#3

Not to be taken into front line trenches.

DESCRIPTION AND RULES FOR OPERATING THE UNIT TYPE MONO-CORD TELEPHONE SWITCHBOARD.

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DESCRIPTION AND RULES FOR OPERATING THE UNIT TYPE MONO-CORD TELEPHONE SWITCHBOARD.

1. The unit type mono-cord telephone switchboard is designed as a field instrument and necessarily lacks some of the refinements of larger switchboards. Each of these switchboards is made up of a number of units, usually four and sometimes twelve, but the number can be varied to suit special circumstances. Each unit is complete in itself and consists of a block of insulating material on which the operating parts are mounted. These are, from top to bottom:

(a) Two metal blocks with screws, by means of which the two-line wires are attached:

(b) Two enclosed fuses in combination with a notched disc lightning arrester:

(c) A line drop normally bridged across the line, but connected to;

(d) A cut-off jack;

(e) The line terminates in a cord and plug attached to the bottom of the unit. The several units are fastened to the frame by means of the top and bottom screws, which go through the unit and into two brass bars extending the full length of the switchboard. A third brass box runs through the frame parallel to the upper and lower bars, for making connection to the night bell circuit.

2. Figure 1 shows the wiring of one unit of this type and also the terminals on the outside of the box for connecting the night alarm circuit battery and bell, the ground connections, and the connection to the field telephone set which must always be used with this board. In this diagram, the brass bars, which are common to all the units, are indicated by letters T, S and M.

3. To remove a unit, take out the extreme upper and lower screws, with a screw-driver, and lift the section clear. It may fit just a little tight, but can usually be shaken out without difficulty. If anything goes wrong with a unit, it is best to remove it and replace it with another, sending the damaged unit to the rear for repair or adjustment. To change a fuse, press down on the lower holding spring with the fingers of one hand

and pull the fuse straight out to the front with the other hand. Operators should watch the fuses, and if a line goes dead, especial attention should be paid to the condition of the fuse. When a fuse burns out, it can usually be seen against the white background, but if the operator finds that the line is dead, he should momentarily short circuit the line with a piece of bare wire placed across the two line blocks, and should then test by putting the operators plug in that line jack and turning the handle of the ringer of his operating set. If a fuse is burned out, the handle will turn over easily and without resistance, but if the break in the line is outside the switchboard, the handle of the magneto will turn with difficulty owing to the short circuit at the line terminals.

4. Figure II shows the several operations that must be followed in all cases in establishing a connection between two stations. Assume line 1 calling line 2; the station on line 1 rings or sends buzzer current over line which operates drop 1, and indicates to the operator that the station on line 1 is calling.

First operation: The operator takes his cord (attached to the bottom of the switchboard) and inserts the plug in jack 1. This connects his operator's telephone with the station on line 1, and by means of his telephone he determines the wishes of the calling party. Suppose the calling party wishes to get line 2.

Second operation: The operator then removes his operator's plug from jack 1 and inserts it in jack 2, at the same time turning the handle of the magneto of his operator's set. This rings the bell on line 2.

Third operation: The party on line 2 answers. The operator then takes the line cord (LC-2) and inserts it in jack 1. This connects line 1 and line 2.

Fourth operation: The operator leaves his plug for a moment in jack 2, in order to see that the parties are properly connected. He then removes the operator's plug and restores the drop of line 1.

Fifth operation: When the parties are through talking, either one or the other or both will ring off. This will throw the drop of line 2, and indicate to the operator that the conversation is completed. He then restores the drop and removes the plug of line 2 from the jack of line 1.

5. In case three or more parties wish to be connected simultaneously, it is only necessary to repeat the above operations for each station called. Assuming station 1 calling 2 and 3, the operator establishes connection between 1 and 2 as above described, then takes the operator's cord and calls station 3, and completes the connection with line cord LC-3

to jack 2, supervises to determine that connections are properly established and then removes the operator's cord. This operation is repeated for each station that is connected.

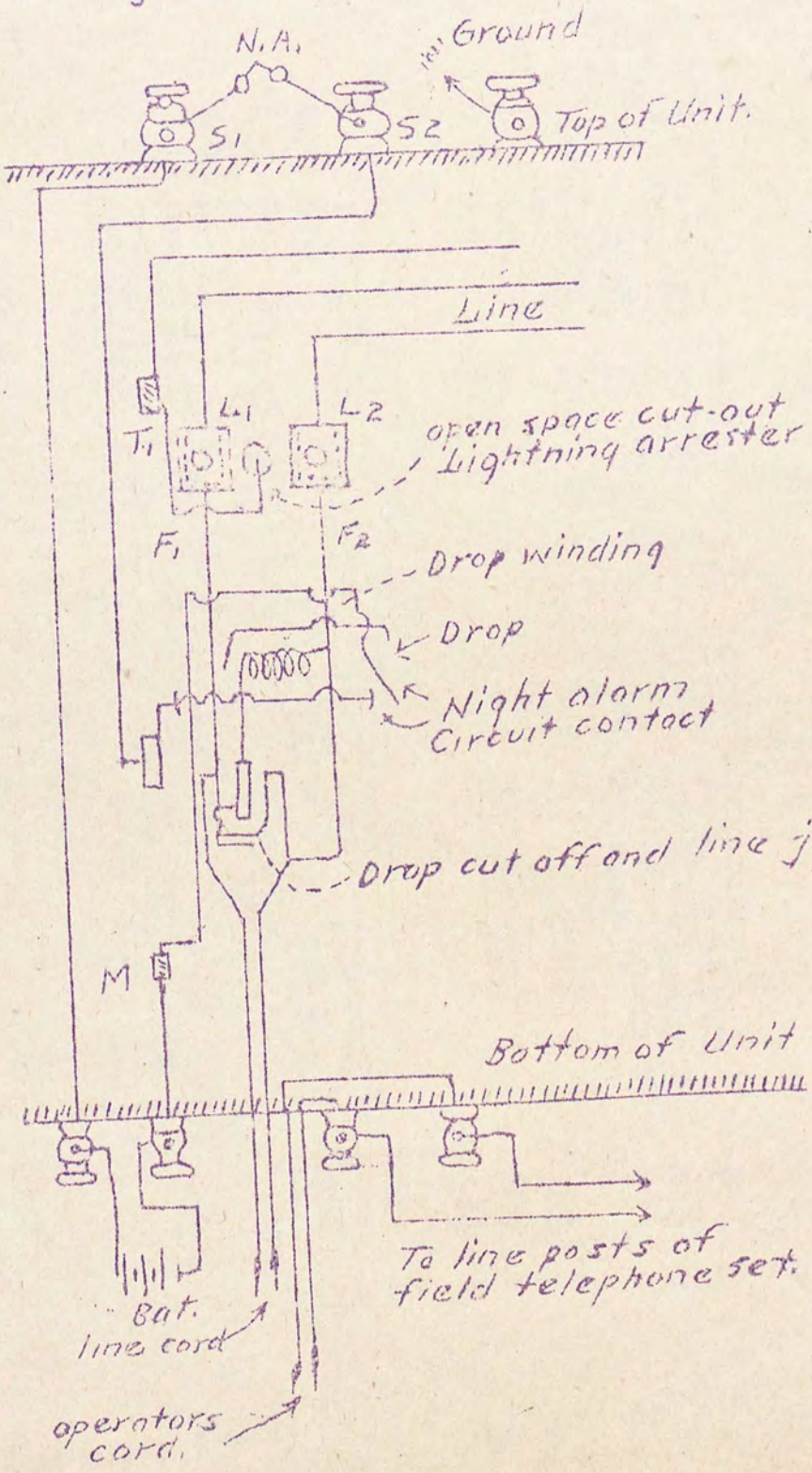
6. The operator should take all possible care of his switchboard and should be particularly careful that it is kept as dry as circumstances will permit. He should not attempt to adjust the drops or to make any adjustments about the board, except to tighten up screws which may work loose and to replace fuses which have burned out. The plugs and jacks should be kept clean, but the cleaning of the jacks should never be done with a metal instrument or with a lead pencil. The operator's telephone should be cared for as carefully as the switchboard, and the operator should keep on hand a reasonable supply of spare batteries and spare fuses, and should know how to obtain additional parts if his supply runs out.

