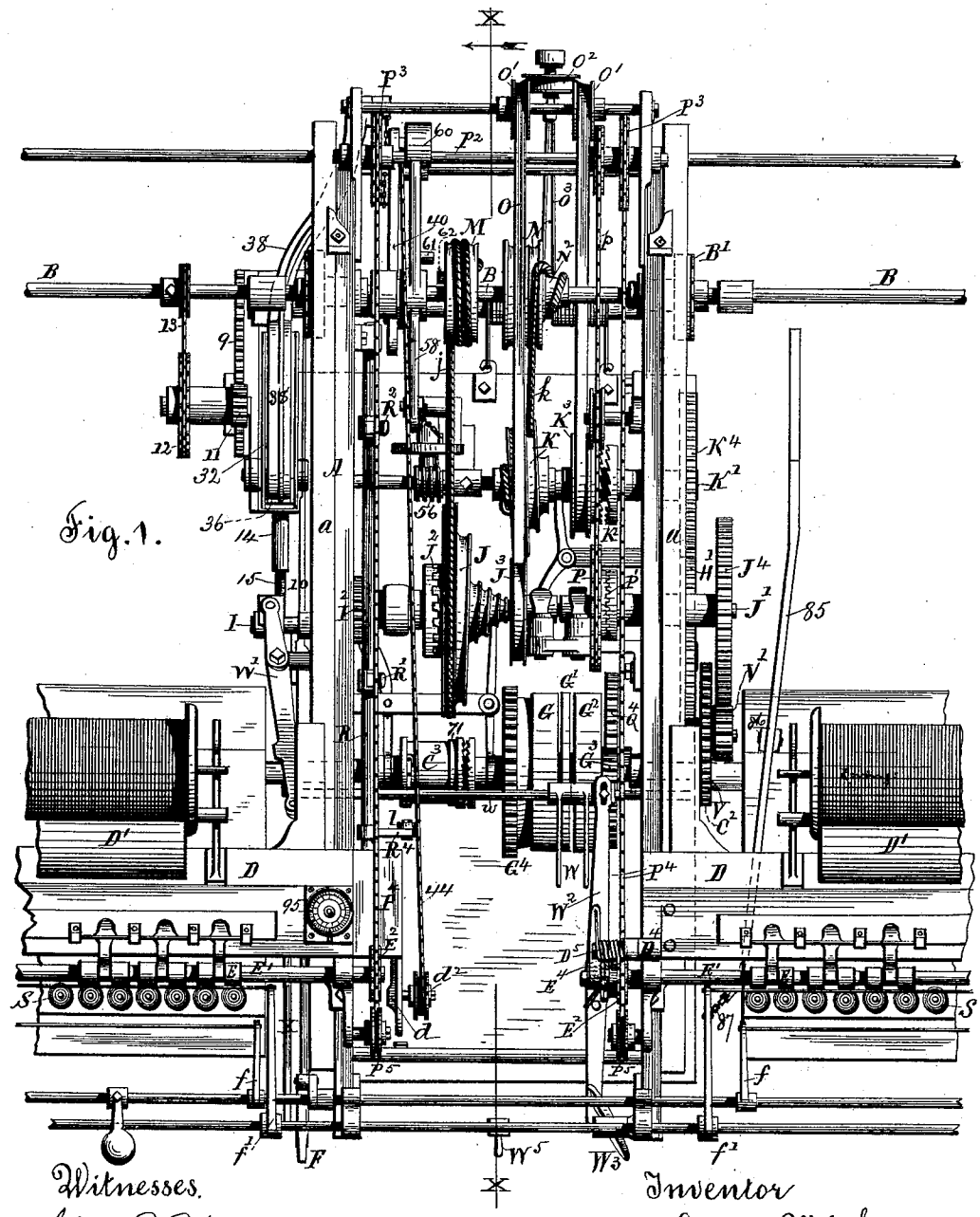
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E. WRIGHT.

SPINNING MULE.

No. 411,082. Patented Sept. 17, 1889.

Fig. 1.



Witnesses.
Ella P. Clemens
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E. WRIGHT.

SPINNING MULE.

No. 411,082. Patented Sept. 17, 1889.

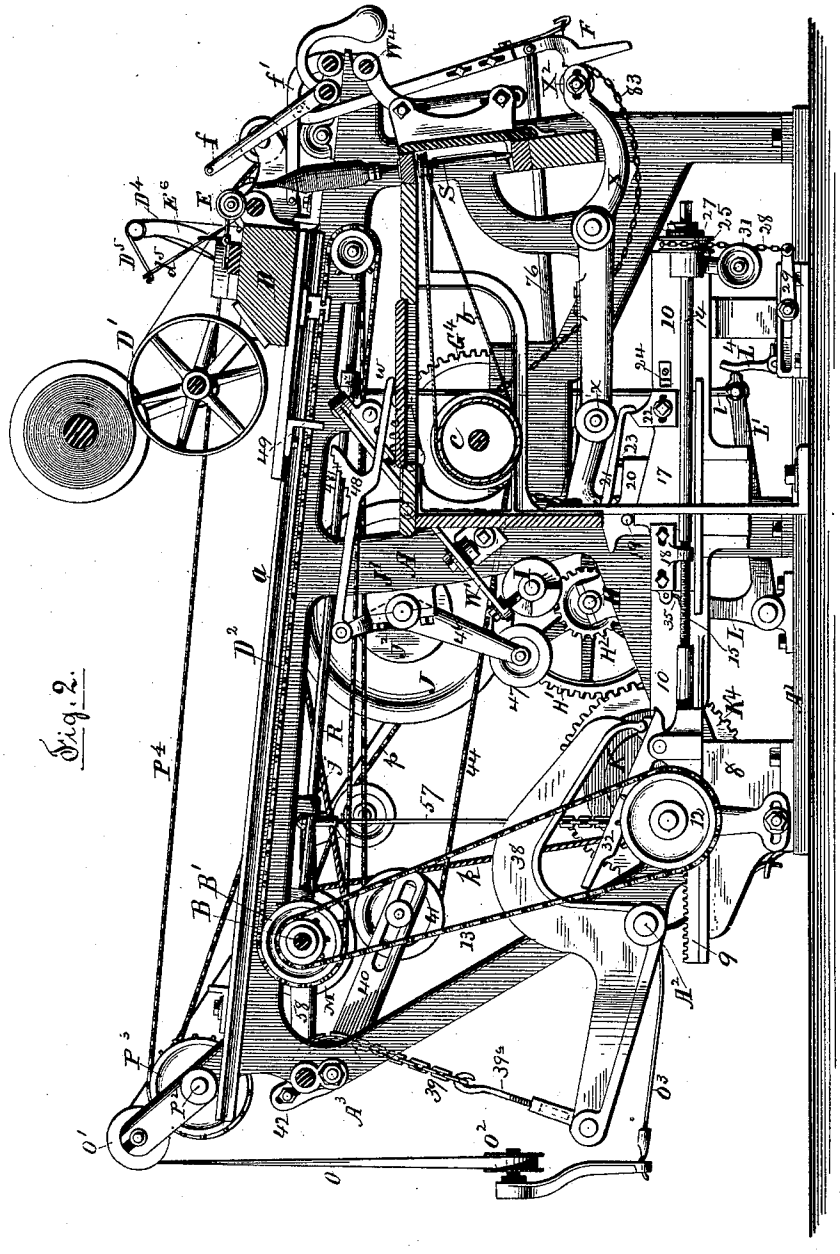


Fig. 2.

Witnesses:
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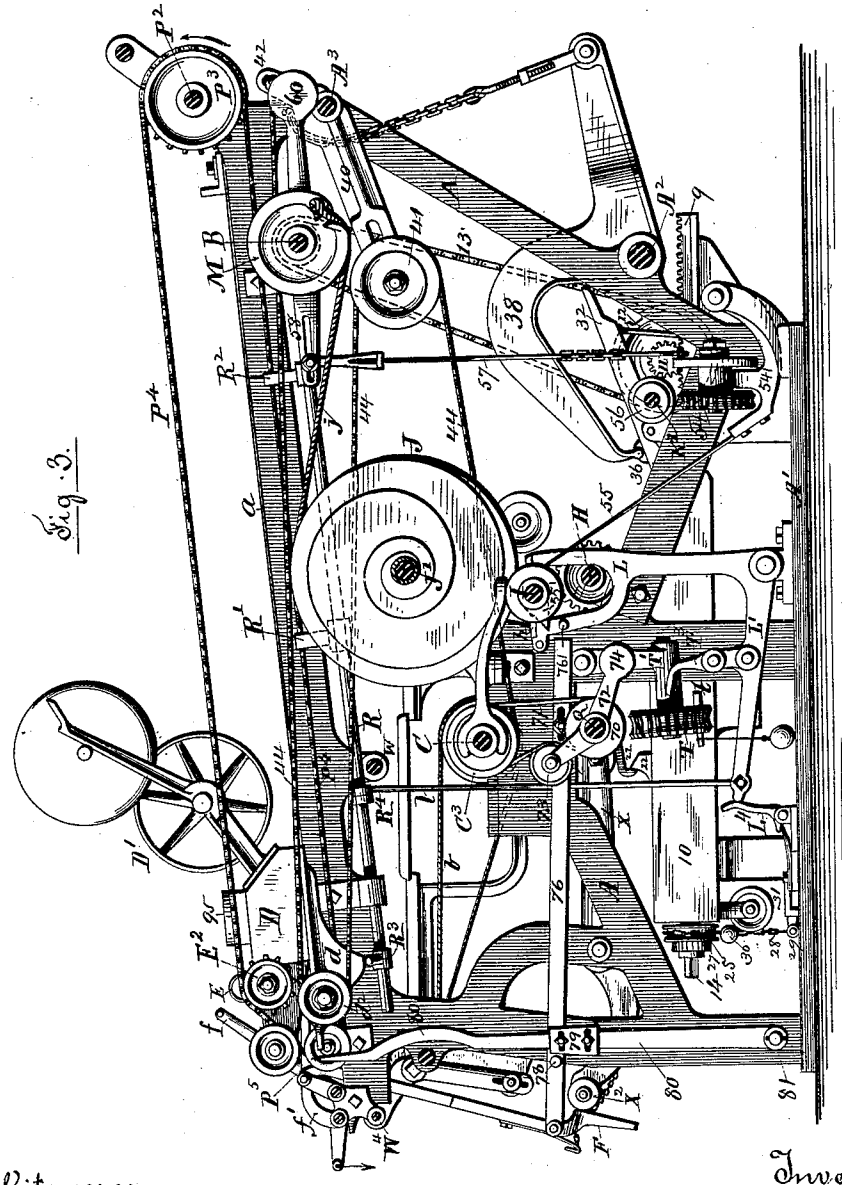
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E. WRIGHT.

SPINNING MULE.

No. 411,082. Patented Sept. 17, 1889.

Fig. 3.



Witnesses
Chas. F. Schmelz,
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E. WRIGHT.

SPINNING MULE.

No. 411,082. Patented Sept. 17, 1889.

