S. D. SPRONG & W. E. McCOY.

CONDUIT FOR HIGH POTENTIAL CONDUCTORS.

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1,043,164.

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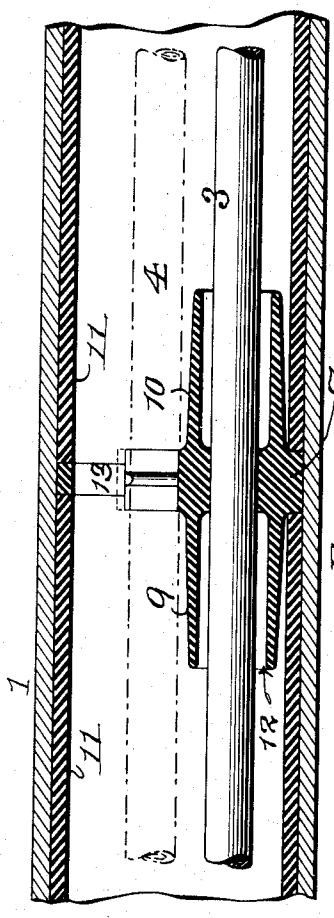

Fig. 1.

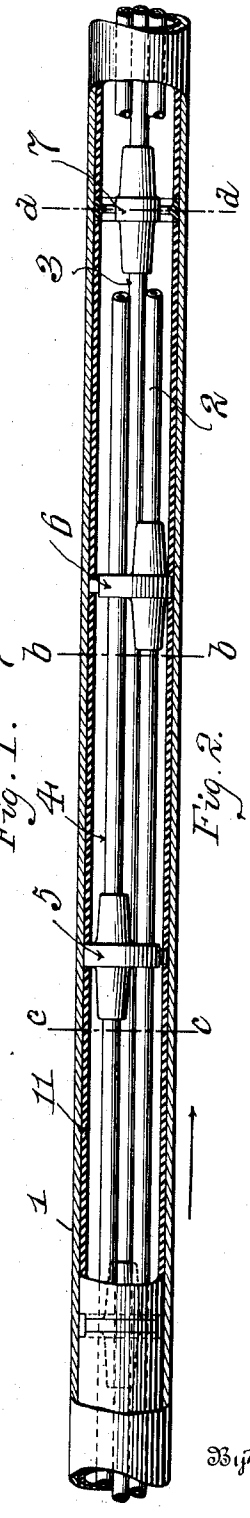

Fig. 2.

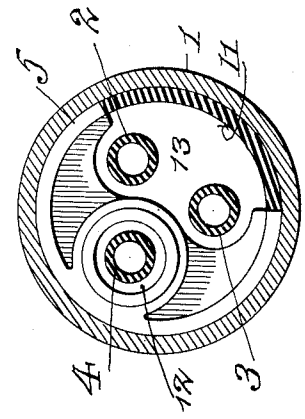

Fig. 5.

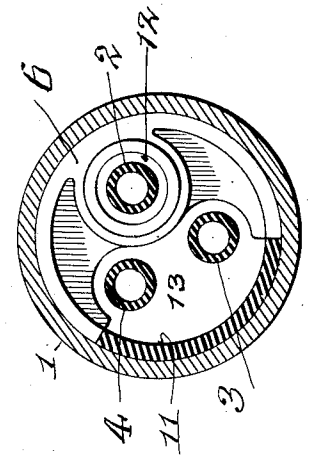

Fig. 4.

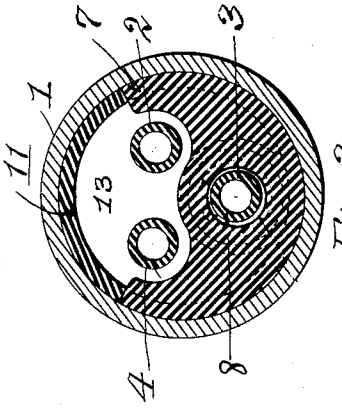

Fig. 3.

Witnesses:
May T. McGarry.
M. R. Breslin

Inventors
Severn D. Sprong
Walter E. McCoy
By their Attorney
Paul Benjamin

UNITED STATES PATENT OFFICE.

