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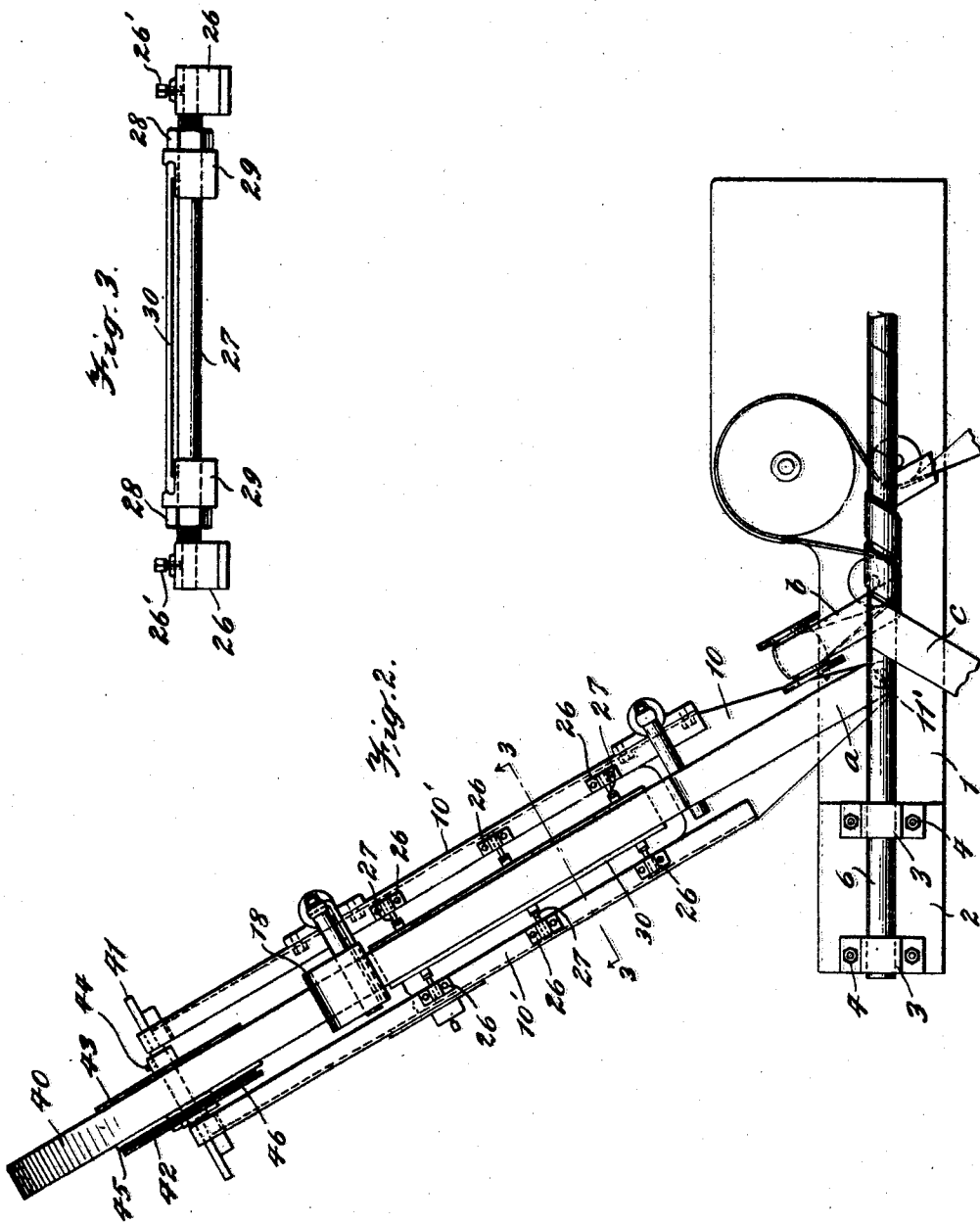
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TUBE FORMING MACHINE

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## UNITED STATES PATENT OFFICE.

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## TUBE-FORMING MACHINE.

