L. A. SUBERS.

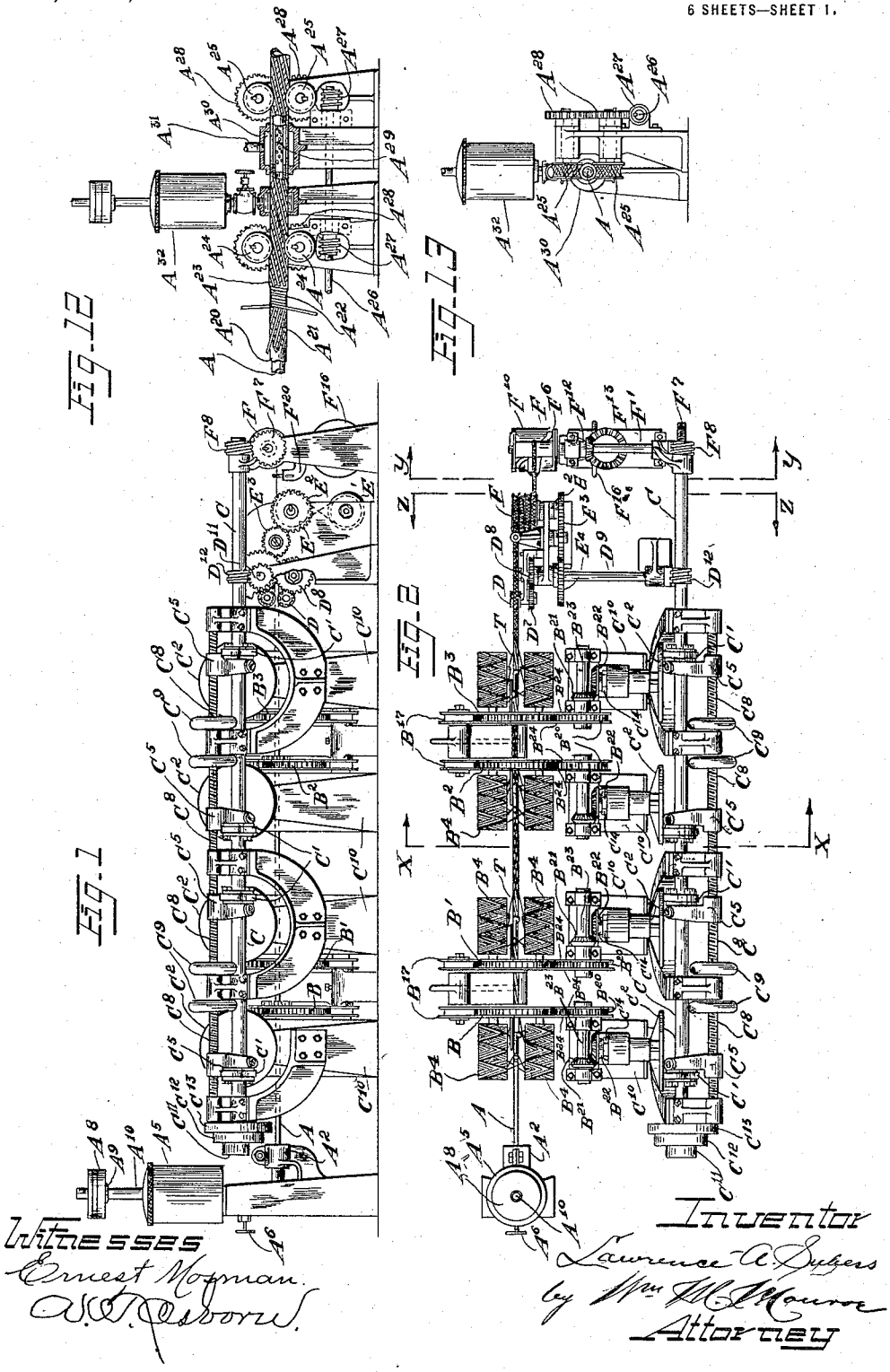
MACHINE FOR CONSTRUCTING A LAMINATED COHESIVE INTERWOUND FABRIC BAND.

APPLICATION FILED AUG. 17, 1914.

1,201,774.

Patented Oct. 17, 1916.

