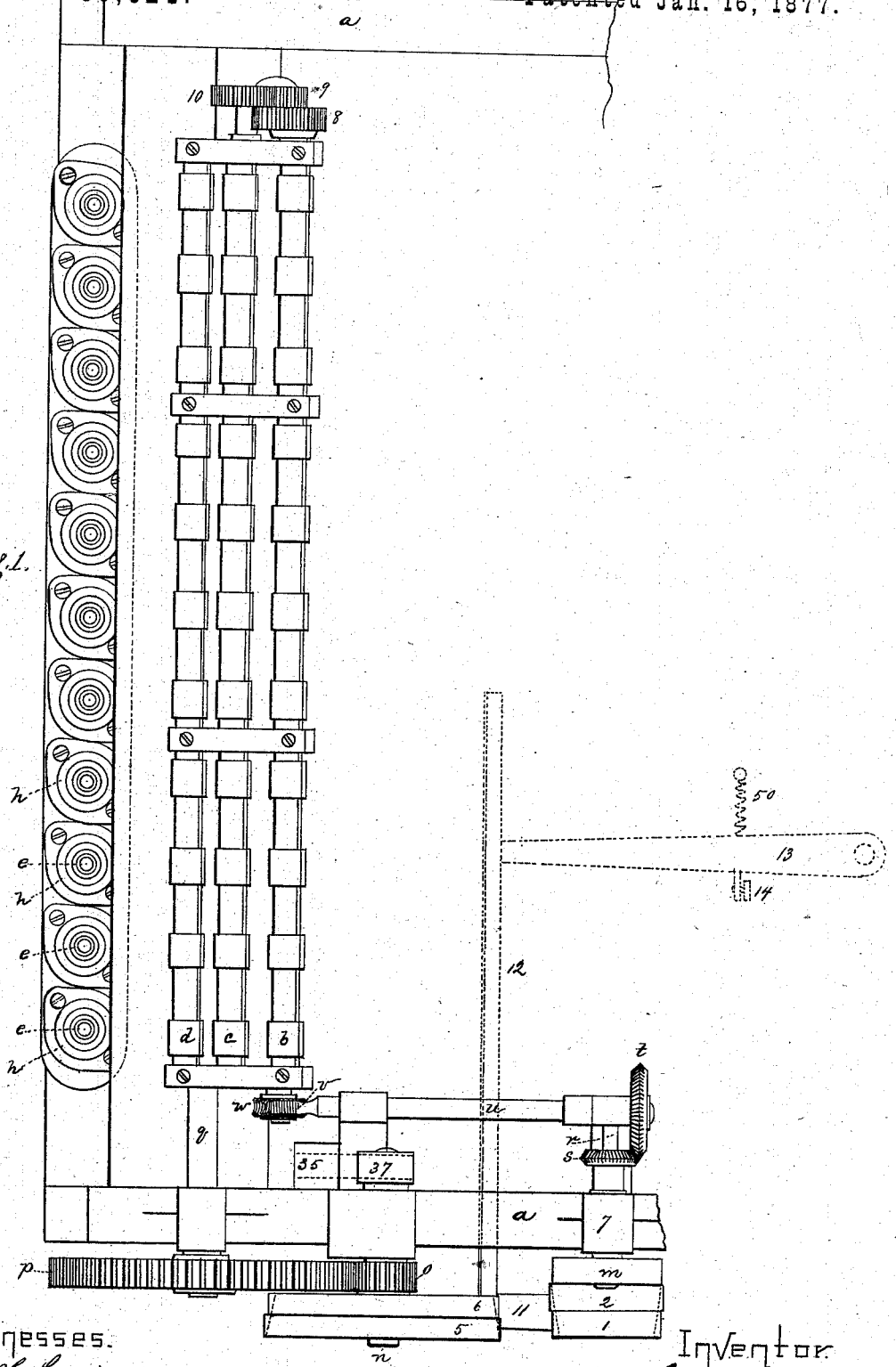
5 Sheets—Sheet 1.

G. DRAPER.

RING SPINNING-FRAME.

No. 186,324. Patented Jan. 16, 1877.

Fig. 1.



Witnesses.
L. H. Latimer.
W. J. Pratt.

Inventor.
George Draper
per Crosby & Gregory's.

5 Sheets—Sheet 2.

G. DRAPER.

RING SPINNING-FRAME.

No. 186,324. Patented Jan. 16, 1877.

Fig. 2.

