L. A. SUBERS.

MACHINE FOR CONSTRUCTING A LAMINATED COHESIVE INTERWOUND TUBULAR FABRIC.

APPLICATION FILED JUNE 18, 1912.

1,136,291.

Patented Apr. 20, 1915.

7 SHEETS—SHEET 1.

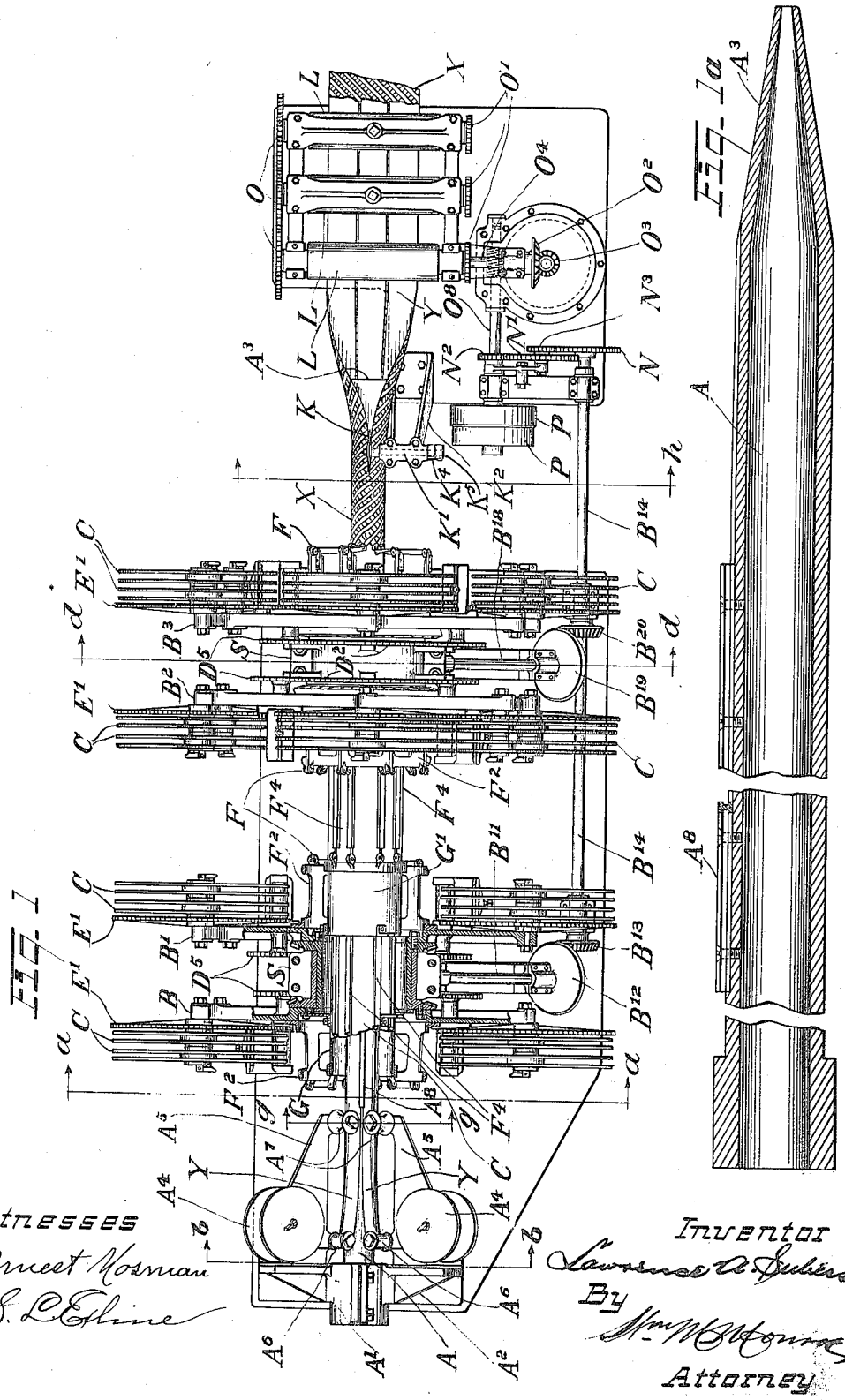


FIG. 1

FIG. 1a

Witnesses

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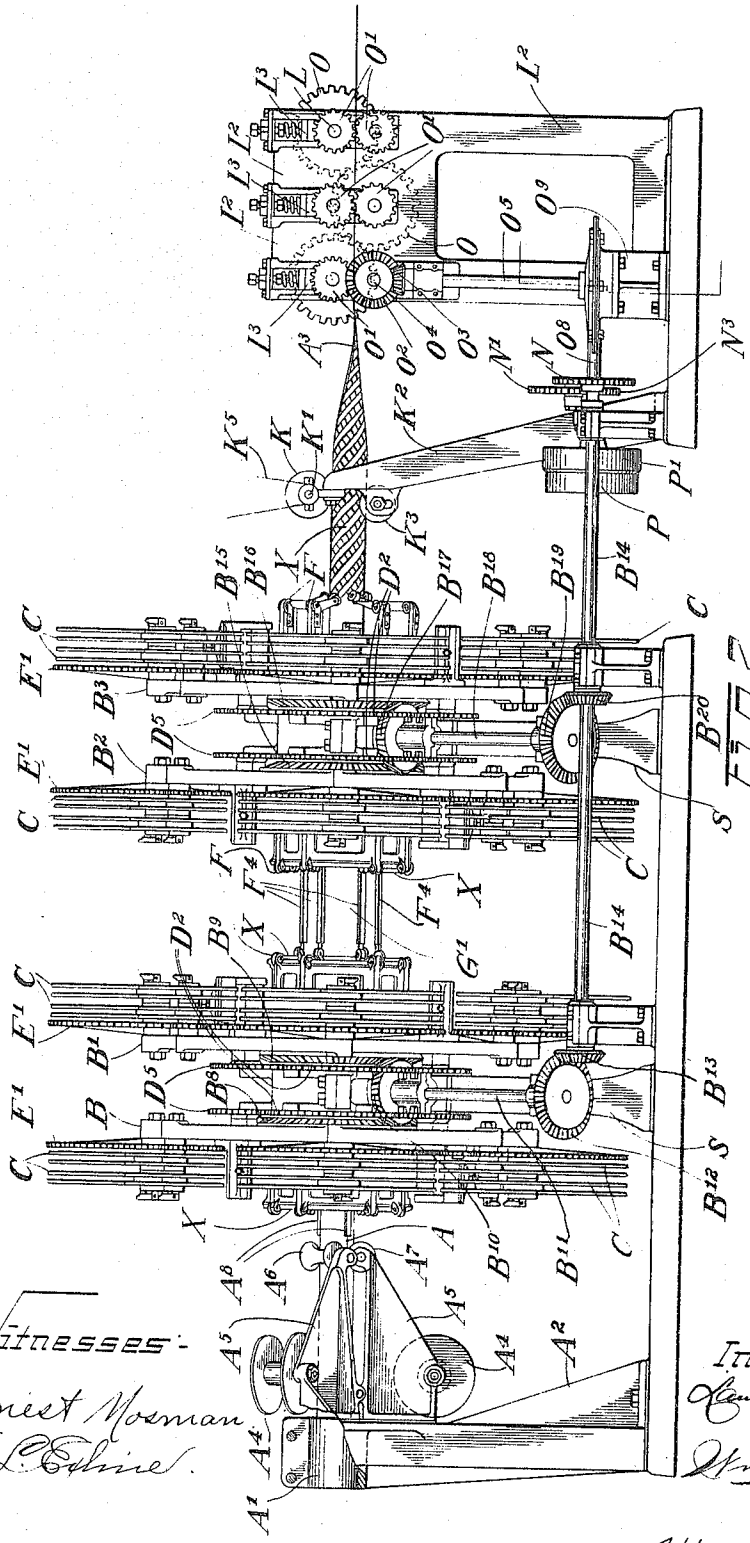


