sear, and a cam formed on the rear face of the sear riding in a notch in the sear holder causes the sear to move laterally when the sear holder is raised, thus releasing the firing pin.

(1) The sear holder is raised by action of the trigger bar when firing the gun with the hand trigger.

(2) A pressure inward on the outer lug of the sear disengages the nose from the firing-pin notch. This pressure is supplied by the trigger motor for the synchronized gun and by the solenoid assembly for the fixed wing guns. (See par. 45*a*.)

h. A transverse cut is made in the bottom of the bolt near its rear end to provide a locking surface against which the breech lock may act; this surface is the forward side of this cut and is inclined at an angle of about 14°. The breech lock is beveled to agree with this cut, the object of the bevel being to provide quick release of the lock and to prevent sticking. Back of the locking surface, a lug is formed on the bottom of the bolt. This lug is provided on account of the action of the accelerator as described in the lock frame group.

16. Operating slide group (fig. 12).—The operating slide group is a part of the assembly of the fixed type gun. It is provided for retraction of the breech mechanism by hand and for use in loading, unloading, and reduction of stoppages in firing.

a. The operating slide is a horizontally sliding member and operates by hand in a tubular housing supported by two brackets attached to the side plates of the gun by screws. The housing is a permanent assembly consisting of the operating slide tube, adapter, and collar, and serves as a bearing for the operating slide rod and operating slide hook as well as a housing for the operating slide spring. The

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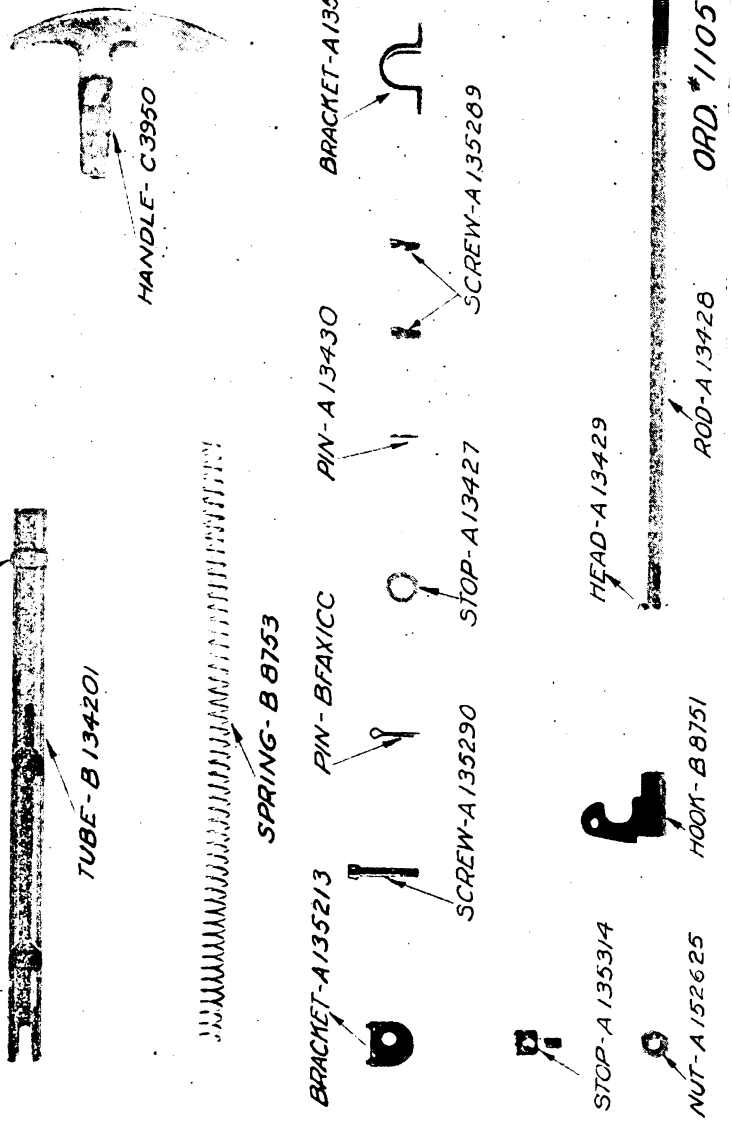


FIGURE 12.—Operating slide group.

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operating slide rod carrying the operating slide hook at its forward end, extends through the housing and is held in the assembled position under tension of the operating slide spring by the operating slide handle which is screwed on the rear end of the rod and secured by a cotter pin. The operating slide hook engages the bolt stud which is located in the bolt and projects through a slot in the gun side plate. The operating slide spring returns the hook to its forward position when the pull on the handle is released.

b. The description given in *a* above covers the operating slide group attached to the fixed gun when it is positioned within the fuselage of an airplane so that access to the handle for direct charging is available. When the gun is installed within the fuselage sufficiently forward of the pilot so that the operating slide cannot be reached, or is within a wing of an airplane, a remote control cable must be attached to the operating slide so that it may be operated from the cockpit. The remote control cable and its fittings are supplied by the Air Corps. The cable may be attached to the operating slide hook or to the end of the operating slide rod. In order to attach the cable to the end of the rod, the cotter pin must be withdrawn from the hole in operating slide handle and the handle unscrewed from the rod.

Caution.—When the operating slide is operated by the remote control cable, the operating slide hook must not turn on the operating slide rod. To prevent its turning, be sure that the operating slide hook pin is inserted in the hole provided in the operating slide rod and hook.

17. Retracting slide group (fig. 13).—*a*. The retracting slide group is a part of the assembly of the flexible type gun. It is provided for retraction of the breech mechanism by hand and for use in loading, unloading, and reduction of stoppages in firing.

b. The retracting slide is a horizontally sliding member and operates by hand in the retracting slide bracket which is attached to the side plate of the gun by screws. The retracting slide, to which is attached the retracting slide handle, engages the retracting slide bolt stud which is located in the bolt and projects through a slot in the gun side plate. When the gun is firing, the bolt stud reciprocates with the bolt but the retracting slide remains stationary and in a forward position, being held by means of the retracting slide plunger located in the retracting slide bracket engaging in a notch in the retracting slide under tension of the retracting slide plunger spring.

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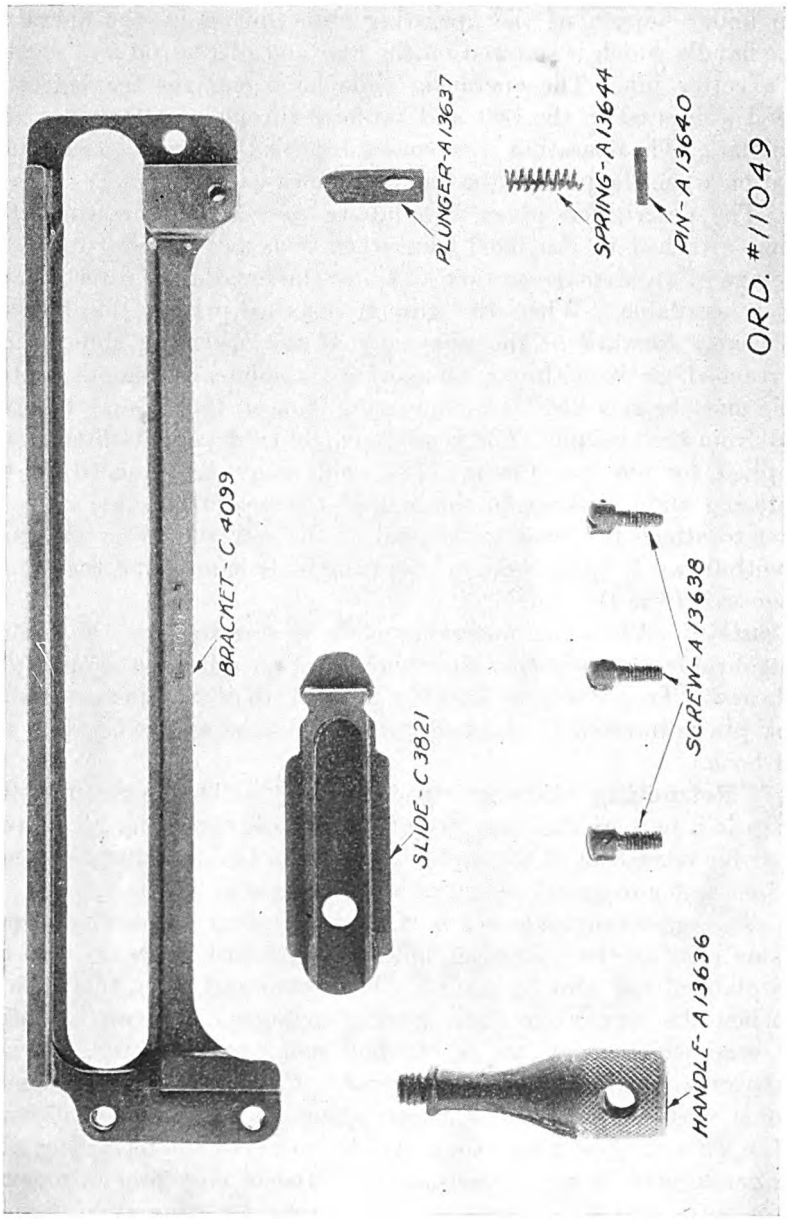


FIGURE 13.—Retracting slide group.

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SECTION IV

DISASSEMBLING, ASSEMBLING, AND ADJUSTMENTS

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Removal of groups from gun	19
Headspace adjustment	20
Replacing groups in gun	21
Detailed disassembling	22
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18. Disassembling, general.—Disassembling will be considered under two general heads: removal of groups to the extent required for head space adjustment, ordinary cleaning, and minor repairs; and detailed disassembling, involving removal of all components from each group.

a. A group is a number of parts which either function together in the gun or are intimately related to each other and should, therefore, be considered together.

b. The removal of the different groups from the gun and complete disassembling may be accomplished with the tools provided. These tools are listed in S. N. L. No. A–28 and described in section VIII of these regulations.

19. Removal of groups from gun.—*a.* Release the cover latch and open the cover. Draw cotter pin out of hole in end of cover pin. Remove cover pin. The cover need not be removed unless desired as the other parts of the gun may be taken out without removing it.

b. Release back plate latch and lift out the back plate. Press forward and away from the side plate on the end of the driving spring rod to release driving spring rod head from slot in right hand side plate.

c. Draw the retracting slide (flexible gun) or the operating slide (fixed gun) to the rear and remove bolt.

d. Remove the bolt, complete, out of the back end of the gun casing. The assembled driving spring unit need not be removed from the bolt to do this.

e. Push in the lock frame retainer with the combination tool through hole in the right side plate and remove the lock frame, barrel extension, and barrel, which are assembled together by pulling out to the

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rear. Use care to see that the lock frame retainer and spring do not fly out when the lock frame is removed from the gun casing.

NOTE.—In case the gun is located in the airplane in such a position that the lock frame retainer cannot be depressed with the combination tool, the release tool should be used.

f. Detach the lock frame from the barrel extension by pressing the accelerator forward.

g. Place the barrel locking spring in the disengaged position and unscrew the barrel from the barrel extension.

NOTE.—In preliminary instructions, procedure should be in the following order: disassembling, assembling, and adjustments.

20. Headspace adjustment.—*a.* Probably the most important adjustment of the machine gun, in order that it may function properly, is the headspace adjustment. By headspace adjustment is meant the adjustment of the space between the rear end of the barrel and the front face of the bolt so that the bolt will press closely against the base of the cartridge when the gun is loaded to fire. This adjustment is made when screwing the barrel into the barrel extension. If the headspace adjustment is not tight enough, the explosion of the powder in the cartridge will cause the rear part of the cartridge case to blow backward and pull the case in two, leaving the front part in the chamber and preventing the entrance of the next cartridge. (See fig. 14.) Often the headspace adjustment may be tight enough to prevent ruptured cartridges but will still be loose enough to allow the bolt too much play for proper synchronization. If the adjustment is made too tight, the recoiling parts will not go home so that the gun can be fired. Care should be taken in making this adjustment as prescribed in *b* below, and in testing the adjustments after the gun is assembled as prescribed in *d* below.

b. To adjust the headspace, remove the bolt, lock frame, barrel extension, and barrel from the casing. Detach the lock frame. Raise the barrel locking spring and force to one side, letting it rest on the barrel extension. Screw the barrel threads into those in the barrel extension as far as they will go without using excessive force; then back off for four or five barrel notches and replace the barrel locking spring in its groove. Reassemble the barrel, barrel extension, lock frame, and bolt in the gun. Insert a dummy cartridge in the T-slot, taking care to see that it is properly positioned, and allow the action to close smartly.

