

Feb. 7, 1939.

M. P. LINK

2,146,305

APPARATUS FOR COATING TUBING

Filed Dec. 24, 1935

2 Sheets-Sheet 1

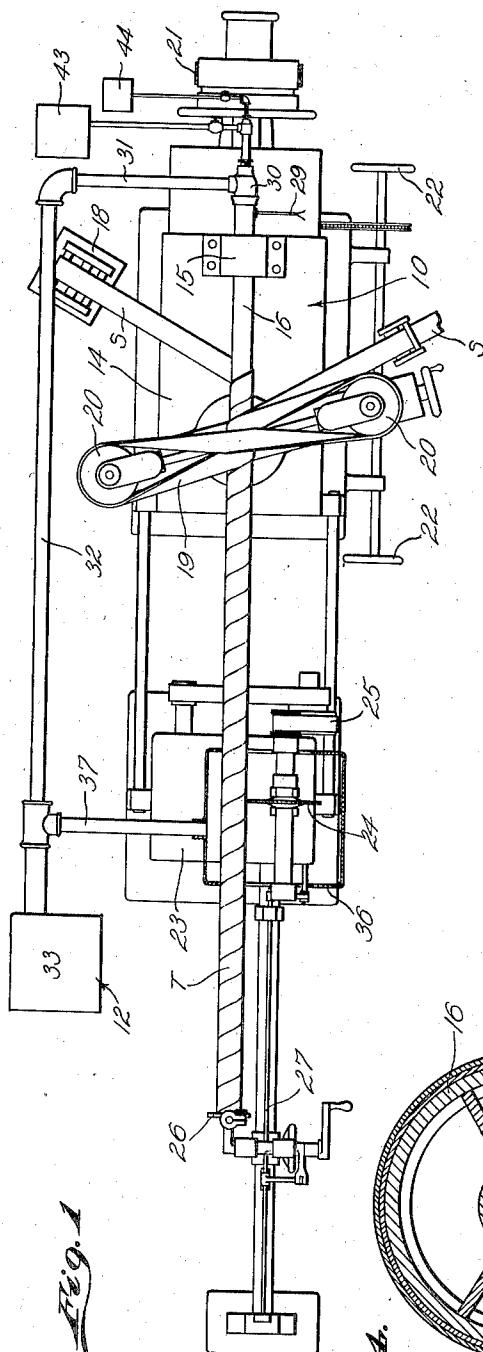


Fig. 1

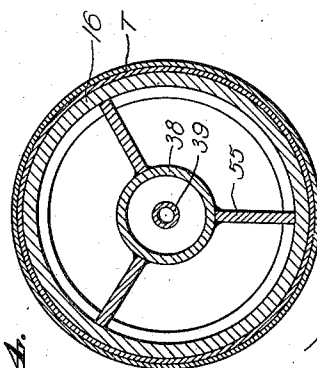


Fig. 4

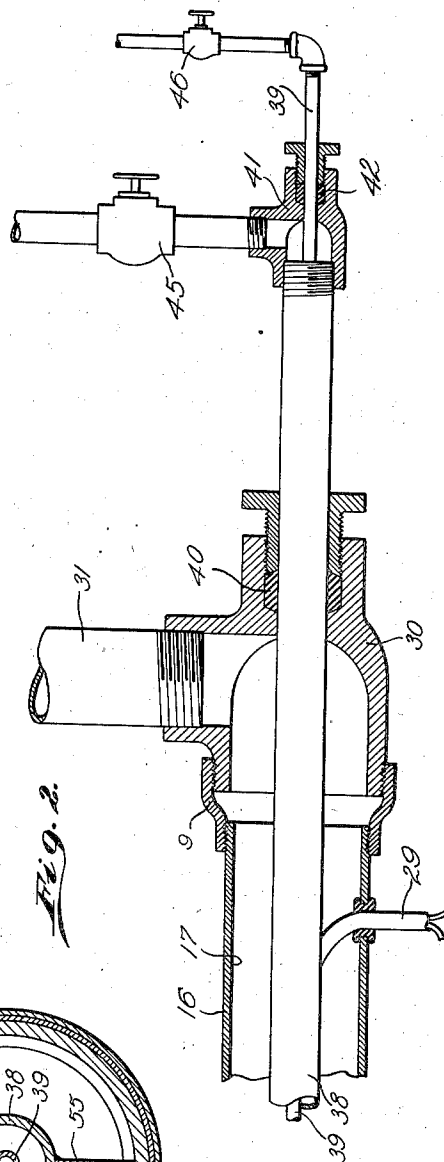


Fig. 2

Inventor
MAXIMILIAN PAUL LINK

By *W. H. Applewell*
His Attorney

Feb. 7, 1939.