Office of the Chief Signal Officer, A. E. F.,

August, 1917.

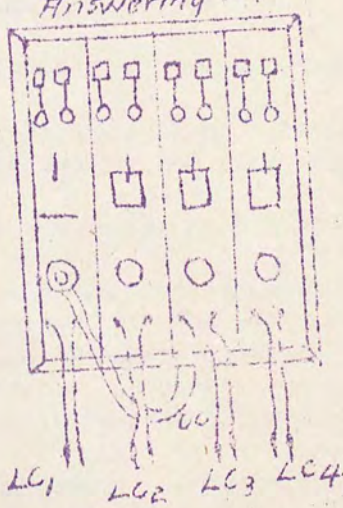
ccb

Night Arlarm Bell.

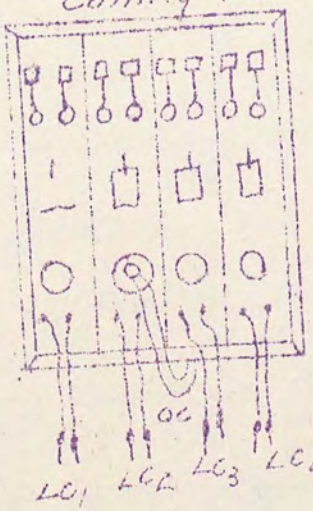


Assuming Line #1 Calling #2. The following proceedure for establishing a call must be followed in all cases.

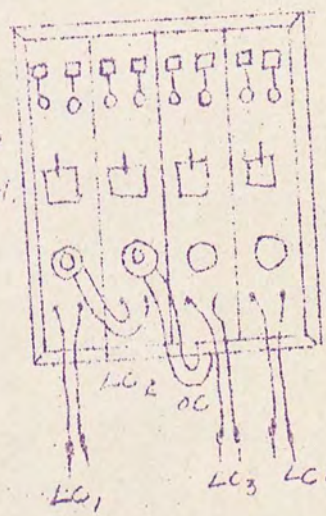
First operation
Answering #1



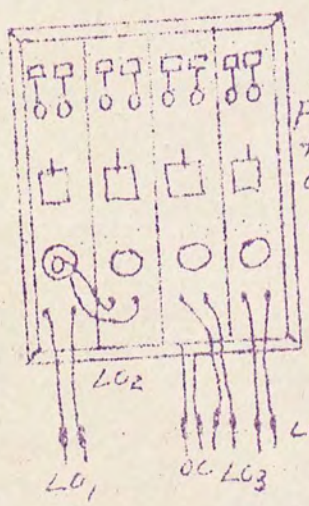
Second operation
Calling #2



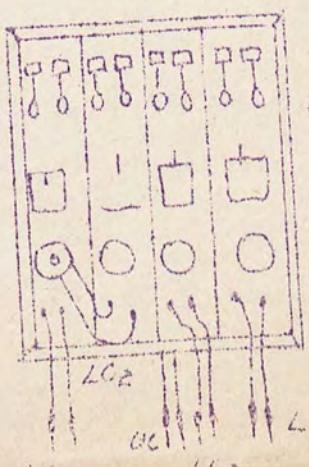
Third operation
Connecting 2 to 1 and supervising to see that conversation is started.



Fourth operation - 1 and 2 connected. Drop restored.



Fifth operation
Parties ringing off



LC = Line Cord
OC - Operators Cord

NOTE ON TYPE "Y" ALTERNATOR AND ITS USE FOR AIRPLANES

DESCRIPTION OF THE ALTERNATOR:

The "Y" alternator is of the Inductive Type.

Its exciter is mounted on the same shaft as the inductor of the alternator and is enclosed in the same frame.

The machine possesses some interesting features.

The alternator and exciter have a common magnetic circuit energized by a single exciting coil. The path of the magnetic flux is through the outer part of the frame, the pole pieces of the exciter, the exciter armature, the shaft common to both the alternator and the exciter, the inductor of the alternator and the alternator armature.

The pole pieces of the exciter are of the same polarity, corresponding opposite poles being framed in the laminated stationary iron of the alternator.

Current is taken off by two brushes bearing on the commutator at an angle of 90°. The terminals of the exciting coil are connected directly to the brushes.

The windings of the alternator armature consists of 24 coils connected in series and fixed in as many slots.

One terminal of the armature winding is grounded to the frame of the machine. The other is connected to control apparatus for the supply of current for T. S. F. heating, Signal lights, etc.

The principal data relating to the machine are:

Normal speed	4500 r.p.m.
Frequency	900 periods
E.M.F. without load	50 volts
Short-Circuit current	7 amperes
Maximum power on a non-inductive resistance	125 watts
Exciting voltage	11.5 volts
Exciting current	1.35 amperes.

Resistance of the armature winding . . . . . 0.9 ohms
Resistance of the armature of the exciter including brushes . . . . . 1.5 ohms
Resistance of the common exciting coil . . . . . 8.5 ohms
Efficiency on full load 55%

The connections of the alternator are shown on diagrams 4, 5 and 6.

Contrary to the arrangement of Type K alternator in which the primary circuit may be adjusted to give 3 working currents, "weak", "medium" and "strong" , type Y alternator works always with full excitation. The adjustment of the power necessary for radio is made on the radio set itself, as explained below.

Diagram 8 shows the relation between volts and amperes at various speeds and various non-inductive loads, the excitation being constant.

Diagram 9 shows no load voltage, short-circuit current of the alternator and the voltage of the exciter as a function of speed. When the alternator is driven from the airplane engine, voltage and current readings interpreted by means of these curves give rotative speeds.

