

FOR OFFICIAL USE ONLY

December, 1938

AIR PUBLICATION 1186  
Volume I

SECTION 6, CHAPTER 3

BUZZER, VALVE, TYPE 2

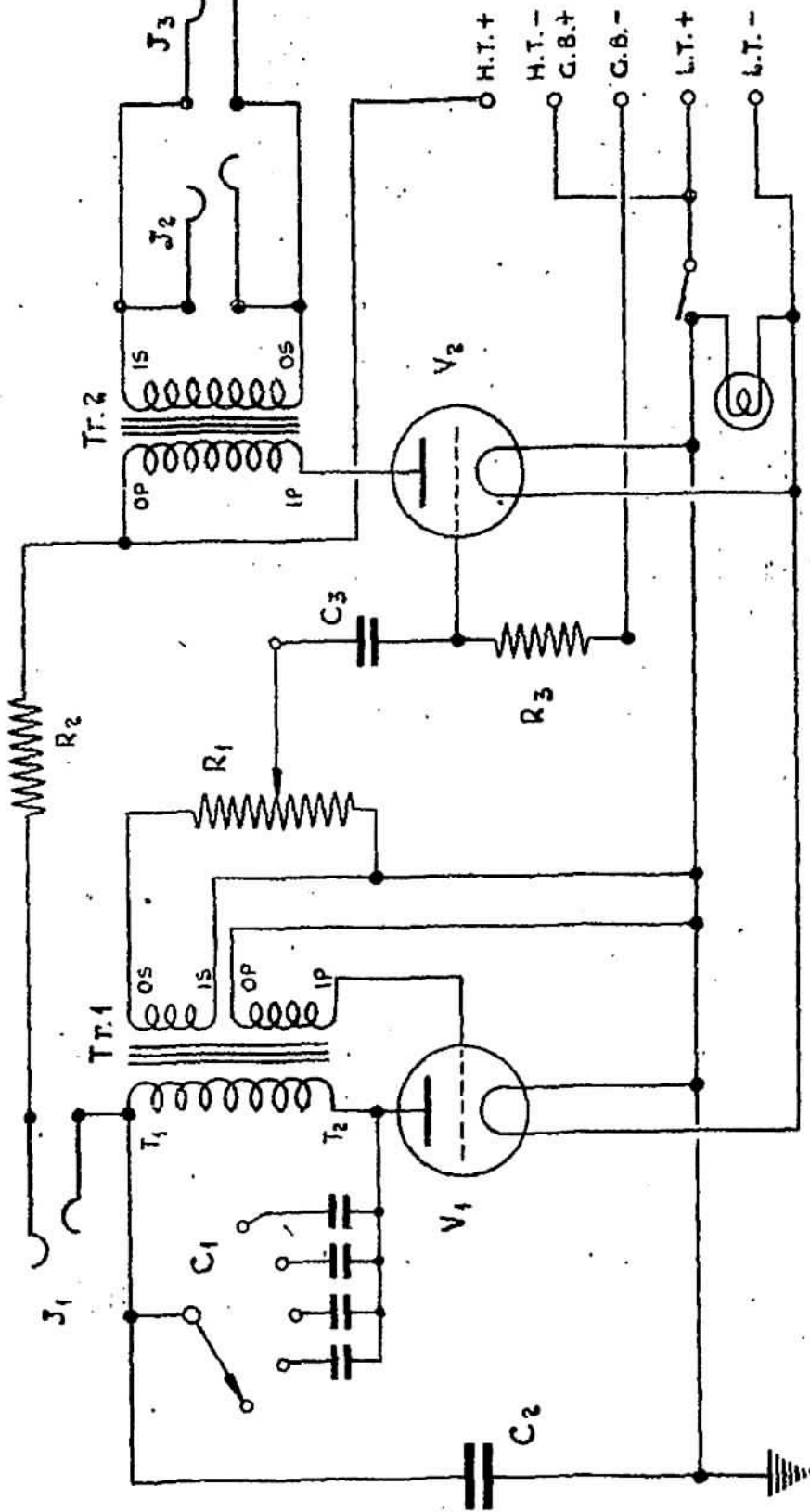
Contents

	Para.
Introduction .. .. .	1
General description .. .. .	2
Constructional details .. .. .	4
Valves and batteries .. .. .	10
Operation .. .. .	11
Maintenance and precautions .. .. .	13
Nomenclature of parts .. .. .	Appendix

