(No Model.)

2 Sheets—Sheet 1.

T. G. TURNER.

LEAD ARMORED CONDUCTORS AND PROCESS OF MAKING THE SAME.

No. 369,372. Patented Sept. 6, 1887.

Fig. 2,

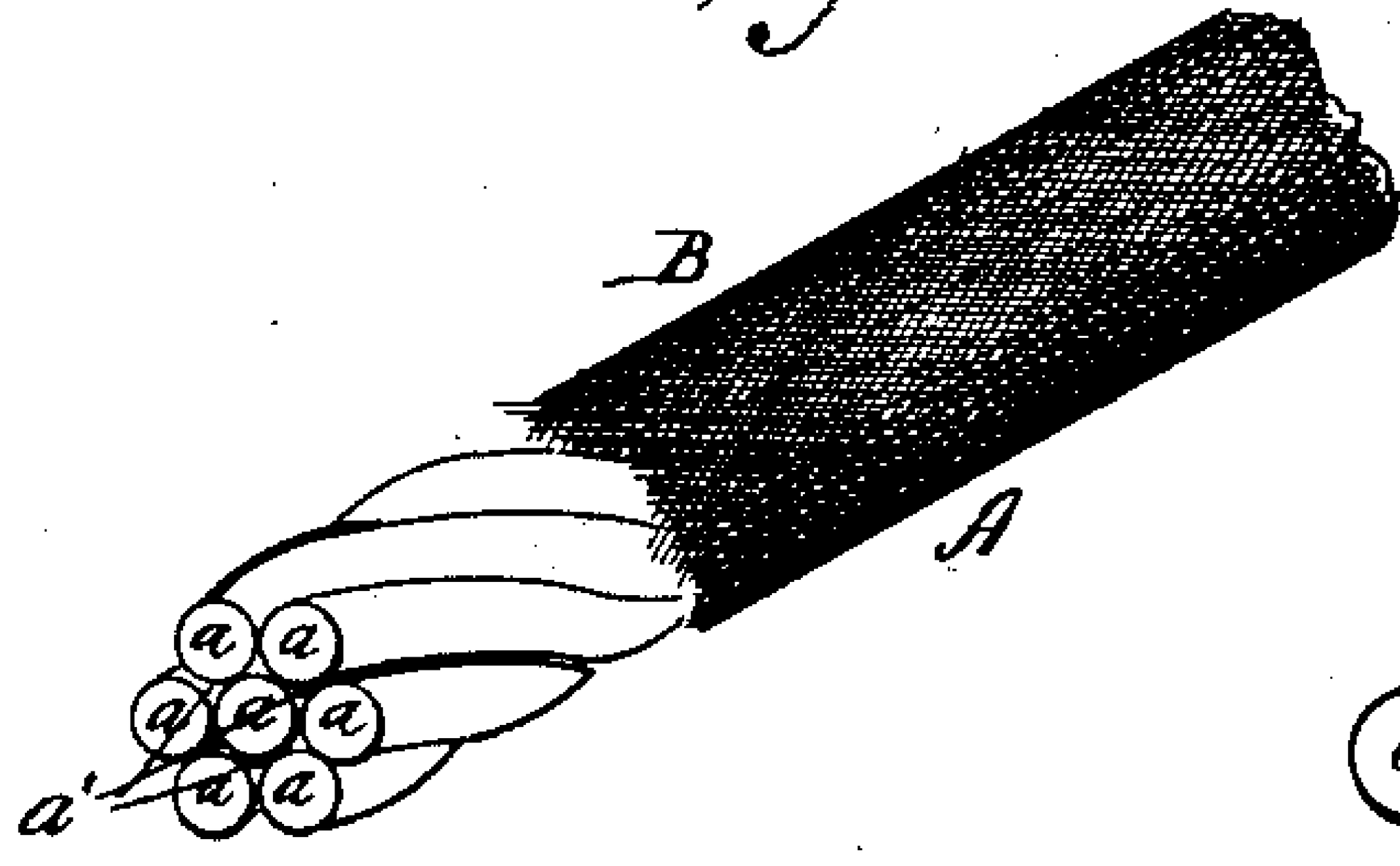


Fig. 1,

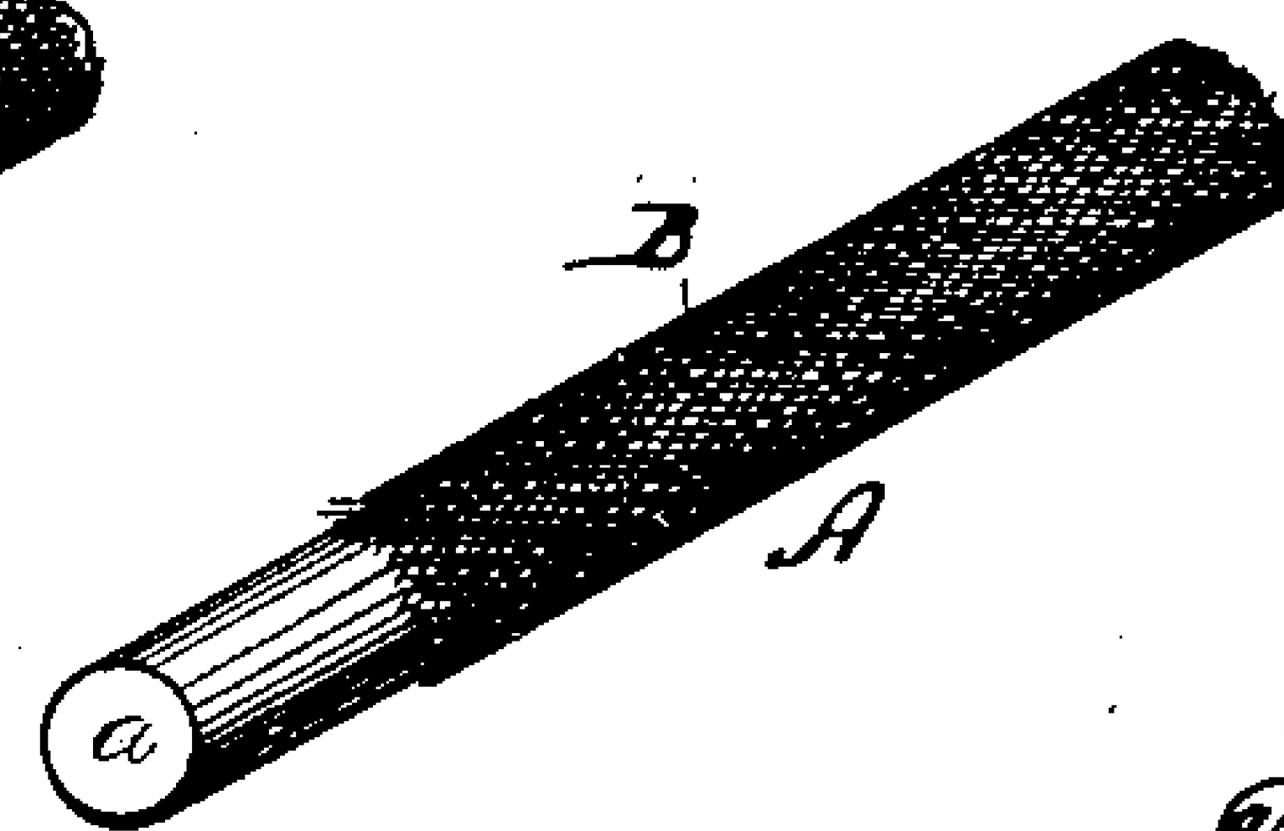


