



DETECTOR No. 4.

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THIS instrument has been evolved with a view to meeting the more stringent conditions due to the changes in the nature of telephone plant to be maintained and, at the same time, to provide a robust detector suitable for general maintenance purposes. The apparatus has been designated "Detector No. 4," and takes the form of a combined voltmeter and ammeter of the moving coil type. It may be regarded as a refinement of the familiar Detector No. 2.

In addition to the instrument itself, shunts and resistance coils or multipliers are provided for external connection by means of which the current and voltage ranges may be considerably

increased. A contact spike is also provided which, when not in use, is housed in a slot at the back. When required the spike is screwed into a socket at the base of the instrument. The spike facilitates the use of the detector in point-to-point testing such as D.P.'s across bolted connections and voltage of individual cells.

The illustration, Fig. 1, gives a general view of the detector together with the accessory resistances, shunts and spike.

The introduction of the compound switch permits of the necessary external connections being made by provision of only 4 terminals. The switch is of a novel character and is in the

form of a commutator and, contrary to the usual practice in switches of this nature, is so arranged that the "clicks" are between the "on" positions. The switch connections are

marked "common positive." Separate terminals are used for current and voltage readings,

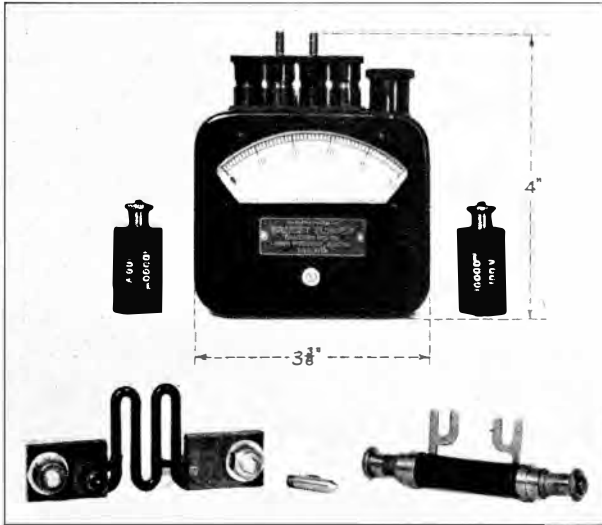


FIG. 1.—GENERAL VIEW OF DETECTOR No. 4 AND PARTS.

thereby made by rubbing contacts which ensure good connection. A margin of operation is also allowed on either side of the switch point. The switch and terminals are shown in Fig. 2.

No. 2 terminal is common to all tests and is

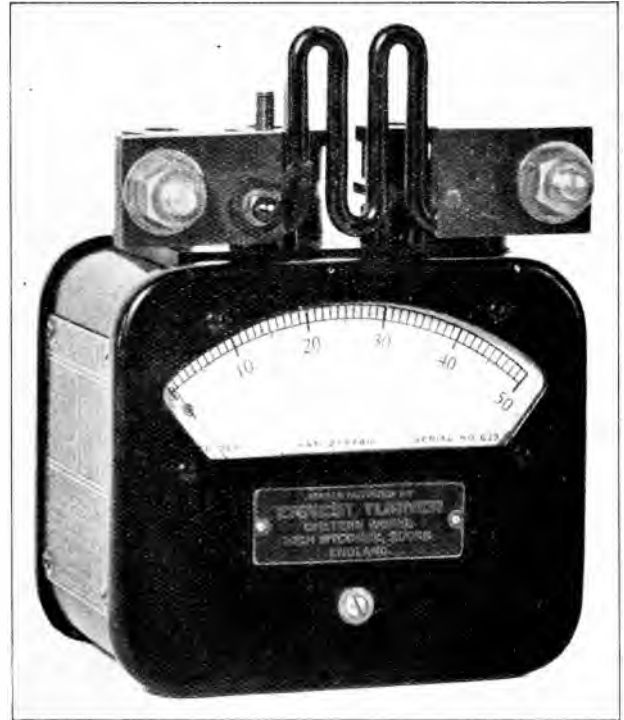


FIG. 3.—DETECTOR WITH 25-AMP SHUNT FITTED.

while the fourth gives connection direct to the moving coil circuit through a fuse.

