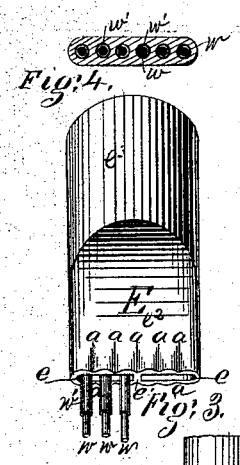
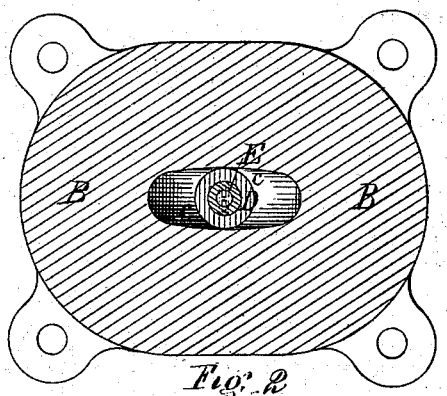
(No Model.)

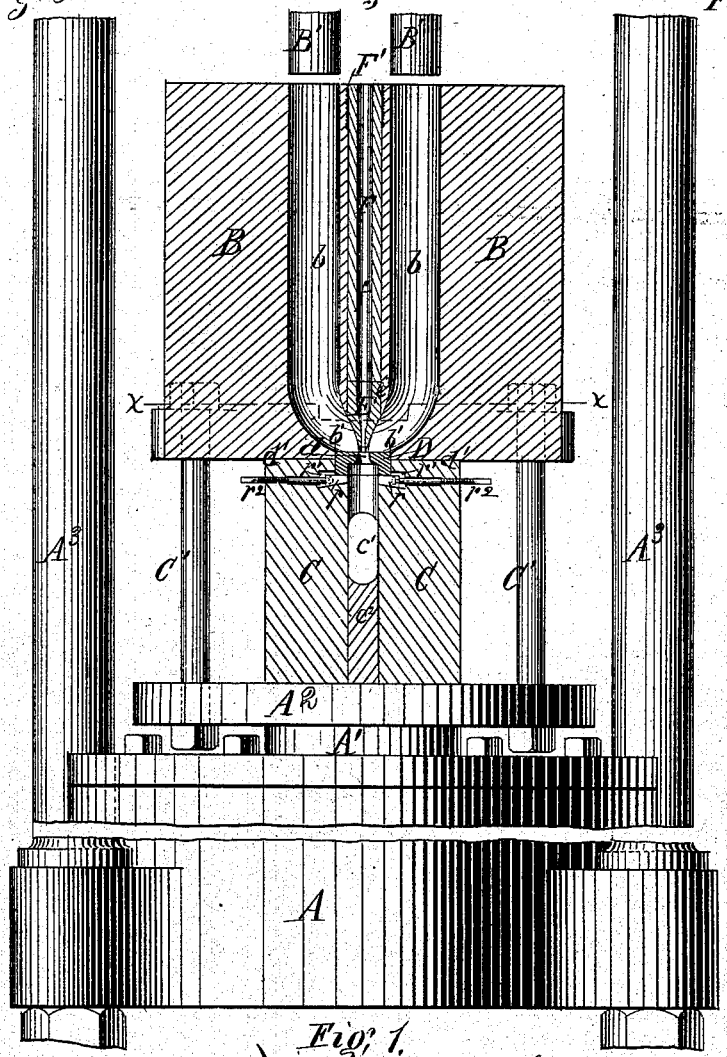
J. FARRELL.

MANUFACTURE OF LEAD COVERED ELECTRIC CONDUCTORS.

No. 262,028. Patented Aug. 1, 1882.







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MANUFACTURE OF LEAD-COVERED ELECTRIC CONDUCTORS.

SPECIFICATION forming part of Letters Patent No. 262,028, dated August 1, 1882.

Application filed January 26, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOHN FARRELL, a citizen of the United States, residing at Pittsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in the Manufacture of Lead-Covered Electric Conductors; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—like letters indicating like parts—

Figure 1 shows in sectional elevation parts of a lead-press for making electric conductors, the same being illustrative of my invention. Fig. 2 is a transverse sectional view of the lead-cylinder and wire-holder, taken in the plane of the line *x x*, Fig. 1. Figs. 3 and 5 are perspective views to an enlarged scale of the lower end or point of different forms of wire-holders adapted for use in accordance with my invention in making different forms of conductors; and Figs. 4 and 6 illustrate in transverse section forms of conductors produced by means of the holders, Figs. 3 and 5, respectively.

My present invention relates to the manufacture of lead-covered electric conductors or cables having two or more wires separately embedded in and covered by a body of lead; and it consists in the construction of the wire-holding mechanism and in certain combinations of the same with a lead-cylinder and die and means for supporting, adjusting, and operating the same, as hereinafter more fully described and claimed.

In making compound electric conductors having two or more wires for separate circuits embedded in a lead covering it is important that the wires be held at the point where the lead covering is applied apart from each other or separated by a uniform space; also, that the wires be arranged compactly, so as to be covered with a minimum quantity of lead. My present invention is especially designed to secure these results.