Fig. 3,

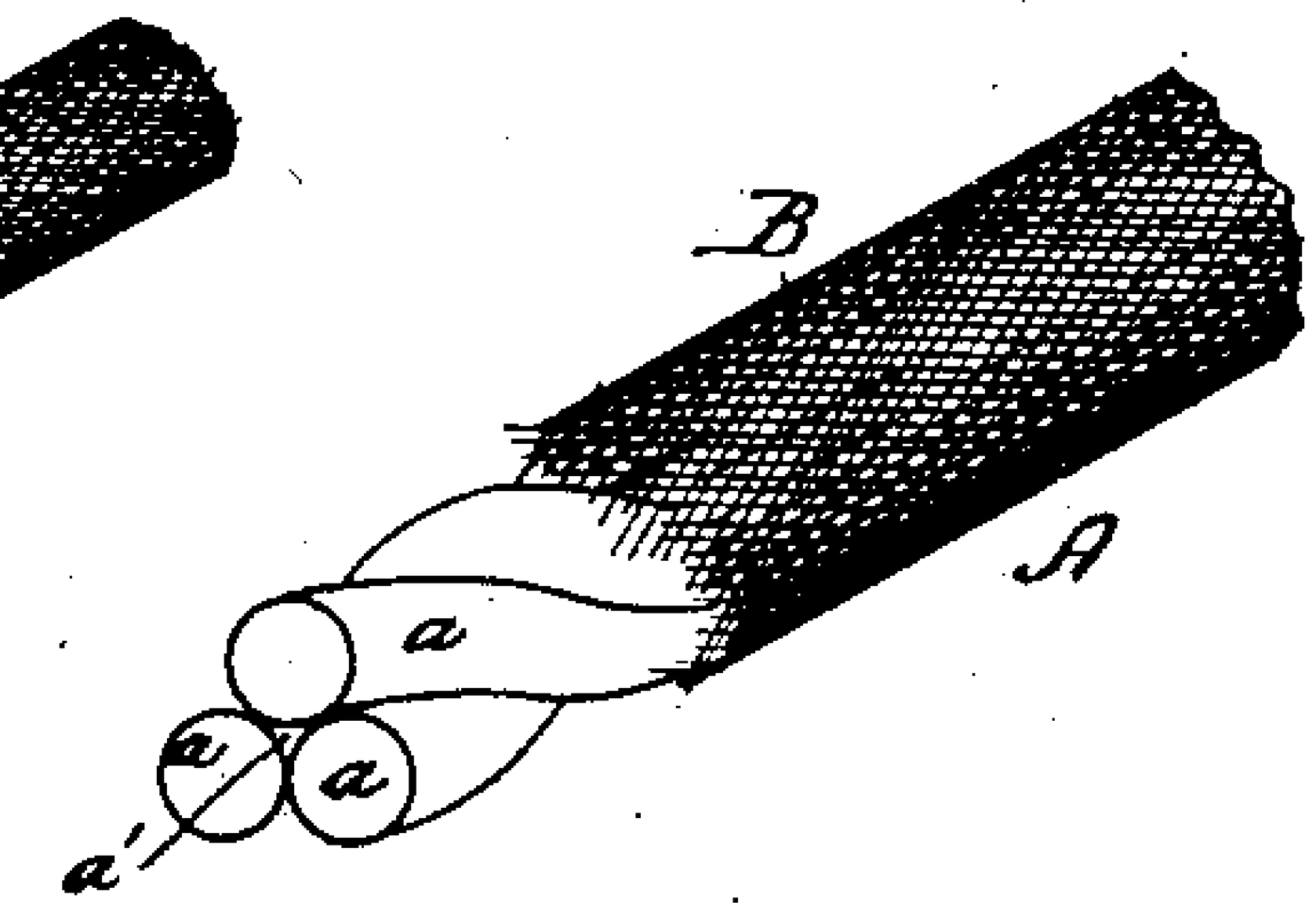


Fig. 4,

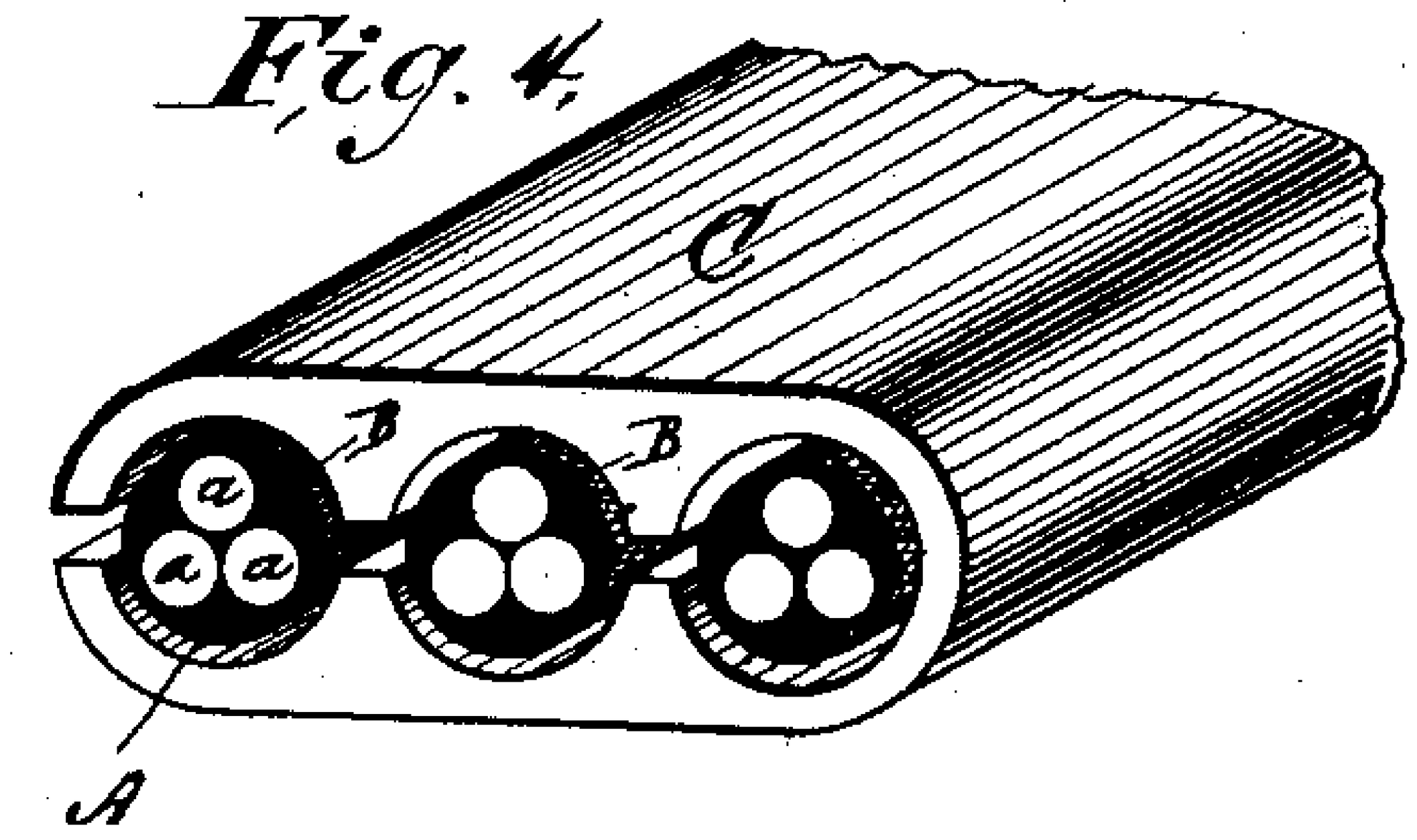


Fig. 5.

