6 Sheets—Sheet 1.

G. DRAPER.

SPINNING-MACHINE.

No. 186,323. Patented Jan. 16, 1877.

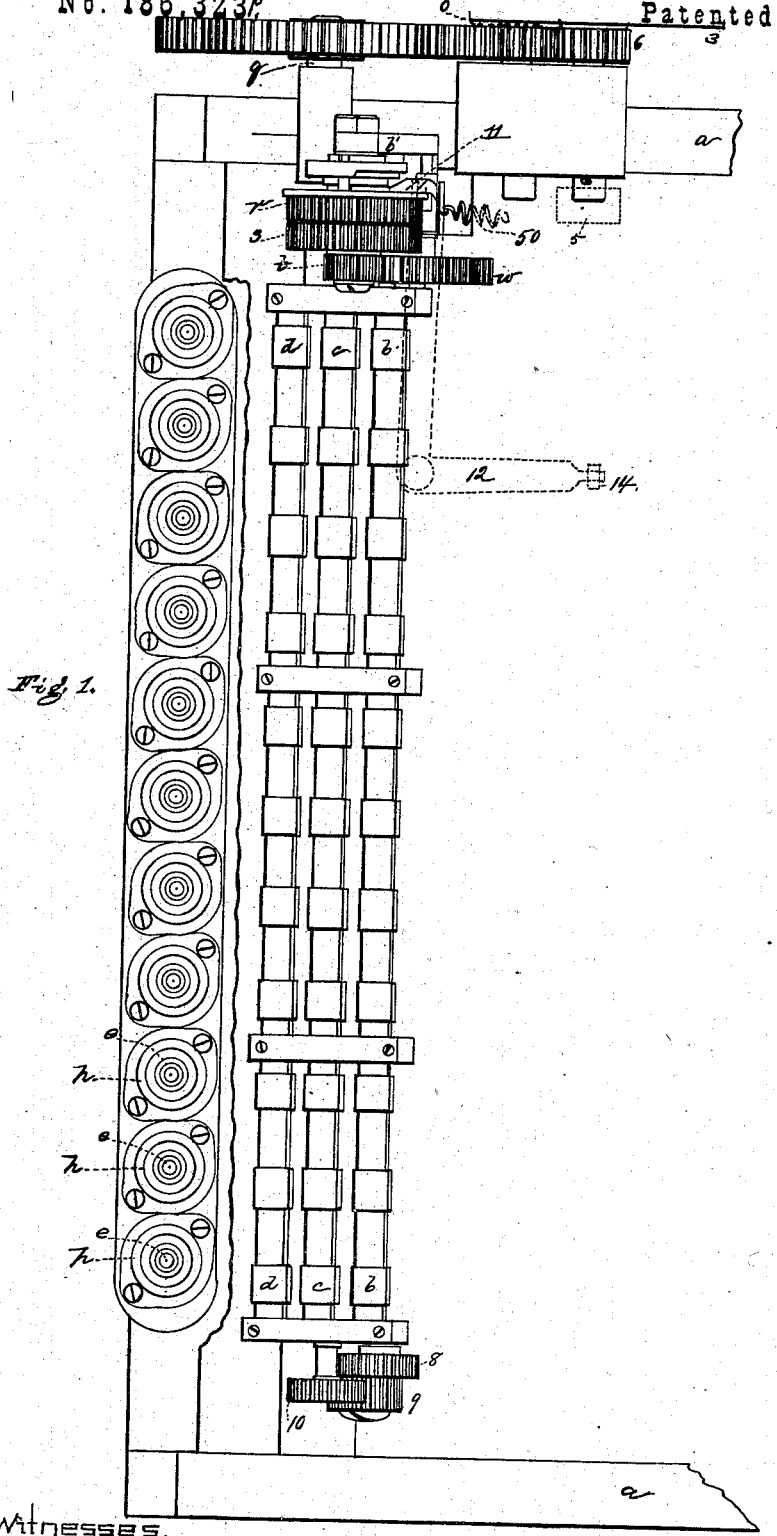

Fig. 1.

Witnesses.
Lett Latimer.
W. J. Pratt.

Inventor.
George Draper.
per Crosby & Gregory Attys.

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G. DRAPER.

SPINNING-MACHINE.

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Fig. 2.