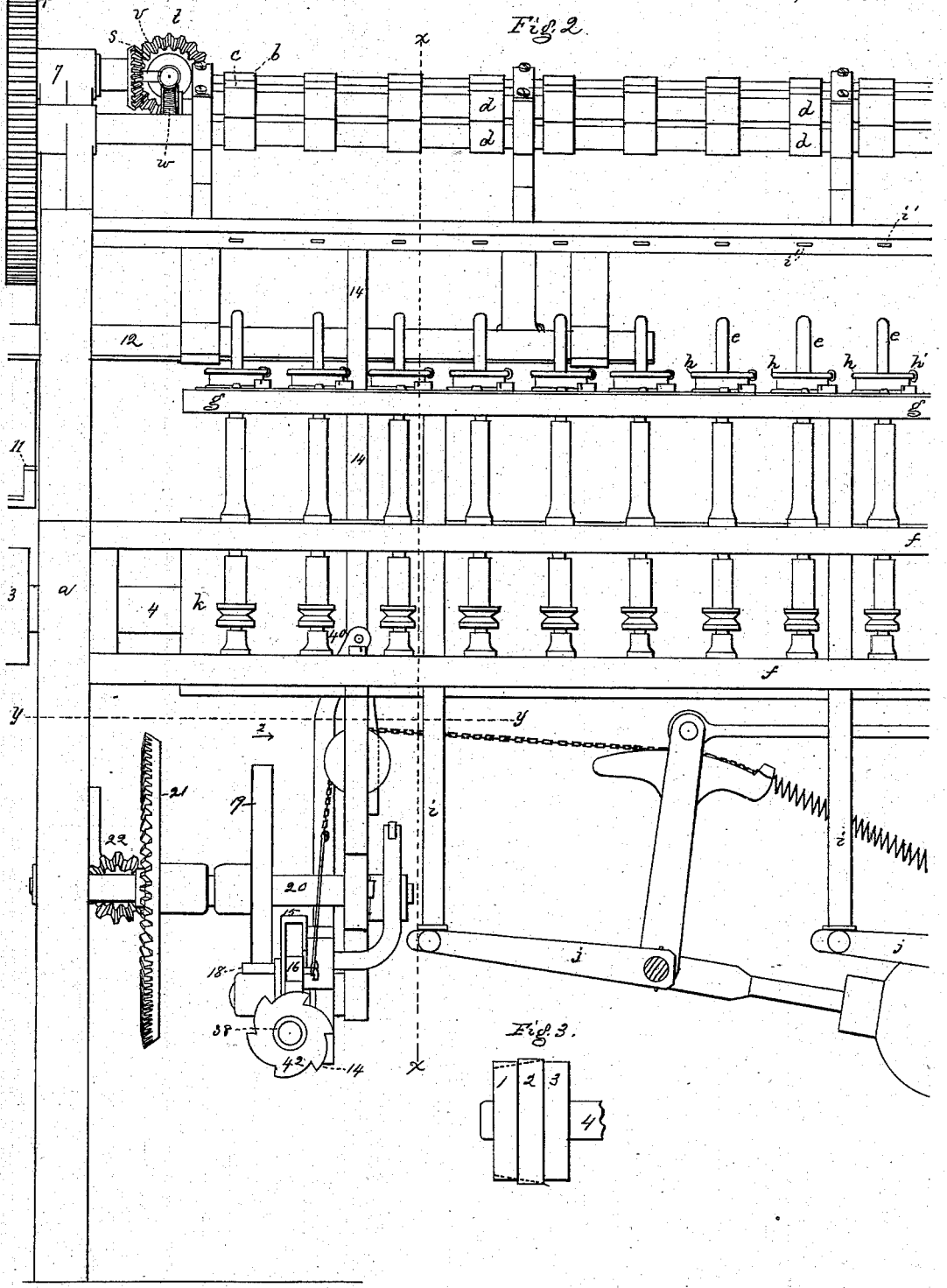


Fig. 3.

Witnesses.
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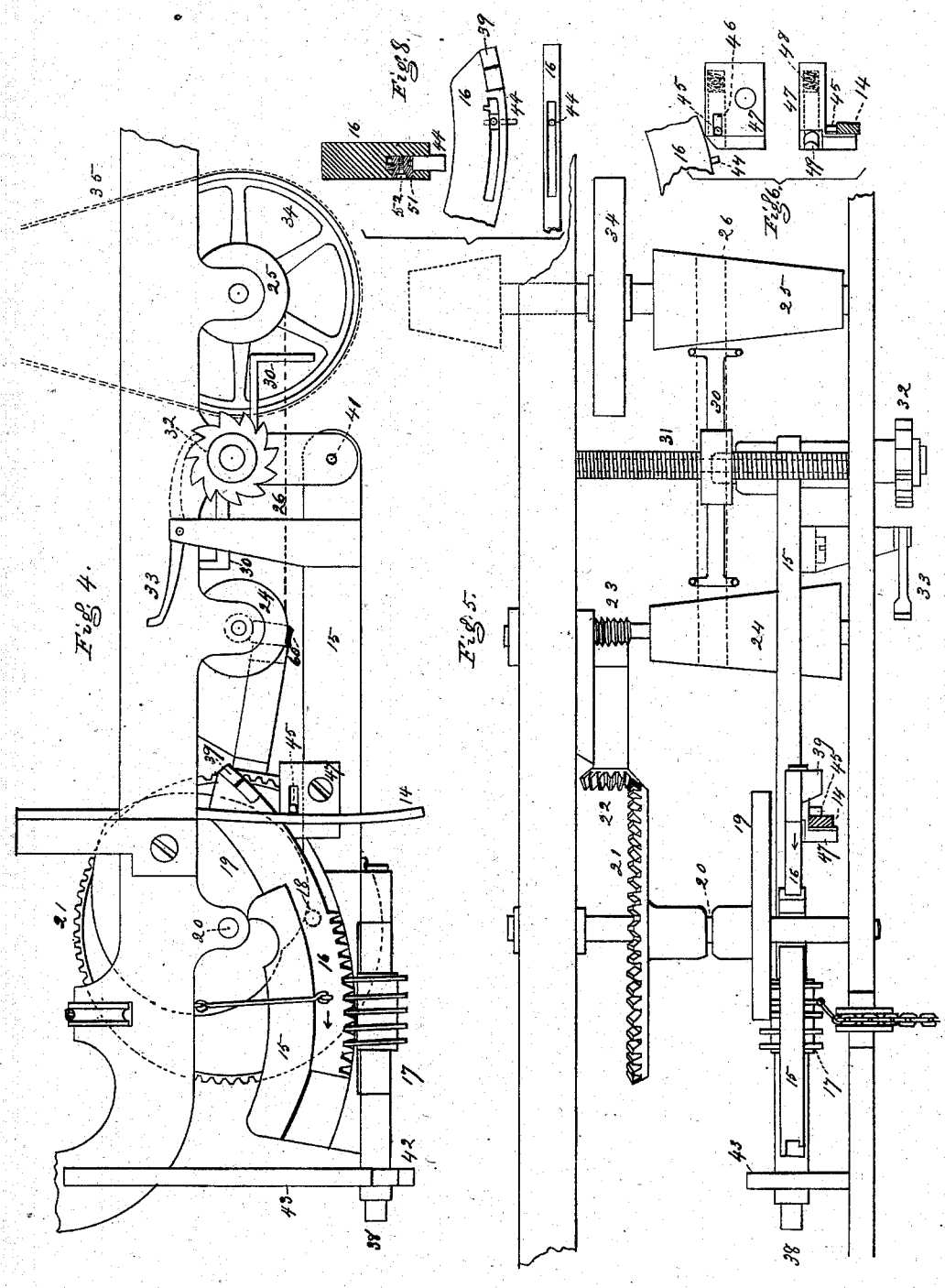
per Crosby & Gregory, Att'ys.

