April 19, 1932. M. O. SCHUR 1,854,230

MANUFACTURE OF WATERPROOF TUBING FROM CELLULOSE PULP

Filed Sept. 28, 1929

Fig. 1.

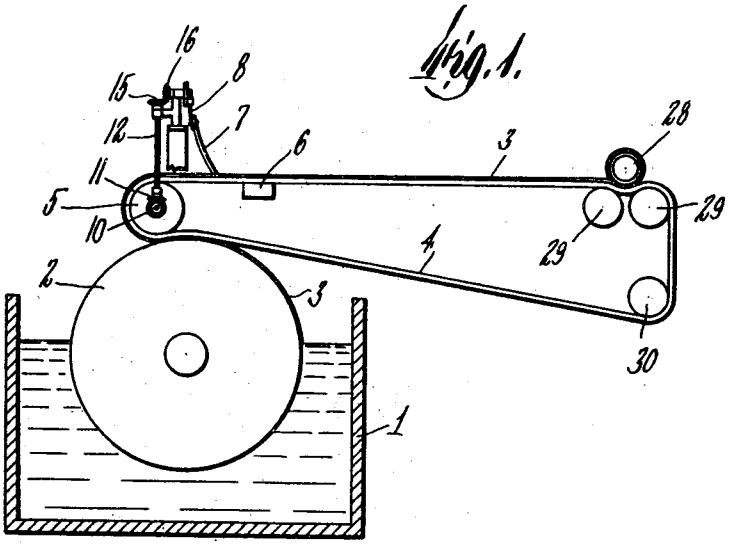


Fig. 4.

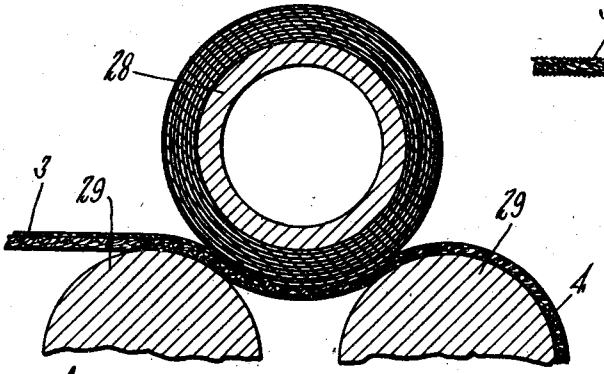
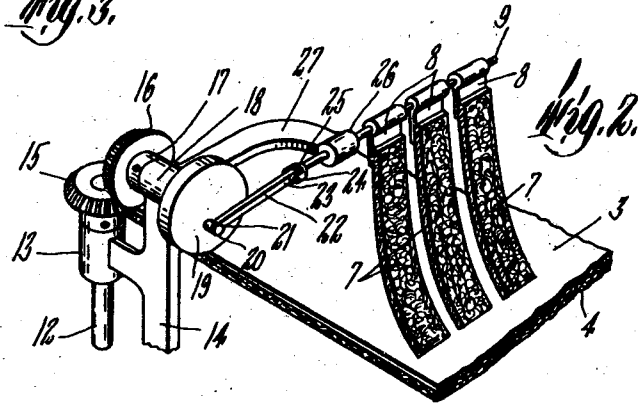


Fig. 3.

Fig. 2.



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UNITED STATES PATENT OFFICE

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MANUFACTURE OF WATERPROOF TUBING FROM CELLULOSE PULP

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This invention relates to the manufacture of multi-ply pulp products, and more particularly to those formed by winding into tubular form a wet web of cellulose pulp produced on machinery of the paper-making type. In the manufacture of such products, it is desired to effect a thorough matting together or interlocking of the successive layers in order to avoid separation of the layers during or after drying. When such products are to be impregnated after drying with liquid waterproofing agents such as molten pitch, it is further desired to produce a product of sufficient porosity to permit such agents to penetrate therethrough in large amount with rapidity and uniformity.