The dimensions of the alternator are as follows:

Diameter . . . . . 115 mm.
Total length . . . . . 383 mm.
Weight of the alternator with its metallic support . . . . . .5020 gr.
Weight of the rotary spark-gap with its fixed electrode for use with driving blade . . . . . 660 gr.
Weight of the wooden driving blade with its hub . . . . . 910 gr.
Weight of the constant speed windmill for Type Y . . . . . 970 gr.
Weight of the cover of the rotary spark-gap and of the pulley (when driven by the motor of the airplane) . . . . . 720 gr.

The hold-down lugs for fixing the machine to the plane have 8 mm. holes drilled in them, their centers forming a rectangle 102 mm. by 90 mm.

The shaft of the machine is parallel to the shorter side of the rectangle.

DRIVING OF THE ALTERNATOR:

The alternator may be driven either by the usual 2 bladed windmill, by a one blade constant speed windmill or by the engine of the airplane , through a belt. These various arrangements may be seen on diagram #3.

Two blade windmill drive:

The alternator is gripped in a steel clamping ring fitted with 4 hold down lugs for securing the apparatus to the special support on the airplane. The clamping ring is similar to that of Type K alternator.

On the shaft of the alternator is a flange keyed in place carrying the toothed disk of the rotary spark-gap and on which is also bolted the hub of the windmill.

The driving blades for Type Y alternator are the same as those of Type K, but the hub is smaller. Type K blades however can be used on Type Y alternator, but a Type K hub should also be used. The blades must be mounted with the concave side in front and the curved side backwards.

The clamp used for supporting the fixed electrode may be employed both for Type K and Type Y alternators.

Constant speed windmill drive:

When the single blade constant speed windmill is used instead of the double blade one, the long key should be replaced by a short one. This key is issued with the windmill.

The windmill is adjusted so as to turn at an approximately constant speed of rotation whatever the speed of the wind, from 100 to 220 kilometers per hour. It should never be taken to pieces.

For further information on this windmill, see: "Note on Type K constant speed wind-mill."

Type Y constant speed windmill is lighter than Type K. The latter can, however, be used on Type Y alternator if necessary.

Engine Drive:

The clamping ring is no longer used; the alternator is supported on an adjustable hanging arrangement which makes it possible to keep the belt tight by means of a spring.

An electrode enclosed in an airtight case, fixed by a clamp to the front part of the alternator is substituted for Type K electrode. The case is to prevent sparks from setting fire to the gasoline. It also contains the disk of the spark gap and the driving sleeve; it can be used both for direct and inductive coupling. The aluminum driving pulley placed in front of the case is 50 mm. in diameter. The leather belt 4 mm. thick and 30 mm. wide has a glued joint.

The manufacturers of various airplanes supply pulleys with disengaging gear as well as spring mounted supports.

The alternator will turn clockwise or counterclockwise according to the direction of rotation of the engine of the airplane on which it is placed. If it turns counterclockwise the leads connecting the exciting coil with the brushes should be interchanged. A small plate between the two brush-holders specifies that the red lead should be connected with the brush-holder placed at the printed end of the arrow showing the direction of totation.

Re-adjustment of the brushes must also be made when the direction of rotation is reversed.

After the cover has been removed, a mark A [redacted] may be seen on the edge of the bearing on the side of the commutator and two other marks B and C on the yoke. The latter two marks are under arrows, the bearing on the commutator side can be turned a little if the four screws which secure it have previously been loosened somewhat. This makes it possible to bring mark A opposite either B or C, according to whether the arrow above B, or that above C, point in the direction of the rotation of the alternator.

CARE OF APPARATUS:

Do not hammer violently on the end of the shaft when windmills are being mounted or removed.

The bearings should not be given too much oil. A drop in each of the two lubricators is sufficient for 10 hours work. The ball bearings are the same model as those of Type K alternator.

See from time to time that the commutator is in good condition. When it is black it should be cleaned with smooth emery cloth and oil and then wiped off with a dry piece of cloth.

USE OF TYPE Y ALTERNATOR:

Diagram 4 shows the general arrangement of electrical apparatus on airplanes with Y alternator.

The latter provides at all times current for the radio set, direct or inductive coupling, through one or another key. When the radio set is not in use, current is available for the operation of the projector, using 7.5 amperes, for heating devices for the pilot and passengers, or for an oil heater.

A 3 way single pole switch is provided for this purpose. It is necessary, however, to reduce the voltage of the alternator and this is done by means of an autotransformer.

RADIO ARRANGEMENT FOR DIRECT COUPLING WITH ROTARY SPARK-GAP:

The radio arrangement only is shown on diagram 5. Two keys are used as shown on diagram 4.

Four ratios of transformation can be obtained with the transformer. One end of the primary is grounded to the frame of the machine; 4 insulated terminals are connected with 4 tapping points of the primary winding. They are marked "fort" (strong), "moyen" (medium), "faible" (weak), "reduit" (reduced). The smallest ratio of transformation obtained, when the whole of the primary is used, is 300.

One end of the secondary winding is connected with an insulated terminal having a safety gap and the other end is in body contact. The adjustment of the safety gap should never be changed. The power used can be decreased by changing the ratio of transformation. When only one part of the primary winding is used, the spark is shorter and the current in the antenna weaker.

The disks used for the rotary spark gap are those of the type K alternator which makes it possible to obtain different spark frequencies. The fixed electrode should be rounded out a half sphere. An average adjustment of this electrode can be obtained, giving a good working with the different disks for various currents. The "fort" adjustment cannot be used with the 6 and 8 disks, as sparking would be produced between the electrodes of the safety-gap.

The K2 direct transformer or the U direct transformer is also 300, can be used instead of Type Y transformer. A resistance may be shunted on the primary of the transformer to reduce the power used. This resistance is 13.5 ohms for "moyen", 5.5 ohms for "faible" and 2.5 ohms for "reduit". A rheostat is furnished for that purpose with the Type U alternator.

For obtaining long wave lengths, a special inductance may be connected in the antenna, instead of unwinding more than 80 meters of antenna wire.

This inductance is composed of flat coils wound on ebonite and embedded in solid insulating material. It is fitted with 3 terminals which make it possible to obtain 16.5, 45 and 75 microhenrys. For the use of this coil see "Note on the use of inductances for increasing the wave-lengths of airplane radio sets."

Weight of transformer	3 k.	650
Weight of the inductance	1 .	110

INDUCTIVE COUPLING

The diagram of the radio set is shown on Fig. 6.

A special diagram containing 2 keys and the heating and projector circuits is shown on Fig. 4.

The current is provided to the oscillatory circuit by an independent transformer. One end of the primary and one end of the secondary of this transformer are connected to the counterpoise. The ratio of transformation is 85.

With the oscillatory circuit (Fig. 6) 6 wave-lengths may be realized: 295 - 320 - 350 - 380 - 410 - 440 meters. The capacity of the mica- condenser is 35-10-4 microfarad. A plug is used to mark variations of the inductance which gives the various wave-lengths.

The primary coil acts inductively on the antenna coil. The coupling of these coils and therefore the current in the antenna may be modified by turning the primary coil opposite the secondary coil.

The current in the antenna is a maximum when the 2 coils are parallel, and it is zero when they are perpendicular to each other.