6 SHEETS—SHEET 1.



Witnesses
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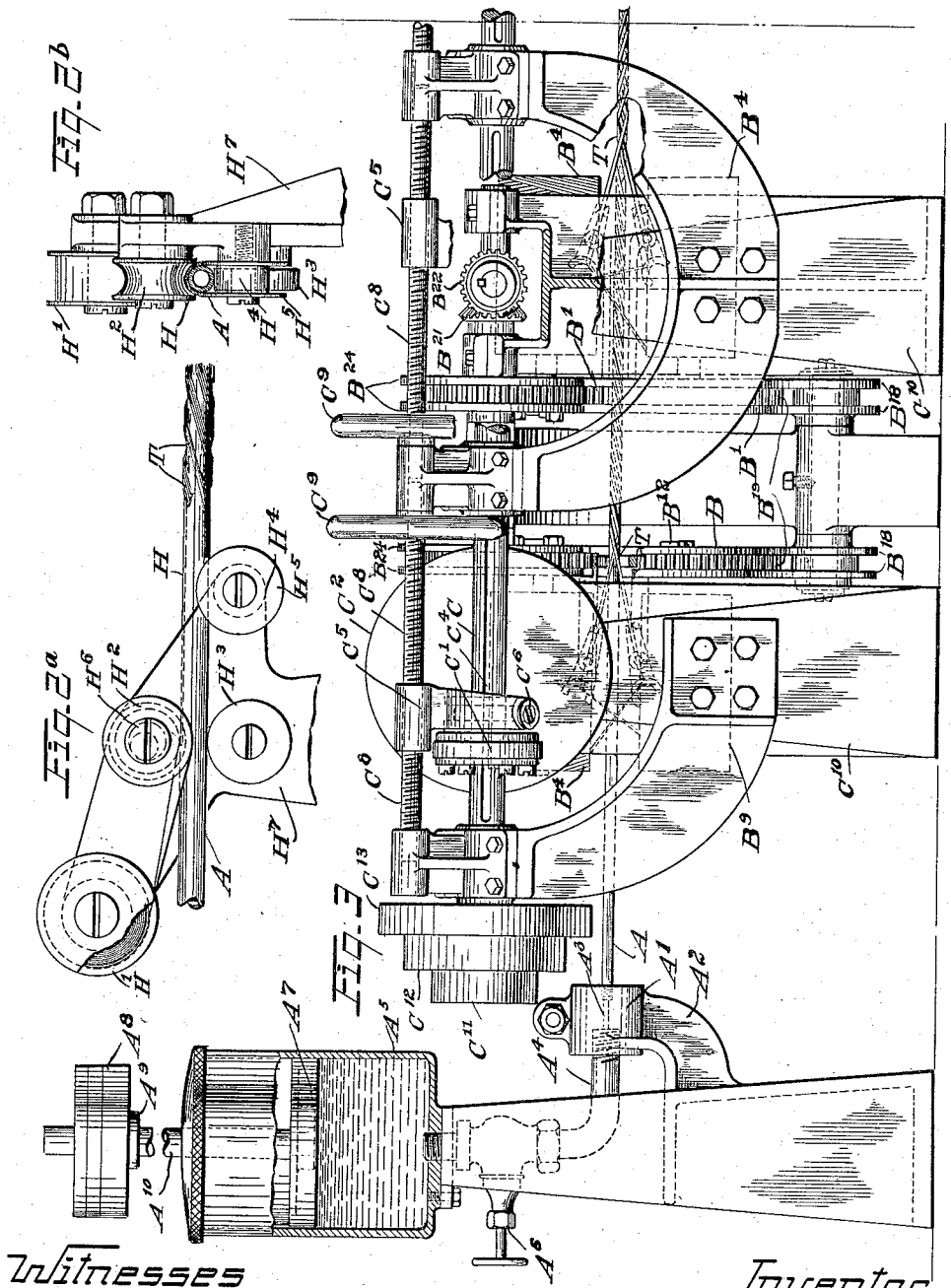

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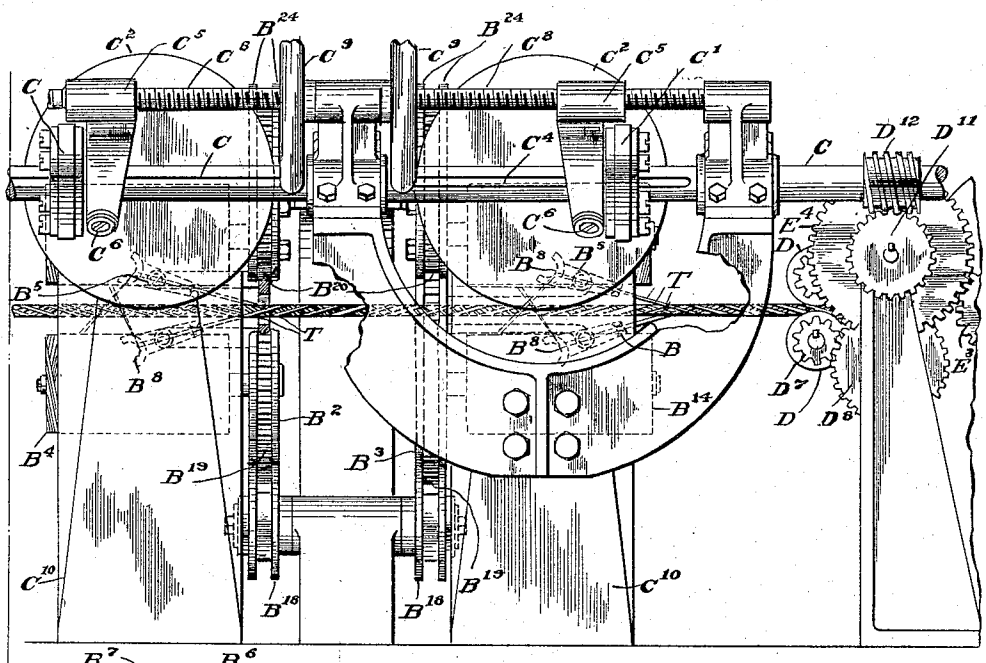

