No. 626,094. Patented May 30, 1899.

JOE RAMSDEN, A. T. TAYLOR & JAMES RAMSDEN.

SELF ACTING MULE.

(Application filed Oct. 18, 1898.)

(No Model.) 3 Sheets—Sheet 1.

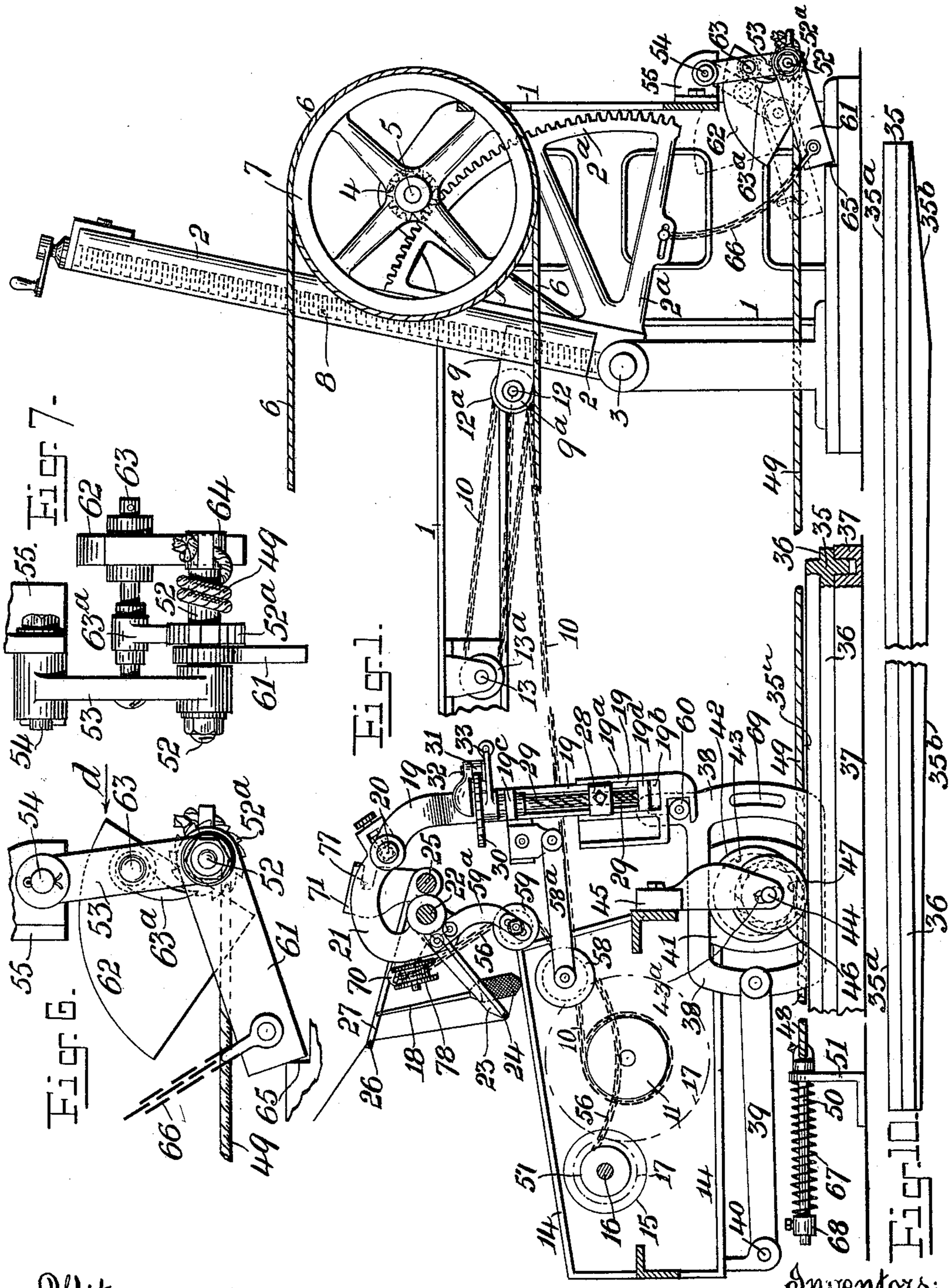

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Fig. 2.

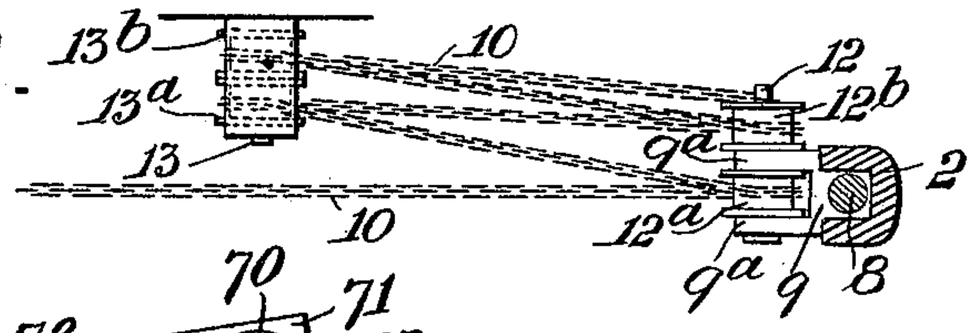

Fig. 5.

