H. L. BROWN.

TEXTILE APPARATUS.

APPLICATION FILED JAN. 31, 1911.

1,016,394.

Patented Feb. 6, 1912.

6 SHEETS—SHEET 1.

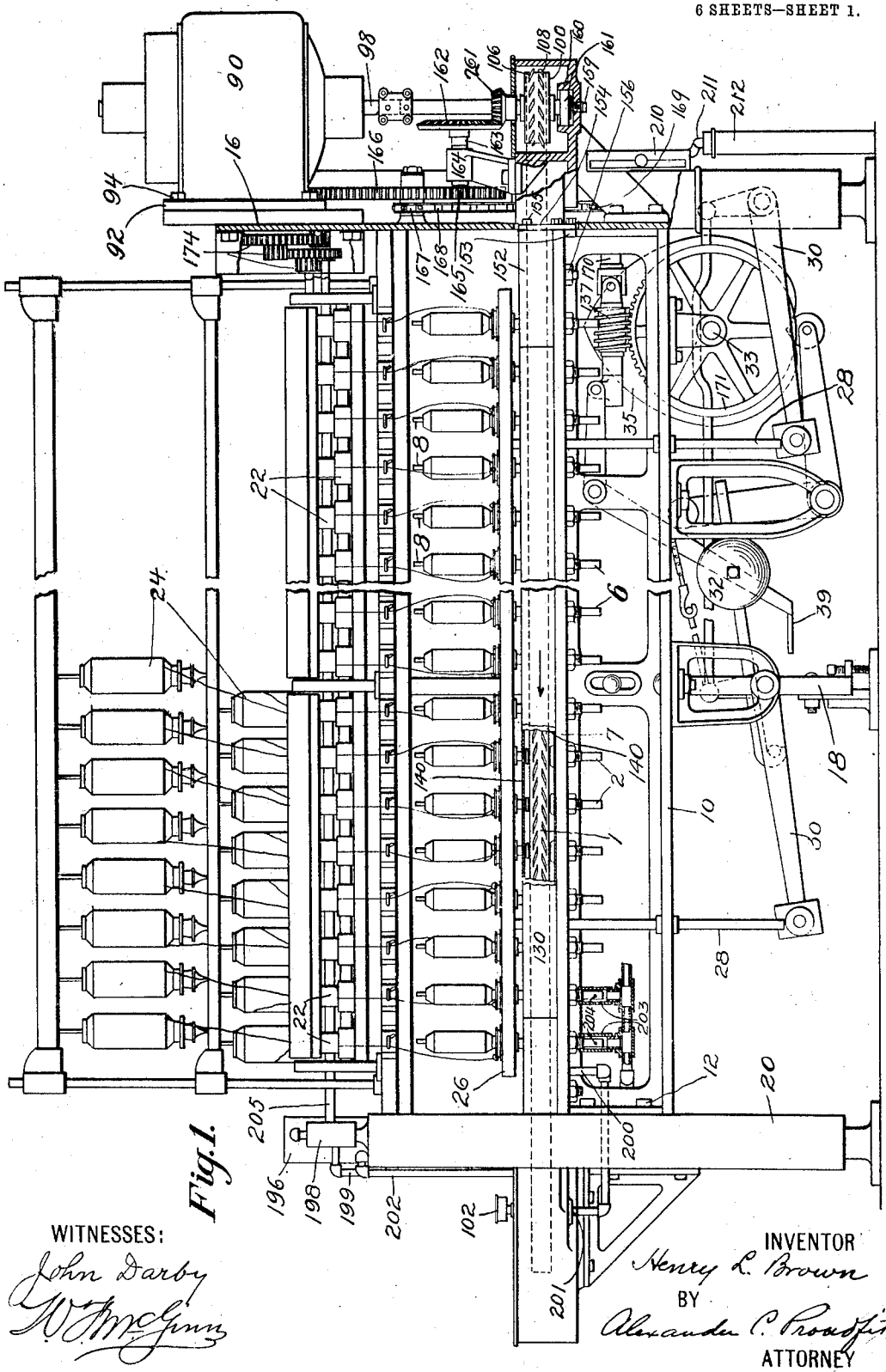

Fig. 1.

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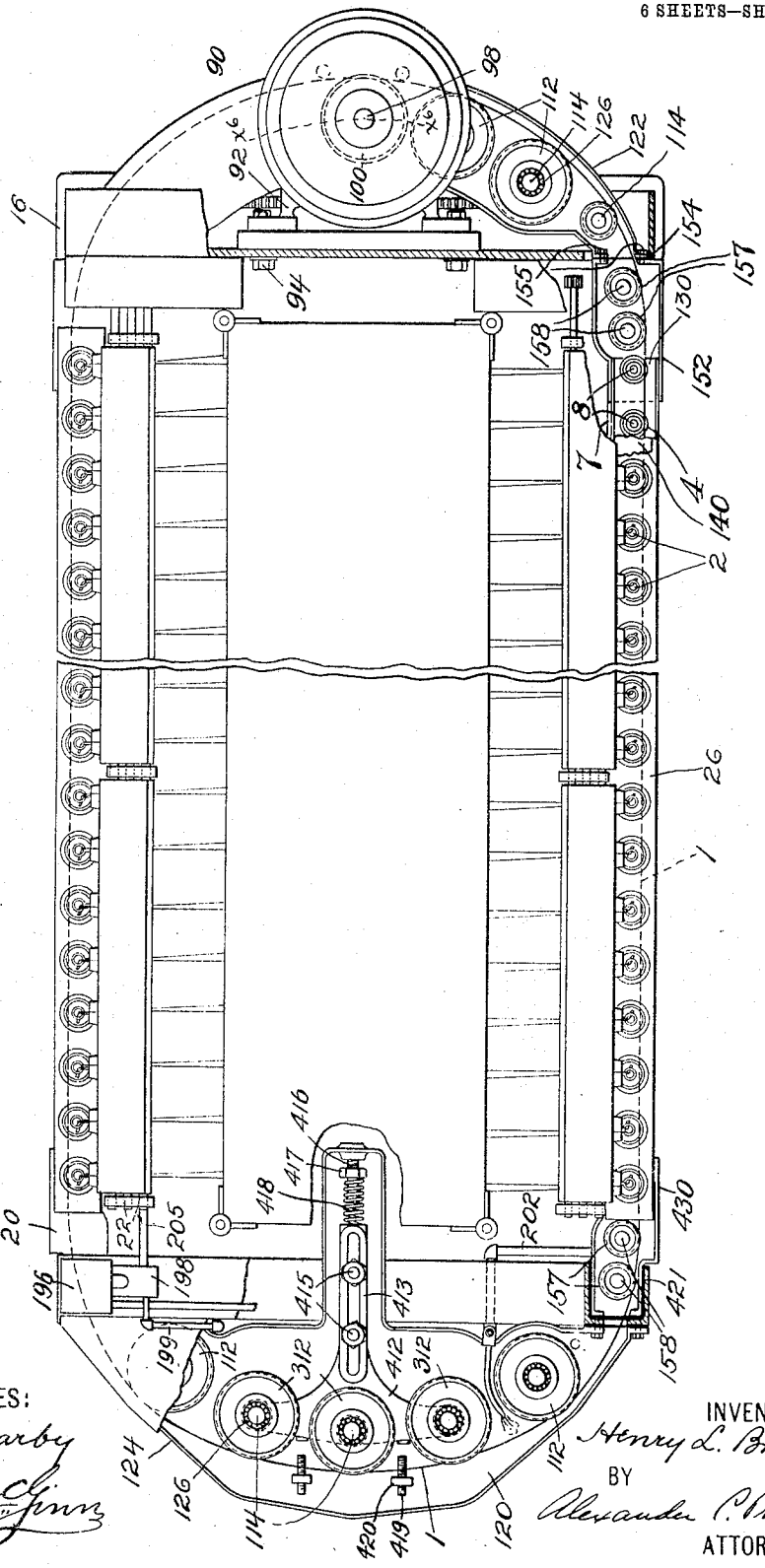

Fig. 2.