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The invention relates to certain improvements in tube making machines in which a continuous length of tubing is formed from superposed strips of paper or the like spirally wound upon a mandrel, and has for one of its objects to provide machines of this character with a special form of feed device to direct the strips onto the mandrel so that the edges of the successive convolutions of each spiral or helix will be in contact, said feed device also involving two pairs of journal bearings to permit the reel from which the paper strip has been nearly exhausted to be shifted from one set of bearings to the other and a full reel to be mounted in the vacated journal bearings whereby the rear end of the strip of paper on the first roll may be attached to the advance end of the strip on the full roll without interrupting the operation of the machine; the feed device also being provided with means for heating and drying the first strip before the latter is delivered to the mandrel, the latter, preferably, also being provided with a heating device to complete the drying of the first strip, thereby insuring the setting of the glue or cement applied to the contacting face of the next superposed strip, so that the finished tube, which may comprise two or more superposed helical strips or layers cemented together, will be in proper condition for delivery to a cutting mechanism, in the form of one or more saws, adapted to cut the tubing into predetermined lengths; the accurate positioning of the helical strips and the rapid setting of the glue or cement by means of which the superposed strips are secured together being necessary to insure the accurate cutting of the tubing without ragging.

The invention is illustrated in the accompanying drawings, in which:—

Fig. 1 is a side elevation of the apparatus.

Fig. 2 is a plan view thereof.

Fig. 3 is a section on line 3—3 of Fig. 2.

Fig. 4 is a partial front elevation of the mandrel carrying frame.

Fig. 5 is an end elevation of the same.

The invention relates to the manufacture of so-called spiral paper tubes, which are formed by winding superposed strips of paper upon a mandrel, the successive strips being so applied that the edges of each helical winding are in contact and the successive strips are applied to break joints with the adjacent strips. As a rule, the first strip ap-

plied to the mandrel is in dry condition and the under surface of the superposed strip is coated with glue or other suitable cement to form an effective joint between the strips when the strips are wound together on the mandrel in superposed relation as stated, the firmly united superposed strips constituting the finished tubing. The latter may consist of two or more plies of superposed helical strips glued or cemented together, as stated, but for the purpose of exemplifying the present invention, it is sufficient to consider a machine adapted to form two-ply tubing, consisting of two superposed helical strips which are wound upon a fixed mandrel of a standard machine partially illustrated in Fig. 2. It has been found of great advantage to associate with machines of this type, a cutting machine for severing the continuous length of formed tubing into sections of predetermined length, but considerable difficulty was experienced in making clean transverse cuts of the fresh tubing because of the tendency of the layers or plies to separate under the action of the saws or cutters, due to the fact that the glue will not set firmly and unites the plies during the short interval between the winding of the tubing and the delivery thereof to the cutting mechanism. It has been found, however, that, by heating and drying the first or foundation strip before the same is applied to the mandrel and preferably also while it is being wound upon the mandrel, a rapid setting of the glue on the adjacent face of the next superposed strip is insured, so that the strips will be firmly united and the completed tubing may be operated upon by the cutting mechanism without danger of the latter making ragged or defective cuts.

It has likewise been found of advantage to so apply the strips to the mandrel that the adjacent edges of successive convolutions of the helices are in contact, so that, when the several plies are united by adhesion, a very strong and durable tubing results. These several requirements are met by the present invention, which provides means for accurately applying the successive helical strips in superposed relation in the manner stated and means for effectively heating and drying the first applied strip, as will be hereinafter explained.

Referring to the drawings, 1 indicates the frame of a tube forming machine of the char-

acter indicated, in which the tube is built up of two or more strips of paper or the like applied in superposed and joint breaking relation upon the mandrel 6, the latter being secured to the top of a standard 2 on the machine frame by means of clamping yokes 3 and bolts 4, this arrangement being provided to facilitate the ready adjustment and substitution of the mandrel when tubes of different sizes are to be formed. This machine is of a well known type and need not be further described.

Pivoted at one end, by a bolt 11', to the top of the machine frame 1, is a frame 10 including horizontally extending parallel rails 10', 10', which are supported at their outboard ends by legs 11 and braces 12. Each leg 11 is provided below the corresponding rail 10' with an open journal bearing 13 and the upper extension of each leg 11 is also provided with an open journal bearing 14, these duplicate sets of journal bearings being designed to permit a reel or spool carrying the strip which forms one of the plies of the finished tubing to be moved from one set of bearings to the other for a purpose to be hereinafter explained. Secured to one of the side rails 10' of the frame 10 is a vertical bracket 15, upon which are mounted two horizontally extending bars 19 and 20 which serve as guides and tensioning devices for the strip as the latter is delivered from the reel, and above the bars aforesaid is mounted a swinging frame 16 carrying a weighted arm 17 upon its outer end, with a facing of leather or similar material 18 surrounding the frame and the weighted arm to constitute a friction brake to apply the necessary tension to the strip as the latter is drawn from the reel. A second set of guide and tension bars 22 and 23 is mounted upon a bracket 21 secured to the same rail 10' as the bracket 15 aforesaid.