In the drawings, A represents the cylinder, A′ the piston-stem, and A^2 the platen, of a hydraulic press of the usual or any desired construction. The cylinder A is bound by two or more columns, A^3, to an upper cross-head, (not shown,) between which and the platen A^2 the parts of the lead-press are arranged and supported. The lead-cylinder B is supported on the platen so as to be movable vertically therewith by means of a tubular block, C, and bolts C′ in any desired number, which latter bind the cylinder and block rigidly together.

Within the cylinder B are made, by preference, two lead-chambers, *b b*, and two corresponding plungers or rams, B′ B′, are secured to the upper cross-head in any convenient way in proper position to enter chambers *b b* as the cylinder is raised and force the lead charge therein downward. At their lower ends these chambers converge and form a common chamber, *c*, (see Fig. 2,) surrounding the lower end of the wire-holder E and opening or discharging through a die, D, directly beneath such holder. This die has a central opening, *d*, which may be of any desired form—as oval, round, angular, scalloped, &c.—adapted to impart the desired exterior shape to the lead covering. The die is made adjustable vertically by means of sliding wedges *r*, seated in grooves or recesses *r′* in the upper end of block C and operated by screw-rods r^2.

In order to prevent lead from entering the joint *d′* between cylinder B and block C, the upper face of die D is raised above the plane of such joint and its side faces are fitted closely in the opening *b′* in the cylinder-bottom.

Vertically through the center of the cylinder is made a bore or passage, F′, in which is screwed or otherwise secured a tubular bushing, F, its central opening, *f*, being of sufficient size to afford passage for the number of wires to be included in the cable or conductor, and also to hold a supply of wax, paraffine, or other similar substance, as presently described. The cylindrical part e^3 of wire-holder E, Figs. 1 and 3, is slipped tightly into the lower end of bore F′, with its upper end abutting against the bushing. It is thus held firmly as against upward pressure of lead thereon. It may be sustained as against gravity by friction or the tightness of its fit within the bore, leaving it free, however, to be removed when desired for replacing with another of different form or size. The bushing F may also be removed for like reasons. Also, if preferred, the bushing and wire-holder may be connected or made

integral instead of separate. For economy and convenience in changing holders I prefer to make them separate, as shown. The form of the wire-holder at the point or lower end will depend upon the desired arrangement of wires in the conductor. I have shown two different forms, Figs. 3 and 5, in order to illustrate better different modes of applying my invention. In Fig. 3 the wires are held in one plane, forming a flat or oval conductor, as in Fig. 4, a corresponding opening being made in die D to give the exterior form. The outer surface of this part of the holder is also reduced or flattened toward the point to a similar form, as at e^2.

In order to afford a comparatively-unobstructed interior passage through the holder, so that the wires may be arranged compactly or brought into close relationship, I make such passage at the point in the form of an open slot, *e*, instead of providing separate perforations for each wire, as heretofore. Any desired number of wires *w* may be passed through such slots close together or with very little space between them, the limit in this respect being only that which detracts from the successful working of the wires in different circuits. In order to afford the requisite strength at the point to resist the pressure of lead, I provide one or more bridges or cross-bars, *e'*, which brace the two walls and prevent compression or collapse.

In order to hold the wires at proper intervals apart, and also to cause lead to flow into the spaces between wires, I make grooves or depressions *a* in the outer surface of the wire-holder, which are deepened toward the point and arranged on the two sides of wire-passage *e*, in pairs or directly opposite, and the wires *w* are passed downward in lines between successive pairs of such grooves, as illustrated in Fig. 3. As lead is forced downward past the holder its flow will be directed by the surrounding die through such grooves into the spaces between wires. This flow being once established with the wires in the position shown, they will be held in such relationship by the pressure of lead alone, and a solid body or covering of lead will be formed around each wire, as illustrated in Fig. 4. By raising or lowering the die D with relation to the point of the wire-holder such lead covering may be pressed upon the wires more or less tightly, as desired; or, on the other hand, the tubular passages occupied by the wires may be made larger than the wires.

Ordinarily I prefer to cover the wires with lead loosely, leaving a little space between the outer surface of the insulating-covering *w'* and the surrounding lead wall, into which wax, paraffine, asphaltum, or similar insulating and preservative substance may be forced. In order to effect this, the insulating material may be placed within the wire-holder and passage *f*, where it will be rendered liquid or plastic by heat from the lead in chambers *b b*, and in such condition it may be forced by a downwardly-moving plunger, by air-pressure or by other suitable means, through the open slots *e* into the space around each wire, thereby expelling air and moisture, perfecting the insulation of the wires and preserving the fibrous or other covering *w'* from decay, deterioration, or injuries to which it may be subject in manufacture of or handling the conductor. I have included in the subject-matter of another application one method of introducing such material under air-pressure, consisting in sealing or closing the wire-openings in the delivery end of the conductor, whereupon a tendency is developed in the operation of applying the lead covering to form a vacuum at or a little below the point of the wire-holder, and pressure of air on the liquid or plastic material above forces it downward to supply such vacuum. Other means may be employed, however, for effecting this end, in all of which the open slots or passages *e* will facilitate the downward flow of such material by affording unobstructed open spaces between wires. The principal purpose, however, of the common or open wire-passages *e* is to permit of a close or compact arrangement of the wires, so as to require a minimum quantity of lead for covering them. Where separate perforations for wire-passage are employed the walls which divide such perforations necessarily occupy considerable space. This is especially true where the point of the holder is made in the form of separate nipples. Such dividing walls or nipples restrict the number of wires that can be passed through a holder of given size. By leading the wires through common slotted openings *e* and spacing them by lead flow and pressure, as described, they can be brought closer together and less lead be employed in covering them than can be done with other forms of wire-holders of which I have knowledge.