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6 SHEETS—SHEET 3.

Fig. 3.

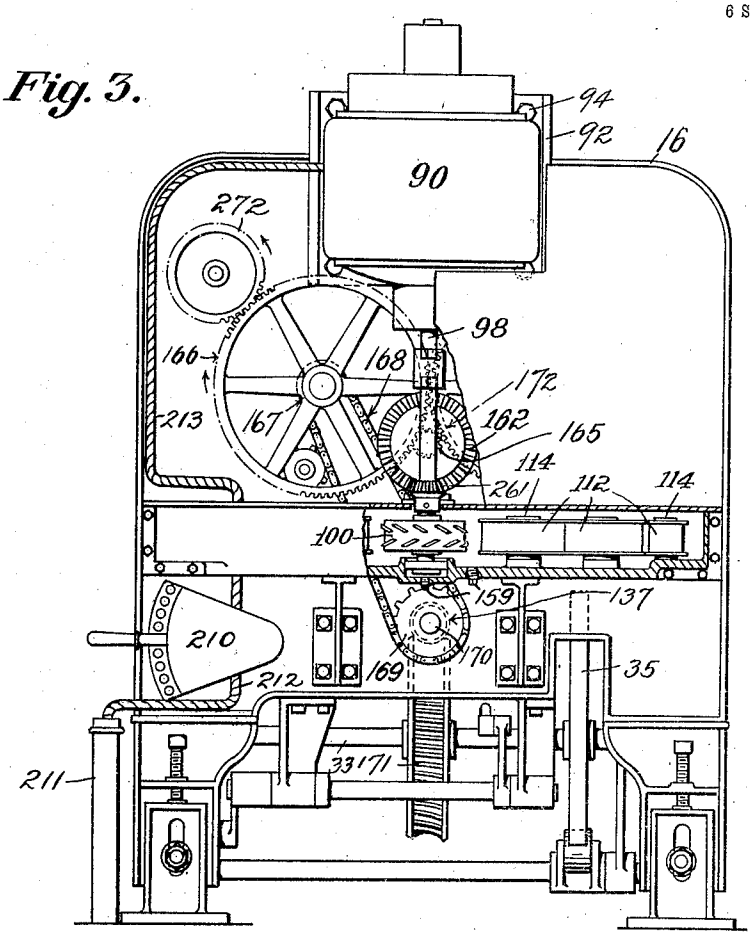
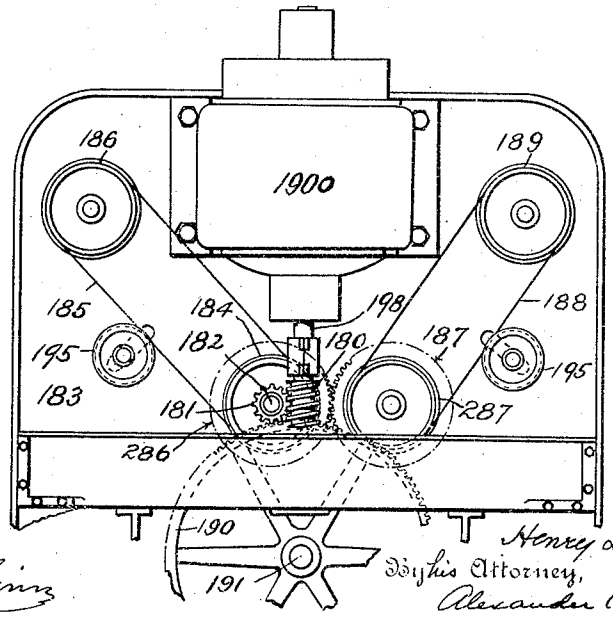


Fig. 4.



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6 SHEETS—SHEET 4.

Fig. 5.

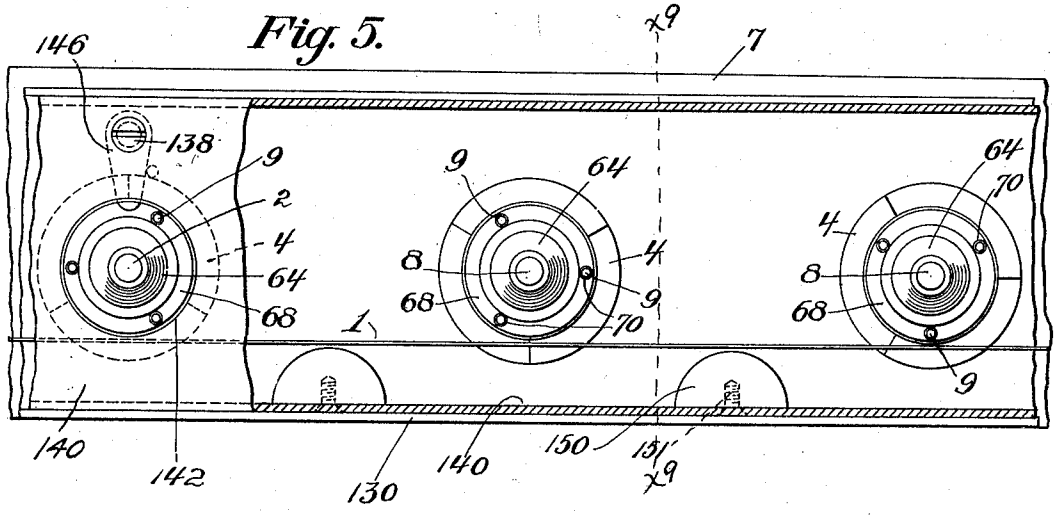

Fig. 6.

