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Notified in A.C.Is. for the week ending 18*th October*, 1939

26
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167

SIGNAL TRAINING

VOLUME III

Pamphlet No. 23

TELEPHONE SETS, F, MARKS I AND I*

1939

By Command of the Army Council,

THE WAR OFFICE,
18*th October*, 1939

LONDON
Printed under the Authority of HIS MAJESTY'S STATIONERY OFFICE
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TELEPHONE SETS, F, MARKS I AND I*

1939

1. General description

1. *Purpose and facilities.*—The Telephone Set, F, Mk. I (*see* Plates I and II), is a portable instrument for army communication. It is not normally used forward of divisional headquarters.

It provides the following facilities :—

i. Calls by buzzer.
ii. Calls by magneto generator.
iii. Responds by bell to magneto generator calling.
iv. Responds by aural indication to buzzer calling.
v. Speech communication.

The telephone will give visual indication of a call to Switchboards U.C. by magneto generator and buzzer, and to Switchboards F and F by magneto generator.

Visual indication of a call to Switchboards Central Battery Signalling (C.B.S.) is given by removal of the handset from the cradle.

The Telephone Set, F, Mk. I*, is similar to the Telephone Set, F, Mk. I, except for small constructional differences. Details given in this pamphlet of the Telephone Set, F, Mk. I, apply to the Telephone Set, F, Mk. I*, except where otherwise stated.

2. *Weight and dimensions.*—Table I gives the approximate overall weight and dimensions of the Telephone Set, F, Mk. I.

TABLE I.—WEIGHT AND DIMENSIONS

Weight complete (1)	Length (2)	Width (3)	Depth (4)
17 lb. 4 oz.	12 ins.	7 ins.	8 ins.

3. *Range of working.*—Reliable speech cannot be obtained through more than 14 to 16 miles of D8 twisted cable or 8 to 10 miles of D3 twisted cable. This corresponds to an attenuation at 800 c/s of approximately 30 to 40 db.

These distances refer to cable in good condition having a minimum number of well-made and well-insulated joints. The use of deteriorated cable, or cable with indifferent joints, may easily reduce these ranges by as much as 50 per cent.

Wet cable and cable laid on the ground, even in good condition, will always give shorter ranges than dry cable or cable supported off the ground.

A single line and earth circuit may give better or worse ranges than a twin line. In general the earth circuit tends to give better and better results relative to the twin line as the distance increases. The effect of bad earths, such as small earth pins in dry sandy soil, may be of the same order as an increase of 10 or 15 miles in the length of the line.

4. *Constructional details.*—The Telephone Set, F, Mk. I, is housed in a metal case which in turn slides into a wooden carrying case provided with a sling (Plate I). A spring stop, which holds the unit in position in the carrying case, is pressed down for the unit to be drawn forward into the operating position. A second stop prevents the unit from sliding completely out of the case. When in the operating position, the outer case gives reasonable protection to the instrument when working in bad weather.

The general lay-out of the instrument is shown in Plates III and IV.

The batteries and the buzzer may be removed from the instrument by first withdrawing it completely from its carrying case, removing the handset from the cradle and unscrewing the two captive screws (*see* Plate II) beside each bell gong. When the lid of the instrument is lifted the batteries will be found at the left-hand side. The lid of the battery compartment, which contains two " S " or " X " type dry cells, is lined with paxolin sheet in order to prevent any possibility of short-circuits.

The two bell gongs are located on top of the instrument, the hammer of the bell mechanism projecting through an opening in the lid between the gongs.

The buzzer, the magneto generator with its associated line connecting switch and gearing, the bell mechanism proper, the condensers, switches, etc., are all contained inside the metal case.

The buzzer slides downwards into a compartment on the right-hand side, the connections being made on the left-hand side of the buzzer by contact springs. The adjustment of the buzzer can only be carried out with the lid of the instrument open.

2. Technical description

1. *The circuit.*—The complete circuit diagram of the instrument, Fig. 1, and the subsidiary diagrams, Figs. 2, 3 and 4, show the essential arrangements of the circuit in the process of calling, receiving calls, and speech communication. Reference to the subsidiary diagrams renders the study of the circuit easier, since the switching processes are eliminated.

i. The buzzer performs three particular functions :—

(*a*) It operates as an A.C. generator in the form of a step-up transformer with " interrupted " primary winding for calling.

(*b*) The secondary winding operates as the two arms of an A.C. bridge network for the suppression of side-tone as described later.

(*c*) The windings (primary and secondary) form a microphone transformer.

ii. In following the circuit it will be convenient to consider the various conditions of use of the instrument, viz. :—

(*a*) *Magneto generator calling.*—When calling by magneto generator (Fig. 1), the process of turning the handle operates a switch (Plate IV) which connects the magneto generator across the line and also disconnects the remainder of the telephone circuit.

(*b*) *Buzzer calling.*—When calling by buzzer (Figs. 1 and 2), pressing the push-button buzzer switch (Plates II and III) disconnects the handset and energizes the buzzer by completing the battery circuit through its primary windings. At the same time a separate pair of contacts on the push-button switch close, and short-circuit the balancing network (R_1, C_4), so that the maximum output is applied to the line. The 0·1 μF blocking condenser C_1 (Plate III) (to 17 c/s ringing frequency) is also shorted out by this switch. The bridging coil (Plate IV) remains across the line as its shunting effect is small at 350 c/s.

(*c*) *Central battery signalling.*—As soon as the handset is removed from the cradle, the cradle switch automatically connects the bridging coil (Fig. 1 and Plate IV) across the line terminals, thereby completing the C.B.S. circuit and operating the indicators at the exchange.

(*d*) *Receiving magneto generator or buzzer calls.*—For magneto generator and buzzer calls it will be seen that the magneto bell (Figs. 1 and 3) is connected in series with a 2 μF condenser C_2 (Plate III), and these are connected across the line, when the handset is resting on the cradle, the cradle switch completing the circuit. The 2 μF condenser prevents the lines being joined by a D.C. path through the bell. This

condenser is included because the D.C. path should only be completed for the Central Battery Signalling operation when the handset is off the cradle. The condenser offers only a negligible impedance to the 17 c/s ringing current, so that this circuit impedance is low compared with the rest of the network, the 0·1 μF condenser C_1 (Plate III) offering a high impedance in the shunt circuit at this frequency.

At buzzer frequencies (about 350 c/s), however, the impedance of the bell is high and that of the 0·1 μF condenser is relatively low ; hence the shunting effect of the bell is small and the usual calling buzz is heard in the receiver. The shunt effect of the rest of the network is small at these frequencies.

(*e*) *Communication* (*see* Plate III).—The basic circuit for conversation (not calling or being called) may be seen in Fig. 4. The function of the anti-sidetone * circuit is clearly seen by reference to the right-hand section of Fig. 4, which shows it in the form of an A.C. Wheatstone bridge. The arms of the bridge are formed by the two secondary windings of the buzzer on one side and on the other by the bridging coil and line, and the balancing network comprising the 400 ohms resistance R_1 and the 0·5 μF condenser C_4, the 0·1 μF condenser C_1 (Fig. 1) being short-circuited when the handset is off the cradle.

It will be noticed that the receiver is connected in series with a 2 μF condenser C_3 in order to prevent D.C. current passing through it. The value of the condenser is large enough to pass to the receiver all normal speech frequency currents.

When the handset is off the cradle the battery contacts on the cradle switch are made, the microphone circuit being completed through the buzzer calling key and the appropriate primary windings of the buzzer. Speech into the microphone then induces voltages into the secondary windings of the buzzer and thence to the line. The step-up transformation ratio of the buzzer, used in this way, is about $3\frac{1}{2}$: 1.

* NOTE.—By sidetone is meant the property of a telephone instrument whereby the operator hears his own voice in the earpiece when he speaks into the microphone. While this property shows the operator that his microphone is working properly, the suppression of side-tone to a low value has the following advantages :—

i. In noisy surroundings the unwanted noise reaching the operator's microphone does not materially affect his receiver and consequently does not interfere with the reception of incoming signals.

ii. The low value of side-tone tends to make the operator speak more loudly and clearly than he would if side-tone were loud.

A condition of balance obtains (*see* Fig. 4) when there is no voltage across the receiver and is set up when :—

$$S_1 : S_2 : : Z_L : Z_B ;$$

where S_1 and S_2=the impedances of the secondary windings of the buzzer.