List of Illustrations

	Fig.
Theoretical circuit diagram .. .. .	1
External view .. .. .	2
Panel, rear view .. .. .	3
Shelf, underside .. .. .	4
Bench wiring diagram .. .. .	5

SECTION 6, CHAPTER 3.



RESISTANCES (OHMS)	CONDENSERS ( $\mu$ F)
R <sub>1</sub> 50,000	C <sub>1</sub> .001, .005, .01, .02.
R <sub>2</sub> 80,000	C <sub>2</sub> 0.1
R <sub>3</sub> 100,000	C <sub>3</sub> .01

FIG. 1, THEORETICAL CIRCUIT DIAGRAM

**BUZZER, VALVE, TYPE 2**

(Stores Ref. 10A/10158)

**INTRODUCTION**

1. The buzzer, valve, type 2, is intended to be used for instructional purposes in Morse signalling. It is so arranged that when a Morse key is connected by means of a standard type of telephone plug, and a line feeding a number of pairs of telephones is plugged into the output jack, Morse signals of pure tone may be transmitted and received. The instrument is capable of giving signals of adequate strength in twenty pairs of telephones. Means are provided for varying the pitch of the note, and a volume control is incorporated to enable the signal strength to be adjusted as required. Arrangements are made by which two or more instruments may be coupled together so that interfering signals may be obtained, giving practise in "over-reading". The weight of the instrument, without batteries, is approximately 7 lb., and with batteries approximately 15½ lb. It measures 9¾ in. by 8¾ in. by 8 in. The transit case measures 11¾ in. by 11¾ in. by 10 in. and weighs 7 lb.

**GENERAL DESCRIPTION**

2. The instrument employs two valves, one of which acts as an audio-frequency oscillator and the other as an amplifier, the telephone circuit being coupled to the anode circuit of the latter by a suitable transformer. The operation of the Morse key makes and breaks the anode circuit of the oscillator valve. The theoretical circuit diagram is given in fig. 1. Associated with the oscillator valve  $V_1$ , is the three-winding transformer  $Tr_1$ . The first winding is connected between grid and filament of the valve, the second is in series with the anode of the valve, and the third is connected between the grid and filament of the amplifier valve  $V_2$ , a suitable condenser  $C_3$ , being inserted in series with the grid. These windings may be referred to as the grid, anode and output windings respectively. When the filaments are heated by completing the L.T. circuit; and the H.T. circuit is completed by means of a Morse key plugged into the jack  $J_1$ , the anode circuit of the oscillator valve is set in oscillation at a frequency which is mainly determined by the oscillation constant (L C value) of the anode circuit. The L C value may be varied between certain limits by means of the capacitance  $C_1$ , which is adjustable in five steps, inclusive of a position in which only the distributed capacitance is operative. The inductance and distributed capacitance is such that the highest obtainable frequency is well within the limits of audibility, and an increase of capacitance causes a reduction of frequency.

3. Since the output winding is coupled to the anode winding, audio-frequency voltages are applied between the grid and filament of the amplifier valve  $V_2$ . The magnitude of this grid swing is controlled by means of a potentiometer  $R_1$ , across the output winding. The primary winding of the output transformer  $Tr_2$ , is in series with the anode of the amplifier valve, and two jacks  $J_2, J_3$ , are connected across the secondary winding. The instructional telephone line is plugged into one of these, and the other is available to plug an interference buzzer into the line. A 4½-volt grid bias battery is provided in order to adjust the mean grid potential of the amplifier valve for best operating conditions. With a fully charged H.T. battery, the correct bias is -3 volts.