M. P. LINK

2,146,305

APPARATUS FOR COATING TUBING

Filed Dec. 24, 1935

2 Sheets-Sheet 2

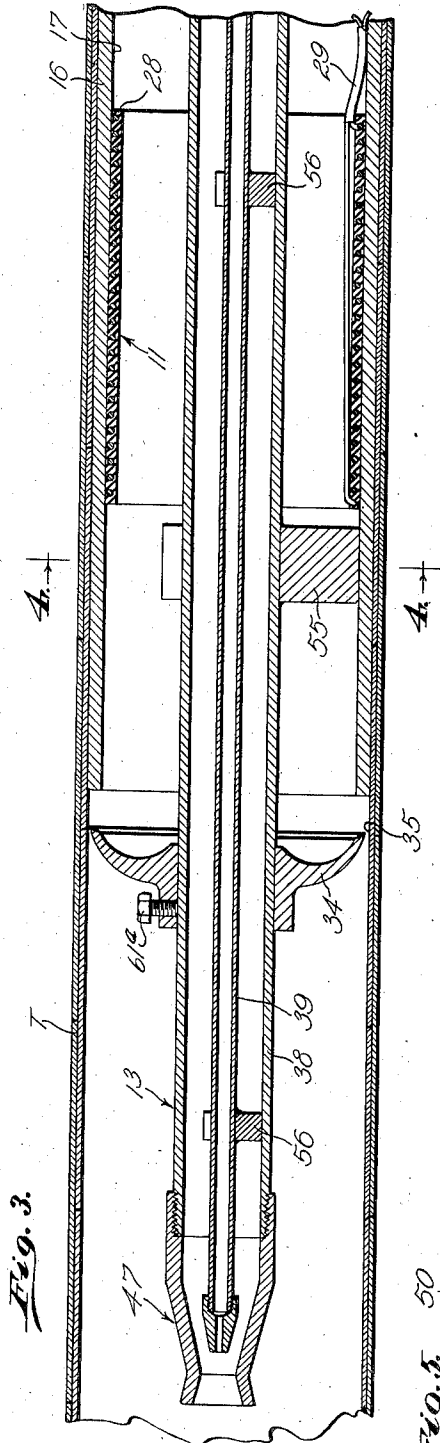


Fig. 7.

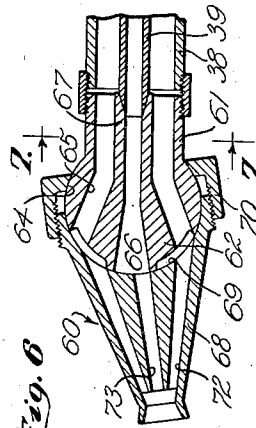
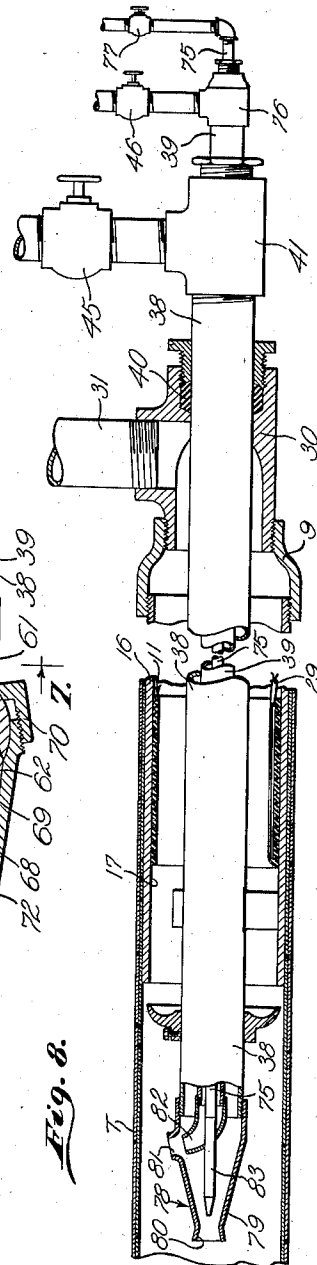
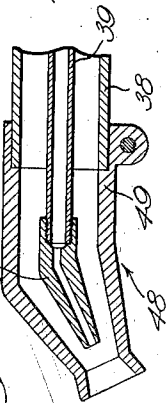