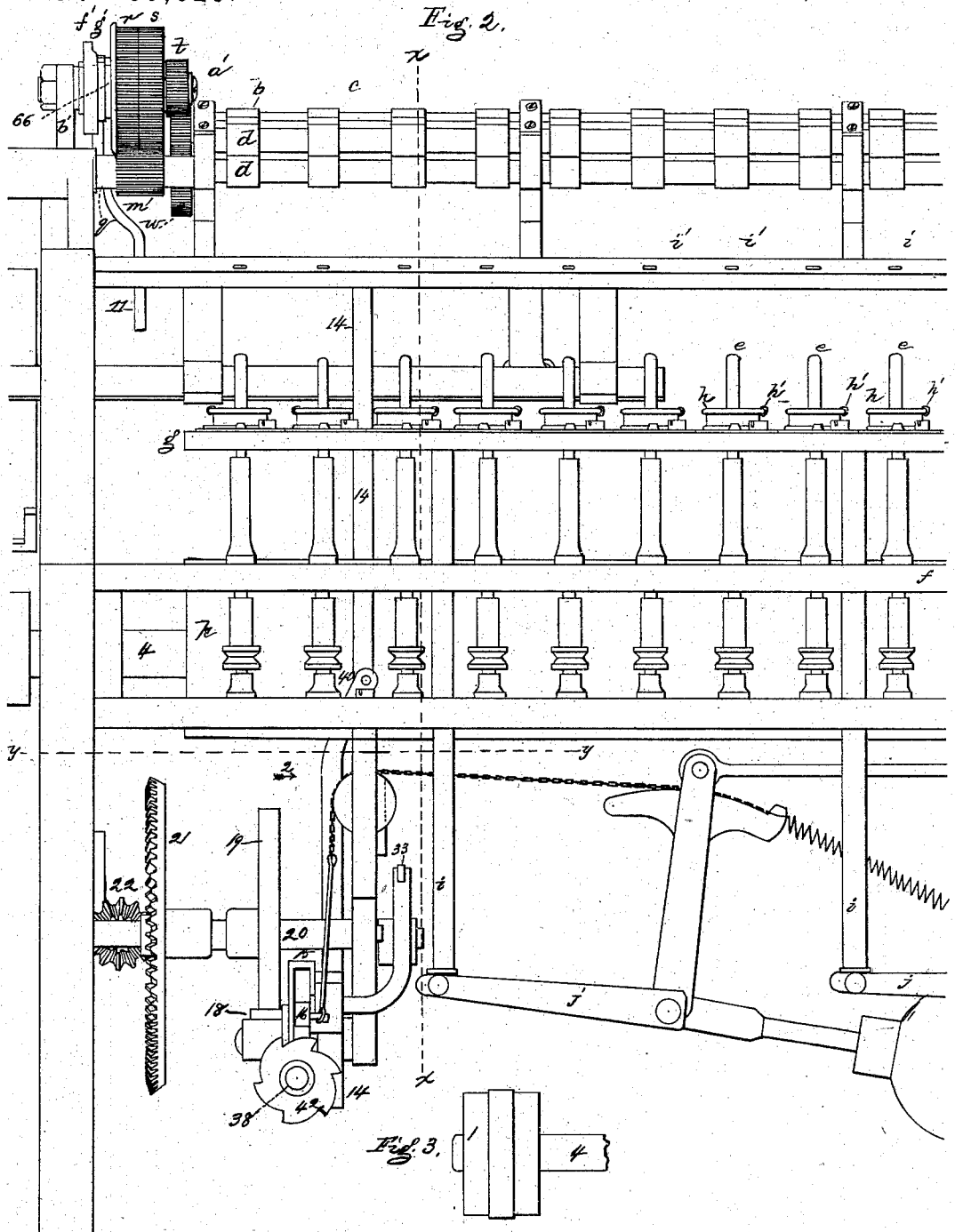

Fig. 3.

Witnesses.
C. H. Latimer.
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G. DRAPER.

SPINNING-MACHINE.