**CONSTRUCTIONAL DETAILS**

4. Three views of the instrument are given in figs. 2, 3 and 4, and a bench wiring diagram in fig. 5. Fig. 2 is an exterior view showing the front panel. The case (1) is of mahogany, and is

## SECTION 6, CHAPTER 3

fitted with a carrying strap of tanned hide. The outside of the case is covered with linen fabric. Both the inside and the outside are painted in standard Air Ministry grey colour and then varnished, with the exception of the battery compartment, which is painted with two coats of acid-resisting black paint. The whole of the electrical components are assembled upon a mild steel chassis which is zinc sprayed all over, the face and edges of the front panel (2) being finished in standard grey stove enamel or cellulose paint. The panel carries the filament switch (3) (Switch, type 70, Stores Ref. 10A/8064). This is a single-pole rotary, cam-operated switch, consisting of two contact arms fitted with gold-silver contacts. Above this switch is a ruby

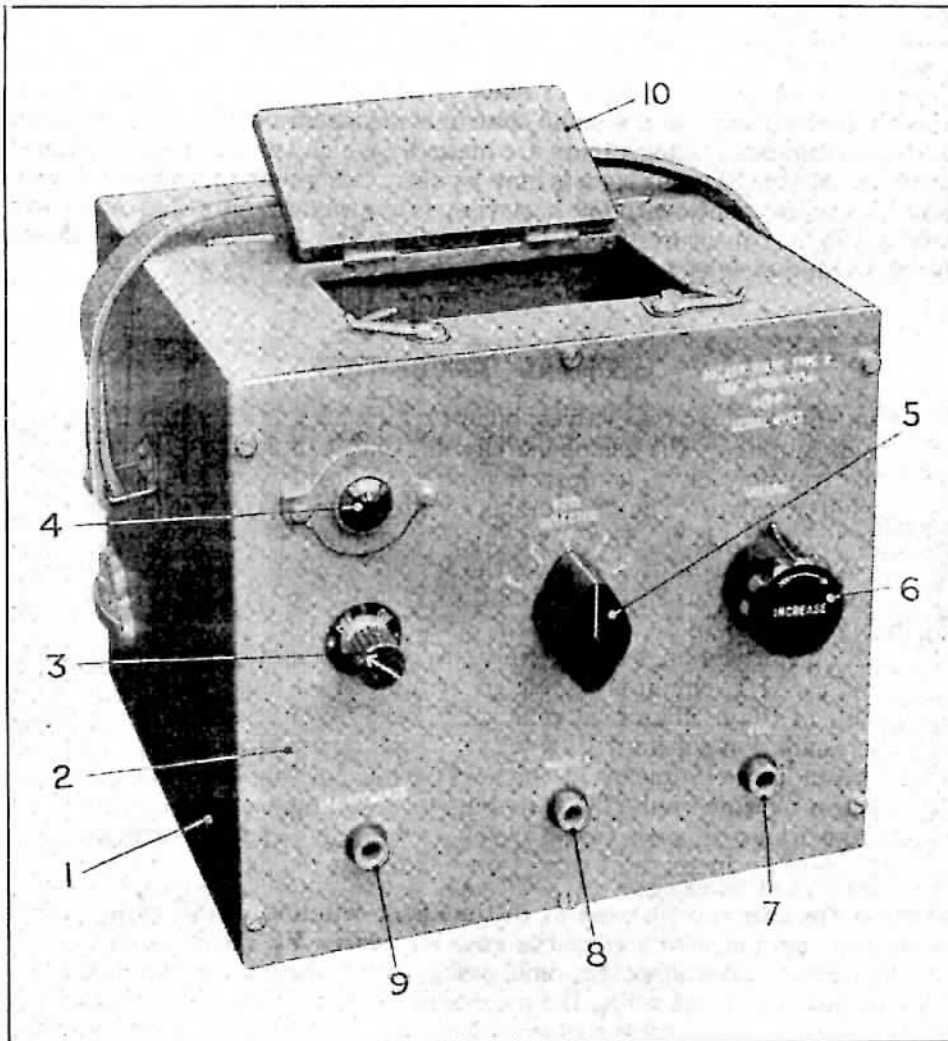


FIG. 2. External view.

lens (4), through which a pilot lamp indicates when the instrument is switched on. The lens is mounted in a pivoted cover which allows access to the pilot lamp. The knob (5) of the note selector switch occupies the centre of the panel. On the right of this is the knob (6) of the volume control potentiometer, while the outer portions of the jacks (7), (8), (9) can be seen near the bottom of the panel. A small hinged door (10) allows access to the interior for the insertion of valves.

