SECONDARY STANDARD FOR CHECKING D-C METERS

1. GENERAL

1.01 This section describes the Weston Model No. 622 Volt-Milliammeter per KS-8039.

1.02 This instrument is provided with the necessary voltage and current scales to facilitate its use as a secondary standard in checking the accuracy of d-c voltmeters, ammeters and milliammeters used in the telephone plant. The instrument is accurate within plus or minus a quarter of one per cent. of full scale deflection.

2. EQUIPMENT FEATURES

2.01 The meter and associated equipment is mounted in a bakelite case with a removable hinged cover. Shielding eliminates the effect of external magnetic fields. The overall dimensions of the case with the cover closed are approximately 7-1/2" x 8" x 4". The general appearance is as shown in Fig. 1.

2.02 The meter has a knife edge pointer and mirror scale. This scale is 6" long and has 150 lines with three rows of scale markings. The inner set of markings consists of 0 to 75 in red characters located between the mirror and the graduations. On the outerside of the arc formed by the graduations, markings of 0 to 150 and 0 to 300 are provided in black characters.

2.03 There is a row of four binding posts across the front of the panel. These are designated from left to right as follows: -, 50 MILLIVOLTS, 100 MILLIVOLTS and VOLTS-MILLIAMPERES.

2.04 To the rear of the - post is a multi-position dial switch designated MILLIAMPERES which establishes the several ranges for checking milliammeters and ammeters of not more than 3 amperes full scale deflection. A similar switch designated VOLTS and located to the rear of the VOLTS-MILLIAMPERES binding post establishes the several voltage ranges of the instrument. A small knob located in the middle of the panel affords means for setting the pointer accurately at the zero point of the scale.

2.05 To provide electrical damping of oscillations of the movable element and thus protect the instrument from damage due to mechanical shocks when it is closed and being carried or moved from place to place, a small push button is provided between the two millivolt binding posts. This push button is so located that when the cover is closed, it is depressed and operates contacts which short-circuit the winding of the movable element.

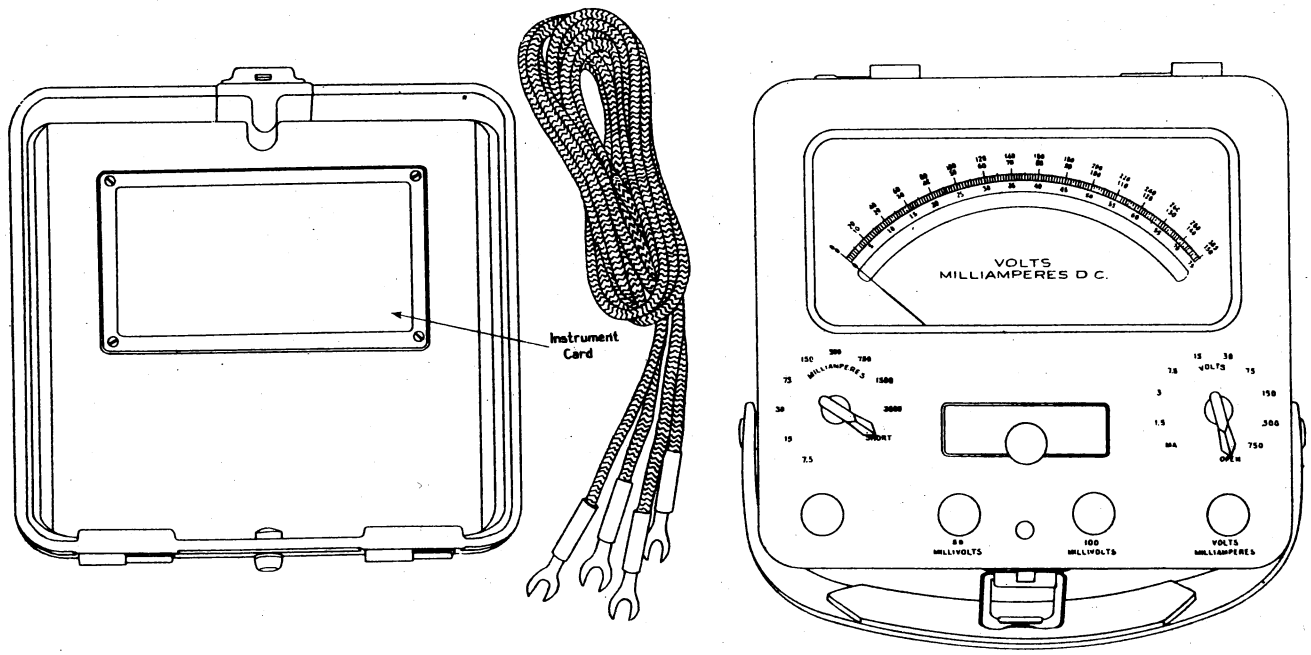

Fig. 1 - Weston Model No. 622, Volt-Milliammeter.