FIG. 2.

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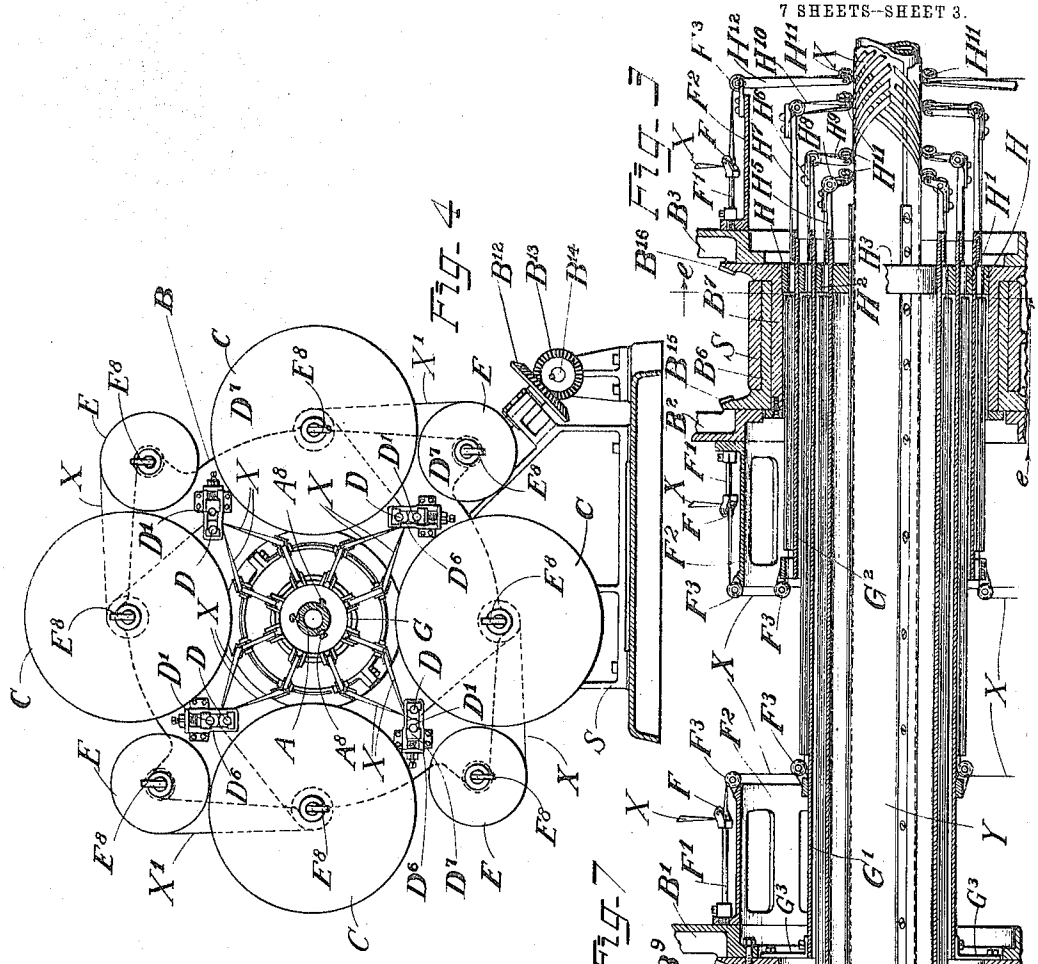


Fig. 4

Fig. 7

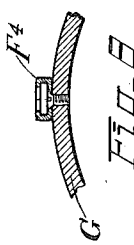


Fig. 8

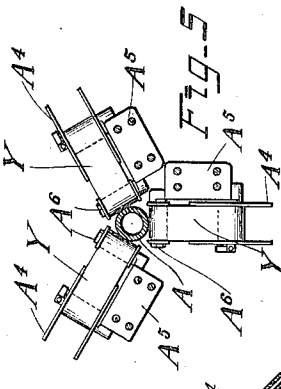


Fig. 5

Fig. 6

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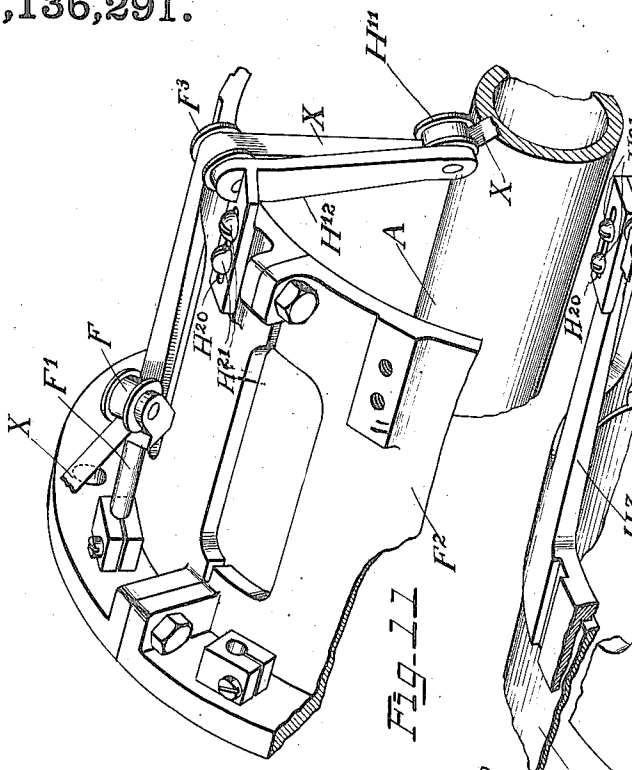


