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A. K. EATON.

Process of and Apparatus for Insulating Telegraph Wires or Cables.

No. 240,106. **Patented April 12, 1881.**

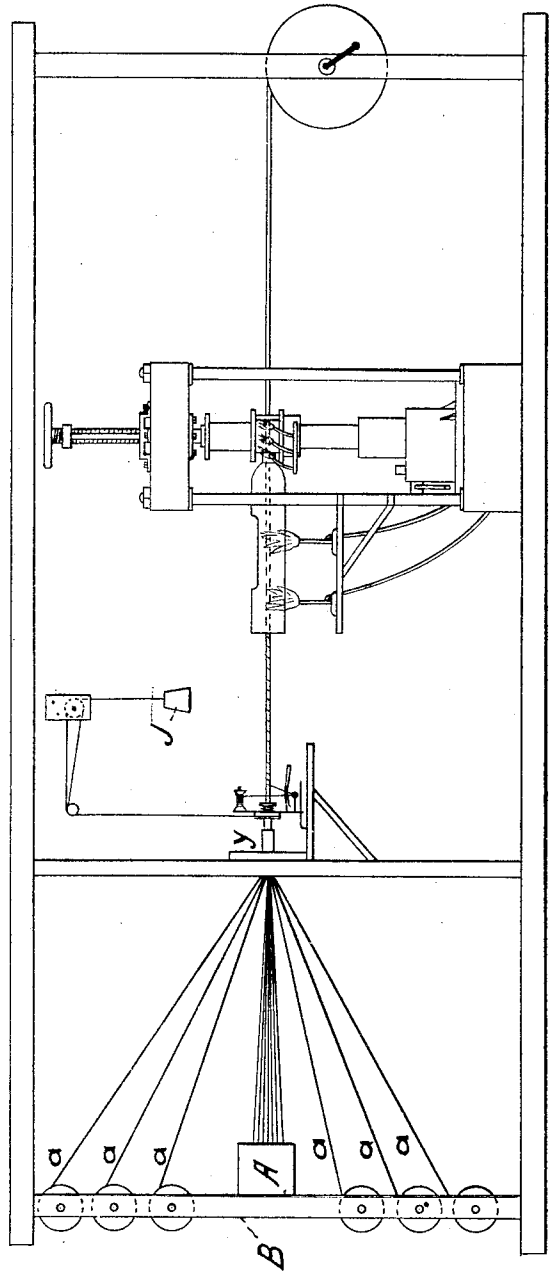


FIG. 1.

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FIG. 2.