The secondary coil is both the secondary of the Tesla transformer and the inductance of the antenna. The value may be modified by changing the position of the plug. The two primary and secondary spindles should always be in the holes marked with the same numbers. For those conditions in the inductance added by the secondary should as a rule tune to the primary on 80 meters long antenna. As the set has no antenna variometer, more or less wire should be unwound to complete the tuning.

There is no fixed spark gap in the oscillatory circuit. This circuit is connected with the rotary spark gap by a special conductor, 1.5 meters long, similar to that used with K 6 oscillatory circuit. The condenser is fitted with a safety-gap the adjustment of which should not be changed.

When the set is inductively coupled, the fixed electrode of the rotary spark-gap should not be the same as that used for the direct coupling. A trapezoid fixed electrode should be used instead of the round one (see drawing).

Weight of the oscillatory circuit Y6: - 4.^{k} 400
Principal dimensions: 250 x 123,
Height: 275 m/m
Weight of the transformer: 1.900 kilo.

INTERCHANGEABILITY OF THE RADIO APPARATUS.

As a rule, a radio set should be used as it is issued, i.e., with its own transformer and oscillatory circuit.

However, if it is necessary, the various parts of the K, Y and U sets may be interchanged provided some precaution be taken.

The direct transformer K2 or the U transformer can be used with type Y generator as has previously been said.

A 2-millihenrys self induction coil should be shunted on the primary of the transformer when the current is provided to the K6 oscillatory circuit by that generator.

The K generator can be worked with Type Y and Type U direct transformers.

When Type K generator is used to supply current to the Y6 oscillatory circuit, the "fort" excitation should be used and a 0.3 millihenrys inductance should be connected in series with the primary of the transformer.

The direct transformers K and Y can be fed by the U generator.

When the K6 oscillatory circuit is used with the U generator a 1.2 millihenrys inductance should be shunted on the primary of the transformer.

If the Y6 oscillatory circuit is used with the U generator, a 2.2 millihenrys inductance should be shunted on the primary of the transformer.

These inductances are intended for producing a primary resonance when the speed of the generator is 7% lower than the normal speed. It is the best way for obtaining in practice a good working of the rotary spark gap. When the inductance is connected in series with the transformer, the resonance speed is decreased; on the contrary it is increased when the inductance is shunted.

The following table indicates the values of the inductance obtained with a laminated core, 20 m/m x 20 m/m x 60 m/m, about which a 1.2 carbon covered copper wire is wound:

3	millihenrys	with	175	turns
2.5	"	"	163	"
2	"	"	146	"
1.5	"	"	126	"
1	"	"	110	"
0.5	"	"	84	"
0.2	"	"	60	"

These inductances may be obtained from the Etablissement Central du Materiel de la Radiotelegraphie Militaire.

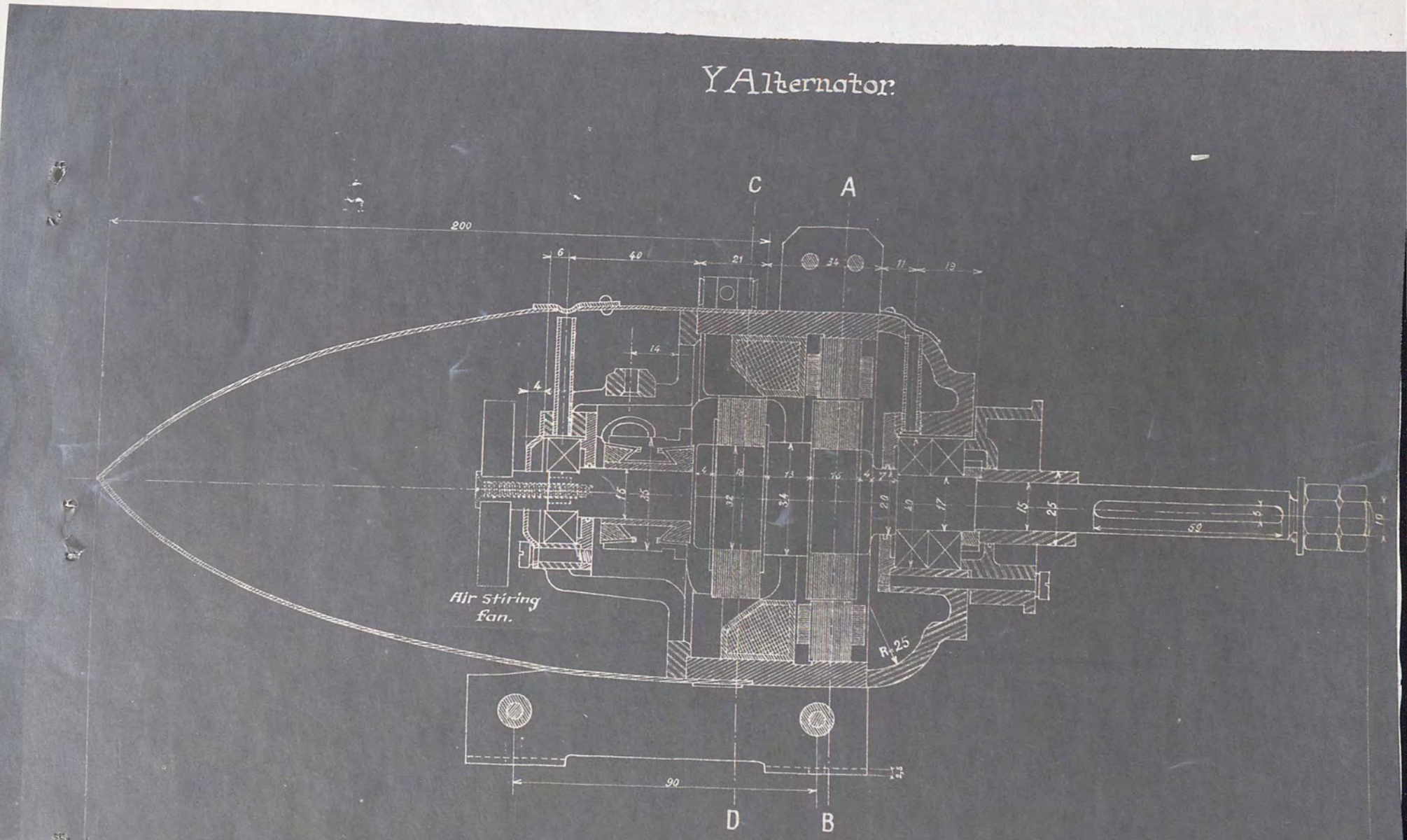
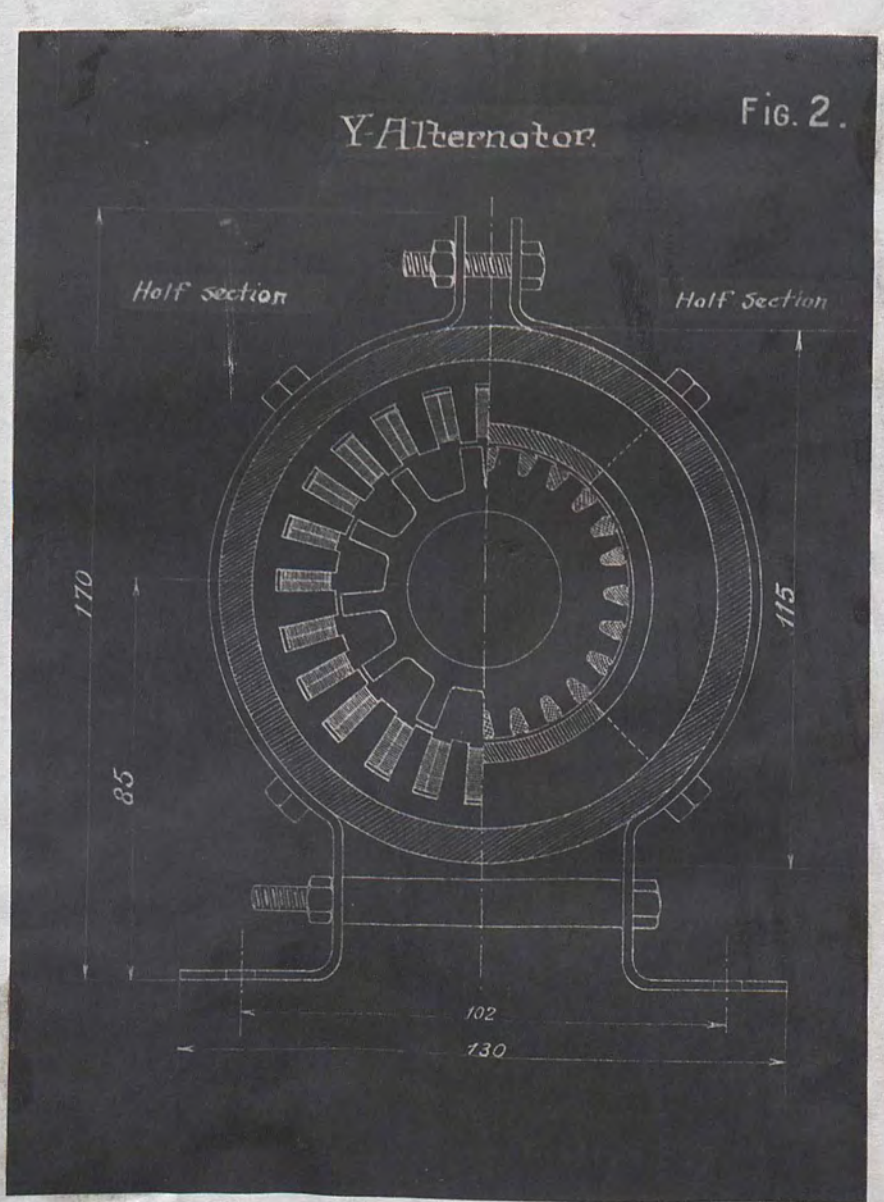