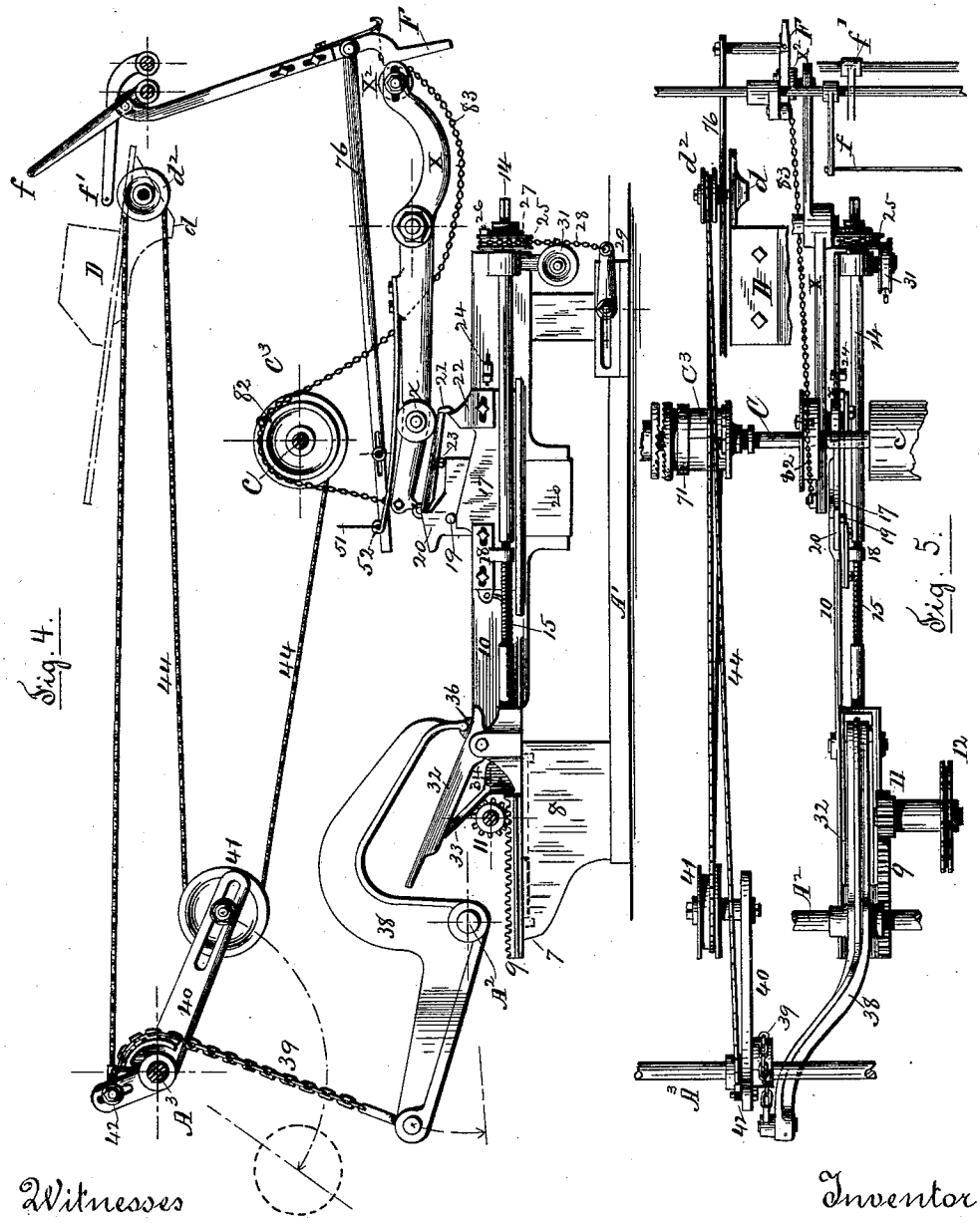


Fig. 4.

Fig. 5.

Witnesses
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E. WRIGHT.

SPINNING MULE.

No. 411,082. Patented Sept. 17, 1889.

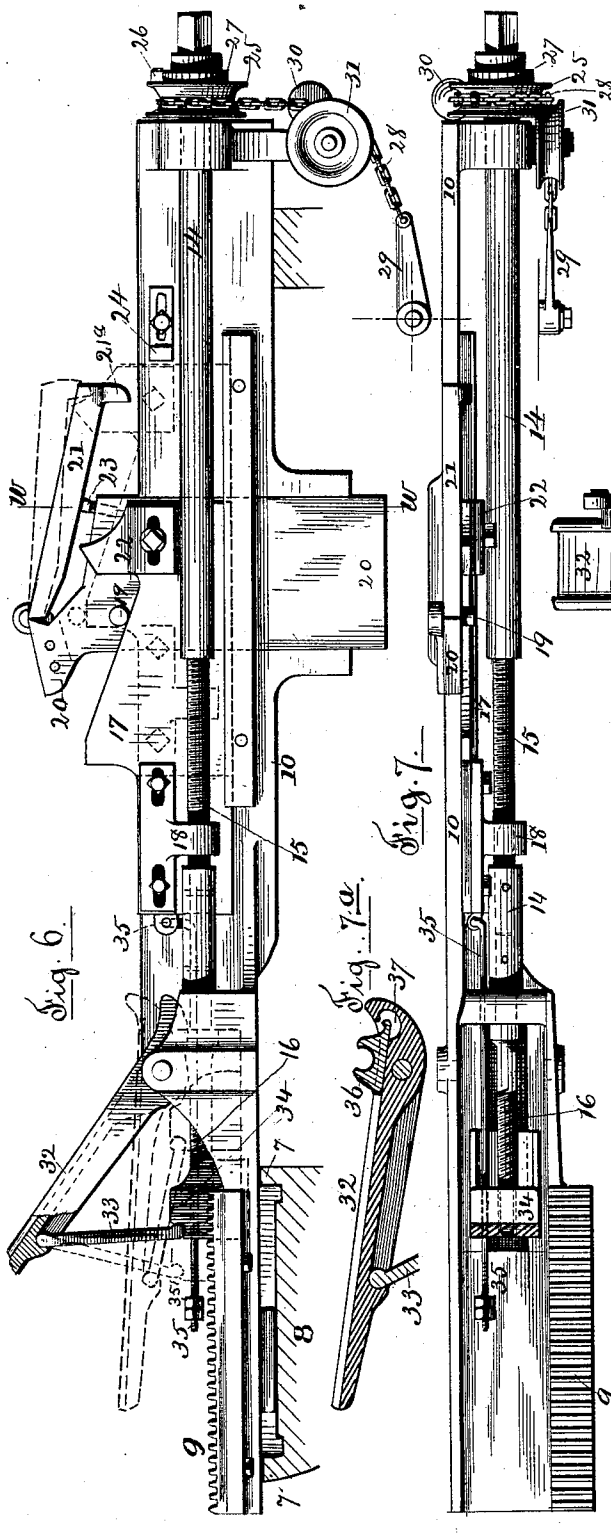


Fig. 6.

Fig. 7.

Fig. 7.a.

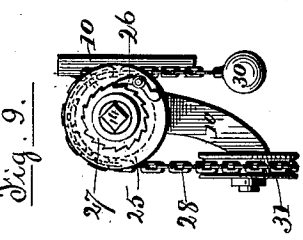


Fig. 9.

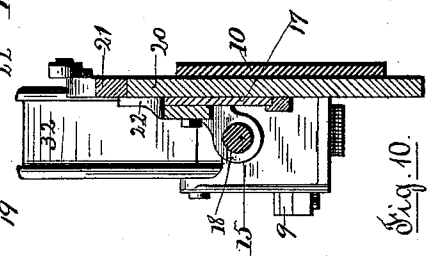


Fig. 10.

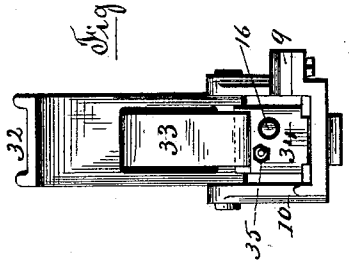


Fig. 8.

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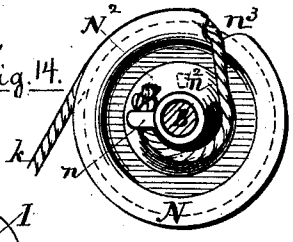
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E. WRIGHT.

SPINNING MULE.

No. 411,082. Patented Sept. 17, 1889.

Fig. 14.



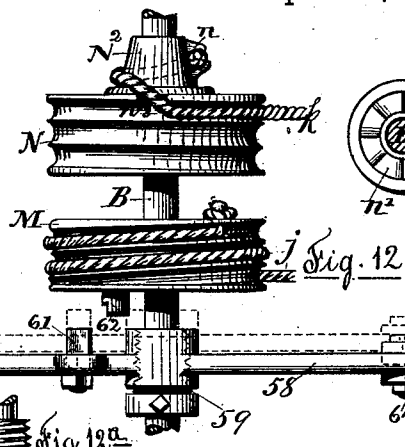


Fig. 15.

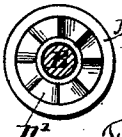


Fig. 12.

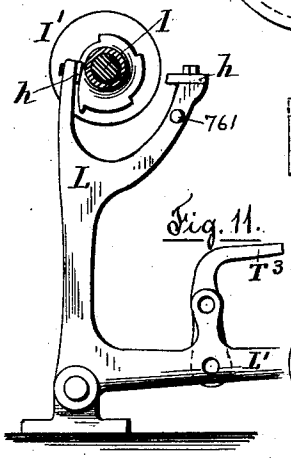


Fig. 11.

Fig. 12a.



Fig. 13.

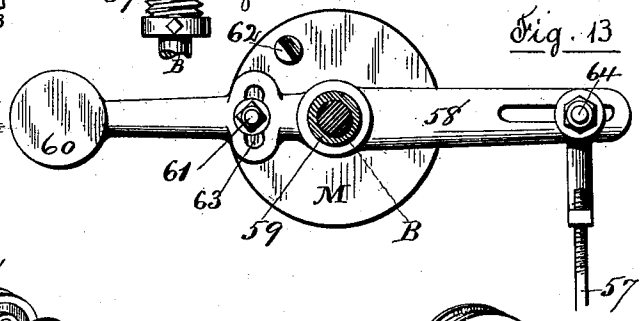
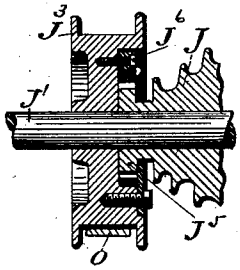


Fig. 18.



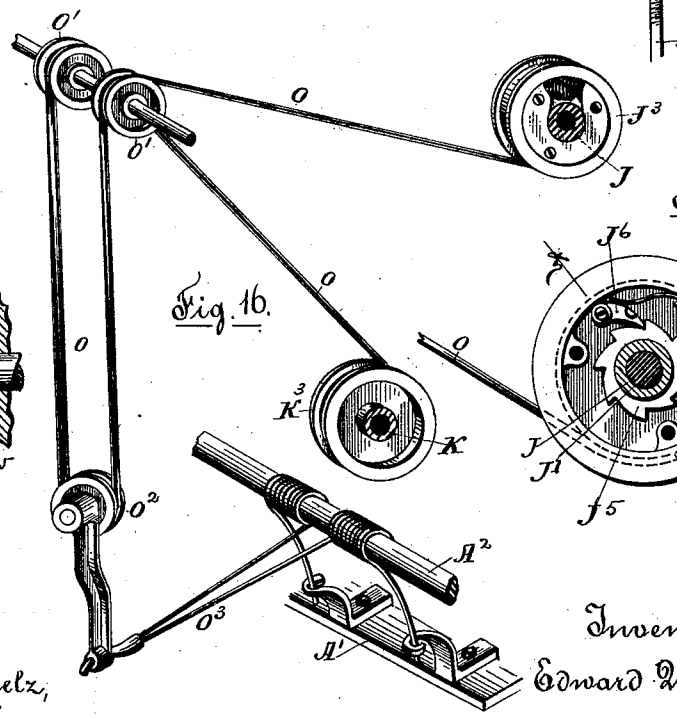


Fig. 17.