(1) If the action closes (barrel extension positions flush with the face of the trunnion block), disassemble the parts of the gun and

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adjust by screwing up the barrel one notch at a time, trying it for closure after each readjustment until the action will not close. Then disassemble the parts, unscrew the barrel one notch, and reassemble.

(2) If the action does *not* close, disassemble the parts of the gun and adjust by unscrewing the barrel one notch at a time, trying it for closure after each readjustment until the action will close.

c. Check the operation of the cocking lever to insure that it retracts the firing pin sufficiently to allow the sear to engage. There should be about 0.05 inch overtravel of the firing pin.

d. A positive rule for headspace adjustment that will fit all cases cannot be given and the following tests must always be applied prior to firing the gun.

(1) Work the bolt by hand two or three times and in case the breech does not lock smoothly, unscrew the barrel one notch.

(2) Raise the cover and the extractor and move the bolt slightly to the rear by means of the bolt stud. If the bolt moves independently of the barrel extension, the adjustment needs tightening. Readjust by screwing up one notch and test again. *There must be no apparent rearward movement of the bolt independent of the barrel extension with a dummy cartridge in the chamber prior to unlocking the breech.* This test of headspace adjustment must always be made when the gun is prepared for firing even though it is supposed to be in adjustment.

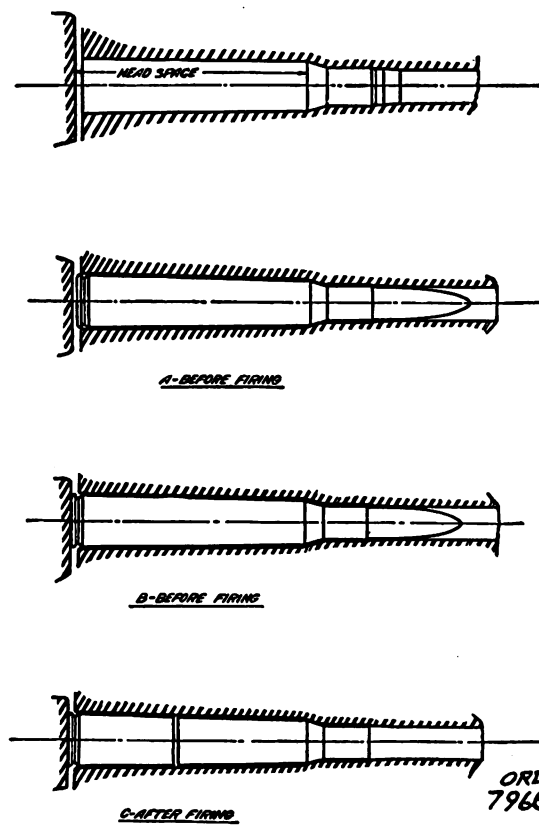


FIGURE 14.—Effect of excessive head space.

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e. In the event that it is impracticable to adjust the headspace so that there is no rearward movement of the bolt independent of the barrel prior to unlocking of the breech as described in *d* (2) above, the barrel should be replaced by another.

f. Quick headspace adjustment.—After the correctness of headspace adjustment for a particular gun has been established by actual firing, the proper notch for headspace adjustment should be marked. Then to adjust headspace quickly, remove barrel assembly from gun, raise the barrel locking spring and force to one side, letting it rest on the barrel extension. Screw barrel into barrel extension tightly without force. Unscrew barrel until the marked notch on the barrel is in line with the barrel locking spring. Place barrel locking spring in notch. *There must be no apparent rearward movement of the bolt independent of the barrel extension with a dummy cartridge in the chamber prior to unlocking the breech.* This test of headspace adjustment must always be made when the gun is prepared for firing even though it is supposed to be in adjustment.

21. Replacing groups in gun.—*a.* The headspace adjustment having been made as prescribed in paragraph 20*b*, hold barrel and barrel extension in left hand, lock frame assembly in right hand. With index finger holding the accelerator up under the barrel extension shank, start the front projections of lock frame into guideways in barrel extension and press forward until the accelerator turns backward between the rear end of the barrel extension and the T-lug and locks the lock frame to the barrel extension. Push down tips of accelerator with thumb to insure positive locking. With these components locked together, the barrel extension and lock frame may be placed in the casing of the gun as a unit. Push these groups forward in casing, forcing the lock frame retainer inward to clear it from right side plate until a click is heard as the lock frame retainer springs out into hole in right side plate.

b. Press cocking lever forward in bolt and insert bolt into casing. Push bolt forward until bolt stud hole is in line with enlarged opening in rear end of bolt stud slot in side plate. Insert bolt stud in bolt, being sure that the collar on the bolt stud is inside the side plate. Push bolt completely forward, guiding extractor from the front with the fingers to prevent it from catching.

c. Insert driving spring rod assembly into hole in bolt. Engage driving spring rod head in its seat in the right hand side plate.

d. Replace the back plate.

e. Replace the cover. Insert cover pin through the hole in trunnion block and cover. Insert cotter pin through hole in end of cover pin. Latch the cover.

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f. Make the test for headspace adjustment prescribed in paragraph 20*d*. If it is found that the bolt and barrel will not go fully home and lock, it is probable that either the breech lock is wrongly assembled or that the adjustment for headspace has been made too tight. Examine in turn for these points and correct the mistake.

g. If faulty headspace adjustment is found, it must be corrected by tightening or loosening the barrel one notch at a time until the proper adjustment is obtained.

22. Detailed disassembling.—*a. Bolt group.*—(1) Withdraw driving spring rod assembly to rear out of bolt. This assembly should not be disassembled unless it is necessary to replace the driving spring. The driving spring and the driving spring rod collar may be removed after driving out the driving spring rod collar stop pin from the driving spring rod.

(2) Remove extractor by rotating upward and pulling out from bolt. The ejector and ejector spring may be removed after driving out the ejector pin.

(3) Remove bolt switch, bolt switch plunger, and bolt switch plunger spring from bolt.

(4) Rotate the cocking lever fully backward. Remove cocking lever pin and cocking lever.

(5) Press in one end of sear which will cause firing pin to snap forward.

(6) With thin end of cocking lever, swing the sear stop out of its groove in bolt into center of bolt, then turn bolt over and push sear stop out of engagement with firing pin spring. Reverse bolt and remove sear stop from slot.

(7) Slide the sear holder with its spring and plunger upward out of the bolt. Remove sear assembly from bolt by sliding it laterally a short distance then lifting out.

(8) If the bolt is held in a vertical position, the firing pin assembly will drop out. The firing pin spring may be removed by driving out the firing pin spring pin. Take precautions to prevent firing pin spring from flying out during the operation.

b. Lock frame group.—(1) Remove the lock frame retainer and spring if not already removed.

(2) Push out accelerator pin and remove accelerator.

(3) Push out trigger bar pin and remove trigger bar and trigger bar spring (flexible type gun only).

(4) Hold the lock frame with left hand, projections pointing upward, slot to left, first finger gripping barrel plunger spring. Press down and out with thumb of right hand or the combination tool to

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disengage barrel plunger guide pin from slot. Allow spring carrying the plunger to rise slowly. Lift out spring and remove spring from barrel plunger.

c. Barrel group.—(1) Raise end of barrel locking spring slightly and force to one side, resting it on the barrel extension.

(2) Remove barrel by unscrewing from barrel extension.

(3) Remove barrel locking spring by sliding it forward out of its seat in the barrel extension.

(4) Push out the breech lock pin and remove the breech lock.

d. Cover group.—(1) Remove cover pin cotter pin, drive out cover pin, and lift the cover free from the trunnion block.

(2) Remove belt feed lever pivot stud cotter pin and, using the combination tool, pry the belt feed lever off its stud, taking care while doing so that the belt feed lever spring plunger and spring do not fly out. In removing the belt feed lever, see that the toe of the lever is in line with the slot in the cover; otherwise it will not pass out.

(3) Remove the belt feed lever spring plunger and belt feed lever plunger spring from the belt feed lever.

(4) Remove belt feed slide complete from its guides in the cover.

(5) Push out the belt feed pawl pin which will enable the belt feed pawl, the belt feed pawl spring, and the belt feed pawl arm to be separated.

(6) Do not remove belt feed pawl arm pin from the belt feed pawl unless necessary for repairs.

(7) Remove cover latch spring stud cotter pin and lift off the cover latch spring.

(8) Remove cover extractor spring by releasing its rear end from its seat in the cover extractor cam and sliding to the rear.

(9) The cover latch and cover latch lever assembly should not be removed from the cover unless necessary for repairs. If it is necessary to remove these parts, drive out the cover latch pin and remove the cover latch lever assembly which allows the cover latch to drop out. The cover latch lever assembly should not be disassembled.

e. Back plate group.—(1) *Fixed type gun.*—(*a*) Push out back plate latch pin cotter pin and remove back plate latch pin, back plate latch, back plate latch spring and plunger.

(*b*) Unscrew the adjusting screws and remove the buffer disks, buffer friction pieces, and buffer plunger. Before assembling read paragraph 23*g*.

(2) *Flexible type gun.*—(*a*) Remove trigger pin cotter pin, push out trigger pin, and remove trigger.

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(*b*) Drive out back plate latch pin and remove back plate latch, back plate latch spring, and plunger.

(*c*) Unscrew trigger safety bracket screw, then remove trigger safety spring and trigger safety spring plunger. Remove trigger safety and trigger safety bracket. The trigger safety assembly should not be removed from the back plate unless necessary for repairs, as the trigger safety bracket screw is staked in to prevent its loosening.

(*d*) Unscrew adjusting screw and remove buffer disks and buffer plate through rear end of buffer tube. Before assembling read paragraph 23*g*.

(*e*) Unscrew the handle tube screws and force out the handle grip assembly. The handle grip assembly should not be disassembled.

f. Operating slide group.—(1) Pull out locking wires and unscrew front and rear operating slide bracket screws. Removal of the front and rear operating slide brackets from the gun casing frees the operating slide assembly.

(2) The operating slide assembly for the fixed fuselage gun installation and the operating slide assembly for the fixed wing gun installation are the same except when assembling the operating slide for fixed wing installation, a steel pin is inserted in hole through operating slide hook and operating slide rod to prevent hook turning on rod. Also the operating slide handle is replaced by a cable which permits remote control of the operating slide. The cable and its fittings are supplied by the Air Corps.

(3) To disassemble the operating slide assembly, proceed as follows:

(*a*) Draw cotter pin from hole in operating slide handle and unscrew handle from operating slide rod.

Caution.—Hold finger on head of operating slide rod while unscrewing handle, allowing operating slide rod to rise slowly under action of operating slide spring.

(*b*) Lift out operating slide rod, operating slide hook, and operating slide spring from operating slide housing.

(*c*) Unscrew operating slide hook stop nut from operating slide hook stop.

(*d*) Unscrew operating slide hook stop from the operating slide housing.

g. Retracting slide group.—(1) Pull out locking wires and unscrew retracting slide bracket screws.

(2) Lift off retracting slide bracket. To remove retracting slide from retracting slide bracket, unscrew retracting slide handle from retracting slide.

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(3) The retracting slide plunger and the retracting slide plunger spring may be removed from the retracting slide bracket by driving out the retracting slide plunger stop pin but should not be done unless necessary for replacement of plunger or spring.

h. Casing group.—(1) Pull out cover detent pawl cotter pin and remove cover detent pawl and cover detent pawl spring.

(2) Pull out the two belt holding pawl pins. Lift out the belt holding pawl and spring, also the front and rear cartridge stops.

(3) Pull out mount adapter bolt cotter pin and unscrew mount adapter bolt nut. Withdraw mount adapter bolt and remove front mount adapter assembly. The front mount adapter assembly should not be disassembled.

(4) Unscrew rear mount adapter screws and remove rear mount adapter.

(5) Pull out breech lock cam cotter pin and remove breech lock cam.

(6) Pull out sight clamp screw cotter pins and unscrew sight clamp screws two or three turns. The front and rear sight brackets may then be removed from the barrel jacket (flexible type gun only).

(7) The front barrel bearing assembly is locked to the barrel jacket after assembly by means of the flange of the special lock washer being crimped into recesses in the forward end of the barrel jacket and rear end of the front barrel bearing; therefore, to remove the front barrel bearing assembly for cleaning or in order to attach the stabilizer, the strap pipe wrench must be applied with enough force to cam the crimped flange out of the locking recess. (An adjustable wrench may be used.) The front barrel bearing plug may be removed from the front barrel bearing with the combination tool.

