(No Model.) 3 Sheets—Sheet 1.

M. R. MUCKLE, Jr. & T. C. SMITH.

SWITCH BOX.

No. 422,244. Patented Feb. 25, 1890.

FIG. 1.

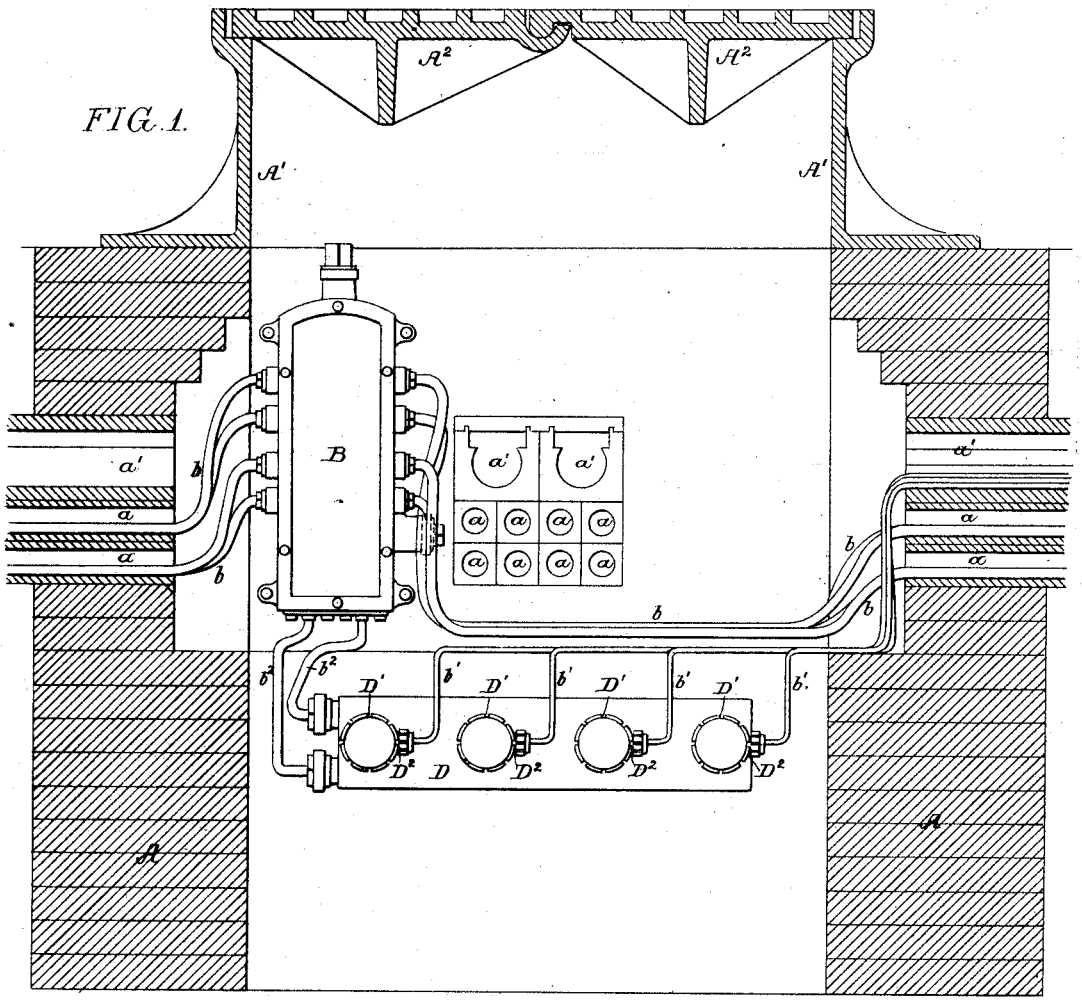
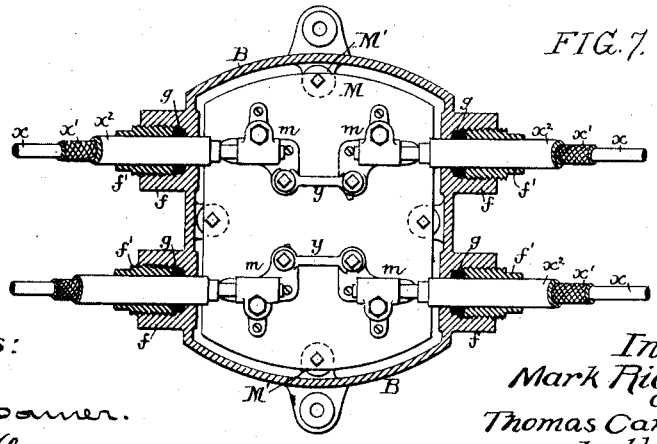


FIG. 7.



