

NEW DEVICES

Ground Tester

As AN aid to the convenient testing of all types of grounds, the Copperweld Steel Company has recently placed on the market a simple, self-contained, direct-reading instrument, sold under the trade name "Direct-R" Ground Tester.

While the average accuracy of the "Direct-R" Ground Tester within its range (1-1,000 ohms) is said to be comparable with other accepted ground testing instruments, the "Direct-R" Ground Tester cannot be used for fractional ohm readings. It is intended to provide a simple instrument which will accurately indicate whether the resistance of a ground, to use one example, is ten, fifteen or fifty ohms. The complete test set is mounted in an oak case, 8.5 in. by 12 in. by 6.25 in., which contains the instrument itself, the 22.5-volt battery, two U-shaped Copperweld auxiliary ground electrodes, two 40-ft. test leads and one 10-ft. test lead. The entire set weighs only 9.5 pounds.

This instrument employs an adaption of the fall-in-potential method of measuring the resistance to ground of an electrode. With the

fall-in-potential method a current is caused to flow through the electrode under test and through an auxiliary electrode. By adjusting this current to a known value and then measuring the fall in potential to a second auxiliary electrode, the resistance to the ground of the electrode under test is determined by Ohm's law,

$$R = \frac{E}{I}$$

This ground tester is essentially a constant current device, that is, a constant value of current is allowed to flow through the electrodes regardless of resistance to ground; then from Ohm's law when I becomes a constant, R is proportional to E . Hence, the voltmeter can be (and is) calibrated directly in terms of resistance and can be read in ohms.

Only one meter is utilized in this ground tester, serving first as an ammeter, and then as a voltmeter which is calibrated in ohms instead of volts. The variable resistance is adjusted to cause a 50 milliampere current (I) to flow through the electrode and the earth. Then, by connecting the meter as a voltmeter, the fall in potential so measured (E) will be directly proportional to the resistance to ground of the electrode

under test (R). Since the resistance of the voltmeter circuit is extremely high in comparison to the resistance of the auxiliary ground, the actual value of this resistance has negligible effect on the meter reading. The effects of polarization, galvanic action, and stray currents are cancelled by means of the rotating polarity reversing switch (really a commutator) which simultaneously reverses both the d-c. potential (supplied by the 22.5-volt battery) and the meter. Stray alternating currents do not introduce errors in the readings.

In making a test measurement of ground resistance, the ground electrode being measured is connected to the binding post marked "Ground Under Test," using the 10-ft. test lead. Each of the two U-shaped auxiliary ground electrodes are pushed into the ground at a location approximately 40 ft. in opposite directions from the instrument, which is located in the vicinity of the ground being tested. The ground under test and the auxiliary grounds are all generally in line with each other, the latter being about 80 ft. apart. The auxiliary grounds are connected to the middle and the right-hand binding posts using the 40-ft. leads, it making no difference to which either is connected.

When everything is connected, the "Commutator" crank, shown to the right below the meter, is turned briskly in the clockwise direction at about two or three revolutions per second. At the same time, with the thumb of the left hand, the push-button marked "Push to Adjust," shown at the left at the bottom of the instrument, is held down, and with the fingers of the left hand, the knob marked "Adjuster," shown at the left below the meter, is turned until the meter pointer centers on the red line marked "Adjustment Setting." This cannot be seen in the picture, but would be a reading of 50 ohms, or the center of the meter scale. The button is then released and the "Commutator" crank is no longer turned. With the index finger of the left hand, the push-button marked "Push to Read Resistance," shown at the bottom right of the instrument, is held down and the "Commutator" crank again turned as before. The meter then reads the resistance of the ground under test directly in ohms when the multiplier switch, marked "Multiply by," shown at the bottom center of the instrument, is on the "Multiply by 1" position with a range of 0 to 100 ohms. On the "Multiply by 10" position, the range is from 0 to 1,000 ohms, and the meter reading should be multiplied by 10.

