TESTER, VALVE, AVO, No. 1

GENERAL DESCRIPTION

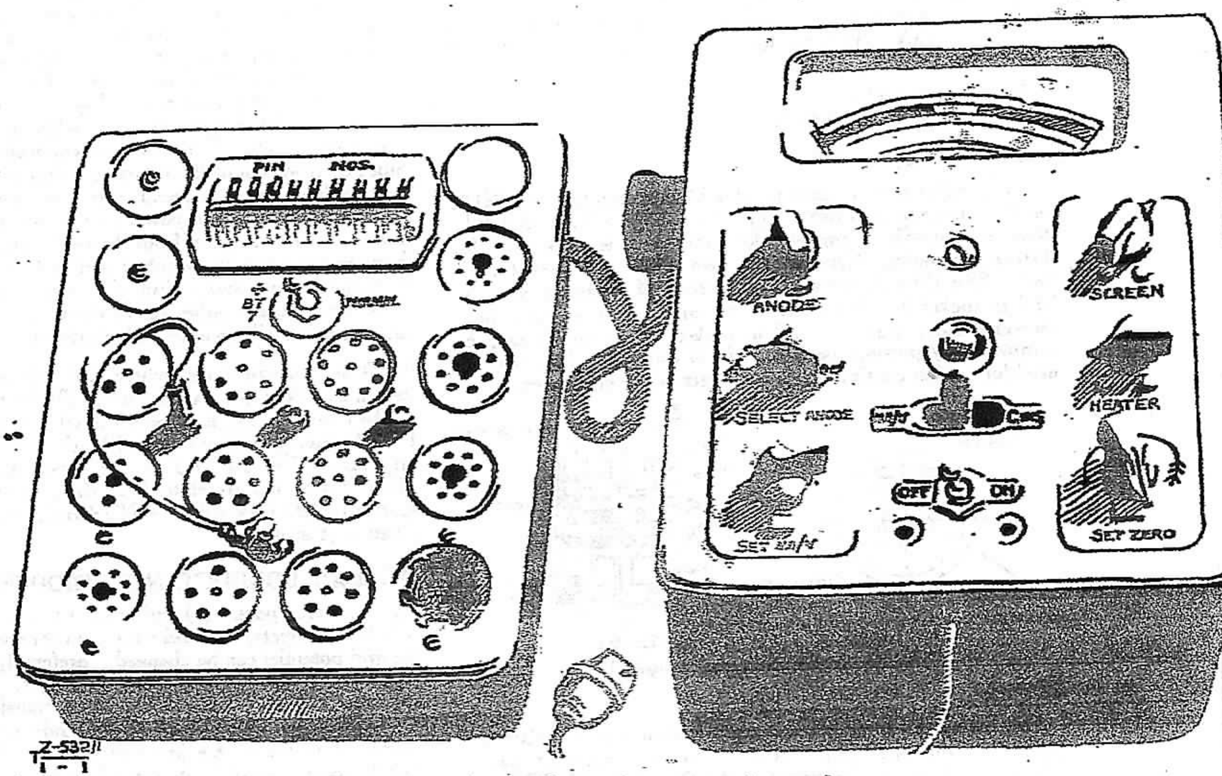

Fig. 1—General view of instrument

1. The object of the Avo valve tester is to give sufficient indication of the all-round efficiency of a valve. The tests which can be made are as follows :—

(a) Insulation and continuity when cold

(b) Mutual conductance, or, in the case of diodes, emission.

(c) Cathode-heater insulation when hot.

2. The tester comprises two separate units, connected together by a 9-core cable and plug.

The main unit

3. This is the larger of the two units, and contains the power supplies, selector switches and indicating meter of the equipment. These are mounted on a bakelite panel (10¾in.×8¾in.) and are enclosed in a metal case (10in.×8in.×4in.)

The subsidiary unit

4. This contains twelve different types of valve holder (recently an additional valve holder for the EF50 valve has been fitted), a rotary selector switch and an auto-transformer. These components are mounted on a metal panel (10¾in.×8¾in.) and enclosed in a metal case (10¾in.×8¾in.×1⅞in.). To this unit is connected the 9-core cable and plug which fits into the appropriate socket on the main unit.