Z_L=the impedance of the line at the line terminals with the line connected.

Z_B=the impedance of the balancing network C_4 and R_1.

The value of Z_B is chosen to represent an average line impedance met with in normal usage.

Speech voltages set up in the secondary do not disturb the degree of balance of the bridge and consequently the side-tone heard in the earpiece is maintained at a level determined by the out of balance of the bridge. For average lines the out of balance gives a suitable amount of side-tone.

The bridging coil remains across the line as its shunting effect is small at speech frequencies.

2. *The buzzer* (Buzzers, T, Mk. I).—The general principles of buzzers used in Army telephone and telegraph apparatus are described in Signal Training, Vol. II, Part III, 1936, Sec. 14. The particular electrical and constructional features of the Buzzer T, Mk. I (Plate VI and Fig. 1), which contribute to the efficiency of the instrument are as follows :—

i. Three primary windings to give a suitable turns ratio of primary to secondary when the instrument is being used as a telephone transformer.
ii. The secondary winding is centre tapped to enable an A.C. bridge circuit to be used for side-tone suppression.
iii. High permeability iron is used for the yokes, pole pieces, armature, etc.
iv. Polarizing magnets of high coercivity are used which are little affected by shocks.
v. The main A.C. magnetic circuit does not pass through any part of the permanent magnets.
vi. Totally enclosed construction.
vii. The metals employed for the magnetic circuits are virtually non-corroding.
viii. Ease of adjustment and stability of the adjustments when made.
ix. The ability to withdraw the buzzer complete from the telephone without disturbing any connections.

Plate VII shows the Buzzer T, Mk. I, partially dismantled. The iron-circuit of the buzzer consists of a yoke carrying two pole-pieces for the bobbins, two flat polarizing magnets

forming side-pieces, and an armature carrying plate. The magnets are 15 per cent. cobalt steel of high coercivity, and the remainder of a special high permeability iron known as " Radiometal ". The armature, also of " Radiometal ", is attached to the armature carrying plate by a flat transverse spring about which it oscillates, the natural period of oscillation being about 350 c/s.

The contacts at each end of the armature are of platinum and are carried on small flat steel springs screwed to the armature. To the top of the armature carrying plate is screwed a moulding which carries the split bushes of brass for the fine thread contact screws. The locking knobs and the split bushes form collets which effectively lock the contact screws without altering their adjustment.

The various terminations of the primary and secondary windings are brought out from the bobbins to contact strips on the back plate of the buzzer. This back plate and the front cover plate are made of bakelized cambric.

Figures of electrical performance of a typical buzzer are as follows :—

Consumption	160 milliamperes at 3 volts.
Power output	270 to 300 milliwatts.
Voltage output ..	16·5 volts across 1,000 ohms.

3. *The magneto generator* (Generators B).—The magneto generator (Plate III) is of the usual post office design.

A full description of this type of instrument is given in Signal Training, Vol. II, Part III, 1936, Sec. 15, paras. 1 and 2.

NOTE.—It will be seen that in the Telephone Sets, F, Mk. I, the magneto generator and bell are connected in a *shunt* type of circuit and the description given in " Signal Training " deals with circuits which are of the *series* type.

4. *The magneto bell.*—The magneto bell is of usual design. The two bobbins of the bell of 500 ohms each are connected in series. The gongs are mounted on the lid of the instrument (Plate II) on either side of the hammer (Plate IV), which projects through a hole in the lid of the instrument when it is closed.

The gongs are mounted eccentrically and are thus adjustable.

For complete description and operation of this type of bell, *see* Signal Training, Vol. II, Part III, 1936, Sec. 15.

5. *The handset* (*see* Plate V).—The handset (Telephones, Hand, No. 1, or Telephones, Hand, No. 3) is a moulding and uses the Receiver inset, No. 1L, and the Microphone capsule, Mk. IV.

Telephones, Hand, No. 1, is used with Telephone Sets, F,

Mk. I, and Telephones, Hand, No. 3, is used with Telephone Sets, F, Mk. I*.

3. Working instructions

1. *Preliminary*

i. Unfasten the two catches of the carrying case and fold back the lid.

ii. Depress the retaining spring in the outer case immediately below the generator handle and keeping it depressed withdraw the instrument from the carrying case.

iii. Remove the handset from the cradle.

iv. Unscrew the two captive screws in front of each gong.

v. Hinge back the lid on which is mounted the gongs and cradle switch button.

vi. Examine the battery and see that two Cells, Dry, X, or two Cells, Inert, S (activated), in good condition, are in place. They should be connected in series and the red and black out-going leads connected to the positive and negative terminals, respectively (*see* diagram on lid). The buzzer will not function properly if these leads are reversed.

Take care that the terminals are clean and that good contacts are made.

vii. See that the buzzer is correctly adjusted (*see* para. 3, Adjustments, below).

viii. Close the lid and replace the captive screws.

ix. Replace the handset on the cradle and push the instrument back in the case as far as the first catch ; this is the normal working position.

x. Plug the 4-point connector of the handset into the appropriate socket.

xi. Connect a twin line, if used, to the terminals L_1 and L_2. If a single line is used, connect to L_1 and after pressing an earth pin into the ground (or other earth connection) connect it to the terminal L_2 by a short length of cable.

2. *Operating the telephone*

i. *To call up*

(*a*) When working to a magneto generator exchange turn the magneto generator handle, then remove the handset and listen.

(*b*) When working to a buzzer exchange press the switch button marked " PRESS FOR BUZZER CALL ", remove the handset and listen.

(*c*) When working to a central battery signalling exchange remove the handset from the cradle and listen.

(*d*) Speak into the handset microphone.

(*e*) When the conversation is finished, the handset must be replaced, and if working to a magneto generator or buzzer exchange, repeat the " call up " signal to " ring off ", turning the magneto generator handle or pressing the push button buzzer switch according to the type of exchange.

NOTE.—The handset must be replaced on the cradle immediately after use.

ii. *Side-tone.*—Side-tone (sound of your voice in the receiver) will normally just be heard if the set is operating properly. With certain types of line, however, side-tone may be inaudible. In such cases prove the instrument by disconnecting one line and listen for side-tone, which should then be clearly audible.

iii. *Calls.*—It should be noted that a call from an exchange equipped with :—

(*a*) A magneto generator will be audible from the magneto bell.

(*b*) A buzzer by a loud buzzing in the receiver of the handset.

NOTE.—No magneto generator calling signal can be received unless the handset is on its cradle.

3. *Adjustments*

i. *To adjust the buzzer*

(*a*) Loosen the collars marked " LOCK " by unscrewing them.

(*b*) Screw out the contact screws a few turns.

(*c*) Press the push button switch marked " PRESS FOR BUZZER CALL ".

(*d*) Keeping the push button switch depressed, screw in the rear adjusting knob until a buzz is heard and adjust until the loudest note is obtained irrespective of quality.

(*e*) Lock the knob.

(*f*) Adjust the front contact knob until a clear and fairly high note is obtained.

(*g*) Lock the knob.

(*h*) Check the adjustments by operating the push button switch and re-adjust if necessary.

NOTE.—Neither the maximum output nor the maximum efficiency is obtained from the buzzer

when adjusted for the highest note. The best quality of the note and permanence of adjustment are achieved when the pitch is a little below the highest obtainable. When adjusting the buzzer contacts care must be exercised not to force the contact screws hard on to the armature contacts or the platinum contacts will be damaged and the buzzer put out of action.

ii. *To adjust the magneto bell.*—Before attempting to make any adjustments to the bell mechanism proper, the gongs on the lid should be examined to ensure that they are not too close together or too far apart. To check this connect the instrument to another instrument provided with a magneto generator or connect up the existing magneto generator to the bell as described in these working instructions under para. 4 (Tests), ii (Magneto generator), sub-para. (*b*), below. The handle of the magneto generator may now be rotated and the bell should ring. If the ringing is weak, loosen the screws holding the gongs in position and rotate the gongs, which are mounted eccentrically, until a position is found which gives the desired results.

To adjust the bell mechanism proceed as follows :—

(*a*) Carry out the operations in para. 1 (Preliminary), sub-paras. i, ii, iii, iv and v, above.