## SECTION 6, CHAPTER 3

5. Fig. 3 shows the components above the shelf of the chassis. The terminal block (1) (Stores Ref. 5C/432) carries the H.T.—, G.B.+ , H.T.+ and G.B.— terminals, to which are connected a set of flexible leads (uniflex red 4) fitted with appropriately engraved battery plugs. Behind this terminal block is the oscillator transformer (2). The core of this transformer is of radio-metal, and has a small air gap. Behind the oscillator transformer is the volume control potentiometer (3). This is a resistance, type 75 (Stores Ref. 10A/7605), of 50,000 ohms, the whole of which is in parallel with the output winding. The centre one of the three terminal lugs is connected internally to the rotary contact arm, and externally, *via* the grid condenser, to the grid socket of the amplifier valve-holder.

6. The two valve-holders (4) and (5), are marked V.R. 21 and V.R. 22 respectively; the former is for the oscillator and the latter for the amplifier valve. On the right of the shelf can be seen a terminal block (6) (Stores Ref. 5C/430) carrying the L.T.+ and L.T.— terminals. Flexible leads (uniflex red 4) terminating in spade terminal lugs are provided for connecting the L.T. accumulator.

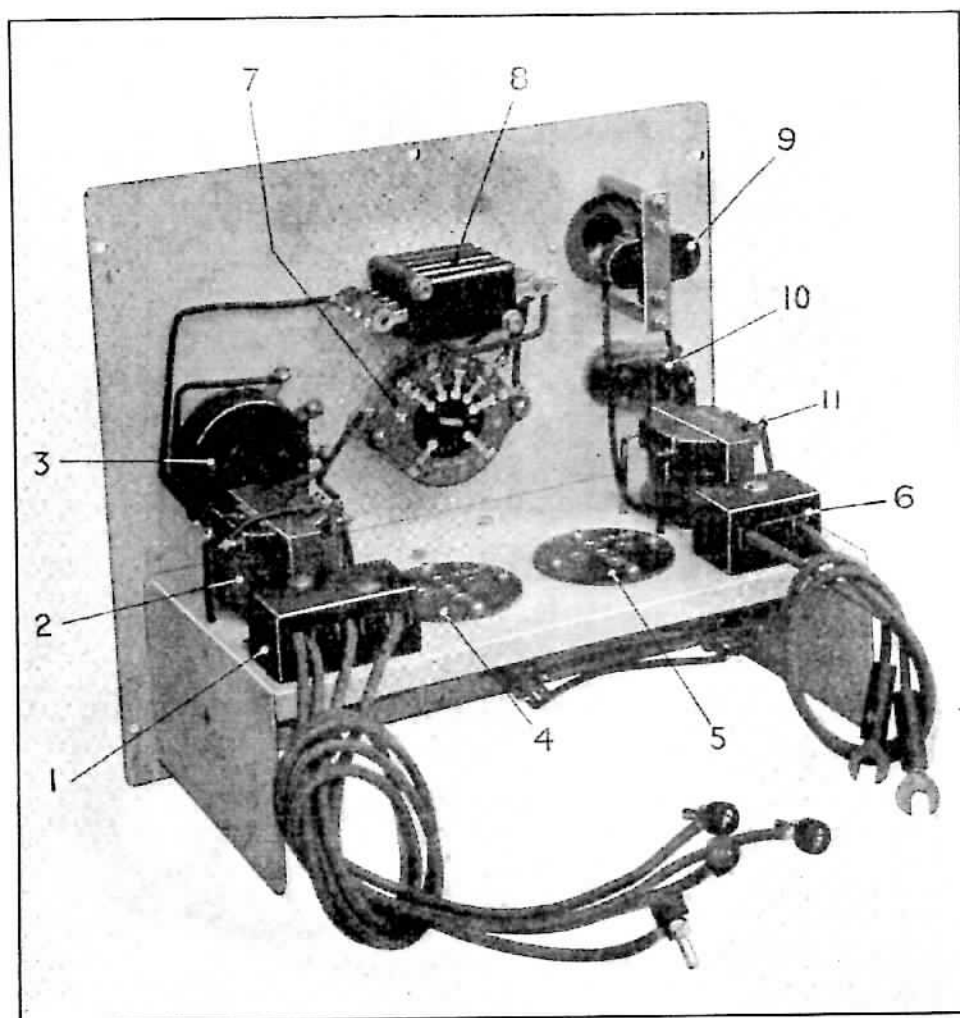


FIG. 3. Panel, rear view.

## SECTION 6, CHAPTER 3

7. In the middle of the panel is seen the note-selector switch (7). This is a single-pole, five-way switch, type 141 (Stores Ref. 10A/10161) and consists of a metal base plate carrying two short metal pillars. These pillars carry a ring of composite insulating material which is fitted with seven radial contacts of silver-gold alloy; of these, only the five upper ones are fitted with terminal lugs. The centre of the ring is filled by a disc of insulating material. This disc carries the moving contact, and may be rotated within certain limits by means of a flat bar which is fitted to the knob of the switch and moves with it. Positive contact is assured by means of a locking device, consisting of a pair of radial arms carrying small rollers. These arms are mounted on the rotating shaft carrying the flat bar. The rollers engage in recesses in the base plate and so lock the switch in any desired position.

8. The four right-hand upper contacts of the selector switch are connected to various members of the bank of fixed condensers (8). There are five separate condensers in this bank. The outer one is a condenser type 384,  $\cdot 001 \mu\text{F}$ . (Stores Ref. 10A/10167). Next to it is a condenser type 385,  $\cdot 005 \mu\text{F}$ . (Stores Ref. 10A/10164), and the three inner ones are condensers type 286,  $\cdot 01 \mu\text{F}$ . (Stores Ref. 10A 9185). The two inner ones are connected in parallel to form