Fig. 4

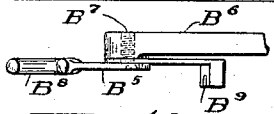

Fig. 4b

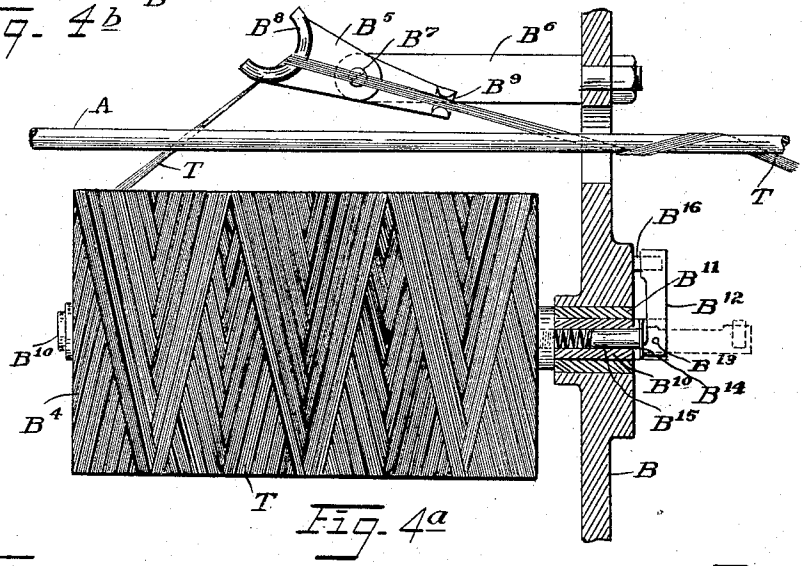

Fig. 4a

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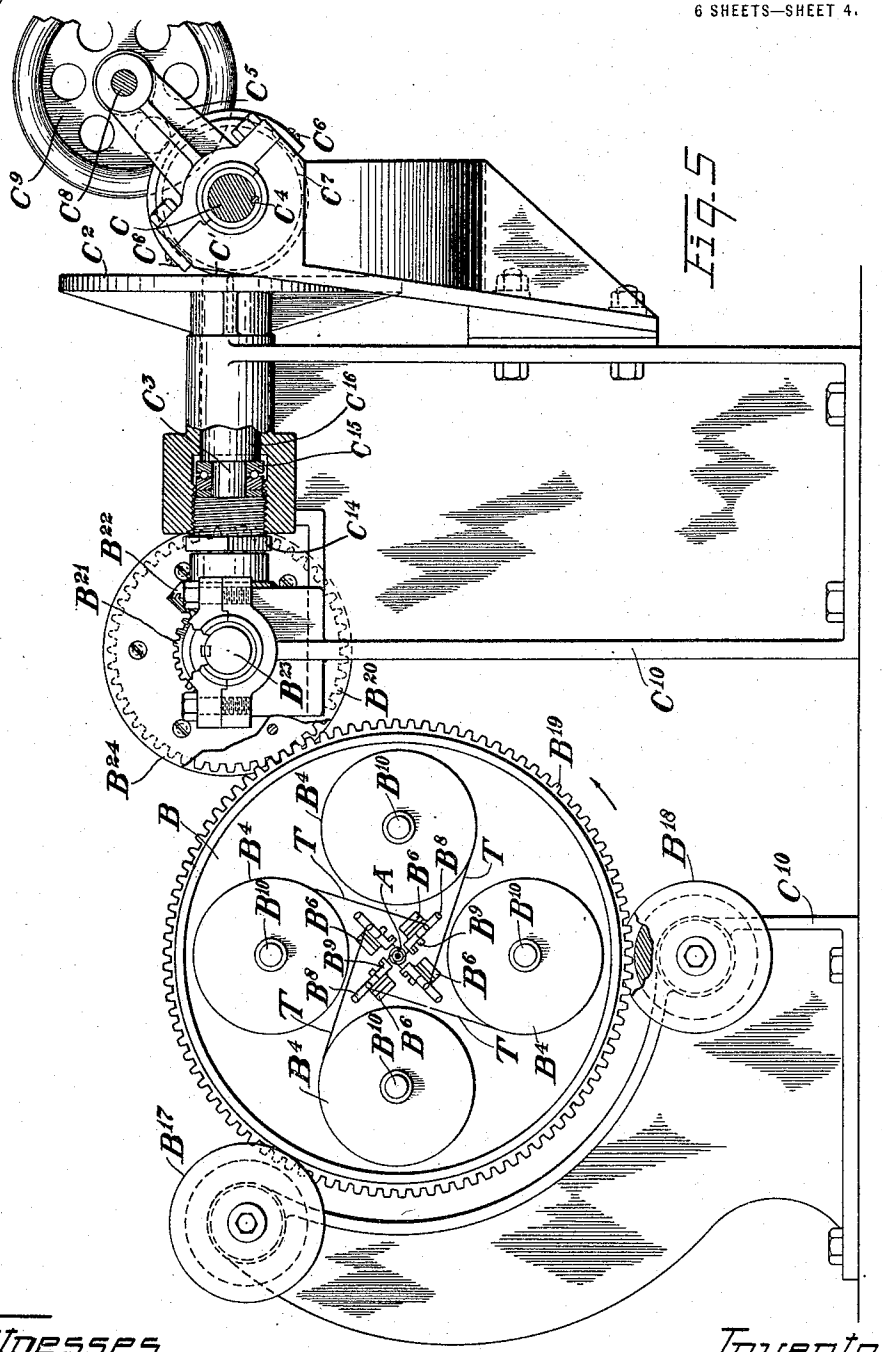

