4 Sheets—Sheet 1.

W. F. DRAPER.

RING SPINNING-FRAME.

No. 186,322. Patented Jan. 16, 1877.

Fig. 1.

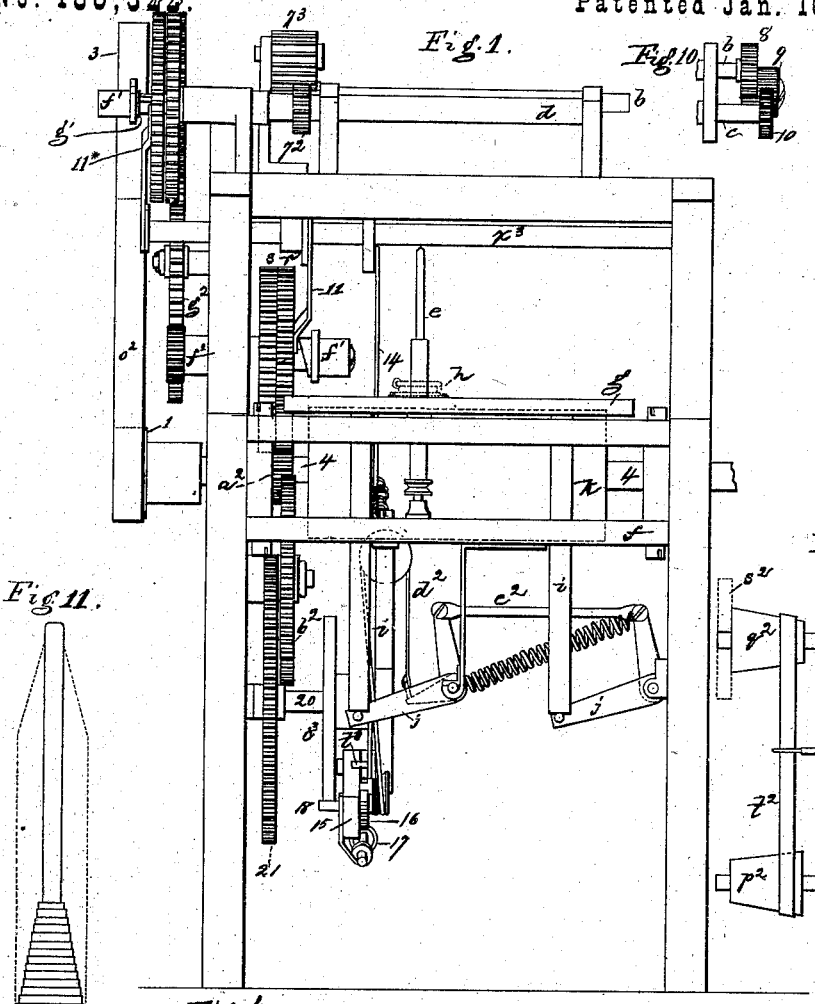


Fig. 10.

Fig. 11.

Fig. 7.

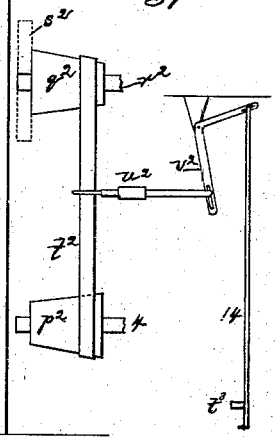
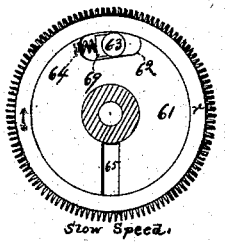
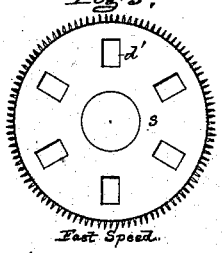


Fig. 4.



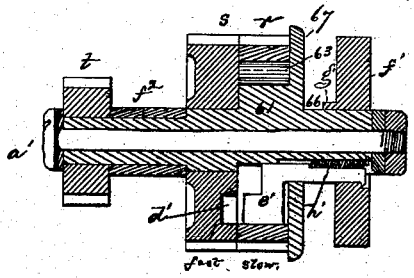
Slow Speed.

Fig. 5.



Fast Speed.

Fig. 3.



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4 Sheets—Sheet 2.

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RING SPINNING-FRAME.

No. 186,522. Patented Jan. 16, 1877.

Fig. 2.