2.06 To facilitate setting the dial switches for the various test conditions and full scale ranges corresponding to the different settings, designations, as shown below, are engraved on the panel opposite each position of the pointer of each switch:

MILLIAMPERES	VOLTS
7.5	MA
15	1.5
30	3
75	7.5
150	15
300	30
750	75
1500	150
3000	300
SHORT	750
	OPEN

2.07 The 50 MILLIVOLTS and 100 MILLIVOLTS terminals are for use in checking instruments which, in conjunction with external shunts, are used to measure currents of more than 3 amperes.

3. CIRCUIT FEATURES

3.01 The voltage ranges have a resistance of 200 ohms per volt. The resistance of the 50 millivolts range is 10 ohms and of the 100 millivolts range 20 ohms, each of which includes the resistance of the leads furnished with the instrument. Thus, when sufficient current is flowing to cause a full scale deflection, the potential, as measured at the far end of the leads, is 50 millivolts in the case of the former range, or 100 millivolts in the case of the latter.

3.02 The dial switches are effective only when connections are made to the - and VOLTS-MILLIAMPERES binding posts and have no effect on the operation of the meter when tests require the connections to be made to the 50 MILLIVOLTS or 100 MILLIVOLTS binding posts.

3.03 The circuit arrangement is shown in Fig. 2.

4. OPERATING FEATURES

General

4.01 In order to minimize the danger of damaging the checking instrument by passing too much current through it when a low scale range is cut in, the practice should normally be followed of setting the VOLTS switch on OPEN and the MILLIAMPERES switch on SHORT before connections are made. Whenever circuits are involved in which there should be no interruption of

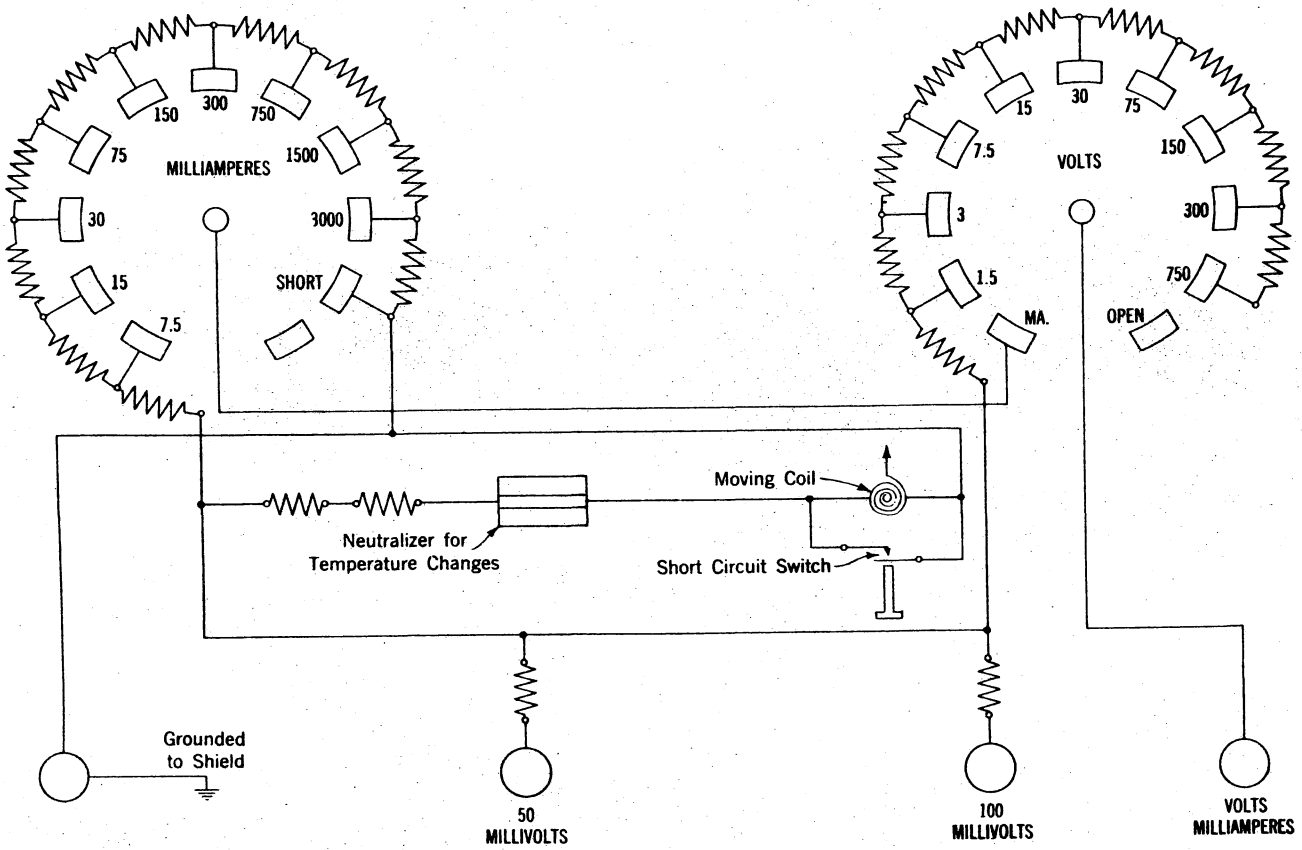

Fig. 2 - Circuit Arrangement of Weston Model No. 622 Volt-Milliammeter.

the current, however, it is essential that care be taken to see that there is a closed path through the meter before the short-circuit path bridging the meter (or meters) is opened (see 4.04).