5 Sheets—Sheet 3.

G. DRAPER.

RING SPINNING-FRAME.

No. 186,324. Patented Jan. 16, 1877.



Witnesses.

C. H. Latimer.

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Attys.

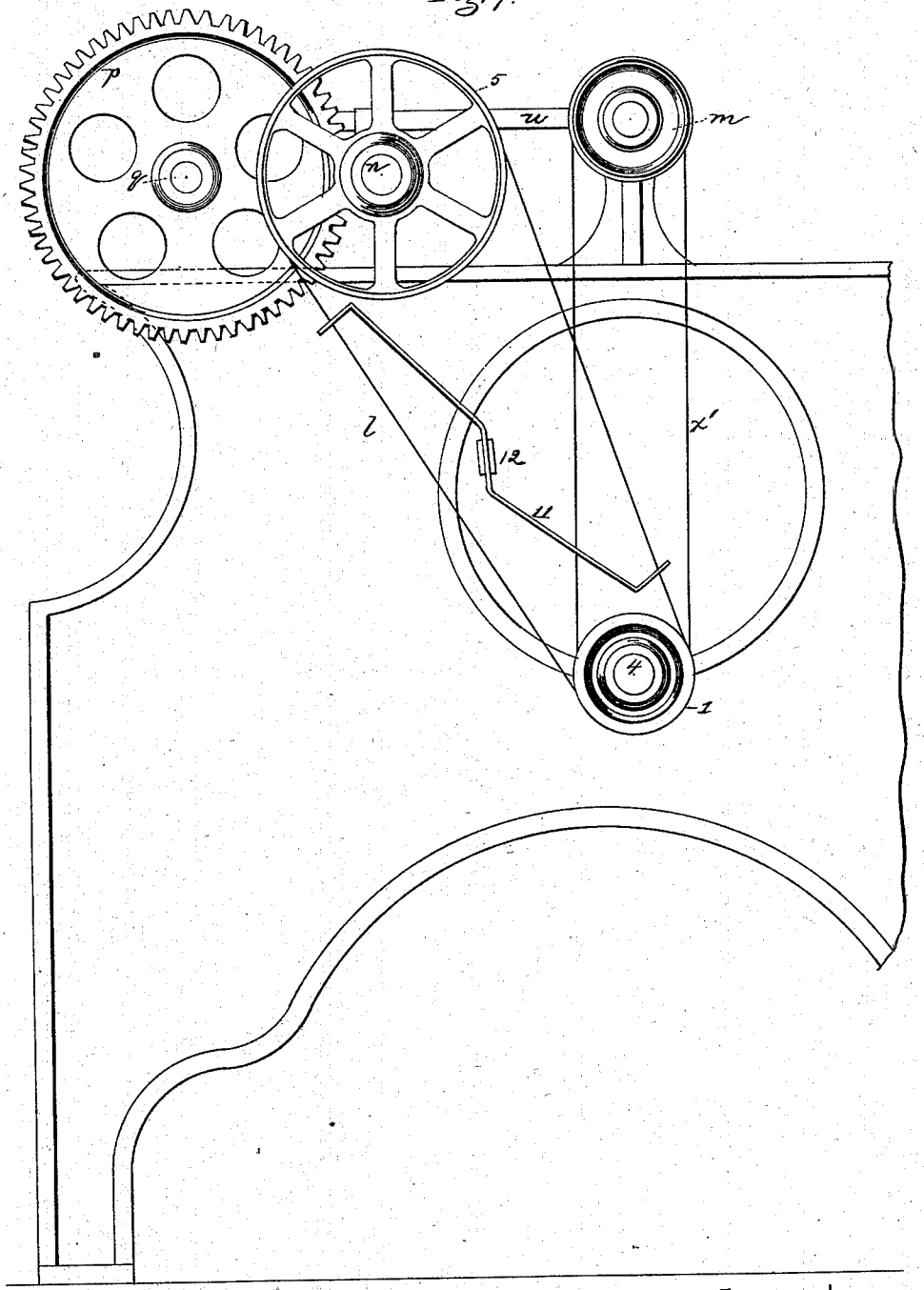
5 Sheets—Sheet 4.

