W. R. SEIGLE.

MACHINE FOR WINDING PAPER TUBES.

APPLICATION FILED JUNE 2, 1911.

1,040,437.

Patented Oct. 8, 1912.

6 SHEETS—SHEET 1.

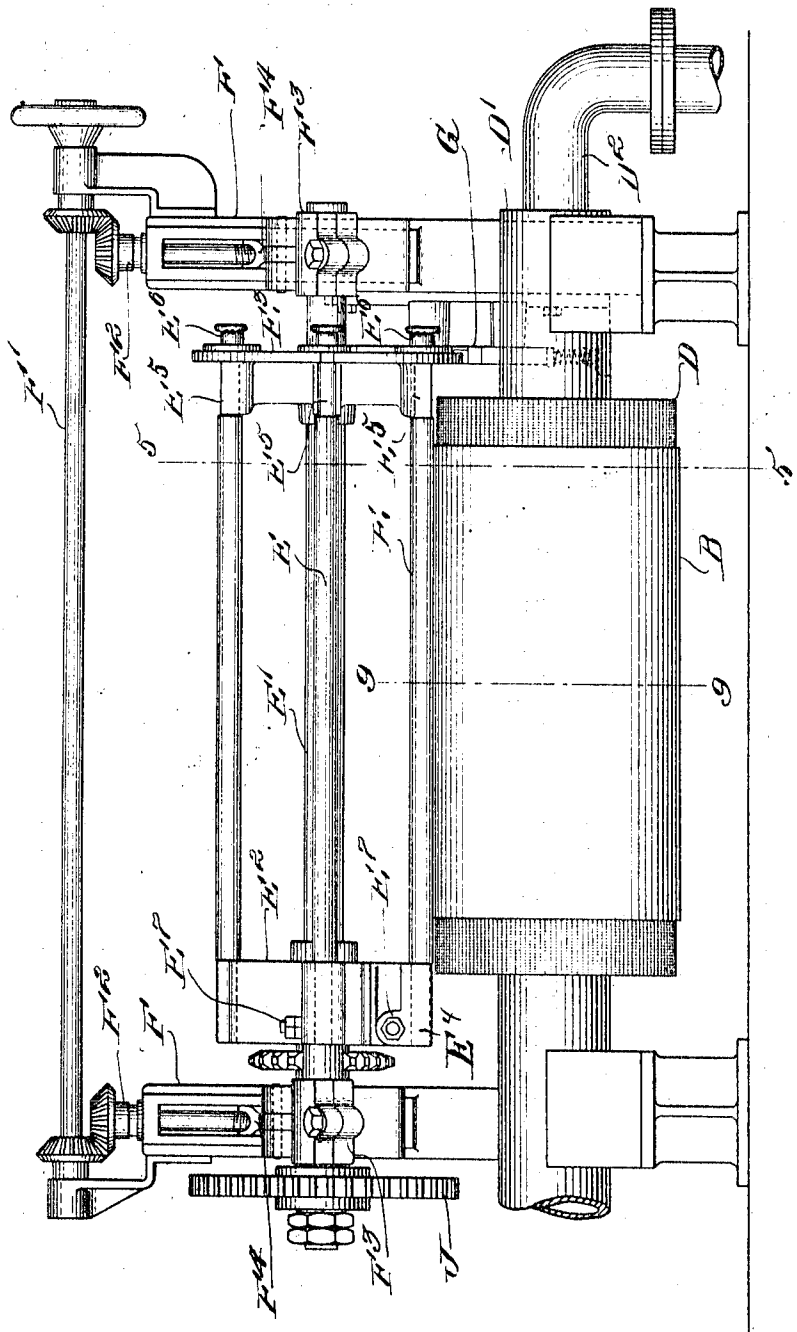

Fig. 1.

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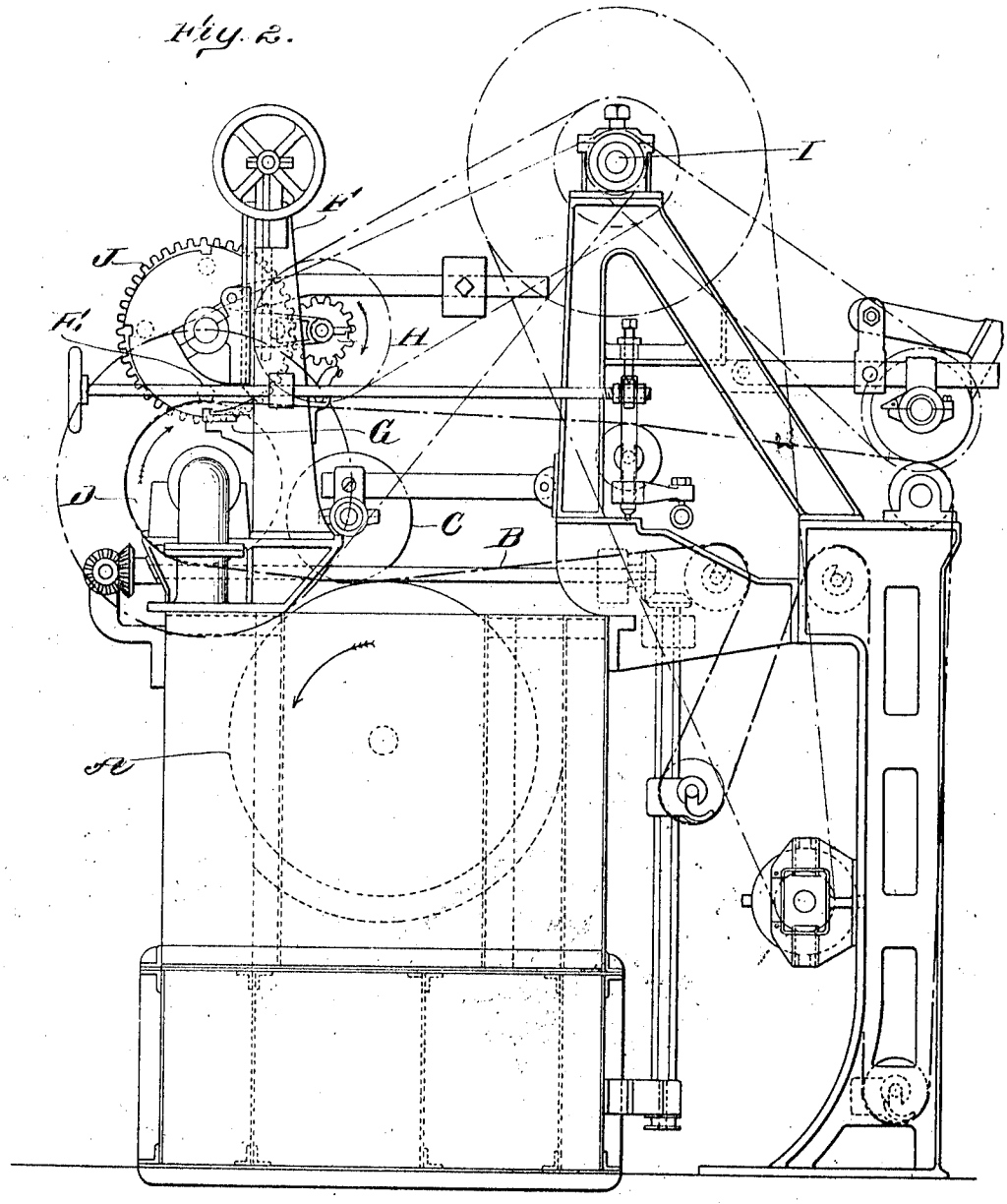
6 SHEETS—SHEET 2.

