O. HOPPE.

FLEXIBLE CONDUIT.

APPLICATION FILED JUNE 15, 1908.

924,782.

Patented June 15, 1909.

2 SHEETS—SHEET 1.

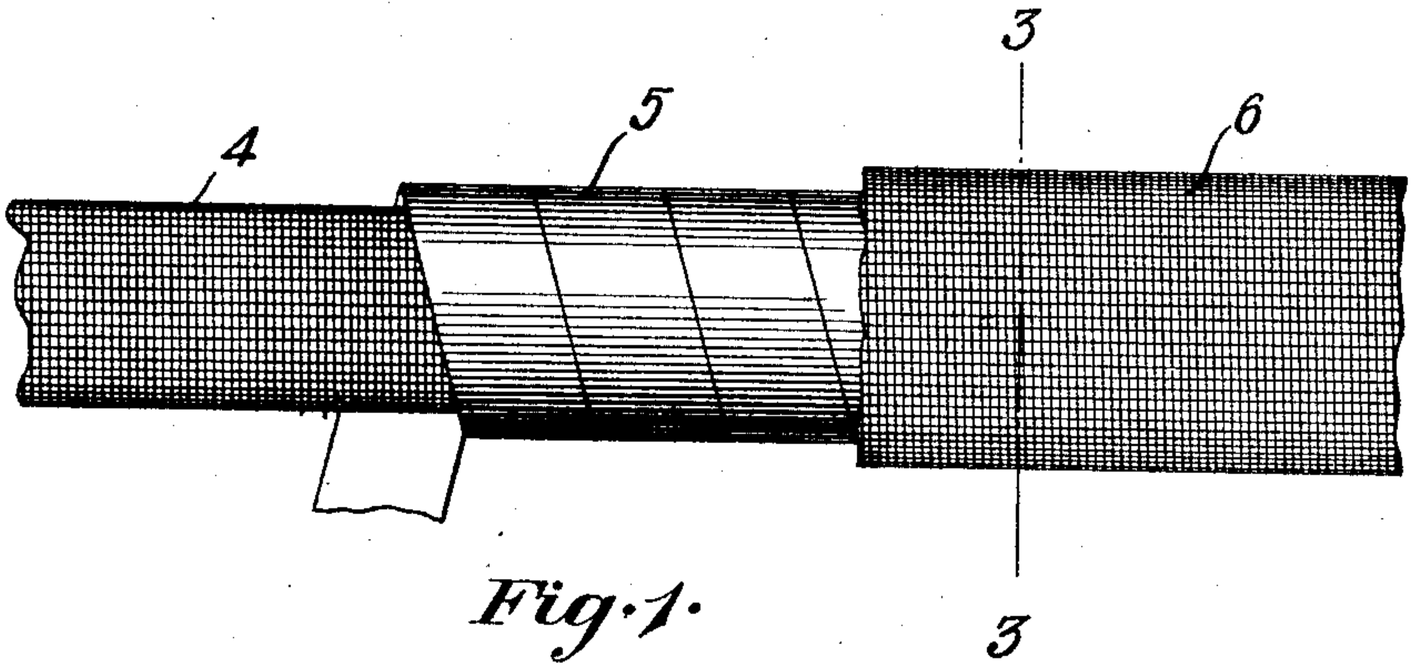

Fig. 1.