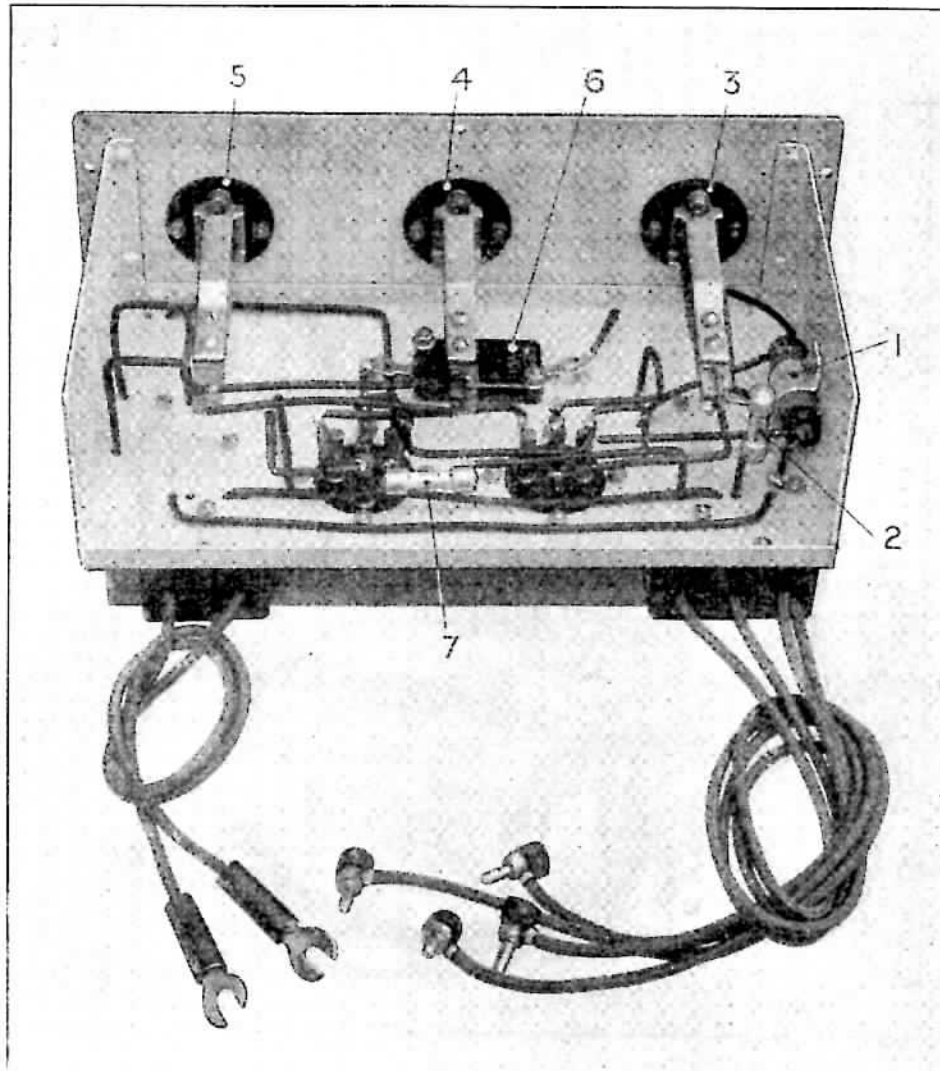


FIG. 4. Shelf, underside.

SECTION 6, CHAPTER 3.