(*b*) Slack off the grub screw which retains the bar magnet in the slotted bar. Move the bar magnet out a little to give a greater throw to the armature or move it in to give less throw as required. This adjustment will alter the degree of movement of the hammer between the gongs.

(*c*) Lock the magnet in the desired position.

4 *Tests*

i. *Buzzer*

(*a*) On pressing the push button switch marked " PRESS FOR BUZZER CALL ", the buzzer should be audible and at the same time a weak buzzing should be heard in the receiver of the handset. A slight shock may be felt if the line terminals are touched with the finger and thumb of one hand while the buzzer is in operation.

(*b*) Remove the handset plug from the jack and with two short lengths of wire connect the two centre pins on the four-pin handset plug to the terminals L_1 and L_2. Press the button switch marked "PRESS FOR BUZZER CALL", and if a loud and clear buzz is heard in the handset it may be assumed that the buzzer is working correctly.

ii. *Magneto generator.*—The magneto generator and its associated switch may be tested by either of the following methods :—

(*a*) By connecting the instrument by means of the terminals L_1 and L_2 to another telephone instrument having a magneto bell. The bell of the additional apparatus should of course ring when the magneto generator handle of the Telephone Set, F, Mk. I, is turned.

(*b*) Open up the instrument as in para. 1 (Preliminary), sub-paras. i, ii, iii, iv and v, above. Then connect a short length of flexible lead to the terminal L_1, and to either of the tags of the 2 μF condenser, i.e. the centre condenser in the condenser bank which is close to the battery compartment. This condenser can be easily identified by means of its brown connecting leads. Close the lid of the instrument and turn the magneto generator handle, when the bell should ring.

(*c*) A slight shock may be felt if L_1 and L_2 are held while the magneto generator handle is turned.

iii. *Receiver.*—A definite click should be heard in the receiver when the buzzer push button switch marked "PRESS FOR BUZZER CALL" is pressed or released. When the buzzer is working, a weak buzzing sound should be heard in the receiver of the handset. A definite click should also be heard in the receiver when the cradle switch is pressed or released.

iv. *Microphone.*—With the line terminals either short-circuited or on open circuit, blow steadily into the microphone and a breathing sound should be heard in the earphone. Pressing the cradle switch should immediately cut off the sound.

v. *Magneto bell.*—The magneto bell can be tested by connecting the telephone set to another instrument fitted with a magneto generator, the magneto generator causing the bell to ring when the handle is turned.

The magneto bell may also be tested by connecting it to the magneto generator in the instrument as in sub-para. ii (*b*), above.

4. Maintenance and repair

1. *General.*—The apparatus should be kept clean and dry. Any parts which are secured by screws and which require replacement can be removed if spares can be obtained, but riveted parts will have to be repaired by Ordnance Workshops.

2. *Battery compartment.*—It is essential that the battery compartment be kept thoroughly clean and any corrosion should be removed from the batteries. This is of importance, since, if battery corrosion continues for any length of time, some difficulty may be experienced in removing the old batteries for replacement purposes.

NOTE.—See that the nuts holding the tags on the two 4 BA terminal studs are tight.

3. *Buzzer.*—Buzzer failure should be overcome by replacement by another buzzer, if possible, before any attempt is made at repairs.

Small parts of the buzzer which are attached by screws (not riveted), such as the bakelized cover plate, adjusting and locking knobs, armature springs, etc., may be replaced if necessary.

Any coil replacements will have to be carried out by Ordnance Workshops.

The contacts of the buzzer, if they have become pitted or dirty, may be cleaned with a contact file or on an oilstone. It is essential that the surfaces of the contacts be perfectly flat, and if no suitable tools are available then the contacts should be left for the attention of Ordnance Workshops.

The threads of the adjusting knobs and locking knobs should be kept free from grit and should be cleaned if they have become stiff or gritty.

The contacts on the side of the buzzer and also the spring contacts on the unit with which they make should be kept clean.

4. *Magneto generator and magneto bell.*—Any parts of the magneto generator and the bell, which are attached by screws, may be removed and replaced, but riveted parts and burnt-

out or otherwise damaged coils should be left for the attention of Ordnance Workshops.

5. *Handset.*—The microphone capsule (Capsule, Microphone, Mk. IV) can be removed and replaced by first removing the cover. This cover can be removed quite easily in the following manner, no force being required. Press a blunt instrument into the small hole in the top side of the cover, and, keeping it pressed down, turn the cover in an anti-clockwise direction, when it will come away readily.

IMPORTANT.—No attempt should be made to remove the cover by *unscrewing*.

Replace the cover as follows :—

Press on the cap of the microphone housing so that when turned clockwise through about 30 degrees it clicks into its correct attitude with respect to the body of the instrument. When in this position the small hole in the cap will point along the handle towards the earpiece.

Small parts of the handset which are attached by screws (not riveted), such as the flat contact springs of the microphone, may be replaced if necessary.

Any coil repairs or replacements will have to be carried out by Ordnance Workshops.

All screw terminals inside the handset should be tight and clean.

6. *Plug and socket for handset, condensers, resistance, etc.*—Examine the plug and socket for the handset; these should be kept clean and the leads in good order.

The resistance, condensers, bridging coil, push button buzzer switch, etc., can be easily unsoldered, unscrewed and replaced if necessary.

APPENDIX I.—LIST OF MAIN COMPONENTS

Description	Reference			Value	Remarks and V.A.O.S. nomenclature
	Symbol	Figure	Plate		
(1)	(2)	(3)	(4)	(5)	(6)
Battery ..	—	1, 2 and 4	IV	—	2 Cells, Dry, X, Mk. II, or 2 Cells, Inert, S, Mk. I (Sect. W2).
Boxes, carrying.	—	—	I	—	Telephone sets, F, Mk. I; Boxes, Mk. I* (Sect. Y). Earlier models of the instrument were supplied with fabric covered wooden boxes as shown in Plate I. The later model has a metal-bound wooden box.
Bridging coil..	—	1, 2, 3 and 4	IV	—	Telephone sets, F, chokes (Sect. Y).
Buzzer ..	—	1, 2 and 4	III, IV, VI and VII	—	Buzzers T, Mk. I (Sect. Y)
Buzzer contact strip.	—	—	IV	—	Telephone sets, F, Mk. I. Contact strips (Sect. Y).
Condenser ..	C_1	1 and 3	III	0·1 μF	Telephone sets, F, Mk. I. Condensers 0·1 mfD (Sect. Y).
Condenser ..	C_2	1 and 3	III	2 μF	Telephone sets, F, Mk. I. Condensers 2 mfD (Sect. Y).
Condenser ..	C_3	1, 3 and 4	III	2 μF	Telephone sets, F, Mk. I. Condensers 2 mfD (Sect. Y).
Condenser ..	C_4	1, 3 and 4	III	0·5 μF	Telephone sets, F, Mk. I. Condensers 0·5 mfD (Sect. Y).
Cradle switch	—	1	II and III	—	Telephone sets, F, Mk. I. Switches, cradle (Sect. Y).

APPENDIX I.—LIST OF MAIN COMPONENTS—*continued.*

Description	Reference			Value	Remarks and V.A.O.S. nomenclature
	Symbol	Figure	Plate		
(1)	(2)	(3)	(4)	(5)	(6)
Handset ..	—	1	I, II, III IV and V	—	Telephones, hand, No. 1, is used with Telephone sets, F, Mk. I, and Telephones, hand, No. 3, is used with Telephone sets, F, Mk. I* (Sect. Y).
Handset jack	—	—	IV	—	Telephone sets, F, jacks (Sect. Y).
Magneto generator.	—	1	III	—	Generators B (Sect. Y).
Magneto bell..	—	1 and 3	II	—	Telephone sets, F, Mk. I. Bell units and Bell gongs, No. 2 (Sect. Y).
Press button switch (key for buzzer call).	—	1	II and III	—	Telephone sets, F, Mk. I. Switches, buzzer (Sect. Y).
Resistance ..	R_1	1, 3 and 4	III and IV	400 ohms	Resistors 2B or 3B 2 watt, 400 ohms (Sect. Z).
Sling	—	—	I	—	Straps, carrying, F (Sect. Y). Earlier models of the instrument were supplied with leather slings as shown in Plate I. These slings are now of webbing material.