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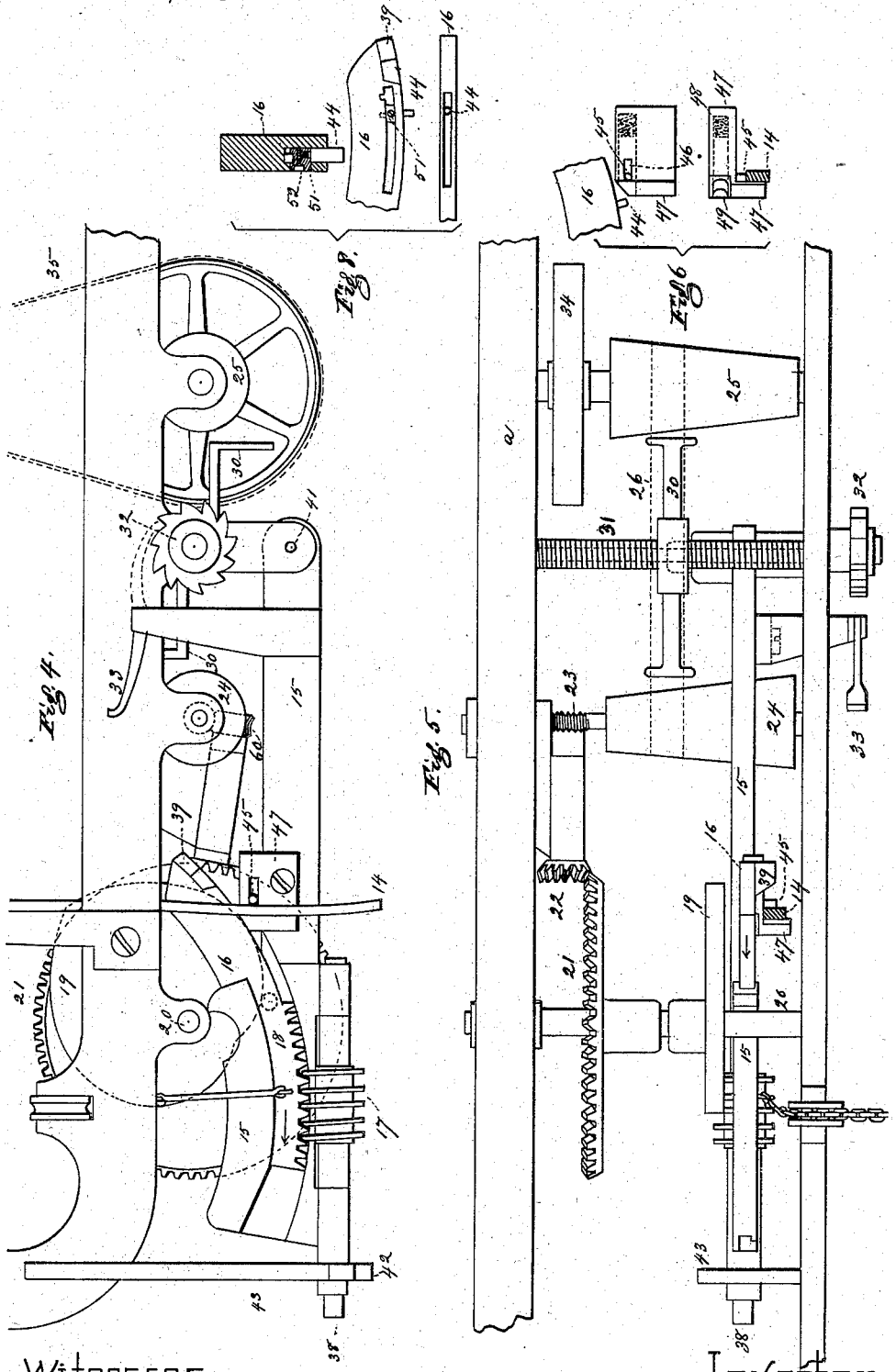

Fig 4.

Fig 5.

Fig 6.

Fig 7.

Witnesses.
C. H. Latimer.
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per Crosby & Gregory Attys.

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G. DRAPER.

SPINNING-MACHINE.

