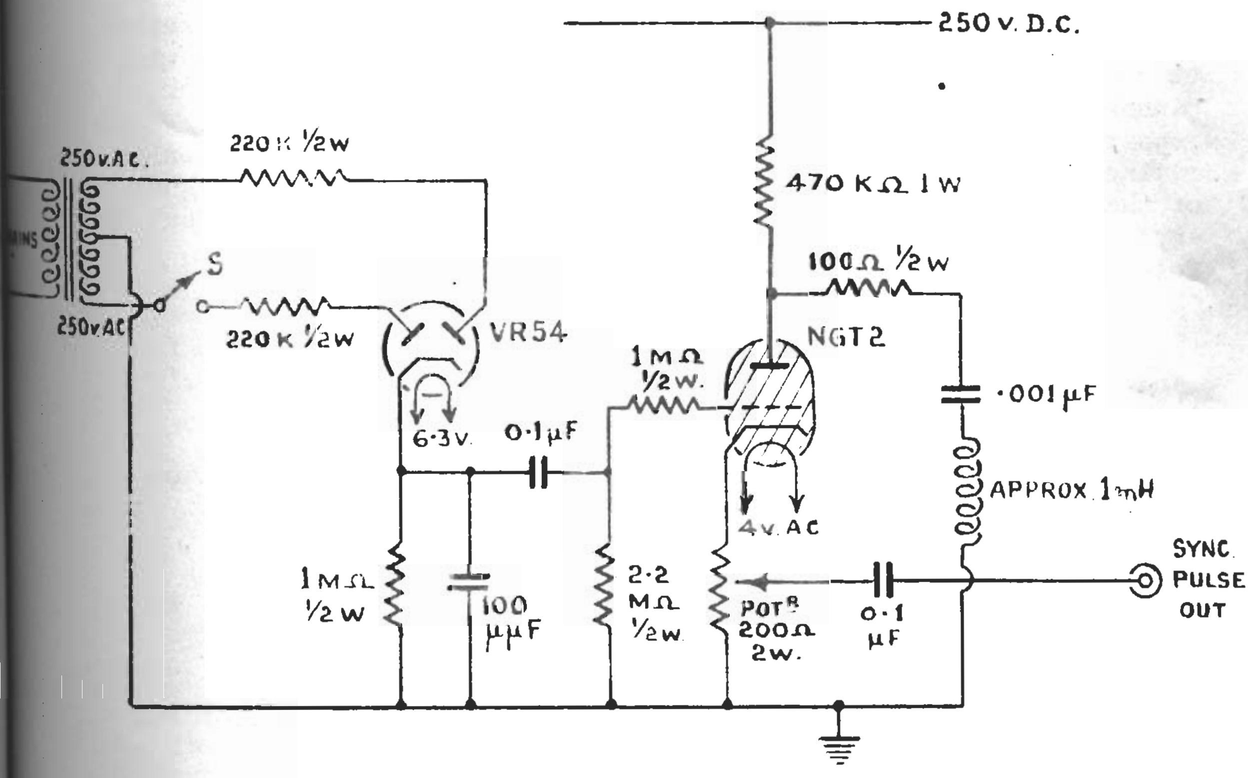
A SIMPLE SYNC PULSE GENERATOR

In servicing and setting-up display equipment a sync pulse is usually required to trigger time-bases, etc. By means of a simple thyatron circuit of the type shown below, a suitable pulse (locked to the mains) may be obtained independently of the Radar Transmitter, a facility which will often be found useful. With the circuit shown, a positive pulse of amplitude 0 - 30 volts, width approximately 3 microseconds, is obtained across 200 ohms. The repetition rate will be 50 or 100 per second if the unit is supplied from the 50 cycle mains, and 500 or 1000 per second if it is supplied from the 500 cycle mains.



When the switch S is open the repetition rate will be 50 or 500; when it is closed, 100 or 1000.

A damping resistance of 1 - 10k. across the inductance may improve the pulse shape. If desired, a phasing network could be introduced between the transformer and the double-diode.