Witnesses
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E. WRIGHT.

SPINNING MULE.

No. 411,082. Patented Sept. 17, 1889.

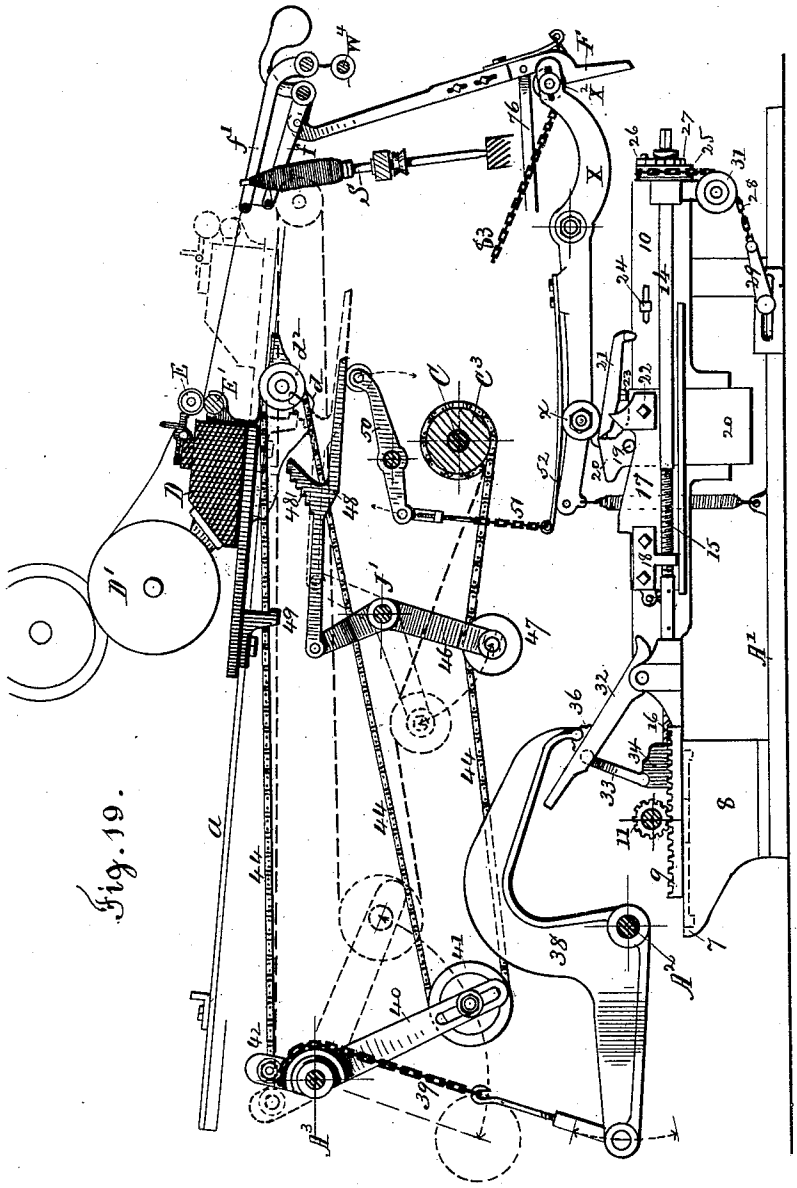


Fig. 19.

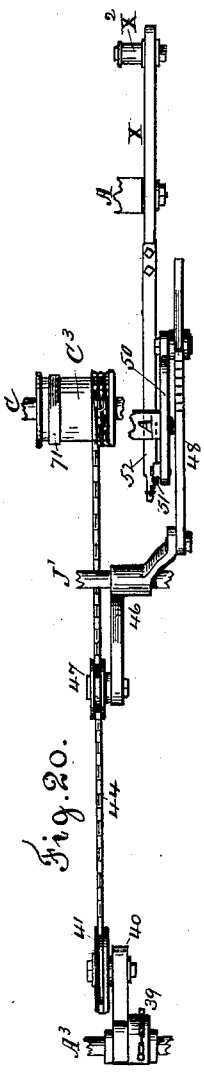


Fig. 20.

Witnesses.
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(No Model.) 10 Sheets—Sheet 8.

E. WRIGHT.

SPINNING MULE.

No. 411,082. Patented Sept. 17, 1889.

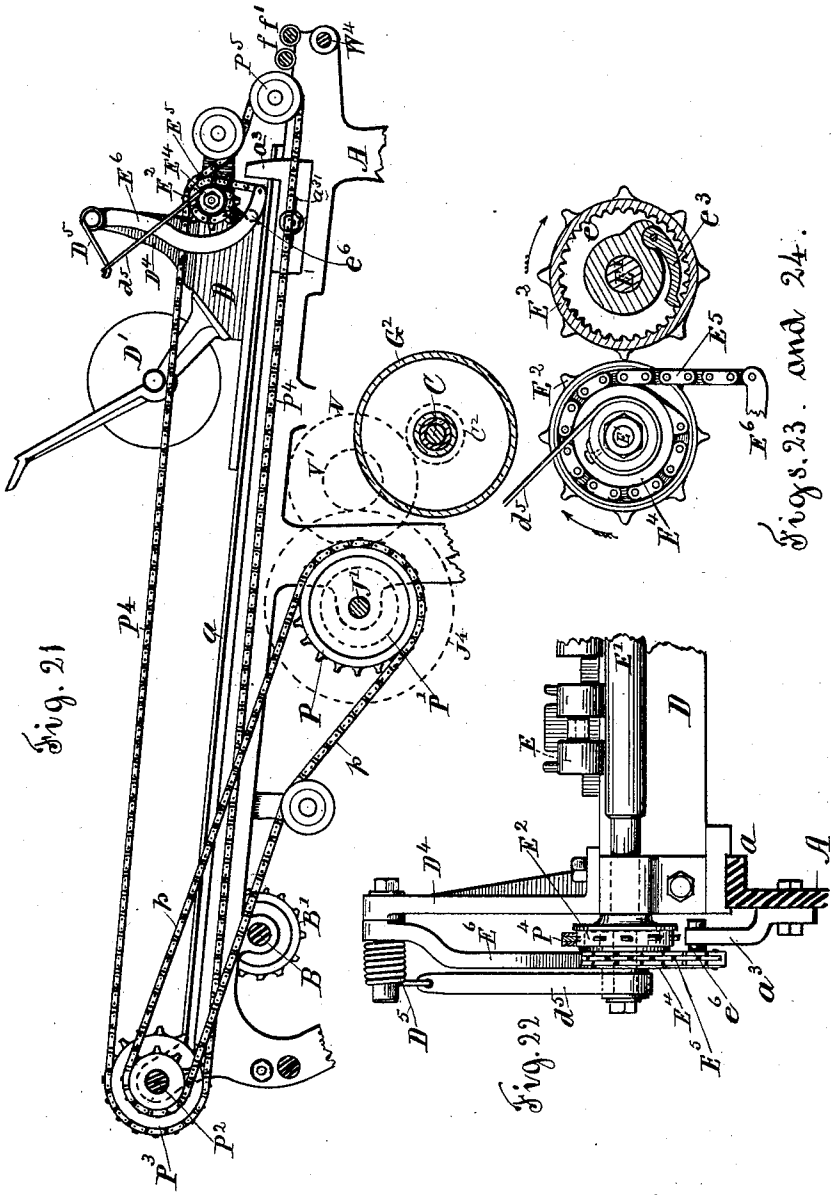


Fig. 21

Figs. 23 and 24.

Fig. 22

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(No Model.) 10 Sheets—Sheet 9.

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SPINNING MULE.

No. 411,082. Patented Sept. 17, 1889.

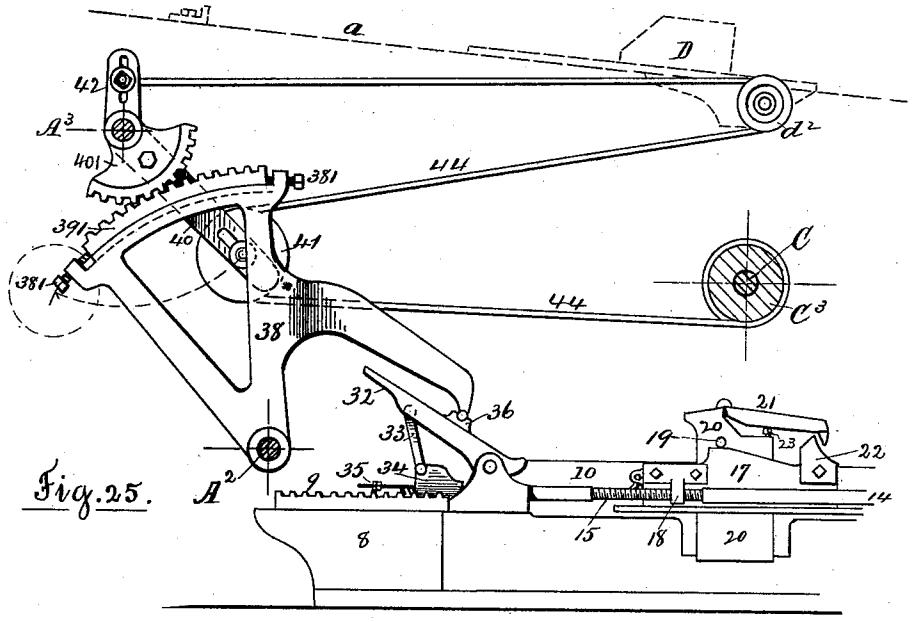


Fig. 25.

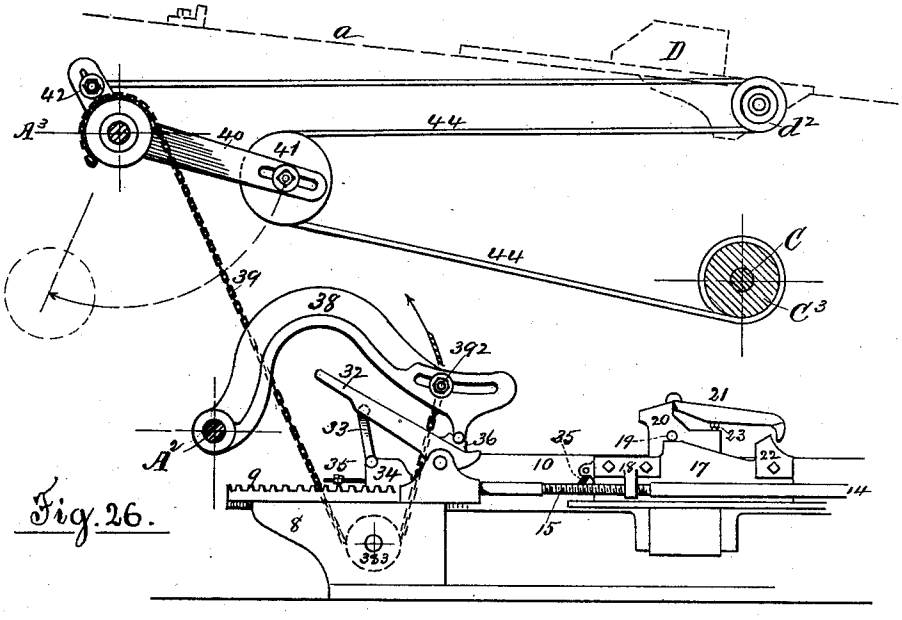


Fig. 26.