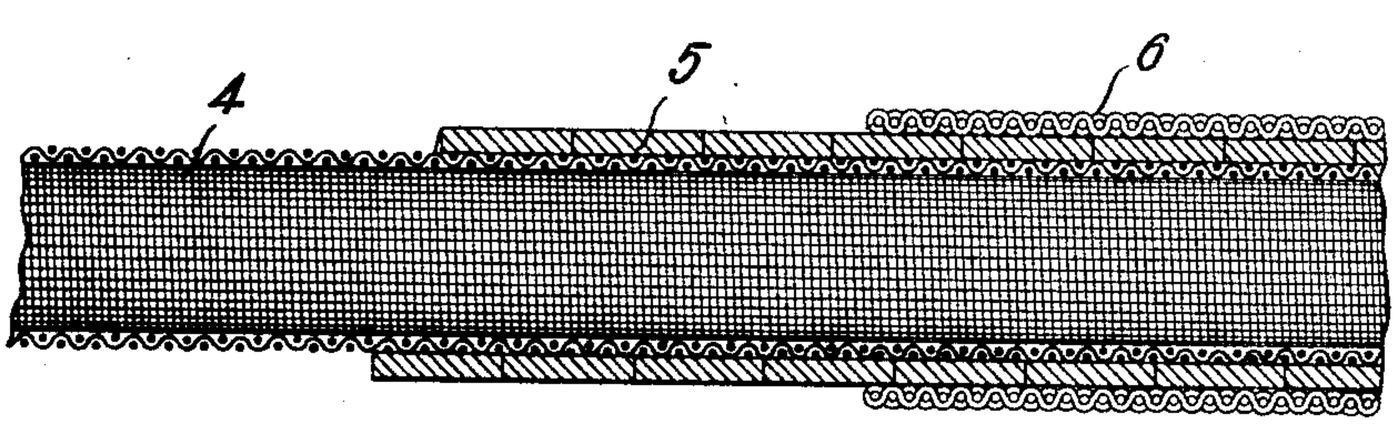

Fig. 2.

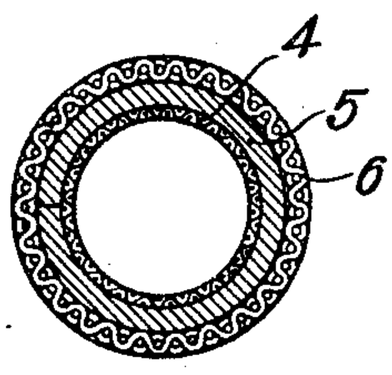

Fig. 3.

Witnesses:
Everett N. Curtis
K. M. Sullivan

