(No Model.)

# T. F. O'CONNOR.

## JOINT FOR ELECTRIC CONDUCTORS.

No. 472,933. Patented Apr. 12, 1892.

Fig. 2.

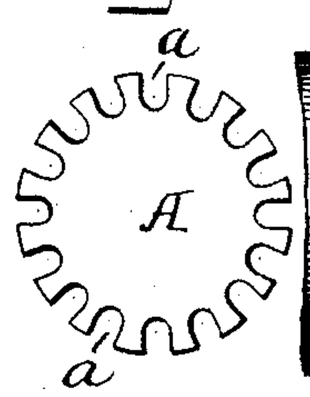



Fig. 1.

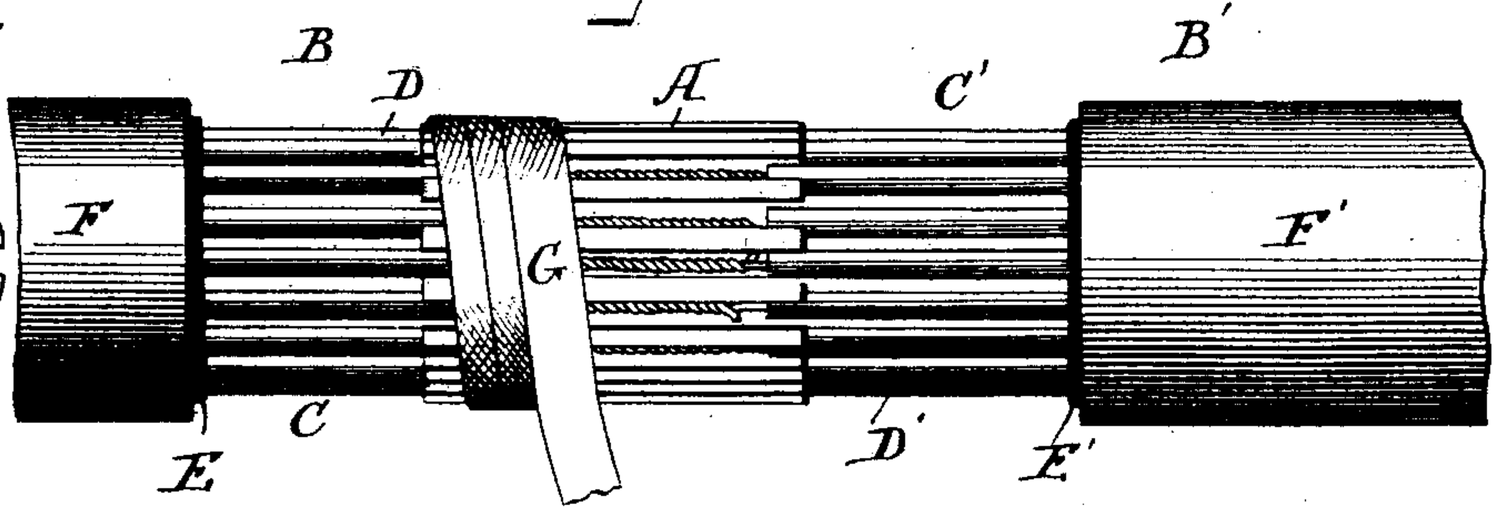



Fig. 4.