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(No Model.) 3 Sheets—Sheet 2.

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FIG. 3.

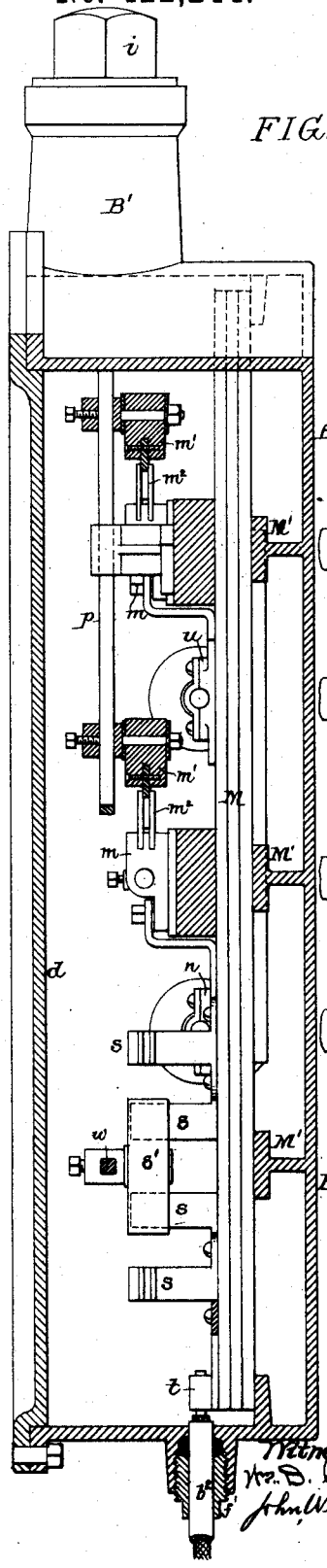
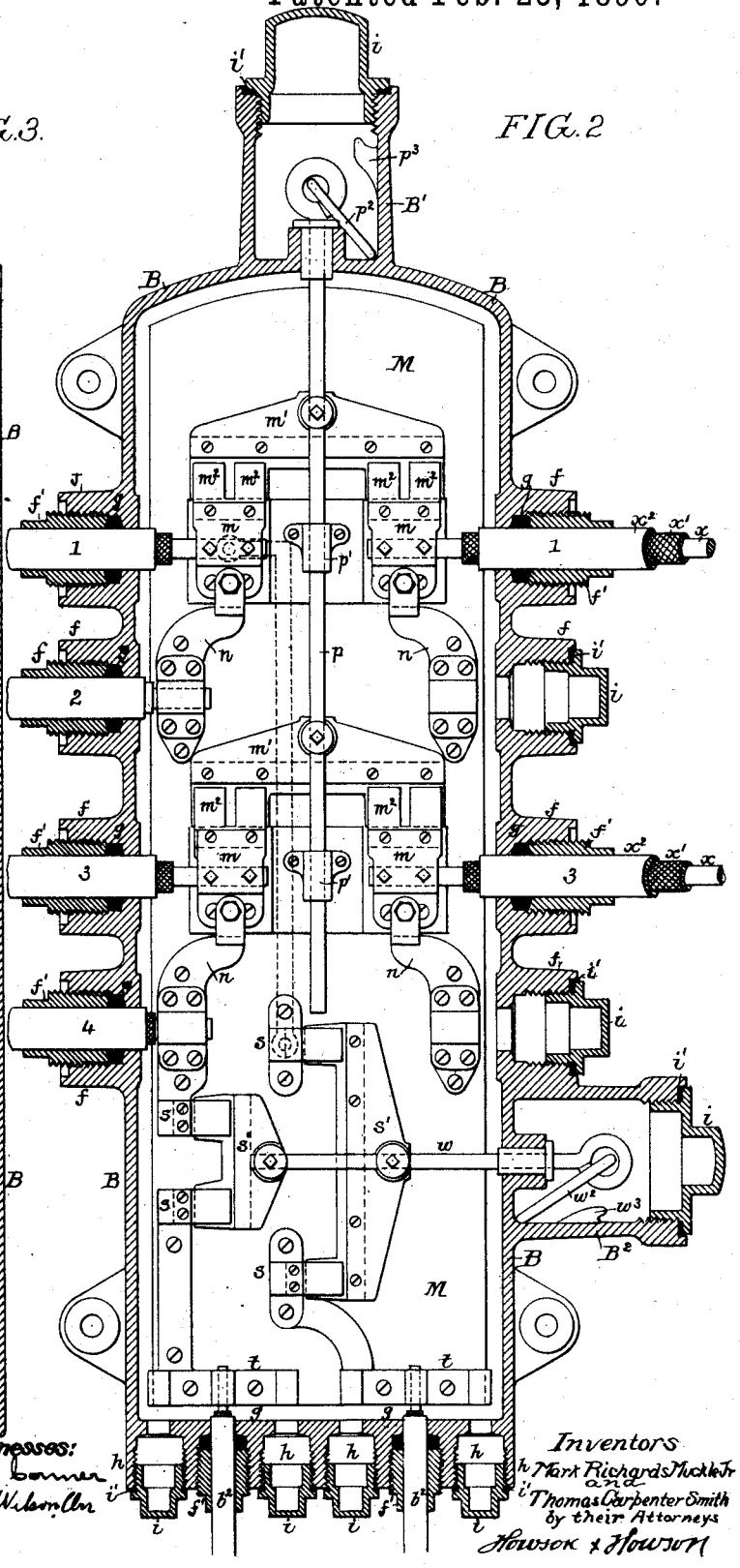