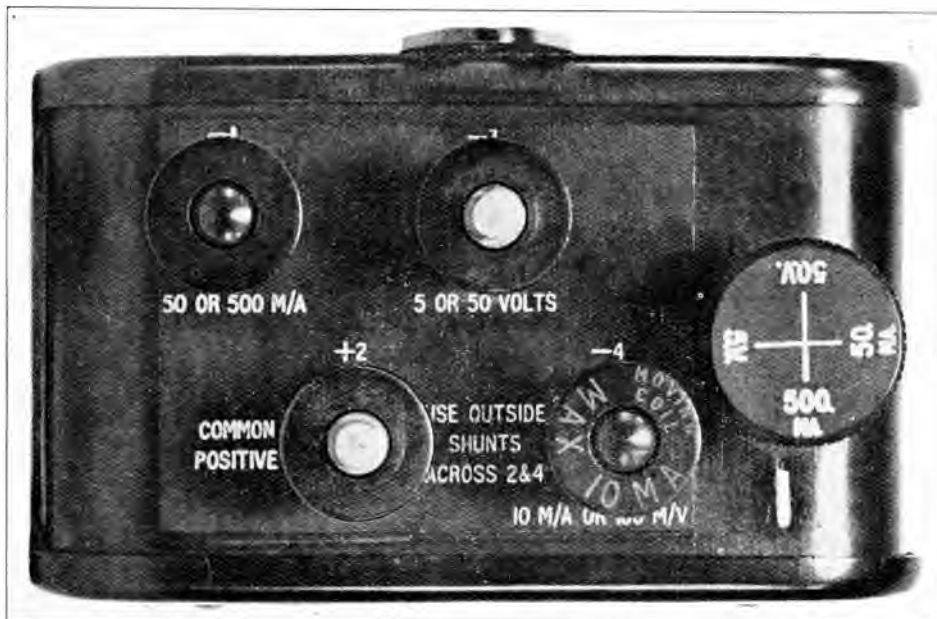


FIG. 2.—PLAN OF TOP, SHOWING TERMINALS.

An interesting feature which conduces to the sensitiveness of the instrument is the low resistance of the moving coil circuit, *i.e.*, 10 ohms, which is made up as follows:—

Moving coil (copper wire) ...	3.00	ohms.
Two hair springs (phosphor bronze)	1.30	„
Fuse (Eureka)	0.70	„
Series resistance (manganin)	5.00	„
	<hr/>	
	10.00	„
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FIG. 4.—DETECTOR WITH BOTH MULTIPLIERS FITTED ON TERMINAL 3.

The make-up of the circuit results in a low overall temperature coefficient; the error due to

temperature variation as an ammeter or voltmeter is 0.13% per degree Centigrade as against 0.427% were the circuit made up of copper wire. When used as a voltmeter the temperature variation is, of course, negligible.

The equipment of shunts and resistances consists of one 5A and one 25A shunt and two 10,000-ohm multipliers.

The shunts are so designed that they may conveniently be fitted across the moving coil terminals Nos. 2 and 4. Fig. 3 illustrates the 25A shunt fitted.

The multipliers may be screwed together in series and the threads of terminals Nos. 2 and 3 are elongated to accommodate one or both, depending on the range required. Fig. 4 shows both multipliers fitted to terminal No. 3. Terminal No. 2 should preferably be used for this purpose if the negative pole be earthed and terminal No. 3 if the positive pole be earthed, the reason being, of course, that it is desirable when working with the higher voltages that the internal connections of the instrument should approximate to earth potential.

A full scale deflection is given with 10 mA and the ranges of the instrument are given in the following table:—

Range.	Terminals.	Value per division.	Resistance in ohms.	Shunts and resistances in use.
<i>Current.</i>				
0—10 mA	2 & 4	0.2 mA	10.00	Direct on moving coil.
0—50 mA	2 & 1	1.0 mA	12.00	Internal shunt.
0—500 mA	2 & 1	10.0 mA	1.47	Internal shunt.
0—5 A	2 & 4	100.0 mA	0.0199	External shunt.
0—25 A	2 & 4	500.0 mA	0.004006	External shunt.
<i>Volts.</i>				
0—0.1 v.	2 & 4	.002 v.	10.00	Direct on moving coil.
0—5 v.	2 & 3	.100 v.	500.00	Internal resistance.
0—50 v.	2 & 3	1.000 v.	5000.00	Internal resistance.
0—150 v.	2 & 3	3.000 v.	15000.00	External resistance.
0—250 v.	2 & 4	5.000 v.	25000.00	External resistance.

