E. D. C. BAYNE & L. A. SUBERS.

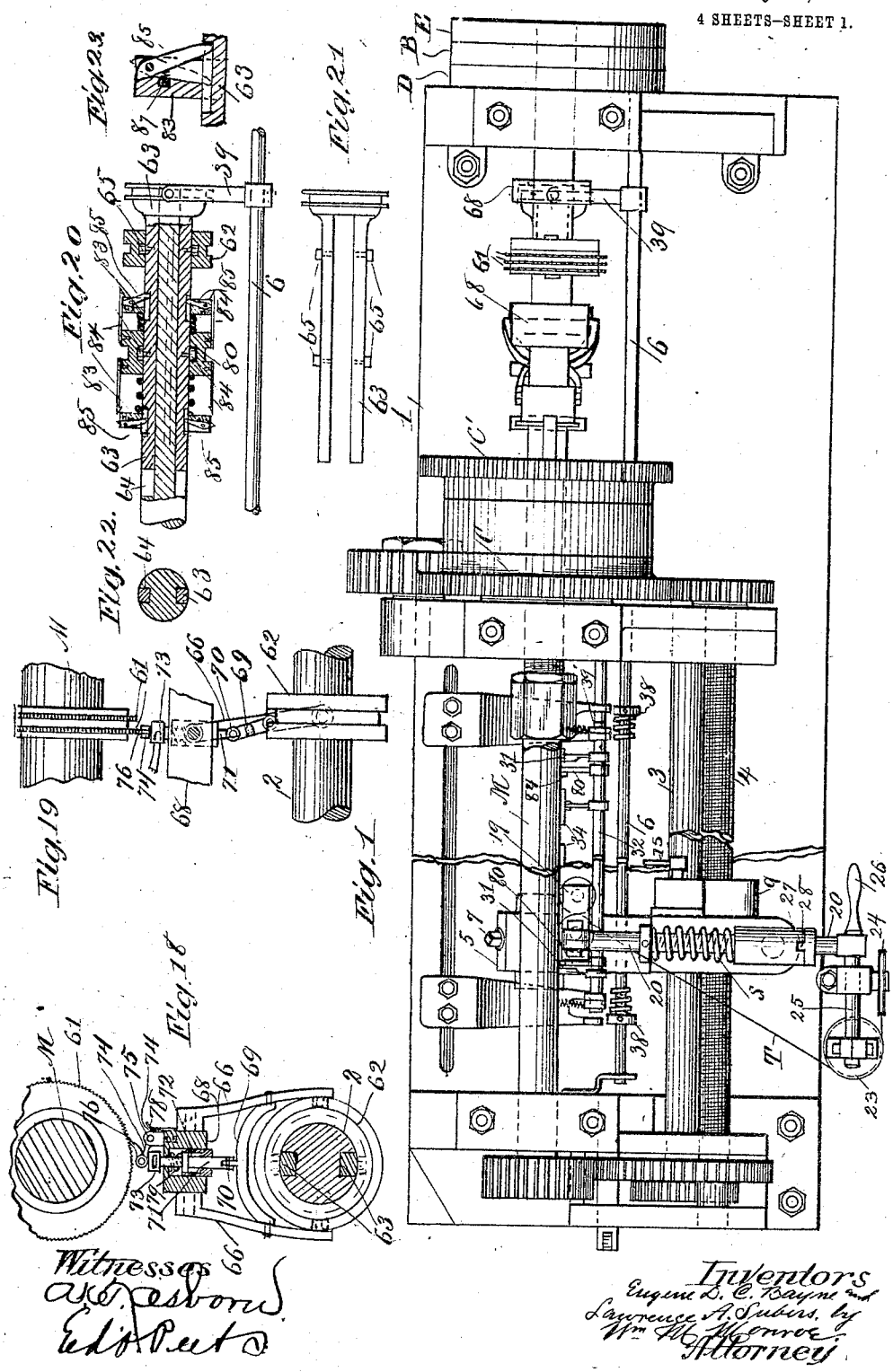
TUBULAR FABRIC FORMING DEVICE.

APPLICATION FILED DEC. 15, 1908.

1,026,648.

Patented May 21, 1912.

4 SHEETS—SHEET 1.



Witnesses
A. G. Osborne
Ed. A. Peet

Inventors
Eugene D. C. Bayne and
Lawrence A. Subers, by
Wm. H. Monroe
Attorney

NORRIS PETERS, INC., LITHO., WASHINGTON, D. C.