(8) The barrel jacket may be removed from the trunnion block but must not be done except in case of necessity as frequent removal will likely result in loose fitting threads. If it is necessary to remove the barrel jacket, unscrew the locking screw and lift off the lock washer and locking plate. The barrel jacket may then be unscrewed with the strap pipe wrench.

23. Sequence in assembling.—In general, groups are assembled and replaced in the gun in the reverse order to which they are removed and disassembled. There are certain precautions in connection with assembling which are outlined below and must be observed in order that the parts may be placed in the gun and may function properly after the gun is assembled. In general, if the gun can be assembled, failure to observe these points will result in failure of the bolt stud to go fully forward on the closing movement of the

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bolt. If the bolt stud will not go fully home on assembling, look for failure in these points or for too tight headspace adjustment.

a. Great emphasis must be placed on correct headspace adjustment (par. 20*b*) and the test for proper headspace adjustment (par. 20*d*). Every machine gunner must know how to make this adjustment and how to test for its correctness after the gun is assembled.

b. In assembling gun, reference should be made to paragraph 25 which outlines method of changing gun from right hand feed to left hand feed.

c. In assembling barrel extension, make sure that the breech lock is inserted correctly; that is, with bevel faces to the front and the double bevel on top.

d. In assembling accelerator in the lock frame, make sure that accelerator tips are up and rounded surface is to the front.

e. In assembling cocking lever in bolt, the rounded nose on lower end of cocking lever must be to the rear of bolt so that it will properly engage rear of slot in firing pin.

f. In assembling cover detent pawl in gun casing, make sure the bevel surface is up.

g. In assembling the backplate group, it must be kept in mind that part of the recoil energy of the bolt is transmitted to the buffer plunger in the form of metal to metal impact of approximately 5,600 pounds. Some of this blow is dissipated by friction between the beveled surfaces of the buffer plunger and the buffer friction pieces and the remainder relayed to the fiber buffer disks. (See par. 12*c*.)

(1) In order that the fiber buffer disks may dissipate and relay this impact, it is necessary that they form a compact column or stack from the face of each buffer friction piece to each adjusting screw.

(2) The disks should be clean and free of rough edges and surfaces and should be assembled in the tube one at a time, being sure that each disk is firmly seated, using sufficient disks (normally 6 in the upper compartment and 10 in the lower compartment) so that when the adjusting screws are inserted and tightened, their tops will be slightly above the top and bottom of the backplate.

(3) Keep the adjusting screws tight at all times. If the top of the adjusting screw becomes flush with the top or bottom of the backplate, remove the adjusting screw and add one or more buffer disks.

(4) Following the assembly described above, tighten the adjusting screws after the first 25 or 50 rounds have been fired and keep them tight thereafter. The stacked buffer disks must always form a compact column compressed between the buffer friction piece and the bottom of the adjusting screws.

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(5) Special care is required when using buffer disks perforated in the center. No more of these perforated disks will be manufactured but supplies on hand should be used until exhausted.

NOTE.—The buffer plunger, the two buffer friction pieces, and the two adjusting screws are used in the vertical buffer back plate only. The spade grip back plate (horizontal buffer) uses a buffer plate which bears directly on the fiber buffer disks (normally consisting of 22) and one adjusting screw. The above information and instructions apply to both type back plates.

h. After the front barrel bearing plug is assembled to the front barrel bearing and the front barrel bearing is assembled to the barrel jacket, make sure that the flange of the front barrel bearing plug and the special lock washer is crimped securely into the locking notches.

i. In assembling operating slide for use on a fixed wing gun, make sure that the operating slide hook pin is inserted in hole through operating slide hook and operating slide rod.

24. Replacing parts.—In an emergency, a broken minor part should be replaced by substituting the complete spare part which contains it. Thus a broken firing pin should be remedied by changing bolts; a broken ejector by changing extractors. Later, as opportunity permits, the small parts will be repaired or replaced in order to make the larger part, removed, again available for use. Where the complete bolt has been changed, a check should be made of the headspace.

25. Changing gun from right hand feed to left hand feed.—In order to change the gun from right hand feed to left hand feed or vice versa, repositioning of parts must be carried out in the bolt assembly, the belt feed mechanism, and certain parts of the gun casing. The following describes, in general terms, the manner of changing the gun from right hand feed to left hand feed. By reversing the process the gun may be changed from left hand feed to right hand feed.

a. Operating slide group (fixed type gun only).—Transfer the operating slide group assembly from left side of gun to right side.

NOTE.—This is done only when it is desired to use this item on the reverse side, as the operating slide may be used on either side irrespective of feeding *but must be on reverse side to trigger motor.*

b. Retracting slide group (flexible type gun only).—The retracting slide may be used on either side, irrespective of feeding.

c. Bolt assembly.—(1) Remove bolt assembly from gun.

(2) Remove extractor assembly from bolt.

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(3) Remove ejector and ejector spring from the extractor assembly and reassemble in the reversed position. (Nose of the ejector should point to the direction from which the gun is to be fed.)

Caution.—The ejector pin which holds the ejector in place is made with a cross notch. In assembling the ejector to the extractor assembly, the ejector pin should be inserted with the notch up so that the notch will engage with the ejector pin spring (straight spring) which is assembled to the ejector. The purpose of the notch in the ejector pin is to hold the pin in place during the operation of the gun.

(4) Lift up the bolt switch high enough to clear the bolt switch plunger and rotate one-half turn so that the bolt switch plunger enters the opposite hole in bolt switch.

NOTE.—When assembled correctly for left hand feed, the enlarged portion of the bolt switch is toward the front of the bolt.

(5) Press in bolt switch and assemble extractor assembly to bolt.

(6) Remove the cocking lever pin, cocking lever, sear stop assembly, sear holder, and sear assembly. Reassemble these parts to the bolt with the sear assembly in the reversed position; that is, the lug on the sear to the right.

NOTE.—This is only necessary in case the trigger motor is to be used on the reverse side. It may be used on either side, irrespective of feeding.

d. Belt feed mechanism.—(1) Open cover and remove belt feed lever. Transfer the belt feed lever spring plunger and spring from lower hole in belt feed lever to the upper hole.

(2) Remove belt feed slide assembly from cover.

(3) Remove belt feed pawl and belt feed pawl arm (belt feed pawl assembly) from the belt feed slide.

(4) Hold the belt feed pawl assembly with the belt feed pawl arm pointing toward the body (spring seat in belt feed pawl up and arm down) and change the belt feed pawl arm from right side of pawl to the left side of pawl.

(5) Reassemble belt feed pawl assembly to belt feed slide.

(6) Reassemble belt feed slide assembly to cover, with belt feed pawl arm pointing toward right side of gun.

(7) Reassemble belt feed lever to cover.

e. Gun casing.—(1) Remove belt holding pawl pins, right and left.

(2) Transfer the front and rear cartridge stops from left side of gun to right side.

(3) Transfer the belt holding pawl and belt holding pawl spring from right side of gun to the left side.

(4) Assemble the belt holding pawl pins, right and left, to the gun.

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(5) Assemble bolt assembly in the gun and complete the assembly of the gun in the usual manner.

f. Inspection before firing gun.—After changing the gun from right hand feed to left hand feed, or vice versa, and also before firing, the gun should be inspected in order to determine that it has been properly assembled. Note should be made of the following when the gun is arranged for left hand feed:

(1) When the cover is open, the upper end of the belt feed lever should position itself toward the left side of the cover.

(2) The belt feed pawl arm should point toward the right with the arm assembled to the upper side of the pawl (cover raised).

(3) The front and rear cartridge stops should be assembled on the right side of the feedway.

(4) The belt holding pawl should be in position on the left side of the feedway.

(5) Looking down on top of the bolt as it is assembled in the gun, the enlarged portion of the bolt switch should be toward the front and the ejector should be located on the right side of the face of the bolt with the concave portion facing to the left.

26. Converting a fixed gun into a flexible gun.—*a.* Remove operating slide assembly from the gun.

b. Remove back plate assembly of the fixed type (vertical buffer).

c. Remove bolt assembly.

d. Partially withdraw lock frame, barrel extension, and barrel from gun and place a trigger bar, trigger bar pin, and trigger bar spring in position in the lock frame.

e. Replace lock frame, barrel extension, and barrel in gun.

f. Replace the bolt assembly in gun and insert a retracting slide bolt stud in bolt instead of an operating slide bolt stud.

g. Insert back plate assembly of the flexible type (double spade grip).

h. Attach the front and rear sight brackets to the barrel jacket.

i. Attach the retracting slide assembly to the gun.

SECTION V

FUNCTIONING

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Release of recoiling parts 38
Loading and locking action 39
Second action of feeding 40

27. Types of fire.—*a.* When mounted as a fixed synchronized gun, fire is semiautomatic and is controlled by mechanical synchronized gears.

b. When mounted as a fixed wing gun or as a flexible gun, the firing is of the full automatic type.

28. To load.—Loading may be considered to include two distinct operations; entering the loaded belt properly into the belt opening and thereafter operating the mechanism of the gun until it is closed, with the cartridge in the chamber and a cartridge in the feedway gripped by the extractor for extraction on the next recoil stroke.

a. The first of these operations may be performed with the cover either open or closed. In either case, enter the double loop end of the belt through the feed opening until the first cartridge is beyond the belt holding pawl. Pull back the retracting slide handle or operating slide and release.

b. The second involves operation of the gun mechanism and may be done either before or during flight by simply drawing the retracting slide handle or operating slide once completely to the rear and allowing the action to spring forward. This operation must start with the action fully closed and the extractor gripping the cartridge in the feedway.

29. To unload.—*a.* Lift cover, remove belt, retract bolt, and make visual inspection of feedway, T-slot, and chamber, to make certain that gun is unloaded.

b. Release bolt and lower cover.

c. Press the trigger or sear mechanism to relieve tension on the firing pin spring.

30. Mechanical functioning.—Functioning begins with the gun assumed to be loaded and ready to fire.

a. Fixed synchronized type gun.—(1) When installed as a fixed synchronized gun, operation of the firing mechanism must be properly timed with reference to the propeller, since the line of fire is through the path of propeller rotation. This timing is effected by the synchronizing mechanism, which is the device driven by the airplane engine for control of the firing of the gun. That part of the device

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mounted on the gun and acting directly on the end of the sear, is called the trigger motor. (See par. 45*a*.)

(2) Provision is made for throwing the trigger mechanism in and out of action by means of a control. The pilot simply operates this control when firing; the engine, acting through the synchronizing mechanism, actually fires the gun.

(3) A stroke of the trigger motor slide forces the sear inward and releases the sear notch from the shoulder of the firing pin. The firing pin spring forces the firing pin forward to fire the cartridge.

b. Fixed wing type gun.—(1) When installed as a fixed wing gun, operation of the firing mechanism is accomplished electrically through the use of a solenoid assembly attached to the gun by means of the trigger motor slots in combination with a gun control switch attached to the airplane stick and a convenient selective switching arrangement in series therewith.

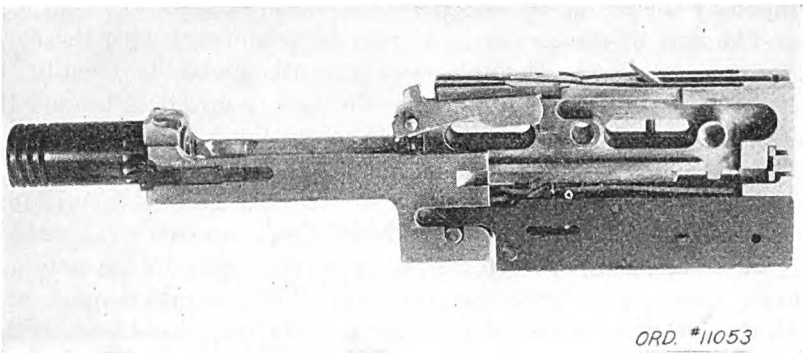


FIGURE 15.—Recoil position of reciprocating parts.

(2) That part of the solenoid assembly mounted on the gun and acting directly on the sear is called the solenoid sear plunger.

(3) A stroke of the solenoid sear plunger forces the sear inward and releases the sear notch from the shoulder of the firing pin. The firing pin spring forces the firing pin forward to fire the cartridge.

c. Flexible type gun.—When installed as a flexible gun, the back plate with hand grips and trigger is provided. If the trigger is pressed, the front end of the trigger bar is caused to move upward and, acting upon the sear spring holder, raises it. The sear spring holder is in close contact with the sear, and a cam formed on the sear riding in a notch in the sear spring holder causes the sear to move laterally, thus releasing the firing pin. The firing pin spring forces the firing pin forward to explode the cartridge.

