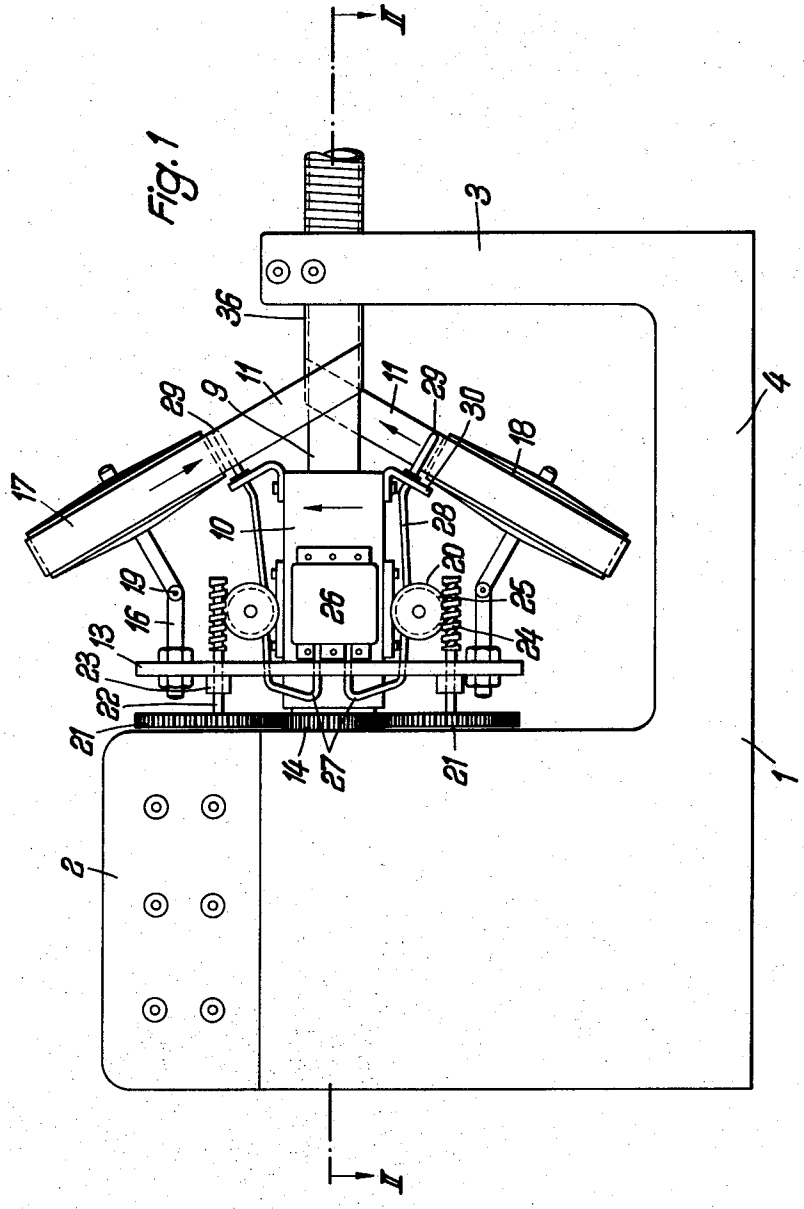
Aug. 9, 1960 L. WESTERBARKEY 2,948,200

METHOD AND APPARATUS FOR WINDING AND CEMENTING TUBES OR HOSE

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Fig. 1



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Fig. 2

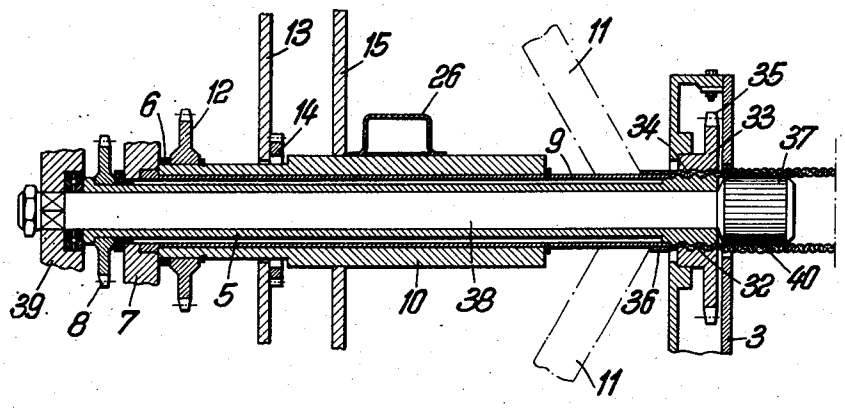
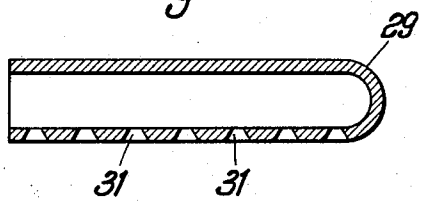


Fig. 3



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METHOD AND APPARATUS FOR WINDING AND CEMENTING TUBES OR HOSE

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The present invention relates to an apparatus for producing flexible tubes or hose made of helically wound, glued strips of paper, metal foil, or other suitable material, or a combination of such materials.