FIG. 2



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(No Model.) 3 Sheets—Sheet 3.

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SWITCH BOX.

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FIG. 4

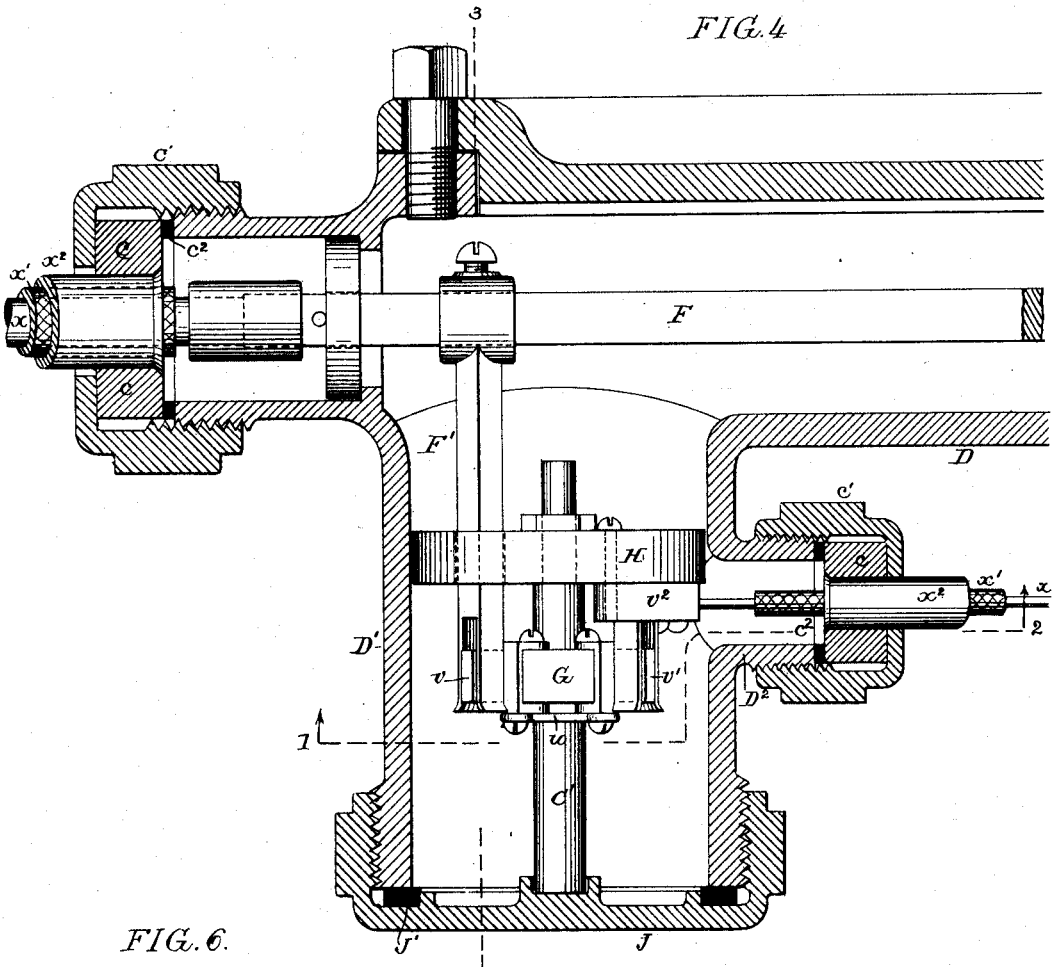


FIG. 6.