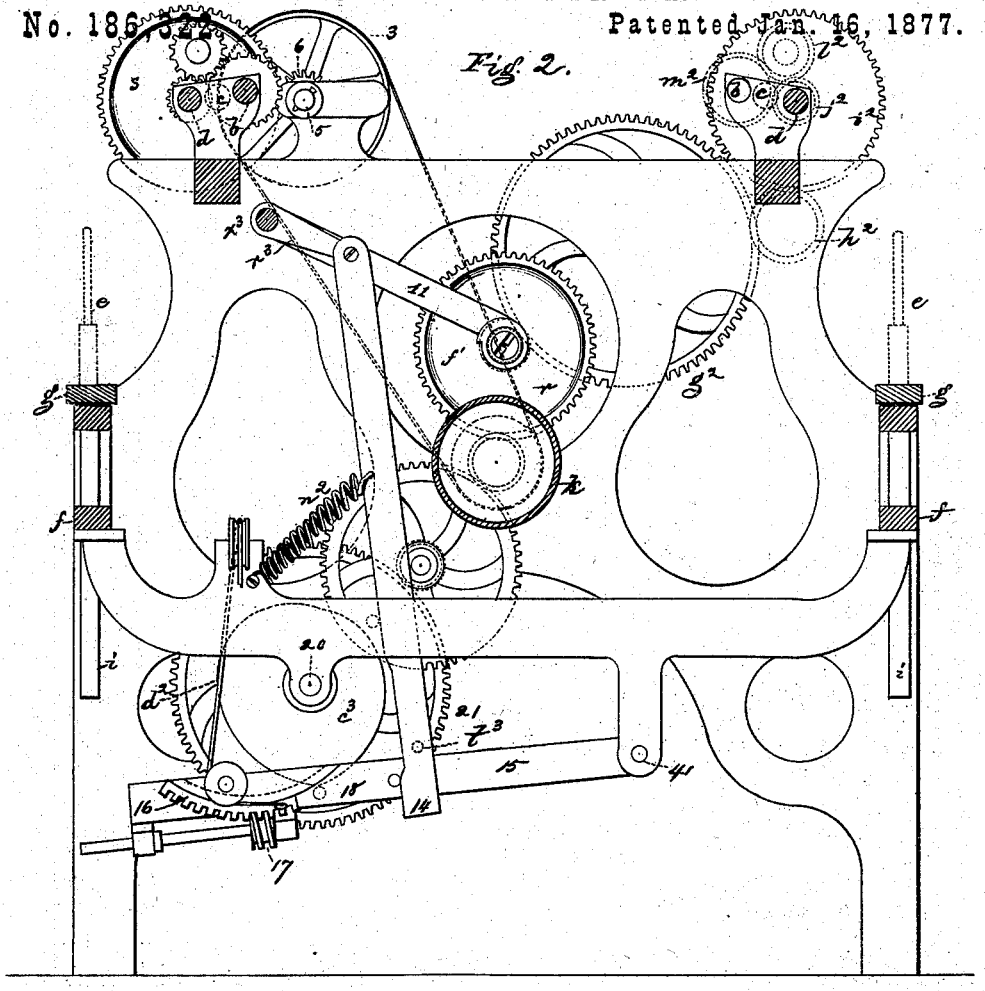
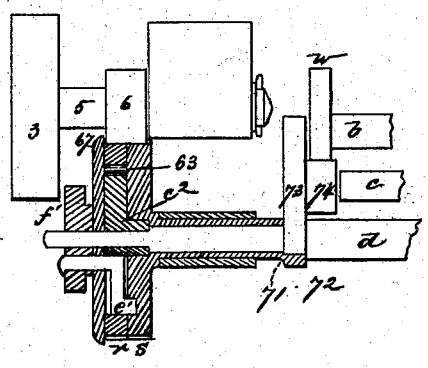


Fig. 6.



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4 Sheets—Sheet 3.

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RING SPINNING-FRAME.

No. 186,322. Patented Jan. 16, 1877.

Fig. 7.

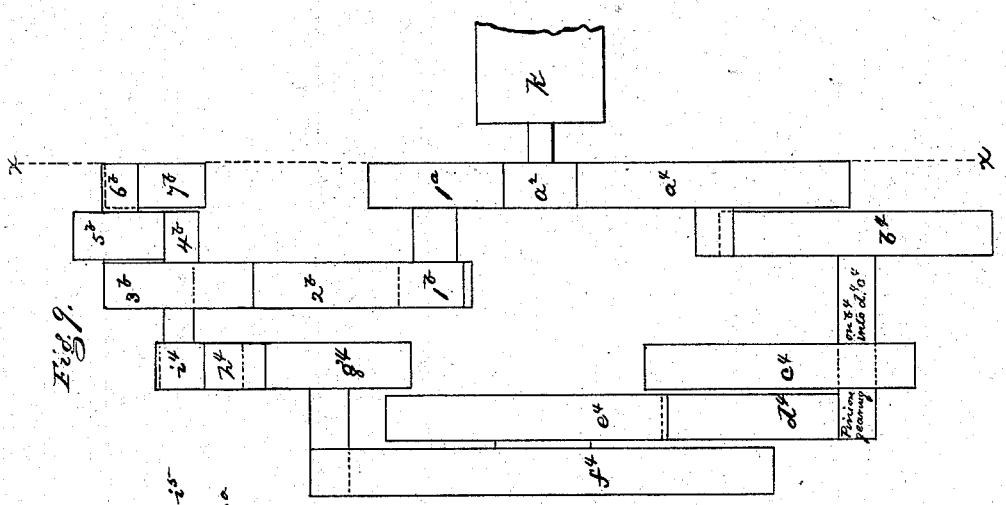
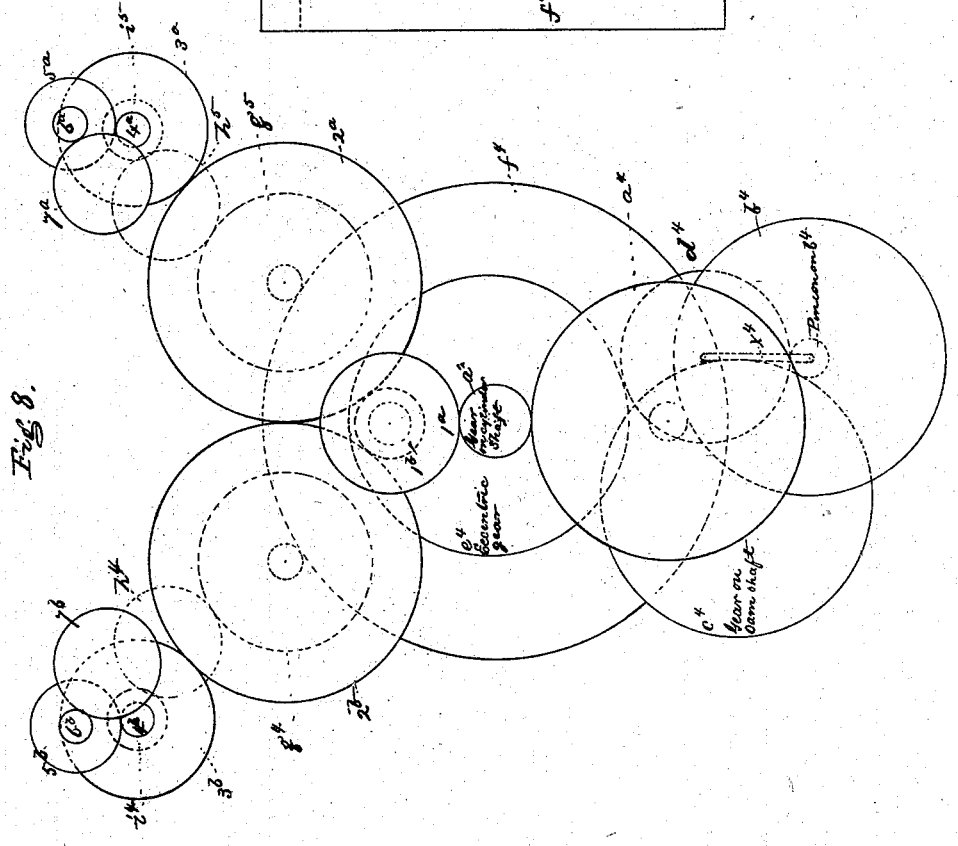