Fig. 2.



Witnesses:
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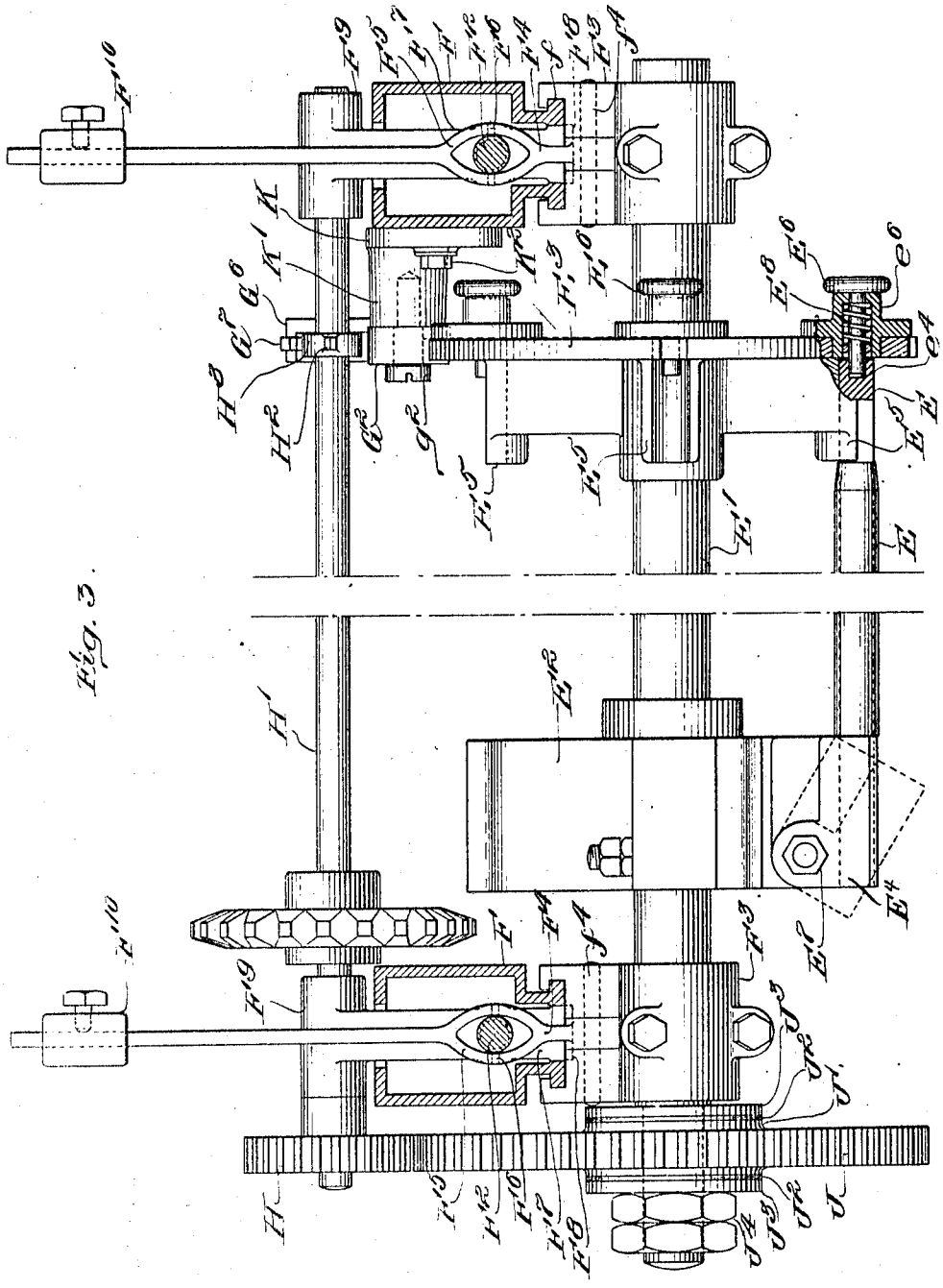

Fig. 3.