Fig. 11

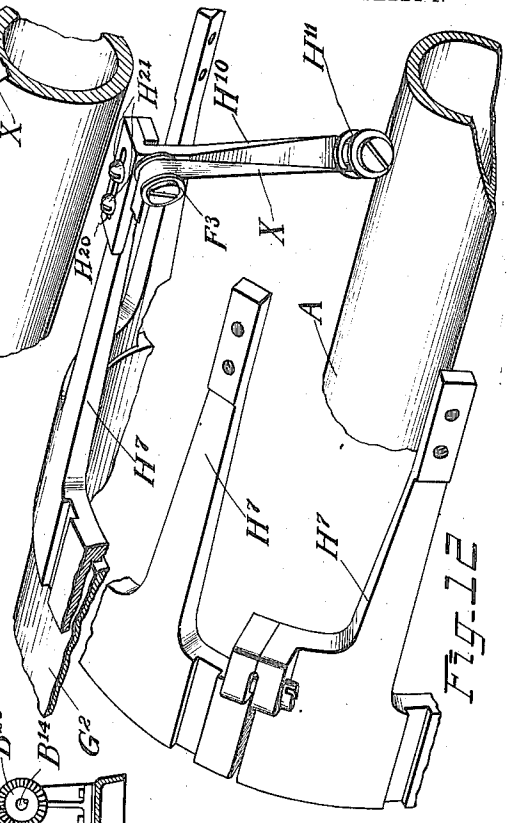


Fig. 12

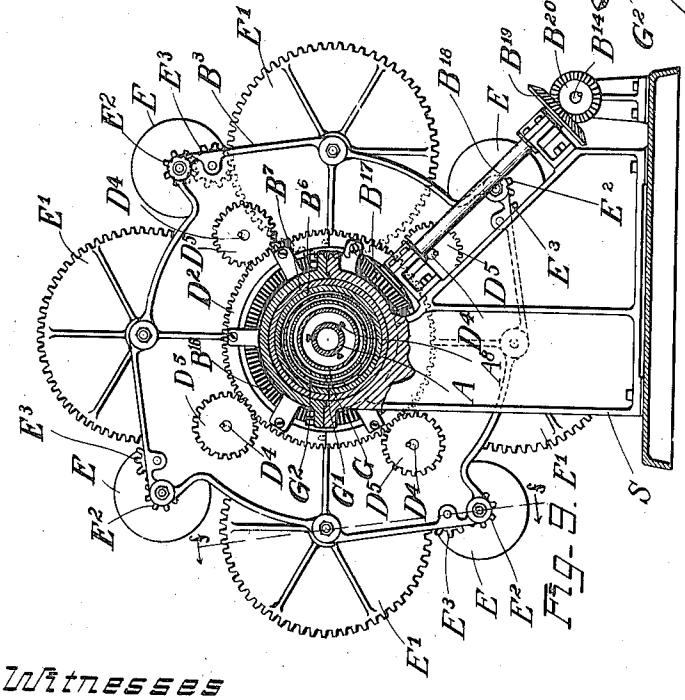


Fig. 9.

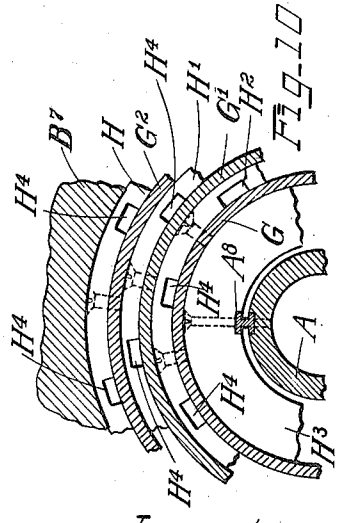


Fig. 10

Witnesses

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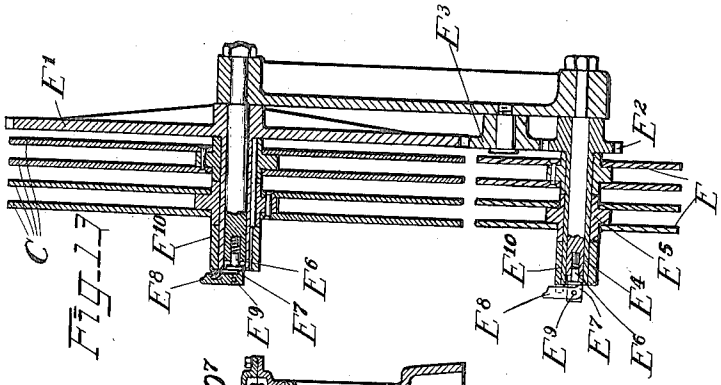