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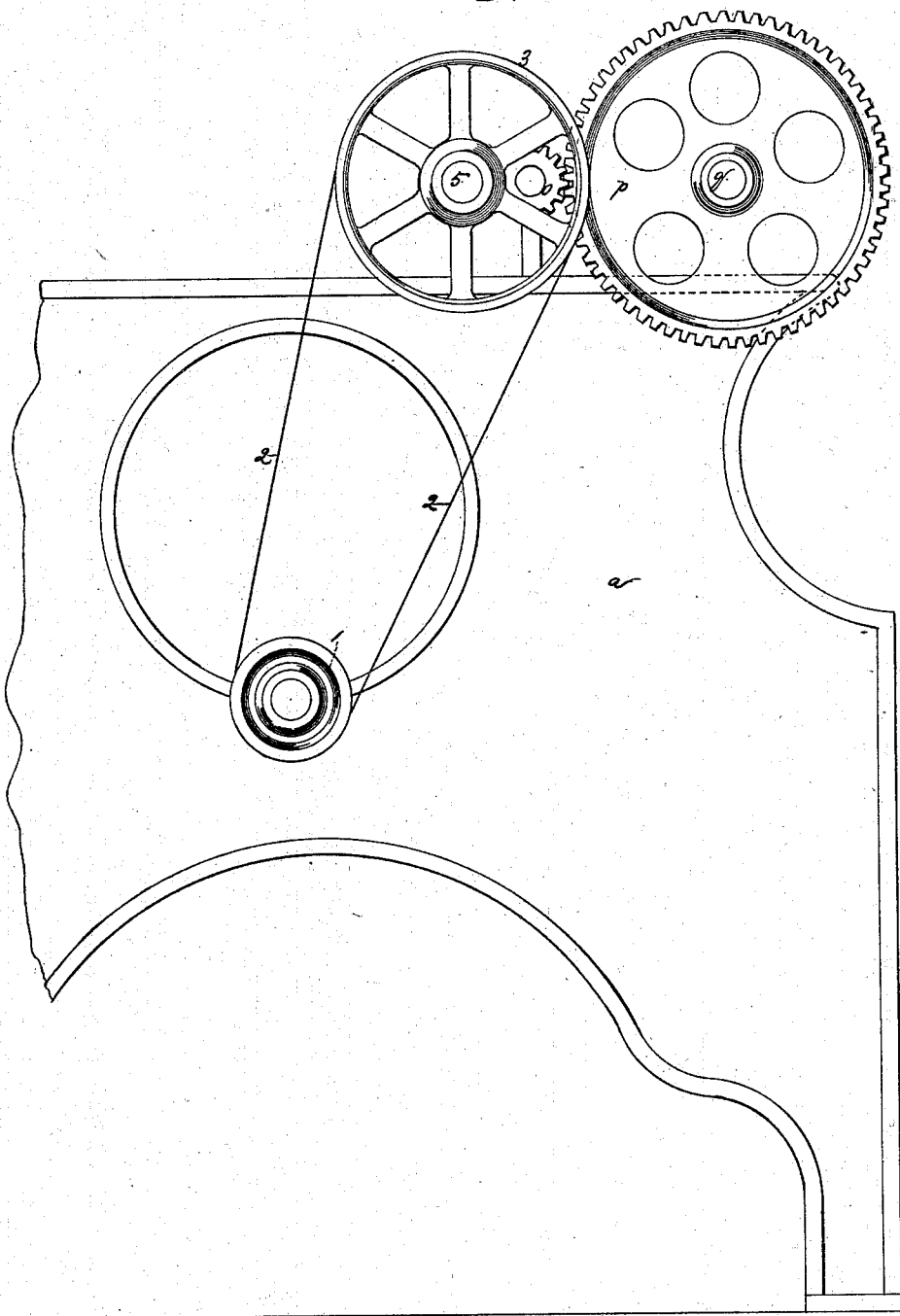
Fig. 7.



Witnesses.
C. H. Latimer.
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G. DRAPER.

SPINNING-MACHINE.

No. 186,323. Patented Jan. 16, 1877.

Fig. 9.

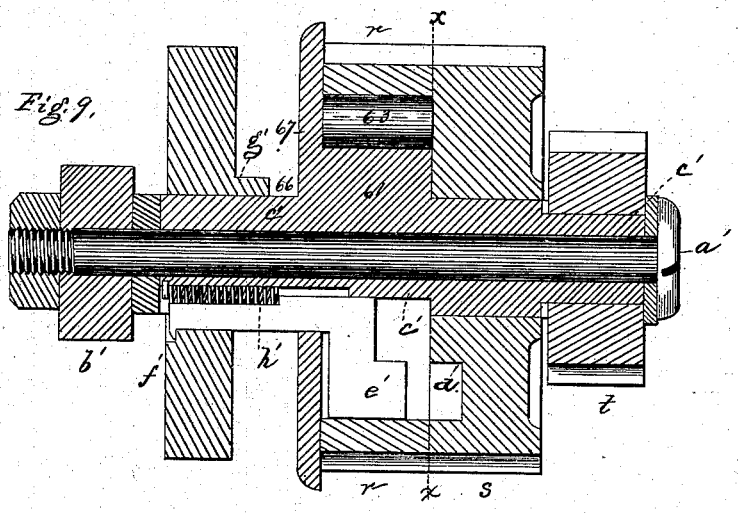


Fig. 10.

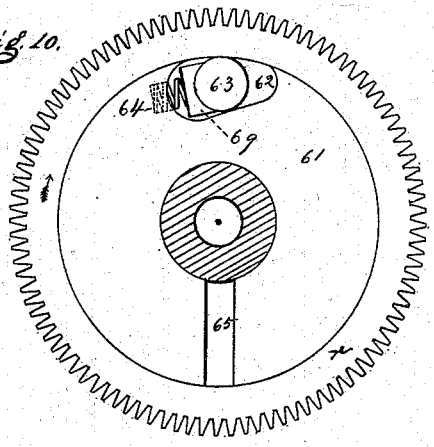


Fig. 11.