E. D. C. BAYNE & L. A. SUBERS.

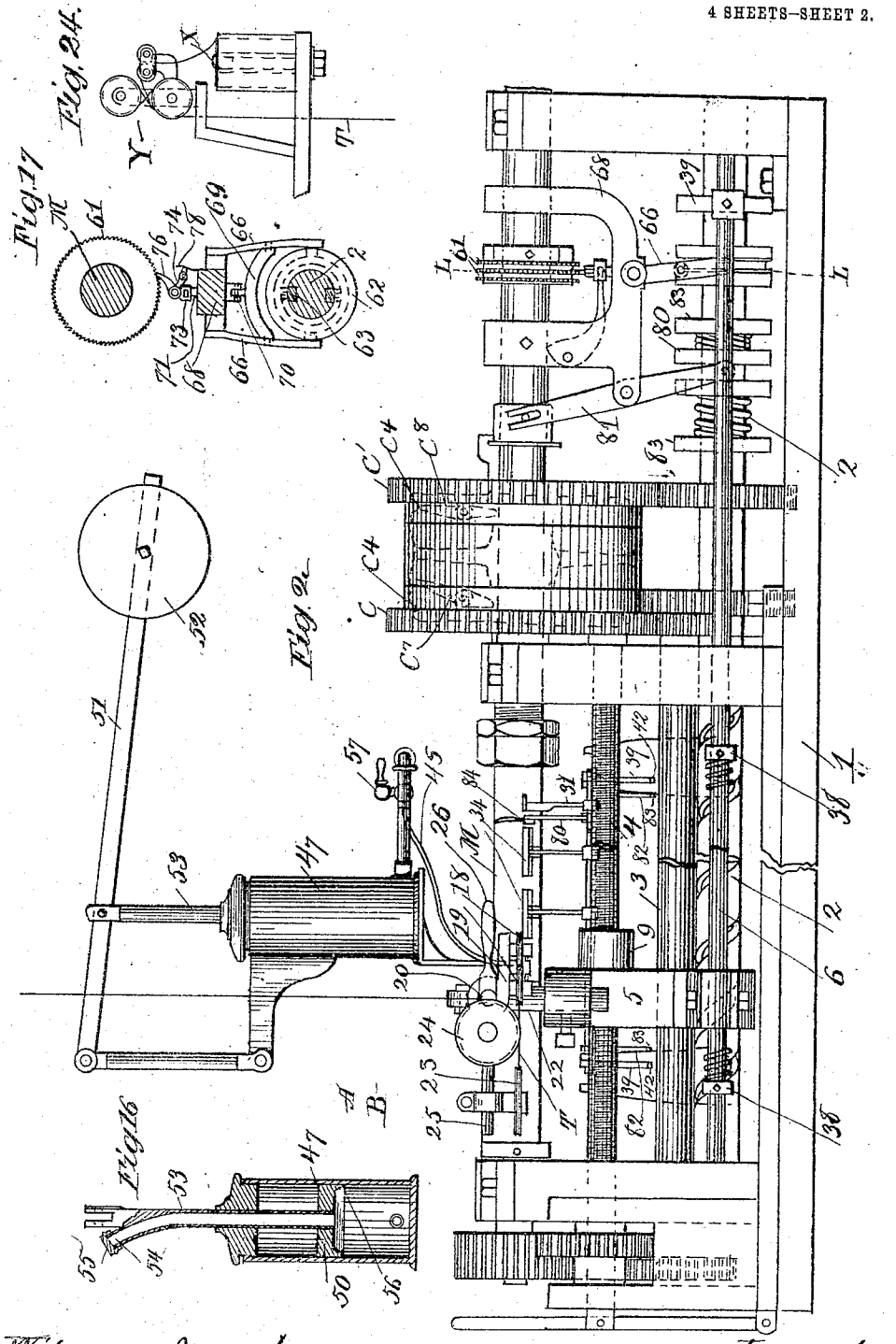
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4 SHEETS—SHEET 2.



Witnesses:
A. D. Osborne
Edw. Peet

Inventors:
Eugene D. C. Bayne and
Lawrence A. Subers
by Wm. McMorrow Attorney

E. D. C. BAYNE & L. A. SUBERS.

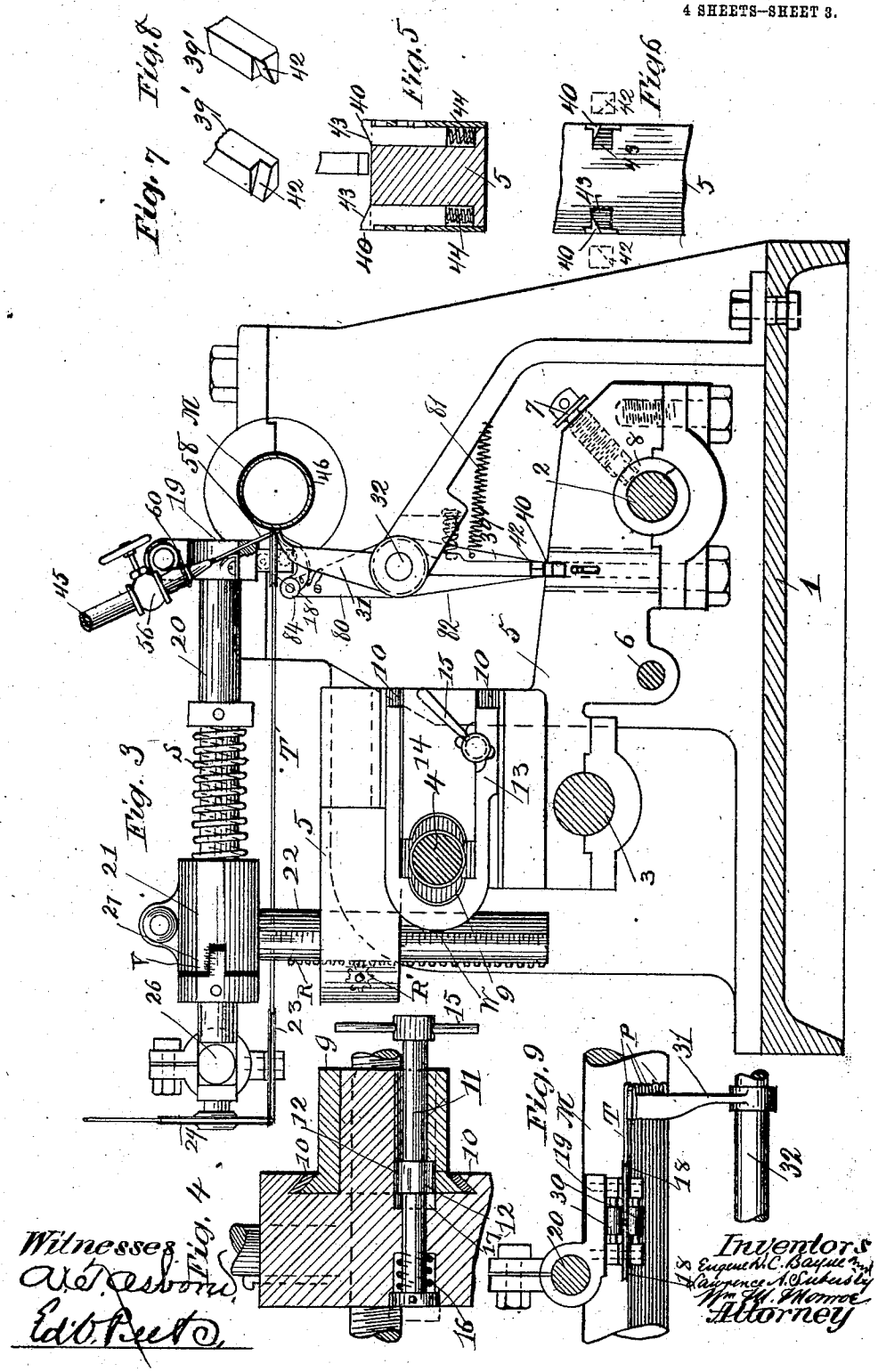
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4 SHEETS—SHEET 3.