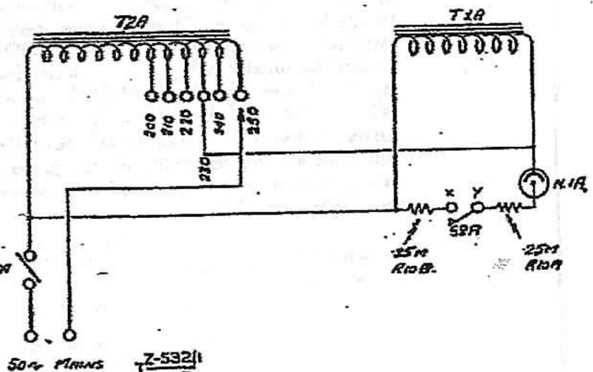

Fig. 2—Circuit diagram of mains transformer unit

Transformers

5. Referring to the complete circuit diagram (Fig. 7), it can be seen that the valve tester consists mainly of two transformers with multi-tapped secondaries. The 50 c/s supply is fed to transformer T2A, whose primary has six tappings ; thus, the instrument can be used on any 50 c/s supply from 200V to 250V. The primary of T1A is connected at the 230V input tapping on

T2A, so that T1A receives a constant 230V supply (Fig. 2). Transformer T2A has a multi-tapped secondary which supplies from 2 to 40V A.C. to the filaments, and another winding supplying 30V and 100V, fed to the ANODE switch at REC and 100. Transformer T1A has three secondary windings :—

(a) One multi-tapped secondary, giving outputs from 12V to 350V, which are fed to the SCREEN and ANODE switches.

(b) L1, giving 1V output.

(c) L2, giving 20V output.

CONTINUITY TESTING

6. In parallel with the primary of T1A is a neon indicator N1A, which is in series with two 0.25 MΩ resisters, R10A and R10B. N1A is primarily a supply pilot lamp, but is also used for testing continuity. Between the two 0.25 MΩ resistors is switch S8A (Fig. 2) operated by insertion of a wander plug and lead in socket X. This breaks the circuit, but on inserting a second wander plug and lead in socket Y, the circuit may be completed by putting the two leads in contact. This may be used for testing continuity, e.g., between valve electrodes.

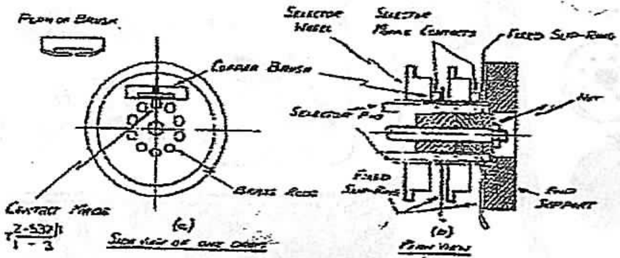

Fig. 3—Details of rotary switch

SWITCHING

7. From the valve data charts information may be obtained concerning the operating conditions for any specified valve. These are set up by adjustment of the SCREEN, ANODE and HEATER switches to the figures indicated. The contact arms of the SCREEN and HEATER switches are directly connected to the 9-pin socket. Except when testing for cathode-heater insulation, the contact arm of the ANODE switch is connected via a milliammeter M1A to one of four pins of the 9-pin socket by means of the SELECT ANODE switch S3A. Across the milliammeter (F.S.D. 0.7 mA), which indicates the anode current of the valve, is a universal shunt, the SET MA/V control, which varies the sensitivity of the meter. The section R1 of this control consists of two fixed wire-wound resistances mounted separately from R4A.

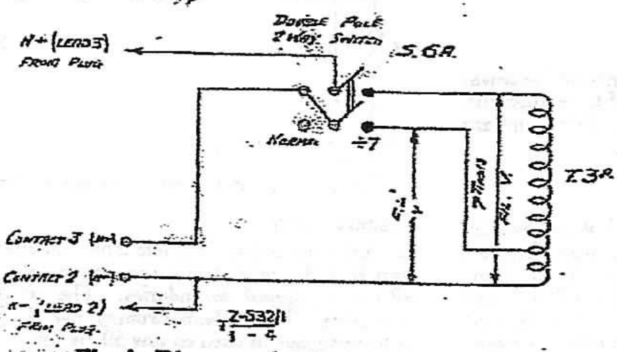

Fig. 4—Diagram of ÷ 7 auto-transformer

8. Having fitted the valve in its appropriate holder on the subsidiary unit, it is now necessary to supply the pins of the valve base with the voltages already selected on the main unit. This is done by means of the rotary selector switch S7 situated on the subsidiary unit. This switch consists of nine sections on a common axis, each of which may be rotated independently. The appropriate setting of each section for any given valve is obtained from a valve data chart. Each section is an ebonite drum carrying a copper brush (Fig. 3a) which can make contact with any one of the ten brass rods which run the entire length of the rotary switch. These rods are connected to the 9-pin socket. Since each section of the rotary switch is connected to one pin of every valve base, it is possible to apply any one of the selected voltages from the main power unit to the appropriate valve pin. There are nine outputs from the cable and ten possible outputs from any one section, which is achieved by feeding rods 0 and 1 in common from lead 1 (Fig. 7). From the foregoing it can be seen that all the supplies to the electrode of the valve are A.C., i.e., the valve will conduct only during positive half-cycles.