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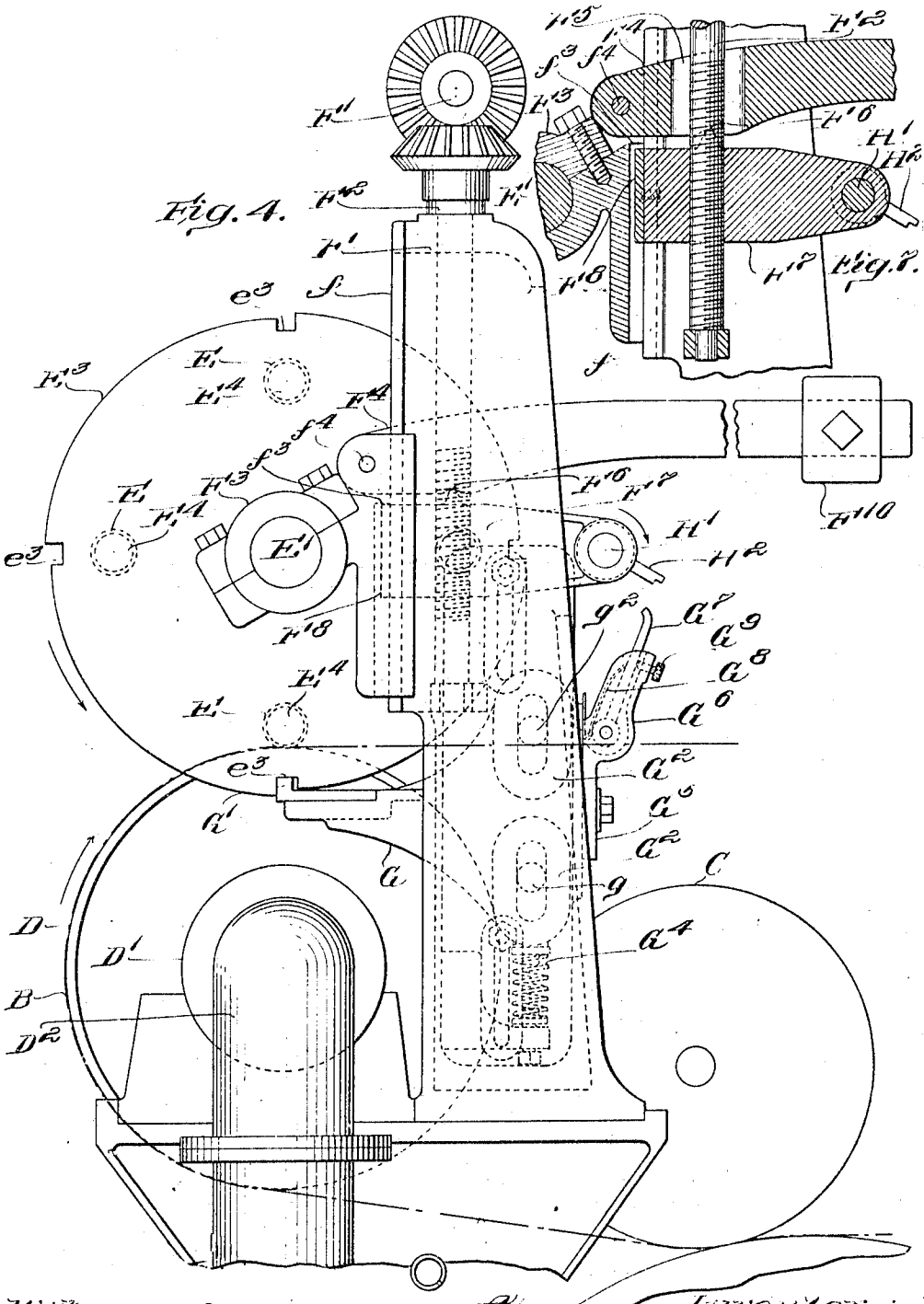

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6 SHEETS—SHEET 5.