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4 SHEETS—SHEET 4.

Fig. 10

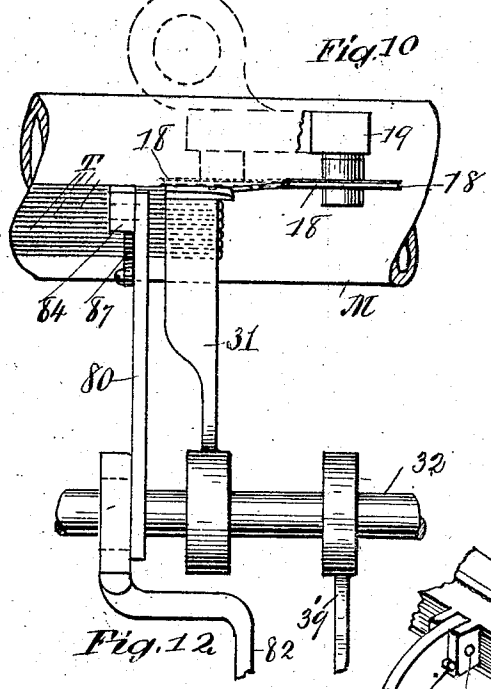


Fig. 11

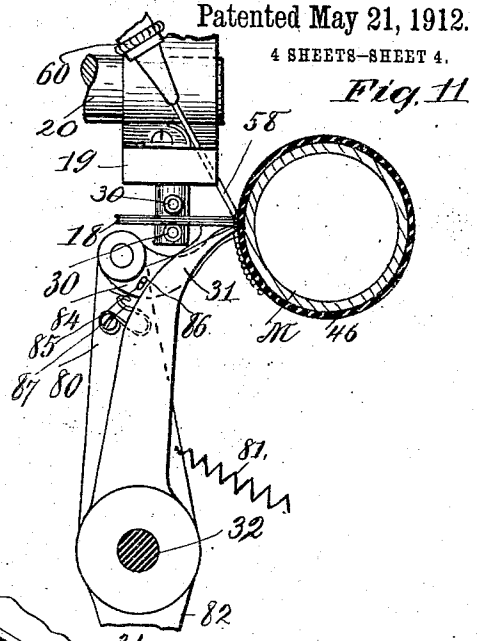
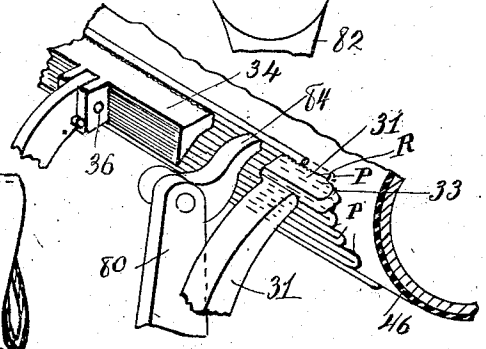


Fig. 12

Fig. 13



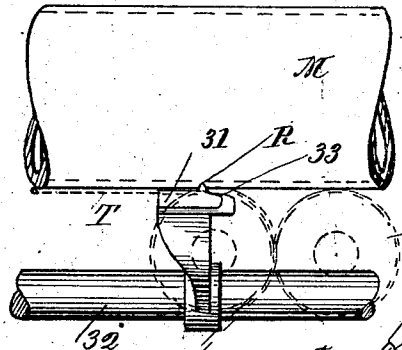


Fig. 14

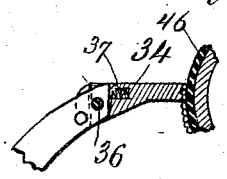


Fig. 15

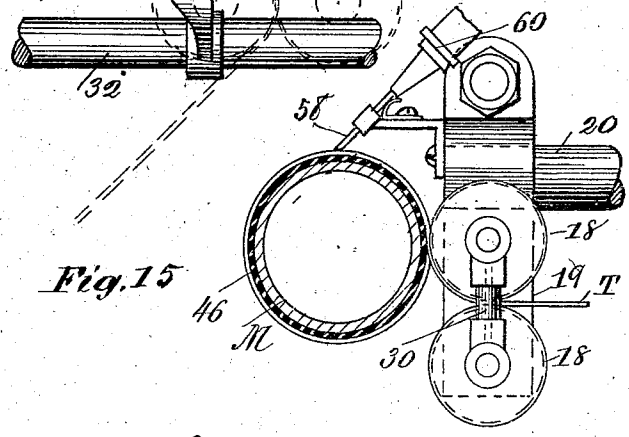
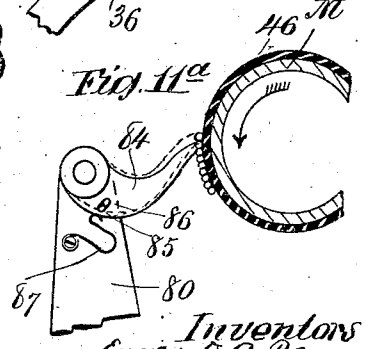