The compound switch has four positions, which are 50 mA, 500 mA, 5 V and 50 V respectively. When multipliers are used the

switch should be in the 50 V position. When external shunts are used the switch should be in

and 25 A and between 2 millivolts and 250 V, a comprehensive range which renders it capable of performing a variety of tests.

When used as a voltmeter the resistance is 100 ohms per volt. In exceptional cases where readings of over 250 volts may be required the range may, of course, be increased by 100 volts or upwards by the addition of the requisite 10,000 ohm multipliers. The voltage readings are to the Grade 1 standard, which is considered essential in view of the importance of the tests required to be carried out.

The internal connections are given in Fig. 5 and the theoretical connections in Fig. 6, which are self-explanatory.

The zero may be adjusted by means of the screw provided. An instruction plate, giving particulars of scale readings and terminals to be used, etc., is mounted on the instrument. The case is of brass, black japanned, and the overall dimensions are 4" x 3 3/8" x 2" deep. The detector is accommodated in a leather case, which is slotted to permit of readings being taken without the instrument being removed, and is fitted with a shoulder strap. An additional leather case is provided for the external shunts and multipliers.

The moving system operates on dead hard steel pivots, which are coned with rounded

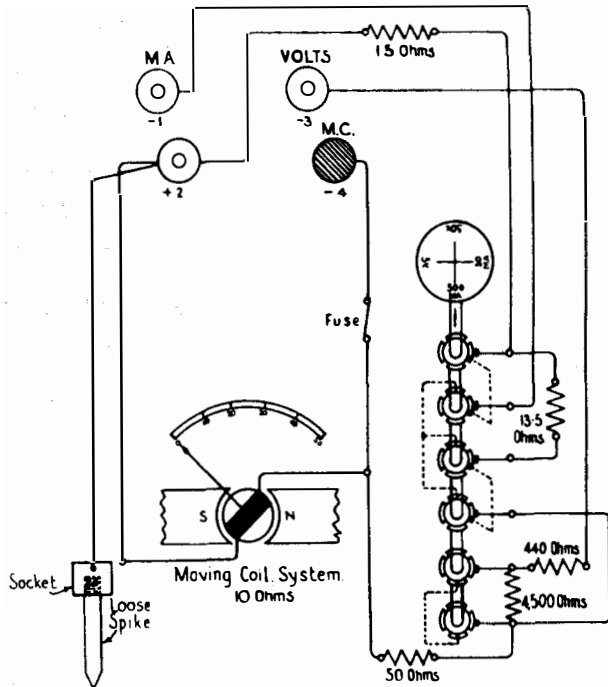


FIG. 5.—INTERNAL CONNECTIONS OF DETECTOR.

either volt position. It will be seen that the range of the instrument lies between 0.2 mA

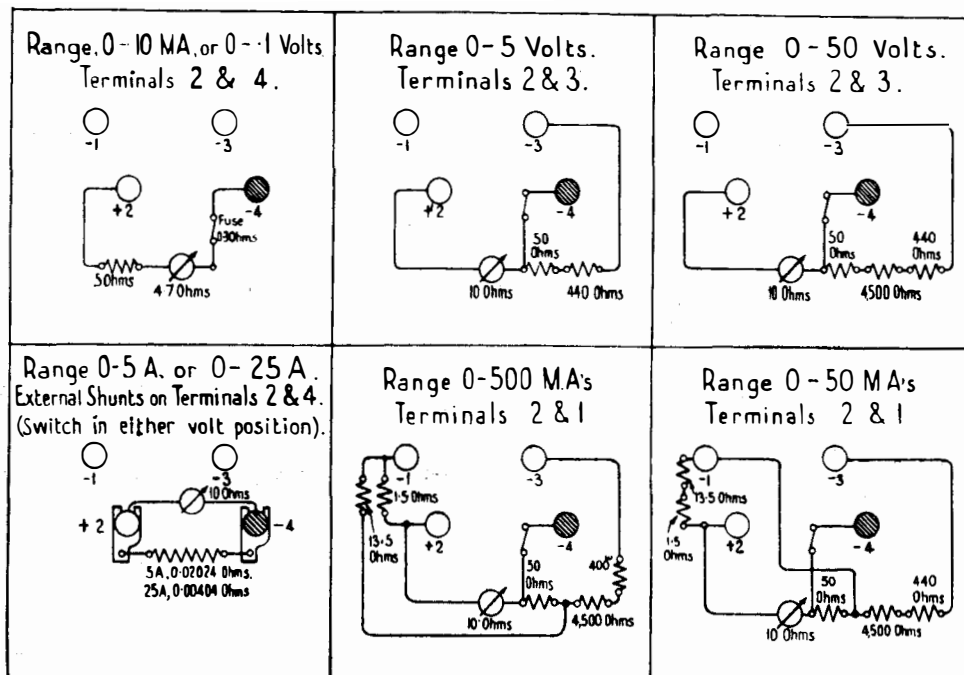


FIG. 6.—CONNECTIONS BETWEEN TERMINALS IN VARIOUS POSITIONS OF SWITCH.