SEVERN D. SPRONG AND WALTER E. McCOY, OF NEW YORK, N. Y., ASSIGNORS OF ONE-THIRD TO FRANK W. SMITH, OF NEW YORK, N. Y.

CONDUIT FOR HIGH-POTENTIAL CONDUCTORS.

1,043,164. Specification of Letters Patent. Patented Nov. 5, 1912.

Application filed October 16, 1911. Serial No. 654,906.

To all whom it may concern:

Be it known that we, SEVERN D. SPRONG and WALTER E. McCOY, citizens of the United States, residing at New York, in the county of New York and State of New York, have invented a certain new and useful Improvement in Conduits for High-Potential Conductors, of which the following is a specification.

In the art of transmitting power by electricity, the demand is to cover increasingly greater distances. This, in turn, has made necessary the use of higher voltages, based on the law that the area of the conductors required for the same amount of power at the same loss in transmission is inversely as the voltage. This has brought about an increase in transmission voltages from the earlier systems employing 6600 and 13000 volts to a number of systems at the present time operating at 110000 volts. The use of higher voltages has occasioned a marked increase in the elaboration and cost of the supporting structures for the high tension wires—the practice at the present time being to employ square lattice work steel towers, spaced from 400 to 600 feet apart, and of sufficient strength to carry usually two 3-phase power circuits and one overhead lightning protection cable. The cost of an overhead line of this description, without real estate or right-of-way—which is purely a local matter—averages $5,500 to $6,000 a mile.

There are certain hazards to an overhead line that cannot be avoided by any excellence of construction of the line itself; such as, malicious mischief in throwing wires over the line, damaging insulators by shooting, and the occasional blowing across the line of trees or branches, due to severe storms.

The art of cable manufacture does not make possible the use of underground conductors with commercial voltages above 20,000 or 30,000. Another difficulty is met in bringing the transmitted power into cities for general distribution. As the transmission potentials cannot be carried overhead through city streets, it is necessary to locate the step down sub-station at some remote outlying point in the suburbs. From here, power at lower voltage may be carried either overhead or underground to centers of distribution within the city, but, in either case, the much lower potential at which the power is carried, and the relatively greater distances between the outside station and the points of distribution, necessitate relatively great investment in cable and carrying structures, whether overhead or underground.

Our present invention provides for placing the high voltage system entirely underground, both for the main transmission line and the extension into a city to the proper points for distribution, and consists in the construction hereinafter more particularly described.

In the accompanying drawings—Figure 1 is a longitudinal vertical section of a portion of our improved conduit for high potential electric conductors. Fig. 2 is a plan view with the top portion of the wall broken away. Fig. 3 is a cross section on the line *a*, *a* of Fig. 2. Fig. 4 is a cross section on the line *b*, *b* of Fig. 2, and Fig. 5 is a cross section on the line *c*, *c* of Fig. 2. The sections are taken in the direction of the arrow in Fig. 2.

Similar numbers of reference indicate like parts.

The conduit 1 is tubular and may be made of metal. The high potential conductors 2, 3, 4, which are led through the conduit, are preferably tubular and of copper, and are disposed 120° apart. Within the conduit, and preferably disposed at uniform intervals apart, are insulating supports 5, 6, 7, for said conductors. Said supports are preferably made of porcelain, or other fictile insulating material, and are approximately crescent-shaped, the outer circumferential edge being struck on the same radius as the inner periphery of the conduit, so as to fit snugly therein and preferably cover a little more than half of the inner circumference of the conduit. In the body of each support is an opening 8, and surrounding said opening and on opposite sides of the support are tubular sleeves 9, 10. As shown in Fig. 1, the line conductor 3 fits in the opening 8 of

the support, and there is a clearance 12 between said conductor and the tubular projections 9, 10.