Fig. 11a



Witnesses
A. D. Osborne.
Edw. Pust

Inventors
Eugene D. C. Bayne
Laurence A. Subers
by Wm. W. Wilson & Co. Attorney

MORRIS PETERS, INC., LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

EUGENE D. C. BAYNE AND LAWRENCE A. SUBERS, OF CLEVELAND, OHIO.

TUBULAR-FABRIC-FORMING DEVICE.

1,026,648. Specification of Letters Patent. Patented May 21, 1912.

Application filed December 15, 1908. Serial No. 467,621.

To all whom it may concern:

Be it known that we, EUGENE D. C. BAYNE and LAWRENCE A. SUBERS, citizens of the United States, and residents of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Tubular-Fabric-Forming Devices, of which we 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 improved machine and process for automatically producing a tubular fabric composed of alternating layers of longitudinally and spirally or transversely applied cords or threads, such as are described in our previous application for Letters Patent of the United States, Serial Nos. 411,960 and 441,988, and in our previously granted Letters Patent of the United States, bearing date of July 21 No. 894,172, and of April 21, 1908, No. 885,219. In these applications and Letters Patent the cords or threads are made flexible and caused to adhere together by coating each strand or longitudinal member thereof with vulcanizable non-fibrous material before twisting them together to form the finished cord or thread, and the fabric to be formed by the improved machine or process comprises unwoven layers of parallel rows of similar cords or threads laid under pressure and adhering together and afterward vulcanized to form a homogeneous fabric. This machine and process are designed to provide a more efficient and practical means and method for applying the said longitudinally, transversely or spirally laid layers of threads than the means and process previously described in out Letters Patent No. 897,339, filed September 1st, 1908, and is also designed to produce an improved fabric.

Further objects are to simplify and improve the structure of the machine and the process heretofore employed for this purpose and the means for exteriorly coating the cords or threads and to lay them under tension and pressure in a fluid cement and to insure regularity and precision in the action of the machine.

The various improvements in the character of the mechanism and process employed over our previously mentioned device may be stated, as follows:—Improved construction of the traveling head which carries the director wheels and its adaptability for use in applying the spiral, longitudinal or transverse coatings or layers of parallel rows of threads. Improvements in the construction of the holding fingers which secure the thread while the reverse movement of the director wheels takes place and for forming the loop in the thread at the extreme limits of the pre-determined length of fabric it is desired to produce. In means for alternately connecting the traveling head with the worm shaft for quick longitudinal movement when applying the longitudinal layer, and with the screw threaded feed shaft when applying the spiral or transverse layer. In improved and simplified means for operating the ratchet wheel which turns the shaft of the mandrel upon which the longitudinal layer is laid, according to the diameter of the cord or thread and the number of rows that can be accommodated on the mandrel. In improved shifting and locking mechanism for the mandrel shaft. In mechanism and process for applying to each row of thread after laying, a solution of fluid vulcanizable cement, designed to provide the required coating necessary for that and the following thread, so as to separate the several threads and to cause them to adhere together practically out of contact with each other, and also to provide a matrix for each cord or thread sufficient when vulcanized to produce a homogenous and flexible fabric.

The invention further comprises, the combination and arrangement of parts and the successive steps of the process, as hereinafter described, exemplified in the accompanying drawings, and specifically pointed out in the claims.

In the accompanying drawings, Figure 1 is a plan view of the improved device, by means of which the fabric is formed; Fig. 2 is a side elevation of the same; Fig. 3 is a side elevation of the traveling head containing the director wheels, showing the various shafts passing therethrough in transverse section; Fig. 4 is a transverse section through this head showing divided nut; Fig. 5 is a transverse section through this head showing the cams which lift the holding fingers; Fig. 6 is a plan view of a portion thereof showing the said cams in plan; Figs. 7 and 8 are perspective views of the cam extremities of all said holding fingers;

Fig. 9 is a side elevation of forming mandrel and director wheels, showing the holding fingers and the looped thread passing through the director wheels on the return stroke; Fig. 10 is a similar view enlarged showing the position of the director wheels at the end of the stroke before forming the loop; Fig. 11 is a transverse section of the forming mandrel showing the main and auxiliary holding fingers and a director wheel passing directly over it; Fig. 11ª is a detail of auxiliary holding finger and arm; Fig. 12 is a plan view of the same parts in the position shown in Fig. 10; Fig. 13 is a perspective view, showing the looped cord or thread and one of the end holding fingers in position, after a loop has been formed at the outer end of the fabric, and also a portion of one of the intermediate holding fingers; Fig. 14 is a transverse section of one of the intermediate fingers showing the spring action thereof; Fig. 15 is a transverse section of the forming mandrel, showing the director wheels in position for applying the spiral or transverse winding; Fig. 16 is a vertical central section of the rubber holding cylinder, shown in the elevation of Fig. 2; Fig. 17 is a transverse section on line L, L, Fig. 2 showing the toggle mechanism for operating the ratchets on the mandrel shaft; Fig. 18 is an enlarged transverse section on the same line showing the pawl actuating mechanism; Fig. 19 is a longitudinal section of the same; Fig. 20 is a longitudinal section of the shifting and locking devices for the clutch for the mandrel shaft; Fig. 21 is a detail elevation of the shifting fork which is embedded in grooves in the worm shaft; Fig. 22 is a transverse section of shaft and fork; Fig. 23 is an enlarged section of one of the locking disks; Fig. 24 is an elevation of the tension device employed for the cord or thread.