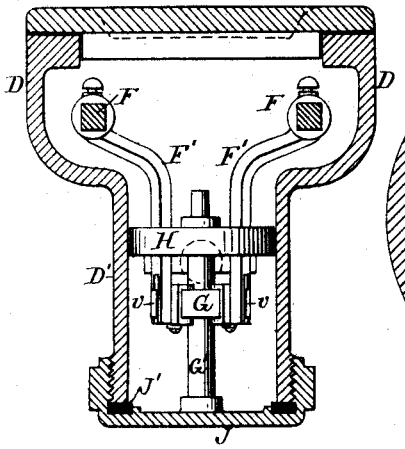
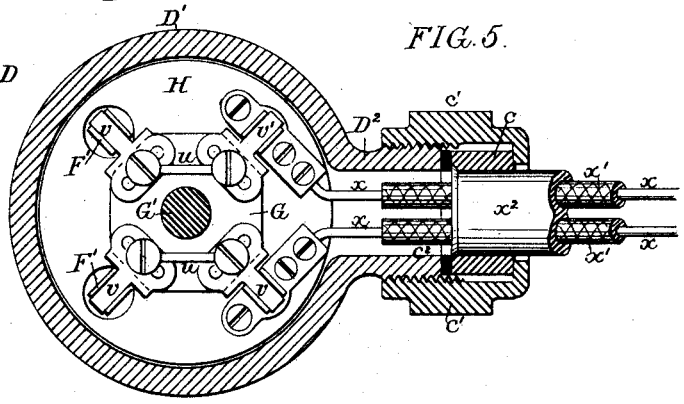


FIG. 5.



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UNITED STATES PATENT OFFICE.

MARK RICHARDS MUCKLE, JR., AND THOMAS CARPENTER SMITH, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNORS TO THEMSELVES AND JOHN S. MUCKLE, OF SAME PLACE.

SWITCH-BOX.

SPECIFICATION forming part of Letters Patent No. 422,244, dated February 25, 1890.

Application filed February 4, 1889. Serial No. 298,615. (No model.)

To all whom it may concern:

Be it known that we, MARK RICHARDS MUCKLE, Jr., a citizen of the United States, and THOMAS CARPENTER SMITH, a subject of the Queen of Great Britain and Ireland, both residents of Philadelphia, Pennsylvania, have invented certain Improvements in Connecting and Distributing Devices for Underground Electrical Systems, of which the following is a specification.

One object of our invention is to prevent grounding of line-conductors or short-circuiting of the current due thereto by reason of the access of moisture to the insulating material between the conductor and the outer protective covering or sheathing usually employed in underground electrical conductor systems, a further object being to effectively protect against the injurious effects of moisture, the connections, switches, cut-outs, etc., usually placed in the man-hole chambers of the conduit, and a still further object being to provide for readily and completely cutting out sections of a line, or for cutting out a series of house-connections from the main line or one or more house-connections of the series. These objects we attain in the manner hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a section of a man-hole chamber for an underground electrical conduit system with parts of the conduits and exterior views of the boxes containing our improved devices for making main-line and house connections, only one of each of these boxes being shown. Fig. 2 is an enlarged vertical section of the box containing the main connections. Fig. 3 is a transverse section of the same, partly in elevation. Fig. 4 is an enlarged section of part of the supplementary or house-connection box. Fig. 5 is a section on the line 1 2, Fig. 4. Fig. 6 is a section on a reduced scale on the line 3 4, Fig. 4; and Fig. 7 is a section of a modified form of main-line connection-box.

In Fig. 1 A represents the masonry lining; A′, the upper metallic structure, and A^2, the lid or cover of the man-hole chamber of an underground electrical conduit system, the conduits leading in various directions from this chamber, and comprising in the present instance lower ducts *a* for the main-line conductors *b* and upper and larger ducts *a′* for the branch or house-connection conductors *b′*, leading to different points between adjoining man-holes.