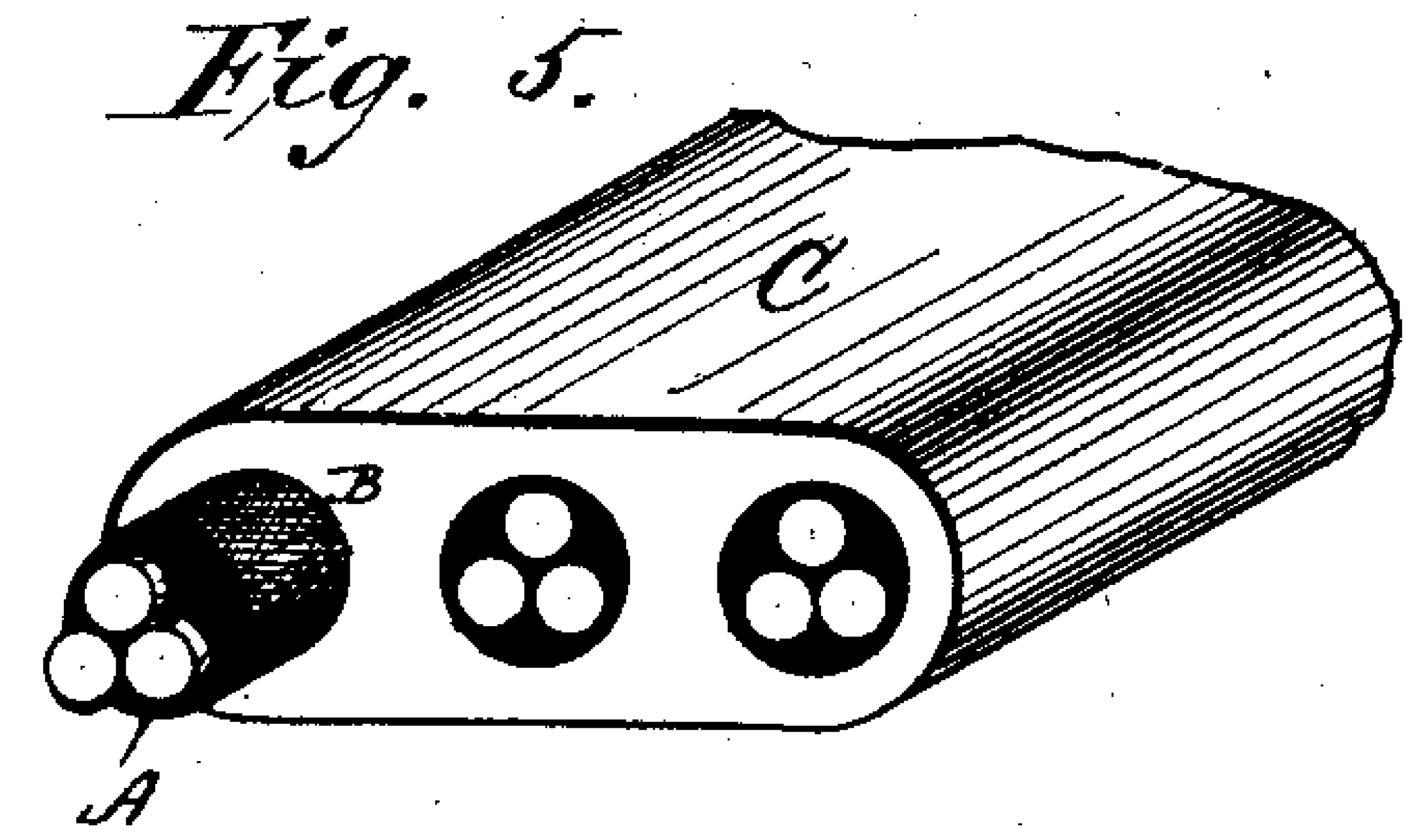


Fig. 6

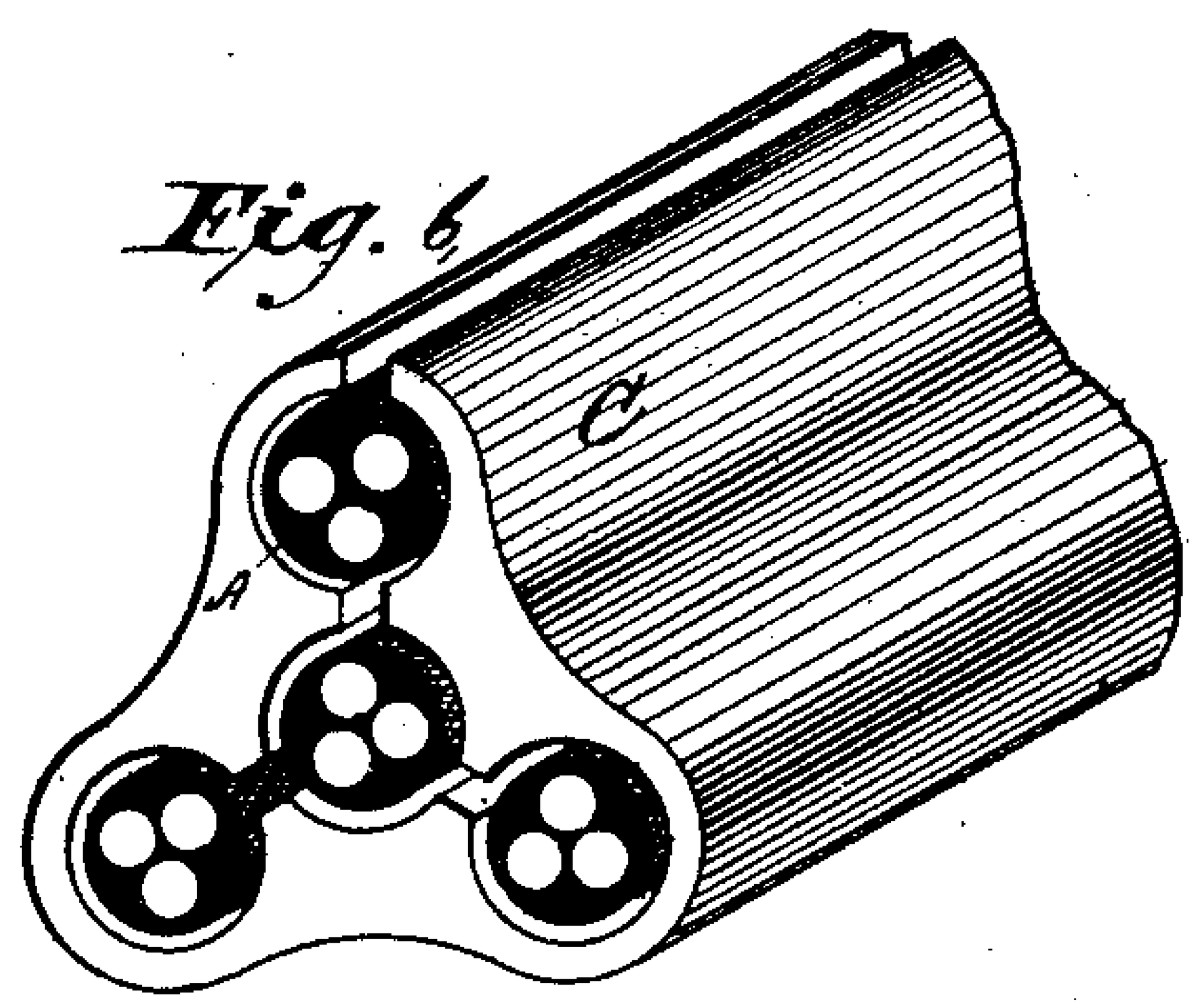


Fig. 7.