In accordance with the method of my invention the web of wet pulp is roughened on both its surfaces before being wound into tubular form, as I have found that not only is a better interlocking effected between the superposed layers, but the resulting product when dried is more porous and may be impregnated more rapidly and more perfectly than heretofore. While my method may be applied to advantage when the web is formed on various types of papermaking machines, it is especially pertinent to webs formed on so-called cylinder machines. I have observed that the wet web as usually removed from the cylinder mould by the carrier felt and then wound on a mandrel or make-up roll, is roughened sufficiently for the purposes of my method, on one face, by contact with the felt, but is smooth on its opposite face, where the effect of surface tension on the water associated with the pulp is to lay down the fibers. It is hence a simple and inexpensive matter to practice my method on such a web, as all that need be done is to roughen the outer surface of the web being carried by the felt, to undo the smoothing effect of surface tension. This may be carried so far as to break up sheet formation, although all that is usually necessary is to produce a fuzzy or rough surface. Heretofore in the winding operation, a rough web surface has been superposed on a comparatively smooth web surface, with the result that interlocking of the successive layers was apt to be imperfect, unless special measures were taken, such as depositing an adhesive, e. g., gelatinized cellulose, on the web surface, or beating the pulp to a high degree to ensure the presence of sufficient gelatinized cellulose in the wet web to effect good bonding between the layers. When the multi-ply product contains considerable gelatinized cellulose, however, it is dense and difficult to impregnate, and if removed from a mandrel in tubular form and dried in such form, drying must be carried out very slowly, in order to avoid warping.

While not limited thereto, my method makes possible the realization of most significant advantages in manufacturing of tubes to be impregnated with waterproofing material such as molten pitch and intended for use as in housing underground electric cables or for conducting aqueous liquids. I have found that the method of my invention makes possible the production of tubes the laminæ of which are more perfectly matted together and which absorb during impregnation more pitch and in a shorter period of time. This increased absorption of pitch is most desirable, since if moisture gains access to the interior of the tube wall, there is a tendency towards swelling and separation of the laminæ. My method may also be used to advantage when making multi-ply boards or sheets on a cylinder machine by winding a wet web on a make-up roll, and then stripping the pulp in sheet form from the roll, the sheet then being dried and, if desired, impregnated with a suitable agent.

With these and other objects and features in view, my invention may best be understood from the following more complete description thereof, when considered in conjunction with the accompanying drawings, which illustrate my method as applied to the manufacture of tubes on a cylinder machine.

Figure 1 represents more or less diagrammatically and conventionally a side elevation of a machine for carrying out my method.

Figure 2 shows in perspective means for roughening the outer surface of the web.

Figure 3 is an enlarged fragmentary section through the winding end of the machine.

Figure 4 is an enlargement of a portion of

Figure 3, to show the roughness of the surfaces of the web being wound.