Fig. 13

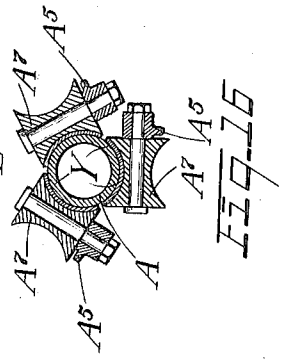


Fig. 16

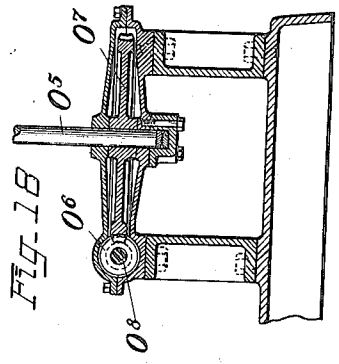


Fig. 18

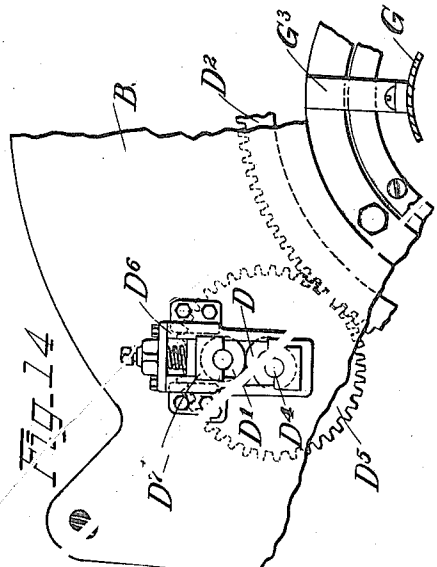


Fig. 14

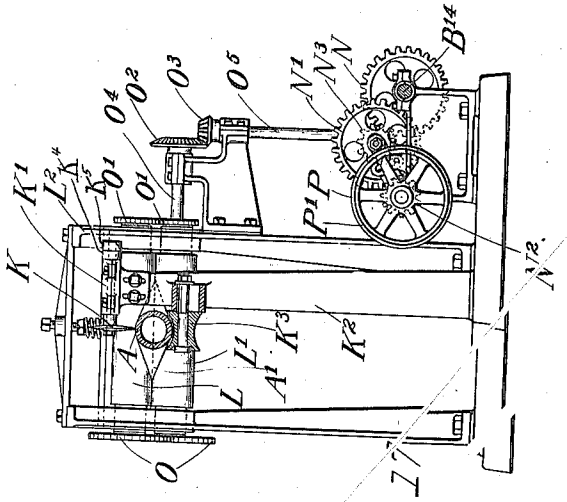


Fig. 17

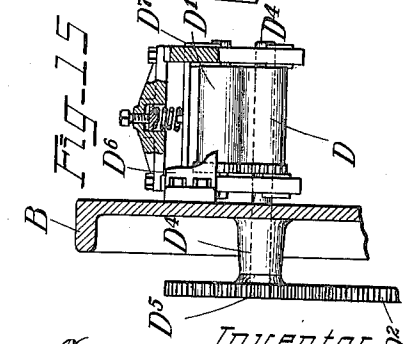


Fig. 15

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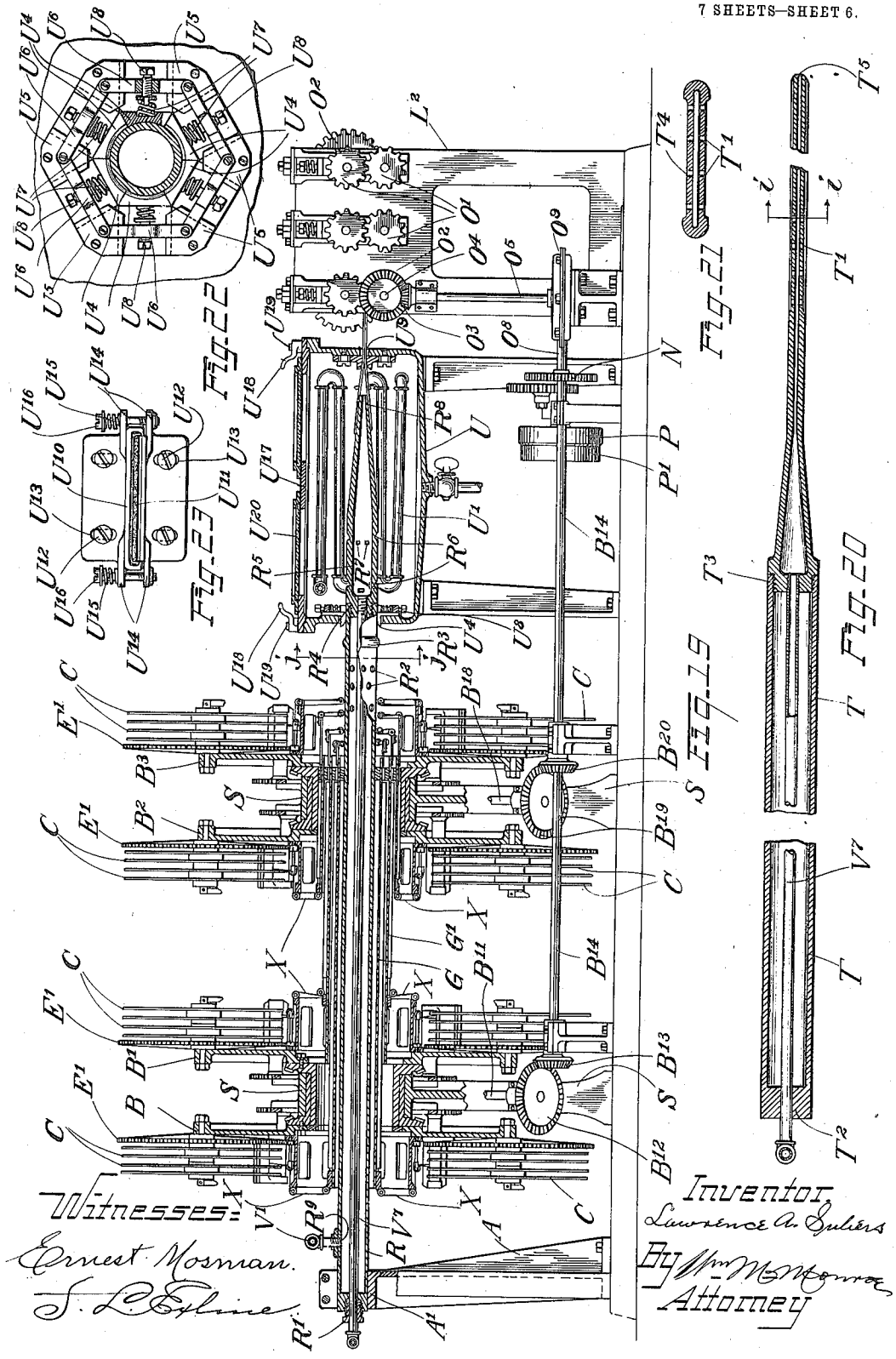
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7 SHEETS—SHEET 7.