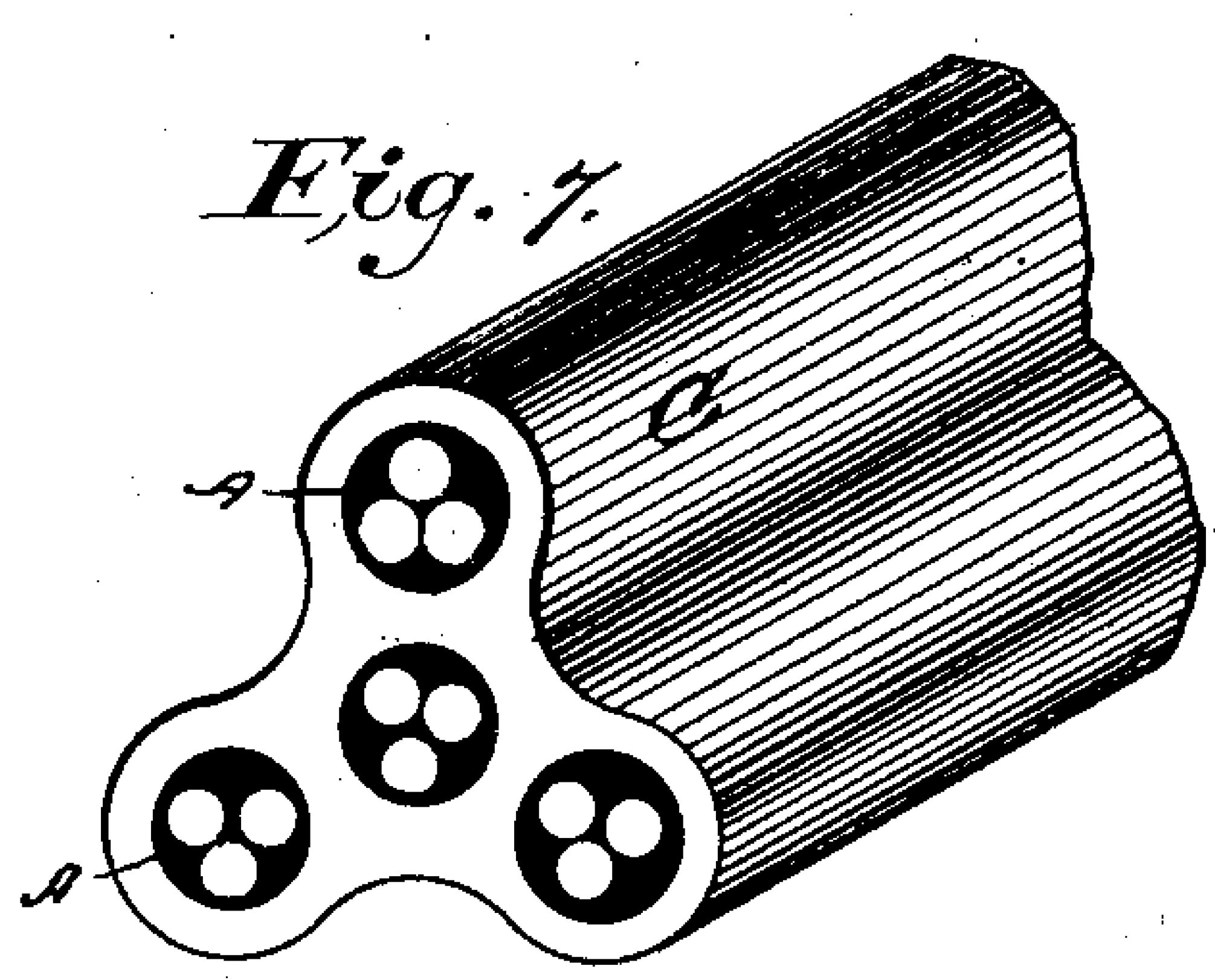


Fig. 8.