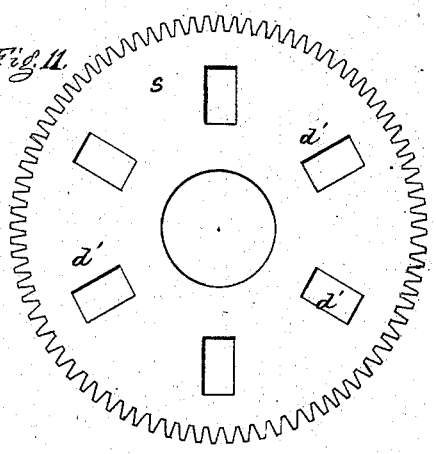
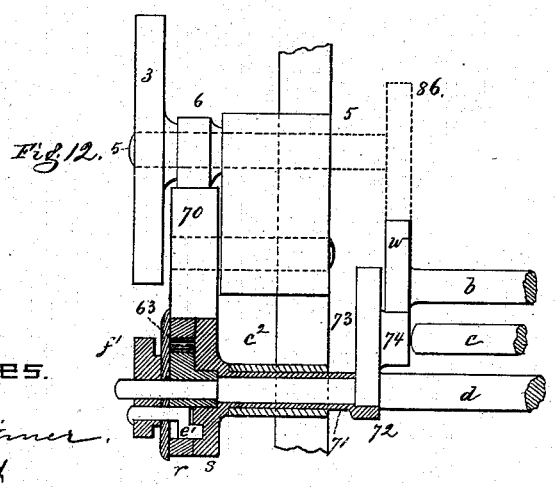


Fig. 12.



Witnesses.

Lott Latimer.

W. J. Pratt.

Inventor

George Draper

per Crosby & Gregory

Attys.

6 Sheets—Sheet 6.

G. DRAPER.

SPINNING-MACHINE.

No. 186,323. Patented Jan. 16, 1877.

Fig. 13.

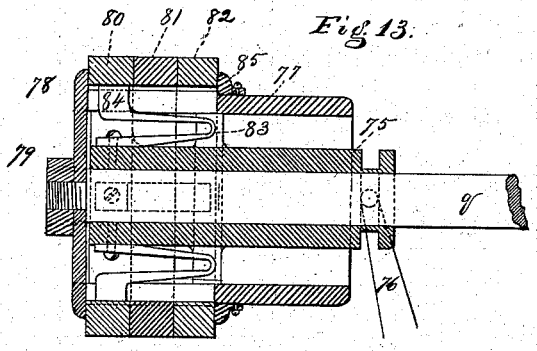


Fig. 14.

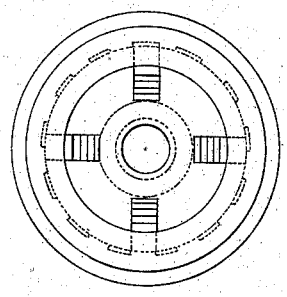


Fig. 15.

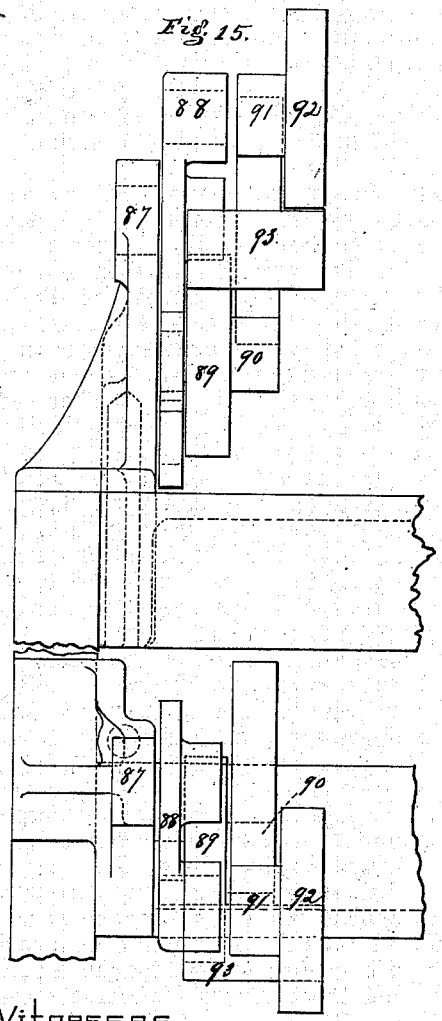
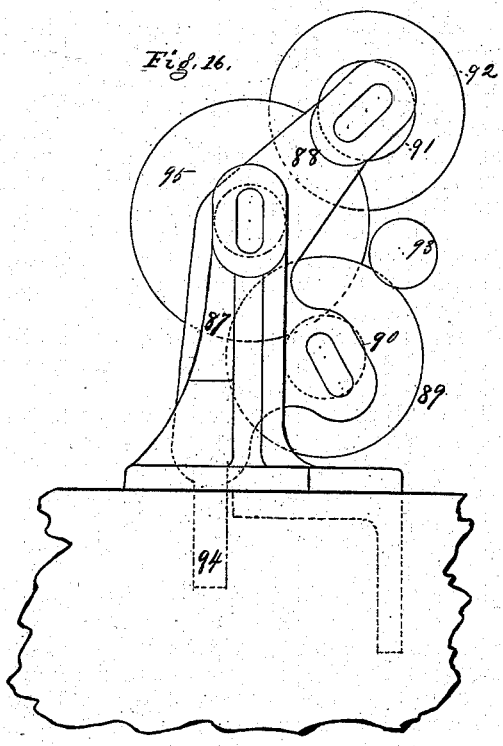


Fig. 16.