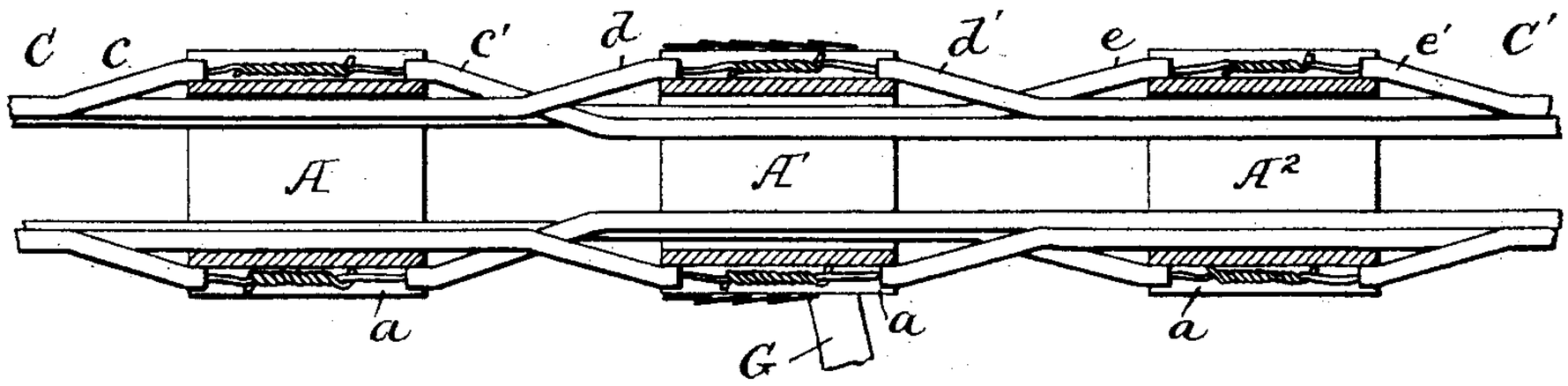



Fig. 5.

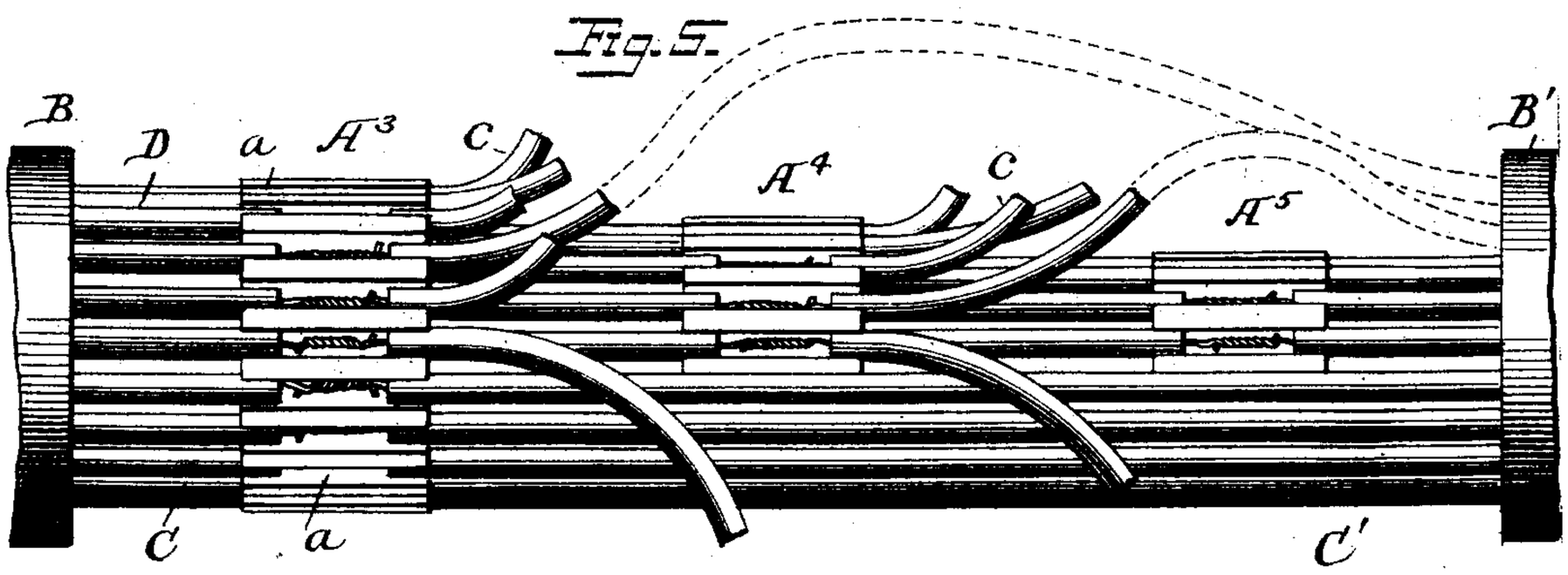
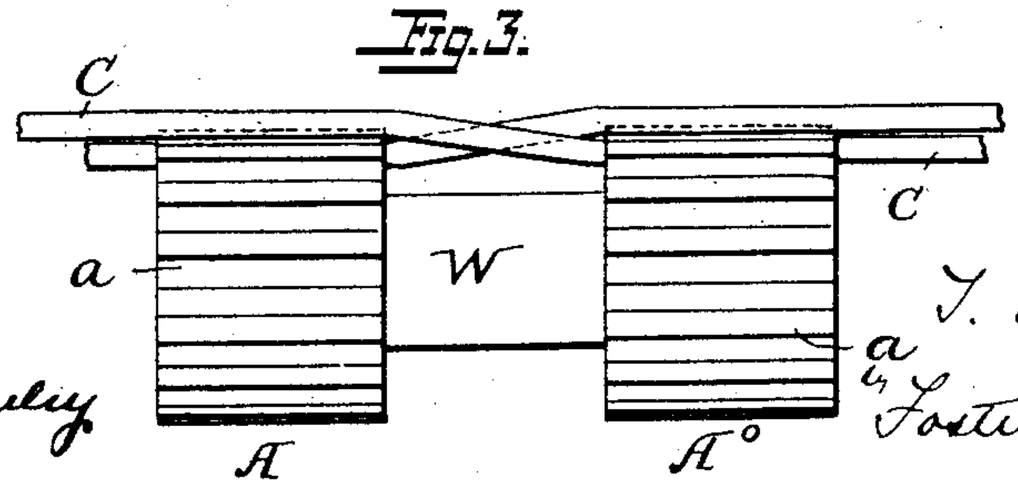