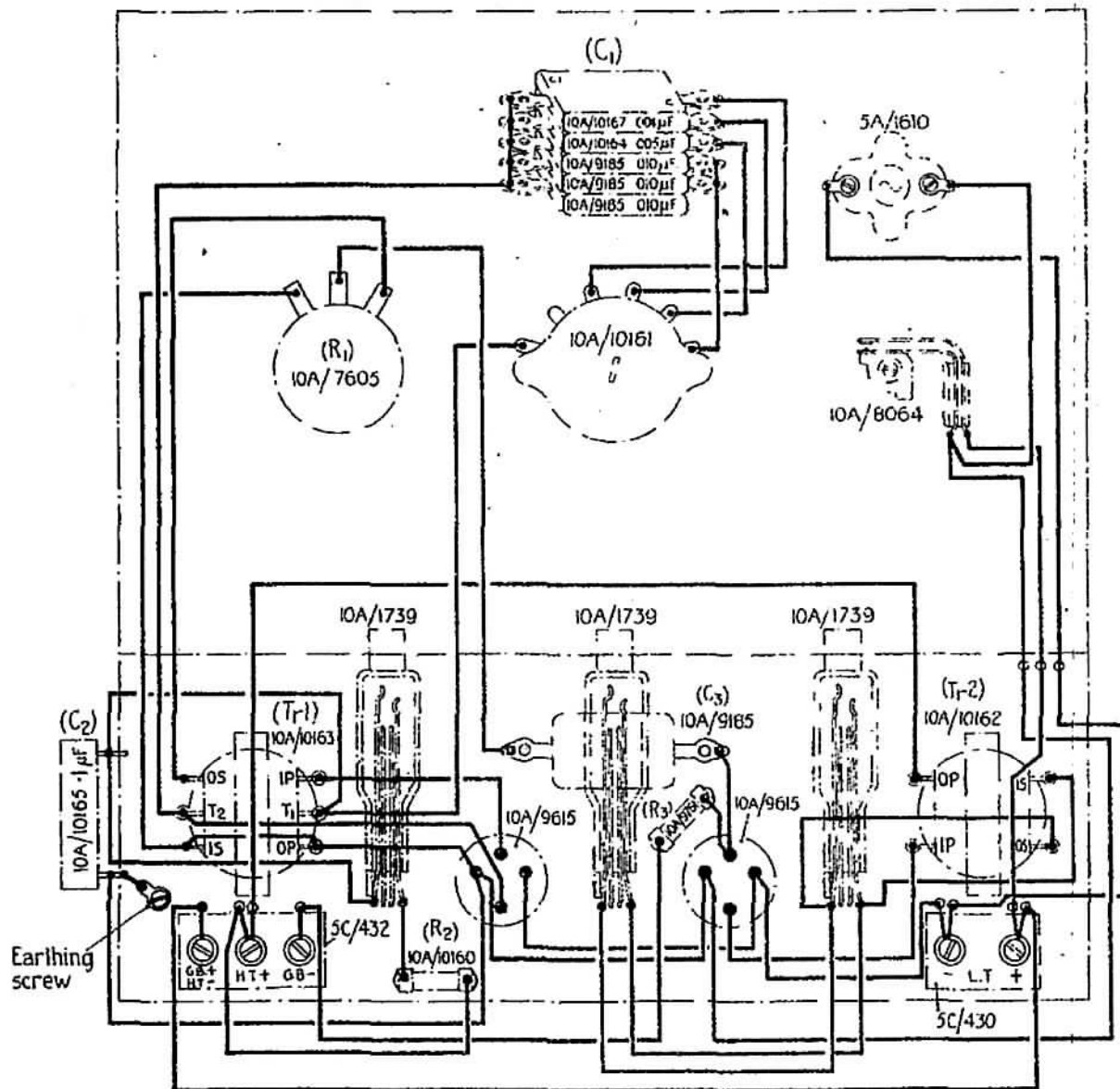


FIG. 5, BENCH WIRING DIAGRAM

## SECTION 6, CHAPTER 3

a single capacitance of  $.02 \mu\text{F}$ . The miniature Edison screw-holder (9) for the pilot lamp is mounted on a metal bracket. The pilot lamp is rated at 3.5 volts and therefore glows with somewhat less than half its normal brilliancy when the L.T. circuit is closed by means of the L.T. switch (10). On the right of the shelf is the output transformer (11) which has a closed core of low hysteresis steel.

9. Fig. 4 shows the components under the shelf. The mains condenser (1) is a condenser type 386,  $.01 \mu\text{F}$ ., paper dielectric (Stores Ref. 10A/10165). Adjacent thereto is a  $\frac{1}{2}$ -watt rod resistance (2) (type 372, 80,000 ohms, Stores Ref. 10A/10160) which is in series with the anode of the oscillator valve, reducing the mean anode-filament P.D. to about 40 volts. The jack (3) is the one provided for the insertion of the Morse key into the anode circuit. The two remaining jacks (4) and (5), are connected in parallel across the secondary winding of the output transformer. All three jacks are of the standard service type (Stores Ref. 10A/1739). The grid condenser (6), which is mounted on the underside of the shelf, is a condenser type 286,  $.01 \mu\text{F}$ . The  $\frac{1}{2}$ -watt rod resistance (7) (type 282, 100,000 ohms, Stores Ref. 10A/9761) is the grid leak for the amplifier valve.

### VALVES AND BATTERIES

10. The L.T. supply is derived from a single 2-volt lead-acid accumulator (Stores Ref. 5A/1514), the H.T. supply from a 60-volt dry battery (Stores Ref. 5A/1334), and the grid bias voltage from a  $4\frac{1}{2}$ -volt dry battery (Stores Ref. 5A/1383). The oscillator valve is a valve, receiving, V.R.21 (Stores Ref. 10A/7738) and the amplifier valve is a valve, receiving, V.R.22 (Stores Ref. 10A/7958).