Between the two sets of guide and tension bars, there is mounted on the rails 10', 10' a heating device over which the strip is drawn on its passage to the mandrel. This heating device may be of any suitable construction. As a matter of convenience and economy, it comprises a flat plate 30 containing an electrical heating resistance, the plate being so disposed that the strip is held in contact with the surface thereof as it passes thereover. Secured in spaced relation on the rails 10', 10' are three pairs of brackets 26, 26, each pair carrying a cross rod 27, and the intermediate pair of brackets being somewhat higher than the end pairs, so that the intermediate cross rod 27 is higher than the end cross rods. As indicated in Fig. 3, the cross rods are locked in position in the bearing brackets 26 by set screws 26'. Slidably mounted on the rods are clamps 29 adapted to engage the lateral edges of the electrical heater 30 and hold the latter in position, these clamps in turn being engaged and held in adjustable position on the rods by set nuts 28 threaded on said rods.

By reason of the higher elevation of the middle cross rod 27, the heating plate 30 will be bowed upwardly, as shown, so that the strip in passing over the surface of the heater will be held in close contact by reason of the fact that the lower tension bars 20 and 23 at opposite ends of the heater are somewhat lower than the front and rear edges of the plate 30. The adjustable clamps 29 for securing the heater in position permit the accurate adjustment of the heater to the direct line of travel of the strip. Current is supplied to the heater 30 by cord conductors 31, in which is interposed a snap switch 32 mounted on the side of the frame.

The paper strip comes in the form of a roll 40 mounted upon a reel or spool provided with a spindle 41 adapted to be engaged with either of the sets of journal bearings 13 and 14 on the frame 10. In order to facilitate the mounting of a roll 40 upon the reel, the latter is provided with a removable flange 43, which is adapted to be locked to the spindle by means of a screw stud 44. The fixed flange 42 of the reel or spool is provided with an annular groove 45, which is engaged by a cord or band 46, which supports a pendant weight 47, the weight and cord constituting a friction brake to prevent the racing of the roll upon sudden stoppage of the machine.

As hereinbefore stated, it is generally desirable to continue the heating and drying of the strip constituting the first ply of the tubing applied directly to the mandrel, during the winding operation, and, to this end, the mandrel 6 is preferably formed of hollow tubing in which is mounted a heating element 50, preferably a conventional resistance heater, adapted to fit the bore of the tube, and the conducting wires 51 being led out through an opening in the tubing and secured to the plug member 52 of a connector, the socket member 53 of which is preferably secured to the spindle support 2 and is, in turn, connected by leads to a suitable snap switch 54, to the terminals of which are secured the supply wires 55.

The machine as hereinbefore described is adjusted and operated as follows: The swinging frame 10, which carries the reel delivering the first strip directly to the mandrel, is so adjusted that the strip is laid upon the mandrel with the edges of the successive convolutions of the strips in contact. This adjustment is effected by swinging the frame 10 about the pivot 11' until the desired position is reached. A full spool or reel is then mounted in the lower journal bearing 13 on the frame 10 and the end of the strip *a* is led under the weighted tension applying member 17, over the guide bar 19, under guide bar 20, over the upper surface of the heating plate or table 30, under guide bar 23, over guide bar 22 onto the mandrel, where the strip is engaged by the winding and feeding

belt *b* of the tube forming machine and laid up in helical form on the mandrel. At the same time, a similar strip *c* is delivered in superposed relation on the first strip, the under surface of the second strip being coated with glue or other suitable adhesive to unite the strips to form a continuous length of two-ply tubing. As the strip passes over the upper surface of the heater 30, the inherent moisture is expelled and the strip is heated to a degree to materially facilitate the setting of the glue on the superposed strip as soon as the two strips are brought into engagement on the mandrel. A further heating and drying of the first strip to insure a practically instantaneous setting of the adhesive is effected by the heating of the mandrel by the heating device 50 mounted within the latter.

As stated, it is desirable to operate the machine continuously and this is rendered possible by the provision of the two sets of journal bearings on the frame 10. When the roll 40 of paper strip is nearly exhausted, the reel or spool carrying the same is removed from the lower journal bearings 13 to the upper journal bearings 14 and another reel or spool containing a full roll applied to lower journal bearings 13. To the end of the strip on the new roll, a small amount of glue is applied and, when the strip on the first roll has been completely run off, the end of the strip is cemented to the end of the new strip on the full reel without interrupting the normal operation of the machine.