Fig. 5.



Inventor
MAXIMILIAN PAUL LINK
By
W. H. Hall
His Attorney

UNITED STATES PATENT OFFICE

2,146,305

APPARATUS FOR COATING TUBING

Maximilian Paul Link, Los Angeles, Calif.

Application December 24, 1935, Serial No. 55,992

8 Claims. (Cl. 91-13)

This invention relates to an apparatus for coating tubular articles and relates more particularly to an apparatus for coating fibrous tubing or paper tubing such as employed in the manufacture of paper containers and the like. A general object of this invention is to provide a simple, rapid and commercially practical method for coating paper tubing and a practical effective apparatus for carrying out said method.

Fibrous tubing or paper tubing is widely used as the body stock for paper containers. The character of the substances or materials to be packaged often makes it necessary to treat or coat the tubing to render it impervious to the packaged material. Heretofore when such a treating or coating of the container tubing was deemed necessary the tubing was bodily immersed in the coating material. The dipping or immersing of the tubing in the coating material is time consuming, requires considerable labor and is wasteful of the coating material.

Another object of this invention is to provide an improved and efficient machine for forming and coating paper tubing.

Another object of this invention is to provide an apparatus for coating tubing that may be embodied in a tubing forming machine as a part thereof or that may be applied to a tube winding or forming machine as an attachment therefor.

Another object of this invention is to provide an apparatus for forming and coating paper tubing that is entirely automatic in its operation.

Another object of this invention is to provide an apparatus for coating paper tubing that first heats and dries the tubing immediately following its formation, then removes all paper particles and dust from the tubing surface to be treated or coated, then applies the treating or coating material to the warm clean dry surface of the tubing and then keeps the treated or coated surface in a clean state until the material has dried or set.

A further object of this invention is to provide a tube coating apparatus of the character mentioned that is simple and inexpensive of manufacture.

The various other objects and features of my invention will be fully understood from the following detailed description of typical preferred forms of apparatus and a typical manner of carrying out the invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a top or plan view of the apparatus provided by this invention showing it in operation in carrying out the method of the invention. Fig. 2 is an enlarged longitudinal detailed sectional view of the inner end portion or supported end portion of the mandrel and the adjacent parts. Fig. 3 is an enlarged longitudinal detailed sectional view of the outer end portion of the mandrel and the adjacent parts. Fig. 4 is a transverse detailed sectional view taken as indicated by line 4-4 on Fig. 3. Figs. 5 and 6 are longitudinal detailed sectional views of alternative or modified forms of nozzles for spraying the coating material onto the interior of the tubing. Fig. 7 is a transverse detailed sectional view taken as indicated by line 7-7 on Fig. 6, and Fig. 8 is a longitudinal detailed sectional view of the mandrel and adjacent parts of a modified form of apparatus.

The tube coating machine or apparatus of the present invention is adapted to be embodied in forms for use in treating tubing of various diameters and in forms for use on or as parts of tube winding or forming machines of various forms and makes. In the following detailed description the tube coating means of the invention will be described in connection with a simple typical form of tube winding machine which may be considered as an element of the invention when the invention is viewed in its broader aspects, it being understood that the invention is not to be construed as limited or restricted to the specific form and application about to be described.

The apparatus of the present invention illustrated in Figs. 1 to 7, inclusive, includes, generally, a machine 10 for winding or forming tubing T and for cutting the tubing into lengths as it is formed, means 11 for heating the tubing immediately following its formation, means 12 for removing paper particles and dust from the interior of the tubing T and means 13 for applying the coating or treating material to the cleaned dry interior of the tubing T.