Witnesses.
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(No Model.) 10 Sheets—Sheet 10.

E. WRIGHT.

SPINNING MULE.

No. 411,082. Patented Sept. 17, 1889.

Fig. 27.

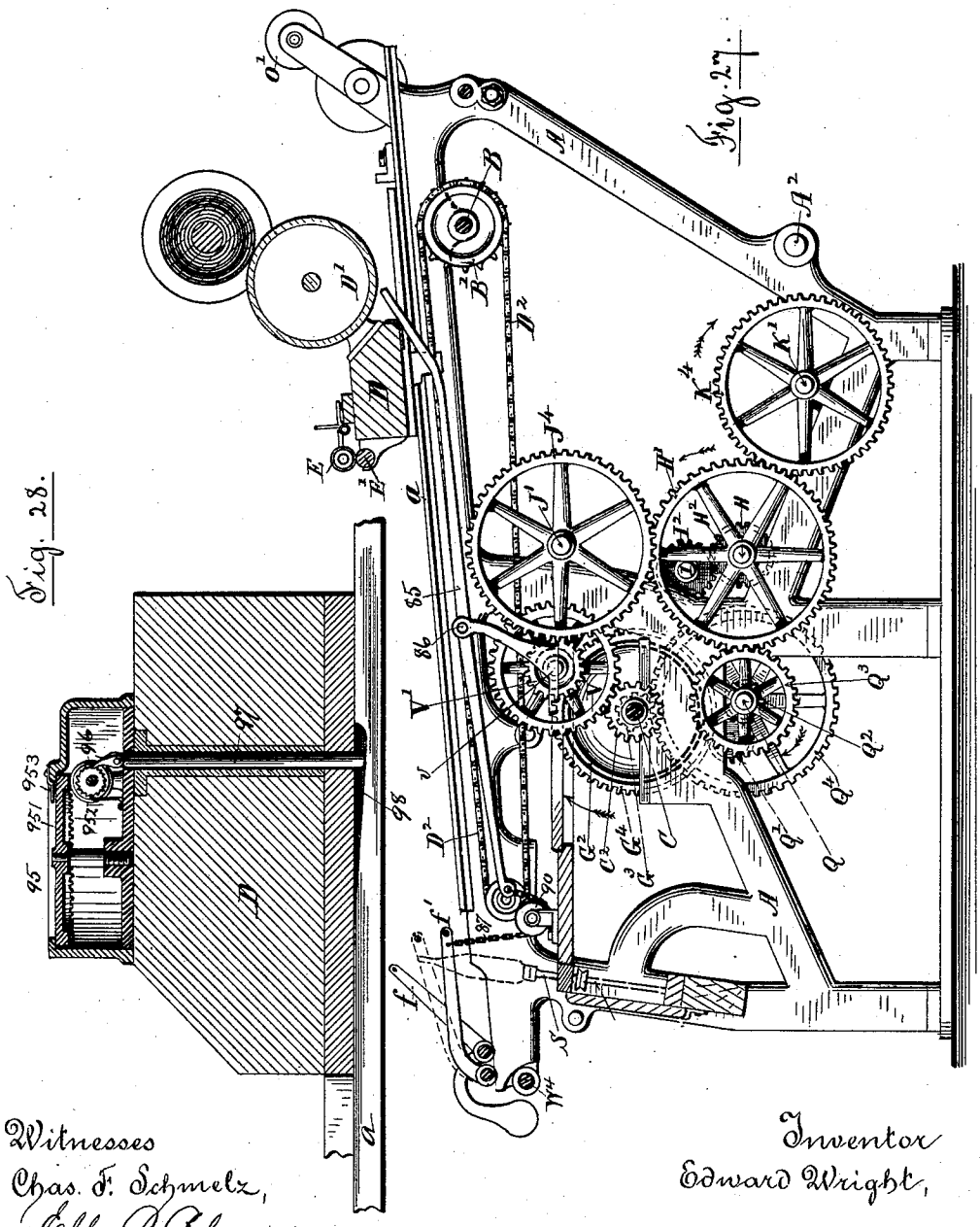


Fig. 28.

Witnesses
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UNITED STATES PATENT OFFICE.

EDWARD WRIGHT, OF WORCESTER, ASSIGNOR TO THE DAVIS & FURBER MACHINE COMPANY, OF NORTH ANDOVER, MASSACHUSETTS.

SPINNING-MULE.

SPECIFICATION forming part of Letters Patent No. 411,082, dated September 17, 1889.

Application filed November 7, 1888. Serial No. 290,231. (No model.)

To all whom it may concern:

Be it known that I, EDWARD WRIGHT, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Spinning-Mules, of which the following, together with the accompanying drawings, is a specification sufficiently full, clear, and exact to enable persons skilled in the art to which this invention appertains to make and use the same.

My present invention relates to improvements in spinning-machines designed for spinning wool and similar fibrous material, the same being more especially adapted to that class of machines described in Letters Patent No. 370,840, heretofore granted to me, wherein the roving-drums and roving-delivering rolls are supported on a movable beam or carrier which travels toward and from the revolving spindles for giving the stretch when spinning and for winding the yarn upon the bobbins.

The object of this invention is, generally, to further improve and perfect the machine and to provide mechanism of superior efficiency and practical utility for the purposes intended.

The several features of my present invention and improvements are particularly pointed out and explained in the following description, the subject-matter claimed being hereinafter definitely specified.

It will be understood that some of my improvements may be employed in spinning-machines without the others, as in any case it is desired.

In the drawings, Figure 1 is a plan view of the operating-head of a spinning-machine embracing my improvements. Fig. 2 is a side elevation of the same, the spindle-supporting frame being shown in section. Fig. 3 is a vertical section through the operating-head at line X X on Fig. 1, looking in the direction of the arrow. Fig. 4 is a side view showing the details of the cop-builder and winding-chain mechanisms. Fig. 5 is a plan view of the same. Fig. 6 is a side view of the cop-builder frame or carrier and the mechanism mounted thereon, drawn to a scale somewhat larger than the preceding figures. Fig. 7 is a plan view of the parts shown in Fig. 6 with the adjusting incline or hinged guideway removed. Fig. 7ª is a longitudinal section of the adjusting inclined guide and slide shoe. Fig. 8 is a rear view of the cop-builder carrier and adjustable guide. Fig. 9 is a front view of the feed-ratchet for the cop-builder-adjusting shaft. Fig. 10 is a section at line *w w* on Fig. 6. Fig. 11 is a side view of the escapement-lever. Fig. 12 is a plan view of a portion of the back shaft, showing the auxiliary scrolls, scroll-rope holder, and easing-in lever. Fig. 12ª is a separate view of the screw-hub on which the easing-in lever is mounted. Fig. 13 is a section of the shaft, showing the side of the easing-in lever and the disk carrying the engaging-stud. Fig. 14 is an end view showing the adjustable scroll-rope holder for the auxiliary scroll. Fig. 15 is a view of the inner face of the scroll-rope holder. Fig. 16 is a detail view of the compensating tension mechanism for the scroll-ropes and operating-scrolls. Fig. 17 shows the take-up device for the draft-scroll tension mechanism. Fig. 18 is a longitudinal section through the take-up devices and end of the draft-scroll. Fig. 19 shows in side elevation detail of mechanism for taking up the winding-chain and tightening the wind of yarn at the completion of the bobbins. Fig. 20 is a plan view of the take-up levers and cop-builder arm shown in Fig. 19. Fig. 21 is a side view of mechanism for starting the roving-delivery rolls before the roll-beam reaches its forward limit of movement. Fig. 22 is a front view of such starting devices, drawn to somewhat larger scale. Figs. 23 and 24 show an end view and section of the operating-wheel and ratchet employed in the starting device for the roving-delivery rolls. Figs. 25 and 26 show modifications in the construction and manner of connecting the quadrant-arm, quadrant-operator, and cop-building mechanism. Fig. 27 is a side view of a device for holding down the counter-faller while backing off and the train of gearing for operating the various shafts; and Fig. 28 is a section of the roll-beam and indicator, showing devices for operating the same.

In my illustrated machine the operating mechanism, disposed in as close and compact a manner as convenient, is located at a central position, while the spindles and roving-drums are arranged on suitable frames that extend to the right and left from this central operating-head to a sufficient distance to accommodate the desired or given number of spindles. As this extension and multiplication of spindles and drums will be well understood, only a few of the spindles are shown in the present drawings, as in Fig. 1.

Referring to parts, A denotes the main frame, upon which are mounted bearings for supporting the various shafts and operating parts.

B indicates the back shaft, which extends throughout the length of the machine and is provided at intervals with sprocket-wheels B′, carrying the chains D^2, by means of which the roll-beam or roving-drum carrier D is moved forward and back.

C indicates the cylinder-shaft, which is also the driving-shaft and extends through the operating-head of the machine, the band-cylinder *c* being coupled thereto axially in line at either end and together running the full length of the machine. The roll-beam D, having the roving-drums D′ and roving-delivery rolls E mounted thereon, is supported by tracks or guideways *a* on the tops of the frame A, and is provided with suitable bearing-shoes that slide along said guideways.

S indicates the spindles, supported in the well-known manner along the front of the frame and rotated by bands *b*, run from the cylinder *c*, as usual.

Fallers *f* and counter-fallers *f*′, of the usual construction, are provided for guiding the yarn onto the bobbins, and said fallers are operated by the faller-lock F and a cop-builder mechanism, which latter is of improved construction, as will be hereinafter explained.

The pulleys G G′ G^2 for the driving-belt are arranged on the cylinder-shaft C. The pulley G is fixed or keyed upon the shaft C. The pulley G′, which is provided with a long sleeve or hub, runs loose on the shaft C and has a pinion G^3 fixed to the end of its hub, while pulley G^2 runs loose upon the hub of pulley G′ and serves as the loose pulley on which the belt runs when the machine is idle. A large gear G^4 is also mounted on shaft C, which is adapted to clutch with pulley G by means of a friction-rim, and is arranged to be thrown into and out of clutch by a lever actuated by one of the cams on the cam-shaft.

H indicates the operator-shaft, I the cam-shaft, J the draft-scroll, and K the in-drawing scroll. The scrolls are respectively mounted on shafts J′ and K′, and are connected by ropes *j* and *k* to the drum-wheels or auxiliary scrolls M and N, fixed on the back shaft B, to which shaft backward and forward rotative motion is imparted by the action of the respective scrolls for moving the roll-beam from and toward the spindles by the chains D^2.

