

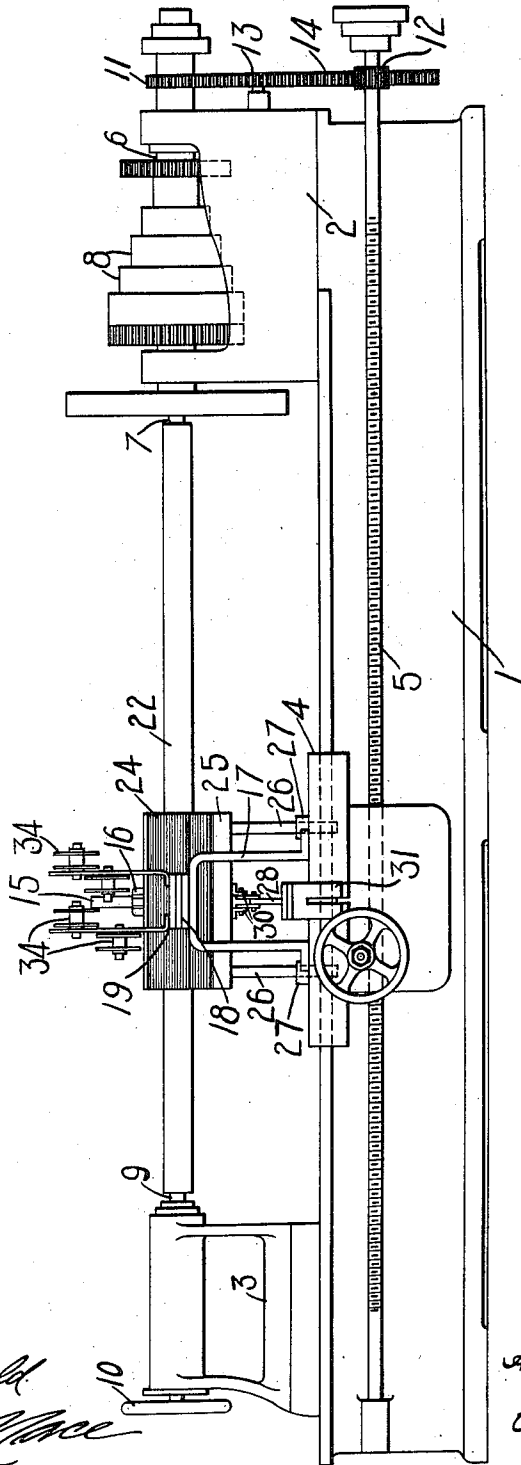
A. B. REYNDERS.
METHOD OF MANUFACTURING TUBES.
APPLICATION FILED DEC. 4, 1913.

1,160,100.

Patented Nov. 9, 1915.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

R. J. Fitzgerald
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INVENTOR

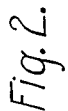
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