The machine 10 is operable to simultaneously wind two or more plies or strips S of paper or other material together to form a self-sustaining tube and to continuously advance the tube or tubing T as it is formed. The machine 10 includes a suitable bed or body 14 provided at one end with a stationary support or head 15. A stationary mandrel 16 is carried by the head 15 to extend longitudinally of the body 14. The mandrel 16 is spaced above the body 14 and is preferably substantially horizontal. The mandrel 16 projects a substantial distance from one end of

the body 14 and may be free or unsupported except for its engagement with the head 15. In accordance with the invention the mandrel 16 is tubular having a central longitudinal opening 17 extending through it from one end to the other. The mandrel 16 forms the support on which the strips S are wound to form the tubing T and the mandrel is preferably removably carried by the head 15 to be replaceable by mandrels of different diameters to adapt the machine 10 for the making of tubing of various sizes.

The strips S of paper or the like to form the plies of the tubing T extend from suitable supply rolls (not shown) and are helically wound on the mandrel 16 in overlapping relation. One or both of the strips S is provided with a suitable adhesive as it moves toward the mandrel 16. In the drawings I have shown one strip S passing through a suitable device 18 which coats one of its surfaces with adhesive to be properly joined with the other strip S when the strips are wound or wrapped together on the mandrel S. The means for winding the strips S on the mandrel 16 may comprise a belt 19 carried by suitable pulleys 20. The belt 19 is angularly disposed with respect to the mandrel 16 and is wrapped or trained over the strips S to exert a winding force on the strips to spirally wrap or wind them on the mandrel 16 in overlapping or superimposed relation. In addition to successively wrapping or winding the strips S on the mandrel 16 the moving belt 19 exerts an axial force which moves the tubing T longitudinally along the mandrel 16 to be continuously fed from its free or outer end. It will be understood, of course, that the belt 19 also exerts a pressing force on the strips S. The belt 19 may be operated by a suitable belt and pulley drive 21 through the medium of a suitable transmission in the body 14 of a type well known to those skilled in the art. The operation of the machine 10 may be readily controlled by suitable hand wheels 22.

The tube winding or tube forming machine 10 preferably includes a unit or device for cutting the tubing T into lengths. The tube cutting device includes a suitable frame 23 spaced beyond the free end of the mandrel 16. A rotating saw 24 is carried by the frame 23 for movement radially of the tubing T and for axial movement with the tubing T. The saw 24 may be operated by a suitable belt drive 25. The tube cutting saw 24 is automatically controlled by the engagement of the outer end of the tubing T with a movable trigger 26. The movement of the trigger 26 is transmitted to the saw governing means by suitable linkage 27. The tube cutting mechanism is such that the saw 24 is moved into cutting engagement with the tubing T and is moved axially with the tubing at the same rate as the tubing following the engagement of the tubing with the trigger 26 so that it is operable to successively cut the tubing into given lengths as the tubing is formed. The operation and control of the tube cutting saw 24 is well known to those skilled in the art. It is to be understood that the machine 10 may embody a tube cutting device embodying one or more knives instead of the saw 24 just described, such knife-type cut off devices being well known to those skilled in the art.

The means 11 for heating the tubing T operates to continuously heat the paper tubing T after it is formed to properly dry the adhesive of the tubing and to prepare the interior of the tubing for the application of the coating material. In

accordance with the invention the tubing heating means 11 is located in the tubular mandrel 16 to warm or heat the mandrel and thus heat the newly formed tubing T passing along the mandrel. The invention contemplates the heating of the mandrel 16 from its interior by means of steam, heated water, heated air or other suitable heating mediums. In the preferred form of the invention illustrated in the drawings the heating means 11 comprises one or more electrical heating units 28 located in the opening 17 of the mandrel 16.