Witnesses.
Lott Coatimer.
W. J. Pratt.

Inventor.
George Draper
per Crosby & Gregory Atty's.

UNITED STATES PATENT OFFICE.

GEORGE DRAPER, OF HOPEDALE, MASSACHUSETTS.

IMPROVEMENT IN SPINNING-MACHINES.

Specification forming part of Letters Patent No. **186,323**, dated January 16, 1877; application filed September 22, 1876.

CASE C.

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 Improved Spinning-Machine, 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 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 farther 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.

When the speed of the back rollers is decreased, the size of the roving is reduced to correspond with the effect produced by the action of the drag or draft, but the twist is not at all altered or affected, for the delivering-rollers deliver substantially the same amount of yarn at each revolution.

When the changeable speed is applied to the front rollers, the size of the roving is reduced as when the speed of the back rollers is decreased, but, in addition thereto, the twist is regulated by varying the amount of yarn delivered by the front rollers.

In other applications filed concurrently with this, I have shown and described speed-changing mechanism applied to the back rollers and to the front rollers, but in such cases the speed is changed through the action of belts. In this instance of my invention, the front and back rollers are connected positively together by means of gearing, whereby the frame when started up, always starts the front and back rollers together, thereby preventing the evil effects that would result by reason of the belts slipping—as, for instance, the breakage of the rovings.

This invention consists in the combination, with spindles and front and back rollers, of speed-changing, or fast and slow speed pinions and gearing, connected or geared positively with the front and back rollers, to automatically impart to such rollers their variable speeds with relation to each other to regulate the size of the yarn, or its size and twist, as herein set forth.

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 the driving-pulley 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; and Fig. 7 an end view. Fig. 9 represents the speed-changing device, or fast and slow speed pinion, in longitudinal section; Fig. 10, a section on line *x x*, Fig. 9; Fig. 11, a face view of one of the toothed portions thereof; Figure 12, a modified form thereof, to operate the front rolls at a variable speed; Figs. 13 and 14, another modification for the same purpose; Fig. 15 and 16, one modification of form of mechanism to decrease the speed of the back rollers.

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.

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 except in Figs. 12, 13, 14, the front or delivery rollers *d*, and spindles, run at a uniform speed with relation to each other, from the commencement to the completion of the full bobbin, substantially the same length of roving being delivered at each revolution of the spindles.

In Figs. 1 to 11, inclusive, the front roller *d* is shown as deriving its motion from a pulley, 1, or a suitable pulley on shaft, 4, of the spindle-drum *k*, (see detail Fig. 3,) wherein the pulley and shaft are broken off and shown separately. This pulley 1 is shown as connected by a band, 2, with a pulley, 3, on a shaft, 5, provided with a toothed pinion, 6, that, through an idle pinion, *o*, engages and moves the gear *p* on the shaft *q*. The front roller-shaft *q*, in Fig. 2, is provided with a long pinion, *m*, that engages the teeth of toothed rings *r s*, of a variable-speed pinion or differential gear, adapted to operate a pinion, *t*, that engages a larger pinion, *w*, on the shaft of the back roller *b*. This roller *b*, at its other end, is provided with a pinion, 8, that engages an idle pinion, 9, that in turn engages pinion 10, and operates the intermediate rollers *c*.

In this invention (see Figs. 1 to 11) the variation in speed between the back and front rollers is made through a variable speed or fast and slow speed pinion, which acts as an intermediate gear between the gears on the front and back rollers. Fig. 9 represents this variable pinion in section. Its stud *a'*, secured to the stand *b'*, sustains the quill *c'*, about which are arranged the toothed rings or wheels *r*, *s*, and *t*. The toothed wheel *t* is fixed to the quill. The toothed ring or pinion *s* is loose on the quill, but its face, as shown in Figs. 9 and 11, is provided with notches *d'* (any suitable number) to receive a pin, *e'*, connected with and so as to be moved by a sliding collar, *f'*, provided with a cam-face, *g'*, adapted to be moved laterally to withdraw the pin from wheel *s* by the action of a lever, 11, to be hereafter described. The pin and collar are moved in the opposite direction by a spring, *h'*, connected therewith, as shown in the drawing.