G. DRAPER.

RING SPINNING-FRAME.

No. 186,324. Patented Jan. 16, 1877.

Fig. 7.



Witnesses.

L. H. Latimer.

W. J. Pratt.

Inventor.

George Draper

per Crosby & Gregory Attys.

5 Sheets—Sheet 5.

G. DRAPER.

RING SPINNING-FRAME.

No. 186,324. Patented Jan. 16, 1877.

Fig. 9

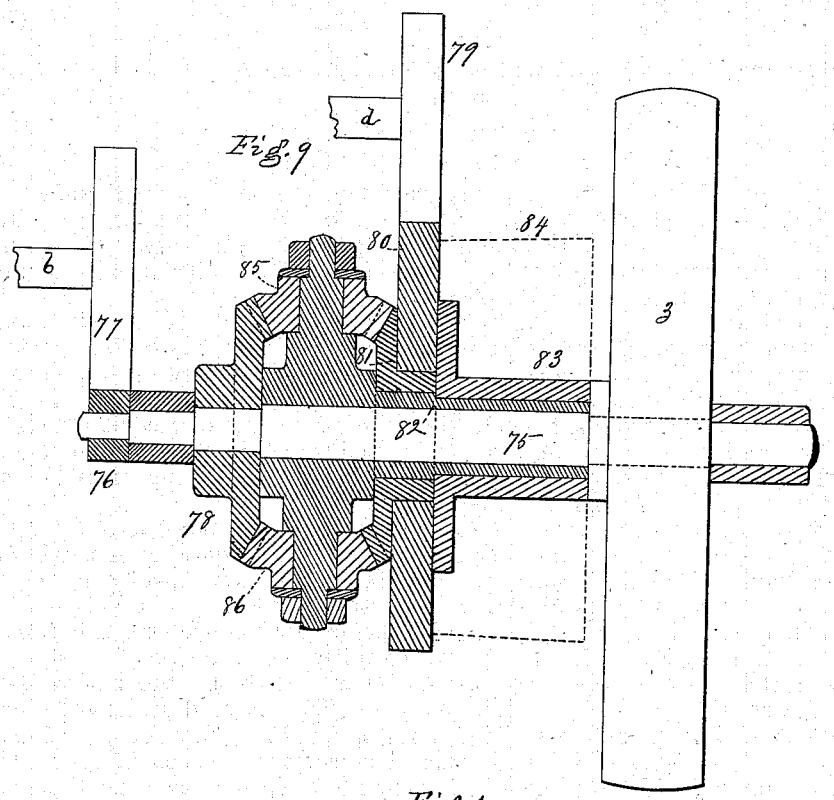
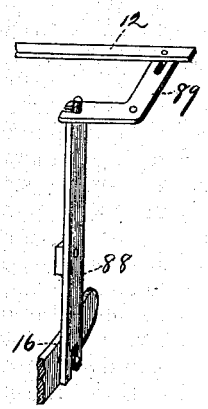


Fig. 10,



Witnesses.
Lott. Latimer.
W. G. Pratt.

Inventor
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per Crosby & Gregory Attys.

UNITED STATES PATENT OFFICE.

GEORGE DRAPER, OF HOPEDALE, MASSACHUSETTS.

IMPROVEMENT IN RING SPINNING-FRAMES.

Specification forming part of Letters Patent No. **186,324**, dated January 16, 1877; application filed September 22, 1876.

CASE B.

To all whom it may concern:

Be it known that I, GEORGE DRAPER, of Hopedale, in the county of Worcester and State of Massachusetts, have invented an Improvement in Ring Spinning-Frames, of which the following is a specification:

This invention relates to improvements in spinning-machinery, and specially to the class of ring spinning and twisting frames.

In ring-spinning the term "draft on the yarn" is employed to designate the strain put on the yarn in passing from the delivering-rollers under the traveler and to the spindle or bobbin, this draft varying according to the angle formed in the yarn when passing from the traveler to the spindle or bobbin. This draft is greatest when the yarn is wound directly upon the spindle or empty bobbin, and decreases as the spindle or bobbin becomes filled, and the angle in the yarn at the traveler is, consequently, decreased.

To produce yarn perfectly even as to size and strength, each inch of yarn delivered by the delivering-rollers should have the same amount of draft, and the same number of twists per inch, and this would be the case if the surface on which the yarn was wound did not vary in size.

In ordinary spinning-frames, when the bobbin is empty, and the drag on the yarn is sufficient to stretch it below its proper size in passing from the delivering-rollers to the bobbin, then the stretched yarn (the spindle and rollers moving at a uniform continuous speed from the commencement to the completion of the filling operation of the bobbin) receives less twist per inch than it should, and besides being smaller is less strong in proportion to to its size, because fine yarn, to make it proportionally strong, requires more twist per inch than does coarse yarn. As the bobbin is filled and increases in size the drag is constantly decreased, and the yarn is larger or coarser, and has more twists per inch than that first wound on the bobbin, and for want of draft is liable to become kinked. This variation in draft upon the yarn results in the production of yarn uneven as to size and strength.