Fig. 8.



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4 Sheets—Sheet 4.

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RING SPINNING-FRAME.

No. 186,322. Patented Jan. 16, 1877.

Fig. 12.

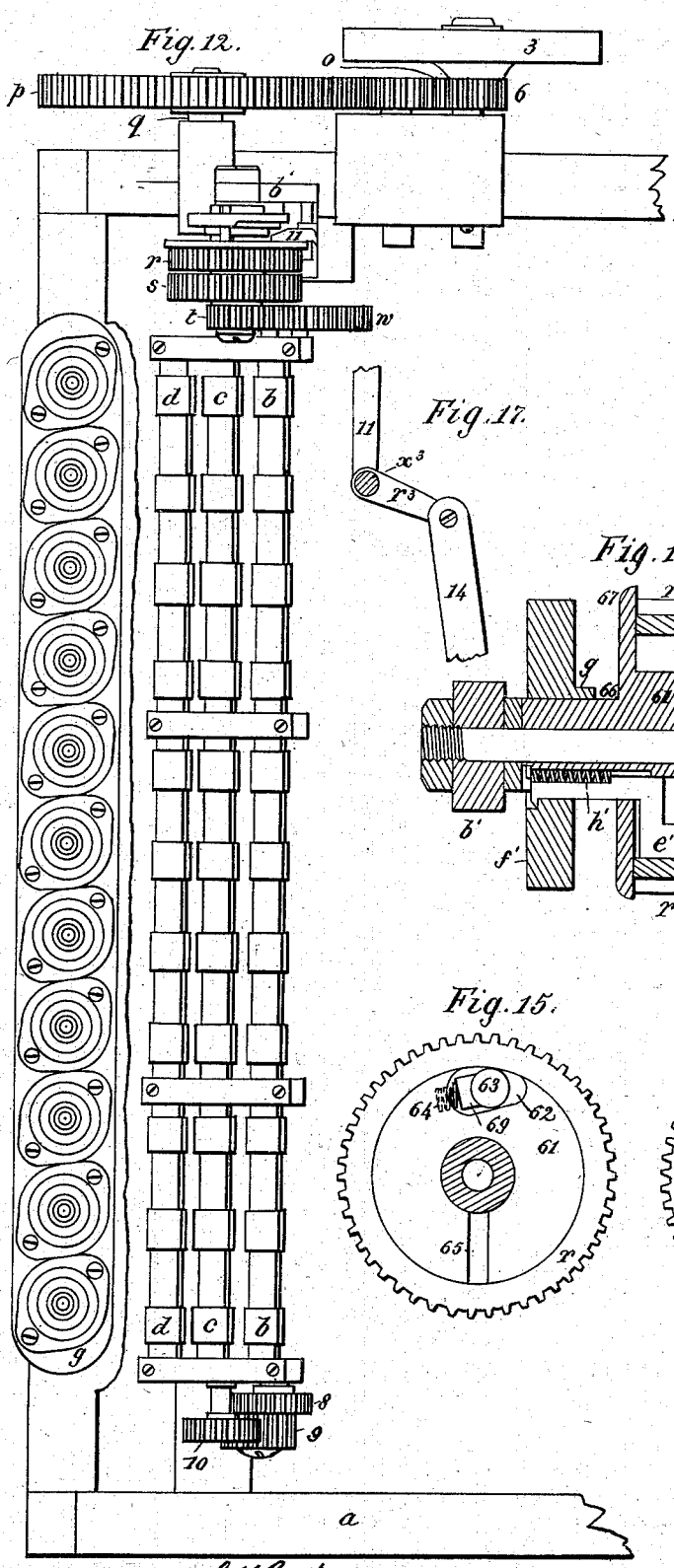


Fig. 13.

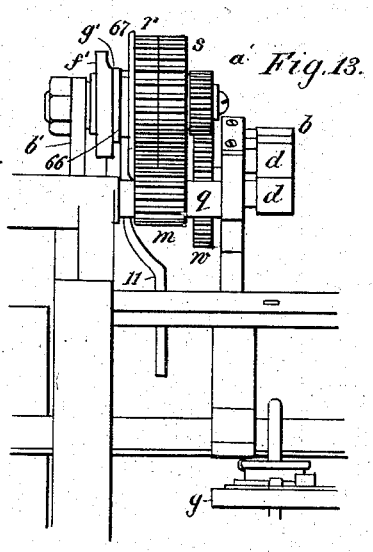
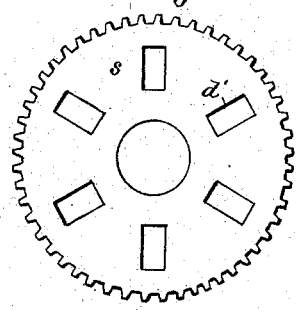


Fig. 17.