Fig. 5

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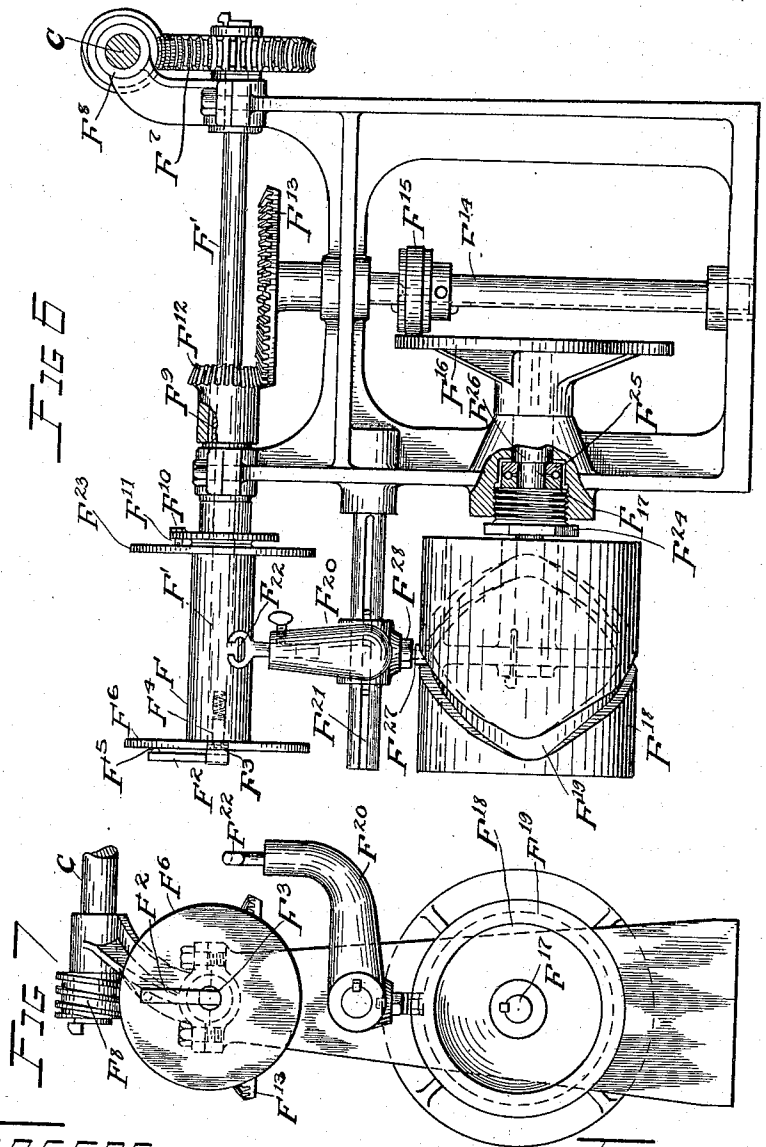