In practice, and owing to this draft, the yarn, as it is first wound on the bobbin, is liable to break or "draw down," thereby wasting time and stock, and lessening the quantity and injuring the quality of the yarn produced.

The yarn first produced is fine, slack twisted, and tender; but as the bobbin increases in size, and the draft decreases, the yarn becomes coarse and has too much twist. This difference in the drag produces bad effects in spinning, and is felt in all the subsequent operations of spooling, warping, dressing, and weaving.

I have heretofore attempted to overcome this difficulty arising from this unequal draft, and Letters Patent No. 27,434 were granted to me for this purpose. In that patent, to which reference may be had, the spindles and delivering-rollers were always run at a uniform and equal speed, and the motion of the back rollers of the set of drawing-rollers was decreased in speed as the bobbins increased in size, this decrease in speed permitting the front rollers to draw out or stretch the roving or yarn then operated upon sufficiently to make it correspond in size with the yarn stretched by the drag or draft, the drag and decreasing speed of the back rollers together acting to make the yarn of substantially uniform size from the commencement to the completion of the full bobbin.

This change of speed of the back rollers in such patent was effected as the bobbins increased in size through an arrangement of belts and gearing connected with the drawing-rollers, and when the bobbins were doffed and the traverse motion was turned back prior to commencing the winding of another set of bobbins, this variable-speed mechanism for the back rollers had also to be set back by hand. If this last operation was neglected by carelessness of the spinner, the yarn on the new set of bobbins would be too small, for the yarn would be drawn too much by the rollers, and the drag would further attenuate it.

In another invention the speed of all the rollers was increased as the bobbins were filled, the spindles moving at a uniform speed, and, consequently, the twist was decreased.

The failure in these earlier cases to provide

means effectual to prevent the starting of the frame without securing the proper draft between the rolls, or their proper slow speed when starting the empty bobbins, compared with what it was before the frame was doffed, hindered the general introduction of such inventions.

This invention relates to mechanism which automatically provides for changing the speed of the front rolls, back rolls, and spindles relatively to each other, so that the draft between the front and back rolls is varied, and the twist per inch of sliver delivered increased or decreased, for the purpose of equalizing the size and twist of the yarn wound upon the bobbin at different stages; also, to the combination, with the drawing-rollers, the spindles, and a traverse mechanism, of a speed-changing mechanism, applied to the front rolls of the set of drawing-rollers, and connected with the traverse mechanism, so as to increase the motion of the front rolls as the bobbins increase in size, and to be reset to the initial position, or position of slow speed, through the action of the traverse mechanism when it is turned back prior to the commencement of a new set of bobbins, substantially as described.

The gist of this present invention, therefore, consists in such a combination of the spindles and back and front rollers as will permit the relative speeds of the front and back rollers and spindles to be automatically varied, so as to regulate both the draft on the roving and the twist in the yarn.

Figure 1 represents, in top view, one-half of a ring spinning-frame provided with my improvements; Fig. 2, a front view of that end of the frame at which the traverse mechanism is located, the view also showing the gearing by which the drawing-rolls are moved; Fig. 3, a detail of driving-pulleys for the drawing-rolls; Fig. 4, a vertical section of part of the frame on lines *x x*, Fig. 2; Fig. 5, a horizontal section of part of the frame on lines *y y*, Fig. 2. Figs. 6 and 8 represent details of traverse mechanism, to be hereafter described; Fig. 7, an end view, and Fig. 9 is a modification of speed-changing mechanism, and Fig. 10 a modification of belt-shifting devices.

It has been considered unnecessary to show in the drawing but one side of the spinning-frame, it being understood that the other side is like it as to the spindles, drawing-rollers, &c. When the speed of the back roller is decreased as the bobbins are filled, the size of the yarn is governed by drawing the roving more as the bobbins are filled, to correspond substantially with the yarn drawn by the action of the drag when the bobbins were started, but in such an arrangement the twist is not at all altered or affected, for the front rollers deliver substantially the same amount of yarn at each revolution. When the front rollers are increased as to their speed, as the bobbins are filled, the roving is drawn out more, as was the case when the speed of the back rollers was decreased, but, in addition to this regulation of size of roving, the front rollers are enabled to deliver a greater length of yarn as the bobbins increase in size, and the twist is regulated, giving the yarn a more uniform number of twists per inch, from the commencement of the empty to the completion of the full bobbin, than can be done by moving the back roller alone slower. This regulation of twist as well as size of yarn is of great importance, and this invention is an improvement on the invention described in another application, case A, filed concurrently with this, in the fact that the twist is also regulated, the increased speed of the front rolls feeding out more yarn to receive the excess of twist gained by the increasing size of the bobbin. The number of turns of twist per inch in a given length of yarn delivered from the rolls, is equal to the number of revolutions of the spindle divided by the length of the yarn in inches, less the number of times the yarn was wound about the spindle or bobbin in the same length of time; consequently more twist is lost when the bobbins are being commenced, or are small, than when they are larger, and to secure even twist a less amount of yarn in length should be delivered to the empty or small bobbins, for the yarn then loses more twist than when the bobbins are large. In consequence of this loss of twist the yarn on the empty bobbins, as ring spinning-frames are now constructed, is weaker than on the full bobbin. This portion of the yarn is subjected to a greater strain both in spinning and spooling. By this invention the yarn may be made stronger on the barrel of the bobbin than on the full bobbin, and I am therefore enabled to provide for and prepare the yarn for the strain to which it is to be subjected in after processes.