In these views, the bed plate, the driving mechanism, operating gearing, mandrel shaft clutch, and worm and fine screw feed shafts are unchanged, also the mandrel and mandrel shaft from the machine described in our previous Letters Patent Number 897,339.

In these views, 1 is the bed plate, 2 the worm shaft for giving the longitudinal movement of the traveling head when applying the longitudinal threads to the mandrel M, 3 is the supporting and guiding shaft for the head, 4 the screw feed shaft therefor, 5 the traveling head and 6 the shifting rod.

In our former device two traveling heads were employed, one for the director wheels adapted to apply the spiral or transverse layer of threads, and one for the wheels applying the longitudinal layer of threads. In this device only one traveling head 5 is employed, and through it both actuating shafts 2 and 4 pass.

A screw threaded pin 7 passing through the head 5 can be made to engage the slot 8 in the worm shaft 2 when desired as shown in Fig. 3 or can be withdrawn therefrom at pleasure to release the traveling head therefrom.

A semi-nut 9 horizontally movable in guides 10, 10 upon the head 5 can be made to engage the screw threaded shaft 4 when spiral winding is desired. This nut can be thrown into and out of contact with the feed screw by means of the pin 11 provided with the oppositely placed cams 12, 12, which are adapted to engage with the arm 13 of the sliding nut 9 on one side and the block 14 on the other side, and by means of a handle 15 the pin can be turned to throw the nut out and into engagement with the screw threaded shaft.

When the parts are in engagement the spring 16 will throw the pin inward and the cams will partially enter an opening 17 in the solid head and thus lock the nut in place. It must then be pulled out by hand when again shifted in position.

The pair of director wheels 18, 18, are supported for vertical and horizontal adjustment upon a plate 19, secured upon a horizontal shaft 20, which is longitudinally adjustable in a clamping sleeve 21, which in turn is mounted upon a shaft 22 vertically adjustable in the traveling head 5.

Guide wheels 23 and 24 carry the cord or thread to the director wheels as shown, in whatever position they may be placed, and are adjustably mounted upon the arm 25 attached to the horizontal shaft 20.

The standard 22 is provided with an adjustment by means of a rack R and a pinion R′ for fine variation in its position. A scale W is attached to the standard, and a similar scale V is engraved on the horizontal rod 20 for adjustment relative to varying sizes of mandrel. This horizontal shaft can be rotated to bring the director wheels also into a vertical position as shown in Fig. 15 by means of a handle 26, and the shaft is locked in either position by means of the grooves 27, 27 in the clamping sleeve 21 and the projecting lugs 28, 28 upon a collar 29 secured upon the horizontal shaft 20. These grooves are separated by arcs of 90° so as to receive the lugs in both horizontal and vertical position. A spring S exerts a constant pressure of the director wheels upon the work.

The cord or thread T is received between the grooved director wheels 18, 18, and is prevented from falling or being drawn out of their grooves by means of small rollers 30, 30, pivoted one on each side of the wheels and overlapping their meeting edges. Near the limits of the movement of the director

wheels are placed the holding fingers 31, 31. These are designed to secure the ends of one row while the following row is being laid.

A fine projecting point R upon the finger lies just over the cord or thread previously laid and over this the loop P is made as the wheels return. The extreme upper edge of the finger is beveled away at 33 to guide the cord or thread as the wheels return, and the wheels run preferably upon the center line of the mandrel. The fingers holding the cord or thread are preferably just below the center line of the mandrel so that the director wheels will pass over them, just escaping them.

In laying the cord or thread the director wheels pass beyond the fingers at each end of the row. Each finger rises as soon as the wheels have passed and releases the cord, while the forming mandrel is rotated to make room for the next following row. The holding finger then falls upon the cord and holds it firmly while the loop P is being formed.

80, 80 are additional holding fingers designed to retain the cord or thread T in place while the fingers 31, 31 are lifted above it. These fingers are pivoted on the same shaft 32 and pressed into engagement with the mandrel by means of springs, 81, 81. They are thrown back just previous to the releasing of the fingers 31 by means of downward projections 82, which have cam shaped extremities 83. These extremities are first engaged by the cams, 40, 40 on the traveling head, and when thrown back thereby, a pivoted arm 84 on each finger is slightly raised by the spring 87, subject to the limit of the slot 85, and pin 86, so that when the arm returns, the engaging extremity of the arm will rise and engage the row of thread just laid, as shown in dotted lines in Fig. 11[a] and as the mandrel revolves the arm will be depressed by it and will come down to the level of the other fingers 31, 31, just below the center line of the mandrel and hold the cord or thread firmly until the fingers 31, 31, are engaging again.

The necessity for this device over the former machine is found in the fluidity of the rubber cement which has not had time to harden, while the coated cords mentioned in the former machine were adhesive enough to hold the cord or thread in place, against the tension under which they were placed.

