GROUNDED TRANSMISSION MEDIUMS .- IV.

Stray Transmission.

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Electrolytically, the most important of the many phases of grounded return investigations is the securing of data relative to the amount of accidental transmission by means of auxiliary earthed conductors, such as water-pipes, gaspipes and cable sheaths; to obtain which several methods have been adopted. These can be roughly summed up under four headings, as follows:—

1. Amperes calculated from drops taken on two-foot lengths.

2. Amperes calculated from ampere and drop readings taken between distant points.

3. Amperes measured between the ends of a break in the accidental conductor.

4. Amperes taken experimentally in connection with plant laid especially for such purpose.

Of these four methods, the first is the most popular one; particularly with those corporations which are arranged on the opposite side to the traction interests. The apparatus required is a meter with fifteen and 150-millivolt ranges with its calibrated leads (preferably a duplex one, Richmond pattern; because such is useful in checking the Conant bondtester used in another branch of the investigations); a medium-sized rough file; a two-foot rule; a cold chisel and a chipping (machinist's) hammer. To use the apparatus, excavations about four feet long and wide enough to allow ingress and egress to the reader are made at various points of such a depth as to completely uncover the pipe or other earthed conductor to be tested. In each hole excavated, the conductor is cleaned at two places about two feet apart by means of the chisel and hammer followed by the file. Points two feet apart are then accurately laid off on such cleaned surfaces with the rule and the drop taken between such with the meter. When all the drops are taken and by use of a prepared table of the resistances of two-foot lengths of different sized pipes or cable-sheaths, the C is calculated by E

—, where E = the reading obtained and R = the resistance R

of the two feet. This popular method, whereby the two feet of metal in each case become a temporary shunt, has been more or less fully described by Maury in vol l., No. 4, p. 74 of Engineering News. For this class of testing, however, the writer prefers to use both sides of the duplex instrument by laying off two two-foot distances (three points), only accepting as true those duplex readings which simultaneously agree. This, because he has found that duplex readings so taken on cable-sheaths have not often agreed. Whether such disagreement was due to the imperfect contacts made by the lead terminals or to the use of the cables for alternating transmission can not, however, be definitely stated at present.

The second method, and, as a rule, most satisfactory one, consists in taking the voltage between two points and then immediately short-circuiting them and taking the voltage and amperage. The apparatus required is a light wagon, a reel, about 500 feet of flexible rubber-covered No. 6 B. & S. wire, the same length of electric light cord, a duplex instrument (ammeter and voltmeter), two single-pole doublethrow switches and four heavy iron clamps. About 475 feet each of the wire and the cord (which should have an inner insulation of rubber) are bound together at points about twelve inches apart by means of insulating tape and wound on the reel which is mounted between two upright castings similar to those which will be described in another article. On one of the flanges of the reel and around but insulated from the axle is secured a circular brass ring which makes contact with a brush so held by a brush-holder attached to but insulated from the frame that the brush will make good contact whether the reel is revolving in one or the other direction. The inner end of the cord is threaded through a hole bored in the flange, projecting a few inches beyond its edge. The outside ends of both the wire and the cord are connected in multiple to the bodies of two of the clamps by means of roundhead machine screws and copper burrs.

Fig. 17 is a sketch showing diagrammatically the arrangement of the switches and instrument, in which A is the duplex instrument with "two" and "twenty" ranges. The left side, in connection with the two shunts B and C, is used

as an ammeter; while the right side is used as a voltmeter. D is a single-pole, double-throw switch, to the middle point of which is connected thirty feet of the heavy wire. E is a small single-pole, double-throw switch, to the middle point of which is connected thirty feet of the flexible cord. To the outer ends of both the wire and the cord are connected in multiple the other two iron clamps. The remainder of the wiring can be traced out without any description.

The two shunts, the two switches, the calibrated leads and the instrument should be obtained from the instrumentmakers all mounted on one base; and on no account ought the makers to be directed as to one details. The method of making shunt connections is a question for the instrument expert only.

To install the apparatus, the reel is placed in the rear end of the wagon and the instrument portion mounted on a smooth plank attached to the side of the wagon which is protected by a canvas covering stretched on a light frame-



ig. 17—Diagrammatic Sketch of Arrangement of Apparatus for Measuring Stray Transmission.

work. From F (Fig. 17) is run a piece of heavy wire to the brush-holder; and from the binding-post G of the meter is connected a small piece of flexible cord long enough to reach to the end of the cord projecting beyond the edge of the reel.

To use the apparatus, the wagon is taken to a hydrant and the clamps from the reel attached to it. The driver is then instructed to go ahead to the next hydrant, to which the clamps from the shunt are attached. Care should be used by one of the attendants that the reel does not "run away with itself " when the wagon is moving. Both switches are then thrown down. If the readings are so slight that the lower scales would be preferable, the switches are thrown up instead. When the proper scales have been selected, the ammeter switch is opened and the deflection of the voltmeter needle watched until satisfactory and steady. Then, remembering this deflection, the ammeter switch is quickly closed and both deflections at once noted. The three readings are then entered as voltage before short-circuiting and as voltage and amperage after short-circuiting. To facilitate the entering of the readings, the reader is supplied with sheets similar to those shown in Fig. 18.

The hands required for the operation of the apparatus, excepting, of course, the expert in general charge of the investigations, are a college or other student of electricity at 1.50 per day; a driver at the local rate of pay; two strong active linemen (helpers) at 1.50 a day; and one bright boy at 50 cents a day. The work and data obtained should be, in his case, for the legal department. The wagon and the hands should report at the office at 8 a.m., and immediately

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