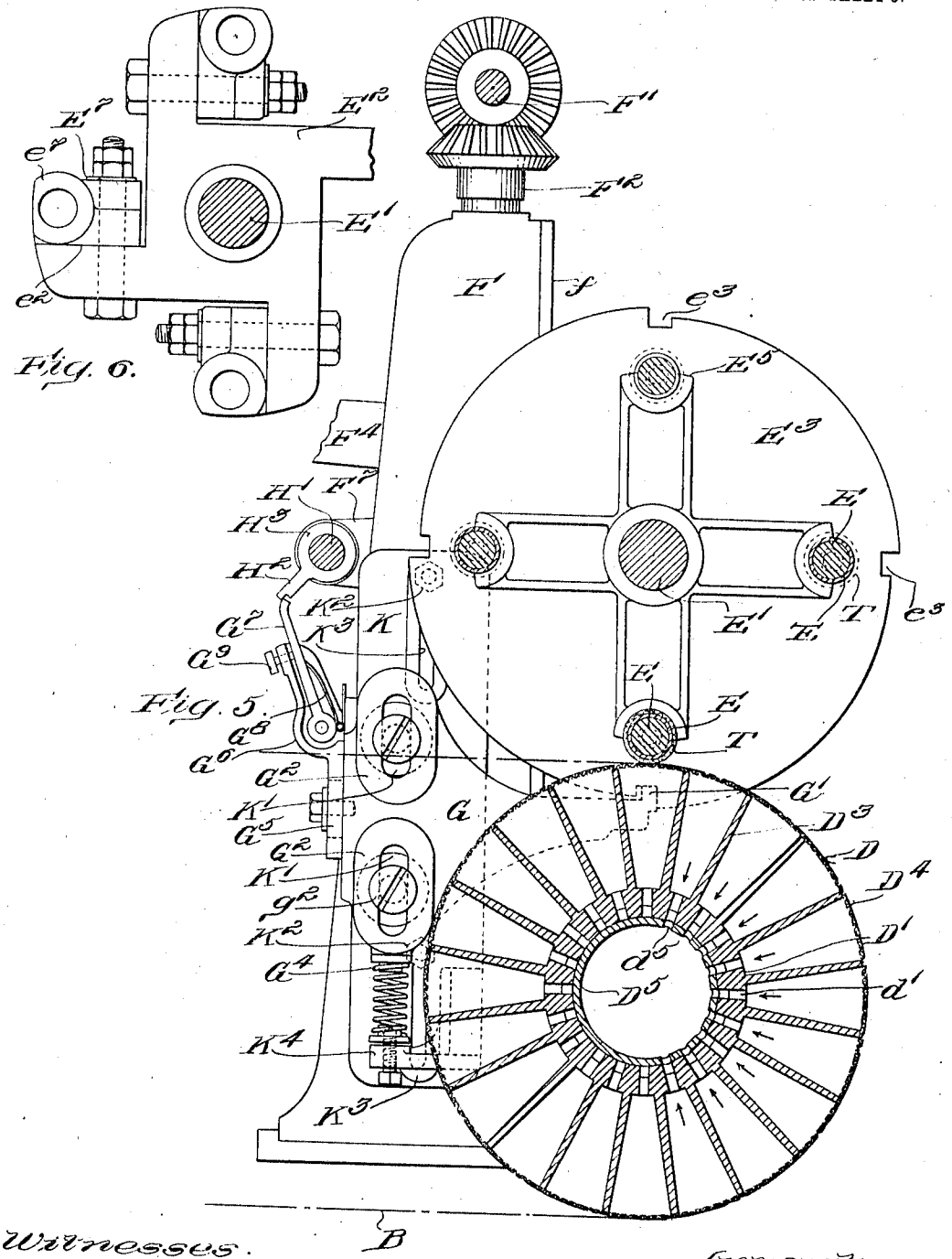

Fig. 6.

Fig. 5.

Witnesses.

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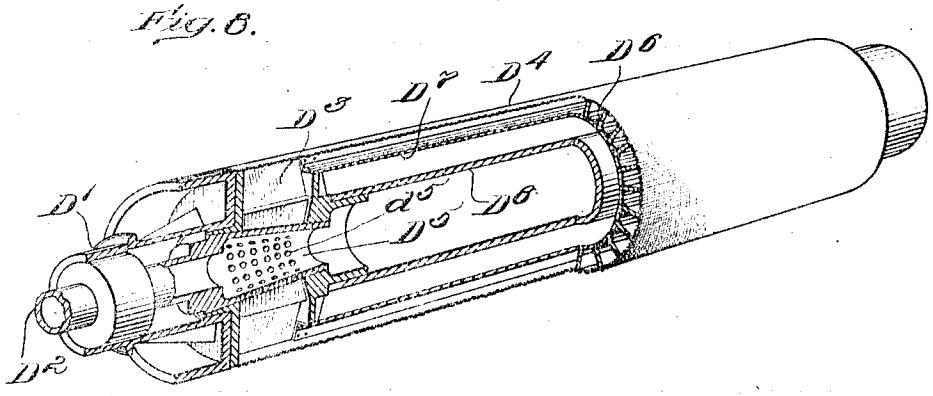
6 SHEETS—SHEET 6.

Fig. 8.



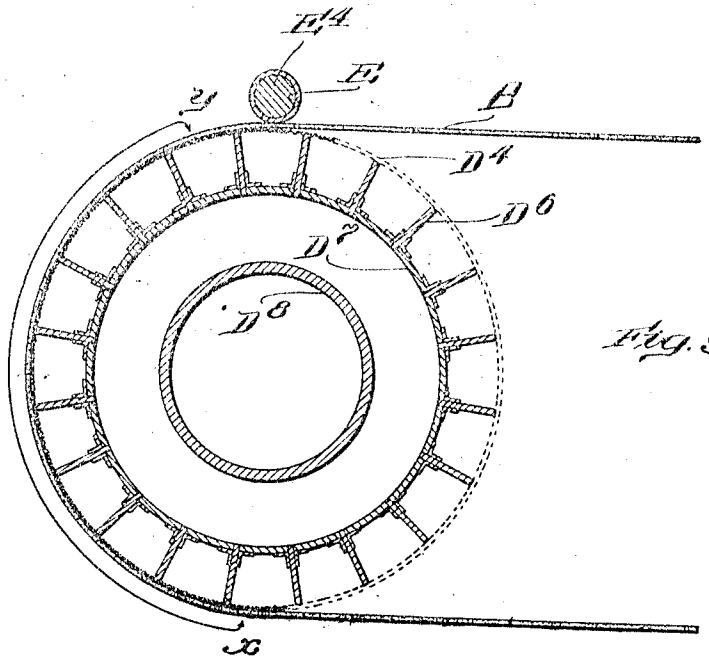


Fig. 9.

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UNITED STATES PATENT OFFICE.

WILLIAM R. SEIGLE, OF NASHUA, NEW HAMPSHIRE.

MACHINE FOR WINDING PAPER TUBES.

1,040,437. Specification of Letters Patent. Patented Oct. 8, 1912.

Application filed June 2, 1911. Serial No. 630,922.

To all whom it may concern:

Be it known that I, WILLIAM R. SEIGLE, a citizen of the United States, and resident of Nashua, in the county of Hillsboro and State of New Hampshire, have invented new and useful Improvements in Machines for Winding Paper Tubes, of which the following is a specification.

My invention relates to the art of forming tubes by winding a felted web, such as a web of paper, in successive convolutions upon a cylindrical mandrel, and consists in improvements in machines for winding such tubes.

The objects of these improvements are to increase the volume of output of a given machine, to produce tubes of high density, strength and regularity of form, and to reduce to a minimum the manual operations incidental to the handling of such a machine and of the product.

Other and further objects and results peculiar to and associated with my improvements will transpire from the subjoined specifications which are addressed to that form of machine in which my improvements are displayed and embodied in the best manner known to me.