Fig. 24

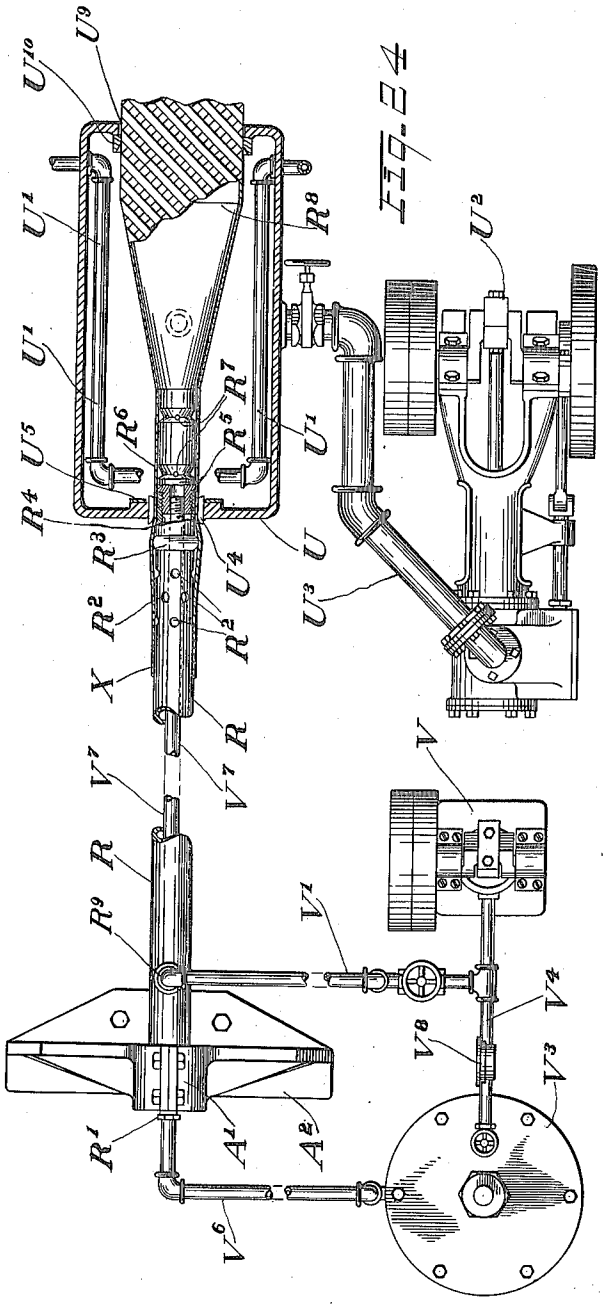


Fig. 25

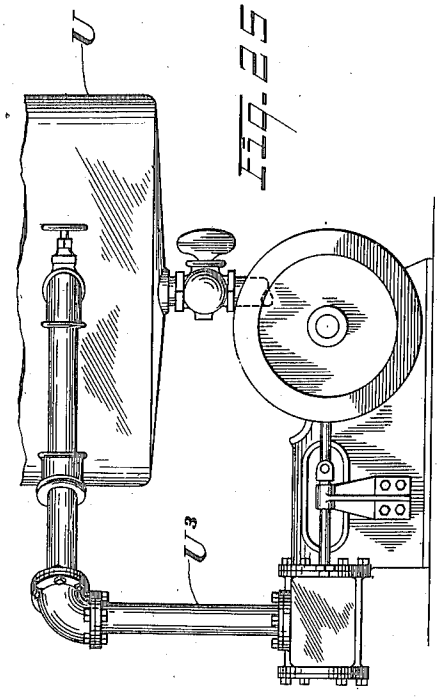
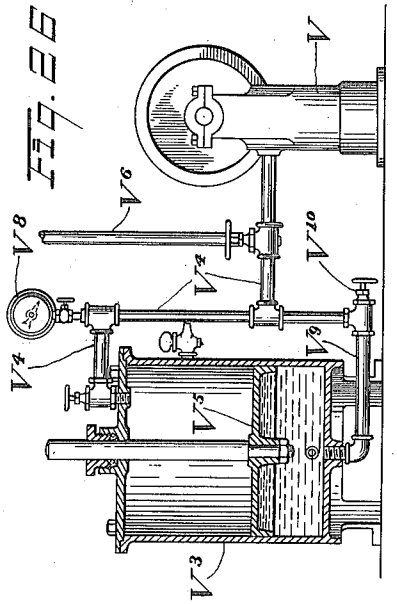


Fig. 26



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UNITED STATES PATENT OFFICE.

LAWRENCE A. SUBERS, OF CLEVELAND, OHIO.

MACHINE FOR CONSTRUCTING A LAMINATED COHESIVE INTERWOUND TUBULAR FABRIC.

1,136,291. Specification of Letters Patent. Patented Apr. 20, 1915.

Application filed June 18, 1912. Serial No. 704,409.

To all whom it may concern:

Be it known that I, LAWRENCE A. SUBERS, a citizen of the United States, and resident of 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 Tubular Fabric, 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 interwinding and laminating fibrous bands (such as described in my previously issued Letters Patent, Numbers 1,024,040, dated Apr. 23, 1912, 1,017,271, dated Feb. 13, 1912, and 1,021,014, dated Mar. 26, 1912,) treated and coated with liquid rubber or other adhesive substance upon a stationary mandrel to form a laminated-cohesive-interwound fabric.

This improved machine is particularly designed to produce a tubular laminated fabric, a sheet fabric of single thickness with raw edges, or a sheet fabric of double thickness with selvage edges, these fabrics being used for various purposes respectively, such as conduits, pneumatic tire farbic or inner linings for the same, or belting, as may be desired.

By the action of the machine the fabric is first constructed in tubular form and may be used as such or it may be cut longitudinally through on one side and then flattened to produce a sheet of fabric or it may be produced in tubular form and then flattened to produce a sheet of fabric with selvage edges.

The invention comprises a series of reels rotatable in alternately opposite directions about a stationary mandrel and carrying rotatable spools upon which the fibrous bands are stored.

It also includes spools upon the reels for receiving strips of practically non-adhesive substance, such as Holland cloth, which is wound between the spirally wound layers of fibrous bands on the band spools, and these additional spools are employed to withdraw the cloth bands from the fibrous bands before the latter are interwound and laminated upon the mandrel.

It also includes means for applying bands of non-adhesive substance, such as Holland cloth to the mandrel in a longitudinal direction to substantially cover the same before the laminated fabric is wound thereon, so as to prevent adhesion of the fabric thereto.

The invention also comprises means for guiding the fabric bands and applying them to the mandrel in opposite directions at predetermined intervals and at predetermined rates of speed, means for slitting the tubular fabric formed thereon and for compressing and flattening the sheet and drawing it off from one extremity of the mandrel.

It also includes means for rotating the reels on which the band spools are mounted at a predetermined rate of speed relative to the speed at which the laminated-cohesive-interwound fabric is drawn along the mandrel by the pulling and compressing rolls, thereby interwinding the fibrous bands at a predetermined angle.

It also provides for treating the interior of the tubular fabric on the mandrel with liquid rubber or other adhesive material under pressure, for evaporating the solvents therein by means of an encompassing chamber, wherein a predetermined degree of heat and percentage of vacuum are maintained, and also for using compressed air to expand the fabric on the mandrel to assist in its longitudinal movement thereon.

It also provides adjustable gates or jaws for the vacuum chamber where the fabric enters and leaves.

It also provides either rotating, compressing and pulling rolls for pulling the fabric from the mandrel in a flattened state, or longitudinally moving chains carrying spurred shoes engaging the fabric on the mandrel to pull it off in tubular shape.

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

In the accompanying drawings, Figure 1 is a plan view of the machine; Fig. 1ª is a longitudinal section of a mandrel employed in this machine; Fig. 2 is a side view of the machine; Fig. 3 is a longitudinal section enlarged of the several guiding cylinders for the fabric bands from which the tubular fabric is constructed, and in this view a por-