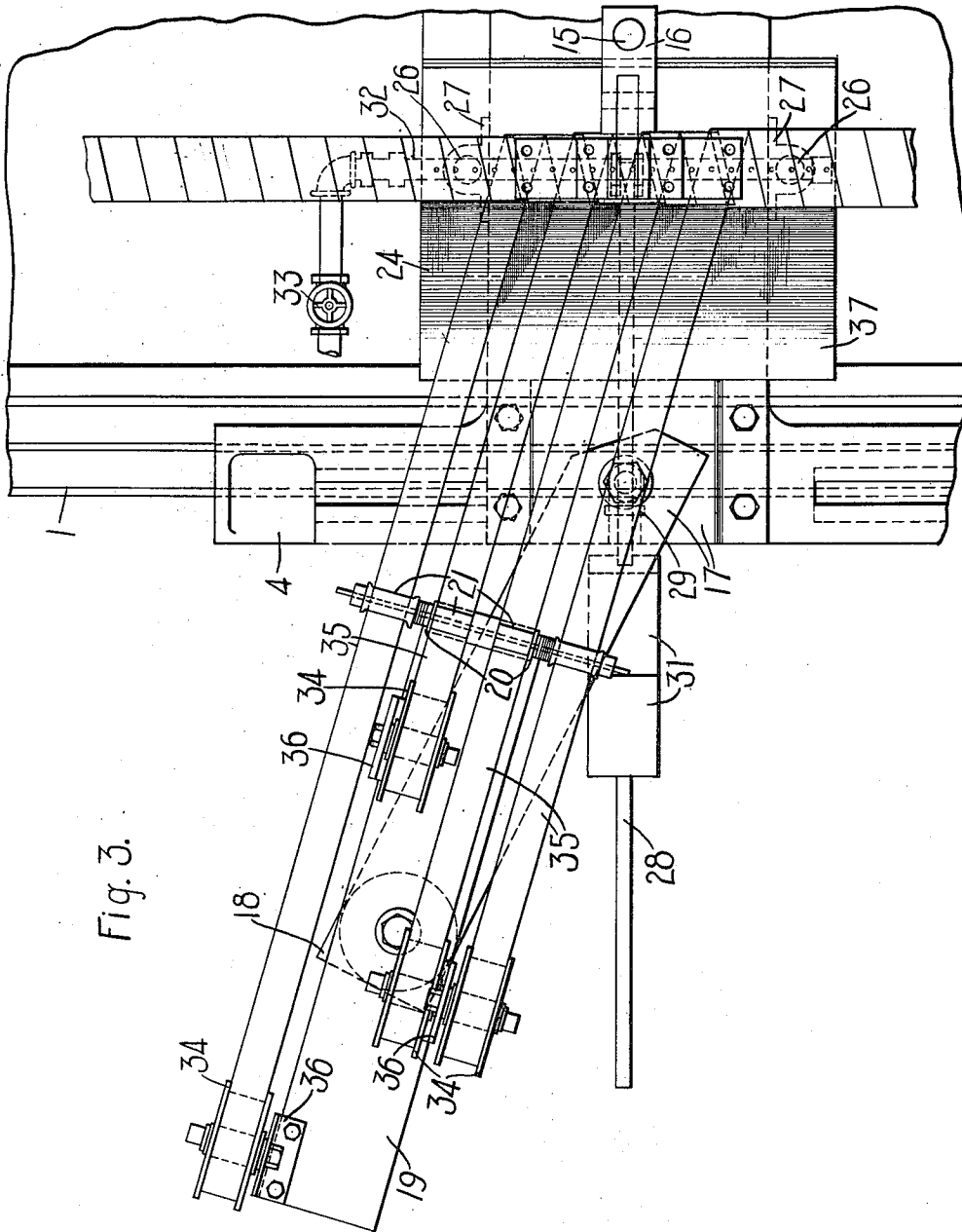


Fig. 3.

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UNITED STATES PATENT OFFICE.

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METHOD OF MANUFACTURING TUBES.

1,160,100.

Specification of Letters Patent.

Patented Nov. 9, 1915.

Original application filed June 9, 1910, Serial No. 566,103. Divided and this application filed December 4, 1913. Serial No. 804,685.

To all whom it may concern:

Be it known that I, ARTHUR B. REYNDERS, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Methods of Manufacturing Tubes, of which the following is a specification.

My invention relates to methods of manufacturing tubes, and it has special reference to such methods as are adapted particularly for producing so called "condenser terminal bushings" of relatively great length for use in connection with high-voltage electrical apparatus.

The object of my invention is to provide a simple and inexpensive method of producing devices of the above indicated character, which may be performed effectively and with facility upon a large commercial scale and which shall be particularly adapted for the production of insulating tubes of great length in a comparatively short time.

Heretofore, insulating tubes of the condenser terminal bushing type have been manufactured from strips of paper or other fabric of a width equal to the desired length of the finished product, which paper has been wound upon a mandrel in a plurality of concentric convolutions.

With the advent of very high-voltage systems, such as have been recently installed, the size, and particularly the length, of protective condenser terminal bushings has materially increased. Limitations as to the lengths of tube or terminal bushings which could be produced in the old manner were imposed by the widths of paper which could be obtained for the purpose. In order, therefore, to meet the requirements of condenser terminal bushings of large size, I propose to employ several rolls of strip paper or fabric which shall be concurrently and progressively wound upon a mandrel in the form of helices, preferably having such a pitch that the edges of the adjacent laps or turns of each helix substantially touch one another. Moreover, I propose to space the several strips apart a distance substantially equal to half the width of a single strip, or at least less than the full width of the strip, whereby the several helical convolutions of each layer overlap two of the convolutions of the adjacent layer. In this

manner, insulating tubes of high dielectric strength and of uniform properties may be conveniently produced, and, by employing a plurality of strips, a corresponding number of layers may be wound at once, whereby the time and labor involved will be reduced to a minimum.

In my co-pending application, Serial 566,103, filed June 9, 1910, and assigned to the Westinghouse Electric & Manufacturing Company of which this application is a division, I have fully set forth and claimed a machine which is particularly adapted for carrying out my invention.

For illustrative purposes I have set forth this machine in the accompanying drawings, of which—

Figure 1 is a view thereof in side elevation, Fig. 2 is a view, partially in section and partially in end elevation, of the apparatus shown in Fig. 1, and Fig. 3 is a plan view thereof.

Referring to the drawings, the apparatus here shown comprises an engine lathe, or similar device having a bed 1, a head stock 2, a tail stock 3, a carriage 4 and a feed screw 5. The head stock 2 is provided with a shaft 6, a live center 7 and the usual cone pulley 8, by which the shaft may be driven from any suitable source of power. The tail stock 3 is provided with a dead center 9 which may be adjusted by means of a hand wheel 10, the tail stock itself being adjustable on the bed 1 in the usual manner. The feed screw 5 is operatively connected to the shaft 6 by means of driving gears 11 and 12 and suitable change gears 13 and 14.

The carriage 4 is provided with an upright or supporting rod 15 to which a guide member 16 is adjustably secured. A frame 17 is screwed to the front of the carriage and comprises an outwardly projecting member 18, to which a spool rest 19 is bolted, or otherwise secured, and a projection 20 upon which a guide roller 21 is rotatably mounted.