REPORT OF DEFECTIVE RADIO EQUIPMENT

In civilian life if a purchaser of a wireless set is dissatisfied with its performance or if some part of the set burns out, he immediately complains to the man who sold it to him. He in turn, knowing that he will never make a living by selling inferior equipment, passes the complaint on to the manufacturer who has a special department to deal with all complaints and to ensure that some action is taken to rectify them. That is the chief reason why broadcasting sets obtain such a high degree of freedom from breakdown.

In September 1943, a procedure was brought into force at Admiralty Signal Establishment which instituted a similar service for naval radio equipment and Form S.1183 "Report of Defective Radio Equipment or Component" was made available to the users. The number of reports on these forms has been disappointingly small and it will be readily appreciated that in a great many cases definite action cannot be taken to replace components unless we have plenty of reports of their breakdown. It is thought that officers and senior ratings may be unaware of A.F.O. 4136/43 and that those who do know of the existence of this Form are expecting to be supplied without any action on their part. Paragraph 5 of this A.F.O. reads as follows:

> "Ships and Establishments are to demand copies required from the R.N. Store Depot, Eleveden Road, Park Royal, N.W.10."

> Note: The Forms are made up in books of 50 Forms in triplicate and instructions for filling them in are printed on the outside cover.

SO PLEASE LAY IN A STOCK OF FORMS AND LET US HAVE YOUR COMPLAINTS AS SOON AS POSSIBLE.

SPREADING THE BUZZ

A.S.E. does its best to weed out weaknesses and incorporate improvements and usually issues the necessary instructions by Fleet Order, but information of a technical nature, such as modifications, still takes a painfully long time in small ships to filter down to the chap who has to do the work - the Radio Mechanic. To ensure that such information is used at the earliest possible opportunity, Flotilla, depot ship and base maintenance officers are urged to do everything they can to ensure that the mechanics in the ships they visit do know about all the latest A.F.O.'s relevant to the sets they have to maintain.

AVOMETER PATTERN 47A

In the course of a repair, it was necessary to trace the circuit of an Avometer Pattern 47A. The information obtained is given here in case others are confronted with an Avometer Breakdown.

GENERAL

The complete circuit is given in Fig. 1. and the disposition of the various components is given in Figure 2. Component values and explanations are given below.

Components.

R1 = 0•020 ohms Meter circuit resistance = 20•0 ohms = M.
R2 = 0•181 ohms
R3 = 1•809 ohms
R4 = 18•09 ohms

R5 = 180 ohms R5 + M = 200 ohms.
R6 = 1800 ohms R6 + R5 + M = 2000 ohms.
R7 = 17•6 Kilohms.
R8 = 400 ohms. R8 + R7 + R6 + R5 + M = 20,000 ohms.
R9 = 59•7 Kilohms.
R10 = 400 ohms R10 + R9 + R8 + R7 + R6 + R5 + M = 80,100 ohms.
R11 = 120 Kilohms. R11 + R10 + R9 + R8 + R7 + R6 + R5 + M = 200,100 ohms.

R12 = 15 ohms.
R13 = 186 ohms
R14 = 1•05 ohms

R15 = 6•42 ohms
R16 = 10•00 ohms
R17 = 14•0 ohms

R18 = 189 ohms

P = 6•0 ohms
Q = 69 ohms
R = 2•15 ohms

S1 = Multi-point switch operated by cam on A.C. Selector. The contacts are as shown (1 to 2; 3 to 4; 5 to 6) except when selector is set to D.C., when contacts are 1 to 3; 5 to 7.

S2 = Switch operated by cam on D.C. selector. The contacts are open except when selector is set to any D.C. current range.

S3 = Switch operated by cam on D.C. selector. The contacts are open except when selector is set to 1 Kilohm range.

S4 = Switch incorporated in Q knob. In the normal position the contact is as shown, and the knob will not rotate. When measuring on the 100 kilohms range, the knob must be raised, which throws S4 over to its other contact, and rheostat can then operate normally.