tion of the mandrel is shown, portions of the reels and driving gears therefor, and the guiding rollers which conduct the bands to their several guide cylinders and thence to the mandrel; Fig. 4 is a transverse section of the mandrel on line *a*—*a* Fig. 1, showing the first reel and first set of spools, the cylinders which guide the bands therefrom to the forward end of the mandrel, the spools for Holland cloth, and the rollers which pull the fibrous bands off from the band storing spools; Fig. 5 is a transverse section on line *b*—*b* Fig. 1, showing rollers upon which the Holland cloth which serves as a lining for the fabric on the mandrel is stored and guiding rollers therefor; Fig. 6 is a transverse section of the mandrel and first guide cylinder taken on line *c*—*c* Fig. 3, showing the band guide tubes on the cylinder and the lining guide rails on the mandrel; Fig. 7 is an enlarged transverse section of one of the T shaped guide rails upon the mandrel; Fig. 8 is an enlarged transverse section showing one of the guide tubes for the fibrous bands upon one of the cylinders; Fig. 9 is a transverse section of a machine on line *d*—*d* Fig. 1, showing means for rotating the reels and also for rotating the spools carrying the fibrous bands and through the agency of these spools rotating the spools carrying the Holland cloth and thereby winding it up as it comes from the spools for fabric bands; Fig. 10 is an enlarged transverse section of the mandrel and guide cylinders taken on line *e*—*e* Fig. 3, showing the supporting rings for the cylinders provided with band guide tube openings; Fig. 11 is a perspective view enlarged of a portion of the cylindrical frame which is attached to the last reel to support the guide rollers for the fibrous bands as they pass from the spools to the mandrel; Fig. 12 is a perspective view of a portion of one of the brackets which carry the guide rollers and serve in continuation of the guide tubes on the cylinders to apply the fibrous bands to the mandrel; Fig. 13 is a transverse section of a portion of one of the reels taken on line *f*—*f* Fig. 9, showing the spools for the fibrous bands and the driving spur gear upon a common shaft, the spools for the Holland cloth and their operating gear mounted upon a parallel shaft, an idler gear operatively connecting these gears and a friction drive for the Holland cloth spools permitting them to slip as the amount of cloth thereon increases; Fig. 14 is a face view of a portion of one of the reels showing a portion of the stationary spur gears, a portion of one of the guide cylinders, one of the pinions which drive the feeding rolls for the fabric bands, and housing therefor; Fig. 15 is a transverse section of a portion of one reel showing the feeding rolls and the spring bearing for one of them, the stationary gear, and the pinion for one of the roll shafts; Fig. 16 is a transverse section on line *g*—*g* Fig. 1, showing the concave rollers employed to shape the lining of Holland cloth about the mandrel; Fig. 17 is a transverse section on line *h*—*h* Fig. 1, showing the mandrel, the rotating cutting knife, the pressure rollers which flatten the fabric, and the operating means therefor; Fig. 18 is a vertical section of the worm gear which drives the pressing rollers and of the main driving shaft; Fig. 19 is a longitudinal vertical section of the machine as arranged for producing the double thick fabric with selvage edges, and shows the added devices for coating the interior of the fabric with rubber, and the vacuum and heat chamber for eliminating the solvents therefrom; Fig. 20 is a longitudinal central section of a modified form of mandrel which may be employed for the double thick fabric offering little resistance to its movement thereon and exposing a large amount of surface to contact with the liquid rubber; Fig. 21 is a transverse section of the mandrel on line *i*—*i* Fig. 20; Fig. 22 is a transverse section of the mandrel on line *j*—*j* Fig. 19, showing the movable gates which substantially exclude the air from the vacuum chamber in which the volatile solvents are evaporated from the adhesive coatings; Fig. 23 is a similar view of the outer gate through which the flattened fabric issues; Fig. 24 is a plan view of the mandrel showing its support and the means for supplying liquid rubber or other adhesive material thereto, for exhausting the air from the vacuum chamber, for supplying heat thereto, and for supplying compressed air to expand the tubular fabric and assist in its movement along the mandrel; Fig. 25 is a side elevation of the vacuum pump showing a portion of the vacuum chamber; Fig. 26 is an elevation of an air pump arranged for supplying compressed air to the mandrel and for supplying pressure to a tank containing rubber.

In these views as shown in Figs. 1 to 18 inclusive, A is the mandrel preferably hollow and rigidly attached at one end to a clamping sleeve or bearing A′ in the standard A^2. An outer extremity of the mandrel A^3 is flattened to assist in opening up the tubular fabric formed upon the mandrel A.

Prior to interwinding and laminating the bands upon the mandrel, the mandrel is substantially surrounded with longitudinally laid strips Y, Y of Holland cloth which prevent the fabric from adhering thereto, and make it possible to draw the fabric easily from the outer extremity of the mandrel as rapidly as it is constructed.

The bands of Holland cloth are stored upon spools A^4, A^4 mounted upon brackets A^5, A^5, (see Figs. 1, 2 and 5) attached to the standard A^2 and pass over guide rollers A^6,

A^6 to give them a horizontal direction, thence the Holland cloth is passed underneath concave rollers A^7, A^7 which lay it firmly upon the mandrel between T shaped rails A^8, A^8 which are equally spaced about the mandrel. In this manner the surface of the mandrel is almost entirely covered and sufficiently to prevent the adhesion of the fabric thereto. The guide rails A^8, A^8 do not extend the full length of the mandrel, but a space is left at the forward extremity upon which the fabric is wound and is then pulled, together with the Holland cloth, over the free end of the mandrel.

The reels are conveniently arranged in pairs, those in the first pair being shown at B and B′ and those in the second pair at B^2, and B^3. The reels in each pair are provided with hubs which are sleeved upon each other and encircle the mandrel. These hubs are mounted in the standards S. The hub B^4 (see Fig. 3) is sleeved over the hub B^5 in the first pair of reels and hub B^6 is sleeved over the hub B^7 in the second pair of reels. The respective reels in each pair are rotated in opposite directions. Those in the first pair B and B′, by means of beveled gears B^8, B^9, are operated to revolve in opposite directions by means of the intermediate bevel gear B^{10}, shaft B^{11}, intermediate bevel gears B^{12} and B^{13}, and longitudinal shaft B^{14}. The second pair of reels B^2 and B^3 are operated in a similar manner by means of bevel gears B^{15} and B^{16}, intermediate bevel gear B^{17}, shaft B^{18}, and bevel gears B^{19} and B^{20}. Upon each reel are pivoted four sets of spools C, C, two spools comprising each set, and upon these spools the fibrous bands X, X alternating with the bands X′, X′ of Holland cloth, to keep them from adhering together, are wound. When unrolled from the spools the fabric bands X, X pass between the pulling rolls, D, D′, (see Figs. 4, 9, 14 and 15), which supply the fabric bands as fast as they are wound upon the mandrel.

As the reels revolve, the rollers D, D′ are rotated to feed the fabric bands by means of the stationary gear D^2 common to all the rollers on each reel and mounted upon the standard S within which the hubs of the reels rotate. Each roller D is provided with an elongated shaft D^4 upon which is secured a pinion D^6 which is driven by means of the stationary gear D^2. The housings D^6, D^6 for the rollers D, D and D′, D′ are attached to the reels B, B′, B^2 and B^3 and are provided with spring pressed bearings D^7, D^7 by means of which the amount of pressure upon the rollers D′, D′ can be adjusted. The spools C, C are slidingly keyed to the elongated hub of the gear E′ which is therefore rotated as the fabric bands are pulled by the rollers D, D′.

The Holland cloth bands X′, X′ are carried away as fast as unrolled from the spools C, C and are wound upon the spools E, E which are rotated by means of the gears E′ and E^2 upon the spool shafts and connecting idler gear E^3 as the fabric bands are pulled off from the spools by means of the rollers D, D′.