In the portion of the apparatus appearing in Fig. 3 of the drawings there is shown one electrical heating unit 28, it being understood that there may be as many heating units 28 provided in the mandrel 16 as deemed necessary for the proper drying and/or heating of the tubing T to prepare it for the reception of the coating material. The heating unit 28 is preferably located in the outer or free end portion of the mandrel 16 although where several heating units 28 are employed they may be spaced along the length of the mandrel 16 as found desirable. The heating unit 28 is preferably tubular and arranged to lie closely against the internal wall of the mandrel 16. The electrical heating unit 28 is suitably insulated and the conductors 29 supplying current to the unit 28 may enter the inner end portion of the tubular mandrel 16 as illustrated in Fig. 2. The elongate tubular heating unit 28 is operable to heat the mandrel 16 throughout a suitable portion of its length and accordingly heats the tubing T moving along the mandrel. The heat thus transmitted to the tubing T thoroughly dries it and where it is desirable to have the tubing T heated when the coating material is applied to it the tubing may be heated sufficiently to be at the proper temperature when it receives the treating or coating material. It will be understood, of course, that the heating unit 28 may be in continuous operation when the machine 10 is operating and may be suitably controlled from any desirable point.

The means 12 for removing dust, lint and particles of paper from the interior of the tubing T is operable to thoroughly clean the interior of the tubing to prepare it for the reception of the coating material. The mandrel 16 preferably has a polished periphery or external surface over which the tubing T moves but the wrapping of the strips S on the mandrel and the movement of the tubing T along the mandrel causes paper dust and paper particles to be deposited on the interior of the tubing T. The means 12 operates to continuously remove this material from the interior of the tubing T after the tubing leaves the outer end of the mandrel 16. In the form of the invention illustrated in the drawings the means 12 provides or causes an inward circulation of air from the free or outer end of the tubing T to move through the mandrel and clear it of dust and paper particles.

The means 12 may include a fitting 30 at the inner end of the mandrel 16. The fitting 30 receives a pipe 31 and maintains the pipe 31 in communication with the opening 17 of the mandrel 16. It is preferred to connect the fitting 30 with the mandrel 16 by an adapter 9 whereby the machine may be provided with mandrels of various diameters without replacing or disturbing the fitting 30 and its associated parts. The pipe 31 extends to and communicates with a suitable source of reduced pressure. In practice

this source of reduced pressure may be in the form of a reduced pressure line 32 extending from a suction fan 33 or the like. The means 12 includes a deflector or baffle 34 positioned within the tubing at the free end of the mandrel 16 to cause the air circulating through the tubing to impinge against the interior of the tubing and clean it of paper particles and dust. The baffle 34 is located a short distance in front of the outer end of the mandrel 16 to be within the portion of the tubing T leaving the mandrel. In accordance with the invention the baffle 34 is slightly smaller in diameter than the mandrel 16 leaving a relatively small annular space 35 between its periphery and the interior of the tubing T. The air passes inwardly through this restricted annular space 35 at an increased velocity and impinges against the internal surface of the tubing T to remove paper particles etc. from the interior of the tubing. The baffle 34 is shaped to effectively deflect the air against the interior of the tubing. The outwardly facing surface of the baffle 34 is convex and curves or tapers to the periphery of the baffle. The inner surface of the baffle 34 is preferably concave as illustrated in Fig. 3 of the drawings. The air deflecting baffle 34 is supported in the tubing T as will be hereinafter described.

In applying certain coating materials to the tubing T it is desirable that the internal surface of the tubing be kept clean until the coating material has set or dried. As the cutting of the tubing T by the saw 24 may produce paper dust and particles in the tubing the means 12 is preferably operable to remove the cuttings from the tubing T and the saw 24. Accordingly, the means 12 preferably includes a hood 36 enclosing the saw 24 and the adjacent portions of the cut-off device. The hood 36 is connected with the low pressure line 32 by a suitable pipe 37. The hood 36 and the pipe 37 carry off the cuttings from the saw 24 during the operation of the saw and remove the cuttings from the interior of the tubing T following each operation of the saw 24 to prevent the paper particles from adhering to the freshly coated interior of the tubing.