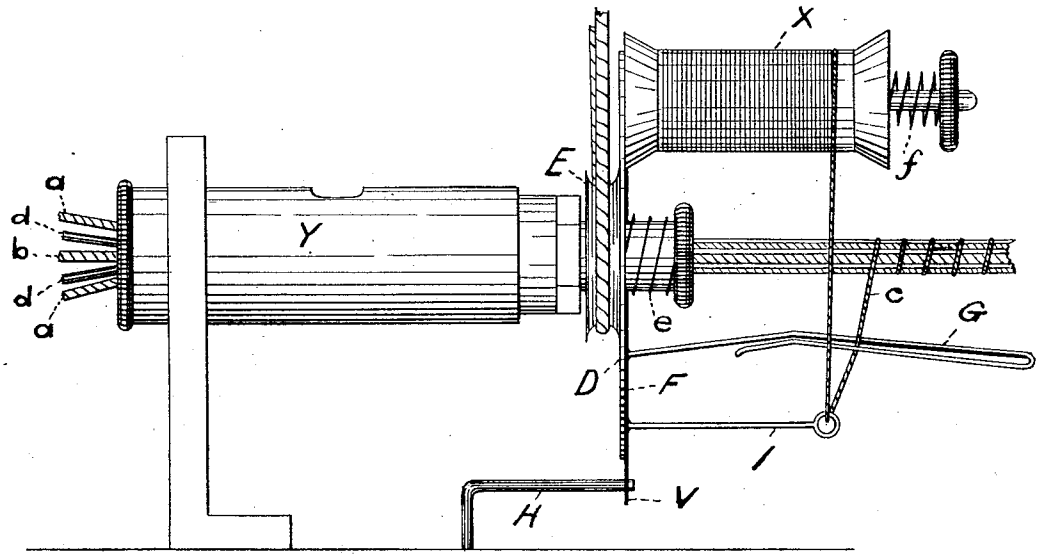
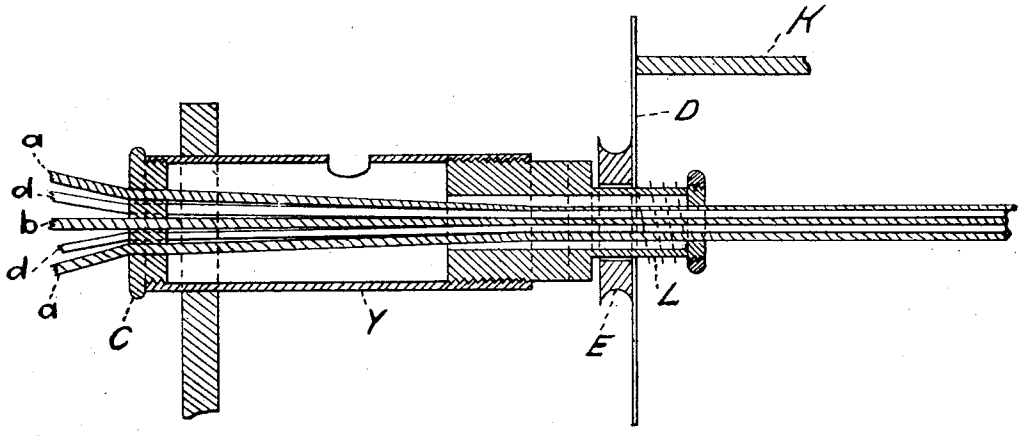


FIG. 3.



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A. K. EATON.

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FIG. 4.

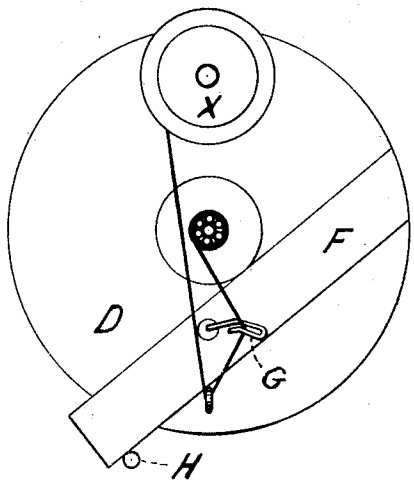


FIG. 5.

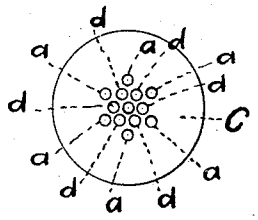


FIG. 6.

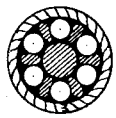


FIG. 7.

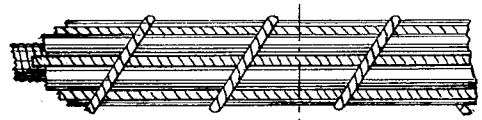




FIG. 8.

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A. K. EATON.

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No. 240,106. **Patented April 12, 1881.**

FIG. 9.