The spools E, E are made to rotate fast enough to roll up the Holland cloth as it unwinds from the spools C, C when full, and as the roll of Holland cloth increases in diameter on the spools E, E, they are allowed to slip on their bearings. This is illustrated in Fig. 13. The spools E are shown sleeved loosely upon a long hub E^4 of the gear E^2 which is keyed upon the spool shaft and a spring pressed pin E^6 presses upon the heel E^7 of a short friction lever E^8 pivoted at E^9 upon the outer end of the shaft. The forward end of this lever presses upon a sleeve E^{10} which engages the hubs of the spools E, E. A similar device is shown attached to the extremity of the shaft for the spools on which the fabric band is wound and by turning the lever longitudinally of the shaft the spools can be drawn off from the hubs of the gears to renew the bands of fabric or to place fresh spools for the reception of Holland cloth. By changing or removing the sleeve E^{10} spools for wider bands may be used or the number of spools may be increased.

As the bands are pulled off from the spools on the revolving reels as shown in Fig. 3 they are guided to their respective places by means of rollers F, F mounted upon adjustable stands F′, F′ upon annular brackets F^2, F^2 secured to their respective reels, and then pass over additional rollers F^3 arranged to guide the bands into a horizontal position, (see Figs. 3 and 11), thence the fabric bands, except those upon the last reels, pass through guiding flattened tubes F^4, F^4 to the forward end of the mandrel. These tubes are supported for convenience upon a series of cylinders G, G′ and G^2 which are attached to their respective reels by means of arms G^3, G^3 at the rear ends. At the front ends the rings H, H′, H^2 are concentrically arranged within the last reel and are respectively attached to a set of cylinders G^2, G′ and G at their forward ends, and also a ring H^3 attached to the mandrel engages the interior of cylinder G (see Figs. 3 and 10). These rings are perforated at H^4, H^4 for the passage of the fabric bands and arms H^5, H^6 and H^7 respectively attached to the forward ends of the cylinders G, G′ and G^2 and downwardly turned arms H^8, H^9 and H^{10} provide supports for the guide rollers H^{11}, H^{11} which guide the fabric bands to their predetermined positions on the mandrel (see Figs. 3 and 12). The annular bracket F^2 upon the last reel B^3 is also provided with downwardly turned arms H^{12}, H^{12} upon which

are mounted the guide rollers H^{11}, H^{11} for guiding the fabric bands to their respective place upon the mandrel.

H^{20}, H^{20}, are slots in the arms H^{10} through which fastening screws H^{21}, H^{21}, are inserted thereby making said arms adjustable upon their supports. In this manner a two-ply laminated fabric composed of interwound laminated fibrous bands treated with adhesive material, is constructed, resulting in a tubular formation of the same. This tube is slit longitudinally by means of a circular knife K mounted upon a shaft K' and upon a bracket K^2 and a concave roller K^3 provides a support for the mandrel A. When the tubular fabric has been slit upon a longitudinal center line, it is opened by means of the flattened extremity of the mandrel A^8 and passes with the Holland cloth between the pulling and flattening rollers L, L and L', L' mounted in the housing frame L^2 which is provided with spring pressed adjustable bearings L^3, L^3, by means of which the pressure can be adjusted. The circular knife is operated by any convenient means such as band wheels K^4 and band K^5 and the pulling rollers are operated by means of gears O and O', bevel gears O^2, O^3 and shafts O^4, O^5 and worm and wheel O^6, O^7, mounted in the bracket O^9, and shaft O^8 (see Fig. 18). Upon this shaft are shown tight and loose pulleys P and P' and the main operating shaft B^{14} for the machine is operatively connected with the shaft O^8 by change gears N, N', N^2 and N^3 of any desired character, such as shown in Figs. 1, 2 and 17.

The reels B, B', B^2 and B^3 are rotated at the same speed in alternately opposite directions by power applied to the main operating shaft B^{14} through the intermediate gears and shafts previously described and at a predetermined relative speed to that of the pulling and compressing rolls L, L, and L', L' or to that of the sprocket wheels which drive the chain mechanism for drawing the fabric in tubular form from the mandrel, thereby interwinding the fibrous bands on the mandrel at a predetermined angle. This relative speed, and hence the angle of interwinding the fibrous bands may be changed by replacing the gears N^3 and N' by gears of different pitch diameter.

In Figs. 19 to 26 inclusive is shown the machine as arranged to form the flat fabric of double thickness with selvage edges, the tubular laminated-cohesive-interwound fabric being treated interiorly with liquid rubber or other adhesive material and flattened without being slit longitudinally. In these views reels, spools, and guiding and pulling devices for forming the laminated-cohesive-interwound fabric are the same as previously described, and no cutting disk and no lining of Holland cloth for the mandrel is employed. In addition to the described mechanism a vacuum and heat chamber for evaporating the solvents in the adhesive material is employed and compressed air is used to assist in releasing the fabric from the mandrel. The hollow mandrel is made in two parts. Part R is secured in the bearing A' of the standard A^2 and has a closed end provided with a stuffing box R' for the passage of a pipe V^7 for rubber and at the other end perforations R^2, R^2 for the issuance of compressed air, has an exterior annular ring R^3, and also is threaded at its end R^4 to receive the second part of the mandrel R^5. The part R^5 is also hollow and is provided with annular depressions R^6, R^6 and perforations R^7, R^7 for passage of liquid rubber or other adhesive material and is screwed into the end R^4 of the first part of the mandrel, this end being closed and tapped to receive the rubber pipe V^7 while the other end R^8 is flattened and perforated to allow the interior of the fabric to be further coated. A pipe V' for compressed air is connected to the mandrel R at R^9.

The second part of the mandrel R^5 is inclosed in a vacuum and heat chamber U, heat being supplied by steam pipes U' or any other desired means. The air is exhausted from this chamber by means of the vacuum pump U^2 and connecting pipe U^3. Gates or jaws U^4 held in place by gibs U^5 and with adjustable pressure by means of yokes U^6, springs U^7 and screws U^8 surround the fabric on the mandrel as it enters the chamber U and substantially exclude the air. The flattened fabric leaves the chamber through the outlet U^9 the air being practically excluded by jaws U^{10} and U^{11}, adjustable by screws U^{12} and slots U^{13} and pressed against the fabric by arms U^{14}, springs U^{15} and screws U^{16}. Access to the chamber is gained by the door plate U^{17} held by locking handles U^{18} and studs U^{19}. Glass covered openings U^{20} render the interior visible.