It will be understood that the succeeding strips or plies of paper may be supplied to the tube forming machine by any of the usual means employed for this purpose and, if desired, a supporting frame and accessories similar to that described for delivering the first ply or strip to the mandrel may be installed for supplying the additional ply or plies, it being understood that in such case the supporting frame corresponding to the frame 10 will not be provided with a heating device.

What I claim is:

1. In a machine for forming tubes from superposed helical strips of paper or the like including a mandrel and means for winding the strips thereon; means for heating and drying the first strip before the same is applied to the mandrel, whereby cementing of the superposed strip thereto will be facilitated.

2. In a machine for forming tubes from superposed helical strips of paper or the like including a mandrel and means for winding the strips thereon; means for heating and drying the first strip before the same is applied to the mandrel, said means comprising a heated plate over which the strip is drawn.

3. In a machine for forming tubes from superposed helical strips of paper or the like including a mandrel and means for winding the strips thereon; means for heating and

drying the first strip before the same is applied to the mandrel, said means comprising an electrically heated plate over which the strip is drawn.

4. In a machine for forming tubes from superposed helical strips of paper or the like including a mandrel and means for winding the strips thereon; means for heating and drying the first strip before the same is applied to the mandrel, and means for heating the mandrel.

5. In a machine for forming tubes from superposed helical strips of paper or the like including a mandrel and means for winding the strips thereon; means for heating and drying the first strip before the same is applied to the mandrel, and an electrical heater mounted inside the mandrel.

6. In a machine for forming tubes from superposed helical strips of paper or the like including a mandrel and means for winding the strips thereon; a frame pivotally connected at one end to the mandrel support for swinging adjustment relative to the mandrel, a paper reel removably journaled on said frame, and a heating device carried by the frame between the reel and the mandrel over which plate a strip is drawn.

7. In a machine for forming tubes from superposed helical strips of paper or the like including a mandrel and means for winding the strips thereon; a frame pivotally connected at one end to the mandrel support for swinging adjustment relative to the mandrel, a paper reel removably journaled on said frame, a heating device carried by the frame between the reel and the mandrel over which plate a strip is drawn, and tension applying means carried by the frame at opposite sides of the heating device.

8. In a machine for forming tubes from superposed helical strips of paper or the like including a mandrel and means for winding the strips thereon; a frame pivotally connected at one end to the mandrel support for swinging adjustment relative to the mandrel, a paper reel removably journaled on said frame, cross rods carried by the frame between the reel and mandrel, clamps on said rods, and a heating plate adjustably held in said clamps and over which the strip is drawn.

9. In a machine for forming tubes from superposed helical strips of paper or the like including a mandrel and means for winding the strips thereon; a frame pivotally connected at one end to the mandrel support for swinging adjustment relative to the mandrel, a paper reel removably journaled on said frame, cross rods carried by the frame between the reel and mandrel, clamps on said rods, and an electrical heating plate adjustably held in said clamps and over which the strip is drawn.

10. In a machine for forming tubes from superposed helical strips of paper or the like

including a mandrel and means for winding the strips thereon; a frame pivotally connected at one end to the mandrel support for swinging adjustment relative to the mandrel, a paper reel removably journaled on said frame, brackets mounted on opposite sides of the frame, cross rods secured in said brackets, clamps slidable on the cross rods, nuts on the rods to adjust the clamps, and a heating plate having its edges engaged by said clamps.

11. In a machine for forming tubes from superposed helical strips of paper or the like including a mandrel and means for winding the strips thereon; a frame pivotally connected at one end to the mandrel support for swinging adjustment relative to the mandrel, a paper reel removably journaled on said frame, brackets mounted on opposite sides of the frame, cross rods secured in said brackets, clamps slidable on the cross rods, nuts on the

rods to adjust the clamps, a heating plate having its edges engaged by said clamps, and tension applying means carried by the frame at opposite ends of the heating plate.

12. In a machine for forming tubes from superposed helical strips of paper or the like including a mandrel and means for winding the strips thereon; a frame having one end pivotally connected to the mandrel support for swinging adjustment relative to the mandrel, lower and upper sets of journal bearings on the opposite end of the frame in which the paper reel is successively mounted, whereby successive strips on following reels may be joined at their ends without interrupting the operation of the machine, and means for guiding the strips from the reel over the frame to the mandrel under tension.

In testimony whereof I affix my signature.  
HENRY DE SMITH.