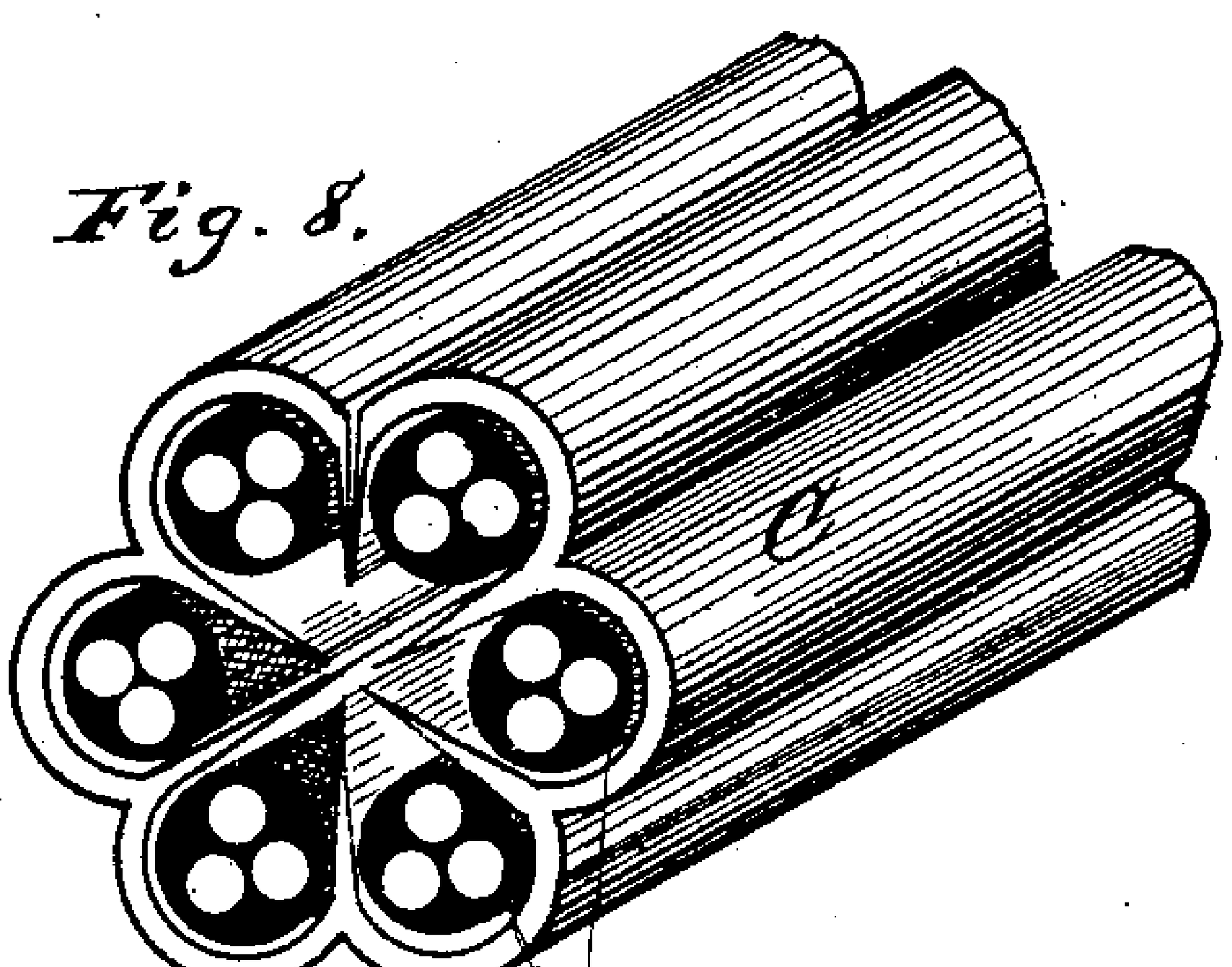
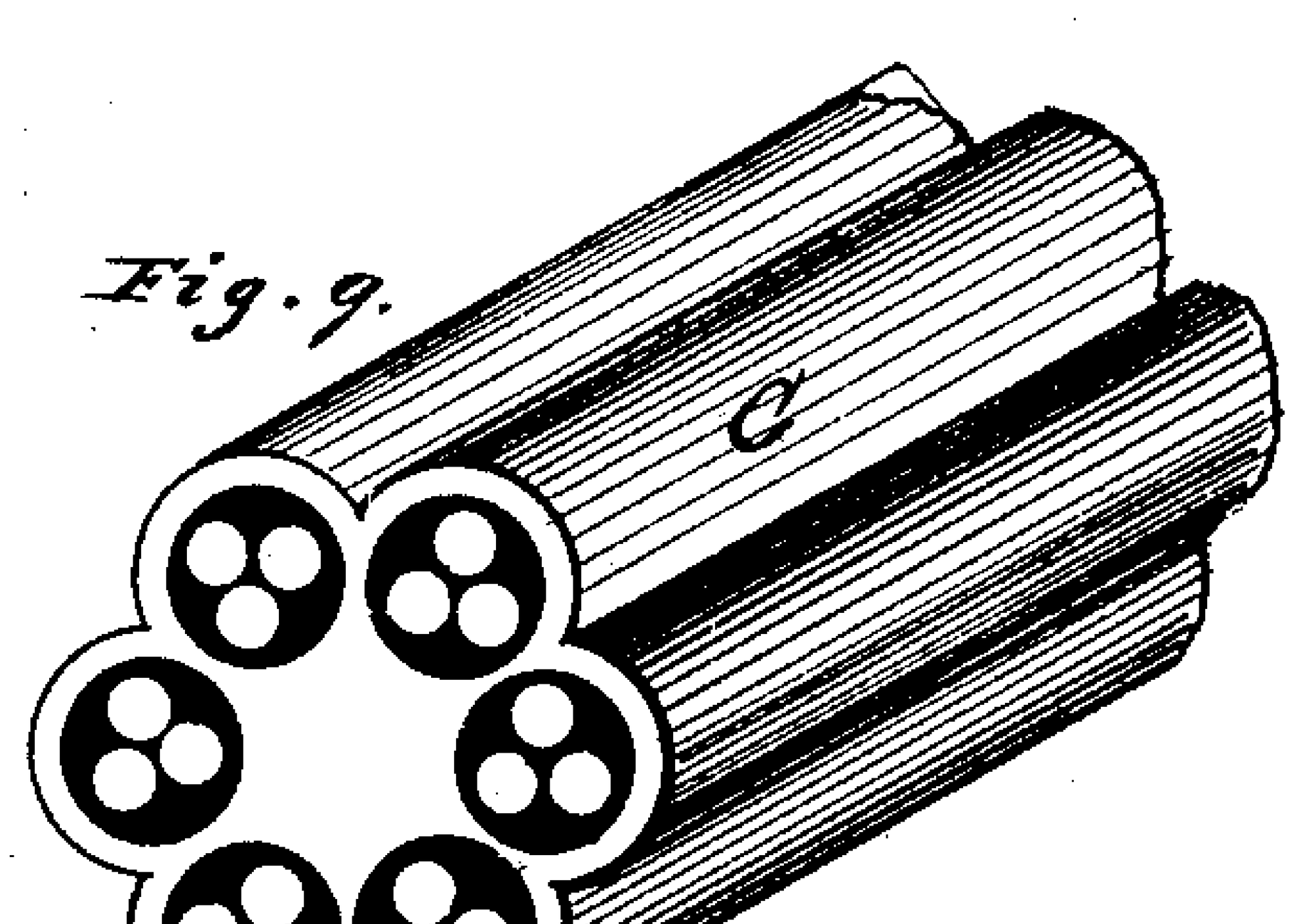


Fig. 9.



WITNESSES

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(No Model.) 2 Sheets—Sheet 2.

T. G. TURNER.

LEAD ARMORED CONDUCTORS AND PROCESS OF MAKING THE SAME.

No. 369,372. Patented Sept. 6, 1887.

Fig. 10.