The frame *a* of the machine is of any ordinary or suitable construction, and is provided, as usual, with back rollers *b*, intermediate rollers *c*, and front rollers *d*, constituting the set of drawing-rollers, with spindles *e*, bolster-rail *f*, ring-rail *g*, rings *h*, and travelers *h'*, guide-wires *i'*, lifting-rods *i*, and levers *j* for moving them, and spindle-driving drum *k*, all of usual construction.

In this plan of my invention the back rollers *b* and spindles run at a uniform speed with relation to each other from the commencement to the completion of the full bobbin; but the front roller has its speed increased to deliver a greater length of roving to the spindles as the bobbins increase in size. The front roll, in this instance, is shown as deriving its motion from pulleys 1 and 2 on the shaft 4 of the spindle-drum *k*. (See Fig. 1 and detail, Fig. 3, wherein the shaft and pulleys 1 2 3 are broken away from the left of Fig. 2.) These pulleys 1 and 2 are shown

as connected by a band, as at *l*, Fig. 7, with double pulleys 5 6 (or equivalent cone-pulleys to vary speed) on a shaft, *n*, provided with a toothed wheel, *o*, the latter engaging a toothed wheel, *p*, on the shaft *q* of the delivery or front rollers *d*. The pulley 3 for operating the back rollers is connected, in this instance, by a band, *x'*, with a pulley, *m*, on a shaft, *r*, sustained in a bearing, 7. This shaft has a bevel-pinion, *s*, that engages a bevel-pinion, *t*, on a shaft, *u*, having a worm, *v*, that engages a worm-gear, *w*, on the lower shaft of the back rollers *b*. A pinion, 8, on the opposite end of the back-roller shaft, engages an idle-pinion, 9, and it, in turn, engages the pinion 10 on, and drives the shaft of, the intermediate rollers *c* of the set of drawing-rollers.

In this form of the invention the speed of the front rollers *d* is to be increased while the bobbins or cops are being filled, the exact time at which the speed is increased depending upon the size of the bobbins, or the size of the yarn, or the action of the drag on the yarn.

When the bobbin is first being wound, and is yet small, the belt *l* connects the smallest pulley 1 and the largest pulley 5, the speed of the front rollers *d* then being the slowest; but when the speed is to be changed, and the front rollers are to be run faster to permit the roving to be drawn out and delivered faster, as before described, then the belt is shifted from pulleys 1 and 5 to pulleys 2 and 6.

The belt *l* may be shifted by any usual belt-shipping mechanism. The belt-shipping mechanism shown in the drawing, in this instance, consists of a fork, 11, carried by a bar, 12, connected with a lever, 13, (shown in dotted lines, Fig. 1,) the lever 13 being connected with a vertical lever, 14, controlled, as to its time of motion for shipping the belt, by means of connecting mechanism, connecting the variable-speed mechanism with the traverse mechanism, one form of such connecting mechanism being hereafter described.

The lever 15 of the traverse mechanism, its rack 16, rack-moving screw 17, and pin 18, are of usual construction; and this lever is connected with and operates the lifting-rail through chains and levers, in a manner well understood. The cam 19, which may be of any usual configuration, acts upon the pin 18 to move the lever 15. The shaft 20, carrying this cam 19, has upon it a toothed wheel, 21, engaged and moved by a bevel-pinion, 22, provided at its other end with a worm-gear, 60, operated by the worm 23 on the shaft of the cone-pulley 24 connected with cone-pulley 25 by a belt, 26, (shown in dotted lines,) and controlled by a belt-shifter, 30, on screw 31, provided with a ratchet-wheel, 32, which may be moved as desired, to move the screw and shift the belt through a pawl, 33. The main cone-pulley 25 derives its motion from the driver of the front roller shaft through a belt, 35, that extends over the pulley 34 and over the pulley 37 on shaft *n*. The cam 19 lifts the lifting-rail to distribute the yarn helically upon the surface of the bobbin.

Cones are shown as employed to drive the traverse, and for the reasons that they permit the speed of the traverse to be changed to accord with different numbers of yarn, and they enable the traverse to be driven at different speeds while a set of bobbins are being filled, so as to lay the yarn upon the bobbins an equal distance apart on the different layers in a manner similar to laying roving on a bobbin by a fly-frame. The cones are useful for other purposes, which will be apparent to spinners.

The cone-pulleys may be moved when it is desired to change the motion of the lifting-rail with relation to the fixed speed of rotation of the spindles, by throwing the pawl 33 into operation, the normal position of pawl 33 being out of engagement with the ratchet, when the speed is not being changed. The pawl 33 (shown in the drawing,) can operate the ratchet and belt in but one direction; but it is evident that another ratchet, with reverse teeth, and operated by another pawl, might be added, and then the belt might be shifted automatically at will in either direction.