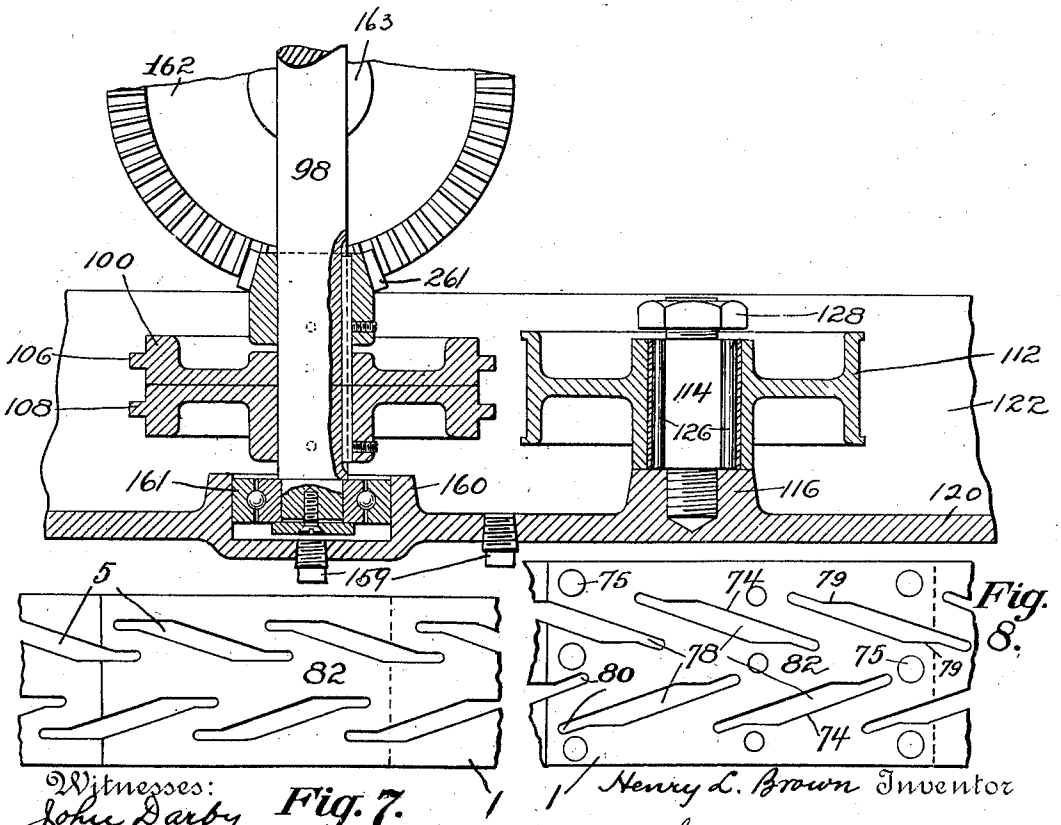

Fig. 8.

Fig. 7.

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6 SHEETS—SHEET 5.

Fig. 9.

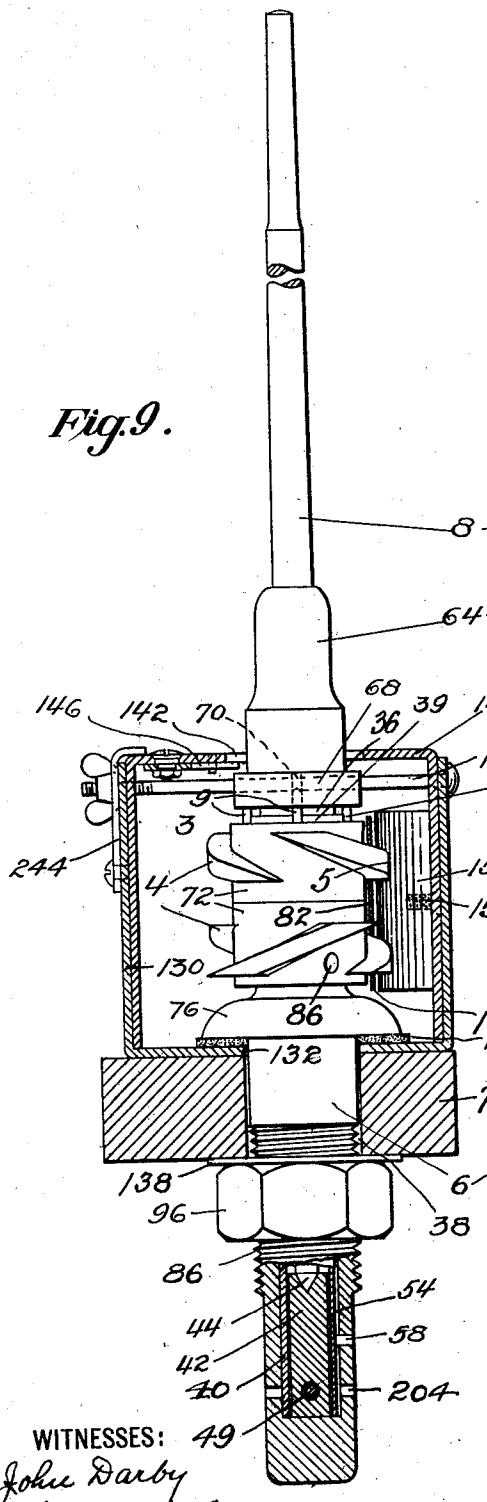
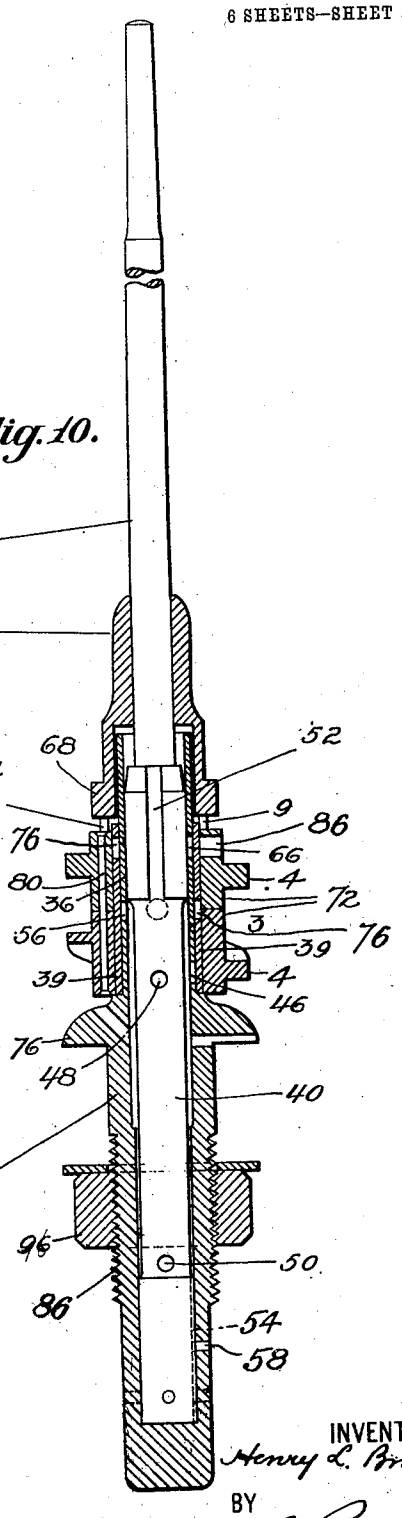


Fig. 10.



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6 SHEETS—SHEET 6.

