(No Model.)

D. O. PAIGE.

ELECTRIC UNDERGROUND CONDUIT.

No. 394,207. Patented Dec. 11, 1888.

Fig. 1.

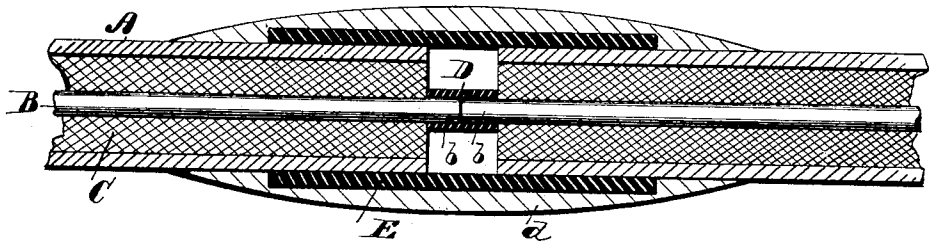


Fig. 2.

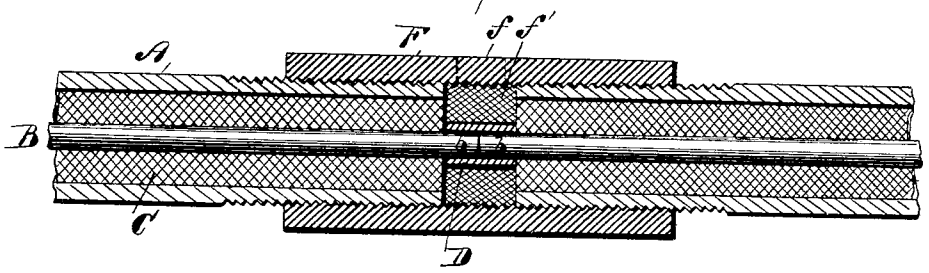
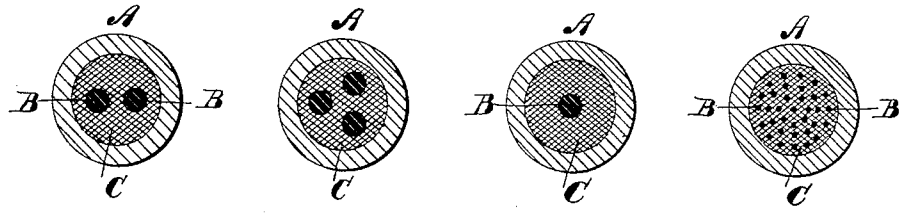


Fig. 3.



WITNESSES.

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ELECTRIC UNDERGROUND CONDUIT.

SPECIFICATION forming part of Letters Patent No. 394,207, dated December 11, 1888.

Application filed March 21, 1888. Serial No. 268,003. (No model.)

To all whom it may concern:

Be it known that I, DAVID O. PAIGE, a citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Electric Underground Conductors; and I declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

In the drawings, Figure 1 is a longitudinal section of a lead pipe and its joint embodying my invention. Fig. 2 is a similar section of an iron pipe with its joint embodying my invention. Fig. 3 represents several wires located in the same tube.

The purpose of my invention is the production of an insulated electric conducting-wire suitable for use in the undergrounding of electric-light wires and in other localities where electric wires are required to be perfectly insulated.

My invention consists, essentially, in arranging the said wires within a lead, iron, or other pipe, said wire or wires each embedded in and thoroughly surrounded with a plastic composed of silicious material, which upon the application of heat will become vitreous, and will thoroughly and permanently support and insulate the said conductor or conductors.

In carrying out my invention, A represents a pipe, of lead, iron, or other suitable material.

B is an interior conducting-wire.

C is the vitreous insulating material which fills the space between the wire and the pipe.