Checking Voltmeters

4.02 When checking voltmeters, the checking meter is connected in parallel with the meter being checked. This is accomplished by connecting a lead from the - binding post of the checking meter to the - terminal of the meter under check and connecting the VOLTS-MILLIAMPERES binding post to the other terminal of the meter under check.

4.03 The VOLTS switch is then turned in a counter-clockwise direction until the setting for the desired scale range is reached.

Checking Milliammeters

4.04 When checking milliammeters, the checking meter is connected in series with the meter being checked. The VOLTS switch is set on MA. If it is necessary to avoid interrupting the circuit, a bridging path is provided to shunt out temporarily that portion of the circuit which must be opened to interpose the checking meter. In these tests, connections are made to the - and VOLTS-MILLIAMPERES binding posts of the checking meter and it is so poled that the current will flow through it in the same direction as through the meter being checked.

4.05 After verifying that the VOLTS switch has been set on MA and the MILLI-AMPERES switch on SHORT, the temporary bridge, if provided, is opened. The MILLI-AMPERES switch is then turned in a counter-clockwise direction until the setting for the desired scale range is reached.

Checking Ammeters

Ammeters with Full Scale Deflection Up to 3 Amperes

4.06 For ammeters up to a range of 3 amperes without external shunt, the checking meter is connected in series with the meter to be checked. When a meter of such range with an external shunt is to be checked, the checking meter is interposed into the circuit in series with the shunt. The dial switches are then set for the proper range, as covered in 4.05.

Ammeters With Full Scale Deflection Greater Than 3 Amperes

4.07 Ammeters with Internal Shunt: For checking ammeters of this size which are equipped with internal shunts, a 60 ampere, 100 millivolt portable testing shunt is used in conjunction with the checking meter. This portable shunt is not covered by the KS specification for the instrument. The portable shunt is needed only when it becomes necessary to check meters as covered in this paragraph. This shunt is connected in series with the ammeter to be checked, observing the precautions against interrupting the current, as covered in 4.01. The meter terminals of the shunt are connected to the - binding post and to the 50 MILLIVOLTS or 100 MILLIVOLTS binding post of the checking instrument, using the leads provided with this instrument. When the 50 MILLIVOLTS binding post is used, a full scale deflection of the checking meter indicates a current of 30 amperes. In this case, the deflections are read on the 0 to 300 scale and each line represents 0.2 ampere. When the 100 MILLIVOLTS binding post is used, a full scale deflection indicates a current of 60 amperes. Under this condition, deflections as read on the 0 to 300 scale, should be multiplied by 2 and the decimal point moved one place to the left in order to determine the value of current in amperes.

4.08 Ammeters With External Shunt: When ammeters are associated with external shunts they are checked as millivoltmeters. In this case the checking meter is connected, by means of its shunt leads, across the shunt of the meter being checked. In making the connections, the negative instrument terminal of this shunt is connected to the - binding post of the checking meter and the positive instrument terminal of the shunt is connected either to the 50 MILLI-VOLTS or to the 100 MILLIVOLTS terminal of the checking meter, depending upon whether the shunt associated with the meter being checked is rated 50 or 100 millivolts.

4.09 Use of Dry Cell and Variable Resistance: In cases where it is desired to check several points on the scale of an ammeter with an external shunt and it is not convenient to vary the current, an alternate procedure may be followed. This consists in disconnecting the meter leads from their shunt, and then connecting them in parallel with the shunt leads of the checking meter as in 4.08. A dry cell is used as a source of current and this is connected in series with a variable resistance such as a 35-type test set. The dry cell with the variable resistance in series with it is bridged across the two pairs of shunt leads, taking the place normally occupied by the associated external shunt of the meter being tested.

Note: When a dry cell is used, it is essential to exercise care that there is always sufficient series resistance so that the current flow through the instruments will not exceed the value for a full scale deflection. When a millivoltmeter is disconnected from its shunt, the voltage of a single dry cell imposed directly across its terminals may easily burn out the winding. About 300 ohms is needed to keep the current from 1 dry cell down to the capacity of the 50 millivolts scale. About 600 ohms is required for half scale and about 1200 ohms for a quarter-scale reading. Half these values would be sufficient for the 100 millivolts scale.