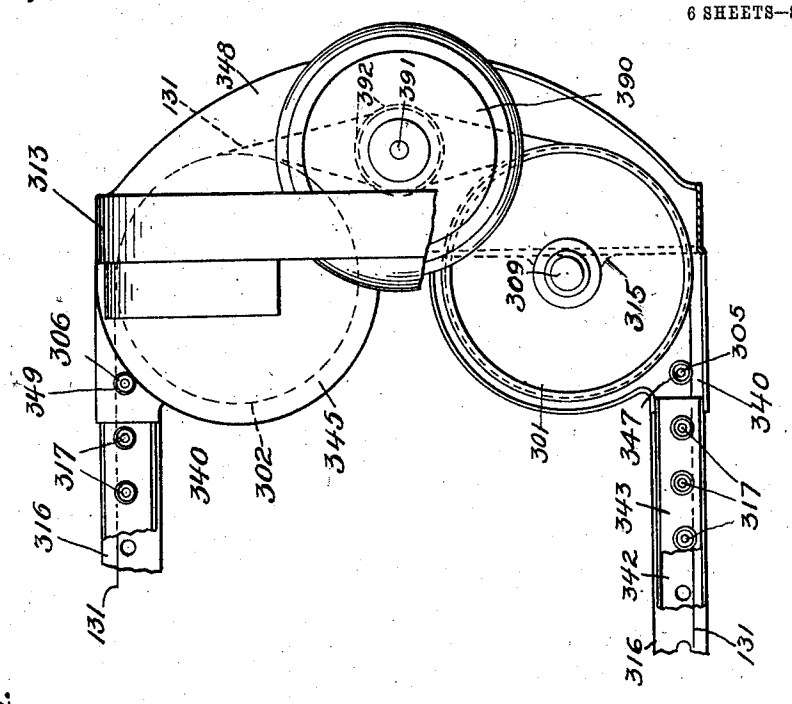
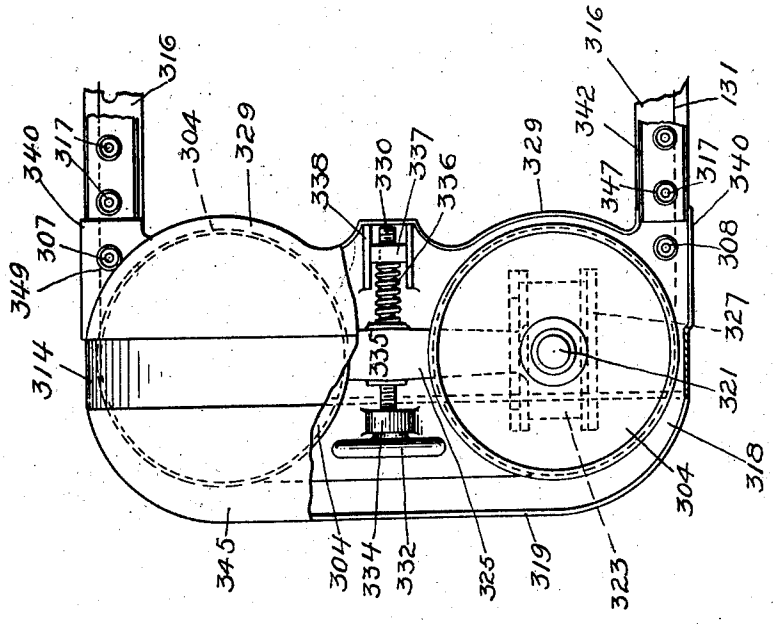


Fig. 11.



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UNITED STATES PATENT OFFICE.

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TEXTILE APPARATUS.

1,016,394. Specification of Letters Patent. Patented Feb. 6, 1912.

Application filed January 31, 1911. Serial No. 605,822.

To all whom it may concern:

Be it known that I, HENRY L. BROWN, of New York, N. Y., have invented certain Improvements in Textile Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like numerals on the drawings designating like parts.

This invention relates to textile apparatus, including machines for spinning, twisting, winding, and analogous treatment of fibers, fibrous materials and filaments, such, for example, as cotton, wool, flax, silk and artificial silk, and is of particular utility when embodied in spinning-frames, although I contemplate the use of my improvements in any field for which they are adapted by their nature.

The primary object of my invention is to provide apparatus for spinning, twisting or winding the yarn or other material continuously, without breaking, and preferably at a constant, predetermined speed, thus to produce a thread of a uniform number of turns to the inch and also of uniform size and smoothness, of high tensile strength, and free from slugs, bunches or knots; a further important object being to provide for the simultaneous production of any desired number of such threads of the same size and strength, so that the operation of the loom or sewing machine in which they are to be used will not be interrupted by the necessity for repairing hundreds of breaks in one or more weak threads running through the warp or spool, and creating imperfections therein. Such simultaneous production of a large number of uniform threads involves the positive actuation at high speeds of a multiplicity of spindles having whirls of relatively small diameter, arranged closely adjacent to each other in the spinning frame, and as at the present day no means for driving such spindles exists which combines the capacity of a flexible band to drive closely arranged small whirls at high speed, with the continuous and uniform actuation characteristic of positive gearing, an important object of my invention is to provide a machine, such as a spinning-frame, comprising a multiplicity of spindles, with a driving-band constructed and arranged to actuate all the spindles positively, in synchronism, in contradistinction to the usual methods of driving spindles by means of one or more bands or belts in frictional engagement with the whirls of the spindles. With few exceptions, the spindles in operation throughout the world, estimated at over one hundred million in number, are driven by such friction bands, and are subject to the disadvantages of operation inherent in frictionally operated actuating mechanism, including the friction due to lateral drag of the band upon the spindle, which should be confined as nearly as possible to one or two pounds when the band is properly set, but frequently runs up to three and four pounds and sometimes to seven or eight pounds when the operative is careless, with an increment of from .00075 H. P. to .00170 H. P. per spindle for each pound of band tension added to the bands, at the ordinary speeds ranging from 4000 to 8000 turns a minute. This increase of power consumed is expended in wear upon the bearings of the spindle-blades, bolsters and other contacting parts. The tension on a band is apt to increase largely during periods of inoperation, when the bands are free to contract. At a very common tension of three pounds, to which the bands of an ordinarily well attended frame may pull at any time under heavy moisture conditions, estimating 80 spindles to the H. P., the band tension has been estimated to consume over forty per cent. of the total power required by the whole frame.

Accordingly it is an object of high importance in my invention to eliminate the tension factor wholly, and this I accomplish preferably by gearing my improved band tangent to the spindle whirl, gear or sprocket wheel, with little or no pressure thereagainst.

Frictionally driven bands and other frictional driving means are liable to slip on the spindle whirls, in which event the spindle runs slow; if the band leaves the whirl, and engages with the spindle blade or a spindle part of smaller diameter than the whirl, the spindle speeds up faster than its neighbors.

Other sources of variation in speed exist, all of which are obviated by my positively geared flexible band.

