L. H. ROGERS.
Electrical Conductors.

No. 220,943. **Patented Oct. 28, 1879.**

Fig. 7.

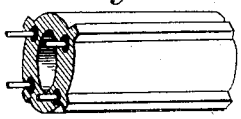


Fig. 1.

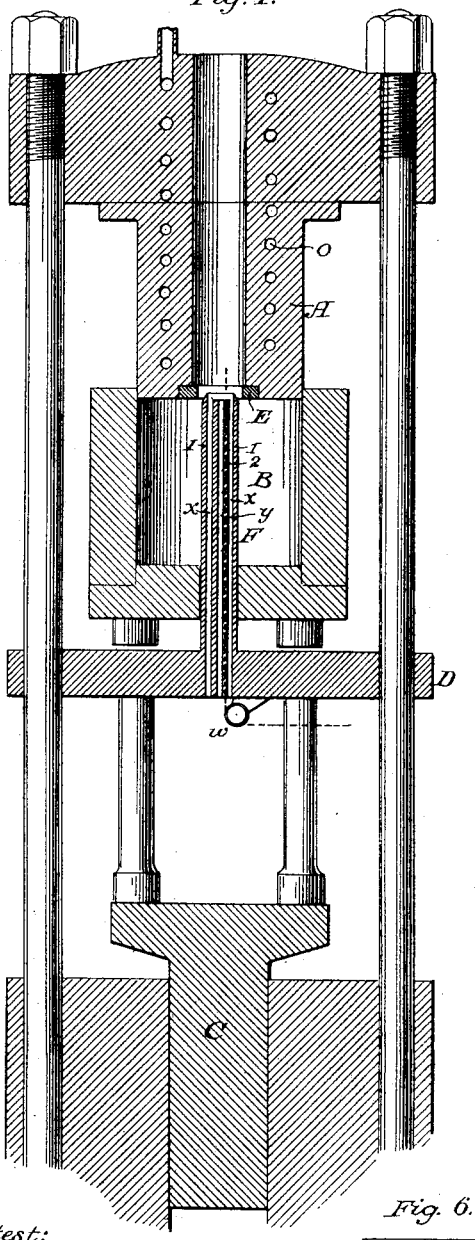


Fig. 2.

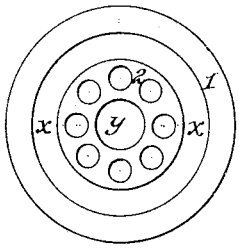


Fig. 3.

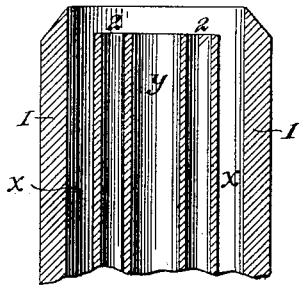


Fig. 4.

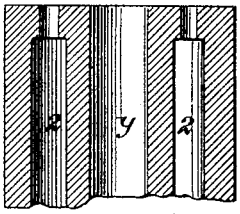


Fig. 5.

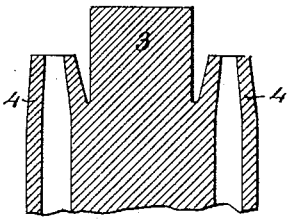
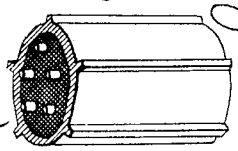


Fig. 6.



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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN ELECTRICAL CONDUCTORS.

Specification forming part of Letters Patent No. **220,943**, dated October 28, 1879; application filed August 7, 1879.

To all whom it may concern:

Be it known that I, LEBBEUS H. ROGERS, of the city and county of New York, in the State of New York, have invented a new and useful Improvement in Electric Conductors, which improvement is fully set forth in the following specification.

This invention relates more particularly to the manufacture of compound wires or cables for underground telegraphs or other purposes.

It consists in the special methods of forming a compound conductor containing a number of wires; also, in the apparatus which is preferably employed in carrying the process into effect; and also in the new article or compound wire, as hereinafter more fully set forth.

The following description will enable those skilled in the art to which it appertains to make and use my invention.

The accompanying drawings illustrate the arrangement of the core and die of a pipe-press, and also the constructions of the cores which are ordinarily employed.

