July 24, 1928. 1,678,390

W. F. HOSFORD

METHOD OF WORKING FIBROUS MATERIAL

Filed Feb. 28, 1927

Fig. 1.

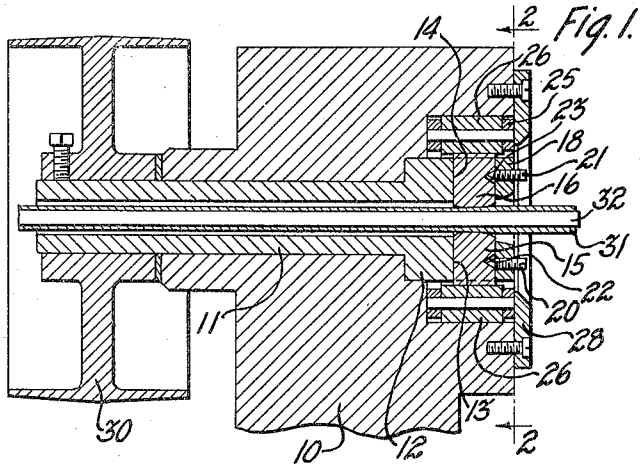


Fig. 2.

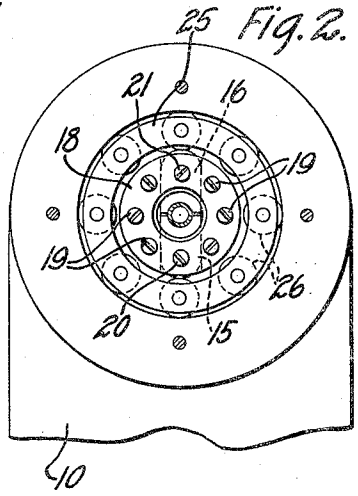


Fig. 3.

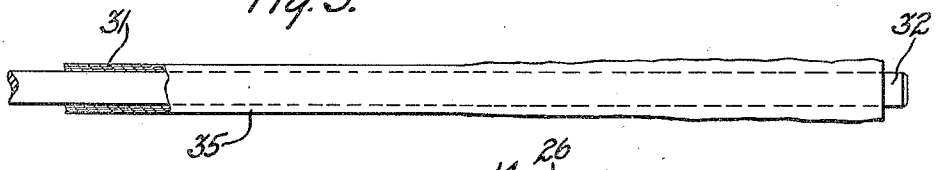


Fig. 4.

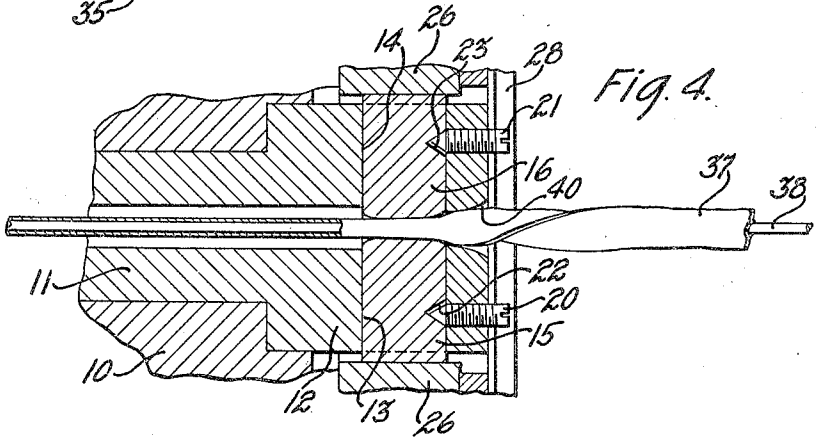


Fig. 5.



Fig. 6.

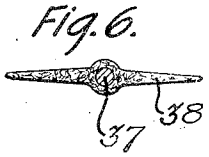


Fig. 7.

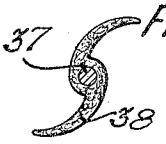


Fig. 8.



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Patented July 24, 1928. 1,678,390

UNITED STATES PATENT OFFICE.

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METHOD OF WORKING FIBROUS MATERIAL.

Application filed February 28, 1927. Serial No. 171,672.

This invention relates to a method of working fibrous material, and more particularly to a method of producing fibrous articles having a curved outer surface, such as tubing and the like.