Inventor:
Oscar Hoppe.
by Chas. F. Perkins Atty.

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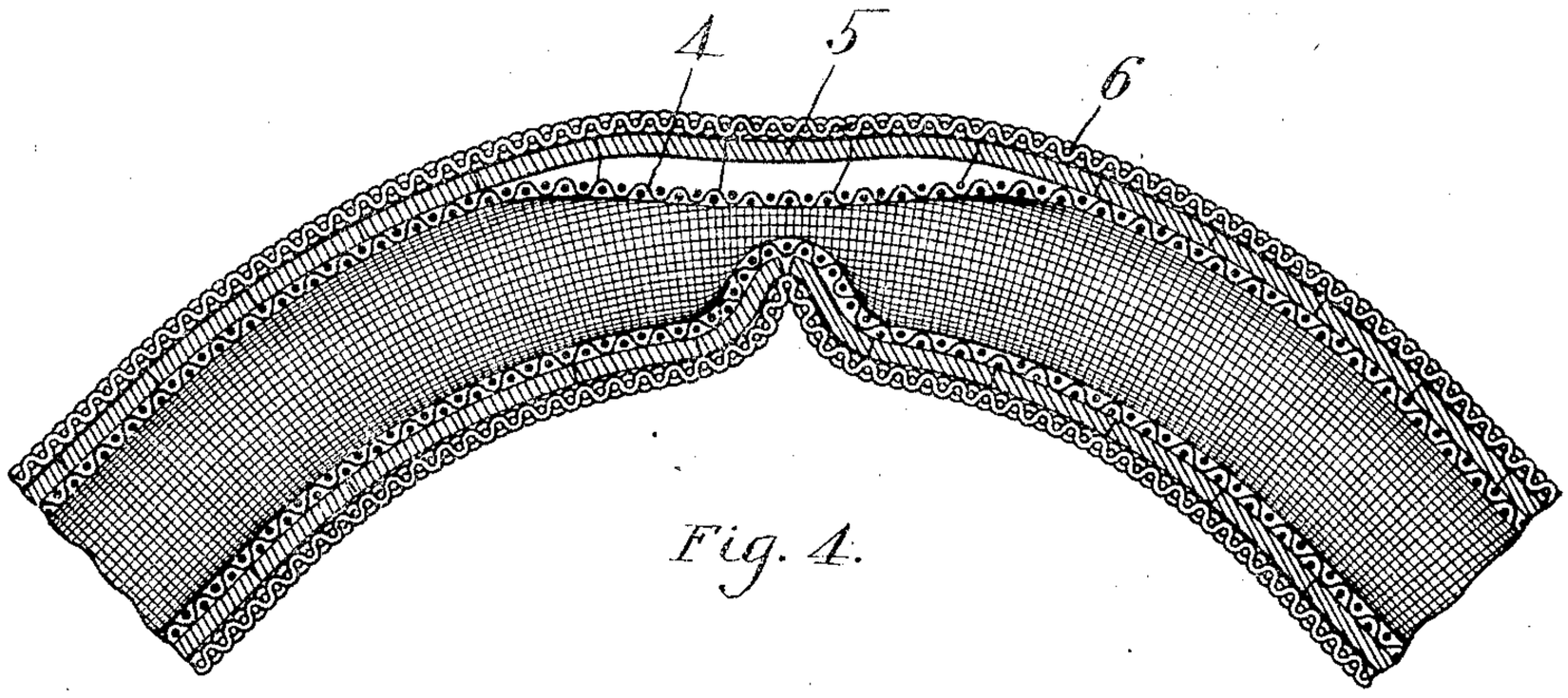