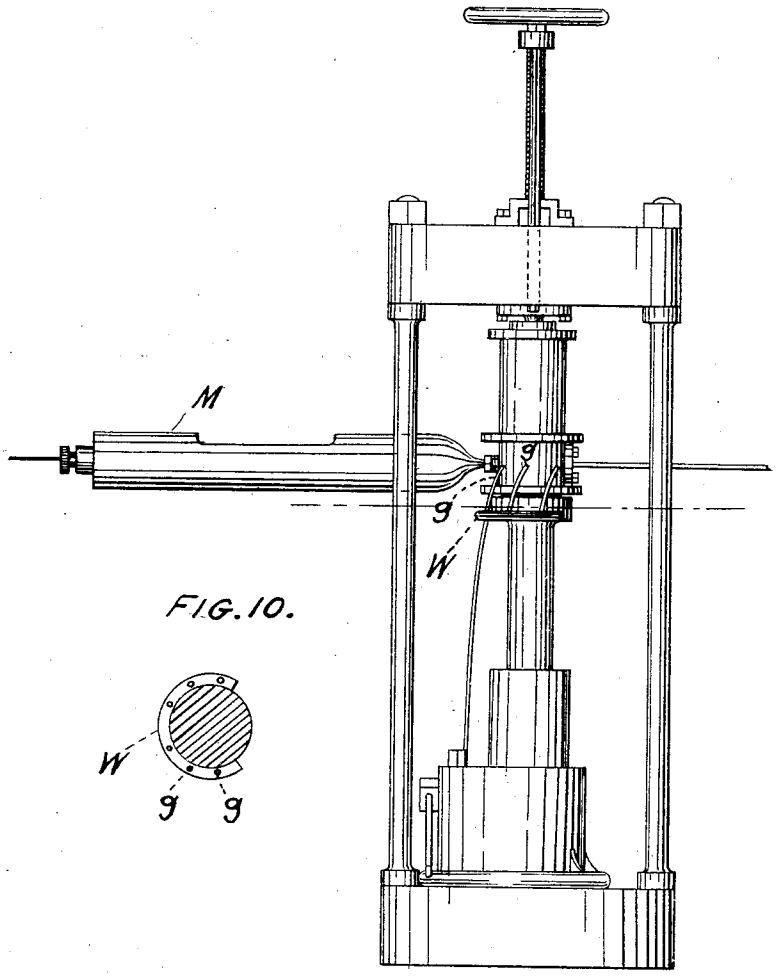


FIG. 10.

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(No Model.)

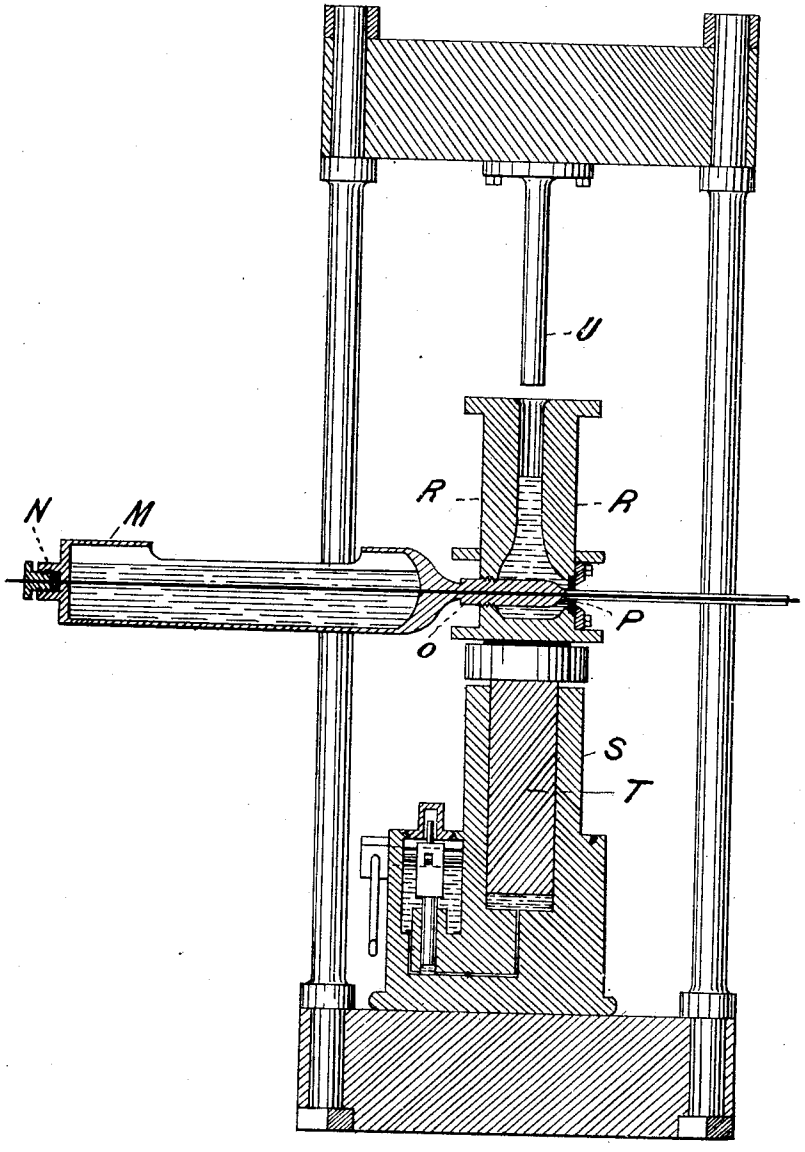
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A. K. EATON.