In accordance with one method employed in the manufacture of fibrous tubing, several layers of vulcanized fibrous material are wrapped around a mandrel to give the ultimate wall thickness desired after which the fibrous material on its mandrel is advanced a plurality of times between a pair of compression rolls having a plurality of peripheral grooves cooperating to form circular passes of gradually decreasing diameters whereby the fibrous tubing is gradually compressed and finished to the desired size and shape. This method of forming and finishing fibrous tubing is very slow due to the large number of times it is necessary to advance the tubing between the compression rolls in order to uniformly compress the tubing to the proper size. Furthermore, it has been found that the production of smooth and uniform tubing by this method requires much skill and experience due to the tendency of projecting ridges or fins being formed on opposite sides of the tubing by the edges of the semi-circular grooves in the compression rolls. Also when forming and polishing fibrous tubing by this method there is a tendency for the fibrous material to become attached to the mandrel, rendering it very difficult and sometimes almost impossible to remove the finished tubing from its mandrel.

The primary object of the present invention is to provide a simple, inexpensive and efficient method of producing smooth and uniform fibrous tubing whereby the above objections are eliminated.

Another object of the invention is to provide a simple and inexpensive method of forming fibrous material on a core to constitute a uniform, homogeneous coating therefor.

In accordance with the invention, an improved method of working fibrous material consists in swaging the fibrous material which may be applied to a core either by wrapping several layers of vulcanized fiber around the core to give the ultimate wall thickness desired or by subjecting the core to a liquid containing pulp in such manner that a coating of pulp becomes attached thereto. By passing the thus treated core lengthwise through a rotating tubular shaft carrying diametrically opposed swaging members which are caused to move inwardly and outwardly along radial lines toward and away from the axis of rotation, the fibrous material is quickly compacted into a smooth and uniform surface.

Other objects and advantages of the invention will become apparent from the following detailed description, and the novel features of the invention will be particularly pointed out in the appended claims.

In the accompanying drawing which illustrates an apparatus by means of which the improved method may be practiced,

Fig. 1 is a fragmentary vertical section of a swaging apparatus by means of which the improved method of finishing fibrous tubing may be practiced;

Fig. 2 is a vertical section taken on line 2—2 of Fig. 1;

Fig. 3 is an enlarged, detail view of a fibrous tubing, a portion of which has been finished by a method embodying the invention;

Fig. 4 is a fragmentary vertical section of an apparatus by means of which the improved method may be practiced for forming pulpous material on a core to constitute a smooth and uniform coating therefor;

Figs. 5 and 6 are enlarged sectional views illustrating the manner in which the pulp is applied to the core before it is delivered to the swaging apparatus, and

Figs. 7 and 8 are enlarged sectional views showing the formation of the pulp coating before and after the swaging operation, respectively.

Although the invention may be practiced to advantage by employing an apparatus of the type herein illustrated and described, it should be understood that the invention is not to be limited to any particular form of apparatus.

Referring to the drawing in detail, the reference numeral 10 indicates a main supporting frame within which is rotatably journaled a tubular shaft 11. Formed in an enlarged forward end 12 of the shaft 11 is a pair of diametrically opposed radial grooves 13 and 14 within which are slidably mounted oppositely disposed swaging dies 15 and 16, respectively. The swaging dies are retained within their guide grooves by means

of an annular plate 18 secured to the end of the shaft 11 by means of screws 19—19 (Fig. 2). Adjusting screws 20 and 21 carried by the plate 18 serve to limit the outward movement of the swaging dies during the inoperative or expanded period of their cycle of operation. These adjusting screws are provided with conical ends which engage cooperating conical apertures 22 and 23 formed in the swaging dies 15 and 16, respectively. It is obvious that if the screws 20 and 21 are withdrawn the swaging dies will have a greater freedom of movement than if the conical ends of these screws nearly seat in the conical apertures, as shown in the drawings.

Mounted in the frame 10 so as to be rotatable around the swaging dies 15 and 16 is a cage 25 carrying a plurality of pairs of diametrically opposed rolls 26—26. An annular plate 28 secured to the frame 10 serves to retain this cage of rolls in position within the frame.

The tubular shaft 11 is driven by means of a pulley 30 connected to any suitable source of power (not shown). During the rotation of the shaft 11, the swaging dies are caused to move outwardly away from the center of the shaft due to centrifugal force. However, the rolls 26 project toward the center of the shaft beyond the path of the curved outer ends of the swaging dies and therefore, as the swaging dies pass each diametrically opposed pair of rolls, they are forced toward each other. Immediately upon passing each pair of diametrically opposed rolls, the swaging dies are caused to move outwardly again due to centrifugal force, thus resulting in a continuous reciprocation of the swaging dies toward and away from each other.