Fig. 4.

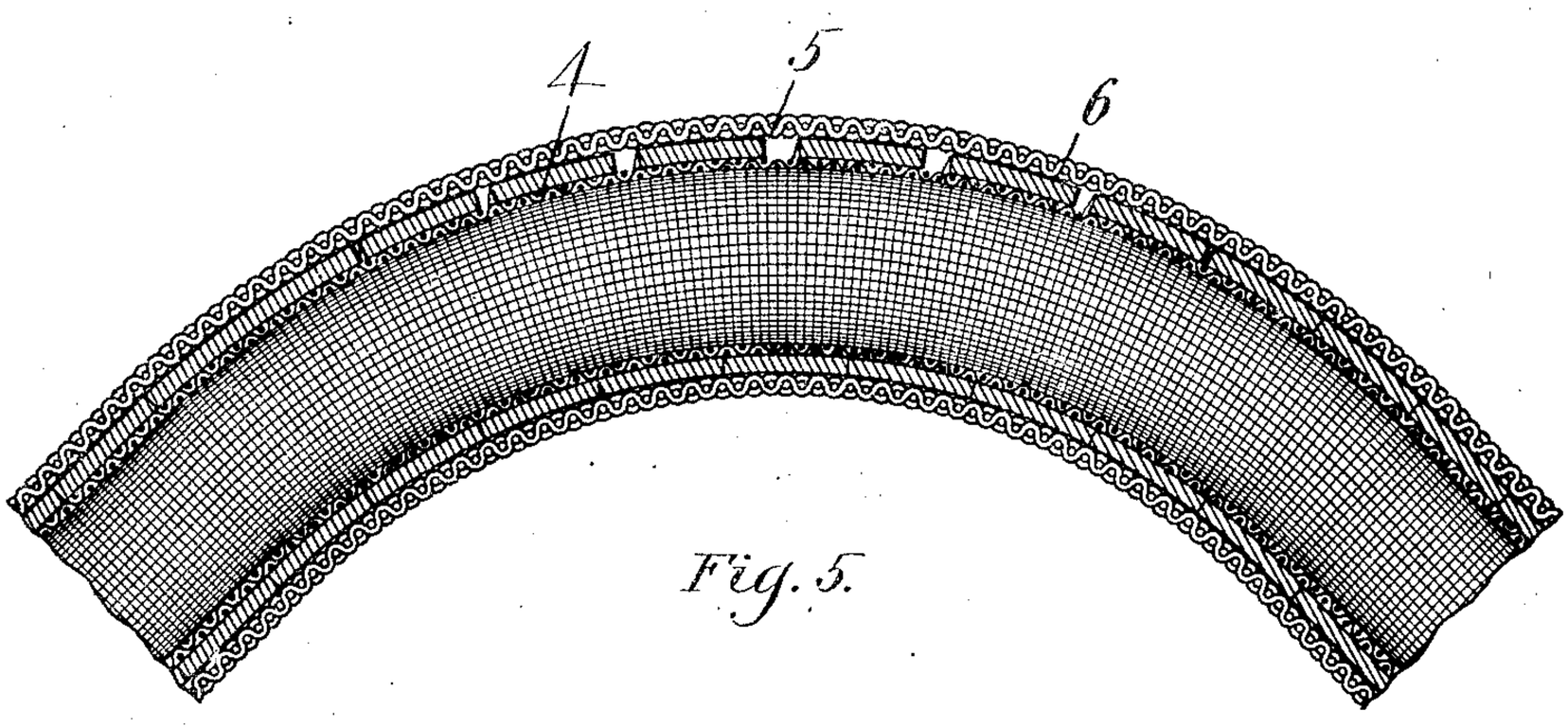

Fig. 5.

Witnesses.
Everett R. Curtis
K. M. Sullivan

Inventor:
Oscar Hoppe
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UNITED STATES PATENT OFFICE.

OSCAR HOPPE, OF BROOKLINE, MASSACHUSETTS, ASSIGNOR TO AMERICAN CIRCULAR LOOM COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MAINE.

FLEXIBLE CONDUIT.

No. 924,782. Specification of Letters Patent. Patented June 15, 1909.

Application filed June 15, 1908. Serial No. 438,468.

To all whom it may concern:

Be it known that I, OSCAR HOPPE, a citizen of the United States, residing at Brookline, in the county of Norfolk and State of Massachusetts, have invented new and useful Improvements in Flexible Conduits, of which the following is a specification.

My invention relates to improvements in flexible conduits for electric conductors, and its object is to overcome various practical defects existing in such conduits now on the market, such as a tendency to collapse when coiled for transportation, installed around sharp curves, or kinked in handling; also to provide against the separation and removal from the conduit by accident or design of any of the tubular structures composing it; and further to provide a smooth interior bore in the conduit under all conditions of installation.

Referring to the drawing in which similar numerals of designation refer to similar parts throughout the several views: Figure 1 is a side elevation of my improved conduit showing portions of the outer covering and spiral removed, in order better to illustrate the various parts. Fig. 2 is a longitudinal section of Fig. 1. Fig. 3 is a cross section on the line 3—3 of Fig. 1. Fig. 4 is a longitudinal section of a bend in a conduit having a stiff inner lining, showing the same collapsed. Fig. 5 is a longitudinal section of a bend in my improved conduit.

My improved conduit consists of a main tube formed of a strip of resilient material, spirally wound, with the edges of the strip in alinement so that they will abut when the tube is straight. Inside of the main tube, and fitting it snugly, is a soft woven or braided fabric, and outside of the main tube is a similar woven fabric, and the whole is saturated with an adhesive composition, cementing all the parts together.

In the drawing, 5 represents a tube composed of a flat strip of firm and resilient material of considerable width,—one-half an inch or more spirally wound without overlapping and so that its edges will be substantially in alinement. This strip forms the main tube or frame work of the conduit, and is designed as an armor to protect the insulated conductor within the conduit from injury by external violence. It may be composed of any suitable material such as metal, or paper fiber, but preferably the latter on account of its being a poor conductor of electricity. It must, however, be of a resilient nature, so as to preserve the tubular form in which it is wound under all conditions to which it is exposed in ordinary use.