The fabric is pulled from the mandrel by pulling and flattening rollers L, L and L', L' previously described. Compressed air is furnished by the air compressor V connected to the mandrel by pipe V' and is supplied to the rubber tank V^3, by the pipe V^4 and acting on the piston V^5 forces the liquid rubber or other adhesive material through the pipe V^6 to the pipe V^7 in the hollow mandrel R. A gage V^8 registers the air pressure used. A secondary pipe V^9 can be used to raise the piston V^5 when the rubber tank is empty, a valve V^{10} closing this pipe when rubber is being forced from the tank.

As the fabric is formed on the mandrel R, it is expanded by the compressed air acting through the perforations R^2 and by the annular ring R^3, thus being practically released

from adhesion to the mandrel, and is pulled into the vacuum chamber U where liquid rubber or other adhesive material is forced through the perforations R^2 and the end of the mandrel R^8 to thoroughly coat and impregnate the interior of the fabric, the solvents being quickly evaporated by the predetermined amount of heat and vacuum maintained in the chamber. The pulling and compressing rolls collapse the tubular band into a solid sheet of double thickness with selvage edges.

Fig. 20 shows a modified form of hollow mandrel adapted for use in forming a double layer fabric with selvage edge being similar to the mandrel R except that its outer portion is flattened but not wholly closed together, and that it is not necessary to use compressed air. The mandrel consists of two parts T and T'. The part T is cylindrical, hollow, closed at the end T^2 to receive the pipe V^7 for rubber and threaded at T^3 to receive the flattened part T' which is tapped to receive the pipe V^7. The part T' is also hollow, grooved top and bottom to reduce the friction of the fabric thereon, and perforated at T^4, T^4 for rubber or other adhesive material, and also at the end T^5. The grooved part of the mandrel lies wholly in the vacuum chamber V and the rubber emerging from the perforations T^4, T^4 and from the end T^5 coats the interior of the fabric.

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

1. The combination with a mandrel, rigidly supported at one end and tapered at the free end, a series of reels encircling the mandrel, alternate reels rotating in opposite directions, a series of spools on which fabric bands alternating with bands of non-adhesive material are wound, means for rotating the reels, spools on said reels for storing the bands of non-adhesive material, said spools for adhesive bands operatively connected with said spools for fabric bands, means for guiding said fabric bands to spaced positions on said mandrel, and means for pulling the tubular fabric thus produced from the mandrel.

2. In combination with a mandrel fixed at one end and unsupported at the other end, a series of reels, alternately rotatable in opposite directions about said mandrel, a series of spools on each reel on which fabric bands alternating with bands of non-adhesive material are wound, spools on said reels for winding said bands of non-adhesive material, said spools for fabric bands and non-adhesive material rotatable in unison, means for guiding the fabric bands to spaced positions near the unsupported end of said mandrel, means for feeding the fabric bands from their respective spools to said mandrel, and means for pulling the fabric formed on the mandrel off from the unsupported end thereof.

3. The combination with a mandrel, supported at one end, of means for lining said mandrel with a non-adhesive material, means for forming a laminated interwound fabric upon the mandrel near its unsupported end, means for cutting through said fabric in a longitudinal line, and means for pulling the cut fabric off from the free end of the mandrel, the said pulling means constituting a flattening means for said fabric.

4. In combination with a mandrel having a tapered extremity and supported at the other end, standards through which said mandrel passes, pairs of reels, having overlapping hubs, sleeved in said standards, a series of spools on each reel on which fabric bands alternating with bands of non-adhesive material are wound, a series of spools which receive the non-adhesive bands from the other spools, pressure rollers adapted to feed the fabric at a predetermined rate of speed from the spools to the mandrel, means for rotating the spools for non-adhesive material conjointly with the rotation of the other series of spools, means for rotating alternate reels in opposite directions, a series of guides encircling the mandrel and guide rollers thereon arranged to lead the fabric bands to the free end of the mandrel, means for pulling the completed fabric from the mandrel and for flattening the same, and change gearing operatively connecting the reel operating mechanism with the pulling devices.

5. In combination, a mandrel supported at one end and tapered at the outer end, a series of longitudinal guides for a non-adhesive material on said mandrel, spools and guide rollers for said non-adhesive material adapted to feed the same between said longitudinal guides, a series of reels encircling the mandrel and spools thereon adapted to store fabric bands alternating with bands of non-adhesive material, means for removing said non-adhesive bands from said fabric bands and for feeding said fabric bands to the mandrel, guiding means for applying said fabric bands to spaced positions on said mandrel at the forward end thereof, and a pulling and flattening device for the completed fabric.

6. In combination with a mandrel supported at one end and flattened at the other end, a series of reels rotatable alternately in opposite directions about said mandrel, a series of spools on said reels on which fabric bands are wound, standards in which the reels rotate, guiding means arranged to lead the fabric bands along said mandrel toward its forward end, and to apply said bands in spaced positions thereon, and a device for

pulling the completed fabric from the outer end of the mandrel.

7. The combination with a mandrel supported at one end of a series of reels rotatable about the mandrel, a series of spool shafts on each reel, a series of spools side by side on each shaft, standards on which said reels are mounted, stationary gears on each standard, a series of feeding rollers for said bands on each reel, geared connections between said rollers and said stationary gears, whereby said bands are fed to the mandrel, a series of guides for said bands arranged to lead said bands to the forward end of said mandrel to form a fabric thereon as said reels rotate, a pulling device for said fabric and an operating device for said reels arranged to operate at a predetermined rate of speed relatively to the feeding device.

8. The combination with a mandrel, of reels rotatable thereabout, a series of spools thereon for layers of fabric bands alternating with layers of bands of non-adhesive material, a series of spools on said reels adapted to receive the bands of non-adhesive material from the other spools as the fabric bands are unwound therefrom, geared connections between the series of spools for fabric bands and the series of spools for non-adhesive material, standards on which the reels are supported, gears fixed on said standards, feeding rollers on said reels, one set for each series of spools, gears for operating said rollers, said fixed gears engaging therewith to rotate said rollers as said reels are rotated and guiding means for said fabric bands.

9. The combination with a mandrel, supported at one end, of standards through which said mandrel passes, pairs of reels provided with hubs rotatably mounted in said standards, one hub in each pair sleeved over the other hub, spools for fabric bands on said reels, brackets encircling said hubs and mounted on said reels, guide rollers thereon for said fabric bands, guiding tubes for said bands passing longitudinally of said mandrel within said hubs and adapted to lead said fabric bands from said guide rollers to the forward end of said mandrel, concentric supports for said tubes secured to said reels at their rear extremities, supporting rings interposed between said concentric supports at their forward ends and provided with guide openings, guide rollers for said bands, supporting arms therefor on said concentric supports, said last named guide rollers adapted to lead said bands to spaced positions on said mandrel, the supporting means for some of said guide rollers being made adjustable to accommodate them to the positions of said spools upon said reels.

In testimony whereof, I hereunto set my hand this 7th day of June 1912.

LAWRENCE A. SUBERS.

In presence of—
S. L. EXLINE,
F. H. TOWNSEND.