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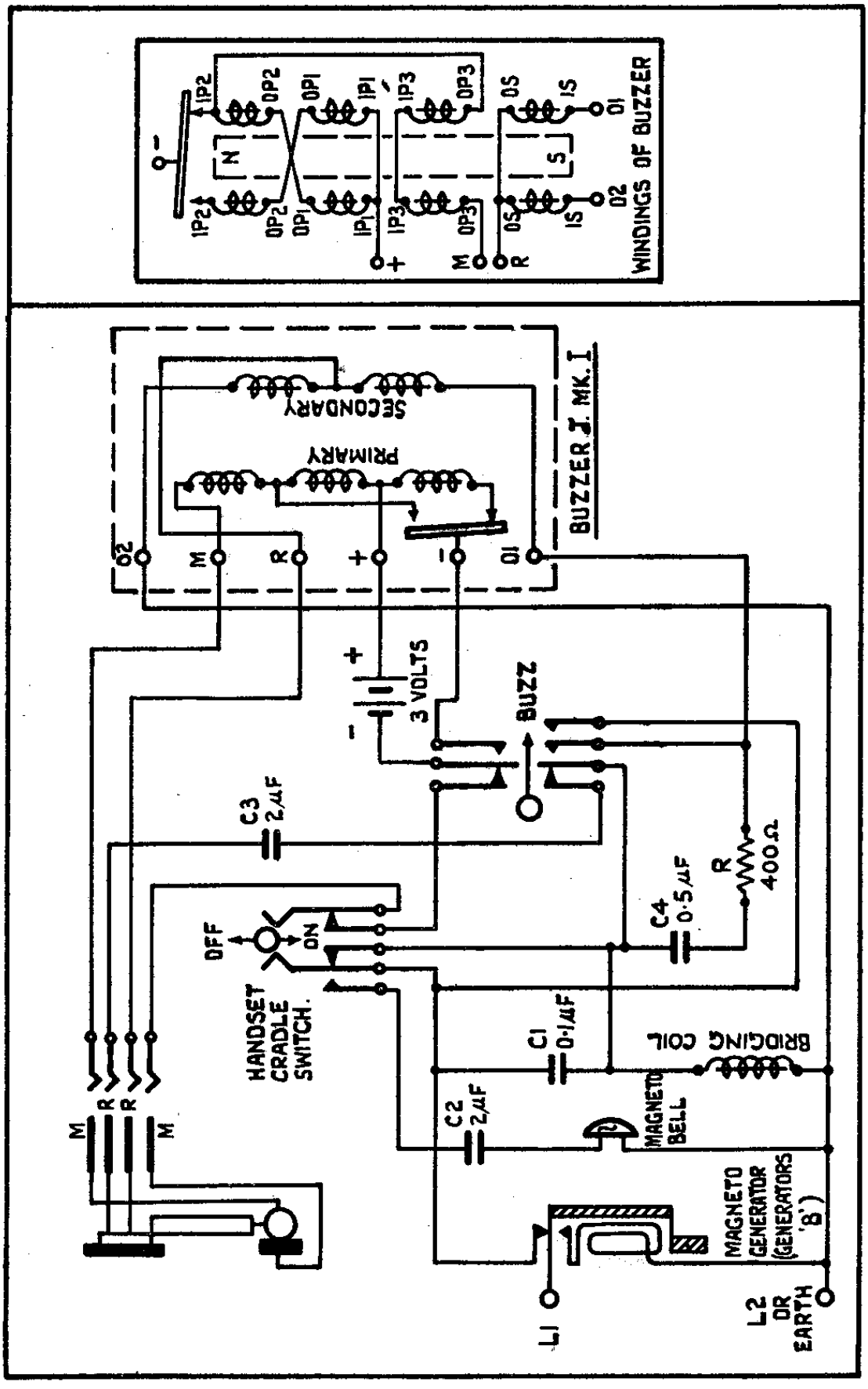
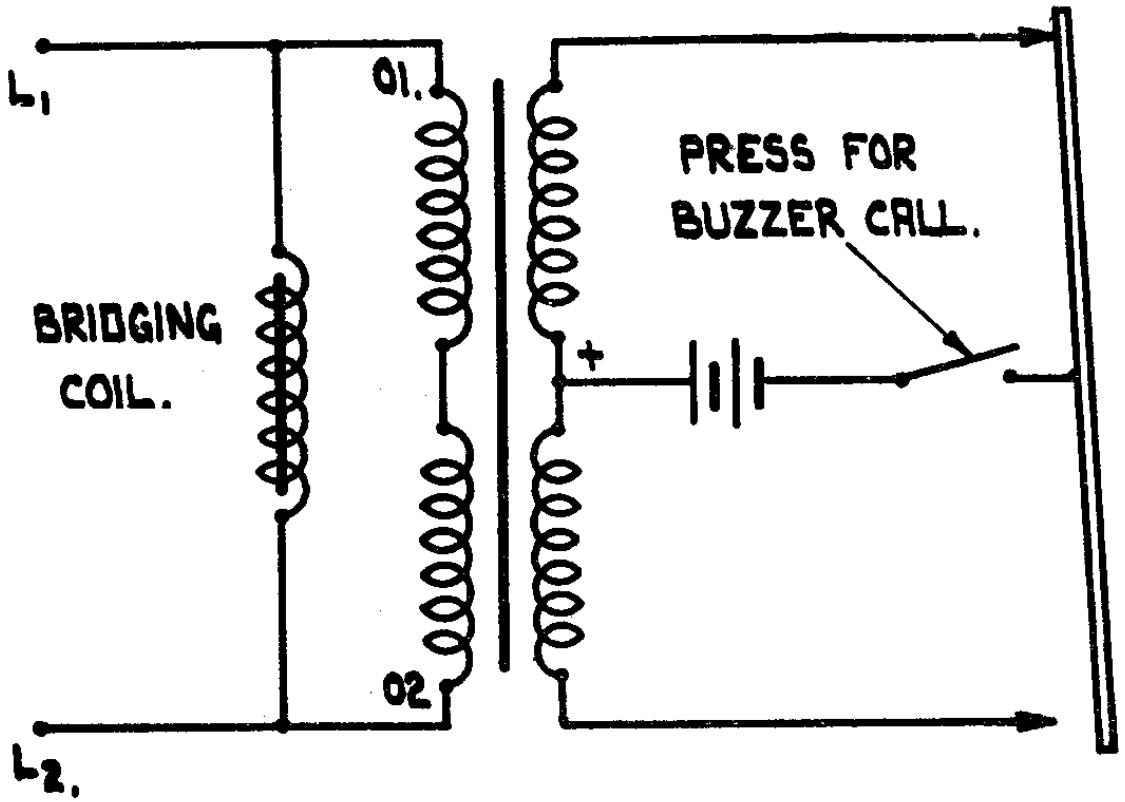