4 represents a woven or braided cotton fabric, made in tubular form. It is seamless and of soft texture, so as to readily conform to the shape of the interior surface of the main tube, to which it is cemented by the adhesive composition with which the conduit is saturated. If the said fabric were of a firm and stiff texture, like duck or canvas, it would be inelastic, and if it adhered firmly to the interior surface of the main tube, it would not permit the main tube to bend without collapsing (see Fig. 4),—and if it did not adhere itself would flatten and contract the diameter of the bore of the conduit. By the employment of an inner tube woven with the threads under moderate tension, a soft and slightly elastic fabric is produced which will permit the convolutions of the main tube to open slightly and sufficiently on the outer curve, and the said tube thereby to bend without flattening. The said inner tube will also adhere to the inner surface of the main tube, and thereby leave the bore of the conduit of the same diameter and shape on the curve as in the straight runs. As the inner tube is also seamless it affords no openings to catch or obstruct the passage of the end of the fish wire employed to draw the conductor into the conduit. The spaces between the convolutions on the outer curve of the main tube 5, as shown in Fig. 5, are closed or bridged by the fabric of the inner tube, which prevents the end of the conductor or the end of the fish wire drawing it in, from being caught in the openings in the spiral tube on the bends of the conduit. It is also essential to the proper construction of my conduit to have somewhere among its members a longitudinal thread or strip for the purpose of preventing the same from being elongated to any substantial extent. For instance, I may construct the inner or outer tube of woven material, in which case the warp threads are sufficient. When, however, the said tubes are braided or knitted, longitudinal threads may be introduced in the stucture thereof and serve the same purpose.

In installing flexible non-metallic conduits

for interior wiring, it often becomes necessary to form sharp bends in the conduit in carrying the same around timbers or other obstructions in the walls or under the flooring, and sometimes there will be two or more bends at various angles within a space of thirty feet. Such installation is more easily accomplished while the building is in process of construction, in order to avoid tearing up of the floors, breaking away of plastering, and injury to interior decorations. After the conduit is placed in the position it is to occupy permanently, the conductor or wire is pulled into the same by means of the fish wire. It is obvious that this operation is a delicate one, and it would be impossible if there were any flattening of the tube or contraction of the bore of the conduit, or if the continuity of the bore were interrupted by spaces in which the newly inserted conductor or the fish wire might catch in passing around curves or bends. It is also highly important that the conduit should be so constructed that the main tube or frame work cannot be withdrawn from its outer covering without destroying the conduit. It is found by experience where the main tube or frame work forms the innermost tube of the conduit, that unscrupulous or careless workmen desiring a larger conduit will draw out the main tube and use simply the shell of the conduit, which is ordinarily composed of the woven covering saturated with insulating compound, and deceive the user in the belief that it consists of the original construction. This deception is easily practiced where the main tube can be readily withdrawn, and enables the workman to use a conduit of smaller size and of less expense than is intended for carrying a conductor of a given size. In order to remove the main spiral tube it is necessary to elongate it by seizing one end and pulling it out straight. By this means it is gradually detached from the outer covering and pulled out of it. By employing the inner woven tube cemented to the spiral tube as described, it is impossible to elongate the latter and detach it from the outer covering and remove it. I am therefore able by means of my construction to accomplish all the desirable objects in a conduit of this character, namely, to prevent an elongation and consequently a contraction of its diameter in straight runs, to prevent a contraction of the diameter by bending on curves in installation or in shipment in coils, to preserve a smooth inner bore free from spaces in a conduit having a spiral main tube, and to prevent the removal of the spiral tube without practical destruction of the conduit.

What I claim and desire to secure by Letters Patent is:—

1. In a conduit for electrical conductors the combination of a tube formed of a strip of resilient material spirally wound and having its edges in alinement and constituting the framework of the conduit, and a seamless non-resilient tube of textile fabric closely fitting the interior of and forming a lining for the said spiral tube.

2. In a conduit for electrical conductors the combination of a tube formed of a strip of resilient material spirally wound and having its edges in alinement and constituting the framework of the conduit, a seamless non-resilient tube of textile fabric closely fitting the interior of and forming a lining for the said spiral tube, and an outer tube of textile fabric surrounding the said spiral tube.

3. In a conduit for electrical conductors the combination of a tube formed of a strip of resilient material spirally wound and having its edges in alinement and constituting the framework of the conduit, a seamless non-resilient tube of textile fabric closely fitting the interior of and forming the lining for the said spiral tube and an outer tube of textile fabric surrounding the said spiral tube, all said tubes being saturated with an adhesive compound and thereby cemented together.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses, this tenth day of June 1908.

OSCAR HOPPE.

Witnesses:
ADA F. MORRISON,
E. C. BELCHER.