The means 13 is operable to continuously apply the treating or coating material to the internal surface of the tubing T after the drying or heating of the tubing by the means 11 and after the internal surface of the tubing has been cleaned by the air passing the baffle 34. The material applying means 13 includes a pipe 38 extending longitudinally through the mandrel 16 and a pipe 39 extending longitudinally through the pipe 38. The pipes 38 and 39 preferably extend centrally through the mandrel 16 to project from its opposite ends. The outer pipe 38 extends through a suitable packing means 40 on the fitting 30 and is provided at its outer end with a suitable fitting 41. The inner pipe 39 continues through the fitting 41 to extend through suitable packing 42. One or more suitable spiders 55 may support the outer pipe 38 in the mandrel 16 and one or more similar spiders 56 may support the pipe 39 in the pipe 38. The deflector or baffle 34 may be supported on the pipe 38 and may be attached thereto by a screw 61^a. One of the pipes 38 or 39 is connected with a source of supply of the coating material and one of the pipes 38 or 39 is connected with a source of air under pressure. In the particular case illustrated in the drawings the outer pipe 38 is connected with a compressor 43 or other source of air under pressure while the inner pipe 39 extends to a source

44 of liquid coating material. If desired or found necessary the coating or treating material may be supplied to the pipe 39 from the source 44 under a suitable pressure. A suitable valve 45 is provided in the air conducting pipe 39 to control the passage of the air therethrough. A conveniently located valve 46 is provided in the material supply pipe 39.

A spray head or nozzle 47 is provided for discharging the coating material against the interior of the tubing T. The pipes 38 and 39 project some distance beyond the free end of the mandrel 16 so that the nozzle 47 thereon discharges the treating or coating material against the exposed internal surface of the tubing T. The nozzle 47 may be of any suitable type or form and may be in the nature of a mixing nozzle whereby the air under pressure spreads or atomizes the coating material from the pipe 39 causing it to spray against the interior of the tubing T. In the particular case illustrated in Fig. 3 of the drawings the nozzle 47 includes two parts or sections threadedly connected with the pipes 38 and 39. The nozzle 47 may or may not be provided with a suitable baffle plate for effecting the more complete distribution and atomization of the coating material. Fig. 5 of the drawings illustrates a modified form of nozzle 48. The nozzle 48 comprises an outer part 49 clamped to the pipe 38 and facing or discharging laterally and an inner part 50 threaded to the inner pipe 39 and discharging laterally from within the outer end of the outer part 49. The air under pressure is continuously passed through the pipe 38 and the coating material is continuously supplied through the pipe 39 so that the nozzle 47 or 48 continuously discharges the coating material against the interior of the tubing T. The tubing T continuously turns or spirals as it advances from the mandrel 16 so that the coating material discharged from the nozzle 47 or 48 is effectively distributed over its entire internal surface.

Figs. 6 and 7 of the drawings illustrate an adjustable nozzle 60 which may be adjusted or regulated to discharge the air under pressure and the coating material axially within the tubing T in different angular directions in the tubing. The nozzle 60 includes an inner part 61 threaded or otherwise attached to the pipe 38 and provided with a substantially spherical head 62. The head 62 is provided with a series of ports 65 communicating with the air conducting pipe 38 and a central port 66 communicating with the coating material conducting pipe 39. The head 62 is provided with an inwardly projecting nipple 67 which has sealing contact with the tapered outer end of the inner pipe 39. The nozzle 60 includes a discharge member 68 which adjustably bears on the head 62. The member 68 has a spherically concaved seat 69 cooperating with the surface of the head 62. A collar 70 is threaded on the member 68 and has a spherically concaved surface 64 cooperating with the head 62 in a zone spaced inwardly from its center to hold the member 68 in proper contact with the head 62. The collar 70 may be threaded on the member 68 to releasably clamp the member in any adjusted position. The discharge member 68 is provided with a series of ports 72 whose inner ends cooperate with the ports 65. A central port 73 is provided in the discharge member 68 and communicates with the port 66 of the head 62. The ports 72 and 73 discharge at the reduced outer end or spout of the discharge member 68 which sprays or discharges the fluid against the interior

of the tubing T. It is believed that it will be apparent how the discharge member 68 may be shifted or adjusted on the spherical head 62 to discharge the coating material at various angles relative to the longitudinal axis of the tubing T.