Among other important factors contributory to the attainment of the above mentioned primary object is the elimination from the spinning operation of environmental influences of a character tending to cause variations in the speed of the spindles, among which influences the irregular absorption of oil by the driving means is included and also the absorption of atmospheric moisture, which varies rapidly often from hour to hour and causes corresponding variations in the tension of the driving bands in common use to actuate the spindles, these bands being made ordinarily of yarn or other hygroscopic or absorbent materials. Similar tensional or other speed changes are also induced by the lint, dust and other extraneous substances with which the bands become loaded and their weight and diameter altered, such substances sometimes finding their way also between the whirl and spindle base, if the latter is not kept properly clean, the friction thus caused increasing appreciably the power required to run the spindle affected, thus reducing its speed, so that it will then turn out a thread weaker than those from other spindles running at correct speed.

Heretofore, the exposed driving bands have been known to take up dirt and sediment to an extent necessitating an extra consumption of .003 H. P. per spindle, which would amount to over half a horse power for a frame of average size, and the bands have also been known to absorb sufficient moisture from the atmosphere during a rainstorm to increase by 10 per cent. the power required to drive them.

Another important object of my invention, therefore, is the inclosure of the driving-band whatever its character, in a suitable container serving to provide a constant environment, excluding extraneous substances, such as lint and dust, which load the exposed bands and belts, as noted above, the container serving also to eliminate the air currents which exposed bands and belts set up, to the detriment of the yarn or threads being spun, especially the higher counts, whose structure is delicate and easily impaired. The container serves also to prevent escape of lubricant, when used, and the band is also so guarded by the container that the persons and clothing of operatives are not endangered by it when in motion as in the case of all friction-bands in present use for spinning frames, which are left exposed.

My invention comprises the further object of providing a positively acting driving-band and actuating mechanism therefor of such construction and arrangement that existing apparatus, such as spinning-frames, may be equipped in the factories with but little alteration of the supporting structure, and at a cost permitting the change to be made as a measure of economy in operation as well as to gain the more uniform product resulting from positive operation of all the spindles in unison at constant speed, and free from the disturbances of product, entanglements and accidents to employees due to exposed driving bands of organic material.

A pump may also be provided.

The various features of my invention will be illustrated and described fully in the accompanying drawings and specification and pointed out in the claims, the same being in continuation of my copending application Serial No. 549,101, filed March 14, 1910, so far as said applications disclose common subject matter.

In the drawings, Figure 1 is a view in front elevation of a spinning frame in the construction of which my improvements have been embodied; Fig. 2 is a plan view of the spinning frame shown in Fig. 1; Fig. 3 is a view in end elevation looking from right to left; Fig. 1; Fig. 4 is a similar view of a modified form of end stand and related parts; Fig. 5 is a plan view on an enlarged scale of a portion of the spindle-rail shown in Fig. 1, with several spindles in place; Fig. 6 is a fragmentary detail view in vertical section, taken on the line x^6—x^6, Fig. 2, upon an enlarged scale and showing the portion of the driving shaft carrying the band-driving-gear; also one of the idler pulleys; Figs. 7 and 8 are respectively fragmentary views in front elevation of bands devised for driving my improved textile apparatus; Fig. 9 is a view in vertical, transverse section of one of the rails, taken upon the line x^9—x^9, Fig. 5, looking from left to right; the spindle being shown in elevation; Fig. 10 shows the spindle separately, in vertical section; Fig. 11 is a fragmentary view in plan similar to Fig. 2, showing a modified form of equipment for the driving mechanism of my improved textile apparatus.

In the embodiment of my invention selected for illustration and description herein to enable ready and complete understanding of my improvements, the part designated by the reference numeral 1 is a driving-band, and the numerals 2 designate spindles, which in accordance with my invention are constructed and arranged to be driven positively by the driving-band, for which purpose any suitable connecting means may be employed. As one convenient form of construction, I have shown each of the spindles as provided with a gear or whirl 3, having teeth 4 to enter driving apertures 5 in the driving-band 1, (see Figs. 7 and 8)

and each mounted to rotate upon an upright base 6, (see Figs. 9 and 10), carried by a rail 7 and within which spindle bases the spindle blades 8 are supported; the gears 3 being coupled to the blades 8 by prongs 9 so that when the band 1 moves lengthwise, it rotates the whirls 3 in synchronism, and the whirls 3 rotate the blades 8 by means of the prongs 9.

The term "spindle" is used herein broadly as a convenient brief designation for the unitary device which receives the material to be treated in an operation analogous to spinning, twisting, winding, spooling, quilling, reeling and similar rotative operations, and the term spindle is used without any limited technical signification, as are also the terms "rail", to designate the supporting structure common to the several spindles; "blade", to designate that part of each spindle which rotates and receives the material to be treated; "base", to designate that part of each spindle secured to the rail or support, and relatively to which the blade rotates; and "whirl", to designate any part of each spindle through which the blade receives rotative actuation from the lengthwise movable band, the expression "gear" being used frequently as a synonym for "whirl" where the operative relation of the coöperating actuative members renders the use of such an expression desirable. When so used the term "gear" is inclusive of such mechanical elements as spiral gears, worms, cogs, and sprocket wheels. The term "band" designates a substantially continuous, lengthwise moving member, not comprising such articulated structures as a sprocket chain, link belt, or jointed rack. The term "textile apparatus" is used to designate generically, machines of the class using spindle devices of all sorts, including spinning and other frames regardless of whether the yarn, thread or other material treated is to be used eventually in looms or sewing machines, or whatever may be its destination.

In the instance selected for illustration and description by way of example, the textile apparatus shown is a cotton-spinning-frame of well-known general construction, comprising an extended metal girder 10, upon which is formed the rail 7, the girder being secured by bolts 12 upon standards 16, 18 and 20, which support also the overhead rolls 22 and spools 24 from which the cotton is fed, and the ring-rails 26 with their traversing plungers 28, operating levers 30, and counterweights 32, all of which may be of any well-known or suitable construction; as also the cam-shafts 33, cam 35, worm-shaft 137 and shipping treadle 39; and as this part of the mechanism herein shown is of the ordinary type, familiar to those skilled in the art, no further description of the same is necessary and the detailed equipment is only shown on part of the frame, the equipment of the remainder involving mere duplication, and being omitted for the sake of clearness and simplicity in the drawings. Other related parts will be described briefly hereinafter. In order to equip such a frame for actuation of the spindles positively by a band, in accordance with my invention, the spindles 2 may, and preferably will, be provided with suitable whirls 3, band 1 and band-driving mechanism, and any suitable construction and arrangement of parts may be adopted for this purpose, the form of construction illustrated by way of example including spindles 2 of well-known type, in which the upper part 36 (see Figs. 9 and 10) of the base 6 has been prepared for my improved whirl by reducing the part 36 to a plain, cylindrical bearing-surface and by boring additional parts 46, 56 and 66 for lubricating purposes, but leaving substantially intact the usual flange 76 and threaded portion 86 provided with a nut 96 by which each such spindle is ordinarily secured within one of the holes 38 usually found in the rails 7. The reference numeral 39 designates a sleeve or bushing provided preferably between the base-neck 36 and the whirl 3, being rotatable independently of both, preferably, and serving as a compound bearing member, for which purpose it is shown as formed slightly longer than the whirl 3, to equalize the bearing surfaces. Brass is one suitable material of which to form the sleeve 39. The interior of the base may likewise be left substantially unchanged, whatever the type of spindle may be, usually, the spindle herein illustrated by way of example, containing a well-known form of bolster 40, having an adjustable step 42 for the foot 44 of the spindle-blade, and having lubricating holes 48 and 50 and grooves 52 and 54 also for lubricating purposes, and to permit the bolster to pass the retaining pin 58 near the bottom of the base. The numeral 49 designates a stud to hold the step 42 adjustably in the bolster part 40. Such interior construction is well understood by those skilled in the art, and is not essential to my present invention, nor is any special type of spindle-blade required, that shown at 8 being of a common and well-known type, tapered above and below, and provided with a sleeve 64 of the sort usually having a whirl formed integrally therewith, the material of the sleeve being preferably reduced to present a collar or shoulder 68 pierced with a plurality of holes, recesses or sockets 70, preferably parallel with the axis of the spindles, to receive the driving prongs 9, so that in instances where prongs are utilized, the driving engagement of the prongs 9 with the blade members 68 occurs at approximately the region occupied by