### OPERATION

11. To bring the instrument into use, first see that the filament switch is in the "off" position. Insert the pilot lamp into its holder through the aperture normally covered by the ruby lens, place a suitable 2-volt accumulator in the battery compartment, and connect up the L.T.+ and L.T.- leads. On moving the L.T. switch to the "on" position the pilot lamp should glow. Switch off the L.T. switch, place the authorized types of 60-volt H.T. and  $4\frac{1}{2}$ -volt grid bias batteries in the battery compartment, connecting these in circuit by means of the flexible leads. The grid bias should normally be  $-3$  volts. Close the cover of the battery compartment and secure it by means of the catches.

12. Plug a pair of service high-resistance telephones into the telephone jack and a Morse key into the key jack. With the L.T. switch in the "off" position insert a valve V.R.21 into the right-hand valve-holder and a valve V.R.22 into the holder on the left. Close the L.T. switch and press the Morse key. A clear musical note should be heard in the telephones. The pitch and intensity of this note should be variable by manipulating the note selector switch and volume control respectively.

### MAINTENANCE AND PRECAUTIONS

13. The instrument requires very little attention. When not in use it should be stored in a clean dry place. The L.T. battery must be periodically recharged in accordance with the routine in force at the particular station. Unless the instrument is in regular use it is advisable to remove the L.T. battery when Morse practice is completed.



## SECTION 6, CHAPTER 3

## APPENDIX

## NOMENCLATURE OF PARTS

The following list of parts is issued for information. When ordering spares for this valve buzzer, the appropriate section of AIR PUBLICATION 1086 must be used.

Ref. No.	Nomenclature.	Quantity.	Remarks.
10A/10158 ..	Buzzer, valve, type 2		
	Consisting of:—		
5C/430 ..	Block, terminal, type B, 2-way No. 1..	1	
5C/432 ..	Block, terminal, type B, 3-way No. 1 ..	1	
10A/10159 ..	Case .. .. .	1	
10A/10165 ..	Condenser, type 386 .. .. .	1	·1 $\mu$ F., paper dielectric, cylindrical.
10A/10167 ..	Condenser, type 384 .. .. .	1	·001 $\mu$ F. $\pm$ 5 per cent. mica, moulded.
10A/9185 ..	Condenser, type 286 .. .. .	4	·01 $\mu$ F.
10A/10164 ..	Condenser, type 385 .. .. .	1	·005 $\mu$ F., mica, moulded.
10A/9615 ..	Holder, valve, type S .. .. .	2	
10A/1739 ..	Jack, telephone, type A .. .. .	3	
5A/1610 ..	Lampholder, miniature Edison screw, batten.	1	
10A/9689 ..	Plug, type 89 .. .. .	1	Engraved H.T.+.
10A/9690 ..	Plug, type 90 .. .. .	1	Engraved H.T.—
10A/9691 ..	Plug, type 91 .. .. .	1	Engraved G.B.+.
10A/9692 ..	Plug, type 92 .. .. .	1	Engraved G.B.—
10A/7605 ..	Resistance, type 75 .. .. .	1	50,000 ohms, potentiometer.
10A/9761 ..	Resistance, type 282 .. .. .	1	100,000 ohms, $\frac{1}{4}$ -watt rod.
10A/10160 ..	Resistance, type 372 .. .. .	1	80,000 ohms, $\frac{1}{4}$ -watt rod.
10A/8064 ..	Switch, type 70 .. .. .	1	Cam-operated, L.T.
10A/10161 ..	Switch, type 141 .. .. .	1	5-position selector switch.
10A/10162 ..	Transformer, L/F., type H .. .. .	1	
10A/10163 ..	Transformer, L/F., type J .. .. .	1	
	Accessories:—		
5A/1514 ..	Accumulator, lead-acid, 2 V., 7 Ah. ..	1	
5A/1383 ..	Battery, dry, 4 $\frac{1}{2}$ V. .. .. .	1	
5A/1334 ..	Battery, dry, 60 V. .. .. .	1	
10A/10298 ..	Case, transit .. .. .	1	
5A/361 ..	Lamp, filament, 3·5 V. .. .. .	1	
10A/7738 ..	Valve, V.R.21 .. .. .	1	Oscillator.
10A/7958 ..	Valve, V.R.22 .. .. .	1	Amplifier.