A mandrel or tube 22 is supported in the lathe centers 7 and 9 in the usual manner and is of such size as to produce a tube having the desired inside diameter. The guide member 16 is provided with rollers 23 having axes which are parallel to that of the mandrel on which they are adapted to rest. A pressure device is also provided which comprises a plate 24, bent into the form of a

trough, a supporting member 25 therefor having downwardly extending projections 26 which are preferably cylindrical in form and extend through guide members 27 on the carriage 4, a lever 28 fulcrumed on a pin 29 at the front of the carriage having one end connected by means of a link 30, to the base member 25, and weights 31 upon the outer end of the lever to maintain a constant pressure between the trough shaped member 24 and the mandrel 22. The pressure exerted between the member 24 and the mandrel 22 may be varied by adjusting the position of the weights 31 on the lever 28. Heat is continually applied to the trough shaped member 24 by any suitable means, such as a gas burner 32, which extends under the member 24 and rests upon the base 25, as shown in Figs. 2 and 3 of the drawings. The burner 32 may be a perforated iron pipe or it may have any other suitable form, the fuel being admitted through a valve 33 into the burner.

It will be observed that, not only the pressure member 24 and the heater 32, but also the spool holder 19 and the guide member 16 are secured to and form a part of the carriage 4.

The operation of the device is as follows: A plurality of spools 34, carrying rolls of comparatively narrow strips 35 of paper or other fabric, are rotatably supported by up-rights 36 which are secured to the member 19 and form a part of the spool holder. As shown in Fig. 3, the spools 34 are so mounted that the strips may be wound upon the mandrel without interfering with one another. The number of spools may be varied, as desired, it being evident that considerable time and expense may be saved by utilizing several spools whereby several superimposed layers may be produced at the same time. Each of the strips is wound upon the mandrel 22, in the form of a helix, and, as the spaces between strips are less than the width of the strips, every turn overlaps two turns of the adjacent layer of paper or fabric similarly produced. When the strips are all properly started, the shaft 6 of the lathe is driven in the usual manner, causing the mandrel 22 to rotate so as to wind on the strips, and the feed screw 5 is rotated slowly so as to produce a movement of the carriage to wind the strips upon the mandrel in the form of helices, preferably having such a pitch that edge-to-edge joints are obtained. Before the process is commenced, the heater is put into operation and the trough shaped member 24 is maintained at a comparatively high temperature. As the strips are fed over the curved portion 37 of the member 24 they are covered with shellac, insulating varnish or some other similar substance which softens upon the application of heat and becomes very hard when cold. All the joints

in the tube are thus filled with an insulating binder and, since the strips are wound upon the mandrel under pressure, a very solid insulating body is produced.

Instead of applying the varnish or shellac to the strips of paper, or other fabric, as they are wound upon the mandrel, specially treated paper may be employed, for example: I have found that if paper is coated with shellac or varnish, which is then allowed to harden, such coated paper may be wound into rolls and then cut into the desired lengths for use in the machine. The temperature of the trough shaped member should be sufficient to soften the varnish or shellac on the surface of the fabric and permit a uniform distribution of the binder, giving substantially the same product as if the varnish were applied as the strips pass to the mandrel. After the carriage has traveled from one end of the mandrel to the other, the strips are cut off and a new layer is commenced.

While I have illustrated and described a form of apparatus which I have found to be particularly well adapted for carrying out my invention, it will be understood, of course, that my method, broadly considered, is independent of the apparatus, and may be practised through the use of widely different agencies, or even by hand manipulation, if desired.

I claim as my invention:

1. The method of making a tube which consists in simultaneously moving a plurality of supplies of strip material along a rotating mandrel to which the said strips are attached and thereby concurrently winding the strips upon the said mandrel in the form of parallel overlapping helices, the said strips being applied in parallel relation and spaced apart a distance less than the width of the strips.

2. The method of making a tube which consists in simultaneously moving a plurality of supplies of strip material along a rotating mandrel to which the said strips are attached and thereby concurrently winding the strips upon the said mandrel in the form of parallel overlapping helices, each of the said helices having a pitch substantially equal to the width of the strips and being so disposed as to overlap the joints between the adjacent convolutions.

3. The method of manufacturing tubes which consists in simultaneously winding a plurality of strips of adhesively coated material upon a rotating mandrel in the form of parallel overlapping helices by moving the said strips longitudinally along the mandrel and applying heat and pressure to the strips during the winding operation.

4. The method of making tubes which consists in simultaneously and progressively winding a plurality of strips of varnish-

coated fabric upon a mandrel in the form of parallel overlapping helices and locally applying heat and pressure to the approaching strips to heat and compress the tube
5 during the winding operation.

5. The method of making a tube which consists in applying the ends of a plurality of spaced strips of material to a mandrel, rotating the mandrel, and simultaneously
10 moving the said strip material parallel to the axis of the said mandrel, whereby the

said strips are wound upon the said mandrel in the form of overlapping helices, the successive turns formed in each strip being disposed in substantially edge-to-edge relation. 15

In testimony whereof, I have hereunto subscribed my name this 1st day of Dec. 1913.

ARTHUR B. REYNDERS.

Witnesses:

A. E. KAISER,
B. B. HINES.