Within the man-hole chamber are placed any desired number of main switch and connection boxes B and supplementary switch or house-connection boxes D, one only of each of these boxes being shown in the drawings, although it should be understood that in practice the chamber will contain as many of each of the boxes as the character of the service to be performed may require.

The box B is composed, preferably, of cast-iron, and has a suitable cap or cover forming a water-tight joint therewith, the top of the box having a projecting nipple B′, and the box also having at one side a laterally-projecting nipple B^2, for a purpose described hereinafter.

The box has at each side a series of nipples *f*, through which the line-conductors enter the box, each of the said conductors consisting of a central wire or conductor proper *x*, the insulating-cover *x′*, and the outer sheathing or protecting-cover x^2, usually of lead.

The sheathed conductors can be passed freely in and out through the nipples *f*; but each nipple has a screw-follower *f′*, and between this follower and a shoulder at the base of the nipple is interposed a ring *g*, of rubber or other equivalent packing material, which, when acted upon by the follower, is pressed firmly against said shoulder at the base of the nipple, and is compressed so firmly upon the outer sheathing or covering x^2 of the conductor as to form a perfectly water-tight joint therewith.

In the bottom of the box B is a row of nipples *h* for the reception of the conductors b^2, leading to the house-connection box D, only one pair of these conductors being shown in the drawings, and the nipples which receive said conductors being provided with screw-followers and packing similar to those for the nipples *f*.

Such of the nipples *f* and *h* as have no conductors therein are closed by screw-caps *i*, pro-

vided with packing i', and the nipples B′ and B^2 are provided with similar screw-caps and packing, so that the box is hermetically sealed, and all the exposed conductors, the insulating-coverings therefor, the switches, the cut-outs, and other connections within the box are effectually protected from moisture which may exist in the man-hole chamber, the guarding against this moisture being a most important factor in all underground electrical conduit systems on account of the tendency of the moisture to cause grounds or short circuits if it has an opportunity to gain access to the naked conductors or to the fibrous covering used for insulating the same.

It will be observed that in a switch-box constructed in accordance with our invention neither the conductor nor the insulating-covering of the same is exposed until it is inside the box, hermetically-closed joints being formed with the outer sheathings or coverings of all of the conductors where they enter the box.

Within the box B a connection is made between the ends of the upper conductor numbered 1 by means of terminals m m and a forked switch-plate m', the conductor-wires x being secured to the terminals m, which have elastic fingers m^2 embracing the wings of the switch-plate m'. Similar terminals and switch-plate connect the ends of the conductor 3, so that the current carried by each of these conductors is passed on through the box from one section of the line to the other.

For convenience of description we will call the upper conductor 1 the "positive conductor," and the conductor 3 the "negative conductor," although it should be understood that our invention is applicable to systems working with alternating currents, and also to those working with continuous currents, the terms "positive" and "negative" being employed in this case simply to indicate the outgoing and return lines. To the nipples at one side of the box are adapted other conductors 2 and 4, and the terminals m m are provided with what may be termed "supplementary terminals" n n, those at one side of the box serving to connect the conductors 2 and 4, respectively, to the terminals m of the positive and negative conductors 1 and 3, so that said conductors 2 and 4 may be used as supplementary conductors or feeders, and may be used in place of the conductors 1 and 3 in case of an accident to either of the latter, or by extending the conductors 2 and 4 from the opposite terminals n said conductors 2 and 4 may form an independent line extending from man-hole chamber to man-hole chamber.

The switch-plates m' are carried by a rod p, which passes through suitable bearings p' in the switch-box and terminates in the nipple B′ at the top of the box; hence on removing the cap i from this nipple the rod may be elevated until the wings of the switch-plates m' are withdrawn from between the spring-fingers m^2 of the terminals m, thus cutting out all of the conductors extending beyond the box.

To prevent the switch-plates from dropping so as to accidentally make connection between the terminals, the upper end of the switch-rod p has a supporting-link p^2, which, when the rod is elevated, is adapted to a rest at p^3 in the nipple B′, and serves to retain said rod in the elevated position.

Connection is made through terminals s and forked switch-plates s' between the positive and negative terminals of the main line and positive and negative manifold plates t at the bottom of the box, these plates receiving the conductors b^2, leading through the nipples h at the bottom of the box to the house-connection switch-box D. Each of these manifold-plates, as shown in the drawings, has facilities for connection with three conductors, although only one conductor is shown connected to each plate.