Referring to Figure 1 of the drawings, 1 indicates a vat into which a suspension of pulp beaten to the desired degree and at a consistency suitable for forming into a web may be delivered. Rotating partially submerged in the pulp suspension, is a cylinder mould 2, on which the pulp deposits as a layer 3, which is carried out of the pulp suspension into contact with a felt 4. The layer of pulp is picked up from the cylinder mould by the felt under the action of sufficient pressure exerted by a couch roll 5. The web of pulp contains considerable water at this stage, and is quite fragile. In order to avoid breaking during subsequent winding, it should be partially dewatered, this being accomplished, as shown, by passing the wet web while supported by the felt over a suction box 6. The passage of the freshly formed pulp matter out of the pool in the cylinder vat causes the outer fibers to "lay down" through the action of surface tension, and a smooth, slimy-feeling surface results on the pulp mat. In accordance with the present invention I may nullify this effect by roughening the surface of the mat before, on, or after the suction box. It is an interesting fact that the beneficial results realized by roughening the sheet persist even though the pulp web passes over one or more suction boxes after the roughening means have been applied. Any suitable roughening means, such as brushes or combs, may be employed, but I have found it expedient to use a series of felt strips 7 for this purpose. The strips may be supported, as shown in Figures 1 and 3, above the machine and transversely of the web, the lower ends of the strips being permitted to drag over the web before it passes over the suction box. A series of felt strips constitutes a flexible arrangement which produces the desired roughening effect without so breaking up the web as to prevent the production of a tube of substantially uniform thickness throughout. The strips may be freely hung from suitable supports 8, fixed to a rod 9 extending transversely of the web. The rod is preferably oscillated transversely of the web to cause a to-and-fro movement of the strips while they are dragging over the web, thereby ensuring a roughening of substantially the entire web surface. Oscillatory movement may be imparted to the rod 9 by any suitable means, for instance, by means actuated by the rotation of the couch roll 5. As shown in Figures 1 and 2, such means may comprise a gear 10 fixed at one end of the couch roll and meshing with a gear 11 fixed to the lower end of a vertical shaft 12, which is journaled in a bearing 13 afforded by a bracket 14. The upper end of the shaft 12 above the bearing 13 is provided with a gear 15 meshing with a gear 16 fixed to one end of a horizontal shaft 17 journaled in a bearing 18 afforded by the bracket 14. The other end of the shaft 17 passes through the bearing 18 and, as shown, terminates in a disk member 19. Fixed eccentrically to the disk 19 is a pin 20 on which is loosely engaged one end 21 of a crank 22, the other end 23 of which is provided on each side with a pin 24 loosely engaging fork members 25 formed at one end of the rod 9. The rod 9 may be guided in its oscillatory movement by a bearing member 26 carried by an arm 27 extending from the bearing member 18. It will thus be seen that, as the couch roll rotates, the shafts 12 and 17 are caused to rotate, the crank 22 converting the rotary movement of the shaft 17 into an oscillating movement and causing the rod 9 to oscillate, carrying the strips 7 to and fro transversely of the web.

The felt 4 as shown carries the web to a rotary mandrel 28 above a pair of rolls 29, which support and guide the felt as the web is being wound on the mandrel, as shown in Figures 3 and 4. The felt is then passed downwardly under a guide roll 30 and is returned to the cylinder mould 3, from which it picks up the layer of pulp continuously being deposited on the mould.

When the desired thickness of tube wall has been attained, the mandrel supporting the wet tube may be transferred to a dryer (not shown) and be replaced by another mandrel. The tubes may be delivered into the dryer, which may be of the type described in Patent No. 1,697,454, issued January 1, 1929, to Orton B. Brown and Howard Parker,—where they are initially subjected to a high humidity at relatively high temperature, say, about 50% humidity at 150° F., and are supported on conveyors, consisting of closely spaced, uniformly rotated rolls. As the tubes assume the wet-bulb temperature, they become somewhat plastic, and under the influence of the rolling they expand a trifle, so that after, say, two or three hours, the mandrels may be withdrawn and the wet tubes allowed to proceed through the dryer free to dry from the inside as well as from the outside. In from eighteen to thirty-six hours, depending upon the thickness of the tube wall and upon the size of the tube, the tubes reach the end of the dryer, containing less than 2% moisture on a bone-dry basis, and may now be impregnated with pitch, which renders them water-resistant.

While my method has been described in connection with the manufacture of tubes using papermaking machinery of the cylinder type, it is to be understood that it may find application in the manufacture of other multi-ply products, for instance, multi-ply sheet material, the wet web being formed on other types of paper machines.

I claim:

In the production of waterproof tubing

from cellulose pulp, the combination of steps which comprises progressively forming a wet web of pulp on a cylinder mold, progressively picking up said web on a carrier felt from said mold, roughening the outer surface of said web while being carried by said felt, removing the roughened web from said felt and simultaneously convoluting it into tubular form, drying the convoluted tube, and impregnating the dried tube with a waterproofing agent of the nature of molten pitch.

In testimony whereof I have affixed my signature.

MILTON O. SCHUR.