After the completion of each set of bobbins they are doffed, or removed from the spindles, and before a new set of bobbins can be properly commenced, the screw-shaft 17 must be turned back, a suitable key fitted to the end 38 being employed, thereby moving the rack 16 toward the outer end of the lever 15, increasing the length of such lever sufficiently to move the ring-rail far enough to properly commence the new bobbins.

Referring to Figs. 4 and 5, we may assume that the bobbins have been filled, and that the rack of the traverse is being moved out in the direction of the arrow preparatory to commencing a new set of bobbins.

Now, when the cam 39 reaches the lever 14 of the speed-changing devices it will move such lever on its fulcrum 40 in the direction of arrow 2, Fig. 2. This lever 14, when moved out by the cam, is locked or held out by a lock composed of a pin, 45, on a rod, 46, fitted to a block, 47, connected with the lever 15, the front end of the rod being beveled, as at 49, and a spring, 48, pressing it forward. This movement of the lever by the cam on the rack, the latter forming part of the traverse mechanism, moves the belt-shipping mechanism of the speed-varying mechanism for the front rollers, so as to place the belt connected with the front rollers on that pair of, or such portions of, the pulleys over which it runs, as to run the pulleys and front rolls at their slowest speed for the commencement of new bobbins.

As the bobbins increase in size, and the

rack 16 is moved toward the fulcrum 41 of lever 15 through the ratchet 42 and pawl 43, a pin, 44, on the rack, and, preferably, made adjustable, meets the inclined end 49 of the rod 46, and crowds it back, thereby removing the pin 45 from behind the lever, when a suitable spring, represented at 50, and shown as connected, in this instance, with the lever 13, (but a spring may be connected with any other portion of the shipping mechanism equally as well,) moves the fork to shift the belt into position for increasing the speed of the front rollers, for the purpose before explained.

By this arrangement it will be observed that the traverse mechanism cannot be turned back or reset for the commencement of new bobbins without also properly changing the variable-speed mechanism for the front rollers, and placing such mechanism in its correct initial position of slow speed, for the commencement of new bobbins.

The pin 44 may be connected with a small block 51, fitted in a groove in the rack-bar, (see Fig. 8,) and the block and pin may be held in adjusted position by a set-screw, 52, screwed into the block.

The specification, so far, describes one plan of, and shows means for, forming the connection between the traverse mechanism and the speeding-varying or changing mechanism. The cam 39 and the pin 44 on the rack, in connection with the lock, constitute, in this instance, the connecting mechanism between the traverse and speed-changing devices.

The upright lever of the speed-varying mechanism is, in this instance, acted upon by projections upon the rack-bar or movable part of the traverse-lever, that regulates the operative length of the traverse, and the distance through which the ring-rail moves.

It will be apparent to those skilled in the mechanic art, that many different forms of mechanical devices may be devised to positively operate belt-shifting or speed-changing devices through some of the moving parts of the traverse mechanism, whereby the speed-changing mechanism may be changed while the bobbins are being filled, and then be rechanged or reset to the speed necessary to properly commence a new set of bobbins, this change last mentioned being governed by the traverse as it is turned back, or before commencing a new set of bobbins.

Instead of the cam and pin, and lock, I may connect the traverse-rack, through links and elbow-levers, with devices for changing speed at the proper time, or I may make the connection with such devices through the cam 19. Instead of employing the particular traverse-lever and rack shown, I may employ any other other well-known form of traverse, wherein there exists the necessity of turning or resetting a portion thereof after doffing the full bobbins, or before commencing a new set of bobbins.

In practice, this invention being applied to the front rollers, the initial or starting speed of such rollers, or the speed at which they are run when the yarn is wound upon the empty bobbin, or on the bare quill or cop, is the slowest speed, and after running a certain time the speed is increased for the purposes before described.

In spinning, say, a No. 27 yarn, it requires about five hours to fill a set of bobbins. For about the first hour the rollers will run at their initial or first speed, and then the speed is changed—in this instance, is increased; but when the bobbins are filled, then the rolls must again run at the initial speed for new bobbins. This change is made dependent upon the resetting of the traverse; but I do not limit myself to the exact construction of devices described for producing these changes, as I expressly intend to use other mechanical devices to operate automatically in an equivalent manner.

The details of the shipping devices may be varied without departing from this invention. Instead of the pulleys 1 2 5 6, I may use any form of expanding or cone-pulleys, usually employed to secure change of speed.

The term traverse is intended to cover and include any usual or proper device to impart to the lifting or ring-rail its usual motion.

As shown in the drawing, the connection with the belt-shipping or speed-changing devices is made through the lever 15, and the device carried by it, and changed in position to control or insure the varying movement of the ring-rail, whereby the yarn is laid in proper position on the bobbin with relation to its ends. The speed-changing mechanism, in this instance of my invention, includes pulleys of different sizes, and belt-shifting mechanism, a connected portion of which extends to the traverse-rack, or equivalent device, changed in practice, by the constantly changing movement of the ring-rail, the belt moving the rolls at different speed between the commencement and completion of the full bobbin.

In this application I have described the changeable speed, as applied to the front rolls, this form of my invention, to control and make the yarn even and uniform, depending upon reducing the size of the roving, and delivering the roving faster, the speed of the delivering-rollers being also increased to regulate the twist.