Fig 6

Fig 7

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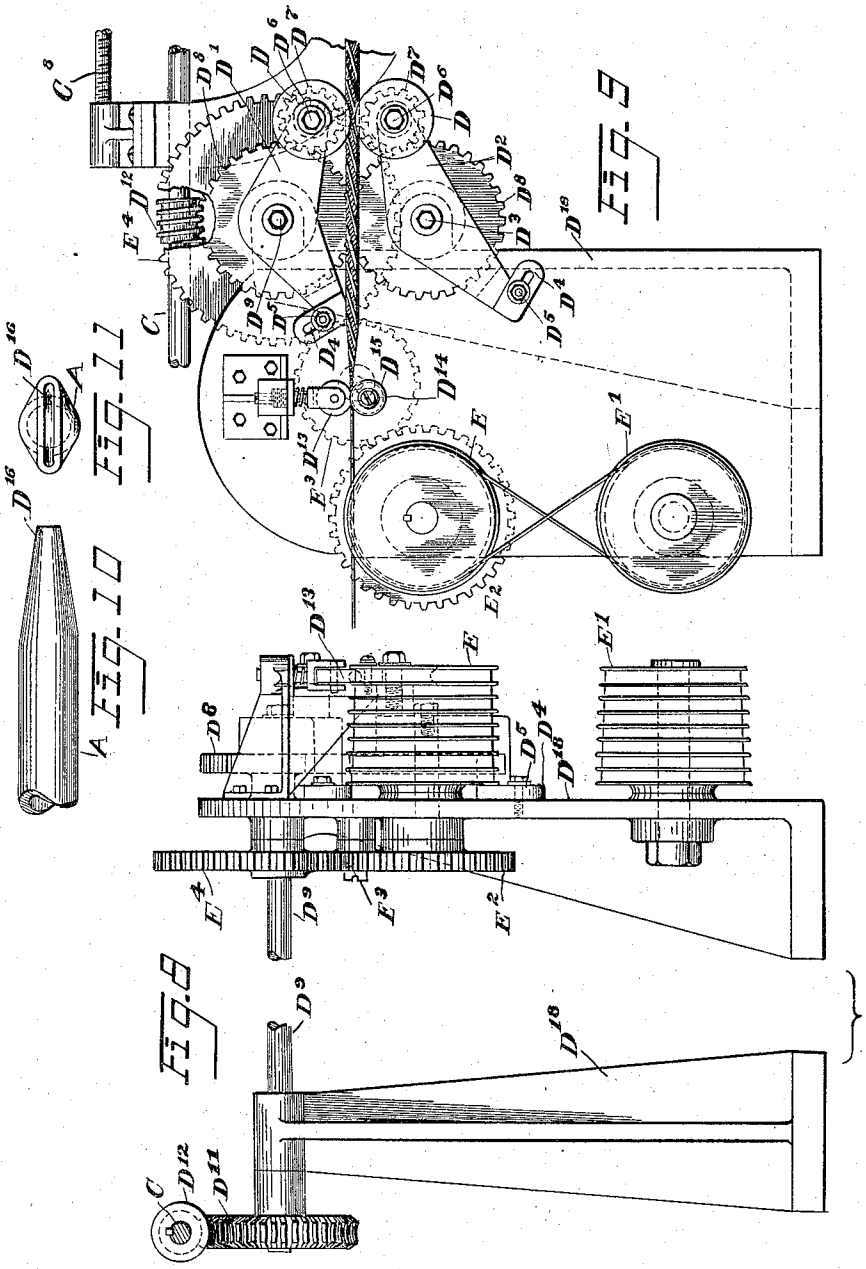

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UNITED STATES PATENT OFFICE.

LAWRENCE A. SUBERS, OF EAST CLEVELAND, OHIO.

MACHINE FOR CONSTRUCTING A LAMINATED COHESIVE INTERWOUND FABRIC BAND.

1,201,774. Specification of Letters Patent. Patented Oct. 17, 1916.

Substituted for application Serial No. 762,712, filed April 21, 1913. This application filed August 17, 1914. Serial No. 857,071.

To all whom it may concern:

Be it known that I, LAWRENCE A. SUBERS, a citizen of the United States, and resident of East Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Machines for Constructing a Laminated Cohesive Interwound Fabric Band, of which I hereby declare the following to be a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

The objects of the invention are to provide an automatically operating machine for manufacturing a continuous fabric band formed preferably from members composed of groups of close lying parallel yarns or threads of a predetermined number and thickness in an interwound laminated manner around a stationary forming tube through which a stream of liquid rubber cement or other adhesive material is forced, forming an inner coating of the fabric which is then collapsed, compressed, stretched and shaped into a band form. This band when completed is adapted for use in the manufacture of cohering interwound laminated fabric as described in my former applications Ser. Nos. 587,629, 587,630, 587,631, 587,632, 587,633 for hose and other manufactured products.

The automatic machine described comprises a forming tube about which the tubular band is constructed and mechanism for constructing the tubular fabric band continuous thereupon, preferably from groups of close lying parallel yarns or threads in conjunction with mechanism for injecting a stream of fluid rubber into the interior of the tubular band, collapsing the band and placing the same under pressure to cause the rubber to permeate all parts of the band.