This conductor is made as follows: I make a dough composed of a mixture of silicate of soda, with silex, sand, crushed quartz, crushed glass, or other similar silicious substance, these all mixed with water to the consistency of a dough and applied as a coating to the wire or wires to be insulated, which wire or wires are introduced within the pipe A. Heat is then applied to the pipe, and in applying the heat I prefer to begin at the middle and cause the heat to approach therefrom toward the ends, in order to drive out such vapor as may be generated by the operation from the ends of the pipe. The heat thus applied is carried to the point necessary for fusing the silicious substance into a vitreous mass. This is accomplished at a temperature considerably below the melting-point of lead, and can therefore be accomplished in a lead pipe as well as in a pipe of iron or other more refractory material. The result of this heat is to create a very hard spongy insulating mass of vitreous matter in the nature of glass. If the quantity of dough is small as compared with the interior of the pipe, the mass will be more spongy; but if the mass of dough nearly fills the pipe the mass will be more dense and less spongy. The heat need be carried only to such a degree as to produce sufficient vitrification to solidify the mass without being carried to the extent of reducing it to the form of a molten glass. A conductor insulated in this way is thoroughly protected against liability of being subsequently brought into contact with the surface of the pipe, for the mass cannot, under any possible conditions which it would be subjected to, be softened or caused to run. It is, moreover, much better protected than conductors surrounded by rubber or cotton fiber or petroleum compounds of any nature, for all such substances are by continued use improved in their conducting qualities, and to that extent their insulating qualities are impaired, so that what was for a period a good insulator eventually becomes a conductor, and so serves to seep off the current and eventually form a connection from the wire to the pipe, and thence, of course, to the ground.

It is especially true of such conductors that the application of heat—such as might be induced by a bad section of wire or a poor joint—will quickly soften and destroy the insulation or convert it into carbon or other conductor. With my insulation, however, heat can in no way impair its conducting quality; in fact a great heat would simply reduce it at that particular point to a more perfect glass, and consequently to the condition of a more perfect insulator, which would at once seal up the passage through which moisture might have gained access to the wire, and would house in and render harmless any remnant of moisture which might remain next to the wire.

The process for connecting the wires and locating them within the pipes prior to heat-

ing may be effected in a variety of ways. Thus, for instance, the wire or wires might be drawn through suitable guides, while the dough is simultaneously squeezed through a surrounding die in the same way that tile is made. This might be easily inserted in the tube by simply wetting the dough, so as to make its surface slippery, which would enable it to be drawn easily through the tube; or the dough, with its wires, might be squeezed directly through the tube from a die, as above explained.

Where the pipe that is employed is of lead, I prefer to make the joints as shown in Fig. 1. To this end I would tin the projecting ends *b* of the wires and would incase them at this point with a thin copper tube, D, and would then solder them together, after which I would apply a collar, E, of lead over the junction of the pipes and finish the same with a wipe-joint, *d*.

If the tube A were of iron, I would unite the ends of the wires in the same manner as above explained, and would then apply a union, F, in the same way that iron pipes are usually united. The wires thus insulated might be single, or the same pipe might contain several wires. The conductors thus insulated may be either laid directly in the ground without any other protection, or may be laid in protecting-conduits.

The joint-piece F may, if desired, be perforated at *f* to facilitate filling in about the joint a filling, *f'*, of insulating compound. This may or may not be employed.

What I claim is—

1. An insulated electrical conductor consisting of the combination, with a wire and a surrounding metallic pipe, of an intermediate insulating material formed of silicate of soda, with silex, crushed quartz, crushed glass, or other similar silicious matter, the same being subsequently vitrified and reduced to the form of a hard spongy vitreous mass by heat, substantially as described.

2. The combination, with an electric-light wire and incasing metallic pipe, of a hard spongy vitreous insulating material, filling the space between the wire and pipe, said vitreous substance composed of silicate of soda and silex, crushed quartz, crushed glass, or other similar silicious materials mixed, with water to a dough and vitrified about the wire in the pipe by heat, substantially as and for the purposes described.

3. The combination, with an electric wire, of an incasing lead pipe and a vitrified insulating mass filling the space between the conductor and the pipe, said mass introduced in the form of a dough composed of silicate of soda, with silex, crushed quartz, crushed glass, or other similar silicious material, mixed to a dough with water and vitrified within the pipe by heat, substantially as and for the purposes described.

In testimony whereof I sign this specification in the presence of two witnesses.

DAVID O. PAIGE.

Witnesses:
M. B. O'DOGHERTY,
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