In another application filed contemporaneously with this, I provide for varying the speed of the back rolls, the twist in the yarn in such case being unaffected.

In another application I provide for connecting the front and back rollers positively, by gearing, and run the front rollers faster, or the back rolls slower, or change the speed of all the rolls between the empty and full bobbins. Instead of the cones for changing the speed of the traverse, I may use any other

well-known devices for making change of speed, as expanding-pulleys. The back rollers, instead of being driven by a belt, may be driven from the drum-shaft by any usual gearing.

I have described that the speed-changing mechanism, acting through the traverse and its connections, changes the speed of the rollers to their initial position, for commencing new bobbins, between the time that the bobbins are full and new bobbins are commenced. This is the correct plan of operation, but it is expressly understood that this invention is not limited to this exact period of time at which the speed is changed after the traverse is turned back. This change of speed should be made before or as the yarn is applied to the bobbins or spindles; but it is apparent that the change might be made at some time immediately after the commencement of the new bobbins instead of before they were commenced.

When the traverse operates to lift the ring-rail for the filling-wind, the rack-bar is replaced by a wheel on which the lifting-rod chain is wound, thereby changing the extremes of motion of the ring-rail. The traverse shown in the drawing, in this instance, is for the warp-wind.

In this instance of my invention, as so far particularly described, the front rolls, reset to their initial position by turning back the traverse, regulate the twist, and draw the yarn more, while the back rolls run at a uniform speed. I prefer this plan of moving the front rolls faster, leaving the back rolls and spindles running as usual, to the plan of increasing the speed of all the rolls; but in some instances I may connect the front rollers with the back rollers by the ordinary gearing common to ring spinning or drawing frames, thereby causing all the rollers to increase or decrease their speed together, and in such modification the shaft *u*, (herein described,) to drive the back rolls, would be omitted.

This plan of varying the speed of the front rollers relatively to the speed of the back rollers and spindles or bobbins, while the bobbins are being filled, is a very important part of this invention; and it is obvious that the invention may be carried out by various forms of mechanical devices.

I have shown belts $l\ x^1$ extended from the pulleys of the drum-shaft to drive the rollers at one side of the frame. In practice, and when rollers are to be driven at each side the frame, these belts will also pass about the pulleys for the other rollers in any usual manner.

In Fig. 9 I show a modified form of differential or variable speed-gear, to be applied to the frame to change the speed of the front rollers with reference to the spindles and back rollers. In such figure the pulley 3 takes the place of the pulleys 5 6. (Shown in Fig. 1.) This pulley is fixed to shaft 75, provided with a pinion, 76, to engage a pinion, 77, on the shaft of the back roller *b*, and with a bevel-pinion, 78, of the differential gear or compound motion, so called.

The back and intermediate rollers receive their motion from the pulley 3, shaft 75, and pinion 76; and in this instance they move at the same speed with relation to the movement of the spindles.

The shaft of the front roller *d* is provided with a pinion, 79, that is engaged and moved by a pinion, 80, attached to the hub of the bevel gear 81 loose on the quill 82. This quill 82 is provided with a fixed pulley, 83, having a cone-surface, 84, over which is passed a belt corresponding with the belt *l*, but connected, in this instance, with a cone-pulley placed on an extended portion of the shaft that carries the cone 25 of the traverse-driving devices. (See dotted lines, Fig. 5.)

The bevel-gear 81 and pinion 80, for operating the front rollers, derive motion from the shaft 75, and bevel-gears 78, 85, and 86. The amount of motion imparted to the front rollers, as compared with the back rollers, depends upon the excess of the speed of the bevel-gear 78 as compared with the speed of the gear 81, the speed of the latter being variable through the pulley 83, 84, and quill 82, and bevel-gears 85, 86, their speed being increased or diminished by shifting the belt on the cam 84. This increase of speed may be made to take place gradually, between the commencement and completion of the full bobbin, by connecting the traverse-rack positively with a vertical lever, 88, the lever having at its lower end a slot to engage a pin in the traverse. The upper end of this lever would be connected with an elbow-lever, 89, arranged to be moved in a horizontal plane about a vertical axis, the other end of the elbow-lever being slotted to engage a pin on the belt-shifting rod 12, provided with the shipping-fork 11, this detail being shown in Fig. 10.

I claim—

1. The combination, with the back rollers and spindles, adapted to be run at uniform relative speeds, as described, of front or delivering rollers, adapted to be varied, independently and automatically, in speed relatively to the speed of the back rollers and spindles, while the bobbins are being filled, substantially as and for the purpose set forth.

2. The combination, with the drawing-rollers, spindles, and traverse mechanism, of speed-changing mechanism applied to the front rolls of the set of drawing-rollers, and adapted to be connected with, and operated through, the traverse mechanism, to effect the increase of the motion of the front rolls while the bobbins are being filled, and to reset the speed-changing mechanism to its initial position when the traverse is turned back, substantially as and for the purposes described.

3. The traverse-lever, its screw, and varia-

ble device, to govern the extent or extremes of motion of the ring-rail, in combination with a lever or member of the speed-changing mechanism, and with means to automatically operate such lever to change the speed of the front rolls to their initial speed, preparatory to commencing a new set of bobbins, through the movement of the variable device that governs the throw of the ring-rail, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGE DRAPER.

Witnesses:
G. W. GREGORY,
W. J. PRATT.