The invention also includes adjustable guides for the groups of close lying parallel yarns or threads, means for adjusting the angle at which they are fed to the forming tube, a device for stretching, forming and coating the collapsed band, and a device for winding the collapsed band upon a spool.

The machine also includes devices for forming a multiple band of a predetermined number of layers, having an inner lining of any desired material, with additional devices for maintaining this multiple band in a cylindrical state if so desired.

The invention also further consists in the combination and arrangement of parts and construction of details as hereinafter described, shown in the accompanying drawings and specifically pointed out in the claims.

In the accompanying drawings Figure 1 is a side elevation of the entire machine; Fig. 2 is a plan view of the same; Fig. 2^a is a side elevation of a device for applying an inner reinforcing member to the former for subsequently covering with the tubular band; Fig. 2^b is an end elevation thereof; Fig. 3 is a side elevation of a portion of the machine, showing the former, rubber tank and first two reels; Fig. 4 is a similar view of the remainder of the machine with the exception of the winding mechanism; Fig. 4^a is a transverse section of reel showing the manner of mounting the spool containing the group of close lying parallel yarns or threads, as it passes from the spool to the reel; Fig. 4^b is an edge elevation of the thread guide and supporting arm therefor; Fig. 5 is a transverse section on line x—x Fig. 2, showing one reel, the thread guides, the three point support for the reel and operating means therefor; Fig. 6 is a transverse section on line y—y Fig. 2 showing the winding mechanism and means for distributing the band upon the spool; Fig. 7 is an end elevation thereof; Fig. 8 is a section on line z—z, Fig. 2 showing the flattening rolls and tension or stretching rolls for the band; Fig. 9 is a side elevation thereof; Fig. 10 is a side view of the delivery end of the forming tube; Fig. 11 is an end view of the same showing the flattened aperture which delivers the liquid rubber in ribbon form adapted to enter the cavity in the tubular band, which is also partially collapsed by the expanded edges of the flattened end of the former. Fig. 12 is a longitudinal section of an additional machine element showing a multiple layer band upon a stationary hollow mandrel and means for applying an exterior coating and means for applying internal and external pressure to the fabric, to keep it expanded; Fig. 13 is an end view thereof.

In these views A is a hollow cylindrical

former open at one end and secured at the other end in a suitable block A′ which is secured in a bracket A^2, and is provided with a perforation A^3 providing communication between the former and a tube A^4 through which the rubber is introduced to the former.

A^5 is a receptacle for fluid rubber or other adhesive material in the bottom of which the tube A^4 is inserted and a valve A^6 controls the flow of rubber from the receptacle to the hollow former.

A^7 is a piston resting upon the top of the rubber in the receptacle and A^8 is a weight resting on a shoulder A^9 upon a stem A^{10} projecting vertically from the piston A^7 and adapted to apply a continuous pressure to the piston, so as to eject the rubber through the hollow former and through the open end thereof.

The forming tube is designed to remain stationary and the tubular band is formed thereon by means of reels B, B′, B^2 and B^3 respectively, which rotate about the former. Upon each reel are mounted the spools B^4, B^4 composed of close lying parallel yarns or threads, and as shown the spools are four in number so as to form a two-ply laminated interwound tube of threads upon the former. Each alternate reel revolves in a different direction so that the threads cross each other at an angle determined by the rate of speed of rotation of the reels and the speed with which the tubular band is pulled off from the former.

The groups of close lying parallel yarns or threads T are already shown in Fig. 4^a and are composed of parallel uncoated twisted yarns or threads and passes over a guide B^5 attached to an arm B^6 upon the reel by means of a belt or screw B^7 upon the guide so that the angle of the guide relative to the former can be adjusted to be as nearly the desired angle of the yarns or threads wound thereon as can be obtained. This guide is provided with two guiding grooves or positions for the yarns or threads B^8 and B^9 respectively. Each spool is tightly mounted upon a rod B^{10} which passes through a bearing B^{11}, and tension upon the spool is obtained by means of an arm B^{12} pivoted upon a projecting end of the rod at B^{13}. This arm is provided with a shoulder B^{14} at one end engaged by a spring pressed pin B^{15} longitudinally secured in the rod, so as to press the outer end of the arm against the reel. A friction block B^{16} such as arguto wood provides the required friction. The arm also forms a locking device to retain the spool in position and when extended as shown in dotted lines, permits the spool and rod to be withdrawn. Each reel is mounted upon two rollers B^{17} and B^{18} and is provided with toothed edge at B^{19} engaged by a driving pinion B^{20} which rotates the reel and has flanges B^{24}, B^{24} which serve with the rollers B^{17} and B^{18} to form a three-point support for the reel.