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31. Backward movement of recoiling parts.—*a.* The explosion of the cartridge forces the barrel to the rear, carrying with it the barrel extension and the bolt which is locked to the barrel extension by the breech lock.

b. When the barrel has recoiled about 3/8 of an inch, the breech lock pin strikes the cam surface of the lock frame projections. This unlocks the bolt from the barrel extension and permits the bolt to continue to the rear.

c. As the barrel extension moves to the rear, it strikes the accelerator and turns it backward.

32. Backward action of the accelerator.—*a.* As the accelerator turns backward, it strikes the bottom projection on the bolt and accelerates it to the rear.

b. The shoulders on the barrel extension T-lug engage behind the claws of the accelerator, locking the barrel extension to the lock frame. This holds the barrel plunger spring compressed. The accelerator stop prevents the accelerator from turning too far.

33. Backward movement of the bolt.—*a.* As the bolt moves backward, the driving spring is compressed.

b. The bolt brings with it a cartridge from the belt gripped in the extractor and an empty case from the chamber gripped in the T-slot.

c. The extractor plunger rides along the top of the extractor cam and extractor feed cam until it is forced in by the beveled part of the extractor feed cam. The extractor is then forced down by the cover extractor cam and the plunger springs out below the extractor feed cam.

34. First action of feeding.—*a.* As the bolt moves backward, the stud on the belt feed lever riding in its cam groove in the top of the bolt moves the belt feed pawl laterally into position behind the next cartridge.

b. The ammunition belt is prevented from falling back out of the gun by the belt holding pawl.

35. Cocking action.—*a.* As the bolt moves backward, the upper end of the cocking lever is forced forward by the top plate bracket attached to the top plate which brings the lower end to the rear.

b. When the lower end of the cocking lever moves to the rear, it brings with it the firing pin, withdrawing the firing pin from the face of the bolt and compressing the firing pin spring against the sear stop pin.

c. The shoulder of the firing pin engages in the notch in the sear under pressure of the sear spring.

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36. Action of the driving spring.—*a.* When the rear end of the bolt strikes the buffer plate (flexible type gun) its remaining force is absorbed in the fiber buffer disks. (See par. 23*g*.)

b. When the rear end of the bolt strikes the buffer plunger (fixed type gun), its remaining force is absorbed in the fiber buffer disks and friction of the buffer friction piece and the buffer plunger. (See par. 23*g*.)

c. The compressed driving spring then forces the bolt forward.

37. Forward movement of the bolt.—*a.* When the bolt starts forward under action of the driving spring, the extractor plunger riding under the extractor feed cam rotates the extractor downward. This causes the extractor to force the cartridge down the T-slot in line with the chamber. The ejector knocks the empty case from the T-slot and holds the cartridge in line with the chamber. (The empty case may have already fallen out without the action of the ejector.)

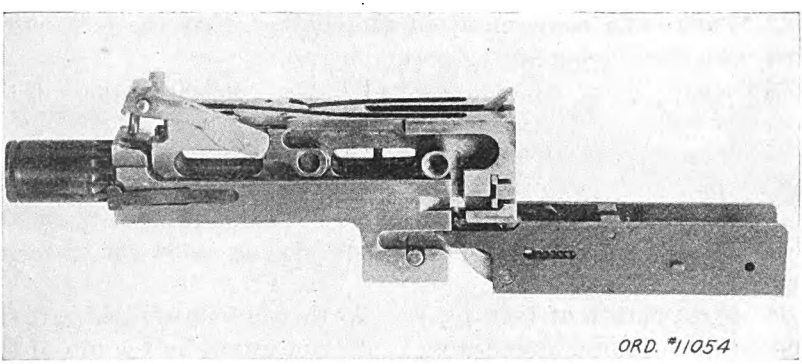


FIGURE 16.—Counterrecoil position of reciprocating parts.

b. The upper end of the cocking lever is forced backward and the lower end moves forward away from the rear of the firing pin.

38. Release of recoiling parts.—*a.* The lug on the lower rear end of the bolt strikes the accelerator and rotates it forward. This unlocks the barrel extension from the lock frame.

b. When the accelerator has been tripped, the barrel extension and barrel move forward, assisted by the barrel plunger spring.

c. Part of the forward force of the bolt acts through the accelerator to push the barrel extension forward.

39. Loading and locking action.—*a.* The extractor rises as the plunger moves along the top of the extractor cam and the ejector moves outward, leaving the cartridge in the chamber gripped by the

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T-slot. The extractor grips the first round in the belt and is held down firmly, ready to extract it, by the cover extractor spring.

b. The breech lock is forced upward by the breech lock cam and locks the breech just before the recoiling parts reach the firing position. The breech lock engages in a recess formed in the bottom of the bolt and thus locks it firmly to the barrel extension and against the rear end of the barrel.

40. Second action of feeding.—*a.* As the bolt goes forward, the stud on the end of the belt feed lever, riding in its cam groove in the top of the bolt, moves the belt feed slide and belt feed pawl in a lateral direction.

b. The belt feed pawl carries the first cartridge against the cartridge stops, ready to be gripped by the extractor.

c. The next cartridge is carried over the belt holding pawl which rises behind it and holds it in position to be engaged by the belt feed pawl on its return movement.

SECTION VI

CARE AND CLEANING

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41. General.—The importance of a thorough knowledge of how to care for and clean the machine gun cannot be overemphasized. The kind of attention given to a weapon of this type determines largely whether or not it will shoot accurately and function properly when needed. The bore and chamber must be kept in perfect condition for accurate shooting. Also it is just as important that the receiver and moving parts be kept clean, lubricated, and in perfect condition for efficient functioning.

42. Removal of carbon deposit.—*a.* During firing of the machine gun, a gradual accumulation of hard carbon occurs in the front barrel bearing. This accumulated carbon, if not removed, will eventually reach a point where it will bind the barrel and may cause the gun to cease functioning. A periodic visual inspection of the front barrel bearing should be made to see if any accumulation of carbon has formed and, if so, it must be removed.

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b. The carbon may be removed easily with the bearing reamer or a scraper upon removal of the front barrel bearing plug. To remove the plug, apply a wrench (combination tool) with sufficient force to cam the crimped flange of the plug out of the recess in the front barrel bearing.

c. Before the guns are stored, the front barrel bearing should be removed from the barrel jacket and the carbon removed from the rear face of the front barrel bearing and the forward surface of the barrel jacket.

43. Cleaning and cleaning materials.—The first step in cleaning is to remove the groups from the gun.

a. Cleaning the bore.—Complete instructions for cleaning the bore and the materials for use therewith are given in TR 1395–A.

b. Cleaning and care of groups other than the bore.—The receiver should be wiped clean, care being taken to remove dirt from the belt holding pawl, after which the cover, bolt, barrel extension, lock frame, and back plate should be wiped thoroughly clean, using a small stick covered with a flannel patch to remove dirt from all recesses. All parts should then be wiped with an oily rag. When the season's firing is completed, the various groups should be completely disassembled and all component parts cleaned and oiled.

c. Preparation of machine guns for long-term storage.—The guns should be cleaned and prepared with particular care. The bore and all parts of the gun should be cleaned, then wiped perfectly dry with rags. In damp climates, particular care must be taken to see that the rags are dry. After drying a part, the bare hands should not touch that part; handle with an oily rag. All metal parts should then be heavily coated with rust-preventive compound. Then, handling the gun with oiled rags, it should be placed in the packing chest, the wooden supports having previously been painted with rust-preventive compound.

(1) Rust-preventive compound is a heavy, dark-colored, sticky grease provided to protect metal surfaces of the gun from corrosion while in storage. It is not a lubricant and should not be used as a lubricant. The compound is of two grades, heavy and medium.

(*a*) Rust-preventive compound, heavy (Spec. U. S. A. 2–82B), is used for long term or permanent storage and must be made fluid prior to use. A practical method to obtain fluidity is to place container in a vessel of water, heating it to a temperature of not over 180° F., the exact temperature being determined by the thickness of the film desired. The higher the temperature of the compound, the thinner is the film applied to the metal. In no case should it be heated

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above 180° F., at which temperature deterioration of the compound sets in. The compound should be heated to the correct temperature for about half an hour before using. Best results will be obtained if the compound is heated to 180° F. and then allowed to cool to the desired consistency before using. The best method of applying the compound is by dipping, as there is much less danger of the inclusion of air bubbles in the grease film by this method.

(*b*) Rust-preventive compound, medium (Spec. U. S. A. 2–84A), is a sluggish liquid which pours at a temperature of 81° F. It is used for short-time protection and should not be used on guns put in permanent storage. It may be applied with a brush or by dipping. In applying, heating is not necessary except in very cold temperatures. Application of the rust-preventive compound to the bore of the machine-gun barrel is done best by dipping the cleaning brush in rust-preventive compound and running it through the bore two or three times.

(2) Prior to placing the weapon in storage the bolt should be in the forward position with the firing pin released. In fact it is good practice to relieve the firing pin tension whenever the weapon is not in use.

d. Cleaning of machine guns when received from long term storage.—Machine guns received from storage are completely coated with rust-preventive compound. Use dry cleaning solvent to remove all traces of this compound, particular care being taken that all recesses in which springs or plungers operate are cleaned thoroughly. After using the dry cleaning solvent, make sure it is completely removed from all parts by wiping with light-colored cloths until no staining of the cloth occurs. The bore and chamber of the barrel must be thoroughly cleaned. All surfaces having been thoroughly cleaned, they should then be protected with a thin film of lubricating oil applied with a rag.

NOTE.—Failure to clean firing pin and driving spring and the recesses in the bolt in which they operate may result in gun failure at normal temperatures and will most certainly result in serious malfunctions if the guns are operated in low-temperature areas, as rust-preventive compound and other foreign matter will cause the lubricating oil to congeal or frost on the mechanism.

e. Dry cleaning solvent (Spec. No. P–S–661). This is a petroleum distillate, noninflammable and noncorrosive, used for removing grease. It is generally applied with rag swabs to large parts and as a bath for small parts. The surfaces must be thoroughly dried immediately after removal of the solvent. To avoid leaving finger marks, which are ordinarily acid and induce corrosion, gloves should be worn by

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persons handling parts after such cleaning. Dry cleaning solvent will attack and discolor rubber.

44. Lubrication and lubricants.—*a.* Proper oiling is second in importance only to intelligent cleaning. It is a vital necessity for the working parts, but the oil should be used sparingly. Oil all bearing surfaces of the gun before firing, taking particular care to see that the exterior of the barrel is oiled at the breech end, also that the cover extractor spring, the cover extractor cam, and the cover detent pawl are oiled. Oil the cocking lever, the groove in bolt for the belt feed lever, the grooves in the barrel extension to take the bolt ribs, the breech lock cam, the extractor cam, the sear mechanism, and the ways of the belt feed slide.

Caution.—In oiling aircraft guns, special care should be taken not to use an excess of oil, as low temperatures that may be encountered will thicken the oil and may cause the gun to malfunction. The parts are best oiled by wiping with a well-oiled rag.

b. If the gun is to be fired in areas where the temperature is 45° F. or above, sperm oil (Spec. U. S. A. 2–45A) should be used when available. When not available, motor oil, weight 20, or any light grade machine oil may be used in an emergency.

c. On all types of machine guns when operated in areas where the temperature is below 45° F., and all aircraft machine guns when operated in the air regardless of ground temperature, aircraft instrument and machine-gun lubricating oil (Spec. U. S. A. 2–27D) should be used.

d. Sperm oil (Spec. U. S. A. 2–45A) is the most suitable oil for preserving the mechanism when in regular or intermittent use. This oil is efficient for preserving the polished surfaces, the bore, and the chamber for a period of from two to six weeks, dependent on the climatic and storage conditions. Aircraft instrument and machine-gun lubricating oil (Spec. U. S. A. 2–27D) should not be considered as a suitable preservative; however, for aircraft guns and other guns operated regularly in cold areas, it should be used and application made more often, as it is a material disadvantage to use sperm oil or other heavy bodied oils, since it is absolutely essential that such oils be removed with cleaning fluid and aircraft instrument and machine-gun lubricating oil applied before an attempt is made to fire the gun in such areas.