By varying the depth of grooves *a* a greater or less amount of lead may be directed into the spaces between wires, so as to fill, or partially fill, the same, whether the wires are arranged close together or separated by a considerable space. Ordinarily, however, I prefer to make the grooves deep enough to fill such spaces with a solid body of lead, as in Fig. 4.

In Fig. 5 I have shown a form of wire-holder adapted to hold the wires in a circle for making a pipe-like conductor. (See Fig. 6.) In this form of holder the wires are passed downward through an annular passage, *i*, between an outer shell, *n*, and inner body, *n'*, bridges *i'* being employed in any desired number to give requisite strength. The wire-passage is thus made open and practically unobstructed, and the wires therein are spaced at its lower extremity by the flow and pressure of lead, direction being given to such flow by grooves *o o'*, made in the walls of the wire-passage, which grooves are arranged in pairs, the outer ones, *o*, being in the same radial lines as the

inner ones, *o'*. These grooves, with the open wire-passage *i*, have the same function and operation as before described with reference to Fig. 3.

In illustrating this application of my invention I have also shown features of invention which are included in the subject-matter of another application—namely, a central supply of lead through the interior of the holder for forming the inner wall of the lead covering, the outer wall being formed from a supply of lead forced downward around the exterior of the holder. Such central supply, as illustrated in the present case, is taken from the main lead-chambers through passages *h h* to an inner chamber, H, within the circle of wires. From this chamber it is pressed downward by pressure within the main chambers past the cone-shaped core H', by which the flow is directed outward to meet that on the exterior from the main chambers, which is directed inward by the surrounding die. In both this central and exterior supply the flow of lead will be directed by the grooves *o o'* into the spaces between adjacent wires, thus spacing the wires and filling more or less between them with lead, depending upon the depth of grooves or depressions, substantially as before described. In this form of holder I prefer to make it and the bushing F integral, or rigidly connected, and screw them into the bore F', so as to secure stability as against pressure from the central lead-supply. Both forms of holders, Figs. 3 and 5, embody the same principles of open wire-passages and spacing the wires by flow of lead. Various other forms may also be employed for making conductors of other shapes with other arrangements of wires which may employ the same principles of construction and operation.

In order to hold the wires in proper relationship to the grooves in the holder before lead-pressure is applied, the ends of the wires may be drawn down through the die and united in any way at proper distance apart; also, paper, cork, or other light packing may be placed in the slots or wire-passages *e* between wires to insure their separation and proper position, and also to prevent premature escape of the liquid contents of the holder. As lead covering is applied to the wires they will be drawn downward thereby and directed outward through side openings, *c'*, in block C by any suitable block, c^2, placed below the opening. Ordinarily the paper or cork packing will be drawn down by the moving wires; but their discharge will be insured when pressure is applied to the liquid or plastic material above. This being done, the operation of covering the wires separately with or in a common body of lead and packing the open space around each wire with the liquid or plastic material will follow as before described.

The wires may be passed to the machine from any suitable reel, and the completed conductor may be wound on reels as it is delivered from opening *c'* in convenient form for handling and ready for use. In this way compound conductors may be made cheaply of any desired length, a minimum quantity of lead be employed in covering the wires, and the wires be protected with any desired amount of preservative and insulating material surrounding each wire.

I claim herein as my invention—

1. A wire-holder for a lead-press, provided with an interior opening for passage of two or more wires, with open spaces between wires, and grooves or depressions in the side walls of such opening for directing a flow of lead into the spaces between wires, substantially as set forth.

2. In combination with the die of a lead-press, a wire-holder having an interior opening for passage of two or more wires in common through the same to the die, with open spaces between wires, and with grooves in the side walls of such opening for directing a flow of lead into the spaces between wires, substantially as set forth.

3. A wire-holder for a lead-press, having a common interior passage for two or more wires, with open space between wires, and grooves or depressions formed in the outer surface of the walls of such passage, arranged opposite each other in pairs corresponding in position with the spaces between wires, substantially as and for the purposes set forth.

4. The combination of lead-cylinder B, tubular support C, die D, resting on the support with its upper face raised above the lower surface of the cylinder, as described, and a wire-holder secured directly to the body of the cylinder above the die for passing wires to the die, substantially as set forth.

In testimony whereof I have hereunto set my hand.

JOHN FARRELL.

Witnesses:
R. H. WHITTLESEY,
C. L. PARKER.