Process of and Apparatus for Insulating Telegraph Wires or Cables.

No. 240,106. **Patented April 12, 1881.**

FIG. 11.



WITNESSES.

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Process of and Apparatus for Insulating Telegraph Wires or Cables.

No. 240,106. **Patented April 12, 1881.**

FIG. 12.

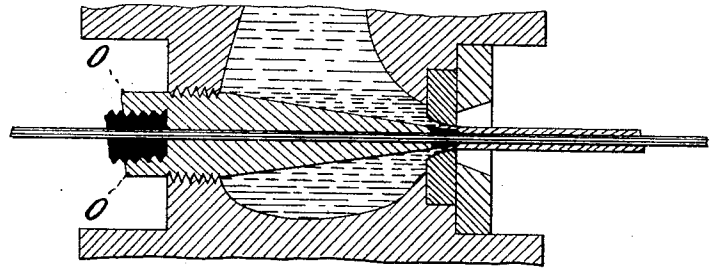


FIG. 13.

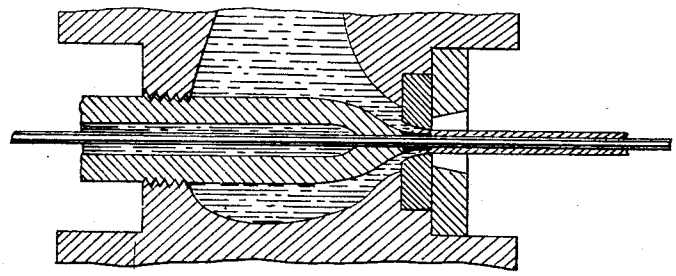
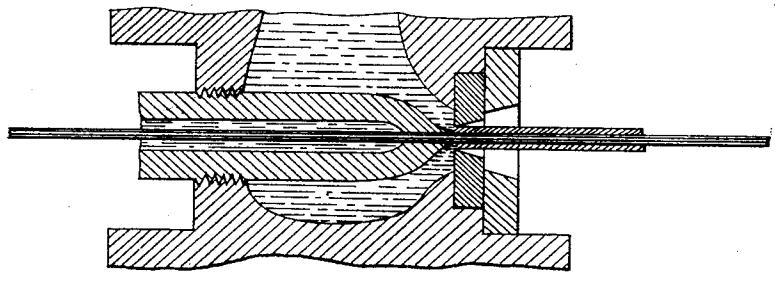


FIG. 14.



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UNITED STATES PATENT OFFICE.

ASAHEL K. EATON, OF BROOKLYN, NEW YORK.

PROCESS OF AND APPARATUS FOR INSULATING TELEGRAPH WIRES OR CABLES.

SPECIFICATION forming part of Letters Patent No. 240,106, dated April 12, 1881.

Application filed August 24, 1880. (No model.)

To all whom it may concern:

Be it known that I, ASAHEL K. EATON, of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in the Process of Manufacturing Compound Telegraph Wires or Cables, and certain new and useful apparatus to be employed in the practice of said process; and I do hereby declare the following to be a description of the same in such full, clear, concise, and exact terms as to enable any one skilled in the arts to which my invention appertains, or with which it is most nearly connected, to make said cable and machinery and to practice said process, reference being had to the accompanying drawings, making part of this specification, and the figures and letters of reference marked thereon.