Fig. 3.

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# UNITED STATES PATENT OFFICE.

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## JOINT FOR ELECTRIC CONDUCTORS.

SPECIFICATION forming part of Letters Patent No. 472,933, dated April 12, 1892.

Application filed January 2, 1892. Serial No. 416,850. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS F. O'CONNOR, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Joints for Electrical Conductors, of which the following is a specification.

My invention relates to joints for electric cables; and it has for its object to produce a joint wherein the adjacent ends of the corresponding conductors may be simply, cheaply, and effectively united, while they may be maintained in proper insulated condition with relation to other joints.

It is well known in the art that it is exceedingly difficult to properly join the numerous wires of an electric cable at the point of junction of the adjacent ends of the two cables in such a manner as to maintain the conductors in a high state of insulation. In making this joint it has heretofore been common to twist or otherwise unite the two ends of the two conductors to form a good electrical union and then to separately insulate this joint of the two conductors, usually by winding tape or other insulating material around the parts thereof. This not only is an exceedingly tedious and slow process, especially in telegraph and telephone cables, where there is a large number of wires, but it is exceedingly difficult to thoroughly insulate each and every separate joint or union, and in any event it forms an unsightly and objectionable mass, projecting beyond the exterior diameter of the cable and rendering the joint liable to wear and injury. It is primarily with the object of overcoming these objections that my present invention is made.

Referring to the accompanying drawings, I have illustrated the preferred embodiments of the general principles of my invention, in which—

Figure 1 is a plan view showing one manner of uniting conductors in connection with my invention. Fig. 2 is an end view of the insulating-block. Fig. 3 is a plan view of a twin-joint block. Fig. 4 is a sectional view showing another application of my invention; and Fig. 5 is a plan view, partly in perspective, showing a further embodiment of my invention.