9. A special case arises where 1.4V filament valves are to be tested, as T2A gives a minimum of 2V for filaments. But close to the rotary switch, is fitted a special auto-transformer which is brought into circuit by the NORMAL ÷7 switch on the subsidiary unit. This has a 7 : 1 step-down ratio, and when the HEATER switch is set to 10V, the effective heater voltage is approximately 1.4V with the NORMAL ÷7 switch in the ÷7 position (Fig. 4).

MUTUAL CONDUCTANCE (DIODES-EMISSION)

10. Consider para. 1(b) and assume that all the valve supplies have been correctly adjusted—there must be some means whereby the grid potential can be changed ; preferably this change should be 1V since mutual conductance is MA/V. The grid potential is obtained from the 1V winding L1 on transformer T1A, which is centre-tapped to chassis. The ends of this winding are connected to the centre key switch S1A. This is a three-way switch, spring-loaded to its central position, as shown in Fig. 7. One end of the winding is thus connected to the grid of the valve, making it ½V negative with respect to the cathode when the valve conducts, i.e., when the anode goes positive.

11. On pressing the key to the MA/V position, the other end of the winding is connected to the grid, making it ½V positive with respect to cathode. Thus if the anode current is noted when the key is in the central position and subtracted from the value obtained when the key is in the MA/V position, the resulting figure is the change in anode current for 1V change in grid potential, i.e., the mutual conductance.

Set zero control

12. The SET ZERO control is used to obviate the necessity of having to make a calculation every time a mutual conductance is made. The 20V winding L2 on transformer T1A feeds a potentiometer which forms part of the SET ZERO control. The other part of the control is a series resistor, ganged in such a way that the backing off potential network presents an approximately constant shunt across the meter circuit. By use of the SET ZERO control any potential up to 20V A.C. may be selected ; this supply is rectified by the metal rectifier and is fed in opposition to the valve anode current. When the centre key is in the central position, the grid of the valve is ½V negative to cathode and the valve passes current. On adjusting the control, a current is fed in opposition to the valve current until the meter reads zero. On pressing the key to MA/V, the grid becomes ½V positive relative to cathode, i.e., an increase of 1V, and the valve

passes more current, and this increase is shown by the meter. Since this increase in current is for a 1V change in grid potential, then the meter figure is a direct reading of mutual conductance.

Contacts	Position of centre key		
	MA/V	Central position	C.INS
AB	Open	Open	Closed
BC	Closed	Closed	Open
DE	Closed	Closed	Open
EF	Open	Open	Closed
GH	Closed	Closed	Open
JK	Closed	Open	Open
KL	Open	Closed	Closed
MN	Closed	Closed	Open
NP	Open	Open	Closed

Table 1—Operation of contacts by centre key switch S1A (Fig. 7)

Percentage efficiency determination

13. A further part of the mutual conductance test is the percentage efficiency determination. As seen in column 8 of the valve data charts, there are figures given as normal mutual conductance values for various makes of valve. To test the percentage efficiency, the SET MA/V control (the universal shunt) is adjusted so that the full scale deflection of the meter corresponds to the value given in column 8. Then, on pressing the centre key to MA/V, the meter will give a reading, which after being multiplied by 10 is the percentage efficiency of the valve (F.S.D. =100%).

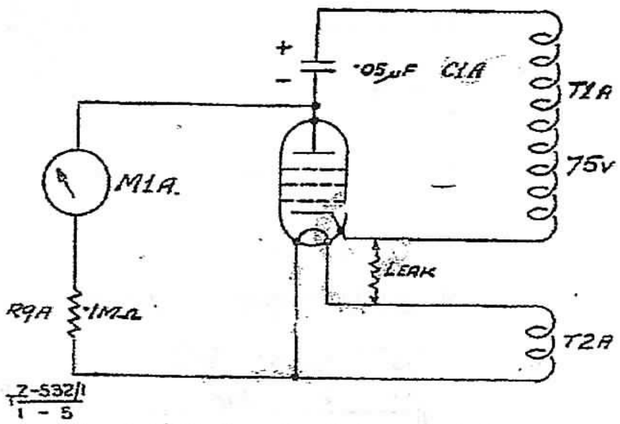

Fig. 5—Equivalent circuit for cathode-heater insulation test

CATHODE-HEATER INSULATION, HOT

14. Consider para. 1(c) and assume the valve to be in its correct holder (with correct settings of all switches and controls)—from Fig. 7 it can be seen that the equivalent circuit used in the cathode-heater insulation test is that shown in Fig. 5. The valve under test is being made to act as a rectifier and the 0.05μF condenser C1A will charge up from the 75V tapping on the main winding of T1A. Any breakdown in cathode-heater insulation will cause the charge on the condenser to leak away through the meter, which will indicate the value of the discharge current. If insulation is good, little, if any, movement of the meter pointer will be observed; the meter dial is calibrated in terms of MΩ insulation (lower black scale).