My inventions and improvements are exemplified in the machine and its parts shown in the accompanying drawings, in which—

Figure 1 is a front elevation of the front portion of the machine; Fig. 2 is a side elevation of the machine, sundry parts thereof being shown in diagram; Fig. 3 is a plan view, partly in section, of the mandrel frame and its adjustable bearings and sundry mechanical adjuncts thereto; Fig. 4 is a side elevation of one of the end standards of the machine and parts immediately associated therewith: Fig. 5 is in part a vertical elevation and in part a vertical section taken at the line 5—5 of Fig. 1 showing one of the end standards and its mechanical adjuncts; Fig. 6 is a detail showing one of the heads of the mandrel frame; Fig. 7 is a detail showing in section portions of the mandrel frame adjusting mechanism; Fig. 8 is a view in perspective and partly in section of the segmental suction roll which performs important functions in the machine; and Fig. 9 is a vertical cross section of the suction roll and tube winding mandrel taken at the line 9—9 of Fig. 1.

For the sake of clearness in exposition, the several functionally related departments of this machine will be separately described; their interrelation will appear in the summary setting forth the operation of the machine as a whole.

Web-forming, couching, conveying and water-extracting mechanism.—A web of paper is formed in the well known manner upon a rotating cylindrical mold indicated at A in Fig. 2. The mold cylinder A, and the factors associated with it, constitutes and represents the web-former. This web is transferred to a web carrier B by the aid of a couch roll C which is heavily felted according to the usual and well known construction. The couch roll C bears with considerable pressure upon the mold cylinder A so as to accomplish its web couching function. The web carrier B is a relatively thin, porous belt, preferably a felt, which intervenes between the couch roll C and the mold cylinder A but is so thin that it does not sensibly modify the action of the couch roll C in the performance of its function which is to remove the web of paper from the mold cylinder A. The web is thus transferred from the cylinder A to the web carrier B. This web carrier is an endless belt which passes from the couch roll C to and around the sectional suction roll D under the tube winding mandrel (presently to be described) and thence over a series of rolls back to the mold cylinder and couch roll. This web carrier B is shown in Fig. 2 by the dot and dash line.

The suction roll D is preferably constructed according to the invention described in the Parker Patent No. 747,632, and is shown in detail in Figs. 8 and 9 hereto annexed. This suction roll is provided with hollow journals D′ which turn on a cylindrical bearing provided by the stationary suction pipe D^2. The interior of the suction roll is divided into segmental compartments by longitudinal radial partitions D^6 which radiate from the inner cylinder D^7 and register with the suction head partitions D^3. At each end of the suction

roll a cone D^5 is mounted; each of these cones is perforated as at d^5. The exterior of the segmental suction roll is covered with a perforated or reticulated metal shell D^4. An exhaust being maintained through the stationary pipe D^2, the air is withdrawn from those segmental compartments which at any time are in communication with the ports d^5 in the cones D^5, so that as the sectional roll revolves, suction may be maintained through a predetermined arc and be released through the remainder of the circumference of the sectional roll. In the machine shown in the drawings hereto annexed the effective suction is maintained from the point x (Fig. 9) to the point y, so that as the compartment which is passing the point y approaches the tube winding mandrel E, the pressure in that compartment rises toward the atmospheric, and at the line of contact between the web carrier B and the mandrel E no tendency of the paper web to adhere to the carrier B is manifested. A paper web formed on the mold cylinder A is thus transferred to the web carrier B, a considerable portion of the water abstracted from the paper web by the suctional action of the segmental roll D, and thereafter the paper web is wound into a tube upon the tube winding mandrel presented for the time being to the web carrier B. The sectional suction roll and the web carrier associated therewith, represent the web-deliverer, that is to say, the functional factors which operate to deliver a web, made by the web-former, to the tube winding devices for formation of a tube.

Tube winding mandrels and mandrel frame.—The mandrel frame with its mandrels is shown in elevation in Fig. 1. Each mandrel E (of which there are four in the illustration shown) is journaled at one end to a pivot block E^4 in the frame head E^2 and at the other end in a half socket E^5 where it is centered by a spring-controlled pin E^6 (see Fig. 3). The mandrel frame heads E^2 and E^3 are secured to the frame shaft E′ which is journaled at either end in a journal box F^3 mounted to slide for vertical adjustment on a standard F. The adjustment of the mandrel frame journal boxes (presently to be described more in detail) is such that each mandrel E when in the position shown in Fig. 1 bears heavily upon the web carrier B, the bearing pressure being supported by the firm and hard surface of the segmental roll D. The yielding mountings of the mandrel frame, in the specific illustration represented by the drawings, constitute means to hold the tube-winding mandrel pressed yieldingly against the web-deliverer, in tube-winding position. The web carrier B is so thin that the pressure effect of a mandrel E upon a web of paper carried by the carrier B is practically the same as though nothing intervened between the mandrel and the surface of the segmental roll D. With a mandrel in this position and bearing upon the web carrier, the paper web, deprived of a portion of its moisture by the operation of the segmental suction roll above described, leaves the web carrier and winds upon the mandrel E which turns in its bearings at E^5 and E^4 causing a tube to be built upon it by successive convolutions of the paper web delivered by the web carrier B. Substantially the whole weight of the mandrel frame and its journal boxes may be made to bear upon the line of contact between the mandrel E and the web carrier B. As a paper tube is built upon the mandrel the mandrel frame, with its journal boxes F^3, rises, the journal boxes sliding in guides on the standards F.