Fig. 14.

Fig. 15.

Fig. 16.



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UNITED STATES PATENT OFFICE.

WILLIAM F. DRAPER, OF HOPEDALE, MASSACHUSETTS.

IMPROVEMENT IN RING-SPINNING FRAMES.

Specification forming part of Letters Patent No. **186,322**, dated January 16, 1877; application filed October 2, 1876.

To all whom it may concern:

Be it known that I, WILLIAM F. 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 ring-spinning frames to spin yarn for weft or filling mainly. Mules are generally employed to spin filling, notwithstanding they do not spin and wind continuously, and notwithstanding the fact that there is much waste in weaving when mule-cops are used.

Mules possess advantages over ordinary spinning-frames in that the strain in winding varies but little, and the twist per inch is nearly uniform, and consequently spinners have been able to put less twist in filling-yarns spun on the mule than in yarns spun on frames, wherein the strain constantly changes from the full to the empty bobbin, this strain being greatest when the yarn is being wound upon the empty bobbin, where there is less twist in the yarn to resist stretching or breaking the same.

The twist put in a given length of yarn spun on a ring-frame is equal to the number of revolutions of the spindle while the yarn is being delivered by the rolls, less the number of times the yarn is wound around the bobbin, suitable allowance being made for the stretching of the yarn. A full bobbin is about one and one-half inch in diameter, and an empty one, as ordinarily made for filling, about five-eighths of an inch, so that when the bobbin is full one turn of twist is lost to about four and one-half inches, and when empty one turn to less than two inches.

In this my improved frame I make the bobbins about five-sixteenths of an inch in diameter, or about one-half smaller, and on an ordinary frame such a bobbin would lose one turn in less than one inch.

This difference in strain or draft of the traveler and in twist makes it necessary, in the first place, to put more twist into the yarn than is desired, and in the second place to use a bobbin with a comparatively large barrel, both of which are serious disadvantages; for hard-twisted filling makes hard, wiry cloth, rough to the touch, and which, in dyeing, will not take color as well as cloth woven of softer spun yarn, and the bobbin with large barrel, besides holding less yarn and unnecessarily increasing the weight to be moved by the spindle and in the shuttle, makes it necessary to stop the loom oftener to replace shuttles, thereby losing time and making more imperfect places in the cloth than would be the case if the shuttle-thread were longer.

The mule spins filling slowly, requires expensive help to operate it, and the cops produced are liable to much waste in weaving.

The ordinary ring-frame, as described, puts in too much twist, and requires a large bobbin to prevent the yarn from pulling apart under the strain to which it is subjected when being wound upon the empty bobbin, and the frame cannot be run at high speed without breaking the yarn at the barrel of the bobbin, where the twist is least, and consequently the yarn is wound soft to decrease the strain thereon.

An ordinary filling-bobbin is provided at its lower end with a conical head, upon which the yarn is wound in successive layers of about the length of, and in line with, the surface of the cone, the diameter of each layer decreasing from the diameter of the full to the diameter of the empty bobbin, and vice versa, during each rise and fall of the ring-rail, the latter rising a little higher and descending not quite so far at each stroke, thereby building up the cone-shaped layers upon the bobbin, leaving the yarn in layers adapted, when the bobbins are in the shuttle, to be readily drawn off.

When filling is being spun on the ring-frame, the strain or drag on the yarn increases and the strength of the yarn decreases constantly when the ring-rail rises, and the strain decreases and the strength increases constantly when the rail descends.

In spinning, much the larger proportion of ends that break break near the bobbin. The difficulty arising from the drag of the traveler when the bobbin is empty or first being wound is experienced in ordinary ring-frames, wherein the bobbins are wound with the warp-wind, or in successive layers, each of larger diameter; but such difficulty has been nearly if not quite remedied by inventions of George Dra-

per, fully described in applications for Letters Patent of the United States, filed September 22, 1876, wherein the action of the drawing-rollers is least upon the yarn as it is being wound upon the empty bobbin, and in patents Nos. 16,028 and 22,899, wherein all the rollers run slower when the bobbins are empty, the spindles running at uniform speed, which results in putting more twist in the yarn when the bobbins are empty. Another application of George Draper goes yet further toward correcting these evils found in ordinary ring-spinning, and varies the speed of the front rollers with relation to the speed of the back rollers and spindles, thereby regulating the draft on the yarn and varying the twist, as fully described in such application, filed September 22, 1876.

This application is an improvement based upon the inventions described in the applications A B C of the said George Draper, filed as above stated, and to them reference may be had.

In this my invention I propose to employ any of the inventions or devices of the said Draper or Smith for varying the speed of the rolls, using such devices, however, in connection with a spinning-frame having devices for winding bobbins with the filling-wind, the speed-changing mechanism being adapted to be changed during each complete rise or fall of the rail, one way during each rise and the other way during each fall of the traverse-rail.

The speed-changing mechanism is connected with, and operated by, some moving part of the traverse, or other moving part of the frame, or through suitable moving devices that will cause the yarn to be coarsened or harder twisted, or both, at each rise and fall of the ring-rail, thereby making the yarn substantially equal in strength and twist at the bobbin, or increasing its strength a little beyond actual requirements in spinning, to enable it to bear the extra strain at the barrel of the bobbin.