Y Alternator
C
A
D
B
200
6
40
21
34
11
13
14
4
Air Stiring
fan.
R=25
90
383

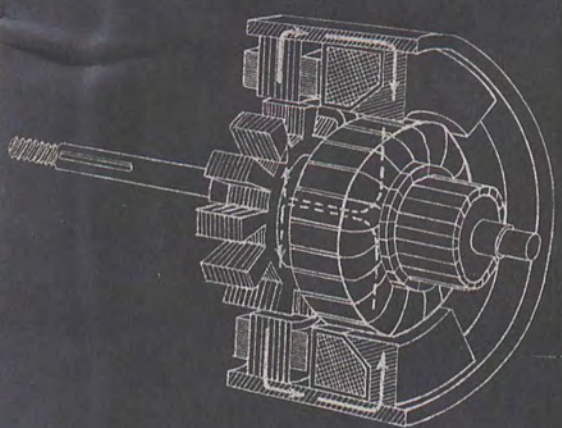
Fig. 1.

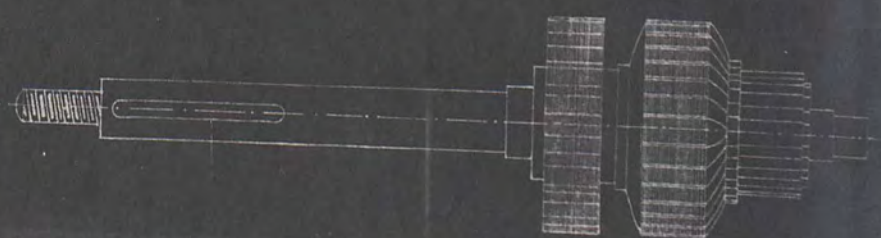

Y-Alternator.
Fig. 2.
Half section
Half Section
170
85
115
102
130

Y Alternator.

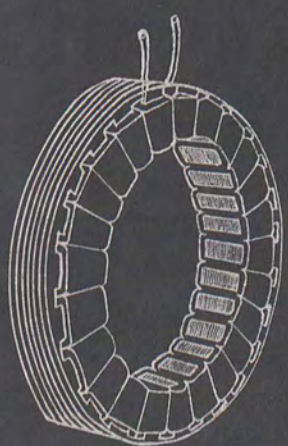
Fig. 2 bis

Section of the magetic circuit.



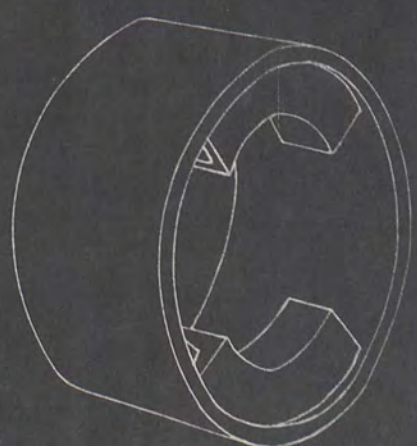


Alternator's shaft and rotating parts.



Alternator's armature.

Exciting coil



Dynamo's yoke and pole pieces.