One of the essential characteristics of my invention consists in the use of what may be termed an "insulated" joint block or blocks, which may be made of hard rubber, indurated fiber, or other suitable material. This block or blocks is provided with a series of grooves or recesses in its outer periphery, and preferably is made annular or ring-shaped. Thus in Figs. 1 and 2, A represents the insulated block provided with a series of grooves *a* in its periphery. B represents the end of a cable having a number of conductors C, each of which is preferably covered with insulating material D, while all are embedded in a mass of insulating material E and the whole usually surrounded with a metal armor F, while B′ represents a similar cable having conductors C′, insulated and protected as before.

In making the joint the ends of the conductors are bared by removing a portion of the insulating material in a usual manner. The block A is then arranged between the adjacent ends of a cable, and the corresponding ends of the conductors C C′ are united together by being twisted, soldered, or otherwise joined to form a good electrical union. This union is placed in one of the recesses *a* of the insulated block, the insulating material of the conductors preferably extending into the recess for a short distance—say for a quarter of an inch, more or less, depending upon the size of the conductors and other conditions. Then the corresponding ends of the other conductors are united in a similar way and placed in the other recesses in the block, so that when all the ends of the corresponding conductors are united the block is practically inclosed between the bare unions or joints of the conductors and each joint or union rests in its respective recess, while the ends of the insulating material of the conductors preferably project a short distance into the recess from each end of the block. It will thus be seen that a symmetrical joint of the cables is provided in which the conductors are properly united and held at the proper distances apart without danger of contact with each other and without the necessity of separately winding or insulating each union. The block may then be wound with some insulating material G, as tape or other

equivalent, and this serves to bind all the exposed unions of the complementary wires firmly in place in the block, and after this the whole joint may be covered with some plastic insulating material, and, if desired, with a lead covering. It will be seen that a joint is produced wherein the parts can be thoroughly united electrically as well as thoroughly insulated from each other and with comparatively little trouble and expense. Furthermore, it will be seen that all the unions of the conductors are exposed simply by removing the insulating material or tape from the outside of the block, and a fault in the insulation or conductivity of the cable-joint can be readily detected, and easy access to each conductor is insured for the purpose of testing the cable between joints or between any one joint and either distant end of the entire cable.

In Fig. 3 I have shown an extension of this general idea, in which the insulated block is what I term a "twin-joint" block—that is, it consists, practically, of two blocks joined together, each having peripheral grooves for the reception of the wires or joints of the pairs of conductors. These grooves alternate in the blocks, as clearly indicated in the drawings. Thus the block A has a series of grooves in which a portion—say one-half—of the conductors are united, while the block $A^{\circ}$, which is connected to block A by a piece W, has peripheral grooves for the reception of the remainder of the joints or unions of the conductors; and it will be readily understood from the drawings that the conductors which are in grooves of one block pass over the ridges between the grooves in the other block. Thus all the wires of the cable are united in two blocks, the joints being supported in the recesses thereof and suitably insulated from each other.

While the above-described arrangement is sufficient for cables of a certain size, in cables where there are a large number of conductors it is found impracticable to use a single block and bring all the unions upon the outside, and I therefore provide an arrangement (shown more particularly in Fig. 4) in which there are a series of three insulated rings or blocks A $A'$ $A^2$, each provided with a series of grooves $a$ in its periphery. With this arrangement the conductors C and $C'$ of the adjacent ends of the cables are cut off at different lengths, so that a conductor $c$, for instance, of the cable at one end is united with a conductor $c'$ of the cable at the other end, the point of union of these cables being at the ring or block A, while a portion of the conductor $c'$ passes through the opening in the rings or blocks $A'$ $A^2$. Another conductor $d$ from one of the cables is spliced or united to a corresponding conductor $d'$ from the other cable—for instance, at the block $A'$—both of these conductors passing through the opening in the rings A $A^2$, respectively. Another pair of conductors $e$ $e'$ are united, and the joint or union placed in one of the recesses of the block $A^2$, while the conductor $e$ passes through the opening in the blocks A $A'$. From this description it will be seen that in carrying out the same arrangement all of the pairs of conductors can be united, and their unions placed in a proper recess in one of the blocks A $A'$ $A^2$, one portion of the conductor passing through one or more of the other blocks. In this way all the unions of the pairs of conductors in a cable are exposed on their respective blocks, and when they are all united insulating material may be applied to each block in the form of tape or otherwise to cover effectually all the union and insure their retention in their respective recesses and their insulation from each other, while at the same time the joint as a whole is about the same diameter as the cables which are united. I have not indicated herein the covering of these blocks with the final coating of insulating material or metal shield, as it is clearly understood that they may or may not be applied, as preferred.