By Figure 1 of the drawings is shown, upon a small scale, a general plan of the cable, the process, and of the machinery, and the several parts and combination of parts composing it. Fig. 2 is a side elevation of part of Fig. 1, to be hereinafter fully explained, and Fig. 3 is a longitudinal vertical section through Fig. 2, omitting the spool X. Fig. 4 is a cross-section through Fig. 2, taken in front of the spool X. Fig. 5 is a view of the left-hand end of the guide-box Y in Figs. 2 and 3. Fig. 6 is a cross-section of the compound wire or cable without the metallic casing. Fig. 7 is a longitudinal section through the same. Fig. 8 is a cross-section through said wire or cable inclosed in a lead casing. Fig. 9 is a side elevation of a press used in the manufacture of said wire or cable. Fig. 10 is a cross-section through said press under the lead-retaining cylinder, showing the application of a series of gas-flames to it, by which the metal for covering the cable is kept in a soft semi-fluid state. Fig. 11 is a vertical section through said press, showing the lead-retaining cylinder, the hydraulic ram and pump, and a reservoir to contain the insulating material used in the manufacture of said wire or cable. Fig. 12 is a cross-section through the lead-retaining cylinder of the press, upon an enlarged scale, for the purpose of showing more distinctly the construction and relation of some of the principal parts in combination. Figs. 13 and 14 are modified forms of Fig. 12, as will be hereinafter more fully explained.

My invention consists, first, of certain improvements in the mechanical process or method, hereinafter described, of manufacturing compound telegraph wires or cables; second, of machinery especially adapted for use in the practice of said process.

My improved compound telegraph wire or cable consists of a series of conducting-wires, assembled around and upon a central cord or strand composed of some good insulating material, and having a cord or strand of said insulating material interposed between them, so that each wire is insulated from all the rest by a straight cord of intervening insulating fabric, (cotton, silk, asbestus, for example,) said wires and cords being held together by a spiral wrapping of said insulating cord, covered with a coating of plastic insulating material and incased in a sheathing of lead or other similar metal.

My process or method of making said compound wire or cable consists of several steps or parts, the first of which is to draw from a spool or ball of insulating-yarn a central cord, first through a guide-box, then through a wrapping-reel, then through an insulating-reservoir, then through a tube or nipple in the lead-retaining cylinder of the press, and finally to a winding-reel. The second step is to draw from suitably arranged and supported spools or balls around this central insulating-cord, and parallel with it, a series of conducting-wires through the same guide-box, but through separate guide-holes, through the same wrapping-reel, the same insulating-reservoir and nipple in the lead-cylinder, to the winding-reel. The third step is to draw from suitably supported and arranged spools or balls of insulating-yarn a cord or strand from each ball or spool through the same guide-box, but through separate guide-holes, and lay it between each two of said conducting-wires, conveying these several insulating-cords forward through the wrapping-reel, the insulating-reservoir, and the nipple or tube in the lead-cylinder to the winding-reel. We have now got all the parallel strands of insulating-cords and conducting-wires composing the compound

wire or cable together and stretched in their proper order through the guide-box and upon the winding-reel. The fourth step is to wrap these several strands of wire and cord together as they leave the guide-box with the insulating-yarn. This is done by means of a wrapping-reel adjusted to rotate around the cable in such manner and velocity with reference to the horizontal velocity of the cable as to lay the strands of the wrapping-cord wide apart around it, like the thread of a screw having a very coarse pitch. The fifth step is to cover the cable externally with a coat of plastic insulating material. This cement coating is composed of about seventy-five parts of paraffine, fifteen parts of gutta-percha, five parts of resin, and five parts of asbestus, and is contained and kept hot in a long reservoir set on a line transverse to the axes of the lead-retaining cylinder, and connected with the tubular transverse core through which the cable passes, the connection between the reservoir and tubular core being tight, and such as to allow the cable to pass freely from one to the other and carry with it the hot plastic insulating material as it moves forward. The sixth step is to incase the cable in a tube or sheathing of lead, or other similar metal, simultaneously with the cement coating, without burning the insulating material and without injuring the insulation of the wire or rupturing the metal sheathing.