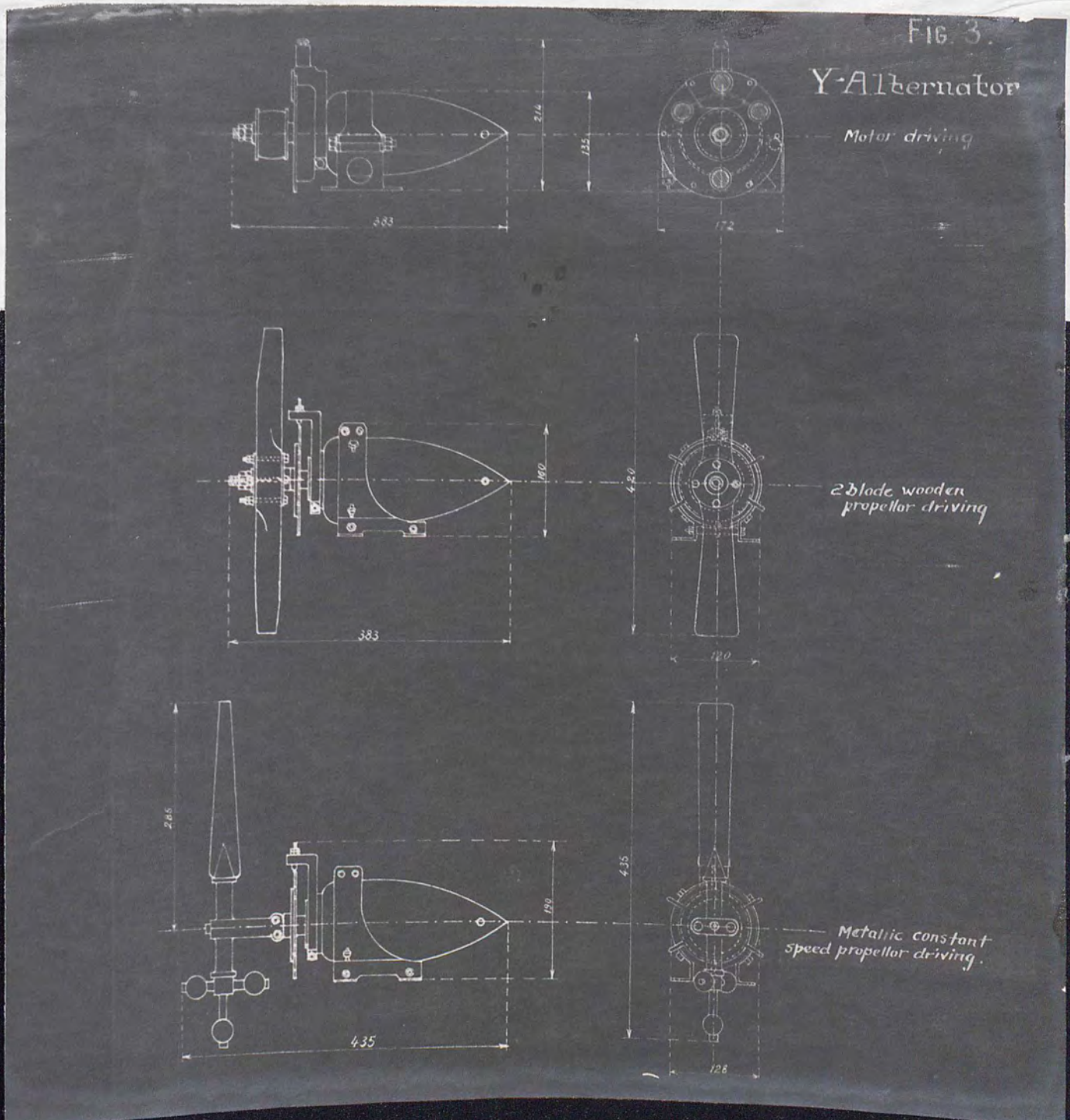
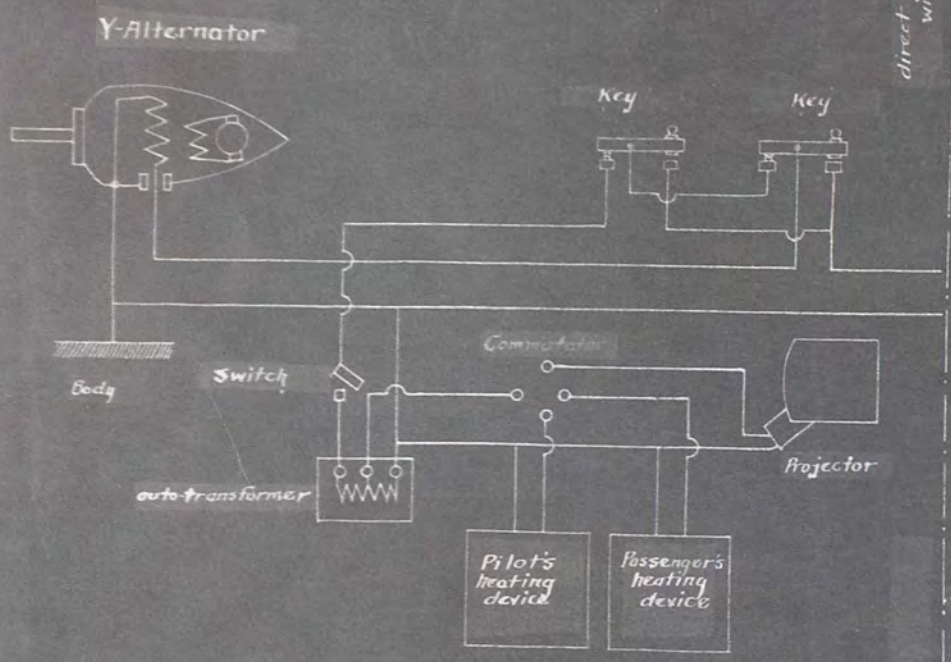


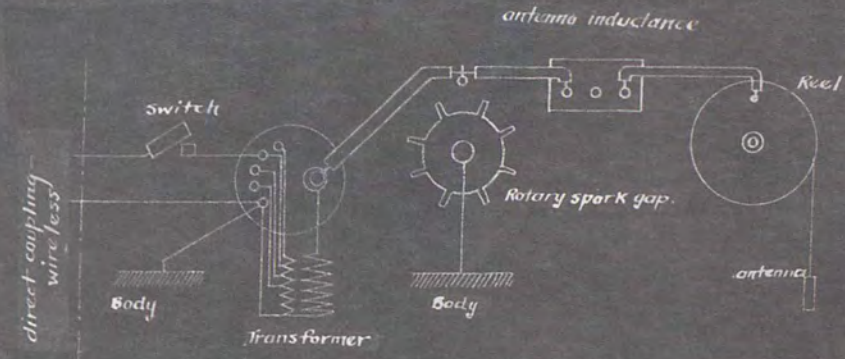
FIG. 3.
Y-Alternator
Motor driving
214
135
383
172
2 blade wooden propellor driving
180
420
383
120
285
190
435
435
Metallic constant speed propellor driving.
128

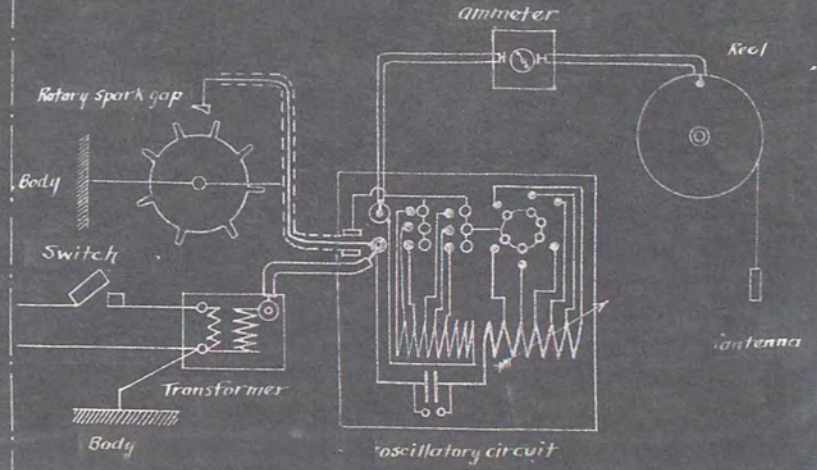
Fig. 4.