In Fig. 5 I have indicated the mode of uniting the pairs of conductors of the adjacent ends of two cables in which the same results are attained by means of my insulated recessed blocks, and in this way I have shown three blocks $A^3$ $A^4$ $A^5$, respectively, each provided with the peripheral grooves and made hollow, but of different sizes. In making this joint I first count off and raise up from the outside of the core as many conductors $c$ as there are grooves in the ring $A^3$, for instance, and then slip the block over the core containing the remaining conductors. Then I count off again and raise up as many conductors $c$ as there are grooves in the second block and slip said block $A^4$ over the core, and so on for as many blocks as are necessary to accommodate the number of wires in the cables. The conductors of the cable $B'$ are then separated outwardly and the conductors corresponding to the conductors passing over the recesses in block $A^5$ are united in any suitable way and placed in the grooves of said block until all the grooves of this block are filled, when it may be wound with insulating-tape or the unions otherwise insulated. Then the necessary number of conductors to be united with the conductors lying in the recesses of the block $A^4$ are joined together and a tape or other insulating material applied over their exposed unions, and so on until finally the outside conductors C are united with their corresponding conductors and placed in the grooves of the block $A^3$ and insulated in the manner before intimated. It will be seen that in this way each pair of conductors can be readily joined at their exposed ends and their union placed in the proper recess, where it will be insulated from its neighbors, and may be held therein by a simple tape or binding over the face of the block, and so on

through each of the blocks, while the cable-joint will be symmetrical and may be completely insulated and protected to correspond with the remaining portions of the cable.

From the above description it will be seen that my invention can be applied in various forms and arrangements of conductors to suit the exigencies of any particular case, and in all instances substantially the same results will be attained in that the joints or unions of each pair of conductors may be readily made while the conductors are in a convenient position, and their unions need not be separately wound or insulated, but be secured in the recesses of their respective blocks, and they can be readily insulated as a whole and will be supported with fixed relations to each other without materially increasing the size of the cable at the joint.

In order that the complementary conductors of the adjacent cables may be properly connected, I find it convenient in some instances to number or otherwise designate the recesses in the blocks, as indicated in Fig. 2, as this enables the making of the joints symmetrical when several sections of cable are to be joined together and assists in designating a fault in any one or more of the conductors.

I do not herein claim, broadly, a supporting-block of insulating material provided with recesses for the reception of the corresponding ends of adjacent conductors.

What I do claim is—

1. A joint for electric cables, comprising a block of insulating material having peripheral grooves, in which grooves the bare ends of the conductors are united and secured, substantially as described.

2. A joint for electric cables, comprising a block of insulating material having peripheral longitudinal grooves, in which grooves the bare ends of the conductors are united and placed, the insulating-covering of the conductors extending a short distance into the grooves, substantially as described.

3. A joint for electric cables, comprising a number of annular blocks of insulating material having peripheral longitudinal grooves, in which grooves the bare ends of the conductors are united and secured, the conductors having exposed portions on one block passing one or more blocks, substantially as described.

4. A joint for electric cables, comprising a series of annular blocks of insulating material having peripheral grooves, in which grooves the bare ends of the united conductors are placed and secured, the unions being exposed on the exterior of the blocks, substantially as described.

5. A joint for electric cables, comprising a number of annular blocks of varying diameter having peripheral longitudinal grooves in which the exposed ends of the conductors are united, the respective blocks embracing the conductors united on the peripheries of the smaller blocks, and the whole forming a symmetrical joint, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

THOMAS F. O'CONNOR.

Witnesses:

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