The reels are all operated from a common shaft C by means of the friction rolls C′, C′ mounted thereon engaging the friction disks C^2, C^2 upon the shafts C^3, C^3, which also carries the bevel pinions B^{22}, B^{22} which in turn engage the bevel gears B^{21}, B^{21}, fixed to the shaft B^{23}, and fixed to this shaft is also the spur pinions B^{20}, B^{20} which engage the toothed periphery of the reels B^{19}, B^{19}. The friction rolls C′, C′ are slidingly mounted upon the main shaft C upon splines C^4, C^4 and are adjusted upon the face of the disk C^2, C^2 by means of arms C^5, C^5 which are operatively connected with the friction rolls by means of pins or screws C^6, C^6 operating in annular grooves C^7, C^7 therein, and screw shafts C^8, C^8 on which the arms C^5, C^5 travel.

The requisite pressure for the driving of the friction disk C^2 by the friction roll C′ is obtained by the screw bushing C^{14} in the bracket C^{10} upon the shaft C^3 engaging the thrust ball bearing C^{15} which in turn engages the shoulder C^{16} upon the shaft C^3, thus pressing the friction disk C^2, against the friction roll C′.

In Figs. 8 and 9 are shown the pulling, stretching and flattening devices. Here the rollers D, D are shown between which the outer end of the tubular former is supported and which also assists in pulling and sliding the fabric along the forming tube. These rollers are pivotally mounted upon arms D^1, D^2 pivoted respectively upon the end of the worm wheel shaft, D^9 and the pin D^3 secured to the standard D^{18} and are adjustable to regulate the pressure and provide for the use of mandrels of different sizes by means of the slotted extremities D^4, D^4 and screws or bolts D^5, D^5. These rollers are secured upon shafts D^6, D^6 and are rotated in opposite directions by means of pinions D^7, D^7, intermeshing gears D^8, D^8 upon shafts D^9, D^3, and on the longer shaft D^9 is also mounted a worm wheel D^{11} which is operated by means of a worm D^{12} upon the common actuating shaft C the speed being determined by the relative proportions of the gears.

After passing between the rollers D, D the tubular fabric passes between the flattening rollers D^{13}, D^{14} one of which D^{14} is provided with overlapping flanges D^{15}, D^{15}, while the other is spring pressed and the friction of these flattening rollers is a double one, first to produce the band shape required and second to force the rubber or other adhesive material injected through the hollow former into the tube through the fabric and thus thoroughly saturate it with rubber from within outwardly.

The shape of the mouth D^{16} of the tube is such as to facilitate the flattening of the fabric before passing underneath the flattening rollers. This is clearly shown in Figs. 10 and 11, and the shape is such as to expand the tubular fabric laterally while the fluid rubber is being injected therein.

At E, E′ are seen pulling rollers having a number of gradually tapering divisions over which the flattened band passes, thus exerting an increasing pressure on the band which slightly stretches the same and secures a powerful grip. This upper pulling roller is operated by gears E^2, E^3 and E^4. The gear E^4 is on the shaft D^9. From this pulling device the band passes to a spool or reel F in a winding device. This reel is mounted loosely upon a shaft F′ and is provided with a friction drive similar to the tension device described for the thread spools. Here F^2 is an arm pivoted in the end of the shaft F′ a shoulder F^3 on the arm engages the end of a spring pin F^4 in the shaft and retains the arm which is provided with a friction point F^5 in engagement with the flange F^6 of the reel.

The reel is operated by means of the worm wheel F^7 engaging a worm F^8 upon the shaft F. A device operated by the reel is employed to lay the band evenly upon the reel and consists of a sleeve F^9 having a flange F^{10} which is provided with a pin F^{11} engaging a hole in the other flange F^{23} of the reel, so that the sleeve will revolve with the reel. Upon this sleeve is a bevel pinion F^{12} which engages the bevel gear F^{13} on a shaft F^{14}. On this shaft is an adjustable friction roll F^{15} which engages a friction disk F^{16} upon a shaft F^{17} having a cam F^{18} thereon.

The requisite driving pressure of the friction disk F^{16} against the roll F^{15} is obtained by means of the screw-bushing F^{24} on the shaft F^{17} pressing the thrust ball bearing F^{25} against the shoulder F^{26} of the shaft F^{17}. The cam F^{18} is provided with a groove F^{19} which engages a roll F^{27} upon the screw pin F^{28} in the arm F^{20} arranged to reciprocate upon a guide F^{21}. The other end of this arm is provided with an adjustable band guide F^{22} which guides the band backward and forward over the reel as the arm F^{20} reciprocates upon the guide F^{21}.

It will be seen that the speed of the reel controls the speed of the sleeve and gear thereon, and the speed of the pulley will remain constant since if the gradually increasing diameter of the reel tends to affect the speed of reeling or winding the band the friction arm F^2 will slip on the flange F^6 of the reel F.

The position of the friction roll F^{15} on the disk F^{16} controls the relative speed of the cam F^{18} to that of the reel F and therefore since one revolution of the cam F^{18} produces one reciprocation of the arm F^{20} different widths of bands may be closely wound on the reel.