In a similar apparatus known prior to this invention the tubes were formed by rotatable coils carrying a supply of paper and revolving around a stationary winding mandrel. In order to glue the individual layers of the tube firmly together, the necessary adhesive was applied to the paper strips in the form of a coating of a synthetic plastic. This required a separate coating and drying process prior to the actual winding operation. Furthermore, after the tube was wound and grooved and before it could be withdrawn as a finished product, it had to be passed through a heating zone to remelt the dried adhesive coating to amalgamate the individual layers.

It is an object of the present invention to provide a tube winding apparatus which no longer requires these preliminary coating and drying operations as well as the subsequent remelting operation, and which thus permits a quicker, more inexpensive, and more economical production of the tubes.

This object of the invention is attained by the combination of a winding mechanism which likewise consists of two or more coils which carry a supply of paper, plastic, metal foil, or other suitable material in strip or ribbon form and revolve around a stationary winding mandrel, and an adhesive applying mechanism which revolves around the winding mandrel together with the supply coils and applies a liquid coating of adhesive upon the strips after the same have been withdrawn from the revolving supply coils and immediately before they are wound upon the stationary mandrel.

The new method of producing tubes also has the advantage that, because of the application of the liquid adhesive immediately prior to the winding operation, such adhesive may be of a lower, less expensive grade than that required in the above-mentioned prior method in which the strips were coated and then dried in a preliminary operation and again heated after being wound to remelt the dried adhesive.

Another important feature of the present invention for attaining the above-mentioned objects and advantages consists in the use of at least one pump which is connected with the revolving adhesive applying mechanism for supplying the necessary amount of adhesive thereto.

Another feature of the invention consists in mounting the adhesive pump or pumps so as to revolve with the supply coils around the stationary winding mandrel.

A further feature of the invention consists in the provision of a series of revolving nozzles which are connected to the pump and through which the liquid adhesive may be applied upon each strip of paper, plastic, metal foil or other material immediately before the same is wound upon the stationary mandrel.

Further objects, features, and advantages of the present invention will be apparent from the following detailed

description thereof, particularly when read with reference to the accompanying diagrammatical drawings, in which—

Fig. 1 illustrates a front view of the entire winding machine;

Fig. 2 illustrates a cross section taken along line II—II of Fig. 1; while

Fig. 3 illustrates a longitudinal cross section through one of the nozzle elements.

Referring to the drawings, the new winding machine for producing flexible tubes or hose consists of a substantially U-shaped machine frame **1** which comprises a housing **2** at one side containing a driving motor and suitable power-transmitting means, not shown, an upright **3** at the other side which also forms a housing containing a grooving mechanism, and an intermediate member **4** forming a base and containing power-transmitting means connecting the driving motor within housing **2** with the grooving mechanism in upright **3**. A hollow shaft **5** is rotatably mounted within a bearing **6** within a stationary housing element **7** and carries a gear or sprocket wheel **8** which is connected through suitable power transmitting means, such as intermediate gears or a chain to the driving motor. Housing part **7** further supports a stationary tubular member **9** which forms a bearing sleeve for supporting a likewise tubular main drive shaft **10** for rotation thereon, and the front portion of which forms a stationary winding mandrel on which two or more long strips **11** of paper, plastic, metal foil, or other suitable flexible material are wound. Within housing **2** shaft **10** carries a gear or sprocket wheel **12** which is likewise connected through suitable power-transmitting means to the driving motor. The front wall **13** of housing **2** which may also carry suitable bearing means, not shown, to support shaft **10** carries on its outside a stationary gear **14**. Shaft **10** has secured thereon a supporting member **15** which may either consist of a transverse bar or a disk on which a pair of angular rods **16** are mounted in diametrically opposite positions. The outer ends of rods **16** form shaft portions on which reels **17** and **18**, respectively, are rotatably mounted, each of which carries a roll of paper, plastic, metal foil, or other flexible material which is unreeled therefrom to form the long strips **11** which are wound upon mandrel **9** to form a tube or hose. If desired, the angularity of rods **16** may also be slightly adjusted by suitable means **19**. The main shaft **10** further carries a pair of pumps **20** in diametrically opposite positions to each other. Each of these pumps **20** is driven by a gear **21** meshing with and revolving around the stationary gear **14** and secured to a shaft **22** which is rotatably mounted in a bearing **23** and carries on its other end a worm **24** which meshes with a worm gear **25** on the shaft of each pump **20**. Gears **21** are preferably made of a synthetic material to reduce the noise of their operation.