the ordinary whirl, adopting the location which has proved satisfactory in spinning practice heretofore, although I do not regard such location as indispensable, its adoption resulting merely from the desire to minimize the changes necessary for ready equipment of existing spinning-frames.

The whirl 3 may be of any suitable material and contour, and that shown herein by way of example comprises a plurality of annuli 72, upon which are formed teeth 4 of any suitable shape, being shown herein as helical, oppositely inclined on adjoining annuli to balance the thrust, and staggered to insure continuity of engagement of a plurality of the teeth 4 with the driving walls 74 of the aperture 78 in the band 1, at any given time. (See Fig. 8.) The annuli 72 are preferably secured together, as by the pins 80 indicated in Fig. 10 and the gear-teeth are preferably cut before hardening the metal of which they are formed. The general effect of such a pattern is that of a "herringbone", and the driving-band 1 may, and preferably will, have its driving apertures arranged in correspondence with the gear teeth 4, the herringbone pattern being more apparent to the observer in the band 1 than in the gear, the staggered arrangement of the gear-teeth 4, and their separation co-axially permitting the band 1 to be formed with a fairly wide, continuous medial web 82, as seen best in Figs. 7 and 8. Such a web adds to the tensile strength of the band and aids it to resist distortion laterally.

The whirls or gears 3 may be connected with the coupling prongs 9 in any convenient fashion, and in the instance illustrated by way of example, the prongs 9 are fitted to the gear permanently, and are of suitable diameter to have an easy slip-fit within the sockets 70 of the collar 68, the blade 8 being readily withdrawable from the spindle at will, while the gear 3 continues to rotate with the driving-band, ready to receive the blade 8 when the latter is replaced.

The coupling prongs or members 9 may be of any suitable number, material, size and arrangement, and as one convenient construction I have shown three equidistant prongs of wire, just long enough to insure their continuous engagement with the collar 68 of the blade 8 when the blade is at home in operative position upon its step 42, the length of the prongs 9 being preferably such that ordinary co-axial play of the whirl 3 will not cause disconnection of the prongs 9 and collar 68, and I may so arrange the length of the prongs 9 that when the blade 8 is dropped into place, the under face of the collar 68 will be engaged with the upper ends of the prongs 9, and their friction against the collar 68 will initiate rotation of the blade 8 until the speed of the latter is approximately that of the whirl 3, when the holes 70 in the collar will register with the prongs 9 and the blade 8 will fall by gravity to its step, and positive rotation of the blade 8 by the whirl 3 will ensue.

If desired the prongs 9 may be slightly resilient to avoid shock during the coupling operation.

I do not claim herein specifically the construction of spindle illustrated by way of example, inasmuch as certain features thereof form the subject matter of my co-pending applications Serial Nos. 536,681 and 594,960. So also I do not claim herein specifically the construction of driving band and gears, illustrated by way of example, inasmuch as certain features thereof form the subject matter of my aforesaid co-pending application, Serial No. 536,681.

The actuation of the driving-band 1 may be accomplished by any suitable mechanism for the transmission of power thereto, and as one convenient form of such mechanism I have shown an electric motor 90 preferably secured suitably to the end standard 16 by brackets 92 and bolts 94 (as seen best in Figs. 1, 2 and 3) this motor having a shaft 98 upon which is mounted a member or gear 100 engaged directly with the band 1, so that when the motor runs at, say, 1800 turns per minute, the blades 8 will be rotated positively, in unison, at say 9500 turns per minute, and the speed selected will remain constant regardless of moisture and temperature changes in the atmosphere, nor will an abnormal degree of moisture cause increased friction on the bearings, and accordingly if humidifiers are used in the spinning-room, its atmosphere may be charged with the maximum degree of moisture desirable for the most perfect condition of the material under treatment, without increasing the consumption of power over that actually required for spinning.

The band 1 and motor 90 may be connected for driving purposes by any suitable means, and as one form of such connection I have shown (see Fig. 3) the gear 100 fixed on the shaft 98 of the motor as having helical teeth 106, 108 in two series to fit the apertures 78 of the band 1, which may be led to and from the driving-gear 100 around any suitable direction devices, in accordance with the exigencies of various installations, as for example by the use of idlers 112 journaled on studs 114 mounted adjustably in bosses 116 in the top 120 of boxes 122 and 124 at the respective ends of the frame, the several bearings being provided preferably with suitable antifriction devices 126 and with fastening nuts 128.

I prefer, in accordance with another important possible object of my invention, to provide for a constant environment for the band 1, whatever its character, and for the

whirls 3, by inclosing them so that they will not be subject to atmospheric influences, nor accessible to foreign substances, and will also be guarded from contact with the persons and clothing of operatives. This inclosure of the band 1 and whirls 3 may be effected by any suitable means, and as one convenient form of construction for this purpose I have shown a container trough 130 of suitable material, preferably rolled sheet metal for the sake of lightness and strength, extended along the upper surface of the rail 7 and having apertures at intervals, as at 132 (see Fig. 9) to pass the spindle-bolsters 6, the latter being secured in place by the suitable means, such as the usual retaining nuts 96, while gaskets or washers 136, 138 of metal, such as iron or lead, or non-metallic material, such as leather, may be provided, if desired to aid in making a tight joint between the spindle 2, container 130 and rail 7.

The use of a metal band 1, as my preferred form of positively acting driving-band, permits me to exercise a wide choice of methods for lubrication of my spindles, inasmuch as it is no longer necessary to exclude the lubricant from access to the driving-band, but on the contrary free lubrication of the metal band is a desideratum, and as one convenient mode of lubrication to meet the changed conditions I have devised a novel system which I will now describe.

Briefly stated, I prefer to provide with lubricant the space inclosed with the band 1, whirls 3, and related co-acting spindle parts, and any suitable means may be adopted for this purpose. As one convenient form of such means, I may introduce a fluid lubricant, such as oil, to the container 130, whence it will flow through the spindle ports 46, to the spindle step 42, and the oil may be of a depth to reach one or more of the moving parts, such as the lower edge of the band 1, and as the latter moves at the rate of several thousand feet a minute, the oil will be sprayed over the co-acting surfaces of the band 1 and whirls 3 effecting perfect lubrication thereof.