My invention, therefore, has reference to the combination, in a ring-spinning frame having a traverse motion to wind bobbins with the filling-wind, of spindles and drawing-rollers with mechanism adapted to automatically change the speed of all the rollers with relation to the spindles, or to automatically change the speed of the front rollers, or of the back rollers, with relation to the other rolls and to the spindles during each complete rise and each complete fall of the traverse or ring rail, or lever of the filling traverse motion, whereby, as the rail rises, there will be more stock or twist, or both, put in the yarn at the roll, and when it falls there will be less, for the purpose of equalizing the size, twist, and strength of the yarn on the bobbin, the yarn being wound in layers running from the outside of the yarn-load to the empty bobbin, and vice versa; also, in the improvement in the art or method of spinning, as hereinafter described, consisting in automatically changing the speeds of some of the rollers with relation to the other rollers and the movement of the spindles, or in changing automatically the speeds of all the rollers with relation to the movement of the spindles, at each rising and falling movement of the ring-rail, whereby the size of the yarn and the amount of twist in each layer of yarn extending from the outside of the yarn-load to the empty bobbin or spindle may be equalized; also, in the combination, with devices for automatically changing the relative speeds of the drawing-rolls with relation to the movement of the spindles, as herein set forth, of a cam to move the traverse faster in one direction than in the other, to bind the yarn, as herein set forth.

Figure 1 in the accompanying drawings represents, in side view, sufficient of a ring-spinning frame to illustrate my invention; Fig. 2, an end view; Fig. 3, a section through one form of speed-changing gear as applied to change the speed of all the rolls with relation to the spindles at each rise and fall of the rail. Figs. 4 and 5 are portions thereof. Fig. 6 is a section of one form of speed-changing gear, applied, in this instance, to increase and decrease the speed of the front rollers at each rise and fall of the ring-rail. Fig. 7 is a modification of speed-changing device to gradually change the speed of the front rolls, or all the rolls, at each traverse. Fig. 8 is a view of a modified form of another arrangement of devices to gradually change the speed of the front rolls, or all the rolls, at each traverse, the view being a section taken from the inner side of the frame on line *x x*, Fig. 9; Fig. 9, a view from the side of the frame, showing the gear shown in Fig. 8; Fig. 10, a detail showing connection of back and front rollers; and Fig. 11, a bobbin. Figs. 12, 13, 14, 15, 16, and 17 represent modifications of the invention, wherein the speed of the back rollers is varied during each complete rise and each complete fall of the ring-rail.

In an application (Case C) filed September 22, 1876, and made by Geo. Draper, there is shown and described a mechanism (a fast and slow speed pinion) to vary the speed of the back rollers as the bobbins are being wound after the manner of the warp-wind. In this present application the speed of the back rollers may also be varied with relation to the front rollers and spindles, as described in such Geo. Draper application, (Case C;) but the change of speed will be made to take place during each complete rise and each complete fall of the ring-rail, the speed of the back rollers being decreased as the yarn is being wound from the small to the large part of the bobbin, cop, or spindle, and increased when being wound from the large to the smaller portion of the bobbin or cop.

Fig. 12 shows in top view, and Fig. 13 in front view, one plan for changing the speed of the back roller, in connection with a ring-

frame for spinning filling, at each rise and fall of the ring-rail. In such figures the pulley 3 on shaft 5 derives motion through a belt, or other driver, connected with the main shaft.

A toothed pinion on shaft 6, through an idle-pinion, *o*, moves gear *p* on shaft *q* of the front roller, and drives it at a uniform motion. The front roller-shaft *q* (see Fig. 13) 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*.

The variation in speed between the back and front rollers is made through a variable-speed pinion, which acts as an intermediate gear between the gears on the front and back rollers.

Fig. 14 represents this variable pinion in section. Its stud a^1, secured to the stand b^1, sustains the quill c^1, 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. 14 and 16, is provided with notches d^1, (any suitable number,) to receive a pin, e^1, connected with, and so as to be moved by, a sliding collar, f^1, provided with a cam-face, g^1, adapted to be moved laterally, to withdraw the pin from the wheel *s*, by the action of the lever or arm 11, before described, but changed in position. (See Fig. 17.) The pin and collar are moved in the opposite direction by a spring, h^1, connected therewith, as shown in the drawings.

The part 61 of the quill c^1 has an opening, 62, to receive a friction-roller, 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. 15, 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^1 is withdrawn, as shown in Fig. 14, 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^1 is withdrawn, the speed of the back rollers is decreased. When the pin e^1 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 the yarn is being wound upon the smaller portion of the bobbin or spindle the pin e^1 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 during the descent of the ring-rail, the yarn being then wound upon a surface increasing in size, the pin e^1 is withdrawn, thereby permitting the toothed rim *r* to operate and drive the back rollers at a slower speed.

The fast and slow speed pinion (described in Figs. 12 to 16) may be thrown into and out of operation at the proper time by the lever 11, to operate the collar in Figs. 12 to 16, it being extended substantially in a vertical direction from the shaft x^3, (see Fig. 17,) worked at the proper time through lever 14 and the traverse-lever 15, (fully shown in Fig. 2, and hereinbefore described,) or by other suitable moving part of the machine or shaft adapted to operate the arm 11, to lock and unlock the gear at the proper times during each complete rise and fall of the ring-rail. The speed of the back rolls may be varied by any of the other forms of devices shown in the said Geo. Draper's application C.

The drawing, Figs. 1 and 2, shows two forms or plans of my invention. In the first plan the speed of all the rollers is changed with relation to the speed of the spindles at each complete rise and each complete fall of the ring-rail or traverse, and in the second the speed of the front roller is changed with relation to the speed of the back rollers and spindles at each complete rise and each complete fall of the ring-rail or traverse.