In Figs. 2^a and 2^b are shown views of a device for inserting an inner lining of fabric or metal or other material in the tube in such a manner as to fit closely therein when it is flattened. Here H is the flexible strip to be inserted wound upon a spool H′ and pressed over the hollow former in advance of the construction of the fabric. H^2 is a curved roller adapted to press the strip H upon the former. H^3 is a supporting roller opposite the roller H^2 and H^4 is a third roller having flanges H^5 which engage the edges of the flexible strip H and prevent it from rotating. The roller H^2 is eccentrically mounted at H^6 to provide for adjustment of pressure. A standard H^7 supports the several parts.

In Figs. 12 and 13 are shown an element of the machine to be used in connection with the same general construction of stationary hollow former and reels when an inner lining is employed. Here A is the former, A^{20} a lining, A^{21}, A^{22}, and A^{23} are the several layers of the laminated interwound fabric, forming a tube as it appears before flattening. A^{24}, A^{24}, and A^{25}, A^{25} are pairs of feeding rollers operated from a common shaft A^{26} and intermediate worms and gears A^{27} and A^{28}. A tank of rubber A^{32} or other adhesive material incloses the fabric to apply the outer coating thereto.

Compressed air or other internal pressure is applied to the fabric through openings A^{29}, A^{29} in the forming tube and external pressure is applied to the fabric through a tube A^{31} and an annular chamber A^{30} inclosing the fabric. The fabric can afterward be flattened or left cylindrical as desired.

Having described the invention, what I claim as new and desire to secure by Letters Patent is:

1. In a machine for forming a band composed or interwound cohering laminated groups of close lying parallel yarns or threads, a rigid tubular former open at the outer end, reels rotatable about the former, spools on said reels upon which said groups of threads are wound, guides on said reels adapted to direct the groups of threads to said former, a pressure device for injecting fluid rubber or other adhesive material through said former into the interior of said tubular fabric, a pressure flattening device by means of which the rubber is caused to permeate the band, and a pulling device, a main shaft and mechanism operatively connecting said shaft and reels and pulling device.

2. In a machine for manufacturing a flat laminated band of cohering interwound groups of close lying parallel yarns or threads and for saturating the same with fluid rubber or other adhesive substance

in combination with a hollow cylindrical former, reels rotatable alternately in opposite directions about said former, spools with groups of threads thereon, guides for said thread, means for injecting fluid rubber through said hollow former into the hollow fabric formed on said tube, a flattening device, and a pulling device for the fabric, and operating means for said reels and pulling device.

3. In a machine for forming a band composed of interwound cohering laminated groups of close lying parallel yarns or threads, a rigid tubular former, a plurality of spools, each having wound thereon a group of close lying parallel threads, rotatable means on which said spools are supported for interwinding the threads on said spools in groups, means whereby adhesive material may be injected through said former to the interior of the band formed by interwinding said groups of threads to form a composite fabric, and means for pulling said fabric along said former.

4. In a machine for forming a band composed of interwound cohering laminated groups of close lying parallel yarns or threads, a rigid tubular former, a plurality of spools, each having wound thereon a group of close lying parallel threads, rotatable means on which said spools are supported for interwinding the threads on said spools in groups, means whereby adhesive material may be injected through said former to the interior of the band formed by interwinding said groups of threads to form a composite fabric, a flattening device for compressing the fabric, a pulling device for the fabric, and operating means for said flattening and pulling devices.

5. A hollow former open at one end, a rubber tank for containing rubber or other adhesive material under pressure communicating with the other end, means for winding a tubular fabric continuously upon said hollow former, tapering pulling rolls over which said fabric is passed to remove it continuously from said former as fast as formed thereon, a pair of flattening rolls between which said fabric passes, when pulled from the former, one of said rolls being under pressure.

6. The combination with a stationary former of a flexible strip mounted adjacent thereto, a forming roller adapted to apply said strip to the surface of the former, a corresponding roller therefor, a third roller provided with flanges adapted to engage the edges of the strip to prevent the same from rotating and a support for said strip and rollers.

7. The combination of a stationary mandrel, a supporting spool for a flexible strip, an adjustable curved roller adapted to guide and press said strip upon said mandrel, a supporting roller for the mandrel placed opposite said pressure roller, and a third roller adapted to engage the edges of said flexible strip to prevent the rotation of the same, and means for supporting said spool and roller.

8. The combination of a stationary mandrel, a support adjacent thereto, a holding device on said support for a flexible strip, a guiding and pressure device for said strip adjustably mounted on said support, a supporting means for said mandrel mounted upon said support, and means for preventing the rotation of said strip upon said mandrel.

In testimony whereof, I hereunto set my hand this fourteenth day of August 1914.

LAWRENCE A. SUBERS.

In presence of—
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A. T. OSBORN.