The scrolls J and K are mounted to turn loose on their respective shafts, and are provided with clutches J^2 and K^2, that connect them with their shafts for action, which clutches are operated by levers actuated at the proper time and in well-known manner by cams on the cam-shaft.

The various changes in the operation of the mechanism are automatically effected under control of the cam-shaft I and its automatic stop-escapement, giving five stops or changes in its revolution; but as this cam-shaft and its manner of operation are substantially similar to that described in my former patent I have not herein illustrated it in detail or particularly described the form and location of the several cams thereon, since it will be understood that the same are of any suitable construction for imparting the action required for throwing into and out of engagement the several clutches.

L indicates the escapement-lever, bifurcated at its end and provided with hardened steel detents or lugs *h*, that engage the ratchets of the escapement-wheel I′, and having an arm L′ projecting from the side thereof, as shown. By making the escapement-lever with the bifurcated head I am enabled to use an outside ratchet for the escapement-wheel and conveniently obtain the five stops or notches, which can be made with great facility, as the notches can be more readily filed to correct form, and also the removable detents *h* can be given greater wearing-surface and be made in a manner to change position from one side to the other as the edges become worn, making a much more serviceable construction than where the escapement-ratchet works on a simple pin or dog and the ratchets are formed within a groove of the escapement-disk. A spring-brake L^4 is provided to act upon the arm L′ of the escapement-lever to retain it at position of adjustment.

The operator-shaft H and scroll-shafts J′ and K′ are rotated by a suitable train of gears. In this train of gearing (see Fig. 27) the gear G^4 operates an auxiliary shaft Q beneath the cylinder-shaft C by meshing into an intermediate gear Q′, that in turn meshes with the pinion Q^2, fixed on said auxiliary shaft. Said shaft carries a gear Q^3, that meshes with gear H′ on the operator-shaft H, which latter shaft carries the gear H^2, that meshes with the gear I^2 on the cam-shaft I. The gear H′ on the operator-shaft meshes with the gear K^4 on the shaft K′ of the in-drawing scroll K. The shaft Q is also provided with a gear Q^4, that meshes with the pinion G^3 on the end of pulley G^2.

A pinion C^2, fixed on the cylinder-shaft C, meshes with a gear V, mounted on a stud *v* on the side of the frame A, which gear carries a pinion V′, that meshes with a gear J^4 on the end of the draft-scroll shaft J′.

The gear G^4 is for "backing off" or reversing the motion of the cylinder and spindles preparatory to winding up the yarn, the motion being transmitted to said gear after it

has been clutched to pulley G through the gears G^3, Q^4, Q^2, and Q′, while the belt is running on the second pulley G′, substantially in the usual manner.

R indicates a rocker-shaft supported in bearings upon and near the top of the frame A and extending parallel with the guide *a*, along which the roll-beam D travels. Said rocker-shaft is provided with a series of fingers R′ R^2 R^3, that engage with a trip-piece *d*, connected with the roll-beam or roving-carrier and formed to crowd the fingers to one side as the roll-beam approaches the position thereof, and thus rock the shaft. Said rocker-shaft is also provided with a rigid arm or crank R^4, the outer end of which is joined by a link or rod *l* with the horizontal arm L′ of the escapement-lever L. The action of the rocker-shaft throws the detents of the escapement-lever L from engagement with the notches of the escapement-wheel I′, thus allowing the cam-shaft I to shift the position of its cams for bringing into operation the different mechanisms, accordingly as the trip-piece *d* strikes the respective fingers in the movement of the roving-carrier.

T indicates the twist-wheel, mounted on a swinging bracket T′, that is worked in conjunction with a cam on the cam-shaft in well-known manner for lifting said twist-wheel and causing it to engage for its operation with a worm-screw on the auxiliary shaft Q. Said wheel is provided with a pin *t*, that moves into contact with a lug or projection T^3 on the arm L′ of the escapement-lever L for throwing the detent *h* from the escapement-wheel I′ when the proper degree of twist has been spun into the yarn.

The belt-shipper W is supported on a reciprocating rod *w* and arranged to be operated automatically by the lever W′ from a cam on the cam-shaft I or to be operated by hand by the lever W^2 in connection with the inclined cam W^3 on a rod W^4, which extends along the front of the machine and is provided at intervals with suitable handles W^5 for turning it.

The take-up mechanism for returning the scrolls to position after the clutches are released, giving tension on the scroll-ropes, and compensating for the expansion and contraction of the ropes due to the variation in the degree of humidity of the atmosphere is a feature of my invention, and is made substantially as follows: Winding wheels or drums J^3 and K^3 are attached to respective scrolls J and K. To the peripheries of these drums a cord, strap, or band O is connected, one end being attached to the drum J^3 and the opposite end to the drum K^3. This strap passes over guide-sheaves O′ and around a sheave or pulley O^2, which is connected with a spring O^3, that presses downward the pulley O^2, and thereby gives pressure simultaneously and uniformly at both ends of the strap, the sheaves or pulleys allowing the strap to adjust itself to the strain at either end and to the action of the respective scrolls when winding and unwinding their ropes, consequently giving proper tension on each of the scrolls one against the other and holding the ropes *j* and *k* uniformly taut at all times, while the yielding of the spring O^3 compensates for any variation in the take up of rope by the scrolls or for any expansion or contraction of the ropes that may be occasioned by climatic changes. The sheaves O′ are arranged to run loose on a cross-bar or shaft at the back of the frame, so that they offer no resistance to the free action of the tension mechanism. In the present instance the spring O^3 is arranged as a heavy wire coiled around a cross-bar A^2 at the lower part of the frame, the center portion of the spring being extended backward and provided with a hook that engages the supporting-block of the pulley O^2. The opposite ends of the wire are held by lugs on the bed-plate A′. (See Fig. 16.)

One of the drums J^3 is preferably provided with means for taking up or letting out the tension-strap O, and may be constructed as indicated in Figs. 17 and 18. In this a ratchet-wheel J^5 is fixed on the end of the scroll J, while the drum J^3 is arranged to turn loose on the hub of said scroll or its shaft, and a pawl J^6 is pivoted on the side of the drum, that engages with the teeth of said ratchet-wheel, it being held thereto by a suitable spring. By turning forward the drum while the scroll and its ratchet-wheel are held stationary the pawl slips over the notches and the strap is wound up more or less upon the drum and held from turning back by the engagement of the pawl. For letting out the strap or loosening the tension the pawl is lifted by means of a small lug that projects from its side, when the ratchet can be turned back the required number of notches and the pawl again allowed to drop into engagement for holding it at that position.

For connecting the scroll-rope *k* to the auxiliary scroll N, I employ an adjustable rope-holding device (see Figs. 12, 14, and 15) consisting of a collar or hub N^2, having a rope-grip or prongs *n* that adapt it for retaining the knotted end of the scroll-rope, which collar is arranged loose on the shaft B adjacent to the side of the drum or scroll N. The inner face of said rope-holder is provided with suitable notches or ratchets *n*′, fitted for engagement with a lug n^2 on the side of the scroll. The scroll-rope *k* is carried through a notch n^3 on the rim of the auxiliary scroll N and passed around the periphery of the rope-holder hub, its knotted end being inserted between the prongs *n*. The strain on the scroll-rope causes the knot to be drawn firmly into the recess between the prongs *n*, where it is held fast, and also causes the rope-holder hub to hug against the side of the anxiliary scroll, so that the lug and notches on their adjacent

faces engage, and thereby retain the rope-holder and rope end securely at position of adjustment.

If it is desired to lengthen or shorten the rope, it can be done by simply sliding the rope-holder hub outward on the shaft B sufficiently to relieve the lug n^2 from the notch n' and then turning the rope-holder on its axis to wind up or slacken the rope to the extent required, and then again allow it to be drawn up against the side of the scroll. This device affords a very simple and convenient means for expeditiously effecting adjustment of the scroll-rope, and obviates the necessity of retying the holding-knot at the end of the rope. The adjustable rope-holding device, in combination with the scroll and scroll-rope, is a feature of my invention.

The improved arrangement of mechanism for controlling the delivery of roving is as follows: On the shaft J′ there is a loose sprocket-wheel P, provided with a clutch P′, arranged to be thrown into and out of action by a lever actuated by one of the cams on the cam-shaft I. Said sprocket-wheel operates, by means of a suitable drive-chain *p*, a short shaft P^2 at the back of the frame, provided with sprocket-wheels P^3, from which drive-chains P^4 extend to and around guide-sheaves P^5 near the front of the machine, said chains passing over and engaging with sprocket-wheels E^2, fixed on the ends of the lower delivery-rolls E′. The drums D′, for supporting the spools of roving, are geared to receive their movement from the roving-delivery rolls in the usual manner, (the gearing being at the ends of the machine, and in the present instance not shown.) During the time that the clutch P′ is thrown in and the sprocket-wheel P is in action the shaft P^2 operates the chains P^4 and the roving-delivery rolls are rotated for feeding off the roving; but when the clutch P′ is thrown off, the friction on the rolls E′ being greater than that on the other parts of the mechanism, the chains P^4 are carried along with the sprocket-wheels E^2 without causing rotation of the rolls E′, since the roll P and shaft P^2 are at such time free to turn loose on their axes and are easily carried around by the backward movement of the chains P^4.

In order that the entire stretch of twisted yarn may be wound onto the bobbins and that the succeeding draft may commence with the feed of roving full from the spindle-points, I employ an auxiliary mechanism for starting the roving-delivery rolls an instant before the roll-beam D reaches the forward limit of movement. This mechanism consists in the present instance of parts arranged substantially as shown in Figs. 21 to 24. In this the sprocket-wheel E^2 on the end of the roving-delivery roll E′ is provided with an internal ratchet *e*, (see Fig. 24,) and adjacent thereto, mounted to run loose on the end of the roll-shaft, is a disk or wheel E^4, which carries a pivoted pawl e^3, that engages the ratchet *e* in a direction for turning the rolls E E′ forward. Upon the periphery of the disk E^4 is wound a chain or band E^5, one end of which is connected to the disk, while the other is connected to a swinging arm E^6, the upper end of which is pivoted to a standard D^4, fixed on the roll-beam D. Connected to and winding upon the hub of the disk E^4 is a strap d^5, the outer end of which is attached to a spring D^5, as indicated. This spring and the strap serve for returning the disk E^4 and pawl e^3 to normal position and for winding the chain E^5 upon the disk. A suitable lug e^6 is formed on the side of the swinging arm E^6 and an adjustable stop-dog a^3 is attached to the frame A for engagement with said lug.

In the operation, when the roller-beam approaches the spindles, the dog a^3, coming in contact with the lug e^6, arrests the arm E^6 and causes draft upon the chain E^5, which effects motion of the disk, and the pawl e^3, by engaging the ratchet *e*, causes slight rotation of the roving-delivery rolls before the roll-beam reaches its forward limit of movement, thereby feeding off sufficient roving to reach from the rolls E to the points of the spindles S before the carrier or roll-beam changes its direction of movement. When the roll-beam is moved back, the arm E^6 is released from the stop-dog, and the disk, chain, and pawl are returned to their normal position by the action of the spring D^5 and strap d^5. The disk E^4 and arm E^6 are held stationary while the roving-rolls are operated by the chain P^4, the movement being then such as to carry the ratchet-teeth *e* of the wheel E^2 past the pawl e^3 without engaging it. This part of my invention, comprising the auxiliary starting mechanism for giving feed of roving before the starting up of the spindles, can be omitted in machines for spinning some grades of stock, if desired, or the devices can be made non-operative by simply shifting the dog a^3, so that it will not engage the lever or arm E^6. The machine will then run without the action of the auxiliary roving-feed. Usually, however, I prefer to use the auxiliary feed mechanism, as above described.