When practicing the invention for producing fibrous tubing, a plurality of layers of vulcanized fibrous material 31 are wrapped around a metal core or mandrel 32 to build up the wall thickness desired in the finished tube. The fibrous tubing on its mandrel thus formed is then passed lengthwise through the center of the rotating shaft 11. Upon the swaging dies engaging each pair of diametrically opposed rolls 26 they are moved toward one another in the manner hereinbefore described, and upon passing each pair of diametrically opposed rolls, the swaging dies are caused to move outwardly again due to centrifugal force.

An intermittent rotation is imparted to the cage of rolls by the swaging dies as they engage each pair of diametrically opposed rolls. This retards the movement of the swaging dies toward and away from each other resulting in a succession of compressing blows of the dies upon the fibrous tubing, whereby the tubing is compressed and its outer surface is smoothly finished as indicated at 35 in Fig. 3 of the drawing. Furthermore, the simultaneous squeezing action and rotation of the swaging dies tends to rotate the tubing around its mandrel during the swaging operation, whereby the inner wall of the tubing is ironed out and prevented from adhering to the surface of the mandrel. Thus, the finished tubing is readily removed from its mandrel.

The present invention may also be practiced to advantage in the manufacture of pulp coated cores wherein a ribbon of pulp is attached to a core by an apparatus of the type shown and described in Patent 1,615,394, issued January 25, 1927, to J. S. Little. In the operation of this apparatus a core is brought into contact with pulpous material deposited upon a foraminous member and then an additional amount of pulpous material is deposited upon the core and the foraminous member. The pulp so deposited and the core are then brought into contact with a felt covered squeezing roll which cooperates with the foraminous member to squeeze out the "free liquid" from the pulp. The partially dried pulp adheres to the core in the form of a ribbon with the core substantially centrally located therein, as shown in Fig. 5 of the accompanying drawing. The core with the pulpous ribbon attached thereto is then passed through a plurality of squeezing rolls which impart to the pulpous ribbon a contour such as illustrated in Fig. 6.

When practicing the present invention, a core 37 with its attached pulpous ribbon 38 is passed lengthwise through the longitudinal bore of the rotating shaft 11. Before entering the forward end of the shaft 11 the pulpous ribbon is preliminarily wrapped around the core by the curved surface 40 (Fig. 4) of the annular plate 18 and thereafter the swaging dies 15 and 16 form or swage the pulpous material into a smooth and uniform coating for the core conforming to the shape thereof. This swaging operation is similar to the swaging operation described above in connection with the finishing of fibrous tubing and therefore a further detailed description thereof is believed to be unnecessary. The formation of the pulpous ribbon after it is first acted upon by the curved surface 40 of the annular plate 18 is shown in Fig. 7 and its formation after the swaging operation has been completed is shown in Fig. 8.

From the above description it is obvious that by practicing the invention a smooth and uniform fibrous tubing may be very quickly produced, and smooth and uniform pulpous coatings may be applied to cores without the exercise of any particular skill. It should be understood also that the invention is capable of other applications within the scope of the appended claims.

What is claimed is:

1. A method of working fibrous material on a core, which comprises swaging the fibrous material.

2. A method of finishing fibrous tubing, which consists in swaging the tubing.

3. A method of finishing fibrous tubing, which consists in subjecting the tubing to a rapid succession of compressing blows applied intermittently and in rapid succession to the outer surface of the tubing.

4. A method of finishing fibrous tubing, which consists in mounting the tubing upon a core of circular cross section, and then subjecting the outer surface of the tubing to a rapid succession of compressing forces whereby a smooth uniform contour is imparted to said tubing.

5. A method of producing fibrous tubing, which consists in applying vulcanized fiber to a mandrel, and then advancing the mandrel and simultaneously subjecting the vulcanized fiber to a rapid succession of compressing blows to produce a smooth uniform tubing freely removable from the mandrel.

6. A method of uniformly finishing fibrous tubing by a single operation, which consists in supporting the tubing upon a core of circular cross section, and then swaging the outer surface of the tubing to produce a smooth uninterrupted finish.

In witness whereof, I hereunto subscribe my name this 15th day of February, A. D. 1927.

WILLIAM FULLER HOSFORD.