FIG. 1

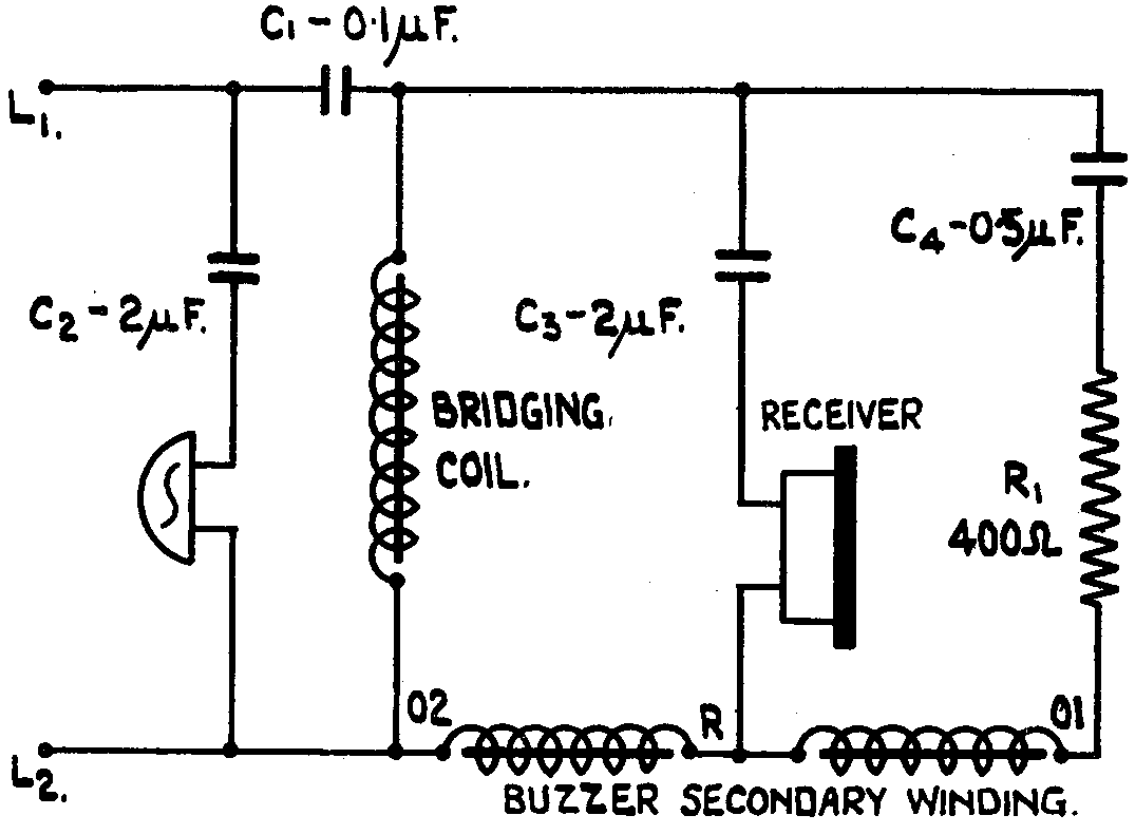
TELEPHONE SETS, F, MK. I.—CIRCUIT DIAGRAM

FIG. 2



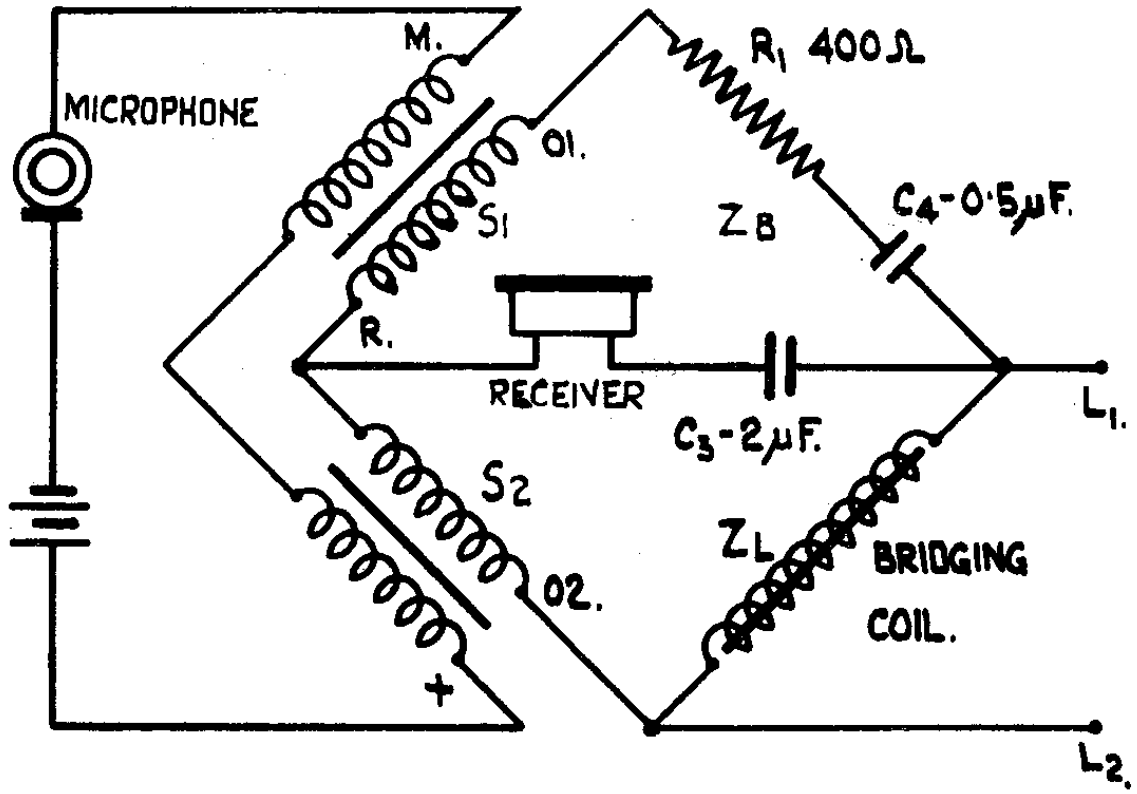
TELEPHONE SETS, F, MK. I.—SIMPLIFIED CIRCUIT. CALLING BY BUZZER

FIG. 3



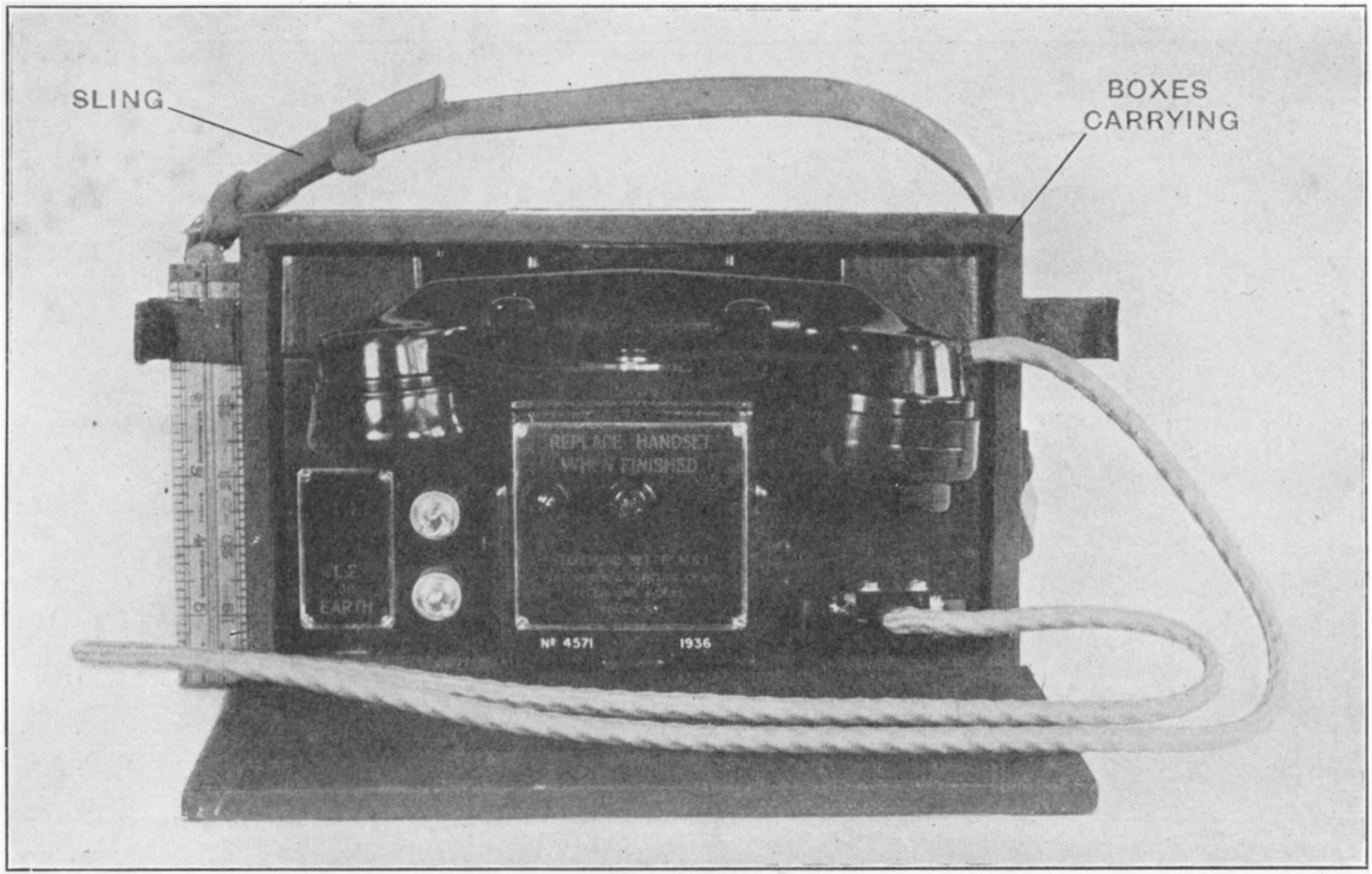
TELEPHONE SETS, F, MK. I.—SIMPLIFIED CIRCUIT. RECEIVING MAGNETO OR BUZZER CALLS (HANDSET ON CRADLE)