34, 34 are the intermediate fingers which hold each row in place while the next is being applied. These fingers with the holding fingers 31, 31 are mounted upon a common rock shaft 32 and operate in unison.

Since the pivotal point of the shaft is not vertically under the mandrel the fingers have a tendency to push each row slightly downward after it is laid and this tendency is overcome by means of the jointed extremity of each intermediate finger 34 pivoted at 36 and a spring 37 slightly separates the upper edge of this joint when free so that when depressed the extremity will have a slight upward movement and press the row holding it in place. The action of the cams 40, 40 to draw back first the fingers 80, 80, and then the fingers 31, is as follows: The traveling head 5 strikes the stops 38 upon the shifting rod, and operates the clutch arm 39 as in the said former machine, to reverse the movements of the worm shaft, and before the end of the stroke is reached, the depending arms, 82, 82, are first engaged by cams 40, 40, to lift the fingers 80, 80, and then the depending arms 39′, 39′, fixed upon the rock shaft 32 at each limit of the desired stroke engage with the cams 40, 40, upon the traveling head and throw back the holding fingers 31, 31, while the mandrel rotates through a distance equal to the position for laying the next row of cord or thread. These cams have oppositely inclined faces which engage inclined faces 83, 83, and 42, 42, upon the lower extremities of the depending arms, so as to throw them inwardly when passing in one direction, but the cams are adapted to be depressed by the said arms on the return stroke by inclined faces 43, 43. Springs 44, 44, return them to place when depressed. The extremities, 83 and 42 are alike and hence a view of one set as in Figs. 7 and 8 will suffice.

While a row is being applied, rubber is caused to flow under pressure from a fine tube 45 upon the upper side of the row of cord or thread, just laid, and to fill the angle between the row just laid and the rubber layer 46 upon which first layer is laid. Thus forming a matrix in which to lay the next row. After the first layer is laid the fluid rubber cement is laid upon that in advance of its director wheels. This flow of rubber is obtained by means of pressure upon a reservoir 47, of rubber, elevated above the mandrel, and provided with the supply tube 45 through which the rubber flows, and also preferably with two controlling valves. The valve 57 is closed when cleaning the reservoir and the valve 56 is used to control the supply to the fabric.

The pressure should be adjustable and may be obtained in any convenient manner, and regulated according to the required rate of flow and density of the rubber solution.

As shown, a piston 50 is adapted to force the fluid out of the tube and a lever 51 and weight 52 adjustable thereon regulate the pressure upon the fluid rubber in the receptacle.

The piston rod 53 is hollow and provided with an external opening 54 through which the rubber can be sucked into the receptacle by raising the piston and can be driven out by lowering the piston, a screw cap 55 is

used to close the opening 54. The edges of the piston are shown sharp at 56 to prevent rubber from coating the sides of the cylinder.

It has been ascertained that by this means a more satisfactory coating is provided for each cord or thread than by passing the cords or threads separately through a bath of rubber before laying them, since the rubber flows into and fills the angles between the threads and forms a solid fabric, the valve 47 controls the flow of rubber through the tube and the valve 46 is then left open.

The nozzle 58 by means of which the rubber is directly applied is preferably secured to the support for the director wheels, so as to travel with them and is shown centrally placed between them, so as to deposit the rubber in advance of the laying of the thread alternately by each roller.

The size and shape of the opening in the nozzle 58 can also be varied to suit the volume of rubber required hence the nozzle is shown detachable at 60 and any number of shapes can be employed and attached in turn as needed.

It is obvious that the forming mandrel can be made of any length and any number of tubes of equal length can be made simultaneously thereon by duplicating the mechanism described for forming one tube at regular intervals, along the forming mandrel, one section serving as an example.

In Figs. 18, 19 and 20 improved mechanism is shown for operating the ratchets 61, 61, by means of which the forming mandrel shaft is turned through the diameter of one thread to make room for successive rows one after the other. In these views 62 is a shifting sleeve upon the worm shaft, operatively connected with a fork 63 slidingly movable in grooves 64 in said shaft, by means of rollers 65, 65 upon said fork. This fork is thrown by means of the shifting arm attached to shifting rod 69 which moves when the head 5 strikes the springs, at each end of its travel, to reverse the movement of the worm shaft as employed in the former machine Letters Patent Number 897,339.

A curved yoke 29 is pivoted at each end in the arms 66, which engage the circumferentially slotted sleeve 62 on each side and the yoke is centrally pivoted at 70 to a vertically movable pin 71 which slides in a tubular bearing 72 in the support 68. The upper extremity of this pin is enlarged at 73 and upon it rests one end of a link 74, the other end of which is pivoted upon the support 68 at 75. A pawl 76 pivoted to this link is raised as the toggle link 69 raises the pin 71 and the movement of the pawl is just sufficient to turn the ratchet wheel one tooth at a time according to the diameter of the cord or thread which is being longitudinally laid. A projecting lug 77″ on the link 74 engages a spring 78 on the support 68 and returns the pawl as the pin 71 retires. This pin is returned by means of the spring 79 as clearly shown in Fig. 18.

The locking device in the shifting mechanism for the worm shaft is also different from that shown in the said former application and is much simplified and is shown clearly in Figs. 20, 21 and 22. Here 63 is the shifting fork slidingly movable in grooves 64 in the shaft.