The attaching-plate of the stop-dog is slotted, as at a^{31}, so that said dog can be adjusted forward or back for giving a longer or shorter arc of movement to the lever and pawl and a consequent variation of the amount of advance feed imparted to the rovings.

The auxiliary starting mechanism may be employed on only one of the lines of roving-delivery rolls, as the rolls of the opposite line or at the other side of the operator-head will be started by the power and motion transmitted from the first-operated wheel E^2 through the chains P^4 and sprocket-wheels P^3.

An important feature of my invention consists in combining and constructing the cop-builder and quadrant mechanisms to operate automatically in conjunction with each other, so that the devices for winding up the yarn and the devices for building or giving shape to

the bobbin are controlled by one set of mechanism or simultaneously adjusted. This feature I believe to be broadly new in spinning machinery. The mechanism is substantially as follows: The cop-builder mechanism is mounted upon a frame or carrier-bar 10, which is supported by suitable bearings and provided with a toothed rack 9. Reciprocating motion is imparted thereto by a pinion 11, connected by a short axle with a sprocket-wheel 12, which is rotated alternately in one direction and the other by a drive-chain 13 from the sprocket-wheel on the back shaft B or by any equivalent mechanism that will impart to said carrier-bar a backward-and-forward reciprocating movement.

The rear bearing bolster or bed 8 is made with a flat surface, on which the bearing-boss of the carrier 10 slides, and this surface is surrounded by a channel and an upwardly-projecting flange 7, as shown in Fig. 6, thus forming a receptacle for holding a quantity of oil sufficient to cover the bearing-surfaces and give a constant and ample lubrication to the parts, which are in the action of the machine subject to great pressure at certain stages of the operation.

The backward movement of the carrier 10 is performed during the time the yarn is being wound on the bobbin. A rotatable shaft 14, having the cop-builder-adjusting screw 15 and slide-adjusting screw 16 formed thereon, is mounted in bearings on the carrier 10, and the longitudinally-movable cop-builder plate 17, also supported on said carrier, is connected by a nut or threaded lug 18 to the cop-builder screw 15, whereby the plate is moved backward or forward along the carrier when the adjusting-shaft is turned in its bearings. The top edge of the plate 17 is made with a short level or straight portion at its rear end, forward of which is a long incline, which level and inclined portions serve as a bearing for the pin or lug 19, that supports the vertically-moving slide 20, which works up and down in suitable guideways on the carrier-bar, the slide being raised or lowered accordingly as the plate 17 is at forward or rearward adjustment or at some intermediate position. The cop-forming bar 21 is hinged to the top of the slide 20, and in connection with the top surface of said slide forms the track on which the roll x of the cop-builder lever or arm X runs for raising and depressing the fallers. The hinge by which the bar 21 is connected to the slide 20 has its axis in line with the top surface on which the roll x travels, and is also at the junction of the backward and forward inclines, the backward incline being stationary on the slide 20, while the forward incline, which is on the bar 21, can be adjusted up or down. An adjusting stud or screw 23 is arranged in the top of the slide 20 beneath the forming-bar 21, by means of which the relation of the cop-forming bar can be adjusted for giving more or less inclination to its top surface. The hinging of the cop-builder bar in the manner described affords facility for varying the winding at the point of the cone on the bobbin to make a longer or shorter taper in the winding without changing the other parts or without change in the winding at the shoulder of the bobbin.

A shaping-lug or cam-plate 22 is attached to the forward end of the builder-plate, and the front upper surface of said cam-plate, which is curved or inclined, is arranged to engage with a lug 21^a, that projects downward from the forward end of the cop-forming bar 21 for lifting said bar, and thereby regulating the length of the winding on of yarn at the base of the bobbin until the bobbin is filled to its maximum circumference. The curve or cam surface of the lug 22 is formed to give a rapid descent of the cop-forming bar at the commencement of the bobbin and then to gradually decrease the movement.

A stop-lug 24 is adjustably fixed to the carrier for limiting the forward movement of the cop-builder plate 17, so that the attendant can at each doffing set the mechanism at the same position for starting the next set of bobbins.

The adjusting-shaft 14 has at its forward end a pulley 25, working loose thereon and carrying a pawl 26, which engages a ratchet-wheel 27, fixed on the end of said shaft. A chain 28 passes over and is attached to said pulley, one end thereof being secured to an arm 29, pivoted to a fixed bracket attached to the floor or other stationary position, while a weight 30 is attached to its other end for rotating the pulley and taking up the slack of the chain when the carrier-bar 10 is moved backward. A sheave 31 is mounted on a suitable stud at the forward end of the carrier, which sheave runs onto the chain 28 as the carrier 10 moves forward, and by drawing down said chain partially rotates the pulley 25, at which time the pawl 26, engaging the teeth of the ratchet 27, causes partial rotation of the adjusting-screw shaft 14 and consequent adjustment of the parts connected therewith.

An adjustable incline or guideway 32 is attached to the carrier 10 and works on a horizontal pivot, whereby it is adapted to assume different degrees of inclination, its rear part being sustained by an adjustable support or hinged brace 33 in connection with a slide-block 34, that moves longitudinally upon the carrier-bar, on which it is confined by suitable guides. The slide-block 34 is screw-threaded, as a nut, to engage the threads 16 on the end of the adjusting shaft 14, by means of which said slide-block is moved forward and back for raising and depressing the rear end of the hinged guideway 32. The slide-block 34 can, when desired, be adjusted to move past the dead-center or beyond the position at which the brace 33 stands vertically, (see dotted lines in Fig. 6,) so as to slightly lower the inclined guide 32 after it has reached its highest position.

The screw-thread 15, that moves the cop-

builder plate, is comparatively fine in proportion to the screw-thread 16 at the end of the shaft, the former having a pitch of about eight to the inch, while the latter has a pitch of about three to the inch, (more or less.) Consequently the slide-block is moved much more rapidly than the plate by a given revolution of the shaft. The screw-threads 16 are of less extent along the shaft than are the threads 15, as well as of greater pitch, so that the nut or slide-block 34 runs off from the end or threaded portion of the shaft, and its backward movement ceases at an early stage of the operation, the limit of such action corresponding to the time of forming the base-cone of the bobbin, while the thread 15 continues to move the cop-builder plate until the bobbin is filled.

A rod 35, connected to the cop-builder plate 17, extends backward through an opening in the slide-block 34 and has upon its screw-threaded end beyond the slide-block adjusting-nuts 351, as indicated. Said rod serves for drawing the slide-block forward and into engagement with the screw-threads on the end of the adjusting-shaft when the cop-builder plate is moved to its forward position. The adjustment of the nuts on the end of this rod 35 is preferably such that when the cop-builder plate 17 is moved forward, so that the junction-point of its incline and level top is beneath the pin 19 on the vertically-moving slide 20, the slide-block 34 will be at a position where its screw-threads will commence to engage the screw-threads 16 on the end of the shaft.

The end of the adjusting-shaft 14 is squared or fitted to receive a wrench or handle for running the cop-builder plate and inclined guideway back to their first or starting positions after a set of bobbins has been filled and preparatory to commencing a new set of bobbins.

An arm or lever 40 is fulcrumed upon an axis near the back of the machine (in the present instance upon the back girt or rod A^3, that connects the frame A) in a manner to swing back and forth. On its lower part said arm carries a pulley 41, revoluble on a suitable stud, which is preferably secured in a slot in the arm, so that the pulley can be adjusted nearer to or farther from the axis on which the arm swings. This adjustment is for the purpose of making cops or bobbins of larger or smaller diameter, adjustment toward the center or axis on which the arm swings giving a smaller diameter of bobbin, and vice versa. No change in the position of the pulley-stud is made except it is desired to change the machine for running bobbins of a different size. The lever 40 serves a purpose similar to that of the part which in other spinning-machines is known as the "quadrant," and I will therefore term it the "quadrant-arm," although the construction and operation are quite different from quadrants as heretofore employed.

Combined with the arm 40 and actuated from the incline 32, I employ a quadrant-operator 38, which preferably consists of a crooked lever fulcrumed on a shaft or axis A^2, fixed on the frame A for action, substantially as indicated. The rear end of the lever 38 is connected to the hub of the arm 40 by a chain 39 or in other equivalent manner, while its forward end works in conjunction with the adjustable inclined guide 32, it being preferably provided with an anti-friction traveler or shoe 36, that slides in the guideway thereon. When the carrier-bar 10 moves forward, the inclined guide lifts the forward end of the quadrant-operator lever 38, causing the arm 40 to swing backward, as indicated in dotted lines, Fig. 4. Then, when the carrier-bar moves backward, the quadrant-operator moves down the inclined guideway and permits the quadrant-arm 40 to again swing forward. The guideway 32 is best provided with an oil-well 37 at its lower end, as shown in Fig. 7^a, into which the end of the shoe 36 dips when at its lowest position and from which it carries up, as it moves back along the guide, a quantity of oil sufficient for lubricating the surface on which said shoe travels. The winding-chain 44 is attached at one end to the winding-drum C^3 on the cylinder-shaft C. It then passes around the pulley 41 on the quadrant-arm, thence around a pulley d^2, running on a stud fixed to the roving-beam D, and thence extends to and is attached to the upper end of the quadrant-arm.

The end of the winding-chain is attached to the upper end of the quadrant-arm by an adjustable stud at 42, by means of which the tension for winding the nose of the bobbin can be increased or diminished. By carrying said stud farther from the axis on which the quadrant-arm swings the mechanism is caused to wind the nose of the bobbin tighter, and by carrying said stud nearer to the axis the mechanism is caused to wind less tight.

When the roving-beam D approaches the spindles, the quadrant-arm, with the pulley 41, swings forward, releasing the winding-chain, the degree of such release being governed by the action of the quadrant-operator in conjunction with the adjustable inclined guideway and adjusting-shaft of the cop-builder mechanism.

The chain 39, which connects the quadrant arm and operator lever, is provided with an adjusting hook or link 39^a, the shank of which is screw-threaded and connected with the lever in a manner to facilitate the lengthening and shortening of the connection, so that the parts can be relatively adjusted to compensate for wear, for the stretch of the chains by use, or for bringing the parts into proper relation when setting up the machine.

The ratchet-wheel 27 at the end of the adjusting-shaft 14 is interchangeable with wheels having different numbers of teeth for spinning different numbers or sizes of yarn, said wheels varying in their numbers of teeth from eight to thirty, (more or less,) as de-

sired, the lesser number of teeth being employed for the coarse sizes, while the greater number are employed for the fine sizes of yarn. The screw-shaft 14 controls both the cop-builder and the winding mechanism; hence the simple change of the ratchet-wheel 27 is all that is required for adapting the cop-builder and winding devices for working any of the various sizes of yarn which it is desired to spin, and thus the cop-builder devices and the winding devices will properly and proportionately coincide in their relative action under any and all circumstances. This is a very important feature, which, so far as I am aware, has never before been attained in any spinning-machine wherein backing off and winding is a part of the operation.