FIG. 4



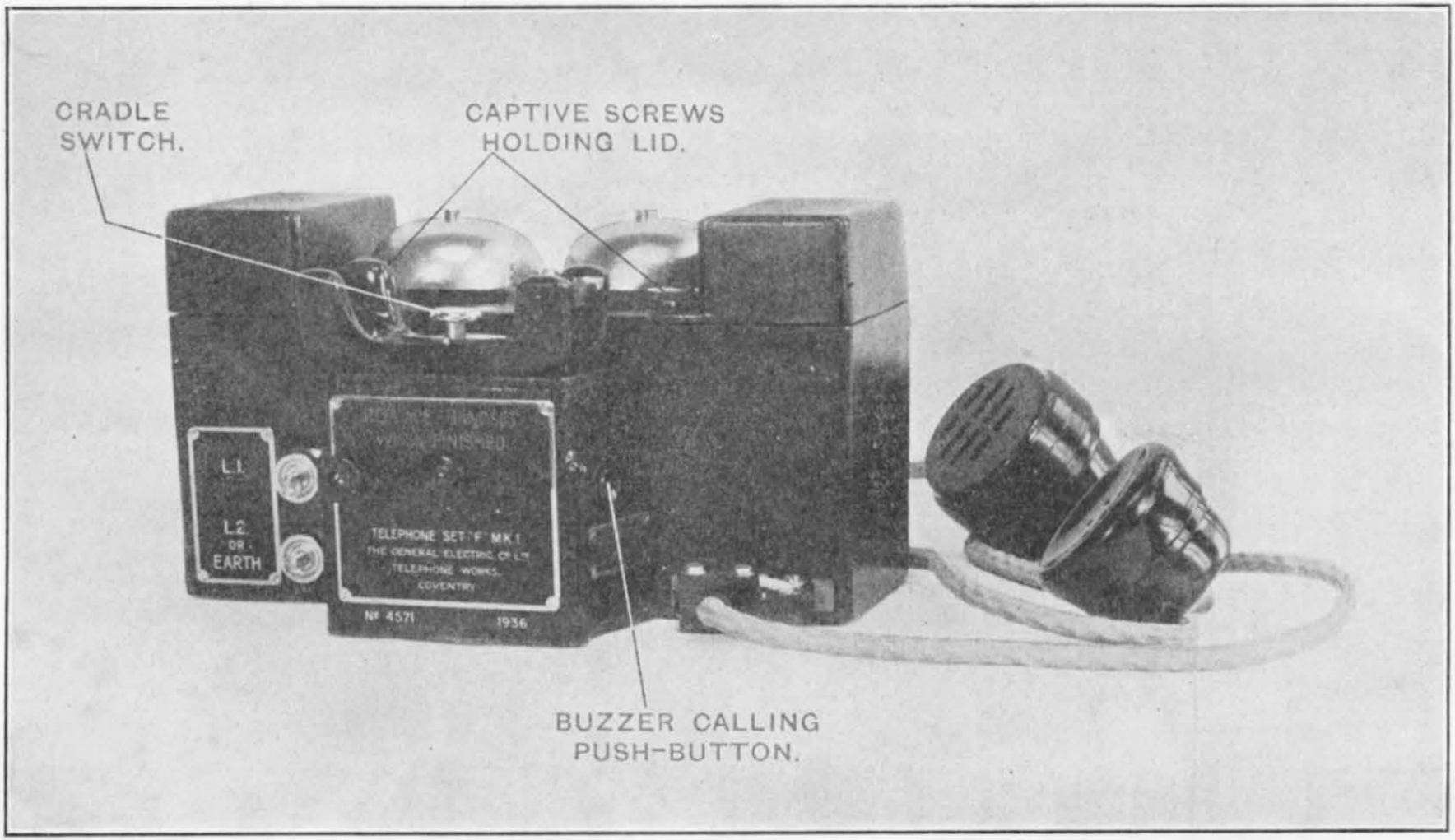
TELEPHONE SETS, F, MK. I.—SIMPLIFIED CIRCUIT. SPEECH COMMUNICATION SHOWING ANTI-SIDE-TONE BRIDGE CIRCUIT