The cords of fibrous insulating material with which the wire is wrapped, and which are used to separate the several wires composing the cable, are composed of cotton, or a similar fibrous material, which, when exposed to heat in air, chars at a temperature of about 275° of Fahrenheit, so that if the wire, with its cotton coating, be exposed to the air as it passes into the hot-lead cylinder of the press, the fibrous insulating material will be charred sufficient to destroy its insulation. To avoid this difficulty I make an air-tight connection between the reservoir containing the plastic insulating material and the tubular core of the press, and heat the insulating compound hot enough to drive out the air and moisture. Through this hot insulating compound I pass the wire with its cotton coating into the tubular core of the lead-cylinder. By these means the air is excluded from the fibrous coating of the wire while it is exposed to the heat of the solution and of the lead-cylinder, and is thus kept from charring, driving out at the same time any moisture there may be in the plastic or fibrous coating of the wire.

It is very important to keep the hot-lead casing from being forced upon the wire cable, so as to displace the soft insulating material. This I do by reducing the delivering end of the tubular core to a thin shell, as above described, no thicker than is necessary to support the pressure, and project it through the die far enough to form a lead tube around the the coated cable of its exact external diameter, and without pressing it upon the cable so as to squeeze out the insulating material, or in any way to impair the insulation of the wires.

To make the lead flow freely through the die around the tubular core I apply a series of gas-flames to the bottom part of the lead-retaining cylinder of the press, and maintain a temperature sufficient to keep the lead soft enough to flow easily under pressure, but not sufficient to make it run through the die without the application of some power to press it.

The machinery used in the manufacture of this wire is, as above stated, outlined by Fig. 1 of the drawings.

The central insulating-cord and the parallel conducting-wires are drawn from a box, A, and the intervening cords, *a a a*, are drawn from spools held by frame B, by which the box A is also supported. These wires and cords all concentrate in a tubular guide-box, *y*, (shown upon an enlarged scale by Figs. 2 and 3 of the drawings.) The left-hand end of this box is fitted with a perforated head, C, as shown by Figs. 3 and 5. The central insulating-cord, *b*, is passed through the central hole in the head C, and the conducting-wires *d* through the holes *d*, and the intervening insulating-cords *a* through the holes *a*, the wires and cords being shown by Figs. 2 and 3, and a plan of the guide-holes by Fig. 5. These wires and cords issue from the opposite end of the guide-box through a hole or tube just large enough to contain them, and being arranged in their proper relation are wrapped together as fast as they are drawn forward by means of a wrapping-reel, consisting in its principal parts of a plate, D, a driving-pulley, E, a stop-lever, F, a guide-lever, G, a stop-pin, H, a bobbin or spool, X, and a reeling eye-pin, I. This wrapping-reel is shown in Fig. 1, and upon an enlarged scale by Figs. 2 and 3. The drawings show it as being operated by a cord and weight, J, though it may of course be operated by any well-known device or part of the machinery suitable for the purpose.

The operation of the reel in wrapping the wire is as follows: The cable, in moving forward, carries the wrapping-yarn *c* with it and draws it tight in the eye of the standard I and against the bent lever G, by which the catch F on the disk D is drawn forward toward the letter V, against the spring *e*, and released from the stop-rod H. The reel then begins to rotate around the cable as a center, and continues to do so, wrapping the cable with a wide spiral wrapping as long as the latter continues its motion forward; but as soon as the cable stops moving forward the tension of the yarn is taken off of the lever G and rod I, and the disk and catch F are pressed back within reach of the stop-pin H, which stops the motion of the reel. The tension of the wrapping-yarn is regulated by means of a spring, *f*, and a thumb-screw on the axes of the spool X. The axis K of the spool is of course carried by the disk D, the pulley E

forming a hub for the disk, and the end L of the guide-box is the axis upon which it rotates around the cable, as clearly appears by Fig. 3 of the drawings. The cable passing forward from the wrapping-reel enters the insulating-reservoir M through a stuffing-box, N. This reservoir consists of a long box or trough, in which the plastic insulating material is contained and heated by flames of gas, as shown by Fig. 1 of the drawings. The inner end of this reservoir is provided with a nipple having a hole through it large enough to admit the cable, and cut with a screw-thread to screw into and make an air-tight joint with the end of the tubular core O, that passes transversely through the lead-retaining cylinder R, by which the sheathing is formed around the cable.