In this application I designate parts like those in the George Draper applications by like letters. The first plan will be first described.

The frame of the machine, the ring-rail *g*, and devices *i j*, for lifting it, bolster-rail *f*, spindles *e*, bearings and drawing-rollers *b c d*, are all of usual construction. The spindle-driving drum *k*, operated in any usual way, has upon it a broad-toothed gear, a^2, that engages pinion b^2, having upon its hub a toothed wheel, that engages and moves the gear 21 on the shaft 20, provided with a traverse-cam, c^3, that, operating against the pin 18 of the traverse-lever 15, pivoted at 41, operates such

lever, and it, through its connections d^2 j e^2, lifts and lowers the ring-rail at each revolution of the cam. This cam c^3 is preferably shaped as an irregular "heart-cam," so as to permit the rail to fall faster than it rises, so that, as the rail falls, the winding of the yarn will be somewhat elongated to bind the cop, as is well understood.

The rack 16 upon the traverse-lever is moved by the screw 17, operated in any usual way, the movement of the rack upon the lever shortening the connection d^2, and causing the ring-rail to be lifted each time a little higher, and permitting it to descend each time not quite so low, but without altering the length of the traverse, as is the well-understood practice in winding bobbins with the filling-wind. This broad gear a^2 also engages the teeth of the fast and slow speed gear s r, substantially such a gear as is shown in Figs. 9, 10, 11 of George Draper's application, (Case C,) filed September 22, 1876, wherein the construction of the fast and slow speed pinion is fully described, and also in Fig. 3 of this present application.

This gear may be described as follows: A quill, 61, sustained in a bearing, f^2, has attached to it a toothed wheel, t, that is to be moved at different velocities by means of either the fast or slow speed pinions s r, driven by the toothed gear a^2, connected with the drum-shaft. The slow-speed pinion r, having the most teeth, is made as a ring fitted to an enlarged portion of hub 61, the hub being provided with a recess, 62, to receive a friction-roller, 63, pressed forward into the smallest portion of such recess by a shoe, 69, acted upon by a spring, 64. The fast-speed pinion s, having the least teeth, is also arranged upon this quill, and has several notches, d^1, to receive a pin, e^1, connected with a sliding collar, f^1, mounted upon the quill. The pin e^1 extends through a slot, 65, in the quill 61, and a suitable spring (herein shown as h^1) acts to move the collar and pin, so that the pin engages the fast-speed pinion s.

When the pin e^1 is withdrawn, as shown in Fig. 3, toothed wheel s is liberated, leaving it free to turn under the action of toothed gears a^2, without moving any other part; but the toothed rim r, acted upon by the toothed gear a^2, causes the roller 63, carried by the quill 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, through gear g^2 h^2, (see dotted lines, Fig. 2,) operates the gear i^2 upon the shaft of the front roller d.

When the pinion t derives its motion from the toothed rim r, as when the pin e^1 is withdrawn, the speed of the rollers will be the slowest. When the pin e^1 is in engagement with the fast-speed pinion or toothed wheel s, then the quill will be driven positively through wheel s, and the pinion t will drive the rollers at their fastest speed. The hub, moved through the fastest wheel s, will travel faster than the rim or wheel r, and, consequently, the cylinder or roller 63 will fall into the enlarged portion of the opening 62.

The front roller-shaft d (see right of Fig. 2) will be provided with a pinion, j^2, that will engage an intermediate, l^2, that will operate a pinion, m^2, upon the back roller, (see dotted lines, Fig. 2,) and the back roller, at its other end, will be provided with a pinion, 8, to engage an intermediate, 9, to operate a pinion, 10, upon the shaft of the middle roller c. In this first plan, the front roller may be geared, in any way common to ordinary ring-frames, with the back roller, and with the middle roller c.

Instead of changing the speed of the rollers during the time that the bobbins are being filled, as is the case when bobbins are wound with the warp-wind, I change the speed during each complete rise and fall of the ring-rail. When the traverse-lever descends the ring-rail rises, and vice versa.

In the drawings, Figs. 1 and 2, the traverse-lever is shown at its lowest position, and in such position the ring-rail would occupy that position of elevation in which the traverse-lever at that stroke would place it, this depending upon the length of the connection.

In the drawing I have not attempted to place the ring-rail in its exact position, as any person skilled in the art will fully understand the correct position for such rail.

The collar f^1 is operated to withdraw the pin e^1 from the fast-speed pinion by means of an arm, 11, adapted to be moved into a position to engage the collar and pinion r, entering, for instance, between the collar and pinion r, or between it and the part 67 of the quill 61, as in Fig. 3. This arm 11 projects from a shaft, x^3, having a short arm, r^3, to which is connected the lever 14, provided with a suitable projection, t^3, to rest upon the traverse-lever 15, (or it may be upon any other moving or running part of, or in connection with, the frame suitably timed with the traverse,) the traverse-lever or other moving part raising the lever 14, a suitable spring, n^2, lowering it. When the traverse-lever 15 is at its lowest position, as shown in the drawings, the lever 14 is down to its lowest position, and the arm 11, then acting upon the collar f^1, holds the collar with the pin e^1 out of engagement with the fast-speed pinion s, and the slow-speed pinion r then operates the drawing-rollers at their slowest speed through the pinion t and pinions g^2 h^2 i^2. When the slow-speed pinion operates the rollers the ring-rail is in its elevated position for the empty bobbin or smallest part of the cone to receive yarn, and the slow speed of the set of rolls then results in increasing the twist. The arm 11 is stopped in its descent by the collar or quill 61. The pin t^3, Figs. 1 and 2, on the lever 14, does not rest upon the traverse-lever 15 when the latter is in its lowest position and the ring-rail is in its highest position. As the traverse-lever rises and the ring-rail falls, the

traverse-lever meets the pin t^3 on the lever 14 and lifts the arm 11, permitting the pin e^1 to engage the fast-speed pinion, and then the speed of the set of rollers is increased to decrease the twist in the yarn, the latter then being wound upon the larger portions of the cone. The change of speed is effected when the ring-rail moves down about one-third or one-half the distance of its traverse, and the fast speed of the set of rollers continues until, in again rising, the ring-rail reaches a point half or two-thirds up, when the slow-speed pinion is again permitted to operate the set of rollers.