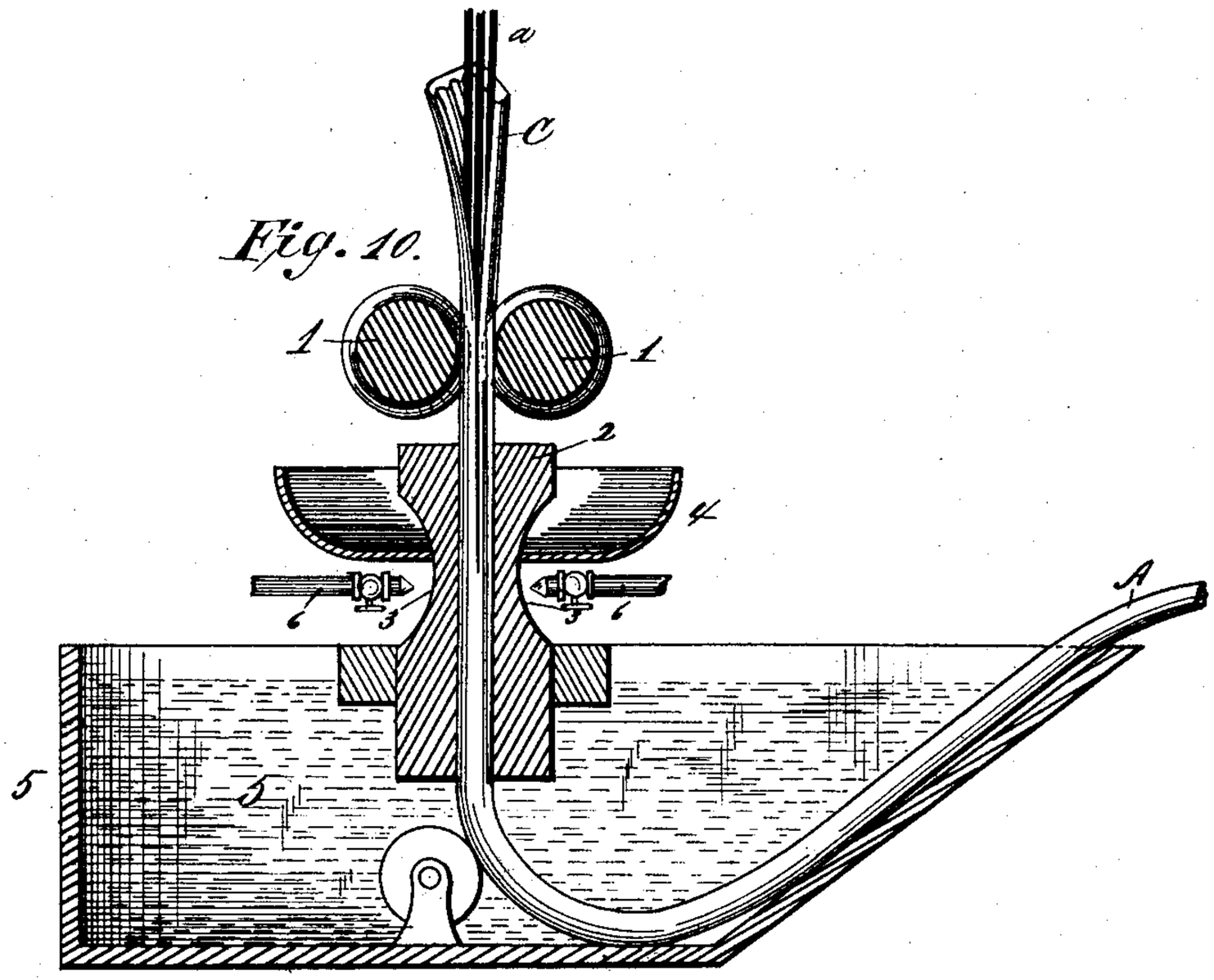
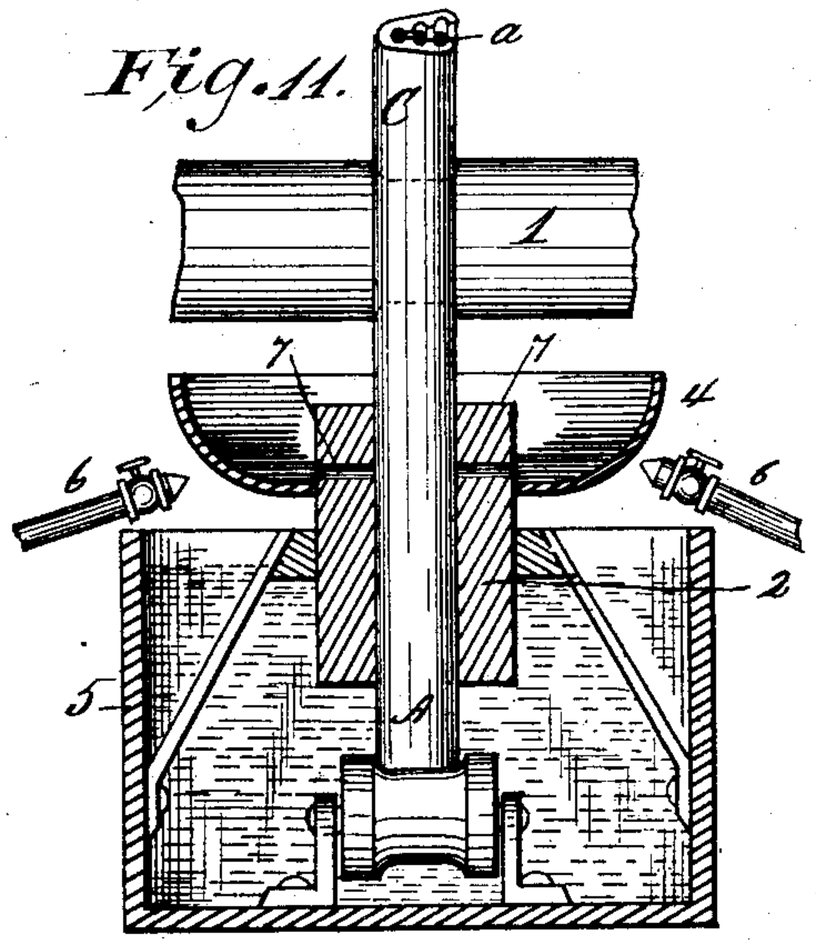


Fig. 11.



WITNESSES

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UNITED STATES PATENT OFFICE.

THOMAS G. TURNER, OF NEW YORK, N. Y.

LEAD-ARMORED CONDUCTOR AND PROCESS OF MAKING THE SAME.

SPECIFICATION forming part of Letters Patent No. 369,372, dated September 6, 1887.

Application filed April 12, 1884. Serial No. 127,667. (No model.)

To all whom it may concern:

Be it known that I, THOMAS G. TURNER, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Lead-Armored Conductors and Process of Making the Same; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to lead-armored cables and to the art of and apparatus for making the same.

Heretofore various methods have been employed for embedding or inclosing insulated conductors in a solid body of lead, among which may be mentioned, first, passing an insulated conductor or conductors through a guide in a lead-press, where molten metal is forced into contact with said conductor in a suitable die and forms a seamless armor; or, second, laying such conductors within or between a sheet or sheets of lead and uniting the opposing surfaces of said sheets in the spaces between the conductors by pressure. In the method first mentioned it has been found that the contact of the molten metal with the insulation of the conductor generates gases, which, escaping through the body of the armor, leaves minute air-holes or "blow-holes," through which moisture penetrates to the insulated covering of the conductor, thus destroying it and bringing the conductor in metallic contact with the armor; and in the last-named method the great pressure required to unite the meeting faces of the armor causes the injury or destruction of the insulating material.