The press is operated by an ordinary hydraulic ram, the cylinder of which is shown by S, and the piston by T. By means of this press the retaining-cylinder R is forced upon the plunger U, by which the lead is forced out of the cylinder through the die in the form of a tube around the cable.

The reservoir M should be made long and comparatively shallow, so as to contain a large amount of material, without depth enough to create a hydraulic head or pressure, and it should be set upon a horizontal plane transverse to the axis of the press on a line with the tubular core, so as to allow the cable ample time to take up the cement as it passes through the reservoir to the tubular core. The cement is thus carried forward by the cable, there being practically no hydraulic head to force it through the tubular core faster than the cable moves forward. The cable should accurately fill the tubular core through which it passes, and the delivering end of said core should be turned down to a thin edge, and should pass through the die and be accurately set in the center of it, so as to make the shell of the metal tube of uniform thickness and of an internal diameter just equal to the external diameter of the cement-covered cable, so as to fit the cable without pressing upon it.

Fig. 12 of the drawings shows how the tubular core should be made in practice. The heavy black lines at the delivering end of the core represent its thin edges extending through the die. Fig. 13 represents the same arrangement of tubular core and die, excepting that in this case the insulating-reservoir extends into the tubular core, or, rather, the tubular core is an extension of the reservoir toward the die. Fig. 14 shows the same arrangement as Fig. 13, excepting that in Fig. 14 the die is reversed, having its smallest diameter turned in toward the end of the core.

By Fig. 9 of the drawings is shown a side elevation of the press with a circular piece of pipe, *w*, wrapped around it, near the bottom of the retaining-cylinder, into which gas-burners *g* are fitted, by which means a series of gas-flames are applied to the retaining-cylinder to heat the lead and keep it soft during the operation of covering the cable with the metal tube.

It will be observed that in making this wire the fibrous insulating-covering is merely wound (not braided) around the wire, so that the metal casing is necessary to hold the wrapping upon the wire, which, in the absence of the metal casing, would be liable to break, unwind, and come off, the lead casing being thus made to perform the double function of holding the wrapping upon the wire, as well as to protect it from the deteriorating effects of the weather, water, or earth, as the case may be, the metal casing being put upon the wire as fast as the wrapping is laid on.

I am aware that it is old to braid a fibrous covering upon telegraph-wire, and that it is also old to incase an insulated wire in a metal casing, the wire being covered with spun glass, asbestus, gutta-percha, and the like, and I of course do not claim any of these; but

What I do claim is—

1. In the manufacture of lead-incased compound telegraph-wire, the combination of mechanical elements, substantially herein described, consisting of a guide-box having separate guide-holes, by which the several wires and insulating-cords are laid together side by side, a reel, by which the wires and cords are wrapped together, a reservoir of insulating material, by which the wires and cords are covered, and a pipe-press having a tubular core, by which the whole is incased in a metal casing.

2. The herein-described continuous process of manufacturing lead-incased telegraph-wire, which process consists of the following steps in succession, viz: first, wrapping the wire or wires with a spiral wrapping, by which it is partially insulated, then passing it through a compound of hot insulating material, by which the insulation is perfected, then pressing upon the wire thus insulated a sheathing of metal, by which it is inclosed and protected.

3. In the process of manufacturing lead-incased telegraph-wire, the means, substantially herein described, of keeping the fibrous wrapping from being charred by the heat of the metal-retaining cylinder, which means consist of a reservoir containing an insulating compound consisting, substantially, of paraffine, gutta-percha, rosin, and asbestus, from which the air and moisture are expelled by heat, and having an air-tight connection with the tubular core of the pipe-press, the cotton-covered wire being submerged in the insulating compound on its way to the press and during the operation of incasing it with metal.

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