Within the conduit 1 and between the successive supports 5, 6, 7, are inserted tubes 11, preferably of fiber or other insulating material. These, besides insulating the interior surface of the conduit, form spacing pieces between the supports, so that when said tubes are made in equal lengths, the supports will be equidistantly spaced from one another. The tubes are pressed in tightly at their ends against the supports so as to prevent rotation of said supports within the conduit. As one line conductor passes through the opening 8 in a support, it follows that the remaining conductors in the conduit pass through the space 13 between the support and conduit. Thus in Fig. 3 the conductor 3 passes through the opening 8, and the conductors 2, 4, through the space 13. In Fig. 4, the conductor 2 passes through the opening 8, and the conductors 3, 4, through the space 13. In Fig. 5, the conductor 4 passes through the opening 8, and the conductors 2, 3, through the space 13. And in the three cases noted, the supports are suitably turned in the conduit to accommodate them to the positions of the several conductors. It is to be observed that the supports 5, 6, 7 do not form transverse partitions completely closing the conduit, but only partly close the same, the spaces 13 being always open. After the parts described are adjusted in place, the conduit is filled with a dielectric, which is introduced in a liquid or plastic state. Such a dielectric is oil, or we may use a dielectric such as pitch, which may be run in liquid and allowed to harden.

It is to be observed that by this construction we obtain individually insulated conductors, no one of which is in contact with any material, which provides a leakage surface to either of the others: as would be the case, for example, if two or more conductors passed through openings in the same insulating support. The shape of the insulated supports also permits of a circulation of liquid dielectric through the conduit. Such circulation, in order to dehydrate said liquid, is set forth in another application for Letters Patent, Serial No. 654,908, filed by us simultaneously herewith.

The conduit is assembled as follows: The tubes are, as usual, made in sections, coupled together by any suitable means. After the end lining piece is inserted in a given section, the line conductors are drawn through. The partition for conductor 1, say, is put over that conductor until it meets the end of the lining piece; then the next lining piece is inserted. The partition becomes clamped at its edge between the two lining pieces and so prevented from rotating. The partition for conductor 2 is then put over that conductor and meets the end of the second lining piece, and so on for conductor 3, if the section happens to be long enough to take three partitions.

We claim:

1. Means for the transmission of high potential currents, comprising a tubular conduit, a liquid dielectric therein, a plurality of line conductors immersed in said dielectric, and a plurality of separated bodies of insulating material, each of said bodies supporting one only of said conductors, and each body having an opening permitting free circulation of liquid dielectric through said conduit.

2. Means for the transmission of high potential currents, comprising a tubular conduit, a liquid dielectric therein, a plurality of line conductors immersed in said dielectric, a plurality of series of transverse partitions, each series inclosing and supporting one only of said line conductors, and each partition having an opening permitting free circulation of said dielectric through said conduit, and means for preventing rotation of said partitions.

3. Means for the transmission of high potential currents, comprising a tubular conduit, a liquid dielectric therein, a plurality of line conductors immersed in said dielectric, and a plurality of series of transverse partitions, each series inclosing and supporting one only of said line conductors, and each partition having an opening permitting free circulation of said dielectric through said conduit.

4. Means for the transmission of high potential currents, comprising a tubular conduit, a liquid dielectric therein, a plurality of line conductors immersed in said dielectric, a plurality of series of partitions of insulating material, each series supporting one of said conductors only, each partition having a sleeve receiving said conductor and formed with a clearance around said conductor extending from said partition to the extremity of said sleeve, and each partition having an opening permitting free circulation of said dielectric through said conduit.

5. Means for the transmission of high potential currents, comprising a tubular conduit, a liquid dielectric therein, a line conductor immersed in said dielectric, a transverse partition of insulating material inclosing and supporting said line conductor and having an opening permitting free circulation of said dielectric through said conduit, and lining tubes of insulating material within said conduit and in contact with opposite sides of said partition.

6. Means for the transmission of high potential currents, comprising a tubular conduit, a liquid dielectric therein, a plurality

of line conductors immersed in said dielectric, a plurality of series of partitions of insulating material, each series supporting one of said conductors only, and each partition having an opening permitting free circulation of said dielectric through said conduit, and lining tubes of insulating material within said conduit interposed between successive partitions and clamping said partitions against rotation between their ends.

In testimony whereof we have affixed our signatures in presence of two witnesses.

SEVERN D. SPRONG.
WALTER E. McCOY.

Witnesses:
GERTRUDE T. PORTER,
MAY T. McGARRY.