Mandrel frame revolving mechanism.—The machine is contrived so that when a tube of paper wound upon a mandrel E has reached a predetermined thickness, the mandrel frame itself is released and made to turn in the journal boxes F^3 until a succeeding bare mandrel is brought into contact with the web carrier thus replacing the mandrel on which a tube has just been wound. The head E^3 of the mandrel frame shown at the right in Fig. 1 is provided with peripheral notches e^3, these notches being four in number to correspond with the number of mandrels E, and constituting stops which coöperate with a detent, presently to be described. The periphery of the head E^3 between each two notches e^3 is not concentric with the shaft E′ but descends toward the center from one notch to the next, so that each notch e^3 is deeper at one side than at the other. A detent G′ engages each of the notches e^3 in succession in a manner presently to be described; for the present it suffices to say that when a tube of paper has attained the desired and predetermined thickness upon a mandrel E and the mandrel frame with its shaft E′ and journal boxes F^3 has risen by reason of the building up of the tube to this predetermined thickness, the detent G′ is released and the mandrel frame is free to turn with its shaft E′ in the journal boxes F^3. The movement of the web carrier B will in itself tend to rotate the mandrel frame in the direction indicated by the arrow in Fig. 4; this tendency however is supplemented by the mechanism shown in Fig. 1 and more in detail in Fig. 3.

At the left hand end of the mandrel frame shaft E′, as viewed in Fig. 1 and Fig. 3, a spur gear wheel J is mounted to turn on the end of the shaft E′ as a bearing. Collars J^3 are secured to the shaft E′ at either side of the hub J′ of the wheel J, and collars or washers J^2 of fiber or other suitable material are interposed between the collars

J^3 and the hub J'. Nuts J^4 on the end of the shaft E' are used to adjust the hub J' and collars J^3 to a proper intimacy of contact. The spur wheel J is constantly driven by a pinion H mounted on the shaft H' and the latter is rotated constantly in the direction shown by the arrow in Fig. 2 through chain and sprocket connections actuated from the main shaft of the machine. The frictional contact between the hub J' of the spur wheel J and the washers J^2 tends to rotate the shaft E' and thus as soon as the mandrel frame is freed from restraint by the removal of the detent G' (Fig. 4), the mandrel frame is rotated in the direction shown by the arrow in Fig. 4. The above described mechanism specifically represents means to move a mandrel out of tube-winding position when, by the operation of disengageable holding devices, the mandrel is set free to be so moved. The operation of the releasing mechanism is momentary only and the detent G' returns to position, so that riding on the eccentric periphery of the head E^3 the detent G' unfailingly engages the mandrel frame head E^3 by entering the next succeeding notch e^3, arresting the rotation of the mandrel frame at the point where the bare mandrel comes into proper contact with the web carrier B.

Mandrel frame detaining and releasing mechanism.—This mechanism is shown in detail in Figs. 4 and 5 though reference may be made to Fig. 3. The detent G' is secured to an arm of the detent plate G. The detent plate G is slotted at G^2 so as to be guided in vertical movement upon the guide pins g^2. The detent plate G is supported upon the spring G^4 which urges the plate upward so as normally to hold the detent G' in contact with the mandrel frame head E^3 and in engagement with a notch e^3. The detent, yieldingly and therefore disengageably held in position against the head of the mandrel frame, in the specific illustration set forth in the drawings, represents and embodies disengageable means to hold a mandrel in tube-winding position. At the rear of the detent plate G the trip plate G^5 is secured, this plate being adjustable vertically upon the detent plate G. In the upper portion of the trip plate G^5 there is formed the housing G^6 in which the trip G^7 is pivotally mounted. A spring G^8 holds the trip G^7 normally in the position shown in Figs. 4 and 5 and an adjusting screw G^9 is provided wherewith to make fine adjustments of the trip G^7.

The shaft H' journaled in bearings F^9 is constantly rotated in the direction indicated by the arrow in Fig. 4. A collar H^3 secured to this shaft carries a radially projecting finger H^2 which rotates immediately above the trip G^7. As a paper tube is wound upon a mandrel E and in the manner hereinabove indicated, it lifts the mandrel frame by force of the growth of the tube itself on the mandrel, the detent plate G, urged upward by the spring G^4 follows the mandrel frame, thus enabling the detent G' to retain its hold upon the mandrel frame head E^3, and this upward movement of the detent plate G continues until the end of the trip G^7 is struck by the rotating finger H^2 and is swung forward and downward carrying with it the detent plate G and disengaging the detent G' from the notch e^3. Thereupon, the mandrel frame rotating mechanism above described turns the mandrel frame bringing the next mandrel into position. Before the next mandrel reaches its position upon the web carrier B, the rotating finger H^2 has left its engagement with the trip G^7, the spring G^4 reasserts itself and lifts the detent plate G and detent G' in time for the latter to catch the next notch e^3. The trip G^7, in conjunction and coöperation with the rotating trip-actuator H^2 constitutes means to disengage the holding devices which hold a mandrel in tube-winding position, and these disengaging means are mediately controlled by the yielding movement of the tube winding mandrel, this movement being in response to the growth of a tube wound on the mandrel.

The thickness of a paper tube to be wound will be determined by the adjustment of the trip plate G^5 supplemented by fine adjustment of the trip G^7 itself. If the trip plate G^5 is raised and secured in raised position on the detent plate G, then in the upward movement of the detent plate, the trip G^7 will be the earlier brought into contact with the rotating finger H^2, and the building up of a tube as T on the mandrel E (see Fig. 5) will be the sooner arrested. To make a thicker tube, other things being the same, the trip plate G^5 will be secured in a lower position on the detent plate G, so that a longer lift is required to bring the trip G^7 into contact with the finger H^2.