Figure 1 is a sectional view of the principal parts of a pipe-press; Fig. 2, an enlarged end view of the core where it enters the die; Fig. 3, a longitudinal section of the same, and Figs. 4 and 5 longitudinal sections of slightly modified constructions. Fig. 6 illustrates the manner of indicating the position of each wire in a compound conductor by means of marks on the outside. Fig. 7 represents a metallic pipe having a number of insulated wires embedded in the walls thereof, with the interior open.

A is the ram of the press; B, the end cylinder; C, the hydraulic piston, and D the core-bar, for holding the core stationary with respect to the die E. 1 is the outer shell of the core. The part marked 2 is a hollow core, which is placed in the center of the outside core. This center core has perforations through its entire length, through each one of which a wire is drawn.

The inner core may be connected at a number of points with the outer shell, or it may be left practically free to adjust itself by the pressure of the surrounding material.

X and Y are hollow spaces, through which tar or other plastic substances can be pressed or gravitate at the same speed as that of the pipe when issuing from the die, and in sufficient quantity to fill it up and completely surround the wires.

In operation, the cylinder B, having been filled with a ductile or plastic metal, as lead or one of its alloys, wires are introduced through the holes in the inner core, 2, the hydraulic piston is put in motion, and the insulating material pressed through the spaces X Y. The pipe inclosing the insulated wires emerges at the top of the press. The outer shell of the core being beveled at the end, and held stationary at the mouth of the die, the metal pipe will be found to make a close joint with the insulated wires. The inner core may also, if desired, be beveled at the side of and between the holes through which the wires pass.

In order the better to secure the uniformity in the conductor produced, the several wires or conductors are kept, during their passage through the die, under tension. This tension can be secured by carrying the wires over rollers to the core, and regulating the delivery by means of a friction-brake either at the rollers or at the coils from which the wires are delivered. One of these rollers, secured to the core-bar, is shown at *w*, Fig. 1.

The compound conductor, as it leaves the press, is wound upon a reel, which, by its revolution, gives the necessary tension. This tension may be automatically regulated by any suitable means—as, for example, the power may be communicated by a friction-connection which is adjusted to slip when the tension exceeds a certain limit.

In order to prevent the displacement of the wires in the metal sheath, which would be liable to occur if the compound conductor should be coiled before the insulating material becomes hard, the compound conductor is passed through cold water, or gases, or other cooling medium. In the drawings I have shown a water-passage, *o*, for this purpose in the upper head piece and in the walls of the ram.

Instead of two there can be four or five cores, one within the other, and they need not necessarily be round, but can be of various shapes, so as to best arrange the wires in their most perfect position to secure insulation. The inner cores can be hollow shells, as in Fig. 4, in which case, instead of boring their entire

length for each hole, all that is necessary is to have holes at proper distances at the end for the wires to come out, so that they do not touch or bundle together while the insulating material is forced around them.

It is not absolutely necessary in this process to have the core beveled or held stationary with respect to the die. It can be square at the edge, and move through the die, as is usual, in which cases the plastic insulation will be forced up and over this edge against the interior walls of the pipe.

The wires can be covered or not before they are passed into the core; but it will readily be seen that if sufficient insulating material is forced into the interior of the pipe to fill it up solidly as the pipe is being formed, and the wires are held with tension below, the wires will be perfectly insulated, provided the small holes in the end of the core are placed at a suitable distance from one another.

If it is desired to cover the wires before introducing them into the machine, any suitable substance may be employed; but asbestus-paper, spun glass, enamel, or other flexible or fibrous material is preferred. In the same manner as above described cables, flat, square, or of any shape (in cross-section) can be made.

If desired, the wires can be embedded in the walls of pipe, forming part of its thickness, and the interior of the pipe can be used for other purposes—thus, for instance, messages or packages could be sent through the tube by pneumatic pressure, and the walls of the same tube could be lined and strengthened with insulated wires for electric purposes; or the interior of the pipes could be used for carrying water or other liquids, gas for illumination or heating purposes, &c. For this purpose I prefer to employ the construction of core shown in Fig. 5, in which the center of the core 3 is solid, and the wires are introduced through a series of holes extending through cores 4, connected at one side with the main core, and arranged in a circle on the outside thereof.

The metal of the cores 4 is preferably extended, as shown, to form nipples. The wires may or may not be covered with insulating material before they are introduced into the core, and plastic insulating material may be forced through the same openings which wires pass through, or other suitable holes may be made—as, for example, holes for the insulating material might be made through the body of the solid core 3, terminating at the end of the nipples of the small cores 4. In the figure (5) the position of the core with relation to the die is indicated.