S5 = Switch operated by button marked " ÷2". The switch is normally as shown, and it is thrown by pressing the button firmly.

T = Transformer. No data on this has been obtained.
B = Metal Rectifier Bridge.
MR = Metal Rectifier connected as shown directly across meter.
E = $1\frac{1}{2}$v. cell.

The resistances were measured with a "bridge-megger" the selectors being set so that the meter was isolated. For resistors R15, R17, and P rheostat S5, the ÷2 button had to be pressed whilst measuring the resistances, to isolate the Avo-meter. Resistance R1 was not measured, but calculated from the others.

All resistors except R1, R11, (and possibly R17) are wire-wound; the first winding of each is made with slightly too high a resistance, and a copper wire from one end is then lapped along the winding till the correct value is obtained, and this shorting wire soldered in position. R11 is wound with extremely fine wire, and is made with slightly low resistance. If it is within 1% of specification, it is accepted; if its resistance is more than 1% low, a 2000 ohm $\frac{1}{4}$ watt carbon resistor is added in series, so that the total resistance is less than 1% high.

Further details of components are given below:-

OVERLOAD RELAY

This is mechanically operated. If the needle is caused to swing hard past the full scale position, a cam on the movement releases a light spring clutch which normally holds the contact marked "cut-out" on the circuit diagram in the closed position. Depressing the "cut-out" knob after release re-sets the clutch mechanism. (See note (1) at end).

It is clear that the current flows during the time taken for the needle to travel across the scale and operate the cut-out mechanism. Normally the cut-out is sufficient safeguard, but with very excessive currents this time required for the relay to operate may be sufficient to cause damage.

METER CIRCUIT

This is shown in Fig. 3.

Evidently R15 is a ballast resistance, adjusted to make R15 and meter in series have a total resistance of 20·0 ohms. (R15 probably also acts as a swamping resistance to reduce the temperature coefficient of resistance of the moving coil).