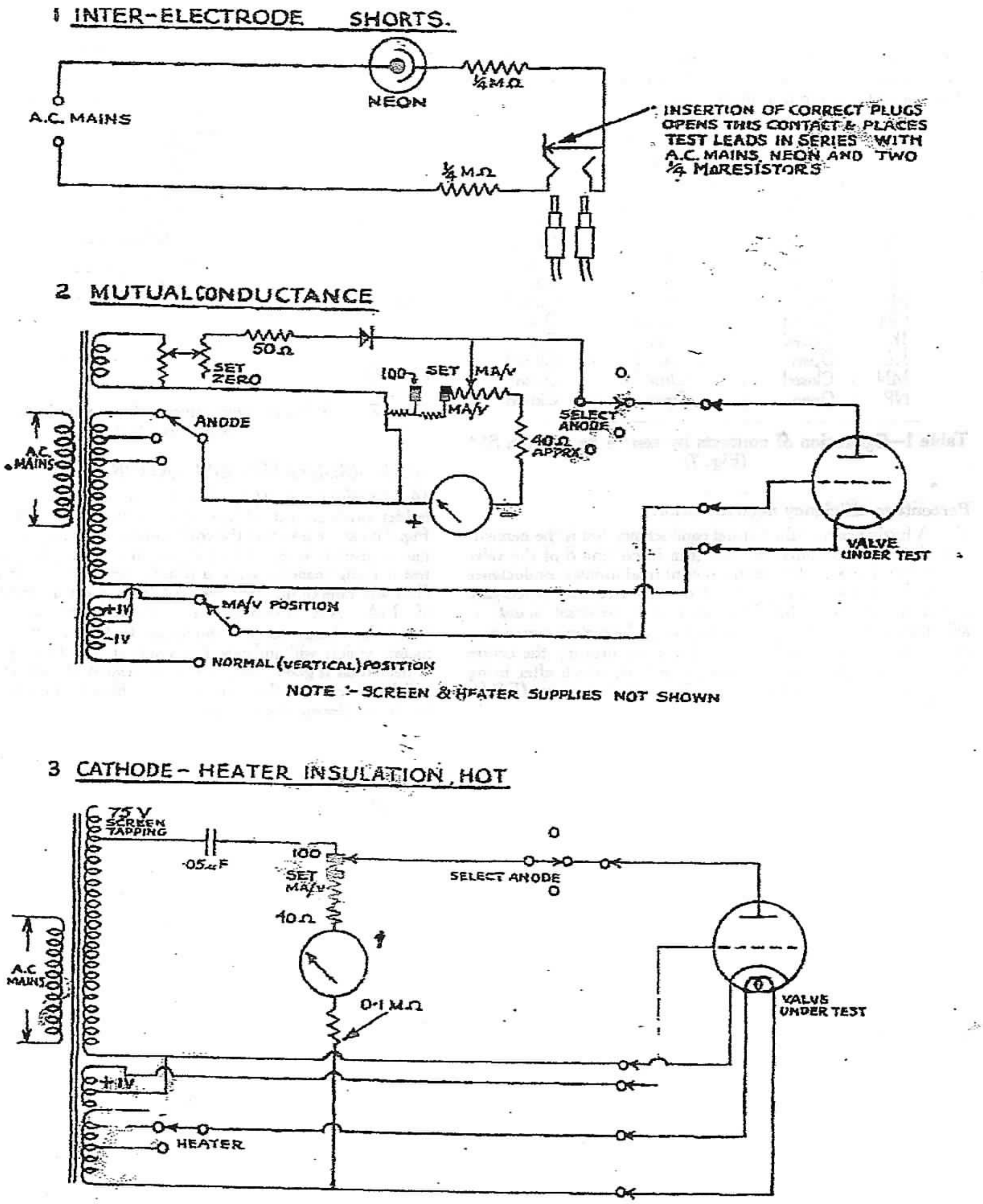

Fig. 3 — Simplified circuits