ends polished under a microscope. The pivot holes are fitted with sapphire jewels. The hair springs are made of phosphor bronze. The frame former is of insulated silver and is wound with copper wire of 5 mils diameter, insulated with single silk and baked in bakelite. The fuse wire is of 2 mils Eureka, which will fuse at 0.5 amperes, the fusing point of the moving coil being approximately 3 amperes. The external shunts are made of manganin wire and are carefully calibrated and interchangeable. The magnet is well aged and the scale accurately divided. The instrument is sufficiently robust to withstand all the ordinary use and most of the occasional abuse which portable instruments are more or less bound to receive. In this connection it is of interest to note the very light weight of the moving system, including the two hair springs, which is 0.7 gram or 10.801 grains as compared with the weight of the instrument which is 1 lb. 10 ozs. Altogether by its sensitiveness, wide range and adaptability it provides an efficient testing instrument

eminently suitable to meet the many and varied requirements in the maintenance of telephone and telegraph apparatus, among which the following may be enumerated:—

Low P.D. tests of power board and secondary cell bolted connections; fuse and switch connections. Tests of main earth connections.

Cable sheath current tests.

Tests of high voltage batteries used in conjunction with Repeater and Wireless Stations and Precision testing.

Secondary Cell discharge readings.

Resistance of power leads.

Internal resistance of Primary Cells.

Automatic exchange maintenance.

Maintenance of Baudot and other machine Telegraphs.

Checking calibration of power board instruments.

It is also suitable for panel mounting on power boards.

TELEGRAPH AND TELEPHONE PLANT IN THE UNITED KINGDOM.
TELEPHONES AND WIRE MILEAGES, THE PROPERTY OF AND MAINTAINED BY
THE POST OFFICE IN EACH ENGINEERING DISTRICT AS AT 31ST MARCH, 1927.

No. of Telephones owned and maintained by the Post Office.	Overhead Wire Mileage.				Engineering District.	Underground Wire Mileage.			
	Telegraph.	Trunk.	Exchange.	Spare.		Telegraph.	Trunk.	Exchange.	Spare.
534,497	541	4,130	52,189	243	London	23,309	60,933	1,936,599	114,257
65,951	1,876	21,656	62,112	1,589	S. East	3,869	40,352	151,433	15,370
69,932	4,465	29,497	49,603	2,413	S. West	16,300	8,964	124,403	55,943
54,938	6,836	33,685	47,772	4,315	Eastern	19,214	33,448	79,927	79,095
87,773	8,678	43,683	55,275	3,496	N. Mid.	22,960	44,982	202,055	124,476
67,323	4,784	28,598	65,048	4,005	S. Mid.	12,957	21,013	133,562	88,875
54,046	4,790	29,099	49,322	2,575	S. Wales	5,787	24,916	97,206	69,757
92,741	8,219	25,338	47,230	4,957	N. Wales	12,826	39,413	214,944	59,633
144,021	1,602	17,013	42,484	2,804	S. Lancs.	12,717	75,696	428,377	46,299
85,327	6,061	29,809	44,479	3,504	N. East	10,612	40,401	194,868	71,419
57,916	3,622	24,224	36,034	1,708	N. West	8,402	31,707	139,978	38,049
43,625	2,531	15,691	23,378	2,653	Northern	4,595	11,511	87,843	53,424
19,649	4,769	6,884	12,933	335	Ireland N.	128	1,977	36,491	718
59,928	5,296	24,310	35,648	1,223	Scot. East	2,863	10,074	138,092	49,955
81,199	7,365	24,098	41,161	838	Scot. West	12,172	24,287	207,897	35,512
1,518,776	71,435	357,715	664,668	36,658	Totals.	168,711	469,674	4,713,675	902,782
1,479,800	72,723	355,078	657,124	36,146	Figures at 31st Dec., 1926.	166,401	448,109	4,013,916	867,514