PLATE I



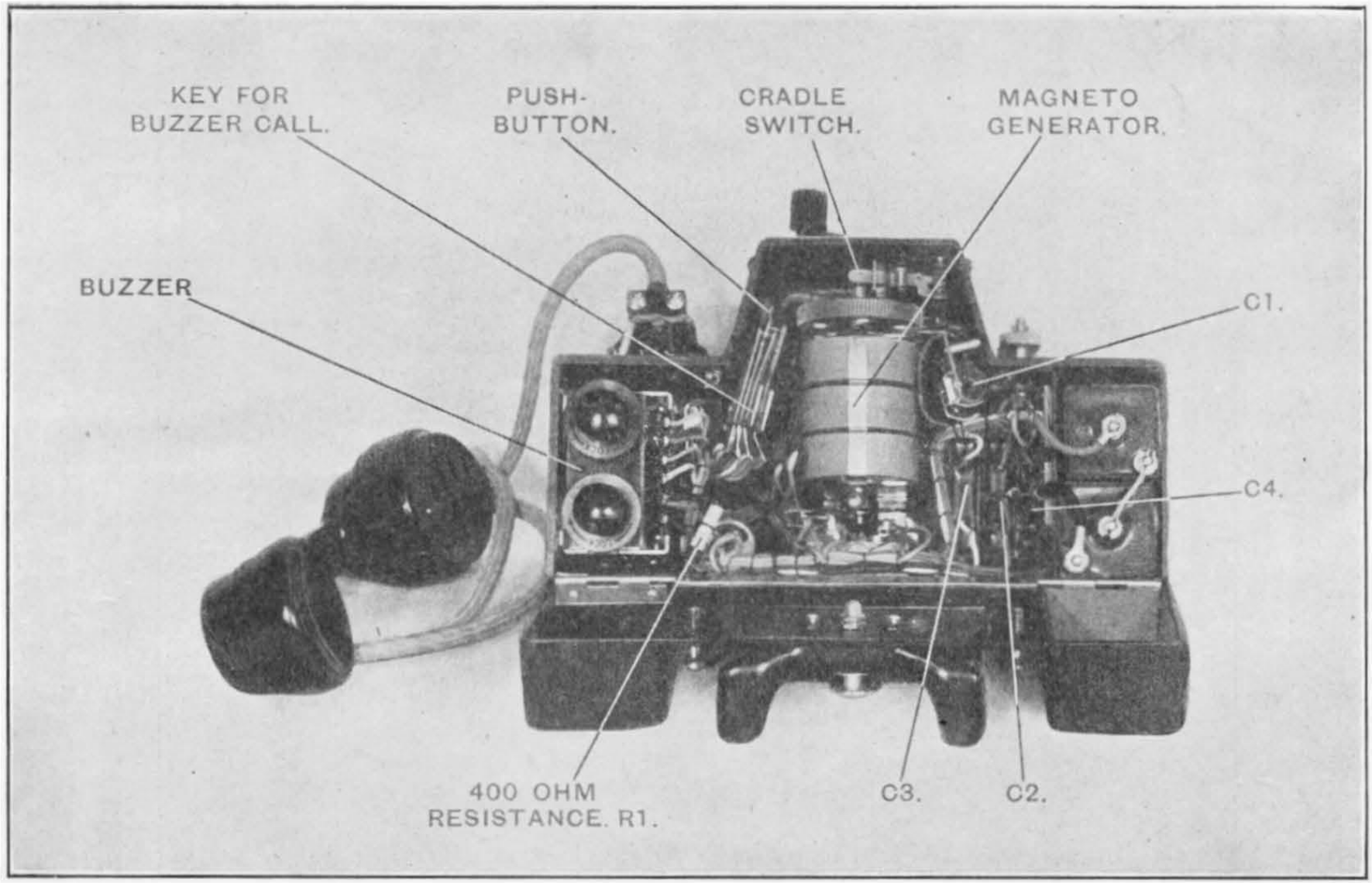
TELEPHONE SETS, F, MK. I.—OPERATING POSITION IN CASE

PLATE II



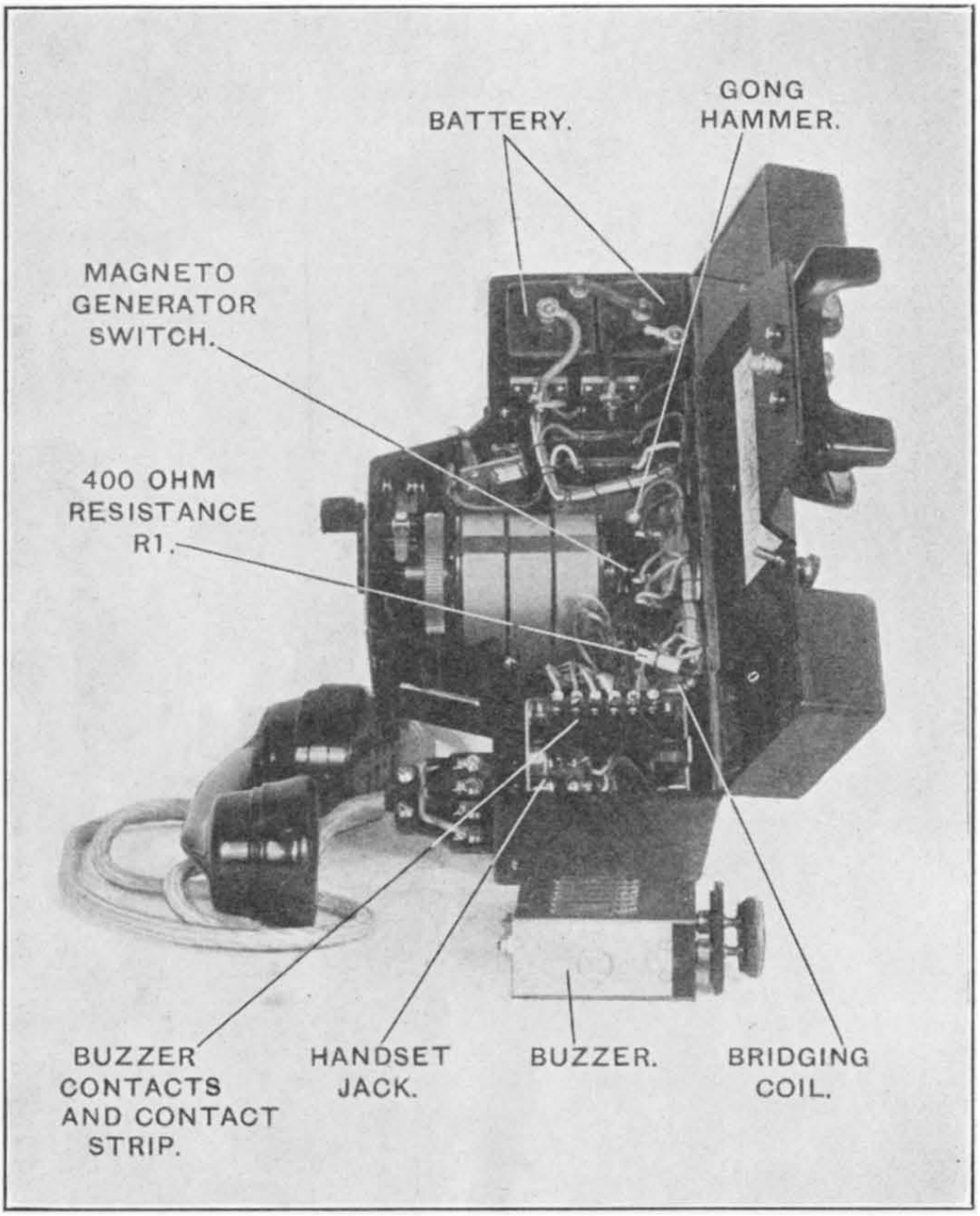
TELEPHONE SETS, F, MK. I.—WITHDRAWN FROM CASE