Instead of the core shown in Fig. 5, the one represented in Figs. 1, 2, and 3 may be used by making the center of the inner core, 2, solid, and extending it out into and through the die.

At the outer end of the hollow or perforated core grooved wheels or other apparatus can be placed to straighten and take out crooks or bends before the wire enters within the said core. The outside of the pipe can be made to have grooves or other marks for indicating the positions of the wires inside.

I do not confine myself to the insulating material to be forced into the pipe, nor the particular disposition or manner, above described, of holding or keeping the wires separated from each other at the end of the die.

The insulation can be effected by a plastic substance that hardens when it is heated at the die, the temperature being increased or regulated by other means, if desired. Gutta-percha or rubber, compounded with sulphur, might be used.

In addition to those mentioned, another way to keep separate the wires is to have a hollow core, and, as the wires enter it, to slip in a series of pieces of flat or other shaped insulating material that will fit or go easily within the interior of the pipe. These pieces, previously perforated or grooved, are placed over the wires. The perforations should be far enough apart to prevent the wires from touching each other. These pieces are allowed to pass up at intervals of two or three inches, more or less, through the hollow core at the same time that the pitch or tar is forced up, filling the inside of the pipe. They then act as additional insulating-supports for the wires through the entire length of the compound conductor. A great number of such perforated interior pieces can be used for insulators, and nothing else forced into the pipe to assist the insulation.

Instead of placing the same pieces over a number of wires, the several wires can have separate small pieces of insulating-tubing slipped over them at intervals of an inch or two, more or less.

Instead of using cores hollow or perforated, as before described, a core with a series of grooves upon its outer surface, with a solid or hollow center, may be employed to advantage in certain cases.

The outer metal sheath may be made of any plastic metal or alloy of lead. An alloy of lead, antimony, or tin might be used. It would resist the teeth of mice better than lead.

If difficulty be anticipated or experienced from rats and mice, the conductor might be wound or otherwise partially covered at the time of manufacture, or afterward, with strips of iron or steel. A layer of asbestus or mineral wool would serve as an additional protection.

The wires or strips above mentioned might be barbed to convey away lightning to prevent fusion of the cable should it be struck. The wires or strips might, if desired, be themselves insulated.

Having thus described my said invention, and the manner in which the same is or may be carried into effect, what I claim, and desire to secure by Letters Patent, is—

1. The method of making or manufacturing compound wires or cables, consisting in forming a pipe of lead or other ductile metal in a

pipe-press, and at the time of its formation introducing throughout its length a number of wires, spacing the said wires and keeping them separate from one another, and forcing insulating material into the pipe between and around the wires, substantially as described.

2. The method of keeping separate the wires in the manufacture of compound wires or cables by the aid of a pipe-press, which consists in passing the wires through separate holes or grooves side by side within the core of the press, substantially as described.

3. In the manufacture of compound conductors, the method of forming the same and insuring the proper position of the conductor or conductors, which consists in pressing a pipe out of ductile metal through a die, introducing therewith, progressively, as it is formed, one or more conductors, and keeping the latter continuously under tension while passing through the die, substantially as described.

4. The method of forming compound wires or cables, adapted also for use as tubes for the transmission of messages by pneumatic pressure and other purposes, which consists in forming a pipe of lead or other ductile metal, and at the time of its formation introducing and embedding in the walls of said pipes insulated wires, substantially as described.

5. The method of indicating the position of wires in a compound wire or cable containing a number of wires in a single sheath, which consists in forming upon the outside of said sheath grooves or marks, which correspond in position with the several wires inside, substantially as described.

6. A compound wire or cable composed of a metallic pipe having insulated wires embedded in the walls thereof, but with its interior open, substantially as set forth.

7. A core for a pipe-press having therein two or more separate holes or perforations, in contradistinction to grooves, the said holes or perforations being arranged at the side of each other, for the passage of separate wires, substantially as described.

8. The combination, with the cylinder, ram, and die of a pipe-press, of a stationary core provided with a series of channels or openings within the core, side by side, substantially as described.

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

LEBBEUS H. ROGERS.

Witnesses:

J. C. SAXTON,

M. M. BUDLONG.