45. Adjustments in the field.—After considerable firing of the gun has been done, some corrections may be necessary to compensate for wear. The only major adjustments to be made in the field are

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those for head space (par. 20) and the checking and setting of the sear throw within the proper limits as shown in *a* below.

a. Checking the sear throw of synchronized guns.—(1) Air Corps Technical Order No. 11–20–3 and Navy publication O. D. 1851 give instructions for setting the trigger motor and adjusting the overtravel of the trigger motor plunger. Although the mean dimensions of the trigger motor components are satisfactory, the maximum and minimum dimensions are such that the distance from the end of the trigger motor slide in the retracted position to the inside face of the side plate of the guns may vary an amount in either direction sufficient to prevent obtaining proper functioning. To overcome this condition, the Army Air Corps is authorizing a change by technical order to all existing trigger motors to provide for the necessary reworking of the assembly. Trigger motors to be procured in the future will be so made to insure a correct throw of the slide without rework. Appropriate action is likewise being taken by the Navy Department. Variations of the unmodified trigger motors may lead to either of two conditions.

(*a*) *First condition.*—If the dimensions of the trigger motor housing are maximum and the dimensions of the trigger motor plunger and slide are minimum, the distance from the end of the slide in the retracted (neutral) position to the inside face of the side plate of the gun will be maximum, and the adjusting screw lock nut may interfere with the trigger motor housing in firing, which will damage or break the impulse cable and result in poor synchronization, a runaway gun, or putting the gun out of action. These variations cause the trigger motor slide to fail to obtain a sufficient travel in the gun to release the sear. This is often erroneously attributed to a spreading of the side plates of the gun. The end of the trigger motor slide in the neutral position can be as much as .136 inch from the inside of the side plate of the gun. Browning machine gun, caliber .30, M2, aircraft, is used as a typical gun to show the conditions. The clearance between the gun receiver and the bolt on the caliber .30, M2 gun may be .022 inch and the sear .015 inch below the edge of the bolt; that is, the distance from the trigger motor slide to the sear may be .173 inch. The sear may require as much as .062 inch to release. This requires a travel distance of the trigger motor slide of .235 inch with no overtravel, yet the trigger motor travel is limited to .210 inch by the ¼-inch synchronizer throw. The Army Air Corps has counterbored the trigger motor housing $\frac{1}{16}$ inch to permit additional movement of the trigger motor plunger. The same purpose is accomplished by the Navy by using a special nut with round shank. If

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the counterboring was not present or the special nut was not used, damage to the impulse cable would result.

(*b*) *Second condition.*—If the dimensions of the trigger motor housing are minimum and the dimensions of the trigger motor plunger and slide are maximum, interference between the sear and the opposite side plate may damage the gun, the impulse cable, or may result in poor synchronization or uncontrolled fire. These conditions place the trigger motor slide .072 inch from the inside of the side plate of the gun. This permits travel of the trigger motor slide into the gun of .138 inch for a full throw of .210 inch of the trigger motor slide. Only the Browning machine gun, caliber .50, M2, can accommodate such throw without a serious mechanical interference.

(2) The increase in engine speeds and variations in the possible sear travel after the sear is contacted by the trigger motor slide found in the several aircraft machine guns, as well as the variations in the throw of the trigger motor slide into the gun, make it necessary to check the guns and trigger motor assemblies to make sure that the sear or sear slide can travel sufficiently to release the firing pin and to have an additional movement to allow for overtravel.

(3) No change in the method of adjusting the trigger motor as covered by the Army and Navy publications is contemplated. However, to correct the conditions outlined above, drawing C45986 (fig. 17) was prepared to show the modifications required of the sears or sear slides of all aircraft machine guns except the caliber .50, M2, which requires no modification. This drawing also shows the correct distance from the trigger motor seat to the end of the trigger motor slide in full travel position. This travel may be obtained by using a trigger motor slide of sufficient length and grinding the slide after assembly to within the dimensions shown. The dimension .322–.009 inch should be established before the trigger motor is attached to the gun. (Some trigger motor slides are too short even though they are within the drawing dimensions, due to the great variations in the dimensions of the trigger motor housing and the trigger motor plunger.) These conditions will be remedied in future manufacture to obtain full interchangeability. The caliber .30, M2 guns affected will be corrected by Ordnance Field Service Modification Work Order No. A28–W5.

(4) These data are not mandatory except for the guns, as the trigger motor is not ordnance equipment. However, good synchronizing and reliable functioning cannot be expected unless an ample throw of the sear is obtained, and yet an excessive throw of the sear, such as to jam the bolt against the opposite side plate of the gun, is avoided.

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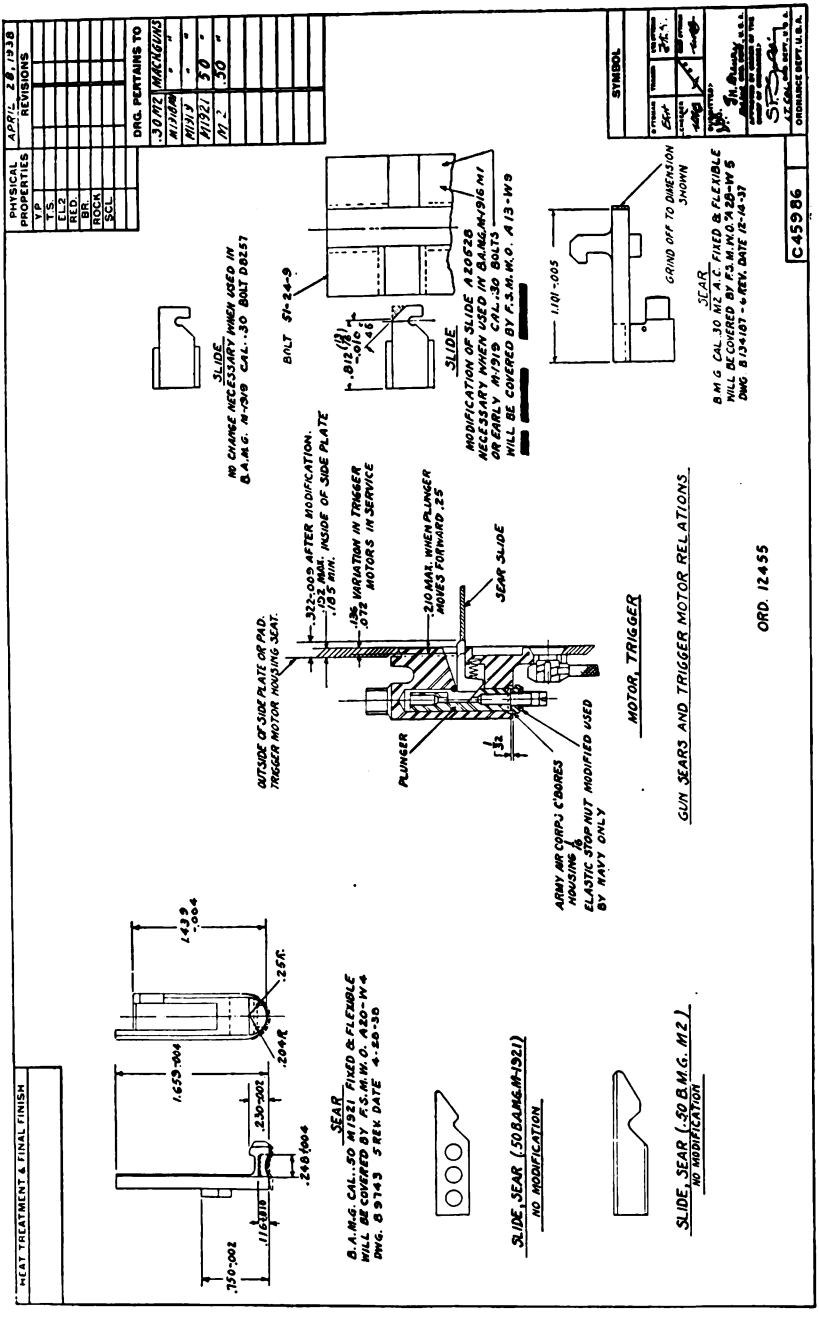


FIGURE 17.—Gun sears and trigger motor relations.

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b. Working in.—A process which has been followed in connection with aircraft machine guns, consisting of careful stoning of working parts to remove burrs and relieve friction in connection with trial firings, is called "working in." The object of this procedure is to bring the gun into its best possible working condition for the twofold purpose of insuring certain functioning in the air and of obtaining a high rate of fire. This can be done in connection with the first few firings, and if done skillfully will be of great benefit to the gun. However, it should not be considered complete after only a few firings. During the entire life of the gun, polishing and stoning to relieve friction and to remove burrs set up by firing, and general attention for the purpose of keeping the gun in good mechanical condition are essential for its proper care. Following is a brief outline covering the points most frequently requiring attention. The outline is not necessarily complete in every detail; other points requiring attention will frequently arise, but by keeping in mind the ideas noted these may be dealt with readily and intelligently.

(1) *Barrel.*—Keep the front and rear bearing surfaces smooth and working freely in their bearings in the front barrel bearing and trunnion block. If fouling (carbon deposit) forms on the barrel, it should be removed with emery cloth. Remove any burrs set up at the edge of the chamber; and if this edge is sharp, round it slightly. The barrel threads should fit easily but not loosely in those of the barrel extension.

(2) *Barrel extension.*—Check the condition of the threads as outlined above in connection with the barrel. Make sure that the bolt slides smoothly in its guides throughout its travel. There are sometimes slight burrs caused by the lower end of the ejector dropping on top of the front end of the barrel extension during the final closing action of the bolt. These burrs should be carefully removed. All working surfaces must be kept smooth and all sharp edges and corners very slightly broken or rounded. This applies particularly to the surfaces in which the bolt, breech lock, and breech lock cam operate. Care should be taken to see that the barrel locking spring has sufficient tension to insure the barrel being locked securely to the barrel extension and that the point of the spring fits snugly in the barrel notches.

(3) *Breech lock.*—Make sure that the breech lock works smoothly but not loosely in its slot in the barrel extension.

(4) *Breech lock cam.*—Examine frequently for wear, and remove all burrs.

(5) *Bolt.*—The bolt is the main working part of the gun and should be given careful attention. Its exterior must be kept in condi-

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tion to work smoothly in both the barrel extension and receiver, and all its components must be in good condition in order to insure satisfactory operation. The cam grooves in the upper surface of the bolt and bolt switch should be kept smooth and their edges free from sharp corners or burrs. The T-slot face of the bolt requires close attention and should be polished to remove rough spots or sharp edges whereever brass collects. This is especially true of the upper ends of the lips which form the T-slot, as it is essential that the cartridge head move smoothly into this slot after extraction from the belt. Check the alinement of a cartridge in the T-slot which should be in the center line of the bore. (See par. 37.) Keep the face of the lug against which the accelerator acts, smooth. Watch carefully for battering at the rear end of the bolt due to impact on the buffer. This kind of damage will result in binding of the sear and sear holder and consequent failure in functioning of the firing mechanism.

(6) *Firing pin assembly.*—Check for free movement in the bolt, and note the condition of striker point and sear lugs. Keep the striker point smooth. The sear lugs must be in good condition with their forward ends sharp. Note that the front surface of the sear lug is under cut to insure the sear holding and that clearance is provided at the bottom for the corresponding sharp edge of the sear. If either the striker point or the sear lugs become damaged, the firing pin should be replaced. If it is suspected that the firing pin spring is weak, as evidenced by a light blow on the primer, the spring should be removed and compared with a new one in free length (5½ inches). If the spring is short in free length or damaged, it must be replaced.

(7) *Cocking lever.*—Keep all working surfaces smooth. Check the operation of the cocking lever to insure that it retracts the firing pin sufficiently to allow the sear to engage. There should be about 0.05 inch overtravel.

(8) *Sear holder and sear assembly.*—These members are very important and must be kept in perfect condition. Care of the sear nose corresponds to that of the sear lugs on the firing pin, and it is advisable always to consider the two together. The sear and sear holder should work smoothly in their guide cuts in the bolt without binding. Keep all working surfaces smooth, especially the cam cuts in the sear and the corresponding lug on the sear holder. Make sure that the sear spring plunger and the sear holder spring plunger work smoothly.

(9) *Driving spring rod assembly.*—Make sure the driving spring rod is straight and the assembly moves freely in the bolt. Keep the tongue and rear end of driving spring rod head smooth and free from burrs. If the driving spring seems weak, try a new spring assembly

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in the gun. If this remedies the sluggishness the old driving spring is weak; however, the old spring should be disassembled and its free length measured. If it is less than 11⅝ inches, it must be replaced.

(10) *Retracting slide bolt stud and operating slide bolt stud.*—Make sure that the collar does not scrape the inside of the side plate. If sharp, break slightly.

(11) *Extractor and ejector.*—Polish all burrs and sharp edges from the functioning surfaces. See that the ejector and the extractor plunger work smoothly. See that the extractor stud fits closely in its hole in the bolt.