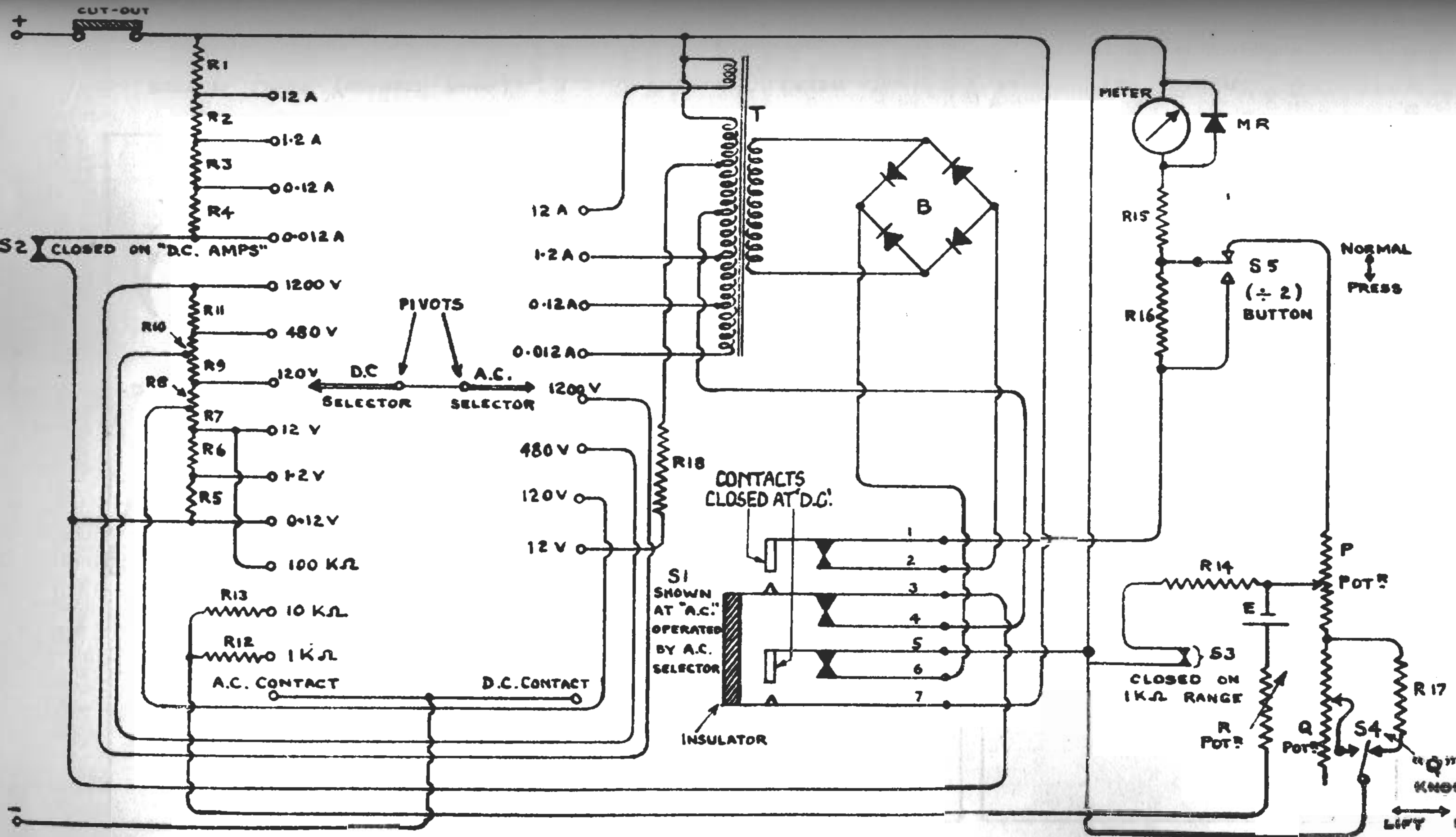
With S5 in the normal position, the meter is shunted by 20 ohms (giving half sensitivity and 10 ohms resistance), and the total resistance is restored to 20 ohms by R16. When S5 is depressed the shunt is removed and R16 shorted, giving again 20 ohms but with full sensitivity (3 mA. full scale.)

The metal rectifier MR is a protection against the application of A.C. when the meter is set to a D.C. range. Without MR no deflection would result, and a heavy overload could be applied. But MR effectively shorts the meter for the negative half cycles, so that the meter receives only the positive half cycles, and hence deflects. In this way an overload can cause the meter to swing past the full scale position and operate the overload relay. (See note (1) at end).

D.C. CURRENT CIRCUIT.

This is shown in Fig. 4 where the shunts and series resistance of the meter, dealt with above, are omitted for clarity.

It can be seen that if R4 burns out, readings will only be obtained on the 0·012A range (and these will be wrong). If R3 burns out, the same deflections will be obtained on the 0·12A and 0·012A ranges, and none on the others. Similarly it can be told immediately whether R2 or R1 has burnt out, by observing which ranges work, and whether their deflections are the same or not.