By combining the cop-builder mechanism with the quadrant and winding mechanism, so that both are simultaneously controlled by the same adjusting-shaft or screw-spindle, as herein set forth, I attain the advantage of a positive uniformity of operation on different sets of bobbins and all numbers of yarn, since the adjustment and regulation of the quadrant-operating devices are automatic and positively in unison with the adjustment and regulation of the cop-builder, either when moving inward or while being returned to starting position, and the quadrant adjustment is not left to the caprice of the attendant while filling the base of the bobbins.

In the modification shown in Fig. 25 I have illustrated the manner in which the quadrant-operator 38 can be connected to the quadrant-arm 40 by gear-teeth in lieu of the chain 39. In this the quadrant-operator is extended and fitted to carry a toothed segment 391, that meshes with a toothed segment 401, formed on or attached to the hub of the quadrant-arm 40. The segment 391 can be made longitudinally adjustable by screws 381, or otherwise, so as to bring the arm 40, and operator-lever 38 into proper relation with reference to the inclined-guide 32 and winding-chain 44. In Fig. 26 I have illustrated a manner of connecting the quadrant-arm 40 and operator-lever 38 by a chain from the forward end of said operator-lever. In this the chain 39 is fixed to a stud 392, that is adjustable in a slot at forward end of the operator-lever, and from thence passes beneath a guide-sheave 383, fixed to the stationary bed or frame, and up to the hub of the quadrant-arm 40. In each of these modifications the inclined guide 32 imparts similar action to the arm 40 by the reciprocation of the cop-builder carrier 10.

Another feature of my invention consists in an automatic take-up which acts on the winding-chain 44 and serves for effecting the tighter winding of the yarn upon the nose of the bobbin. This mechanism (see Figs. 2 and 19) consists of a swinging lever 46, carrying at its lower end a sheave or guide-pulley 47, over which the winding-chain 44 passes, while its upper end is connected to an actuating-bar 48, which is furnished with an inclined ratchet or series of notches or steps 481, for engagement with a detent or lug 49, that is fixed on or connected with the roll-beam D. The forward end of the actuating-bar 48 is sustained by a stud, roll, or bearing on the arm of a lever 50, that is centrally fulcrumed on a suitable support-bracket or projecting part of the frame A, the other end of said lever being connected by a chain or link 51 with the rear end of the cop-builder arm X, or, preferably, as in the present instance, to the end of a spring-bar 52, attached to said cop-builder arm, as indicated in Fig. 19. Depression of the rear end of the cop-builder arm as it follows the action of the builder-bar mechanism effects a corresponding elevation of the ratcheted end of the actuating-bar 48, causing when at sufficient height its engagement and movement to a greater or less extent with the detent 49 on the roll-beam D. When the detent 49 engages the bar 48 and carries it forward, the lever 46 lifts the pulley 47 against the chain 44 and causes an extra pull or strain on said winding-chain (see dotted lines, Fig. 19) and a quickened action of the spindles the instant the yarn is being wound on at the extreme point or nose of the bobbin, thus tightening the winding of the yarn at such point. When commencing and while filling the body of the bobbins, the bar 48 is depressed so low that its ratcheted end is not engaged by the detent 49, the parts being ordinarily adjusted so that this mechanism is brought into action only for the completion or final finishing of the bobbins.

Another feature of my invention comprises the improved mechanism for easing in the roving-drum carrier or roll-beam D to accommodate the shortening of the strands of yarn by the twisting. For this I employ a worm-gear 54, mounted on a swing-bracket 541, having a spring-bar 55, which works in conjunction with a cam 551 on the cam-shaft I for raising said wheel into mesh with a worm 56 on the shaft K′. Said worm-wheel has attached to its side or to the opposite end of its axle-stud a crank which is connected by a chain and rod 57 with a balanced lever 58, mounted upon a screw-threaded hub 59, fixed on the back shaft B. (See Figs. 3, 12, and 13.) The lever 58 is counterweighted at its rear end, as at 60, to lift the rod, chain, and crank and to return the worm-wheel 54 to normal position when it is thrown out of engagement with the worm 56. Upon the side of the lever is a pin or lug 61, that engages at the proper time with a stud 62 on the side of the auxiliary scroll M, or, if in any case preferred, said stud can be upon a separate disk or arm fixed to the back shaft B in lieu of the side of the scroll. The hub of the lever 58 is screw-threaded and fitted to the hub 59 in such manner that rotation of the shaft B causes a movement of the lever longitudinally upon shaft B toward and from the auxiliary scroll. (See dotted lines, Fig. 12.) This movement is

sufficient to bring the lug 61 into engagement with the stud 62 when the rope *j* is wound upon the draft-scroll J and to carry the parts away from each other, so that the lug 61 escapes the lug 62 at other revolutions of the back shaft B. The operation of easing in is effected at the time the lugs are brought into engagement with each other, at which time the worm-wheel 54 is in mesh with the worm 56, it being lifted up by its arm 55 in contact with a cam on the cam-shaft. The action of the crank on the worm-wheel draws down the connecting-rod 57, depressing the forward end of the lever 58 and lifting the lug 61 against the lug 62, thereby causing slight forward rotation of the back shaft B sufficient to move the roll-beam D forward as the yarn shortens by twisting and previous to the in-drawing movement for winding up the spun yarn. The lever 58 is preferably slotted, as at 63, (see Fig. 13,) to facilitate the adjustment of the stud 61, so that it will engage with the stud 62 at the proper instant. The connection-pivot 64 at the forward end of the lever is made adjustable toward or from the fulcrum, thus affording facility for varying the extent of the easing-in action by varying the leverage so that the stud 61 moves in a longer or shorter arc. The rod 57 is best provided with a screw-threaded extension or turn-buckle to facilitate lengthening or shortening the connection.

The clutch for connecting the winding-drum to the cylinder-shaft is substantially as heretofore employed; but the means for producing friction for winding up the chain upon said drum is a feature of my present invention. Upon the auxiliary shaft Q, below the cylinder-shaft C, I arrange a pulley 70, from which a belt 71 is carried around the winding-drum C^3, and mounted on said auxiliary shaft is a loose swinging lever 72, one arm of which is provided with a pulley 73, which runs against said belt 71 for tightening it upon the drum and its pulley, while the other end of the lever is provided with a counter-weight 74 for pressing the tightener-pulley against the belt. The counter-weight 74 is given enough preponderance to cause friction of the belt on the drum sufficient to wind up chain 44 when the roll-beam moves backward, but not enough to prevent the drum slipping within the belt by the draft on the chain 44 when winding the yarn.

To the side of the faller-lock F is pivoted a backwardly-extending bar 76, the rear end of which is in position to engage the lug 761 on the escapement-lever L when the faller-lock is drawn back under the roll X^2 of the cop-builder arm X. Projecting from the side of said bar is a lug or pin 78, which is engaged by a plate 79, adjustably fixed upon the side of an upright lever 80, the lower end of which is pivoted to the bed-frame at 81, while its upper end is in position to engage with a lug or arm that projects from the roll-beam or its shoe when at its forward position. In its forward movement the roll-beam strikes the upper end of said upright lever to throw off the faller-lock F from the roll X^2 at the instant the roll-beam reaches its forward position. The plate 79 upon the lever 80, which engages the lug 78, can be adjusted for causing the faller-lock to be thrown off at the proper instant of time. The backing-off clutch 82 and faller-lock chain 83 are of the usual construction and are arranged to operate in the well-known manner. The drawing up of the chain 83 and locking of the faller-lock on the roll X^2 of the cop-builder arm X force back the escapement-lever L by means of the arm 76 and throws the lug *h* off the escapement-wheel ratchet, at which time the action of the cam-shaft I brings into operation the in-drawing scroll and winding mechanisms.

For preventing the counter-faller *f'* from rising while backing off and while the roll-beam D is at rearward position I employ a device which consists of a lever 85, fulcrumed at 86 to a suitable bracket or support on the frame of the machine and having its forward end connected by a cord or chain 87 with the counter-faller *f'*, said chain being passed under a guide-sheave 90, as indicated in Fig. 27. The rear end of the lever 85 is shaped with a suitable cam or inclined surface, which is engaged by the roll-beam D, or a detent attached thereto, when said roll-beam is at backward position, thereby holding the lever depressed at its rear end and causing the consequent elevation of its forward end, which draws down the chain passing beneath the sheave, so that the counter-faller is positively held depressed so long as the roll-beam D is in contact with the lever; but when the roll-beam approaches the spindles said lever is freed and the counter-faller is released for doing its work while winding the yarn on the bobbins.

The clock or indicator 95, for denoting the runs of yarn, may be of any suitable construction. In the present instance it comprises a rotating graduated dial 951, mounted within a suitable case on a vertical axial stud and provided with gear-teeth that engage with a worm-screw 952 on a horizontal arbor furnished with ratchet mechanism, whereby motion is imparted to the dial. An index-point 953, fixed on the case, extends onto the graduated circle for denoting the degree of movement of the dial. Said clock is mounted upon the roll beam or carrier over one of the guide-ways *a*, on which said roll-beam travels, and is operated by means of a ratchet and pawl 96, the pawl being connected with a bar 97, to which movement is imparted by an incline or cam surface 98, formed in the guide *a*, (see Fig. 28,) into which the end of the bar 97 drops when the roll-beam approaches the limit of its forward movement, and is subsequently lifted as the roll-beam moves backward, so that the pawl is actuated for operating the indicator mechanism one step (more or less) at each backward movement of the roll-beam

by reason of the end of the bar 97 sliding up the incline 98.

I claim as my invention, to be secured by Letters Patent—

1. The combination, substantially as described, of the backwardly and forwardly movable roll-beam D, supported by guides *a* on the frame and provided with the trip-piece *d*, the rocker-shaft R, mounted in bearings on the beam-supporting frame and provided with fingers R′ R^2 R^3 and arm R^4, the escapement-lever L, having the upright bifurcated arm with engaging-lugs *h h*, and the horizontal arm L′, fulcrumed at its angle in connection with the bed A′, the rod *l*, connecting the arm L of said lever with the arm R^4 of the rock-shaft, and the cam-shaft I, having the escapement-wheel fitted for engagement by said lugs *h h* on the escapement-lever, all arranged and operating as set forth.

2. The escapement-lever constructed with a bifurcated top carrying the steel detents *h*, and having the arm L′ and the spring-brake L^4, acting against said arm, in combination with the escapement-ratchet having its teeth externally disposed, the connecting-rod *l*, rocker-shaft R, and its actuating mechanism, substantially as and for the purpose set forth.

3. The combination, with the draft-scroll and in-drawing scroll, of a yielding take-up or tension band connecting both of said scrolls, and a spring connected to said band by a running attachment for simultaneously giving tension on both of said scrolls, while the take-up is free to adjust itself to the action of either scroll, substantially as set forth.

4. The combination of the scrolls J and K, the drums J^3 and K^3, the band or strap O, guide-sheaves O′, pulley O^2, and spring O^3, substantially as and for the purposes set forth.

5. The combination, with the scrolls and tension take-up strap, of the take-up drum mounted to turn loose on the shaft or hub of one of the scrolls, the scroll-hub provided with a ratchet-wheel J^4, and the pawl J^6, pivoted to the drum and engaging said ratchet, substantially as and for the purpose set forth.