100 is the main shifting spool, 101 the rock arm which operates the main shifting clutch 102 as described in said former application, which throws gears C and C′ alternately into operative connection with the mandrel shaft by means of internal rock arms C^7 and C^8 adapted to engage internal teeth C^4 in said gears. This has been previously described and has not been changed since said former application was filed. On each side of the main shifting spool 100 are shown the disks 103, 103 which are fixed upon the worm shaft and the fork passes through them. Upon the rim of the main shifting pool 100 are secured spring catches 104, 104 which are adapted to alternately catch upon the edges of the disks 103, 103, and hold the rock arm securely from movement until the return stroke. Upon the return stroke pawls 85, 85, pivoted in the disks 83, 83 are engaged by shoulders 86, 86 in the fork arms and their outer ends raise and release the spring catches 104, 104 so that the return movement can be made. Small springs, 87, 87 return the pawls 85, 85 and the spiral springs 88, 88 return the parts when the spring catches are released.

The mandrel shaft M is prevented from rotating by means of a cam lever 90, pivoted at 92 in the support 68. This lever is held normally into engagement with the shaft M by means of a narrow extremity 93 inserted into the head 73 of the pin 71, and the spring 79. When the pin rises the lever releases the shaft M.

It will be seen that by the use of this device a fabric can be made comprising one continuous thread laid in parallel rows. The longitudinal rows are looped back upon each other by the reversal of movement of the traveling head and the loops determine the length of the fabric and form a firm selvage edge therefor. As soon as one layer is laid in a longitudinal direction the director wheels are placed in a vertical position, the traveling head is connected with the fine screw threaded shaft, and a spiral winding is commenced.

The direction of the spiral winding can be changed at pleasure by reversing the movements of the mandrel. This reversing movement is provided for by means of the

fixed belt pulley B and loose pulleys D and E upon one of which a crossed belt can be placed.

One spiral layer upon the mandrel can be wound in one direction and the next in another direction, and there may be as many layers as desired formed in the fabric alternating longitudinally laid and spirally or transversely wound layers, and all are continuously formed from one cord or thread.

One of the most important advantages of the fluid rubber reservoir and the applicator tube for laying the cement upon the fabric, instead of the former method of coating each cord or thread prior to laying it in the fabric, is found in the fact that the cord or thread is dry and non-adhesive, so that it can be stored, as shown in the spool X, and need not be brought from the coating and twisting or winding machine directly to the fabric making machine. It is also much easier to handle in every way, and a heavier coating can be applied by this means, filling all the interstices between the cords or threads and producing a perfect matrix therefor.

It is obvious that by duplicating the director wheels, more than one cord or thread can be laid at one time, and by lengthening the mandrel and duplicating the traveling head and accessory parts and holding fingers and operating mechanism therefor, an additional section or sections of fabric can be simultaneously formed without departing from the spirit of the invention.

In carrying out this process it is essential that the cord or thread should be placed under tension and the cords or threads in the completed fabric shall be under uniform tension in all directions. Hence, an adjustable tension device is employed preferably as shown in Fig. 24 where the cord or thread T is shown, passing from a vertical spool X through the adjustable differential tension device Y, shown and described in an accompanying application, Serial No. 467,620 and employed in the coating and twisting machine therein described and hence not specifically described herein.

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

1. In a machine for laying cords or threads upon a mandrel, alternately in spiral and horizontal parallel rows, in combination with said mandrel, a traveling head, a pair of grooved director wheels adjustably mounted upon said traveling head, and adapted to take alternately a vertical and a horizontal position thereon relatively to said mandrel, a locking device adapted to secure said director wheels in each position, a worm shaft and a fine screw feed shaft passing through said traveling head, means for operatively connecting said traveling head, alternately with said shafts, means for reversing the movement of the worm shaft at predetermined intervals, a pawl and ratchet wheel device for rotating said mandrel, the diameter of one cord or thread, while the traveling head is connected with the worm shaft, at the end of the travel of the head in each direction, and means for applying a coating of rubber to the mandrel and last laid cord or thread in advance of the director wheels.

2. In a machine for laying a succession of rows of cords or threads upon a mandrel, in combination with said mandrel, a support for said mandrel, a traveling head adapted to move longitudinally of said mandrel, director wheels for said cord or thread, adjustably secured in said head, a reservoir for fluid coating material adjacent to said traveling head, a nozzle for said fluid adapted to travel with said traveling head, said nozzle communicating with said reservoir, said nozzle adapted to travel in advance of said director wheels and to apply said coating fluid to the surface upon which said cord or thread is about to be laid and to the row of cord or thread last laid, and mechanism for moving said traveling head.

3. In a machine for laying a cord or thread in parallel rows upon a mandrel, the combination with the mandrel, of a support therefor, a traveling head adapted to move longitudinally of the mandrel, a pair of director wheels adjustably secured in said head, over one of which said cord or thread is adapted to pass to said mandrel, means for giving a positive parallel movement to said traveling head relatively to said mandrel, a reservoir for tenacious vulcanizable fluid adjacent to said mandrel, a nozzle secured closely adjacent to said director wheels, and movable therewith and communicating with said reservoir, and adapted to apply said fluid to the surface upon which the said cord or thread is to be laid and upon the adjacent row of cord or thread, in advance of the laying director wheel.

4. In a machine for laying parallel rows of cords or threads longitudinally upon a mandrel, in combination with the mandrel, a supporting bed for the mandrel, a worm shaft mounted in said bed, parallel with said mandrel, means for rotating said worm shaft, a head adapted to travel on said worm shaft and to be actuated thereby, a pair of director wheels, a support therefor in said traveling head, said wheels adapted to apply said cord or thread to said mandrel, means for intermittently and periodically rotating said mandrel, and means for reversing the movements of the said shaft, said reversing means controllable by the movement of said traveling head, means for securing the mandrel from rotation alternating with said rotating means therefor,

mechanism for securing the row of cord or thread last laid from movement while the following row is being laid, means for doubling the cord or thread at the end of each row, said securing and doubling mechanism being controlled by the movements of said traveling head and instrumentalities for applying a coating of non-fibrous and vulcanizable material to the receiving surface in advance of the cord or thread being laid.