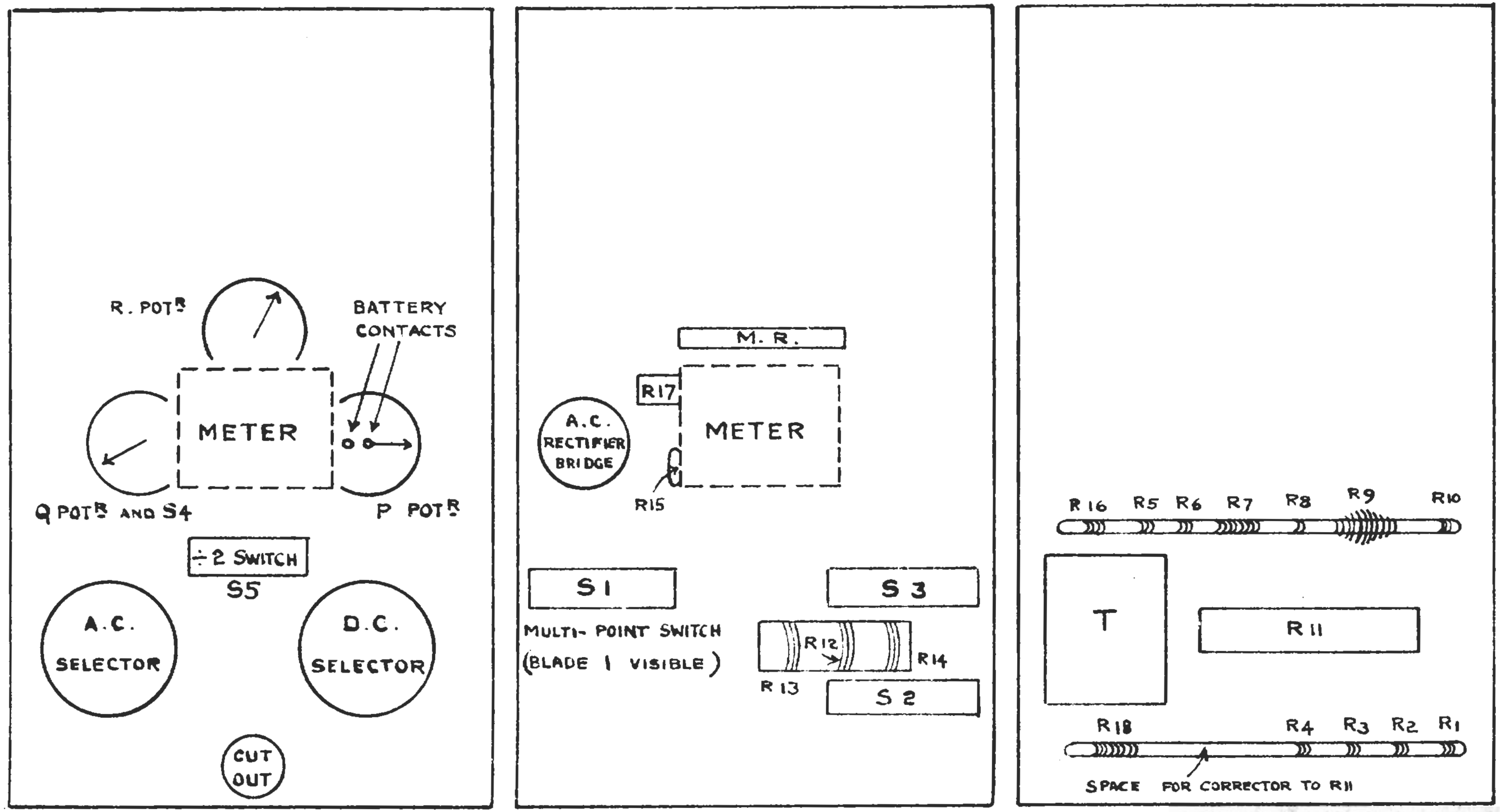
CIRCUIT DIAGRAM

FIG. 1.

AVOMETER PATT 47A

VIEW FROM BACK

FIG. 2.



BOTTOM LAYER (NEAREST PANEL) MIDDLE LAYER TOP LAYER

D.C. VOLTAGE RANGES.

These utilise resistances R5 to R11 in series and a break in any of these can be detected by observing which ranges work. In this case those ranges which continue to work will indicate correctly.

A.C. VOLTAGE RANGES.

The upper three of these use the same set of series resistors as for the D.C. voltage ranges. Thus if the D.C. voltage ranges work but not the A.C., the trouble must be in the transformer T or bridge B (or switch S1, which is unlikely), and not in the resistors.

The A.C. current ranges may yield information on which (if any) of the transformer tappings have failed. If the readings can be obtained on any one A.C. Range the bridge B and transformer secondary must be working.