6. The combination, with the back shaft, the auxiliary scroll, and scroll-rope winding thereon, of the adjustable rope-holding hub provided with means for the attachment of the end of the scroll-rope thereto, mounted loose upon said shaft adjacent to the end of said auxiliary scroll, said hub and scroll being formed with intermatching lugs and notches that prevent backward rotation of said rope-holding hub when the adjacent end faces of said hub and scroll are brought together, substantially as set forth.

7. The combination, with the movable roll-beam, the roving-delivering rolls, the roll-operating chain, and the sprocket-wheels that carry said chain, of an auxiliary starting-clutch in connection with the roving-delivering-roll shaft, a chain and operating-gear to rotate said clutch, and an actuating-dog attached to the stationary part of the machine, that engages and imparts movement thereto as said roll-beam approaches the spindles, as set forth, for starting the roving-feed an instant before the roll-beam reaches its forward limit of movement.

8. The combination, with the roving-carrier or roll-beam, roving-delivery rolls, their drive-chain, and sprocket-wheel E^2, internally ratcheted at *e*, of the disk or wheel E^4, mounted on the roll-shaft and carrying the pawl e^3, the swinging arm E^6, the connecting-chain E^5, strap d^5, and spring D^5, and dog a^3, substantially as and for the purpose set forth.

9. The combination of the carrier 10, longitudinally-movable plate 17, its top edge having the level and inclined portions and carrying nut 18 and cam-block 22, the slide 20, having the pin 19, the cop-forming bar 21, hinged at its rear end to said slide, the cop-builder arm X, having roll *x*, that travels on said bar, the stop-dog 24, the shaft 14, having screw-threads 15, the pulley 25, pawl 26, ratchet 27, chain 28, arm 29, weight 30, and sheave 31, for rotating said shaft, all arranged for operation substantially as set forth.

10. The combination, with the movable carrier having the cop-builder mechanism supported thereon and the quadrant-arm that governs the action of the winding-chain, of an inclined guide supported on said carrier, a quadrant-operator that receives its movement from said guide, and connections for transmitting motion from said quadrant-operator to the quadrant-arm, substantially as described, whereby said arm is caused to act in unison with the action of the cop-builder mechanism.

11. The combination, with the carrier having cop-builder mechanism mounted thereon and the quadrant-arm that governs the action of the winding-chain, of an adjustable inclined guideway supported and hinged upon said carrier, a movable brace and slide-block for raising and depressing the free end of said guideway, a quadrant-operator that receives movement from said guideway, connections for transmitting motion from the quadrant-operator to the quadrant-arm, and means, substantially as described, for adjusting the inclination of said guideway simultaneously with the adjustment of the cop-builder plate, for the purposes set forth.

12. In a spinning-machine, in combination with the winding-drum, winding-chain, fallers, and faller-locking mechanism, the quadrant and cop-builder mechanism arranged for conjunctive action, substantially as described, means for operating the quadrant, together with the cop-builder, an adjuster-shaft with an actuating-ratchet, and a plurality of engaging-screws, whereby both the quadrant and cop-builder are controlled or adjusted at the same operation simultaneously, as set forth.

13. The combination of the carrier 10, the cop-builder plate 17, longitudinally movable on the carrier, the adjustable guide 32, its

support 33, and the slide-block 34, the adjusting-shaft 14, supported in bearings on said carrier and provided with a screw-thread 15, engaging with a nut fixed to said cop-builder plate, and a screw-thread 16, engaging a threaded opening in the slide-block, and the rod 35, having one of its ends connected with the cop-builder plate and its other end extending through an opening in said slide-block, screw-threaded, and provided with adjusting-nuts, for the purpose set forth.

14. The combination, with the adjusting screw-shaft mounted on the carrier and the actuating-gear for said carrier, of the loose pulley 25, the interchangeable ratchet-wheel 27, keyed on the shaft, the pawl 26, pivoted on said pulley, the chain 28, attached to said pulley, the swinging arm 29, pivoted to a stationary support with its movable end attached to said chain, a counter-weight 30, and the sheave 31, connected with said carrier for imparting intermittent rotative action to said shaft, substantially as set forth.

15. The adjustable inclined guide 32, its supporting-brace 33, and slide-block 34, in combination with the carrier 10, adjusting-shaft 14, having the screw-thread 16, quadrant-operator 38, having a shoe 36, that works on said guide, quadrant-arm 40, carrying the sheave 41, connections for transmitting motion to said arm from the quadrant-operator, and means, substantially as described, for moving said carrier backward and forward, substantially as set forth.

16. The combination, with the movable roll-beams carrying the sheave d^2, the winding-drum C^3 on the cylinder-shaft, and the winding or quadrant chain 44, of the arm 40, swinging on an axis at A^3 and provided with a sheave 41, that carries said chain, the quadrant-operator 38, fulcrumed at A^2 and having connection for moving said arm, the cop-builder carrier 10, an adjustable hinged guide 32 thereon for actuating said quadrant-operator, a slide-block and hinged brace supporting said guide, the cop-builder plate, the adjusting-shaft having screw-threads 16 and 15, respectively fitted for moving said slide-block and the cop-builder plate, and the rod 35, provided with an adjustable stop or nuts, connecting said slide-block and cop-builder plate, substantially as and for the purpose set forth.

17. The quadrant-arm 40, having an upwardly-extending end 42, to which the end of the winding-chain is attached, in combination with the cylinder winding-drum, winding-chain 44, guide-sheave 41, roll-beam D, sheave d^3, quadrant-operator 38, operator-connections 39, and means for actuating said quadrant-operator, substantially as and for the purpose set forth.

18. The combination of the cylinder winding-drum, winding-chain 44, quadrant-arm 40, quadrant-operator 38, adjustable quadrant-operator guide 32, its movable support-block 34 and brace 38, adjusting-shaft 14, with screw-threads 16, an interchangeable ratchet 27 on said shaft, a pawl 26, pivoted on the rotating sheave-disk 25 and engaging with said ratchet, and means, substantially as described, for operating the same, as and for the purpose set forth.

19. The adjustable inclined bar 32, having its hinged supporting-brace, and slide-block 34, adapted to move past the center or vertical plane of the hinging axis of the brace, in combination with the reciprocating carrier 10, quadrant-operator 38, actuated by said inclined bar, and the adjusting-screw 16, mounted in bearings on the reciprocating carrier for shifting said slide-block and support, substantially as set forth.

20. The inclined guideway 32, having an oil-well 37 formed in the lower end thereof, and the bearing-shoe on the end of the quadrant-operator adapted to dip into the oil-well, in combination with the quadrant-operator, the movable carrier whereon said guideway is supported, and means, substantially as set forth, for imparting motion thereto.

21. The combination, with the cop-builder and quadrant-operator mechanisms, of the reciprocating carrier having a bearing-boss on its lower side and a support or pillow-block 8, provided with a bearing-surface on which said boss slides, a depression or channel at the ends thereof, and an upwardly-extending lip or flange surrounding said bearing-surface, substantially as and for the purpose set forth.

22. In combination with the roll-beam or roving carrier D, winding-chain 44, and cop-builder arm X, the swing-lever 46, carrying a pulley 47, that engages said chain, a ratcheted actuating-bar 48, connected with said lever, a lifting-lever 50, for raising and depressing the ratcheted end of said actuating-bar, a connection 51, for moving said lifting-lever with the cop-builder arm, and a lug or detent 49, connected with the roll-beam that engages the ratcheted end of said actuating-bar and imparts movement thereto, for the purpose set forth.

23. The combination of the cylinder C′, drum C^3, winding-chain 44, roll-beam D, carrying guide-sheave d^2 and lug 49, quadrant-arm 40, carrying-sheave 41, connecting-chain 39, quadrant-operator 38, adjustable incline 32, its lifting-arm 33 and slide-block 34, reciprocative carrier 10, with the cop-builder mechanism, and adjusting-shaft 14, with screws 15 and 16, mounted on the reciprocating carrier, the cop-builder arm X, faller-lock F, fallers f, take-up lever 46, carrying-sheave 47, ratcheted actuating-bar 48, lifting-lever 50, connection 51, and operating-detent 49, substantially as and for the purposes set forth.

24. The spring-bar 52, in combination with the faller-lock mechanism, roll-beam D, having the detent 49, take-up actuating-bar 48, its lifting-lever 50, and connecting-chain 51, substantially as and for the purpose set forth.

25. The combination, substantially as described, of the roll-beam D, the chains D^2, attached thereto, the sprocket-wheels B′, the back shaft B, a scroll or disk M, fixed on said shaft and carrying a stud 62, a counterbalanced lever mounted upon a screw-threaded hub fixed on said shaft adjacent to the disk and provided with a stud 61 for engagement with said stud 62, and an operating-connection 57, attached to the arm of said lever, and means for imparting motion thereto, for the purpose set forth.

26. The combination, substantially as described, of the back shaft B, the scroll or disk M, fixed thereon and carrying the stud 62, the counterbalanced lever 58, fulcrumed upon a screw-threaded hub fixed on said shaft and carrying the pin 61, the worm-wheel 54, carrying a crank, and connection 57, for operating said lever, a swinging bracket whereon said worm-wheel is mounted, having the spring-arm 55, the cam-shaft I, provided with a cam that engages said arm, and a worm-screw 56 and shaft for operating said worm-wheel, for the purposes set forth.

27. The combination, with the quadrant-arm, its chain, and the winding-drum on the cylinder-shaft in a spinning-machine, of a frictional belt acting on said drum in opposition to the draft of the chain with force sufficient for winding the chain thereon when slack, but whose force is easily overcome by the draft of the chain-operating mechanism in action when winding up the yarn, substantially as set forth.

28. The combination, with the winding-chain 44, winding-drum C^3, and auxiliary shaft Q, of the friction belt 71, its pulley 70, and the counterweighted lever 72, carrying a tightening-pulley 73, that is pressed against said belt by the counter-weight to give friction on the winding-drum for winding up the quadrant-chain, substantially as set forth.

29. The combination, substantially as described, with the faller-lock, escapement-lever, and roll-beam, of the trip-bar 76, pivoted upon the faller-lock, with its rear end in line with a lug on said escapement-lever L, and having the lug or stud 78 near its forward end, the upright lever 80, pivoted at its lower end and its upper end at position to engage the roll-beam, and centrally provided with an adjustable plate 79, for engaging the lug 76 on said trip-bar, all arranged and operating substantially as and for the purposes set forth.

30. The combination, with the movable roll-beam D and counter-faller *f′*, of a lever 85, one end of which is connected with the counter-faller by a cord or chain 87 and its opposite end having a cam or inclined surface on which the roll-beam engages when at backward position, substantially as and for the purpose set forth.

31. The combination, with the movable roll-beam, the indicator-clock, and indicator-operating mechanism mounted thereon, of a guide-way *a*, upon which the roll-beam travels, provided with a depression having the inclined surface 98 formed thereon, and the pawl-actuating bar 97, arranged to drop into said depression and receive movement from said incline as the roll-beam passes over the same, substantially as set forth.

Witness my hand this 22d day of October, A. D. 1888.

EDWARD WRIGHT.

Witnesses:
CHAS. H. BURLEIGH,
ELLA P. BLENUS.