It is obvious that the time at which this change of speed takes place may be varied by changing the position of the pin t^3 upon the lever, such pin being preferably made adjustable in any well-known way.

In the second plan of this my invention (see the left-hand side of Fig. 2 and front of Fig. 1) the fast and slow speed-pinion, or speed-changing gear, is placed in connection with the shaft of the front roller, substantially as shown in Fig. 12 of the application (Case C) of the said George Draper.

The operation of the fast and slow speed gearing in this plan may be fully understood from the sectional Fig. 6. In this second plan the speed of the front roller is to be varied (in this instance increased) with relation to the speed of the back rollers and spindles at each downward movement of the ring-rail, and decreased at each upward movement thereof, instead of once during the winding of the bobbins, as when the bobbins are wound after the manner of the warp-wind. In Fig. 6 the fast and slow speed pinions *r s* are placed outside the frame. Pulley 3 is provided with a pinion, 6, having a broad face capable of engaging the teeth of rim *r* and wheel *s*, as in the case of pinion a^2, before described.

Toothed wheel *s* in this modification has a long sleeve, 71, with a pinion, 72, that engages a gear, 73, suitably connected with a pinion, *w*, on the shaft of the back roller, connected at its other end (as shown in Fig. 10, and before described) with the roller *c*. In such figure the pin e^1 and collar f^1 are the same as in Fig. 3, and the pin is to be withdrawn by means of an arm, 11*, that operates in connection with the collar, as the arm 11 described in connection with Fig. 3, and as described and shown in Figs. 1, 2, and 9 of the said George Draper's application, (Case C.)

The quill c^2 in Fig. 6 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^1, the rim *r* moving thereon, all as shown in Fig. 3. When yarn is being wound upon the barrel of the bobbin or cop-tube, the pin e^1 is withdrawn, and the slow-speed pinion or rim *r* then drives the front roller at its slowest speed—the toothed wheel *s*, also moved by the pinion 6, through its sleeve 71 and pinion 72, moving the back rollers. When the speed of the front rollers is to be increased with relation to the speed of the spindles and back rollers, the pin e^1 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*. When the slow-speed pinion operates the front roller, the yarn to be wound upon the barrel of the bobbin is coarsened and the twist is increased, to compensate for the action of the drag of the traveler and the loss of twist, as before explained. When the ring-rail descends about one-third or one-half its traverse, the traverse-lever, operating upon the lever 14, as before described, will move the shaft x^3, and the arm 11* will be lifted from the collar f^1, and the pin e^1 will engage the fast-speed pinion *s*, and operate the front roller at an increased speed, drawing out the roving and decreasing the twist during the remainder of the descent of the ring-rail, and until the ring-rail in its ascent rises from half to two-thirds of its traverse, or during such time as the yarn is moved upon the larger portion of the cone. This operation is repeated during each complete rise and fall of the traverse.

The pulley 3 derives its motion, in this instance, from a band, o^2, on a pulley, 1, of shaft 4. A ring-spinning frame embodying this my invention, adapted to spin filling, will perform, substantially, fifty per cent. more work than a mule, because in my frame the motions are continuous; and as I am enabled to wind the yarn very firmly, there is little if any cop-waste in weaving, which, in some mills, amounts to about two dollars per annum for each loom operated. As compared with other or ordinary ring-spinning frames, this frame will bear higher speed and put a larger amount of yarn upon the bobbin, and, what is of great importance, it will spin filling with less twist, producing a soft, slack-twisted yarn, in my opinion equal to that spun upon a mule.

In Fig. 7 I show an arrangement of speed-changing gearing to change the speed gradually as the traverse-lever rises and falls. In such figure the shaft 4 of the driving-drum is provided with a cone, p^2, that is connected with a reverse-cone, q^2, on a shaft, r^2, provided with a pinion, s^2, by means of a belt, t^2. This belt is guided and moved by a suitable belt-shifter, u^2, connected with lever 14 by an elbow-lever, v^2, the lever 14 being, in this instance, connected positively with the traverse-lever 15 by means of a pin, t^3, on the lever 14 entering an opening in the lever 15, or vice versa, so that the lever 15 will move the lever 14 and belt-shifter positively as the traverse-lever is raised and lowered.

In Fig. 7 the parts are in the position they will occupy when the traverse-lever is fully lifted, the ring-rail then being down, the yarn

being then wound upon the full part of the cone, the fast speed being then necessary. Now, as the traverse-lever descends and the rail rises, the belt-shifter acts to move the belt along the cones, gradually decreasing the speed of all the rollers, or of the front rollers alone, the back rollers, in such instance, being driven positively at a uniform speed.

A toothed pinion, s^2, (shown in dotted lines,) on the driven shaft r^2, will be geared by suitable intermediates with toothed gears upon the front rollers, they being geared with the other rollers of the set of drawing-rollers in any ordinary way. This plan varies the speed of all the rolls; but in case it is desired to drive the front roll alone at varying speed, the pinion s^2 may be geared by intermediates with a pinion fast on the front-roll shaft, and a sleeve provided with pinions, and mounted on the front-roller shaft, may be operated at a uniform speed to drive the back rolls.