RESISTANCE RANGES

The 1 kilohm and 10 kilohm resistance ranges are operated by a $1\frac{1}{2}$v. cell contained in the meter case. It is important to notice that the current flows out into the resistance under test from the terminal marked −, and into the meter again through the terminal marked +. In other words, the potential applied to the resistor under test is of opposite polarity to that marked on the terminals. This is of importance if an Avo is used to test electrolytic condensers for breakdown.

The circuits employed are as shown in Fig. 5. For the 1 kilohm and 10 kilohm ranges it should be noted that the current flows through S5 (the ÷2 button) as part of the main circuit. Depressing this button on these ranges will break the circuit completely.

On the 100 kilohm range knob Q should be raised and turned to correct the zero for the applied voltage. S5 connects a variable shunt (variable by a potentiometer Q) across the meter, so that depressing this button will remove all control over the setting.

Finally it might be mentioned that if switch S3 failed to operate, on the 1 kilohm range, or if R14, were burnt out, a low value shunt which should be across the meter at this setting would be missing, so that excessive currents (and frequent tripping out of the overload relay) would result. This was occurring on one meter examined.

NOTES

(1) The description given is correct as regards overloads which give a more-than-full scale deflection or overloads which are applied slowly, In the case of a sudden overload the cut-out can be tripped by an "inertia" effect:-

The pointer is pivoted on a plate which is rigidly fixed to the moving coil, the pivot being away from the axis of rotation of the moving coil. It is normally held in fixed relation to the moving coil by a light spring pressing it in a direction of increasing deflection. When a sudden overload is applied, the current in the moving coil applies a sudden turning force which is, in turn, applied to the pointer by means of the light spring. If the force is sufficiently sudden, the inertia of the pointer prevents its movement, and the moving coil leaves the pointer behind. This means that relative motion takes place between the pointer and the moving coil. As a result of this motion, a projection on the "heel" of the pointer catches on an internally toothed rack which surrounds the movement and moves it in a clockwise direction. This rack, in moving, releases the cut-out.

(2) The forces which retain the relay are small, the operation depends on gravity to a certain extent. If the cut-out operates with the face of the meter vertical, it is usually necessary to turn the meter to "face horizontal" position, before re-setting the cut out.

(3) The presence of the Rectifier MR can cause some confusion. An experimenter once wanted to know if A.C. or D.C. was present in a lightning conductor. With the switch at A.C. there was no visible reading. With the switch at D.C. there was a deflection which did not change in direction with the reversal of the test leads.

Solution

A small amount of A.C. was present, and it happened that the meter was more sensitive to A.C. on the lowest current D.C. range than on the lowest current A.C. range, owing to the rectifying effect of MR.

(4) If a high resistance winding is burnt out, it can well be replaced by a carbon resistor. A resistor of too low a value is chosen and it is filed down until the resistance is correct. A coating of shellac can then be applied to protect the resistor from the effect of moisture.

(5) The above description refers to Pattern 47A. Model 40 (No Admiralty Pattern No.) differs from Pattern 47A in the following ways:-

(a) Two $4\frac{1}{2}$ volt internal batteries are connected in series in circuit when on the 100,000 ohms range. The 100,000 ohm contact of the "D.C." switch is, in this case, disconnected from the junction of R6 and R7 and is connected instead to the positive pole of this battery. The negative pole of the battery is connected through a 1980 ohm resistor to the junction of R16 and R5.

(6) At one period, Model 40's were supplied to the Admiralty instead of Patt. 47A, and were marked "47A" with a letter "S" above the number. The instruction card on the back was still marked "Model 40".

(b) Some Patt. 47As are in cases marked Model 40 - the instruction card on the back is marked Patt. 47A.