5. In a machine for applying longitudinal rows of cords or threads upon a mandrel, the combination with the mandrel, of a traveling head, adapted to move longitudinally of said mandrel, a pair of director wheels, adjustably and horizontally secured in said traveling head, over which alternately said cord or thread is adapted to pass to said mandrel, mechanism the movements of which are controlled by said traveling head, for giving a reciprocating longitudinal movement of said traveling head parallel to said mandrel, a pawl and ratchet device for periodically rotating said mandrel, the diameter of one cord or thread spring pressed holding fingers adapted to secure the last laid row of cord or thread while the next is being laid, one finger located at each end of the row, a common pivot shaft for both said fingers, a needle point on each finger over which the cord or thread is adapted to be folded on the return movement of the director wheels, intermediate holding fingers on said pivot shaft and mechanism controlled by the movement of the traveling head for withdrawing said holding fingers at the time that the mandrel is being rotated by said ratchet device and releasing the same before the said cord or thread is doubled.

6. The combination with a mandrel and worm and screw threaded shafts of a traveling head, a pair of director wheels, a support therefor adjustably secured in said head for horizontal and vertical position of said director wheels, a nut portion in said head, movable into and out of engagement with said screw threaded shaft, a pin in said head adapted to detachably engage with said worm shaft, a support for said shafts and mandrel.

7. In a machine for applying parallel rows of cords or threads to a mandrel to form an unwoven fabric, the combination with the mandrel and cord or thread laying devices, of a receptacle for non-fibrous and vulcanizable fluid, adjacent to said mandrel, a pipe leading therefrom, a traveling nozzle adapted to move in advance of said cord or thread laying devices and to apply said fluid to said mandrel and rows of cords or thread thereon, a tube connecting said nozzle with said receptacle, and an adjustable pressure device in said receptacle.

8. The combination with a rotatable worm shaft, and a mandrel shaft, a traveling head, a shifting rod, adapted to be engaged by said traveling head at each end of its stroke, a shifting arm upon the rod, the worm shaft driving and reversing gearing for said worm shaft, controlled by said shifting arm and a locking device for said shifting device, said locking device comprising a sleeve movable on said worm shaft with said shifting arm, a disk fixed on said shaft, one on each side of said sleeve, a spring pawl fixed on each side of said sleeve, said pawls adapted to alternately engage with said fixed disks as said sleeve moves on said shaft, and a pawl pivoted in each disk, and means for raising said last named pawls to release said spring pawls at the limits of the movements of said sleeve.

9. The combination with a rotatable worm shaft and a reversing arm therefor, of a fork movable in said shaft and operatively connected with said reversing arm, a sleeve upon the shaft adapted to move with said fork, a disk fixed on said shaft on each side of said sleeve, a spring pawl projecting from each side of said sleeve, and pawls pivoted in said disks and adapted to engage with said fork at each end of its stroke and release said spring pawls, prior to the return movement of said fork, substantially as described.

10. The combination with a mandrel, and a rotatable worm shaft, of a traveling head, operatively connected with the worm shaft, means for rotating said shaft, a reversing device for said shaft and an operating rod therefor controllable by the movements of said traveling head, a ratchet device adapted to periodically rotate said mandrel and mechanism for operating said ratchet device at the time of reversing the direction of movement of said worm shaft, and for locking said mandrel from movement as soon as it has been rotated by said ratchet device.

11. The combination with a mandrel and mandrel shaft, a traveling head and a worm shaft, of a reversing device therefor, controlled by said traveling head, a shifting arm therefor, a sliding fork in said worm shaft controlled by said shifting arm, a movable sleeve on said fork, a support on said mandrel shaft, swinging arms pivoted in said support and sleeve at their ends, a toggle link pivoted in said arms, a vertically moving pin in said support, pivoted to said toggle link, a ratchet wheel on said mandrel shaft, a link pivoted at one end on said support and having its other end resting on said pin, a pawl pivoted to said link and adapted to engage said ratchet wheel, a return spring for said pin, and a return spring for said link, and a lever pivoted in said support, said lever having one end engaging said pin and the other adapted to engage and secure

said mandrel shaft from movement when said pin is depressed.

12. In a device for laying cord or thread under tension upon a mandrel, the combination with a rotatable mandrel adapted to move periodically at definite intervals, of director wheels adapted to apply a row of said cord or thread longitudinally thereto, and reciprocable upon said mandrel, and a traveling head upon which said wheels are mounted, holding fingers arranged at each end of the travel of the said director wheels and adapted to engage the row of cord or thread last laid, while a new row is laid upon the mandrel, means for raising said fingers when the mandrel rotates, said raising means operated by said mandrel and auxiliary fingers adapted to retain their engagement, while said mandrel rotates, and to prevent said cord or thread from being detached from its location on said mandrel.

13. In a device for retaining a cord or thread under tension on a rotatable mandrel, in combination with said mandrel, a holding finger provided with a depending cam shaped arm, a hinged arm, upon said finger, adapted to engage said cord or thread and retain it in place upon said mandrel while said mandrel rotates, a return spring therefor, and means for limiting the movement of said arm.

In testimony whereof, we hereunto set our hands this 9th day of December 1908.

EUGENE D. C. BAYNE.
LAWRENCE A. SUBERS.

In presence of—
A. K. T. OSBORNE,
ED. O. PEET.