(12) *Lock frame.*—Keep the breech lock pin cams at the forward end smooth. Check the action of the barrel plunger. If considered necessary, check the free length of the barrel plunger spring (free length 3⅝ inches). If set more than ¼ inch, spring should be replaced.

(13) *Accelerator.*—Remove any burrs which form on the accelerator.

(14) *Back plate assembly (fixed type gun).*—Make sure the adjusting screws are tightly screwed down upon the fiber buffer disks at all times. (See par. 23*g*.) Check the action of the back plate latch. Keep guide cuts in back plate smooth and free from burrs.

(15) *Back plate assembly (flexible type gun).*—Make sure the adjusting screw is tightly screwed down upon the fiber buffer disks at all times. (See par. 23*g*.) Check the action of the trigger, trigger safety, and back plate latch. Keep the trigger smooth at point of contact with trigger bar. Keep guide cuts in back plate smooth and free from burrs. Make sure that trigger safety bracket screw is securely staked in place.

(16) *Cover assembly.*—Polish the edges of cover extractor cam and the cover extractor spring. Smooth the lower corners of the ribs which support the belt feed slide and make sure that the slide moves freely in its guides. Keep the stud on the end of the belt feed lever smooth and free from burrs. See that the belt feed pawl and belt feed pawl arm are smooth and free from burrs and that the arm is not bent out of shape. Test the belt feed lever and the belt feed pawl for functioning. Check the action of the cover latch. Keep the cam surface of the cover latch smooth. Make sure the cover latch pin is securely in place and headed flush at rear of cover latch. See that serrations formed in front of cover are smooth and free from burrs.

(17) *Casing assembly.*—Remove any burrs that form in the feedway for the belt. Make sure that the belt holding pawl and its

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spring work properly, and that the cartridge stops, particularly the rear one, are in good condition and permit the cartridge in the bolt T-slot ((5) above) to be in alinement with the center line of the bore without binding in the T-slot and/or against the rear cartridge stop. To remedy, stone or replace the rear cartridge stop. Remove any burrs which develop on the extractor cam, extractor feed cam, and around the edges of the trigger motor slots. Keep the cover detent pawl smooth and free from burrs. Make sure that the barrel jacket assembly and the front barrel bearing and plug are locked in place.

(18) *Operating slide assembly (fixed type gun only).*—Test operating slide for smooth functioning. Keep locking lug on end of operating slide rod and locking notches formed in operating slide housing smooth and free from burrs.

(19) *Retracting slide assembly (flexible type gun only).*—Test retracting slide for smooth functioning. Keep inner surface of retracting slide and the slot in retracting slide bracket smooth and free from burrs.

46. Points to be observed before a flight.—The following points must be observed before leaving the ground:

a. Wipe the bore and chamber of gun barrel.

b. See that the adjusting screws are screwed in tight against buffer disks in back plate. (See par. 23*g*.)

c. Test the functioning of gun by hand, using dummy cartridges.

d. Test the functioning of operating slide (fixed type gun only) or retracting slide (flexible type gun only).

e. Oil carefully. (See par. 44.)

f. See that the sight bases are clamped securely in place and that the sights are installed in the bases (flexible type gun only).

g. Make sure that ammunition belt is in good condition and properly loaded.

h. Carefully place the belt in the ammunition chest and see that the metallic belt link chutes are in good condition and in proper alinement.

i. Load the gun partially or completely as directed.

47. Points to be observed after a flight.—The following points must be observed as soon after a flight as practicable:

a. Unload the gun completely and remove belt from ammunition chest.

b. Clean the bore and all working parts. If this cannot be done at once, oil carefully to prevent rust.

c. Release the firing pin spring.

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d. The armorer must get a detailed account from the gunner or pilot of the gun's behavior in the air. If stoppages have occurred, their cause must be determined and corrected immediately.

e. At the first opportunity dismount the gun; clean, oil, and inspect all parts. Make needed repairs and replacements.

f. On assembling, check the operation with dummy cartridges and release the firing pin spring after insuring that functioning and adjustments are correct.

SECTION VII

MALFUNCTIONS

	Paragraph
Definitions	48
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To use the ruptured cartridge extractor	51
To remove a cartridge from the T-slot	52
To remove a case from the chamber	53

48. Definitions.—*a.* A malfunction is an improper action of some part of the gun, resulting in a stoppage; for example, failure to extract the empty cartridge case.

b. Any accidental cessation of fire is a stoppage. It may be a faulty cartridge or a malfunction of some part of the gun. The fact that all the ammunition in the belt being fed into the gun has been exhausted should not be called a malfunction since it is a cessation of fire from natural results.

c. Immediate action is the term applied to that operation required to clear a temporary stoppage.

49. Stoppages.—*a. Prevention.*—Proper care of the gun and attention to the points before and after a flight will greatly reduce the liability to stoppages, particularly if the gunner has an intelligent understanding of the reasons why stoppages generally occur. Prevention is the best remedy for all stoppages. Nevertheless, stoppages will occur in spite of all that can be done to prevent them.

b. Classes.—Stoppages may be classed under two headings as follows:

(1) *Temporary.*—Temporary stoppages are those susceptible to correction in flight such as stoppages due to faulty ammunition or neglect of points to be observed before a flight. (See par. 46.)

(2) *Prolonged.*—Prolonged stoppages are those due to the failure of some part that cannot, as a rule, be readily corrected without skilled assistance.

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c. Classified table.—(1) Stoppages are classified according to the position in which the retracting slide bolt stud or operating slide bolt stud is found when the gun stops firing.

(*a*) *First position.*—Bolt stud all the way forward.

(*b*) *Second position.*—Bolt stud just in rear of all the way forward to halfway back.

(*c*) *Third position.*—Bolt stud just in rear of halfway back to all the way back.

(2) A table of stoppages classified according to the position of the bolt stud follows:

CLASSIFIED TABLE OF STOPPAGES

Position of bolt stud	Stoppages	Method of preparation for instruction purposes in application of immediate action and clearing of stoppages
First position.	1. Misfire due to defective primer.	1. Place a dummy cartridge in the belt.
	2. Short or broken firing pin.	2. Place five successive dummy cartridges in belt for instruction in immediate action.
	3. Weak or broken firing pin spring.	3. Same as 2 above. Assemble with defective part for instruction in stoppages.
	4. Faulty engagement of firing pin and sear notch.	4. Same as 2 above.
	5. Worn or bent cocking lever.	5. Assemble with defective part.
	6. Belt improperly loaded. (May cause a second position stoppage.)	6. Pull a cartridge partially out of the belt.
	7. Short round.	7. Place a short round in the belt.
	8. Bent or worn belt feed lever. (May cause a second position stoppage.)	8. Assemble with defective part.
	9. Belt feed pawl spring weak or out.	9. Remove belt feed pawl spring.
	10. Cover extractor spring weak or out.	10. Remove cover extractor spring.
	11. Defective bolt switch. (Stud on end of belt feed lever jumps out of cam groove.)	11. Assemble with defective part.
	12. Damaged extractor. (May cause a second position stoppage.)	12. Assemble with defective part.
	13. Belt holding pawl out or spring weak.	13. Remove belt holding pawl.
	14. Belt holding pawl fails to depress. (May cause a third position stoppage.)	14. Fill recess with foreign matter.
	15. Front end of trigger bar bent downward (flexible type gun only).	15. Assemble with defective part.
	16. Tip of trigger broken (flexible type gun only).	16. Do not prepare.

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CLASSIFIED TABLE OF STOPPAGES—Continued

Position of bolt stud	Stoppages	Method of preparation for instruction purposes in application of immediate action and clearing of stoppages
Second position.	1. Separated case which stays in the chamber when bolt is pulled to rear.	1. Insert the front end of a separated case in the chamber and load.
	2. Separated case which is removed from the chamber by the new round when bolt is pulled to the rear.	2. Drive the front portion of a cartridge securely on a dummy cartridge. Pull the bolt to the rear and place the cartridge properly on the face of the bolt. Ease the bolt forward.
	3. Separated cases due to too much head space. (May result in either 1 or 2 above.)	3. Do not prepare.
	4. Head space adjustment too tight.	4. Do not prepare.
	5. Broken or missing barrel locking spring. (May result in either 3 or 4 above.)	5. Do not prepare.
	6. Broken extractor or ejector.	6. Assemble with defective part.
	7. Driving spring weak.	7. Assemble with weak or short driving spring.
	8. Barrel plunger spring weak.	8. Assemble with weak or short barrel plunger spring.
	9. Broken T-lug or bent barrel plunger stud on barrel extension.	9. Assemble with defective part.
	10. Bullet loose in cartridge case.	10. Do not prepare.
	11. Tight link in belt.	11. Do not prepare.
	12. Bulged round.	12. Insert bulged round in belt.
	13. Operating slide rod bent. (May cause a third position stoppage) (fixed type gun only).	13. Assemble with bent operating slide rod.
Third position.	1. Battered or thick rim of cartridge.	1. Place a battered or thick rimmed cartridge in belt.
	2. Broken cannelure.	2. Place a dummy cartridge with rim filed off in chamber.
	3. Enlarged hole in recoil plate. (Set back primer).	3. Do not prepare.
	4. Belt feed pawl arm bent or broken.	4. Assemble with defective part.
	5. Top cam of extractor worn.	5. Assemble with defective part.
	6. Cover extractor cam worn.	6. Assemble with defective part.
	7. Broken or damaged T cut in bolt.	7. Do not prepare.
	8. Bullet strikes face of barrel, caused by (a) thin rim of cartridge, (b) weak or improperly seated extractor spring, (c) worn extractor, (d) worn T-slot, (e) excessive head space, (f) binding of barrel in front barrel bearing, (g) ejector spring solid height too great, and/or (h) weak ejector spring.	8. Do not prepare.

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d. Immediate action.—Very few stoppages can be remedied in the air; in fact, only those which can be remedied by pulling back the retracting slide handle or operating slide. Nevertheless, it is of vital interest to the gunner to know as much as possible about the causes of and remedies for the various stoppages. Information contained in the classified table of stoppages in *c* above, and notes given herein on immediate action are to be considered primarily in relation to practice firing on the ground, as it is in such firing that the fundamentals of the operation of the gun are learned. The gunner may subsequently apply the knowledge of stoppages thus gained to operation in flight and will be able to determine quickly whether any particular stoppage can be readily corrected or if it requires more extensive repairs than he can make.

(1) *While in flight.*—If gun fails to fire, see that the cover is latched properly. Then pull the operating slide to the rear and release quickly, allowing the bolt to go forward. If the gun still fails to fire, repeat the operation.

(2) *Practice firing on the ground.*—When a stoppage is experienced, first note the position of the bolt stud. Never push the bolt forward. Proceed as follows:

(*a*) *Gun fails to fire.*—With the hand, feel of rounds entering feedway. Straighten if required. See that cover is latched. Then pull retracting slide handle to the rear twice and release it. Fire.

(*b*) *Gun still fails to fire.*—Raise cover and note position of bolt. If bolt is not closed, pull back retracting slide handle and remove cartridge in T-slot. Examine it. If cartridge is warm, let it cool for about 30 seconds. If it shows the ring mark of a separated case, use the ruptured cartridge extractor as outlined in paragraph 51. If bolt is closed, pull retracting slide handle once to the rear. If a cartridge is ejected, examine for broken firing pin. If no cartridge is ejected, examine feed mechanism and extractor and remedy defect. Reload. Fire.

Caution.—After any stoppage which appears to be caused by insufficient recoil, make sure that the bore is clear before continuing firing. It is possible that such a stoppage, for instance one caused by incomplete ignition of the powder charge, may result in the bullet lodging in the bore, and in case this happens and another round is fired before the bore is cleared, the gun certainly will be seriously damaged.

50. Unusual malfunctions.—The following stoppages and unusual actions of the gun cannot be depended upon to leave the bolt stud in any particular position and will not respond to ordinary immediate action.

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a. Broken barrel extension.—(1) The bolt will not go home and the gun will stop firing with the bolt stud in the second or third position. In rare cases the gun will fire a few rounds with a broken barrel extension. When performing immediate action, the breakage will be obvious.

(2) To remedy, remove the broken part from the gun, procure a serviceable barrel extension, readjust the headspace, assemble the gun, lower and latch the cover, load, and fire.

b. Uncontrolled automatic fire.—When the gun is assembled with the trigger bar and back plate having hand grips and a trigger (flexible type gun) it will not be controllable through the trigger if the forward end of the trigger bar is sprung upward. It will fire the moment the bolt is home the second time during loading, or, if the defect occurs during firing, the gun will not stop firing when the trigger is released. To remedy—

(1) Raise the cover and remove the ammunition belt. (Raising the cover stops the firing.)