The operation of the apparatus described above is as follows: Assuming that the strips S are trained on the mandrel 16 as illustrated in Fig. 1 and that the belt 19 is in continuous operation, the belt operates to successively wind the strips S on the mandrel 16 and thus cause the formation and the advancement of the tubing T along the mandrel. The adhesive applied by the device 18 properly connects or bonds together the superimposed strips S as they are wound together to form the tubing T. The knife or saw 24 under the automatic control of the trigger 26 operates to automatically cut the tubing T into sections of uniform length. The heating unit 28 is preferably continuously energized and the blower 12 is preferably in continuous operation. The valves 45 and 46 are suitably adjusted to provide for the continuous discharge of air under pressure and the coating material from the nozzle 47, 48 or 60.

The heating unit 28 operates to heat the mandrel 16 which in turn heats the tubing T as it moves along the mandrel. This heating of the tubing T fully dries the adhesive of the tubing and heats or warms the tubing to condition it for the application of the coating material. Thus the tubing T is dry and may be heated as it leaves the end of the mandrel 16. It is to be understood that the heating unit 28 may be positioned and regulated to merely heat the tubing T sufficiently to fully dry it without causing it to remain heated above a normal temperature when it leaves the end of the mandrel 16. The air under pressure drawn through the tubing T by the blower 12 is deflected against the interior of the tubing T by the baffle 34 and passes through the reduced clearance space 35 at an increased velocity to impinge against and clean the internal surface of the tubing T. The hood 36 connected with the reduced pressure line 32 by the pipe 37 removes the paper cuttings and lint from the tubing T at its outer end or at the saw 24 to prevent the cuttings and paper lint from entering the tubing.

The dried and fully cleaned tubing T continuously advancing to the nozzle 47, 48 or 60, receives the coating material discharged from the nozzle. The nozzle 47, 48 or 60 continuously sprays the treating or coating material on the internal surface of the tubing T. The internal surface of the tubing T has been thoroughly dried by the heating means 11 and has been fully cleaned by the air deflected against it by the baffle 34 to be in proper condition to receive the coating material. When the character of the treating or coating material being applied to the tubing makes it necessary or desirable to have the tubing T warm or heated as it receives the material, there may be a multiplicity of heating units 28 in the mandrel 16 or the heating unit 28 may be such that it heats the tubing T to the necessary degree. The tubing T continuously turns or rotates as it advances from the mandrel 16 so that its entire internal surface receives the treating or coating material from the nozzle 47, 48 or 60. The material discharged from the nozzle 47, 48 or 60 quickly sets or dries on the dry warm tubing T and the tubing is usually fully dried when it is cut by the saw 24. The tube forming and coating operation may be continuous as

just described, and the apparatus requires little attention or regulation.

Fig. 8 of the drawings illustrates a form of the invention that is useful in coating tubing when it is desirable to apply a priming coat or first coat to the interior of the tubing before applying the finish coat or final coat of treating material. The mandrel 16, the heating means 11, the pipes 38 and 39 with their fittings 30 and 41 may be the same as described above. The mandrel 16 is mounted in the tube winding machine as above described and the pipe 31 is connected with the reduced pressure line 32. The pipe 38 may be connected with a suitable source of air under pressure and the flow through the pipe 38 is controlled by the valve 45. The inner pipe 39 may be connected with a source of supply of the priming coat material (not shown). In accordance with the form of the invention illustrated in Fig. 8 of the drawings a third pipe 75 extends longitudinally through the pipe 39 to conduct the final coating material. The inner pipe 75 enters the pipe 39 through a fitting 76 and is controlled by a conveniently located valve 77. The pipe 75 may extend to a source of the coating or treating material which may be maintained under a suitable pressure if found desirable.

A nozzle is provided at the ends of the pipes 38, 39 and 75 for discharging both the priming material and the final coating material. The particular nozzle 78 illustrated in the drawings includes an outer discharge part 79 attached to the air conducting pipe 38 and provided with a central outer discharge opening 80 and a lateral discharge opening 81 spaced inwardly from the opening 80. A laterally projecting discharge part 82 is provided on the pipe 39 to discharge the priming material outwardly through the opening 81. There is a suitable clearance space between the liquid discharge part 82 and the wall of the opening 81 to permit the air under pressure to discharge outwardly through the port 81 with the liquid from the discharge part 82. A constricted discharge extension 83 is provided on the outer end of the pipe 75 and discharges the final coating material from the outer end of the outer part 79. Suitable clearance is provided in the central port or opening 80 to permit the air under pressure from the pipe 38 to discharge therethrough together with the coating material from the pipe extension 83.