I may provide the base 6 with ports 56 and 66 located suitably to enable the oil which is drawn up from the step 42 by rotation of the spindle blades 8 to gain access to the bearing between the bolster parts 36 and the bushings 39, and whirls 3 rotating thereon, and may provide the bushings 39 and whirls 3 with ports 76 and 86 respectively, through which oil may be driven by centrifugal force, the tendency of these rotating parts being to suck up oil from between the blade 8 and bolster 6, and also from between the whirl 3, bushing 39 and bolster part 36 and throw it out against the band 1 thus automatically setting up a constantly recurrent circulation over all the bearings, and the lengthwise movement of the band 1 completes the distributive action, which extends to the driving gear 100 and idlers 112. If desired, the idlers 112 and motor shaft 98 may be provided with anti-friction devices such as the rolls 126.

A suitable cover 140 is preferably provided for the container 130 and as one convenient form of cover, I have shown an inverted U-shaped trough similar to the container proper, and having apertures 142 to pass the spindle-blades 8 and collars 68, the collars 68 ordinarily standing wholly or partly below the lower edge of the cover as shown in Fig. 9 to throw off any oil which may creep up on the spindle blade 8. This cover 140 may be secured in place by suitable fastening means, such as the bolts 144, or spring clips 244, and may conveniently serve as the support for suitable retaining means, such as the turn-buttons 146 to be engaged with the collars 68 on the spindle-blades 8, to prevent displacement of the blades by accident, or when the bobbins 148 are being doffed. The cover 140 may also be provided with suitable guiding devices, such as the ribs 150 secured by screws 151 (see Figs. 5 and 9) serving as one form of means to prevent undue outward movement of the band 1 away from whirls 3 and out of mesh with the teeth 4. At each end of the container in order to make an oil tight joint for the end boxes respectively I prefer to provide a trough shaped casting 152 having a flange 153 coming opposite a similar flange 154 upon the end box, these flanges being secured together by bolts 155. The trough 130 enters the open free end of the member 152, the material of each part being reduced preferably somewhat to avoid undue thickness at the joint.

The casting 152 may be secured to the rail 7 as by the bolt shown at 156 in Fig. 1, and I may provide one or more idlers 157 upon studs 158 in this casting portion of the container, as shown in Fig. 2.

Considerable oil will be carried by the band into the end box, and I may and preferably do provide vents therefor, by plugs 159. One of these vents can be seen most readily in Fig. 6 directly under a circular flange 160, which serves as a retaining wall for an anti-friction bearing 161 with which the end of the motor shaft 98 is preferaby provided. The shaft 98 is also provided, preferably, with means to actuate the mechanism which operates the ring rail, and as one convenient form of device for this purpose, I have shown a bevel gear 261 upon the shaft meshing with a vertical bevel gear 162 upon a shaft 163 mounted in bearing 164 having a pinion 165 in engagement with a gear 166, which has upon its hub a sprocket wheel 167 connected by a sprocket chain 168 with another sprocket

wheel 169 upon worm shaft 170 which meshes with a gear 171 upon the shaft 33 which operates the cam 35 hereinbefore described, to raise and lower the ring rail 26, in a manner too well known to require further description.

The gear 166 meshes with a gear 172 best seen in Fig. 3, which actuates the gearing 174 (see Fig. 1), by which the drawing down rolls 22 are actuated, this arrangement being of well known construction and not requiring detailed description herein. A similar gear 272 is also actuated by the large gear 166 to operate the drawing-down rolls on the front of the spinning frame.

In order to condense the operating parts of the frame as much as possible, I may, and prefer to, utilize a modified form of actuating mechanism for the ring rail and the drawing down rolls, the same being shown in Fig. 4, and comprising a worm 180 upon the motor shaft 198 in mesh with a worm-wheel 181 upon a counter shaft 182 carried by the end-stand 183, this shaft being provided with a gear 184 having helical teeth of the type shown on the gear 100, suitable to coöperate with a band 185, running to a gear 186 forming part of the train which actuates the drawing down rolls. A gear 286 is also provided on the shaft 182, and is engaged with a gear 187 having on its hub a gear 287 with spiral teeth engaged with a band 188 running to a gear 189 which actuates the drawing down roll train upon the other side of the spinning frame, in reversed direction to that already described.

A gear 190 on the worm shaft 191 which operates the cam for the ring rail motion is shown toward the bottom of Fig. 4, and is engaged with a gear, not shown, upon the shaft 182 behind the worm-wheel 181. Idlers 195 provide one convenient form of means for taking up the driving bands just described.

The numeral 1900 designates the electric motor used preferably for driving the frame.

I have shown in Fig. 8 means for connecting the band, such connection being made in any suitable fashion, one convenient form being to provide rivets 75 passing through the overlapping ends of the band, the rivets preferably being flattened out as indicated to distribute the wear, and the ends of the band being preferably filed or ground off or chamfered to reduce the thickness at the region of the joint, although considerable additional thickness does not interfere with the operation of the band. Care must be exercised to have the apertures 78 registered exactly in the overlapping parts, so that the inclined driving surfaces 74 will register properly, and the shoulders 79, the latter being parallel with the line of movement of the band. The numeral 80 indicates extensions of the apertures 78 to provide clearance for the ends of the teeth 4 on the whirls, and the driving walls 74 are preferably staggered so that their engagement with the said teeth is continuous.

In Fig. 7 I have shown a somewhat different form of band, the characteristics of which appear clearly in the figure and do not require detailed description at this time. Each of the bands has a continuous web 82 through the center and may be driven in either direction by the gear 100, and will in turn serve to drive gears or whirls 3 in either direction and the spindles therewith.

Any suitable means may be provided to furnish fluid lubricant under pressure, as for example the storage tank 196 which may be provided with a rotary pump 198 connected by a pipe 199 with the trough as at 200, and also with the end box as at 201, the tank 196 having suitable conduits 202 connected by couplings 203 with the spindles which may have apertures 204 to permit the entrance of the lubricant by gravity or under pressure from the pump 198. The pump may be driven in any suitable manner as for example by means of a connection 205 with the rolls 22.

I do not claim herein specifically the construction of lubricating apparatus illustrated by way of example, inasmuch as the same forms the subject matter of my copending applications Serial Nos. 436,772 and 549,101.

At 210 I have shown a switch for controlling the motor to which conductors may be led in conduits 211, 212, 213.

Where it is possible to carry the band around direction pulleys or idlers of relatively large diameter I prefer to do so on account of the relatively low speed of pulleys, and in Fig. 11 I have shown sufficient portions of a frame to permit a ready understanding of the construction, arrangement and operation of apparatus embodying four direction pulleys, the diameter of these being approximately fifteen inches as I have found that size satisfactory in practice, the band conforming to that circumference without deterioration at the high speed of three thousand feet per minute.

The general construction of the frame shown partly in Fig. 11 may, and preferably will, be substantially like that already illustrated and described with reference to the frame shown in Figs. 1 to 10, and accordingly I have shown only the end-stands with their related parts, and connected portions of the spindle rail and the container for the driving band, which I will now describe.