(2) Remove the trigger bar from gun.

(3) Examine trigger bar, and, if possible, remedy the defect or assemble a new trigger bar in gun.

51. To use the ruptured cartridge extractor.—There are two styles of ruptured cartridge extractors provided. One, the Mk. II, is similar in form to a cartridge. The other, the Mk. IV, is of the same general form with the addition of a lever handle. A detailed description of these ruptured cartridge extractors is given in paragraph 55 *h* and *i*.

a. To use the Mk. II ruptured cartridge extractor, place it in the feedway against the cartridge stops and engage the rim with the extractor on the bolt. Hold down the extractor with the fingers and draw the bolt to the rear. Allow the bolt to go forward slowly, guiding the ruptured cartridge extractor down the T-slot to insure its entering the chamber smoothly. Allow the bolt to go fully forward, withdraw it slightly, and let it go forward again to insure seating of the ruptured cartridge extractor in the separated case. Place hand under receiver and pull the retracting slide handle to the rear, catching the ruptured cartridge extractor as it falls out.

Caution.—In using the ruptured cartridge extractor, do not let the bolt fly forward from the rear, as the shoulder on the ruptured cartridge extractor is likely to strike the edge of the chamber and make a burr on it which will prevent the full entry of a cartridge and render the barrel useless.

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b. To use the Mk. IV ruptured cartridge extractor, draw the retracting slide handle to the rear and "hang the bolt" by engaging the extractor plunger in the notch in the rear of the extractor feed cam. Insert the nose of the ruptured cartridge extractor in the chamber, handle up, push forward to seat firmly in the separated case, and pull backward on the handle.

c. Separated cases should be removed from the ruptured cartridge extractors so that they will again be ready for use. To do this, the end of the ruptured cartridge extractor must be unscrewed, the separated case taken off, and the end screwed on again.

d. If several separated cases occur, tighten the headspace as prescribed in paragraph 20*b*.

52. To remove a cartridge from the T-slot.—*a.* Hold back the bolt and raise the extractor. The cartridge will usually fall out unless it has a thick rim or the T-slot is defective.

b. If the cartridge will not fall out when the extractor is raised, use the combination tool. If the cartridge is not below the bolt stud slot, insert the screw driver end of the combination tool through the slot under the rear end of the cartridge and pry cartridge up and out of the T-slot, holding down the front end of the cartridge with the finger.

c. If cartridge is too far down the T-slot for the insertion of the combination tool, "knock it down." Hold the bolt to the rear with the extractor raised. Place the screw driver end of the combination tool through the top of the receiver into the top of the cannelure of the cartridge and drive the cartridge downward out of the T-slot by striking the upper end of the combination tool with the palm of the hand.

53. To remove a case from the chamber.—If there is an empty case with broken rim stuck in the chamber, remove cartridge from T-slot if there is one, hold back bolt, insert the cleaning rod from the muzzle, and knock the empty case from the chamber. If several cartridges stick in the chamber in close succession, put some oil on the chamber cleaning brush, thoroughly scrub the chamber with the brush, then wipe out the chamber with a dry rag.

SECTION VIII

SPARE PARTS AND ACCESSORIES

Paragraph
Spare parts 54
Accessories 55

54. Spare parts.—The parts of any machine gun will in time become unserviceable through breakage or wear resulting from con-

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tinuous usage. For this reason, spare parts are provided for replacement purposes. They should be kept clean and lightly oiled to prevent rust. They are divided into two groups: spare parts and basic spare parts.

a. Spare parts are extra parts provided with the gun for replacement of the parts most likely to fail; for use in making minor repairs; and in general care of the gun. Sets of spare parts should be kept complete at all times. Whenever a spare part is taken to replace a defective part in the gun, the defective part should be repaired or a new one substituted in the spare part set as soon as possible. Parts that are carried complete, such as the spare bolt, should at all times be correctly assembled and ready for immediate insertion in the gun. The allowance of these spare parts is prescribed in Standard Nomenclature List No. A–28.

b. Basic spare parts are sets of parts provided for the use of ordnance maintenance companies and include all parts necessary to repair the gun. The allowance of basic spare parts is prescribed in the addendum to Standard Nomenclature List No. A–28.

55. Accessories.—Accessories include tools for disassembling, assembling, making adjustments, and cleaning the gun, as well as packing chests and auxiliary equipment. They must not be used for any purpose other than that for which they are intended. When not in use they should be stored in their proper place or receptacle provided for them. There are a number of accessories provided with the gun, the names or general characteristics of which indicate their use and application. Therefore no detailed description nor method of use is outlined herein. The special accessories, however, being of a different nature, the description and purpose of each are outlined below:

a. Cleaning rod, M2 (fig. 18).—This is a steel cleaning rod consisting of two sections fastened together with a swivel joint. The rear end is provided with a tubular steel handle which swivels on the rod. The front end is provided with threads for attaching the cleaning brush, caliber .30, M2, and has a slot formed for holding a cloth cleaning patch.

b. Jointed cleaning rod, M1 (fig. 18).—This is a steel cleaning rod consisting of four sections, each with threaded dowels for joining the sections. The rear section is provided with a tubular steel handle which swivels on the rod. The forward section is made of two pieces fastened together with a swivel joint. The front end is provided with threads for attaching the cleaning brush, caliber .30, M2, and has a slot formed for holding a cloth cleaning patch.

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c. Cleaning brush, caliber .30, M2 (fig. 18).—The brush consists of the core, bristles, and tip. The core, made of brass wire, is twisted in a spiral and holds the bronze bristles in place. The ends of the core are secured in the brass tip, one end of which has threads formed for attaching the brush to the cleaning rod.

d. Cleaning rod case, M1 (fig. 18).—This case is a fabric container sewed to form five pockets, four of which hold the section of the jointed cleaning rod, M1, and the other pocket holds the cleaning brush, caliber .30, M2. A web billet and chape with buckle are sewed on the front of the case to secure the sections of the cleaning rod. A web hanger with brass double hook is sewed on the back of the case.

e. Barrel reflector.—This is a mirror reflector in a brass housing which, when placed in the chamber, affords the observer a view of the bore of the barrel.

f. Chamber cleaning brush, M6 (fig. 18).—The chamber cleaning brush consists of a bristle brush, the bristles being retained by a twisted wire. The handle is formed by extending the twisted wire to the rear, the end of which terminates in the form of a loop.

g. Combination tool, M2 (fig. 18).—This tool is a special wrench, punch, and screw driver, used for disassembling, assembling, and making adjustments of the gun. The main body is a flat steel member having formed on one end three wrench openings and a large screw driver blade and on the other end a small screw driver blade. Nearly midway of the ends of the body is riveted a punch which can be turned parallel to the body when not in use.

h. Ruptured cartridge extractor, Mk. II (fig. 18).—(1) The ruptured cartridge extractor, Mk. II, has the general form of a cartridge, is made of steel, and consists of three parts: the spindle, the head, and the sleeve. The spindle is shaped like a cartridge case, with an extracting groove or cannelure similar to the cartridge case. Just forward of the extracting groove is a shoulder which limits the travel of the extractor into the chamber. The head consists of a long pin threaded at the back end and enlarged and rounded at the front end. In rear of the forward end is a shoulder which limits the forward travel of the sleeve. Back of this shoulder is a cone taper. The sleeve is tapered at its forward end, the taper ending in a square shoulder. Three longitudinal slits 120° apart extend three-fourths of the length of the sleeve to the rear. The sleeve fits loosely over the pin portion of the head, which in turn is screwed into the spindle.

(2) When the ruptured cartridge extractor is inserted in that portion of the cartridge case remaining in the chamber, the sleeve is forced back to the spindle and its front end compresses as this portion

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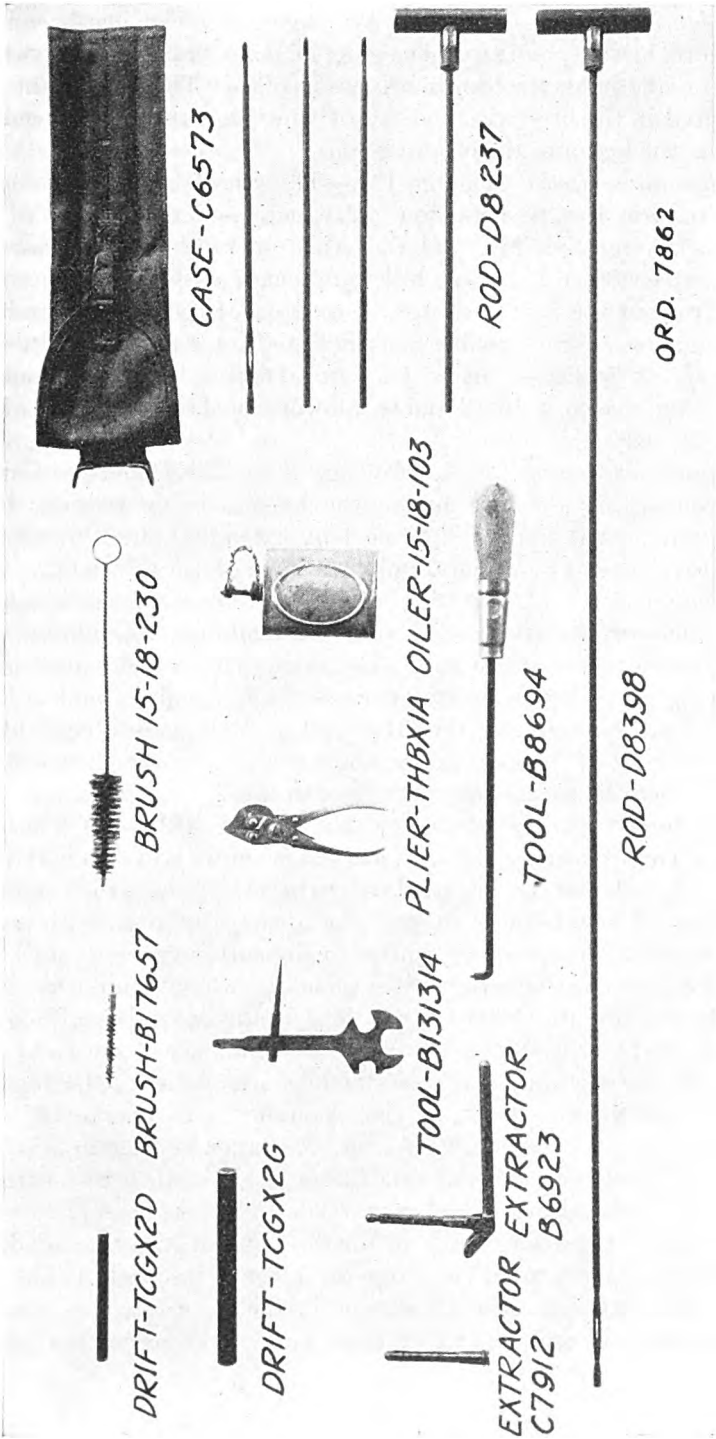


FIGURE 18.—Accessories.

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of the sleeve passes through the neck of the cartridge case. When the shoulder portion of the sleeve passes out of the cartridge case, the pressure being relieved, the sleeve expands to its normal position. The neck of the cartridge case is now held in back of the shoulder of the sleeve. When the spindle holding the head is withdrawn, the sleeve and the ruptured cartridge remain stationary until the cone of the head further expands the sleeve and the sleeve comes in contact with the square shoulder of the head. The sleeve containing the portion of the ruptured cartridge is now withdrawn with the positive action of the bolt and ruptured cartridge extractor. The method of using the ruptured cartridge extractor is given in paragraph 51*a*.

i. Ruptured cartridge extractor, Mk. IV (fig. 18).—The ruptured cartridge extractor, Mk. IV, is of the same general form as the Mk. II, with the addition of a lever handle. The method of using the ruptured cartridge extractor, Mk. IV, is given in paragraph 51*b*.

j. Release tool (fig. 18).—This tool is used to depress the lock frame retainer through the hole in side plate when the gun is installed in a position where it is not possible to use the combination tool for this purpose. The tool consists of a ¼-inch square steel rod, one end of which is bent at a right angle. The bent portion, ½ inch long, is turned down to ⅛-inch diameter for a distance of ⅛ inch. The other end of the rod is provided with a wooden handle which is held in place with a steel pin. The over-all length of the tool is 15½ inches.

k. Spare barrel cover, M9.—The spare barrel cover, M9, is made of olive drab cotton duck, the sewed edge being bound with olive drab cotton webbing. The bottom of the cover is closed and the top folds over and fastens with a metal snap fastener. The interior, for approximately 24 inches from the bottom, is lined with asbestos cloth and the remainder of the interior, including the flap, is lined with latigo leather. One side of the cover has "COVER, SPARE BARREL, M9—D30674" stenciled in black with letters and numbers ½ inch high. The cover is designed to carry one spare barrel.

l. Metallic link belt (fig. 19).—(1) This belt is made up by assembling ammunition into metallic belt links and may be formed into any desired length of belt. As the ammunition is extracted from the belt the link is left free to be ejected from the gun. A chute is provided that carries them clear of the airplane.