PLATE III



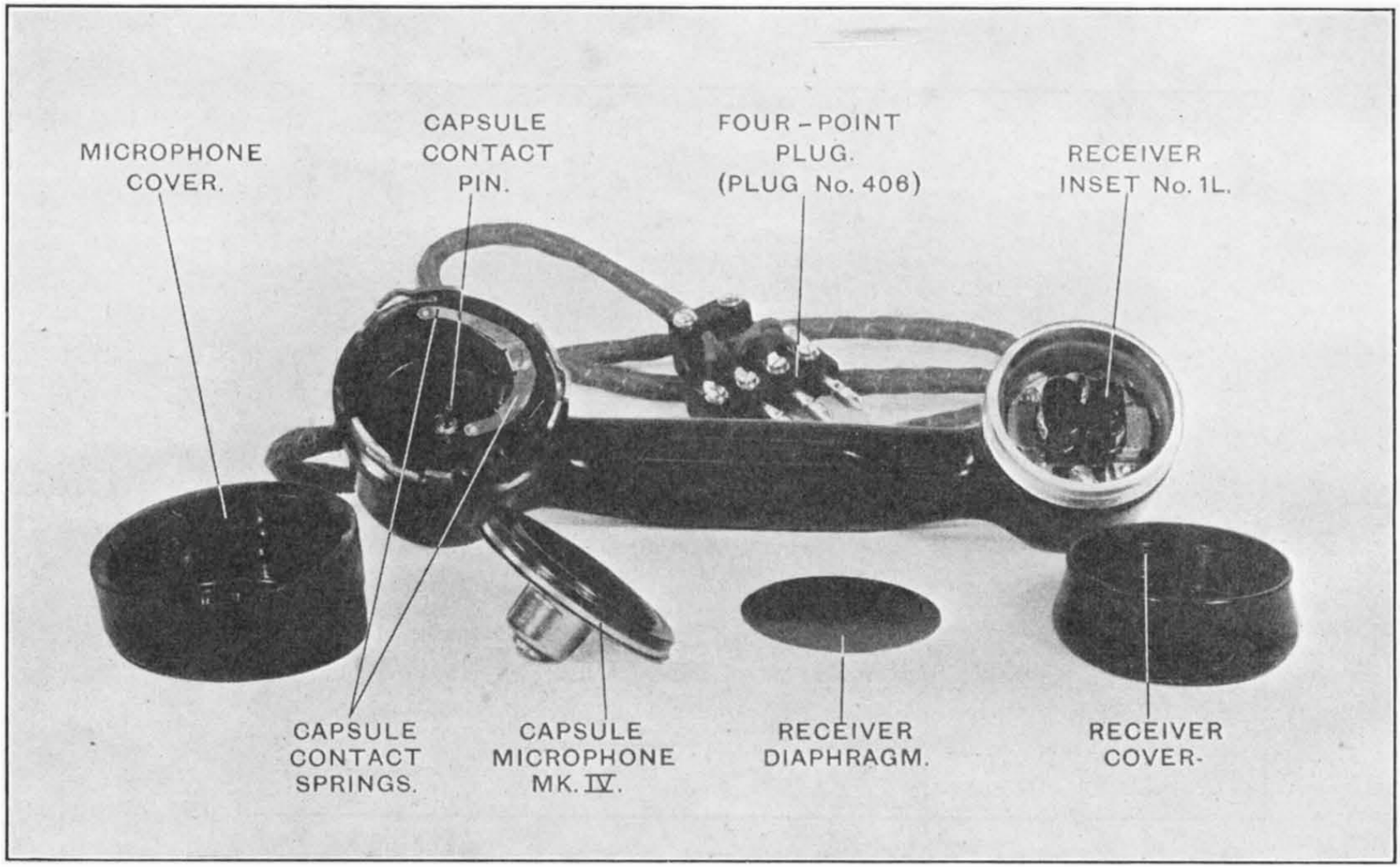
TELEPHONE SETS, F, MK. I.—INTERNAL VIEW

PLATE IV



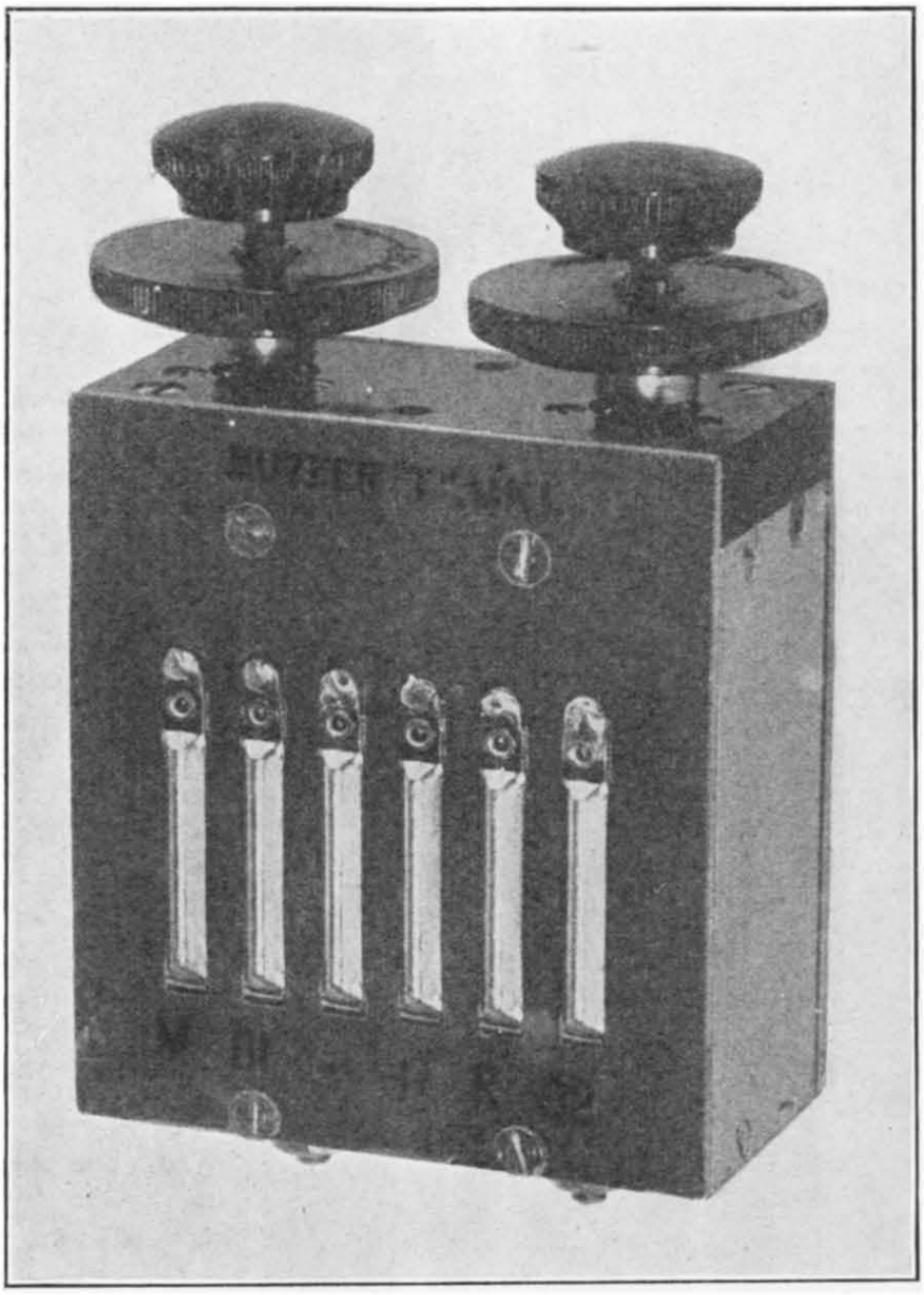
TELEPHONE SETS, F, MK. I.—VIEW OPEN, FROM ABOVE, BUZZER REMOVED

PLATE V



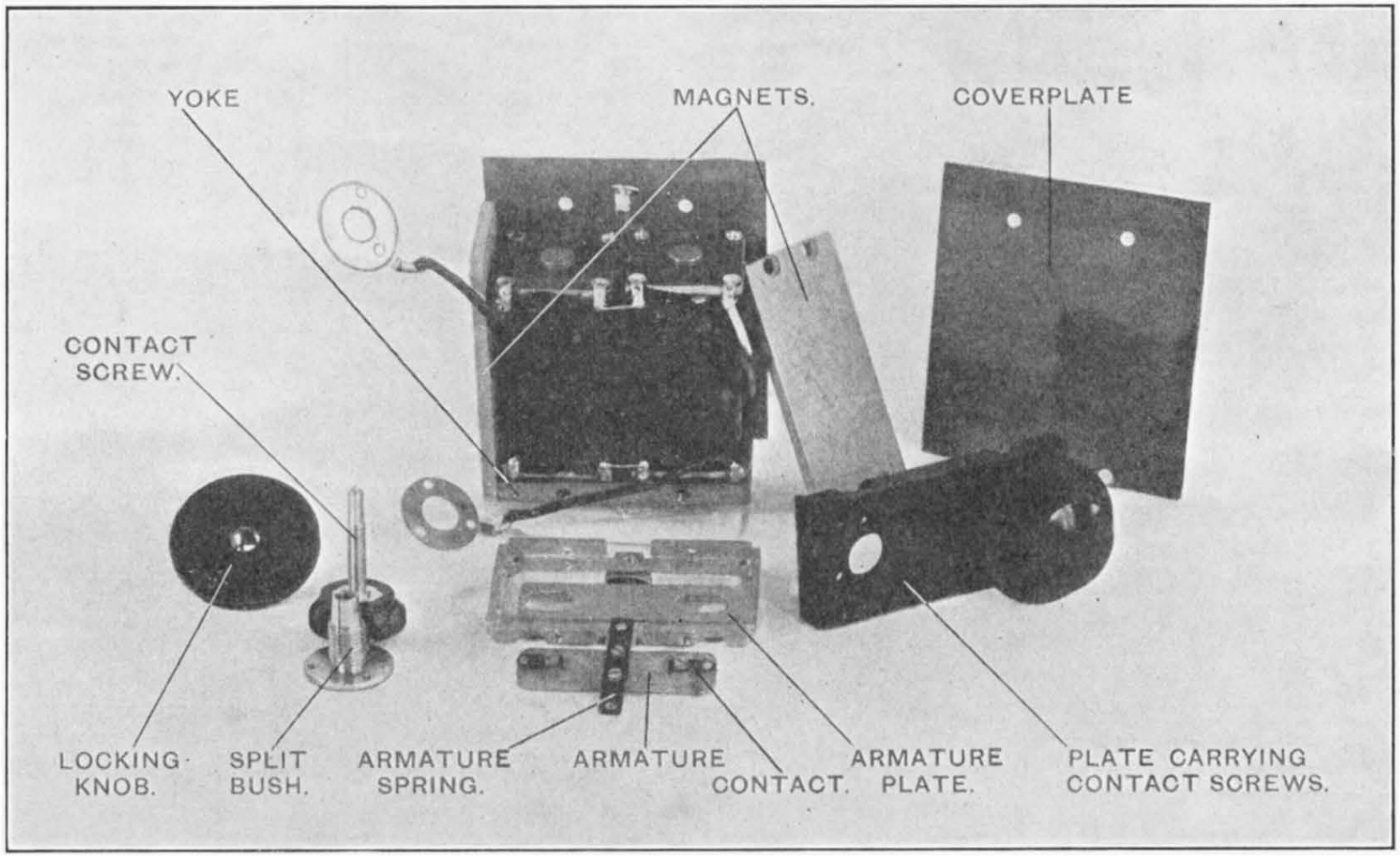
TELEPHONE SETS, F, MK. I.—HANDSET DISMANTLED TO SHOW COMPONENT PARTS

PLATE VI



TELEPHONE SETS, F, MK. I.—BUZZER T, MK. I

PLATE VII



TELEPHONE SETS, F, MK. I.—BUZZER T, MK. I, PARTLY DISMANTLED