It is desirable that the motor and direction pulleys shall have as little extension as possible beyond the end-stands, and on the other hand that the number of spindles usually in such frames shall not be

diminished by the equipment with my improvements, and accordingly for the purpose of meeting these requirements, I place the direction pulleys 301, 302, 303 and 304 as near as possible to the spindles 305, 306, 307, 308 nearest the corner of the frame at which the respective direction pulleys or idlers are situated. In the instance illustrated, the distance between the first spindle 305 at the lower right hand corner of the frame, and the adjacent idler 301, is ample, and the bearing 309 for that idler may be supported from the inner side of the end-stand 313 with which the boss 315 may be cast as an integral structure, the stud which constitutes the bearing axis being set therein in any suitable fashion. So also, the idler 302 indicated by dotted lines in the upper right hand corner of Fig. 11 will be supported similarly at the other side of the end-stand 313, and the band 131 will be carried across upon these pulleys the peripheries of which are tangent to that part of the run of the band which extends along the rail 316 in operative relation with the spindles upon latter, to which spindles I have given for the sake of convenience the reference numeral 317 except those already numbered 305, 306, 307, 308. The band thus arranged may be actuated by any suitable mechanism, and as one convenient form of mechanism for this purpose I have shown, and prefer to utilize, a prime mover, having a rotary member which can be geared directly to the driving band, and for this purpose I have shown an electric motor 390 having a shaft 391 provided with a gear 392 of the type already described with reference to the motor illustrated with reference to Figs. 1 to 10 inclusive, this gear being engaged positively with the band 131, so that the motion of the armature shaft is transmitted directly and positively to the spindles.

I prefer to locate the motor with the axis of the shaft 391 substantially in a line tangent to the idlers 301, 302 as illustrated in Fig. 11, inasmuch as this arrangement permits the direction of rotation of these bands and spindles to be reversed readily according as the band 131 is placed toward the front of the gear 392 or at the rear thereof, and the speed of actuation of the band may likewise be changed readily by changing the gear 392 for one of larger or smaller diameter, or a plain driving pulley of large diameter may be used advantageously at times, owing to the large surface engaged frictionally. For the purpose of facilitating such changes by slackening the band, and for the general purpose of controlling the tension of the band, I prefer to provide suitable means of any convenient sort. One convenient type of device for that purpose comprises an arrangement of one or more of the idlers so that they can be moved substantially in parallelism with the operative run of the band, and as a convenient construction to permit such adjustment, I have shown the idlers 303 and 304 as mounted upon studs 321 carried by sliding bearing blocks 323 connected by a cross bar 325, preferably, so that the adjustive movement of these idlers will be uniform and in synchronism with each other. To maintain the alinement of the adjustive movement with the line of movement of the band 131, I have shown guides 327 to receive the blocks 323, these guides being shown as carried by a member 318 which may be constituted by the bottom of a casing 319 cast integrally with the end-stand 314 of the frame. I prefer to provide also suitable means to place the band under a yielding tension, and any suitable means may be provided for this purpose. As one such means, I have shown a screw shaft 330 rotatable by means of a hand-wheel 332 within a bearing post 334 extending upward from the casing 319, and passing through the member 325 at 335, the screw shaft 330 being provided with a coil spring 336 interposed between the portion 335 and a nut 337 engaged with the threaded portion of the shaft 330. Slideways 338 are shown to prevent rotation of the nut upon the shaft when the latter is turned by the hand-wheel 332. Rotation of the hand-wheel toward the right will therefore draw the nut 337 toward the operator, and will take up the slack in the band 131, the spring 336 holding the band at the desired tension, according to the amount of rotation of the shaft 330 by the hand-wheel 332.

Preferably the casing 319 will be extended as at 329, to inclose the inner portion of the idlers 303 and 304, and the casing may have gateways 340 lying upon the rail 316, and serving to make a suitable joint with the trough 342 which I prefer to provide as a container for the lubricant used upon the band 131, and spindle whirls 347, the trough having preferably also a cover 343 which completes the inclosure of the actuating parts of the spindles, while a cover 345 serves to complete the inclosure of the idlers 303 and 304. Similar covers 345 and 348 are provided to complete the inclosure of the idlers 302, etc., in connection with the end-stand 313.

It will be observed that the end spindles 305, 306, 307, 308 are situated in the gateways 340, and the portion of the cover at this region will therefore preferably have apertures 349 to pass these spindles.

The form of spinning-frame illustrated in Fig. 11 may be constructed with but slight change in the patterns of the end-stands and substantially without any change in the remainder of the spinning-frame, except the elimination of parts such as the "tin drum," driving bands and their related parts no

longer required after equipment with my improved positive band drive, and the operation of the form of mechanism illustrated in Fig. 11 is substantially identical with that heretofore described with reference to the mechanism described with respect to Figs. 1 to 10 inclusive.

It will be noted from Figs. 1, 2, 7 and 8 that the band is driven by engagement of the teeth 106, 108 with the inner walls of the band's driving apertures 78, but the band drives the whirls 3 by engagement of the outer walls 74 of the band's driving apertures, and thus the wear is distributed, an important factor in the economical operation of my improved textile apparatus.

Having illustrated and described my invention thus fully, and suitable means by which the same may be put into practice I wish it to be understood that I do not limit myself to the specific materials and constructional forms selected for illustration and description herein by way of example, nor do I limit myself in general otherwise than as set forth in the claims, read in connection with this specification.

What I claim as new, and desire to secure by Letters Patent of the United States of America, is:—

1. Apparatus for treatment of fibrous materials and filaments, such as for spinning cotton; said apparatus comprising a multiplicity of rotatable spindles to receive and treat said materials, and an endless flexible, metal band, flat throughout its length, and geared with said spindles to drive them positively.

2. Apparatus of the class described, for treating fibrous materials and filaments; said apparatus comprising a plurality of spindles provided respectively with actuating members comprising each a plurality of peripheral actuating projections; a support for said spindles; and a metallic band provided with means to engage said projections successively, and to be engaged progressively with successive portions of each actuating projection, said progressive engagement with each projection continuing until engagement has been initiated with a succeeding projection on the same actuating member, to rotate said spindles positively; substantially as described.

3. Apparatus of the class described for treating fibrous materials and filaments; said apparatus comprising a plurality of spindles; a support therefor; a metal band constructed and arranged to operate said spindles positively; actuating means on said band; and means to surround said band, spindles and actuating means at the region of operative engagement therebetween to prevent escape of lubricant, and also to prevent injury to operatives by escape of said band in the event of accidental displacement thereof; substantially as described.

4. Apparatus of the class described; said apparatus comprising a plurality of spindles, and members on, and to rotate with, said spindles, said members being provided respectively with peripheral teeth; a support for said spindles; a metal band, flat throughout its length, constructed and arranged to engage said teeth positively and progressively, to rotate said spindles; and means to lubricate said operating parts; substantially as described.

Signed at New York in the county and State of New York this 30th day of January, 1911.

HENRY L. BROWN.

Witnesses:
ALEXANDER C. PROUDFIT,
ELVA D. FOLLETT.