(2) The belts must be free from kinks or tight hinge loops, cartridge heads must be well alined, and the belt must enter the gun with the double loop of the link leading in order to feed properly.

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(3) In no instance will the links be oiled in order to make the belt more flexible, as this will cause a gumming or slipping of the feed pawls of the gun.

m. Link loading machine, caliber .30 M3 (fig. 20).—The link loading machine is used for the rapid loading of ammunition into metallic links. It may be screwed to a bench, ammunition box, or other suitable base when in use. Screw holes are provided in the loading machine base for this purpose. Links, properly assembled, are placed on the loading machine base adjacent to the U-shaped stops, and the proper number of cartridges placed in the grooves corresponding to each link. The loading is performed by the operation of the link loading handle, which, when pushed forward to the stop, will load the ammunition to the correct depth in the links. Care should be taken to properly handle that portion of the loaded belt which is adjacent to the new section being loaded.

n. Armorer's tool chest, M1 (fig. 21).—The armorer's tool chest, M1 provides for the storage and transportation of the tools required for maintenance of aircraft machine guns. It is made of sheet steel, 20 inches long, 11 inches wide, 13 inches high in the center and 9½ inches high on each side; the entire surface is painted olive drab. The top portion of each end is triangular in shape. The cover is made in two sections; each section is hinged to the side and fastened near the center with spring catches and a lock. A handle is provided on top for convenience in handling. A list of contents of the chest is given in Standard Nomenclature List No. A–28.

o. Arm chest (fig. 22).—The arm chest is used for packing one completely assembled machine gun. It is made of wood, held together with nails. Handles are provided at either end for convenient handling. The top or cover is secured to the chest by wood screws; the heads of two of these screws are covered with sealing wax, into which a suitable impression is made. The interior of the chest is provided with several wooden spacer blocks for securing the gun in place.

p. Steel chest, M5.—This chest is provided for the storage and transportation of accessories and spare parts; the quantity of accessories and spare parts carried in the chest is determined by the organization. The chest is made of sheet steel, 16⅜ inches long, 7⅜ inches wide and 7¼ inches high, the entire surface is painted olive drab. The cover is provided with hinges, lock and side catches, also a handle on top for convenience in handling. The weight of the chest empty is 6 pounds, 6 ounces.

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q. Stabilizer, caliber .30, M2 (fig. 23).—(1) The stabilizer is an accessory used by the Navy which may be substituted for the front barrel bearing assembly on both the fixed and flexible type of gun. It serves as a combination front barrel bearing, recoil check, flash hider, smoke consumer, and blast reducer, and consists of four parts: the stabilizer body, the gas retainer, the barrel bearing, and the barrel bearing plug. The stabilizer should not be disassembled except for

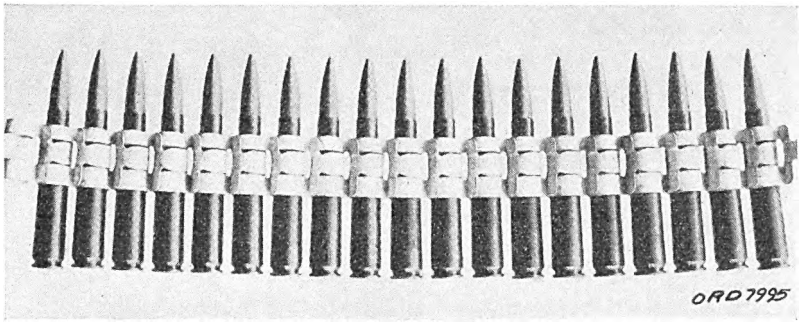


FIGURE 19.—Metallic link belt.

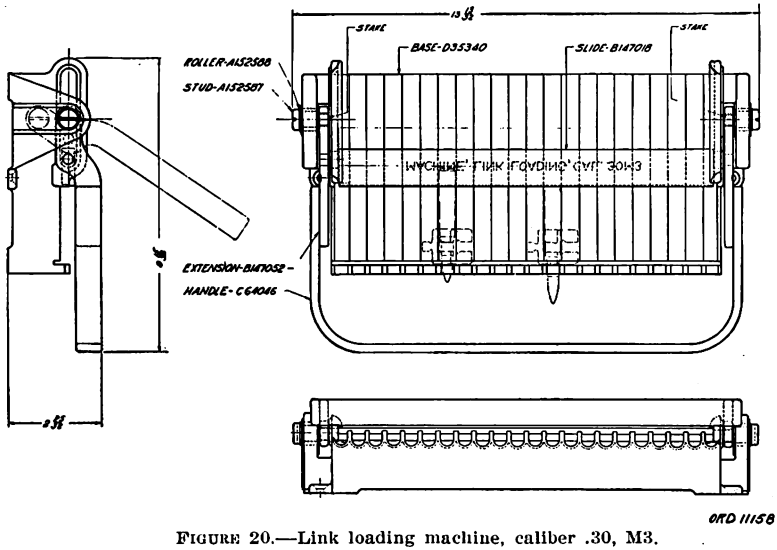


FIGURE 20.—Link loading machine, caliber .30, M3.

repair or occasionally for cleaning, as the body and gas retainer are securely staked in place to prevent their unscrewing.

(2) To attach the stabilizer, remove the front barrel bearing assembly from the barrel jacket of the gun. Screw the stabilizer into the barrel jacket, making sure the shoulder bears against the end

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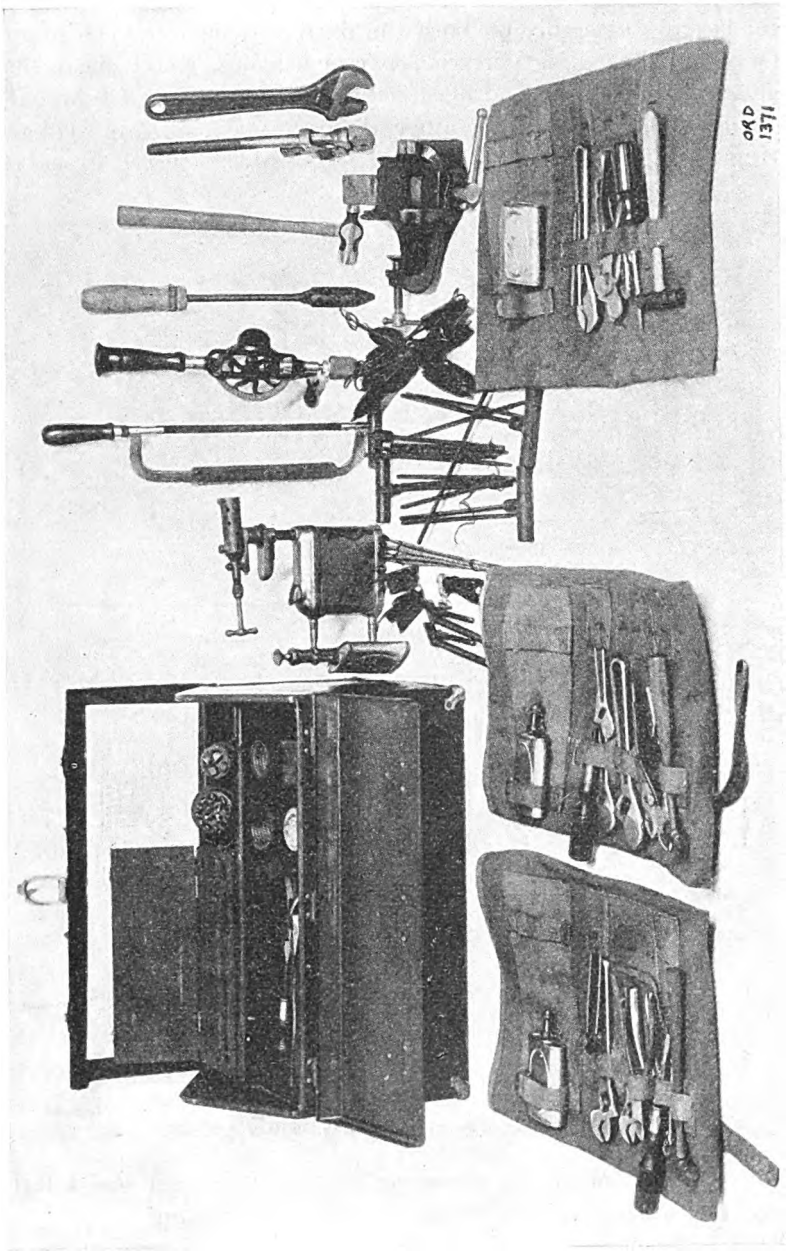


FIGURE 21.—Armorer's tool chest, M1, with contents.

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of the barrel jacket; then crimp the shoulder into one of the slots provided in the end of the barrel jacket to prevent the stabilizer from becoming loose.

r. Strap pipe wrench.—This wrench is for use in removing and installing the stabilizer, front barrel bearing, and barrel jacket. It consists of a handle 12 inches long to which is attached a treated

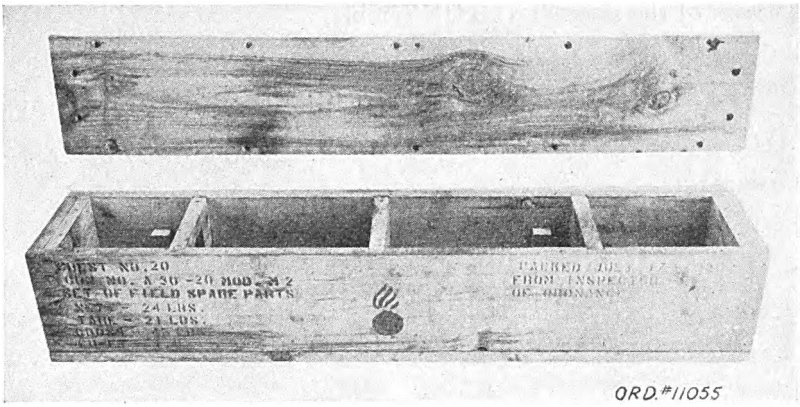


FIGURE 22.—Arm chest.

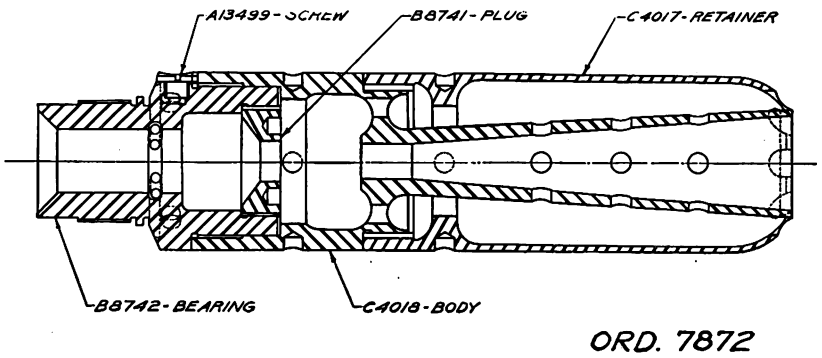


FIGURE 23.—Stabilizer, caliber .30, M2.

fabric strap approximately 20 inches long. To use, the free end of the strap is placed to encircle the surface, pulled taut, and fastened to the handle. It provides an effective wrench which will not mar, distort, or deface the surface on which used.

s. Trigger motor slot cover.—This is used to cover the trigger motor slot in the side plate of the machine gun. The cover assembly consists of the body, slide, shaft, spring, washer, and pin. The body is the main component. One large and two small lugs are formed on

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the bottom of the body. The large lug is beveled to suit the beveled edge of the trigger motor slot in the side plate of the gun. The two small lugs are drilled to receive the shaft of the shaft and slide assembly. This shaft and slide assembly, composed of the beveled end slide pressed on the outer end of the shaft, carries the spring which maintains the slide in the extended position, forming a latch to retain the cover assembly on the side plate. A steel pin and washer limits the travel of the shaft and slide assembly.

[A. G. 062.12 (10-25-38).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Acting Chief of Staff.

OFFICIAL:
E. S. ADAMS,
Major General,
The Adjutant General.

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