AVOMETER PATT. 47A

D.C. CURRENT & METER CIRCUITS

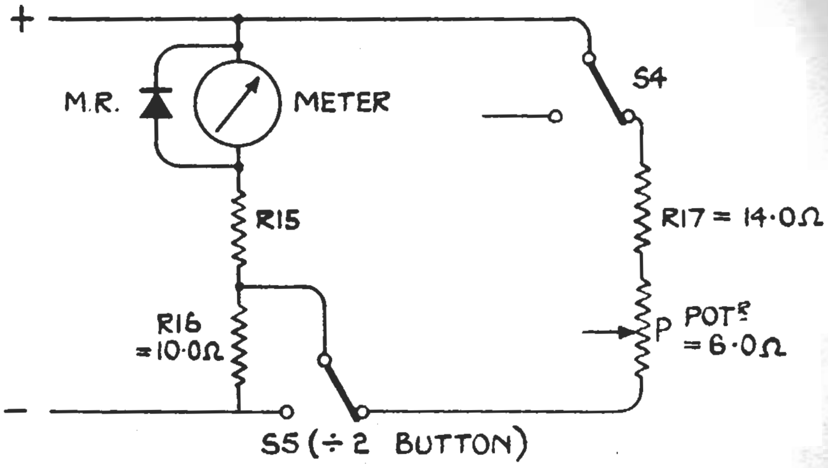


FIG 3

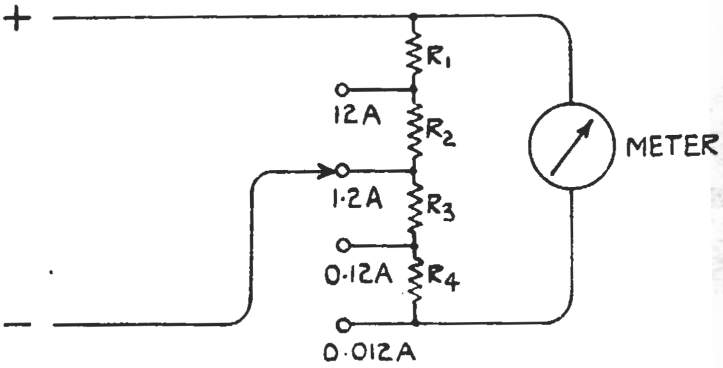


FIG. 4

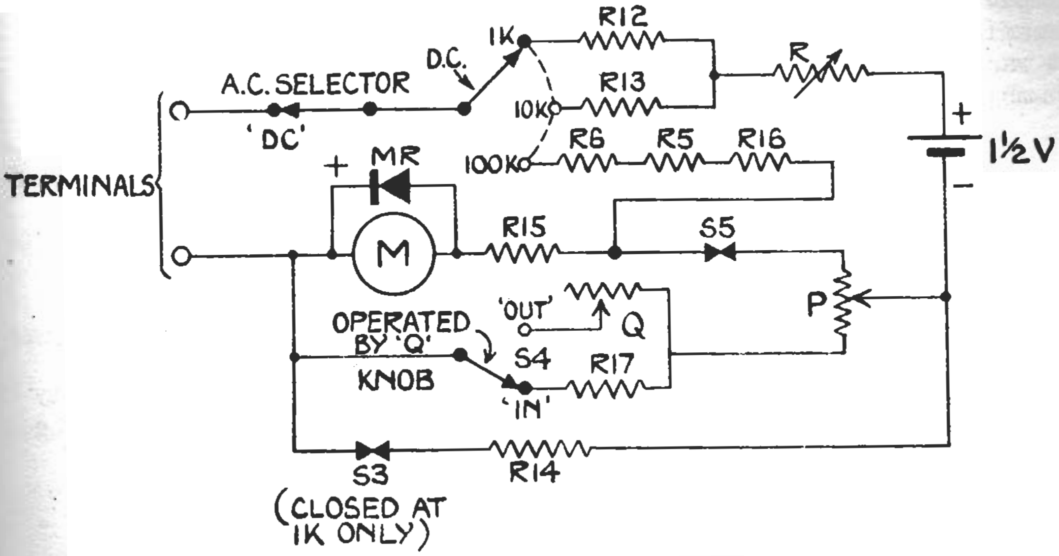


FIG. 5