Airplanes equipment with Y Generator.

Fitting of the projectors, heating device and of the wireless on either direct or inductive coupling.







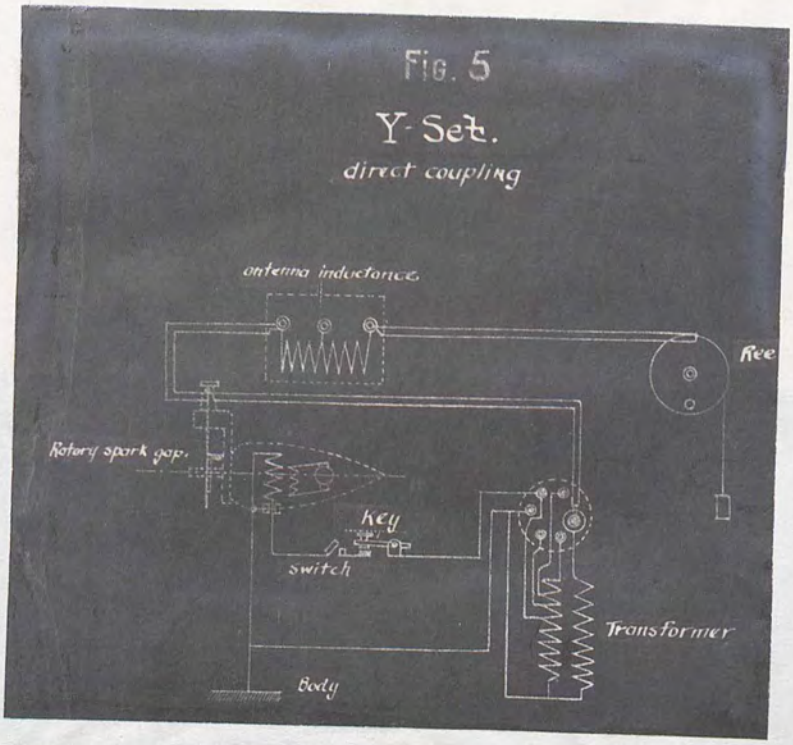


Fig. 5
Y-Set.
direct coupling
antenna inductance
Ree
Rotary spark gap.
Key
switch
Transformer
Body

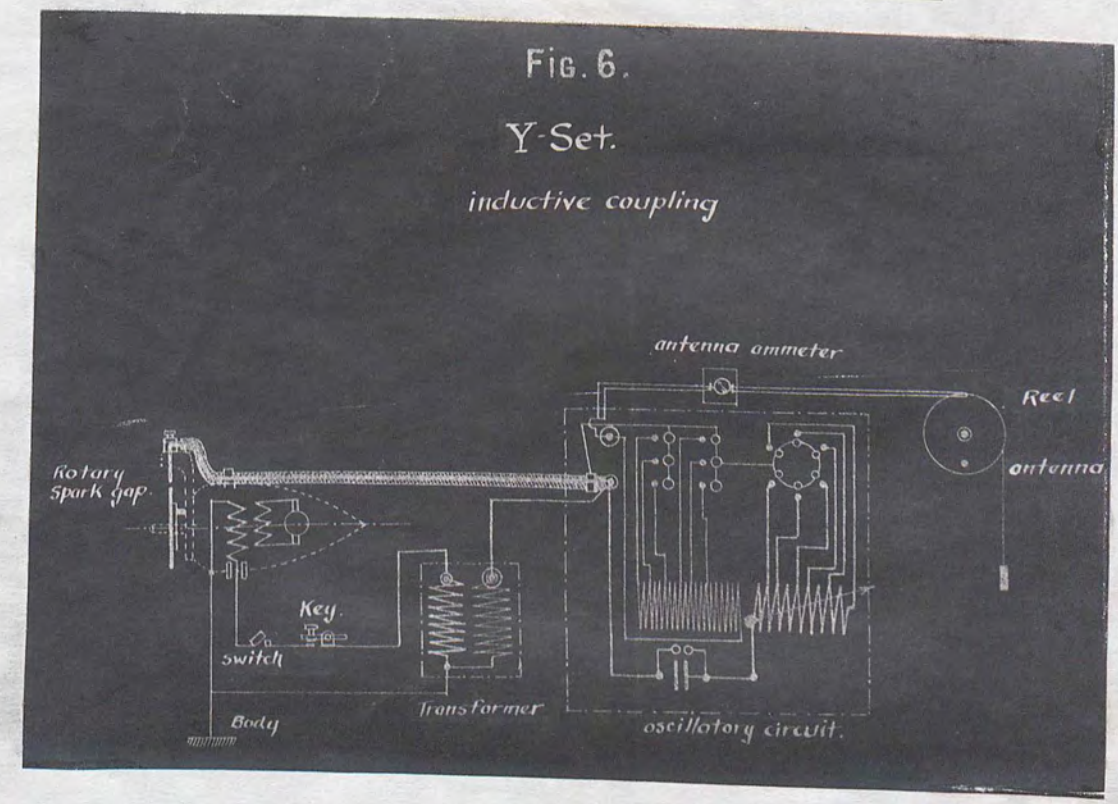


Fig. 6.
Y-Set.
inductive coupling
antenna ammeter
Reel
antenna
Rotary
Spark gap.
Key.
switch
Body
Transformer
oscillatory circuit.