The part 61 of the quill *c'* has an opening, 62, in which is placed a friction-roll, 63, preferably thrown into the smaller portion of the opening 62, by a spiral or other spring, 64, that presses against a shoe, 69. This part 61

of the quill has also a slot, 65, through which passes the pin e'. The toothed rim r or slow-speed pinion is mounted upon this enlarged portion 61 of the quill, as shown in Fig. 10, and has at its periphery more teeth than has the periphery of toothed rim or wheel s, the fast-speed pinion. In an ordinary-sized spinning-frame rim r will have about ninety-six teeth, and rim or wheel s about eighty-seven teeth. The exact number of teeth depends upon the difference in speed it is desired to produce between the front and back rollers, this depending upon the roving and size of the yarn to be produced, and the amount of drag.

The teeth of rims or wheels $r\,s$ are engaged by the pinion m on the front roller. When the pin e' is withdrawn, as shown in Fig. 9, toothed wheel s is liberated, leaving it free to turn under the action of pinion m without moving any other part; but the toothed rim r, acted upon by the pinion m, causes the roller 63 in the part 61 to move forward into the smallest portion of the opening 62, in which position it wedges between the rim r and quill, and the rim then moves the quill and pinion t, that operates the back rollers.

When the pinion t derives its motion from the toothed rim r, as when the pin e' is withdrawn, the speed of the back rollers is decreased. When the pin e' is in engagement with the toothed wheel s, then the quill is driven positively through wheel s, and the pinion t drives the back roller at its fastest speed. The hub moved through the fastest wheel s travels faster than the rim or wheel r, and, consequently, the cylinder or roller 63 falls into the enlarged portion of the opening 62.

When new bobbins are being commenced, the pin e' is in engagement with the toothed wheel s of least teeth, the back rollers then moving at their fastest speed, but at the proper time between the commencement and completion of the bobbins the pin e' is withdrawn, thereby permitting the toothed rim r to operate and drive the back rollers at a slower speed. The exact time at which the speed of the rollers will be changed will depend upon or be governed by the size of the bobbins, or the size of the yarn, or the action of the drag on the yarn.

The devices, in this instance, to throw the fast or slow speed pinion into or out of operation, consist of a lever, 11, actuated by a lever, 12, (shown in dotted lines, Fig. 1,) the lever 12 being connected with a vertical lever, 14, controlled as to its time of motion for withdrawing the pin and changing the speed of the rollers, by means of mechanism connected with the traverse mechanism, one form of such connecting mechanism being hereafter described. The upper end of lever 11 is beveled to permit it to be turned or moved into the groove 66 between the cam g' of the collar and the part 67 of the quill.

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 will or may derive its motion from a belt, 35, that will extend over a pulley on shaft 5, or from other suitable source. 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 bobbin 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 speed-varying mechanism for the back rollers, so as to withdraw the pin e' connecting the fast and slow speed pinions, thereby running the back rolls at their fastest speed through pinions s, 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 12, (but a spring may be connected with any other portion of the lever equally as well,) moves the lever 11, to draw the pin e' and disengage the parts r s, in order to decrease the speed of the back 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 rollers, and placing such mechanism in its correct initial position 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 lever 14 for operating the speed 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 the lever 14 that operates the speed-changing devices. This upright lever 14 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 either a fast or slow speed pinion of the speed-changing devices, through some of the moving parts of the traverse mechanism, whereby the speed-changing mechism may be changed while the bobbins are being filled, and then be re-changed 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 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, as so far described, being applied to the back 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 fastest speed, and after running a certain time the speed is made slower, 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 made slower; 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 term traverse is intended to cover and include any usual or proper device to impart to the lifting or ring-rail its usual motion. 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.

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.

I have so far specifically described how

the speed of the back-rolls may be decreased as the bobbins are being filled. This invention of positively connecting the front and back rollers by means of gearing is applicable equally as well to the class of machines described by me in another application filed concurrently herewith, and to which reference may be had, wherein the speed of the front rolls is increased or changed with relation to the speed of the spindles and back rolls, and wherein the twist is regulated, as therein described. In that class of machines the initial or first speed of the front rollers, or the speed at which the front rollers are run when commencing to wind the yarn on the bare bobbin or cop-tube or spindle is the slowest speed, and after running a certain time the speed of the front rollers is increased. I consider that form of this invention in which the speed of the front rollers is varied with relation to the speed of the spindles and back rollers, as and for the purpose described in Case B, as the preferable form of this invention.

To apply the fast and slow speed pinions or speed-changing or differential gearing to the front rolls, so as to increase their speed, the parts will be constructed as shown in Fig. 12. In such figure, the fast and slow speed-pinions *r s* are placed outside the frame *a*. Pulley 3, the same as that shown in Figs. 1 and 7, is provided with a pinion, 6, that engages an intermediate pinion, 70, of larger size, having a broad face capable of engaging the teeth of rim *r* and wheel *s*, as in the case of pinion *m*, before described.