As it is desirable to have a machine adapted to winding tubes of different diameters, that is to say, upon mandrels of different diameters, the entire system represented by the detent plate G and trip plate G^5 and their adjuncts, is made vertically adjustable by being mounted upon a plate K on which are formed the bosses K' in which the guide pins g^2 are secured. The bracket K^4 which serves as a seat for the spring G^4 is secured to or integral with the plate K and the plate K is slotted as at K^3 to admit holding bolts K^2 by means of which the plate K is secured at any desired position within the range of adjustment afforded by the slots K^3. Thus, if the mandrel frame be equipped with larger mandrels and the vertically adjustable journal boxes F^3 of the mandrel frame be therefore raised, the holding plate K will be raised accordingly so that the starting

point for operation of the detent plate will correspond to the new condition. The shaft H′ is mounted in bearings F⁶ which are raised or lowered together with the journal boxes F⁵, so that the positional relation of the shaft H′ and the shaft E′ remains the same.

Mandrel frame adjusting mechanism.—Between the end standards F of the machine (see Fig. 1) the shaft F′ extends and this shaft is in bevel gear connection with the vertical screw shafts F². Each of these vertical screw shafts F² is threaded through a nut F⁷ shown in Figs. 4 and 7 and the nut is movable up and down between the side webs of the standard F. At the front of the standard the nut F⁷ is faced with a hardened plate F⁸ and at the rear the nut F⁷ develops into the journal F⁹ in which the shaft H′ turns. The journal box F⁵ is mounted to slide up and down on the gibs *f* (see Figs. 3 and 4) and is formed with an internal ledge at *f*³ which bears upon the hardened plate F⁸, so that thereby the nut F⁷ may afford support to the slidingly mounted journal box F⁵. The upper portion of the journal box F⁵ is formed so as to receive the pin *f*⁴ which serves as the pivot for the lever F⁴. This lever is divided at F⁵ so as loosely to embrace the screw shaft F² and bears upon the fulcrum-edges F⁹ which are formed in the top of the nut F⁷. On the rearwardly extending portion of the lever F⁴ counterweights as F¹⁰ may be suspended and the size and position of such counterweights will in part determine the total weight with which a mandrel E bears upon the web carrier B supported by the roll D. The above described suspension or mode of suspension of the journal boxes F⁵ enables the journal boxes and mandrel frame to be lowered until the entire weight of the frame is supported by the lower mandrel, bearing upon the web carrier B and roll D. If this total weight is to be diminished the counterweights F¹⁰ are used as above suggested. If the total weight is to be increased either the dimensions and therefore the weight of the parts of the mandrel frame may be made larger or weights may be hung directly upon the journal bearings F⁵. When the growth of a tube upon the lower mandrel raises the mandrel frame the journal boxes F⁵ rise, the clearance shown in Fig. 7 allowing this to be accomplished without interference from the nut F⁷.

Mandrel stripping devices.—As hereinabove described, the left end bearing of each mandrel consists of a pivoted journal E⁷ which turns in the mandrel frame head E² and is supported by one of the flat bearing surfaces *e*². The mandrels are composed each of a cylindrical core E⁴ and the mandrel itself, that is to say, the cylindrical body on which the tube is actually wound consists of a sleeve of metal which fits on the cylindrical core E⁴ quite closely but may slide easily thereon. This sleeve is preferably composed of aluminum tubing. One end of the mandrel core is journaled in the socket *e*⁷ of the pivoted journal box E⁷ while the other end rests in the half bearing E⁵ and is bored at *e*⁶ to receive one of the spring controlled pins E⁶. These pins E⁶ are mounted in housings *e*⁶ which are secured to the head plate E² and the springs E⁸ urge the pins inwardly, that is to say, toward engagement with the mandrel cores E⁴. When in the operation of the machine a mandrel is brought forward and downward with the tube of paper upon it, a workman slides out the pin E⁶ and then swings the mandrel with its paper tube outward, the pivoted bearing E⁷ turning for the purpose into the position shown by dotted lines in Fig. 3. Then the mandrel, that is to say, the shell or sleeve E with the paper tube on it is slipped off the mandrel core E⁴, another similar shell replaced on the core, the mandrel core E⁴ is swung inward to reëngage the half bearing E⁵ and to be engaged by the pin E⁶, while the paper tube supported by the removed mandrel shell is taken to the drying room.

The mandrel core and its removed shell or sleeve forms the subject matter of an application for patent filed concurrently herewith by me serially numbered 630,921 and is reserved for claim therein.

The above described machine operates as follows: The mandrel frame being equipped with tube winding mandrels of a selected size, the mandrel frame journal boxes being vertically adjusted so that the lower mandrel bears on the web carrier and is supported by the segmental suction roll, the detent plate being adjusted with the detent in position to hold the mandrel frame, the detent plate tripping mechanism being adjusted to allow the machine to form a paper tube of predetermined thickness, and the machine being in motion, a paper web is formed on the mold cylinder, transferred to the web carrier, deprived of a portion of its water and then transferred to the tube winding mandrel, whereupon the paper tube grows by the accumulation of successive convolutions of web, lifting the mandrel frame and its connected mechanism until the trip is struck by the rotating finger which by depressing the trip throws the detent out of action and allows the mandrel frame rotating mechanism to exert its effect, rotating the mandrel frame, carrying the completed tube away from the web carrier and placing a fresh mandrel in contact with the web carrier, the detent returning to position meanwhile in order to stop the mandrel frame in its rotation at the proper

point to enable the fresh mandrel to form a tube in coöperation with the web carrier. As the paper tubes are brought to the front of the machine by the intermittent rotation of the mandrel frame, the tubular mandrels are slipped off the mandrel cores, and fresh tubular mandrels substituted.

Incidentally I have described my inventions and improvements as applied to a paper tube winding machine of a type heretofore invented by me which forms the subject matter of an application for patent filed Jan. 4, 1911 by me serially numbered 600,795. I prefer this type of machine for the reason that by its aid one is enabled to wind paper tubes of greater density, strength and regularity than upon tube winding machines heretofore in operation so far as the same are known to me. This type of tube winding machine is one characterized by the employment of a relatively thin web carrier which intervenes successively between a heavily felted couch roll and a mold cylinder and then between a tube winding mandrel and a firm, hard supporting surface such as is afforded by the metallic sectional suction roll, and which is characterized also by the maintenance of water abstracting suction on the web carrier up to a point near to but short of the line of contact between the mandrel and the web carrier. The improvements hereinabove described and hereinbelow claimed will, I believe, operate to best advantage when incorporated with a machine of the general character just indicated; these improvements may, however, be found adaptable to tube winding machines of other types and may lend advantage thereto by reason of their automatic character, complete adjustability and rapid operation.