In using speed-changing devices for the drawing-rollers in a frame adapted to the filling-wind, and wherein the speed is changed during each complete rise and each complete fall of the ring-rail or traverse, it will be observed that it is unnecessary to reset the speed-changing devices when the traverse-rack is turned back or reset to commence new bobbins, for, in a frame embodying my invention, the speed-changing devices, once operating correctly, are always in operative relation with the movement of the traverse.

The fast and slow speed pinions may be operated from any moving part of the traverse besides the traverse-lever.

In the plans so far described, the speed-changing devices for varying the speed of the rolls have been adapted to be changed as to position through the action of the traverse-lever; but I do not desire to limit this invention to varying the speed of the rollers by the particular fast and slow speed pinions described, or the cones, for I may use a form of compound gear substantially as represented in Fig. 9 of George Draper's said application, (Case B,) or I may use an eccentric gear properly connected by gearing with the front rollers. In this last plan the change of speed would be continuous, taking place at each rising and falling movement of the traverse; but the speed-changing devices need not necessarily have any connection with any part of the traverse, but may be driven from the drum-shaft, or any other suitable driving-shaft timed to operate the eccentric gear in unison with the traversing movement of the ring-rail. Figs. 8 and 9 show one plan of varying the speed of the rollers through an eccentric gear.

In Figs. 8 and 9, a^2 represents the gear on the cylinder or drum-shaft. The back rollers at one side of the frame are driven from this gear through gear 1^a and its attached pinion 1^b, it engaging an intermediate, 2^a, that engages a gear, 3^a, loose on the front-roller shaft. The gear 3^a has a pinion, 4^a, that gears into an intermediate, 5^a, provided with a pinion, 6^a, that engages a gear, 7^a, on the back-roller shaft. The back roller, at the opposite side of the frame, is driven from intermediate 2^a through intermediate 2^b, that engages intermediate 3^b, loose on the shaft of the front roller, a pinion, 4^b, on 3^b engaging an intermediate, 5^b, provided with a pinion, 6^b, that engages a pinion, 7^b, on the back roller.

The front roller derives its variable speed from the gear a^2. The gear a^2 engages an intermediate, a^4, having a pinion, which engages an intermediate, b^4, having a long pinion, which engages the gear c^4 on the shaft that carries the traverse cam, and also an intermediate, d^4, that engages with the eccentric gear e^4, having an attached large gear, f^4, which engages a pinion on intermediate g^4, that operates intermediate h^4, that engages a gear, i^4, on the front-roller shaft at one side the frame. The front roller at the other side of the frame is operated from f^4 through a pinion on intermediate g^5, that engages an intermediate, h^5, connected with the front-roller gear i^5, so as to move it in the proper direction. The eccentric gear approximates in shape the shape of the heart-cam c^3, Fig. 2. The intermediate d^4, that engages the eccentric gear e^4 and the pinion on f^4, is supported on a movable arm, x^4, connecting the center of the pinion with the center of d^4.

The speed of the front rollers may be varied through a belt-shifting arrangement, as shown in Fig. 7, and then the back rollers may be driven at uniform speed, as described in Figs. 8 and 9. With the devices for operating the front rolls, as in Figs. 8 and 9, to vary the speed of all the rolls, the back rolls might be driven from the front rolls, as described in my first plan in Figs. 1 and 2.

My improved frame operates to spin and wind the yarn by a method essentially different from that practiced in any other machine known to me. These same plans can be employed to spin directly upon the spindles without the use of bobbins, and I do not limit the invention to the use of a bobbin of any particular shape.

This invention, so far described, has been considered with reference to spinning filling; but it is obvious that the same devices may be employed with great advantage for the production of warp-yarns, they being wound upon the bobbins with the filling-wind.

In winding warp or weft upon bobbins or spindles after the manner of the filling-wind, or in cone-shaped layers, from the outside of the yarn-load to the empty bobbin or spindle the weight of the yarn on the bobbin is kept down near the bolster-bearing of the spindle, and the weight of the yarn is gradually applied toward the upper end of the bobbin, thereby saving power and wear of spindles, and enabling the spindles to bear higher speed than were the bobbins wound after the manner of the warp-wind.

The change of speed in all forms of my invention takes place during the time that each layer of yarn extending from the surface or outer portion of the yarn-load to the empty bobbin, or vice versa, is being laid.

This invention may be embodied in a spinning-machine wherein the bobbins and spindles are raised and lowered by the traverse.

I claim—

1. In a ring-spinning frame, provided with a traverse mechanism to wind the yarn in cone-shaped layers from the outside of the yarn-load to the empty bobbin or spindle, the combination of spindles and drawing rollers with mechanism adapted to automatically vary the speed of part of the rollers of the set with relation to the others and the spindles, or of all the rollers with relation to the spindles, during each complete rise and each complete fall of the traverse-rail, the whole being constructed to operate substantially as and for the purpose described.

2. The improvement herein described in the art or method of spinning on ring-spinning frames, consisting in automatically varying the speeds of the rollers with relation to each other and the spindles during each complete rising and falling movement of the traverse-rail, to equalize the size of and twist in the yarn, substantially as set forth.

3. In a ring-spinning frame, the combination, with speed-changing mechanism adapted to automatically vary the speed of the rollers with relation to each other and to the spindles, to equalize the size of and twist in the yarn, as described, at each rise and fall of the ring-rail or traverse, of a cam to move the ring-rail or traverse faster in one direction than in the other, to bind the yarn, substantially as described.

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

WM. F. DRAPER.

Witnesses:
GEO. W. GREGORY,
S. B. KIDDER.