The object of my invention is to avoid the objections herein referred to and to so construct the cable that the positions of the respective conductors with relation to each other will not be disturbed during the process of manufacture.

The invention will be fully described in the ensuing specification, and the novel features claimed in the clauses at the close thereof.

In the accompanying drawings, Figure 1 illustrates an ordinary insulated conductor. Figs. 2 and 3 represent conductors composed of a spirally-arranged group of bare wires inclosed in an insulating-sheath. Figs. 4, 6, and 8 represent in perspective three forms of the rolled ribbons of lead bent up to inclose the insulated conductors within the longitudinal channels. Figs. 5, 7, and 9 represent in perspective sections of the finished cable. Fig. 10 is a vertical section of one form of device for uniting the meeting faces of the lead ribbon. Fig. 11 is a vertical section of a modified form of such device.

Any usual form of insulated conductor, A, may be used, though I prefer that they be composed of two or more small wires, *a*, twisted upon each other and in electrical contact, the whole being then covered by any suitable insulating material, B, such as cotton thread, to protect the conductors from contact with the lead armor C. The conductor formed of a spirally-arranged group of wires inclosed in a single insulating-covering is intended to be used as the single wire. The spiral twisting of the wires within the solid armor will admit of the changes of length (due to changes of temperature to which they must be subjected in use and during the process of manufacture of the lead cable) without destroying the conductor by parting or breaking, as is often found to be the case where a solid wire is used as a conductor; also, the irregular spaces *a* between the various wires so spirally twisted upon each other will permit of the free escape of all gases generated by the heated lead armor coming in contact with the insulation of the conductors.

One very serious trouble encountered in the making of the class of lead cables to which my invention relates is the destruction of the insulation of the conductors A by coming in contact with the heated lead of which the armor is formed. In my improved process I form the lead armor C by means of rolls, (not shown,) which may be associated with or form part of the mechanism illustrated, into a tape or ribbon of such shape that when folded about the conductors each of the latter will be inclosed in a separate longitudinal socket or channel. The armor may be given any desired cross-sectional contour, and when folded about the conductors is passed to feed-rollers 1, thence to a vertical die or mold, 2. The lower end of this die or mold is immersed in a cooling-bath, 5, and against the reduced portion 3 of the

walls of the die or mold, above the bath, heat is projected sufficient to melt or fuse the lead armor C as it passes down through the die. The lead as fused will mold itself solidly around the conductors, and as it passes on downward will be rapidly cooled in the lower end of the die 2, which is immersed in the bath. All gases and air forced off by the heated lead will find free exit upward through the spaces between the individual wires of the conductors and between the conductors and the adjacent surfaces of the ribbon or armor into the open air; also, the conductors will be maintained in their true position with relation to each other within the armor, the folded lead above and the finished cable below acting as constant guides to hold them in position.

I have seen samples of molded cables in which the protecting armor varied in a few inches of the length from the thickness of this paper to one-eighth of an inch. In such a cable the insulation would be soon destroyed in the earth and cable rendered useless; also by this process there need be no excessive heating of the insulation of the conductors, just enough heat being projected against the walls of the die to fuse the lead. To facilitate this I cut away the outer wall of the die at the point 3, upon which the heat is projected, so that the heat will be more easily communicated to a small section of the cable as it passes down within the die to the cooling-bath. I also provide a variable feed (not shown) for the feeding-rolls. Surrounding the die, at or just above the point where it is cut away, is a cup, 4, to be filled with lead or solder. This cup receives sufficient heat from the nozzles 6 to keep the lead or solder contained within it in a molten state, and serves as a shield to the die to prevent too great heating. Sufficient heat will readily pass through the walls of the die to fuse the cable, and the molten metal in the cup will act as an indicator, as it will chill about the die if the feed of the cable into the die be too rapid, the attendant soon learning to adjust the feed to a nicety. Furthermore, it being advisable to subject the cable to as little heating as possible, the cup 4 can be so adjusted upon the die that its edges will rise above the mouth of the die, and if filled with a metal or solder which melts at a lower temperature than the lead only just so much heat need be applied as will melt the solder and cause it to flow into the seam of the cable and solder it, making a solid cable at a much lower temperature than where the lead is fused; or small apertures 7 may lead through the walls of the die from the interior of the cup. This will add to the cost of the cable to the extent of the cost of the solder, but will insure the insulation on the wire not being disturbed by the excessive heating.

While I prefer to use conductors composed of grouped wires, as shown in Figs. 2 and 3, it will be understood that the cable may be formed with the ordinary single-wire conductors; and I do not wish to confine myself to a die made of a single piece of metal, as I contemplate, in some instances, forming the upper end of the die of metal and the lower end of some material which will resist heat, so that said lower end may be kept at a low temperature to more readily and rapidly set the lead.

The lead ribbon or ribbons should be fed to the die at a greater speed than the conductors, for reasons which will be apparent. These lead ribbons may have a film of solder rolled upon their inner faces, so that said faces may be united in the die by the application of a lesser degree of heat than would be required to fuse the ribbon.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The improvement in the art of making lead-armored cables, which consists in seating two or more insulated conductors in longitudinal channels formed in a ribbon or ribbons of lead and uniting the meeting faces of the ribbon by heat during its passage through a die having the desired cross-sectional contour, substantially as specified.

2. The improvement in the art of making lead-armored cables, which consists in seating two or more insulated conductors in longitudinal channels formed in a ribbon or ribbons of lead and fusing and cooling the lead ribbon during its passage through a die having the desired cross-sectional contour, substantially as specified.

3. The improvement in the art of making lead-armored cables, which consists in seating two or more insulated conductors in longitudinal channels formed in a ribbon or ribbons of lead having a facing of solder so as to permit of the welding of the meeting edges by the application of a lower heat than that needed to fuse the lead.

In testimony whereof I affix my signature in presence of two witnesses.

THOMAS G. TURNER.

Witnesses:
BENJ. T. RHOADS, JR.,
J. H. CHESLEY.