The nozzle 78 just described may be suitably modified to adapt the apparatus for the proper handling of treating and coating material of various characters. The operation of the apparatus shown in Fig. 8 of the drawings is substantially identical with that of the apparatus described above. The tubing T is continuously wound on the mandrel 16 and advanced from its outer end. The heating unit 28 operates to heat and dry the tubing as it moves along the mandrel 16. The valves 45, 46 and 77 may be suitably regulated to provide for the proper discharge of the air under pressure, the priming material and the final coating material from the nozzle 78. The discharge opening 81 of the nozzle 78 discharges the priming material and air under pressure laterally so that the internal surface of the tubing T is first provided with a priming coat. The outer opening 80 of the nozzle 78 discharges the final coating material to impinge against the interior of the tubing T outwardly of or beyond the opening 81. In this manner the interior of the tubing T is continuously treated with a priming coat and with a final coat or application of coating material.

Having described only typical preferred forms of apparatus of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims:

Having described my invention, I claim:

1. Apparatus for treating fiber tubing comprising a mandrel on which the tubing is movable, means for applying heat to the tubing, means for removing fiber particles from the interior of the tubing as the tubing advances, and means for applying a treating material to the cleaned interior of the tubing as the tubing advances.

2. Apparatus for coating tubing comprising a tubular mandrel on which the tubing is movable to pass from one end thereof, means maintaining a reduced pressure in communication with the other end of the mandrel to produce a current therethrough to clean the portion of the tubing leaving the mandrel, a conduit in the mandrel carrying the coating material, and a nozzle on the conduit discharging the material against the interior of said portion of the tubing.

3. Apparatus for treating tubing comprising a mandrel on which the tubing is movable, means heating the mandrel to heat the tubing moving thereon, means cleaning the interior of the tubing as it moves from the mandrel, and means for applying material to the clean interior of the tubing as it moves from the mandrel.

4. Apparatus for treating tubing comprising a tubular mandrel on which the tubing is movable, means circulating air through the mandrel to clean the interior of the portion of the tubing leaving the mandrel, and means for applying material to the cleaned internal surface of the tubing.

5. Apparatus for treating tubing comprising a tubular mandrel on which the tubing is movable, a heating unit in the mandrel for heating the tubing moving thereon, means for circulating air

longitudinally through the mandrel, a deflector deflecting the circulating air laterally to impinge against and clean the interior of the tubing leaving the mandrel, a conductor extending through the mandrel for carrying a coating material, and a device for discharging the coating material from the conductor on the cleaned interior of the tubing.

6. Apparatus for treating tubing comprising a tubular mandrel on which the tubing is movable, a heating unit in the mandrel for heating the tubing moving thereon, means connected with an end of the mandrel for circulating air longitudinally through the mandrel to impinge against and clean the interior of the tubing leaving the mandrel, a conductor extending through the mandrel for carrying a coating material, a pipe extending through the mandrel and carrying air under pressure, and a device mixing the said material and air under pressure and spraying the material against the interior of the cleaned tubing.

7. Apparatus for treating tubing comprising a tubular mandrel on which the tubing is movable, a device for cutting the tubing into lengths as it moves from the mandrel, means for circulating air through the mandrel to clean the interior of the tubing as the tubing leaves the mandrel, means for carrying the cuttings away from said device, and means for applying material to the interior of the tubing after it has been cleaned by the first named means.

8. Apparatus for coating tubing comprising a tubular mandrel on which the tubing may be moved, three conduits extending longitudinally through the mandrel, one conducting air under pressure, one conducting a priming material, and one conducting a final coating material, means discharging air and the priming material against the interior of the tubing, and means discharging air and the coating material against the interior of the tubing.

MAXIMILIAN PAUL LINK.