Shaft **10** further carries a container **26** of any suitable shape which is connected by tubes **27** to pumps **20**, each of which, in turn, is connected by a tube **28** to a nozzle member **29** which is secured by a bracket **30** to shaft **10**. Similarly as angular rods **16** supporting reels **17** and **18**, respectively, the angularity of brackets **30** may also be slightly adjustable by suitable means, not shown. Container **26** has a suitable closable filling opening, not shown, through which it may be filled with a suitable liquid adhesive which is then supplied by pumps **20** to nozzle members **29**. Each of these nozzle members, as illustrated particularly in Fig. 3, consists of a tube which is closed at one end and has a row of conical nozzle openings **31** at one side facing toward the respective strip **11**. Pumps **20** are driven at a speed in a suitable relation to the speed of the main shaft **10** and the winding speed of strips **11** so as to control the amount of adhesive applied to the strips.

As already indicated, upright 3 also forms a housing which encloses a grooving mechanism which, after the above-described winding mechanism has formed a tube or hose on the stationary mandrel 9, is adapted to mold the wall of the tube into a helically grooved shape which renders the tube flexible. This grooving mechanism consists of a set of outer screw threads 32 on the end of hollow shaft 5, and a nut-shaped member 33 with corresponding inner screw threads 34 and a gear or sprocket wheel 35 thereon which is driven by the motor in housing 2 through suitable power transmitting means partly located in the base member 4. Gears or sprocket wheels 8 and 12 on shafts 5 and 10 are driven in the same direction while gear or sprocket wheel 35 is driven in the opposite direction so that the corresponding screw threads 32 and 34 also rotate in the opposite directions to each other and at the same speed. Thus, when the end of the smoothly wound tube 36 is moved into engagement with the rear end of threads 32 and 34 it will be gripped between these two sets of threads and since these threads are in a fixed position relative to each other, they will draw upon and convey tube 36 continuously forward and thereby impress continuous helical grooves into the outer and inner surfaces of tube 36 and mold the entire wall of the tube into a spiral accordion-like shape. After passing out of threads 32 and 34, tube 36 slides upon a stationary serrated member 37 on one end of a shaft 38 which extends through hollow shaft 5 and is secured to a stationary part 39 of housing 2. By the friction between the inner corrugations 40 of tube 36 and the serrated outer surface of member 37, the individual corrugations of the spiral tube are pressed against each other, while the adhesive sets, thus producing a flexible tube of a relatively great wall thickness and high compressive strength.

In the operation of the tube winding machine, strips 11 are drawn off reels 17 and 18, are wound around the stationary mandrel 9 and at first fed forwardly by hand until they are grasped by threads 32 and 34 of the grooving and feeding mechanism. Thereafter, the entire operation continues automatically, reels 17 and 18 revolve around mandrel 9, and strips 11, during their passage from the reels to mandrel 9, are coated with liquid adhesive which is pumped by pumps 20 from container 26 into the likewise revolving nozzle members 29 and is then passed through nozzle openings 31 and sprayed upon one side of strips 11. The speed of revolution of reels 17 and 18 is in accord with the feeding speed of the wound tube which results from the opposite rotation of threads 32 and 34 along the tube.

Although in the above description of one preferred embodiment of my invention it is said that only two strips are being wound upon mandrel 9, any suitable larger number of supply reels and nozzle members may be provided on shaft 10. Also, the pump mechanism may be considerably modified. For example, instead of

providing a separate pump for each nozzle member 29, a single pump of any suitable design may be mounted on shaft 10. Also, instead of mounting the pump or pumps on shaft 10 so as to revolve thereon, a single pump may be provided in a stationary position and connected to the revolving nozzles so as to supply the same with liquid adhesive by any suitable means known as such. The container for holding a supply of adhesive, instead of being mounted on shaft 10 and rotatable therewith, may also be disposed in a stationary position and connected in any suitable manner known as such to the revolving pump on shaft 10.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. An apparatus for producing a flexible tube, which comprises a stationary winding mandrel, a plurality of reels, each reel adapted to carry a supply of strips of flexible material and disposed at an oblique angle to the mandrel, means for storing and feeding a liquid adhesive to said material at a point intermediate at least one of said reels and said mandrel, means for revolving said reels and said adhesive storing and feeding means about said stationary mandrel, whereby a helically wound tube is formed on said mandrel from said strips when the strips are applied to the mandrel and drawn off the reels upon revolution thereof, said revolving means comprising a main shaft coaxial with said stationary mandrel, means for rotating said shaft, and means for mounting said reels and adhesive storing and feeding means on said shaft so as to be rotatable with said shaft, said adhesive storing and feeding means comprising a container constituting said liquid adhesive storing means, the adhesive feeding means comprising at least one pump mounted on said main shaft and rotatable therewith, positive transmission means between the shaft and the pump for driving said pump upon rotation of the shaft, means for applying said adhesive upon said flexible material, and means for connecting said container with said pump and said pump to said applying means.

2. An apparatus as defined in claim 1, wherein said applying means comprise a plurality of spraying nozzles disposed substantially parallel and adjacent to said material at said intermediate point between each of said reels and said stationary mandrel.

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