Toothed wheel *s* in this modification has a long sleeve, 71, with a pinion, 72, that engages a gear, 73, having an attached pinion, 74, that engages the pinion *w* on the shaft of the back roller, connected at its other end (as shown in Fig. 1) with the roller *c*. In such figure the pin *e'* and collar *f'* are the same as in Fig. 9, and the pin is to be withdrawn, as described and shown in Figs. 1, 2, and 9.

The quill c^2 in Fig. 12 is connected positively with the extended shaft of the front roller *d*, it being provided with an opening, 62, a roller, 63, and a slot, 65, for pin *e'*, the rim *r* moving thereon, all as shown in Fig. 10.

When the bobbin is empty the pin e^1 is withdrawn, and rim *r* then drives the front roller at its slowest speed, the toothed wheel *s*, also moved by the pinion 70 through its sleeve 71 and pinion 72, moving the back rollers. When the speed of the front rollers is to be increased or changed with relation to the speed of the spindles and back rollers, the pin *e'* is moved so as to engage the fast-speed wheel *s*, and then the front roll is moved through the medium of the pinion *s*, and at a faster speed than when moved by rim or pinion *r*. In this case, however, the fast-speed pinion yet continues to move the back rollers at the speed at which they were moved when the front rollers were moved by the rim *r*.

In Figs. 13 and 14 I show another modification, to vary the speed of the front rolls with relation to the spindles and back rollers. The shaft *q* is an extended part of the front-roller shaft. A quill, 75, placed upon this shaft, is adapted to be moved longitudinally thereon under the action of a forked lever, 76, connected by a link with the upper end of the lever 14 acted upon by the cam 39 of the traverse mechanism. A hub, 77, has its end 78 connected positively with the end of shaft *q* by a nut, 79, or otherwise. About this hub is placed, in this instance, three toothed rims, 80 81 82, the one 80 having a greater number of teeth than the one 81, and the one 81 having more teeth than the one 82. The springs 83—four or more—are connected positively with the quill, and the ends 84 of the springs extend through elongated slots in the periphery of the hub 77. When the frame is started, and the front rolls are to be driven at their slowest speed, the ends 84 of the spring-teeth engage notches in the interior of the rim 80, as shown in Figs. 13 and 14. When the speed of the front roll is to be changed or increased, the quill and springs are moved toward the right, (see Fig. 13,) and in such position the ends 84 will engage one of the other rims, 81 or 82. The rims 80 81 82 are held upon the hub by a collar, 85. The rims 80 81 82 will be driven from a long pinion placed on shaft 5, (see Fig. 12,) instead of the pinion 6, the shaft carrying such pinion being moved a little toward the front roller. In this modification the back rollers, as shown and described in Fig. 12, must be driven from a pinion, 86, on a suitable prolongation of the shaft 5, such pinion (shown in dotted lines) engaging the pinion *w* on the back roller.

In Figs. 15 and 16 I show a modification to decrease the speed of the back rollers as the bobbins are being filled. In said figures, 87 is a stand on which is pivoted a pinion-shifting arm, 88, provided at each end with two toothed wheels, 89 90, and 91 92, the pinions 89 and 92 being of the same size and the pinion 91 being larger than pinion 90. The pinion 93 is a long pinion placed on the shaft of the front roller *d*, and adapted to be engaged by either the pinion 89 or 92, as the pinion-shifting arm 88 is moved through the action of the levers 12 14 (shown in Fig. 1,) the end 94 of the shifting-lever entering a slot in lever 12.

In this modification the front roller is driven in any ordinary way, and it, through its pinion 93 and pinions 89 90 or 91 92, moves the back-roller pinion 95. When the yarn is first being wound upon the bobbins the pinion 92 is in gear with the pinion 93, and the pinion 91 then drives the back roller at its fastest speed; but as the bobbins are being filled the position of the pinion-shifter is changed through the traverse, and pinion 89 is engaged with pinion 93, and then the pinion 90 drives the back roller slower.

This invention of positively connecting the front and back rollers by gearing is also ap-

plicable to a frame in which the speed of all the rollers is changed automatically through the traverse, as before described. In such a form of the frame the front roller or the back roller, made variable as to speed by mechanism substantially as described, may be connected with the back or the front roller by the gearing now commonly employed to connect front and back rollers.

I claim—

1. The combination, with the spindles and front and back rolls, or either, of speed-changing or fast and slow speed pinions and gearing connected or geared positively with the front and back rollers, or either, and adapted to automatically impart to such rollers variable speeds with relation to each other to regulate the size of the yarn being spun, or its size and twist, substantially as described.

2. The combination, with the front and back rollers, of the set of drawing-rollers of fast and slow speed pinions, having different numbers of teeth, and a mechanism adapted to automatically connect either of them with or to disconnect either of them from the drawing-rollers, to vary the speed of the said rollers, 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.