What I claim and desire to secure by Letters Patent is:

1. In a tube winding machine, the combination with a web-former and web-deliverer, of a mandrel frame, a mandrel mounted thereon, movable bearings wherein the mandrel frame is rotatably mounted, disengageable devices to hold the mandrel frame with the mandrel in tube winding position, means to disengage said holding devices, controlled by the yielding movement of the mandrel frame in response to the growth of a tube wound upon the mandrel, and frictionally operating means to rotate the disengaged mandrel frame to carry the mandrel out of tube winding position.

2. In a tube winding machine, the combination with a web-former and web-deliverer, of a mandrel frame, a series of mandrels mounted thereon, movable bearings wherein the mandrel frame is rotatably mounted, a series of stops on the mandrel frame corresponding to the mandrels in number and disposition, disengageable devices coöperating with said stops in succession to hold the mandrel frame with a mandrel in tube winding position, means to disengage said holding devices, mediately controlled by the yielding movement of the mandrel frame in response to the growth of a tube wound on a mandrel, and frictionally operating means to rotate the disengaged mandrel frame to carry a mandrel out of tube winding position and into a succeeding position of engagement of the holding devices with the stop corresponding to the next mandrel in succession.

3. In a tube winding machine of the character described, the combination of a mandrel frame, movable bearings wherein the mandrel frame is rotatably mounted, mandrels mounted in the mandrel frame, a series of stops on the mandrel frame, and disengageable holding devices coöperating with said stops in succession, comprising a detent plate, yielding means to urge it normally toward position of engagement with said stops, a detent, a trip mounted on the detent plate, and a trip actuator in the path of movement of the trip to coöperate with the trip to disengage the detent from the mandrel frame.

4. In a tube winding machine of the character described, the combination of a mandrel frame, movable bearings wherein the mandrel frame is rotatably mounted, mandrels mounted in the mandrel frame, a series of stops on the mandrel frame, and disengageable holding devices coöperating with said stops in succession, comprising a detent plate and a detent thereon, yielding means to urge the detent plate normally toward position of engagement with said stops, a trip mounted on the detent plate and a trip actuator in the path of movement of the trip to coöperate with the trip to move the detent out of engagement with a mandrel frame stop, and means to adjust the detent plate and its yielding support as a whole toward or from the mandrel frame, to suit mandrels of different diameters.

5. In a tube winding machine of the character described, the combination of a mandrel frame, movable bearings wherein the mandrel frame is rotatably mounted, mandrels mounted in the mandrel frame, a series of stops on the mandrel frame, and disengageable holding devices coöperating with said stops in succession, comprising a detent plate with a detent thereon, yielding means to urge the detent plate normally toward position of engagement with said stops, a trip mounted on the detent plate, a trip actuator in the path of movement of the trip, to coöperate with the trip to disengage the detent from the mandrel frame, and means to adjust the positional relation of the trip and trip actuator.

6. In a tube winding machine of the char-

acter described, the combination of a mandrel frame, movable bearings wherein the mandrel frame is rotatably mounted, devices to raise and lower said mandrel frame bearings, mandrels mounted in the mandrel frame, a series of stops on the mandrel frame, disengageable holding devices coöperating with said stops in succession, and means to disengage said holding devices, carried by said mandrel-frame-bearing raising and lowering devices, and means to rotate the disengaged mandrel frame to remove a mandrel from tube winding position.

7. In a tube winding machine of the character described, the combination of a mandrel frame, movable bearings wherein the mandrel frame is rotatably mounted, mandrels mounted in the mandrel frame, a series of stops on the mandrel frame, disengageable holding devices coöperating with said stops in succession comprising a detent, a detent plate, a spring seat for the detent plate, a trip on the detent plate, screw and nut gears to raise and lower the mandrel frame bearings, a shaft journaled on the nuts, and a trip actuator on the shaft to engage the trip and depress the detent plate against the spring seat thereof.

8. In a tube winding machine of the character described, the combination of a mandrel frame, movable bearings wherein the mandrel frame is rotatably mounted, mandrels mounted in the mandrel frame, a series of stops on the mandrel frame, disengageable holding devices comprising a detent cooperating with said stops, a trip adjustable with reference to the detent, and a trip actuator to engage the trip and move the detent from a stop on the mandrel frame.

9. In a winding machine of the character described, the combination of a mandrel frame, movable bearings in which the mandrel frame is rotatably mounted, mandrels mounted in the mandrel frame, a series of stops on the mandrel frame corresponding in number and disposition with the mandrels, and disengageable holding devices, comprising a detent plate, a detent thereon to engage said stops, a pivoted yieldingly held trip secured to and adjustable on the detent plate, a spring seat for the detent plate, and a rotatably mounted trip actuator to engage the trip.

10. In a winding machine of the character described, the combination of a mandrel frame, movable bearings in which the mandrel frame is rotatably mounted, mandrels mounted in the mandrel frame, a series of stops on the mandrel frame corresponding in number and disposition with the mandrels, and disengageable holding devices, comprising a detent plate, a detent thereon to engage said stops, a pivoted yieldingly held trip secured to and adjustable on the detent plate, a spring seat for the detent plate, said seat adjustable with reference to the mandrel frame, and a rotatably mounted trip actuator to engage the trip.

Signed by me at Boston, Massachusetts, this 26th day of May, 1911.

WILLIAM R. SEIGLE.

Witnesses:
ROBERT CUSHMAN,
CHARLES D. WOODBERRY.