The sheathing or outer covering of each of the conductors x^2 for the house-connection switch-box has a block c, which is pressed by a screw-cap c' against a packing-ring c^2 at the end of said box, and each of said conductors is in communication within the box with a rod F running throughout the length of the box.

The box D has a number of projecting nipples D′, into each of which project arms F′, one of which extends laterally from each of the rods F, the outer ends of these arms being forked for the reception of fingers v, projecting from a switch-block G, of non-conducting material, having other fingers v', electrically connected with the fingers v by means of wires u and engaging with spring-fingers projecting from blocks v^2, carried by a plug H of insulating material within the nipple D′.

The blocks v^2 are connected, respectively, to the positive and negative conductors of the house-connection b', which is preferably of the duplex form illustrated in Fig. 5, and is led out through the supplementary nipple D^2 at the side of the nipple D′, a hermetically-closed joint being formed at this point in the same manner as where the main conductor enters the box D, as above described.

The switch-plates s' are controlled by a rod w, which terminates in the side nipple B^2 of the box B, is operated in the same manner as the rod p to open the switch and cut out the series of house-connections from the main line, and has a retaining-link w^2 and lug w^3, similar to the link p^2 and lug p^3 of the rod p.

Any particular house-connection of the series may be cut out without affecting the other connections by first removing from the proper nipple D′ of the house-connection box D the screw-cap J, which, with its packing J′, closes the outer end of the same, and then pulling out the rod G′, carrying the switch-block G, until the fingers v v' are withdrawn from contact with the forked ends of the rods F′ and blocks v^2, the house-connection leading from that nipple being thus cut out of circuit.

In cases where a line is to be simply carried through a man-hole chamber without making any house-connections therein, we may use a box similar to that shown in Fig. 7, in which the positive and negative terminals are connected by means of simple links *y*.

The various terminals and the manifold plates are mounted upon a supporting-plate M, which should be of suitable insulating material, this plate being secured to studs M′ at the back of the box B, but being otherwise free from contact with the shell of the box.

All of the sections of the line are short—that is to say, extend only from one man-hole chamber to the next—and as all connections between the successive sections of the line are formed by switches any section can be readily cut out of circuit for testing purposes, no permanent joints having to be broken for this purpose, and as each test is only for a short length of conductor any faults or defects can be readily and accurately located.

It should be understood that by the term "sheathing" is not necessarily implied a metal covering or armor for the conductor, as in some cases the insulating material itself may be of other than fibrous character—rubber, for instance—and may thus constitute the sheathing as well as the insulator, the tight joint being formed directly with said insulating-sheathing.

Having thus described our invention, we claim and desire to secure by Letters Patent—

1. The combination of the main conductors, a switch-box therefor, the house-conductors, a switch-box for the latter, and conductors extending from the main switch-box to the house-connection switch-box, substantially as specified.

2. The combination of a switch-box, sheathed and insulated conductors forming hermetically-sealed joints with the box, switches connecting the conductors within the box, and a switch-rod terminating in a nipple, which is provided with a hermetically-sealed cap or cover, substantially as specified.

3. The combination of a main switch-box, house-connection switch-boxes, the main conductors, manifold plates for branch conductors leading to the house-connection boxes, and connections between the main conductors and the manifold plates, all substantially as specified.

4. The combination of the main switch-box, the main conductors therein, the manifold plates for the house-conductors, connections between the main conductors and manifold plates, and switches connected to one rod for simultaneously putting in or cutting out of circuit both manifold plates, substantially as specified.

5. The combination of the main switch-box, a series of main conductors entering the same, a multiple switch connecting said series of main conductors, and a single switch-rod for simultaneously putting the whole series of conductors in or out of circuit, substantially as specified.

6. The combination of the house-connection switch-box and its two main conductors, each having a lateral branch, house-connection terminals having lateral branches, and a switch having fingers connected in pairs, one pair for the positive terminals and the other pair for the negative terminals, substantially as specified.

7. The combination, in an underground electrical system, of a series of man-hole chambers and line-conductors made in short sections extending from chamber to chamber, water-tight boxes contained in said man-hole chambers and containing the terminals of successive sections of the conductors, switches within said boxes for making and breaking the connection between such successive sections, and switch-rods extending through the casings of the boxes, substantially as specified.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

MARK RICHARDS MUCKLE, JR.
THOMAS CARPENTER SMITH.

Witnesses:
WILLIAM D. CONNER,
HARRY SMITH.