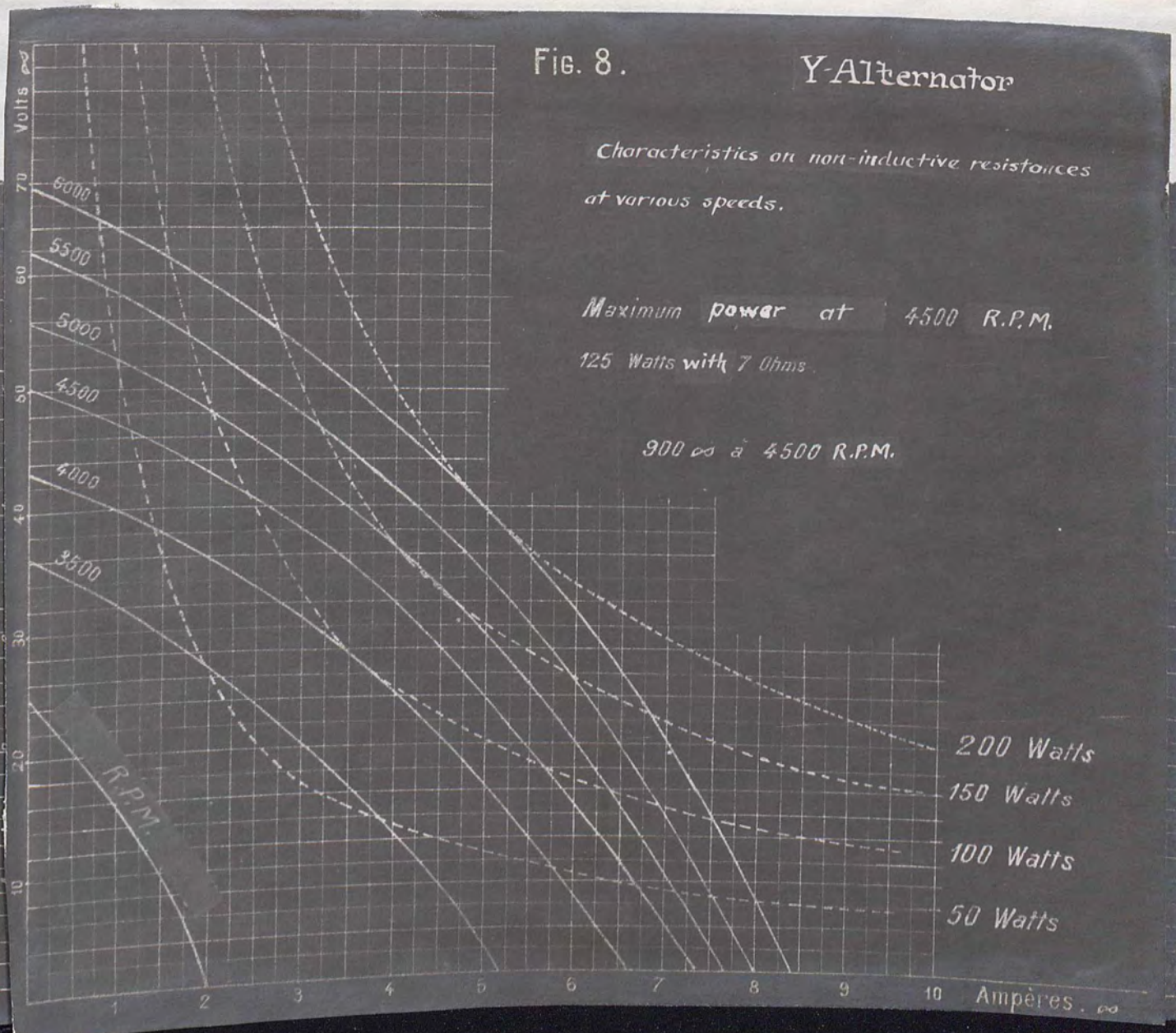
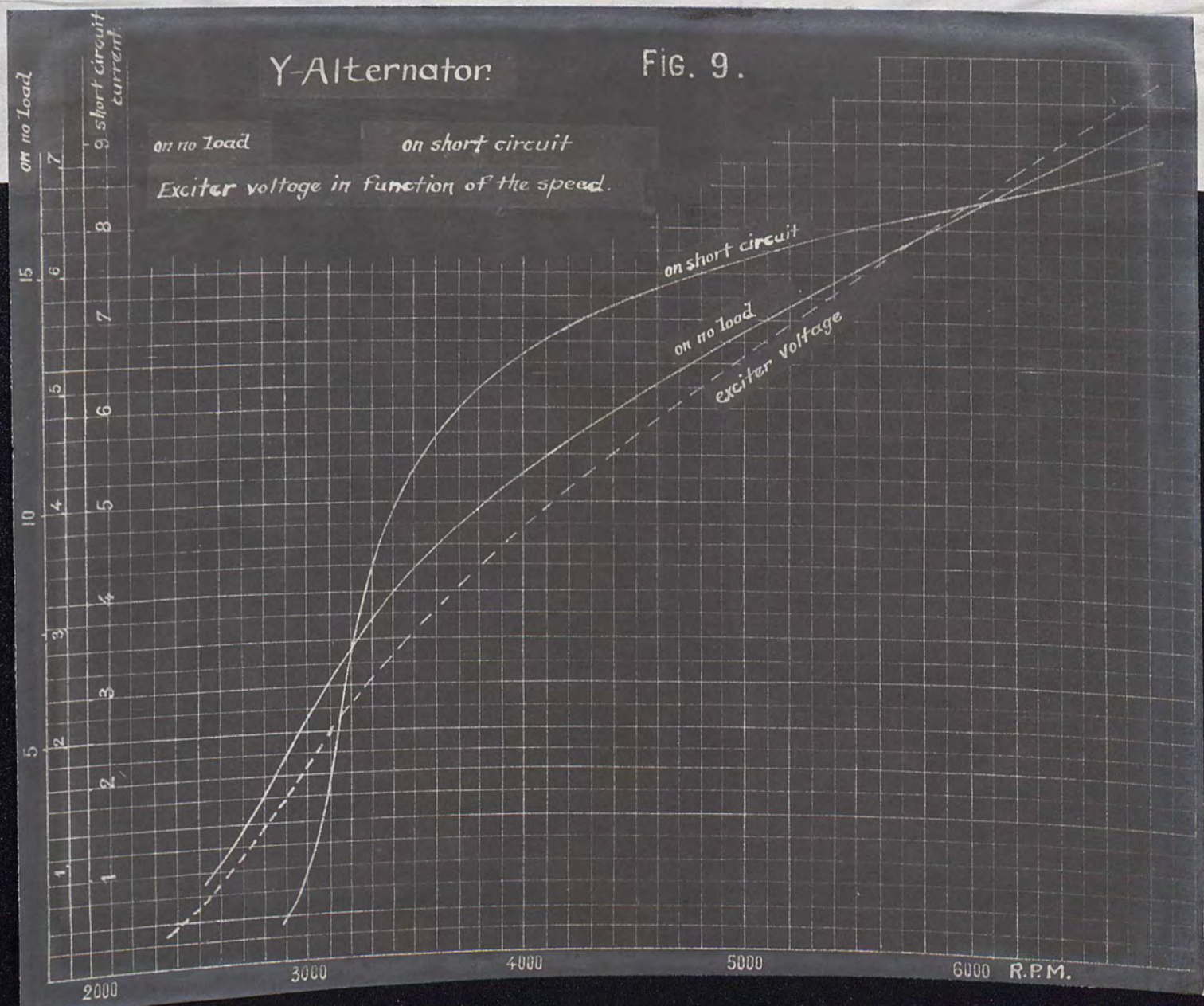


Fig. 8.
Y-Alternator
Characteristics on non-inductive resistances at various speeds.
Maximum power at 4500 R.P.M.
125 Watts with 7 Ohms.
900 ∞ à 4500 R.P.M.
Volts
6000
5500
5000
4500
4000
3500
R.P.M.
200 Watts
150 Watts
100 Watts
50 Watts
1 2 3 4 5 6 7 8 9 10 Ampères. ∞


Y-Alternator
Fig. 9.
on no load
on short circuit
Exciter voltage in function of the speed.
on short circuit
on no load
exciter voltage
on no Load
short circuit current
2000
3000
4000
5000
6000
R.P.M.