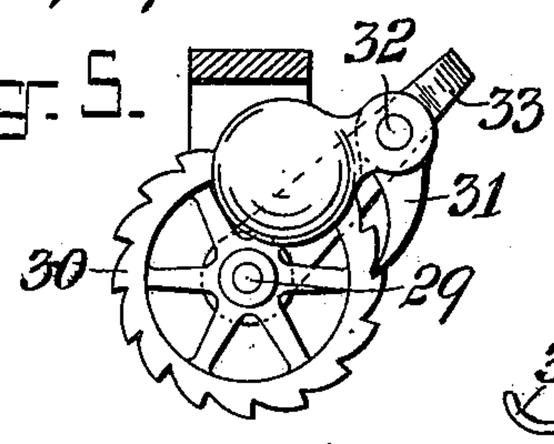

Fig. 3.

Fig. 3A.

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Fig. 4. Fig. 8.

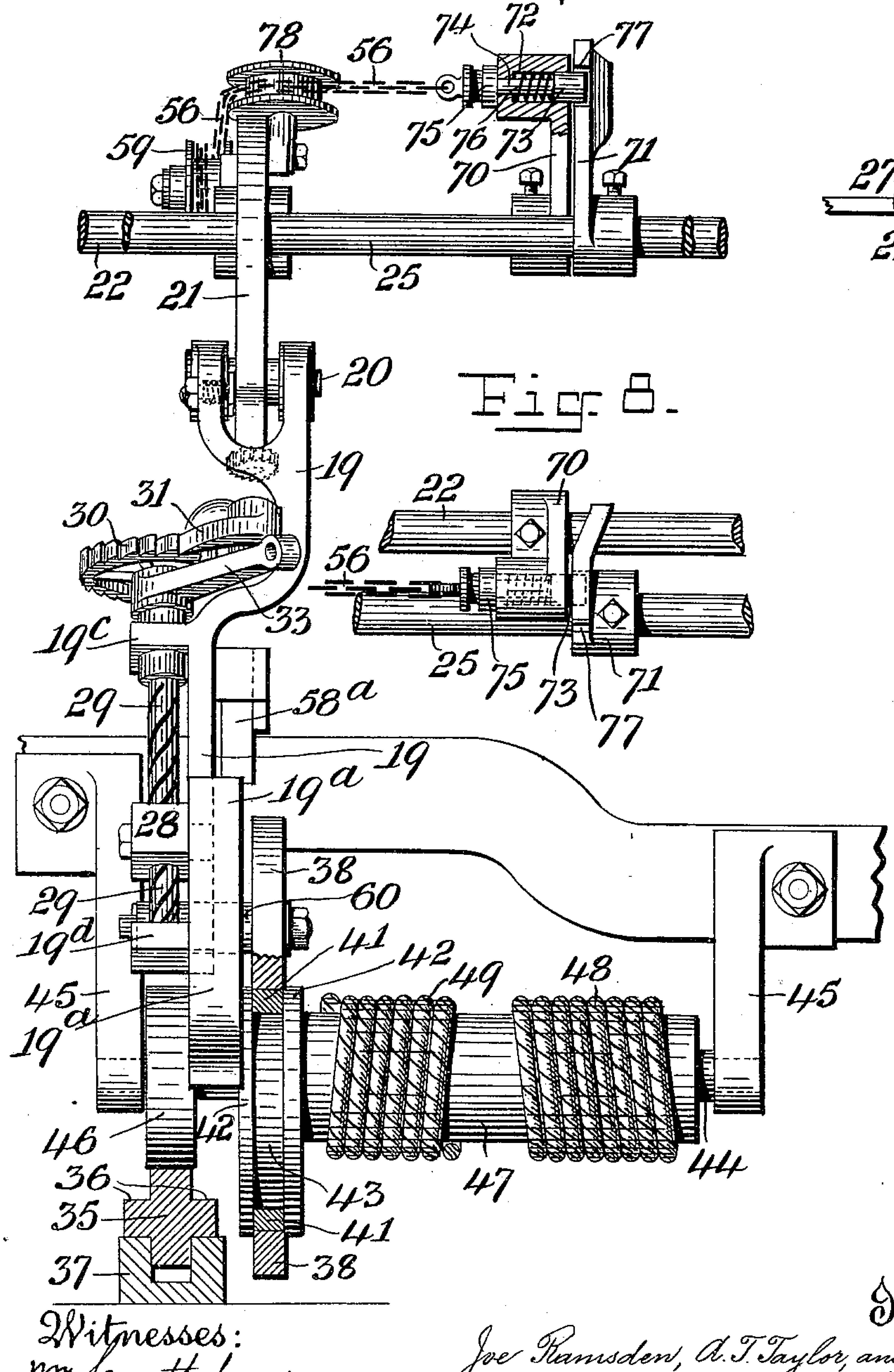
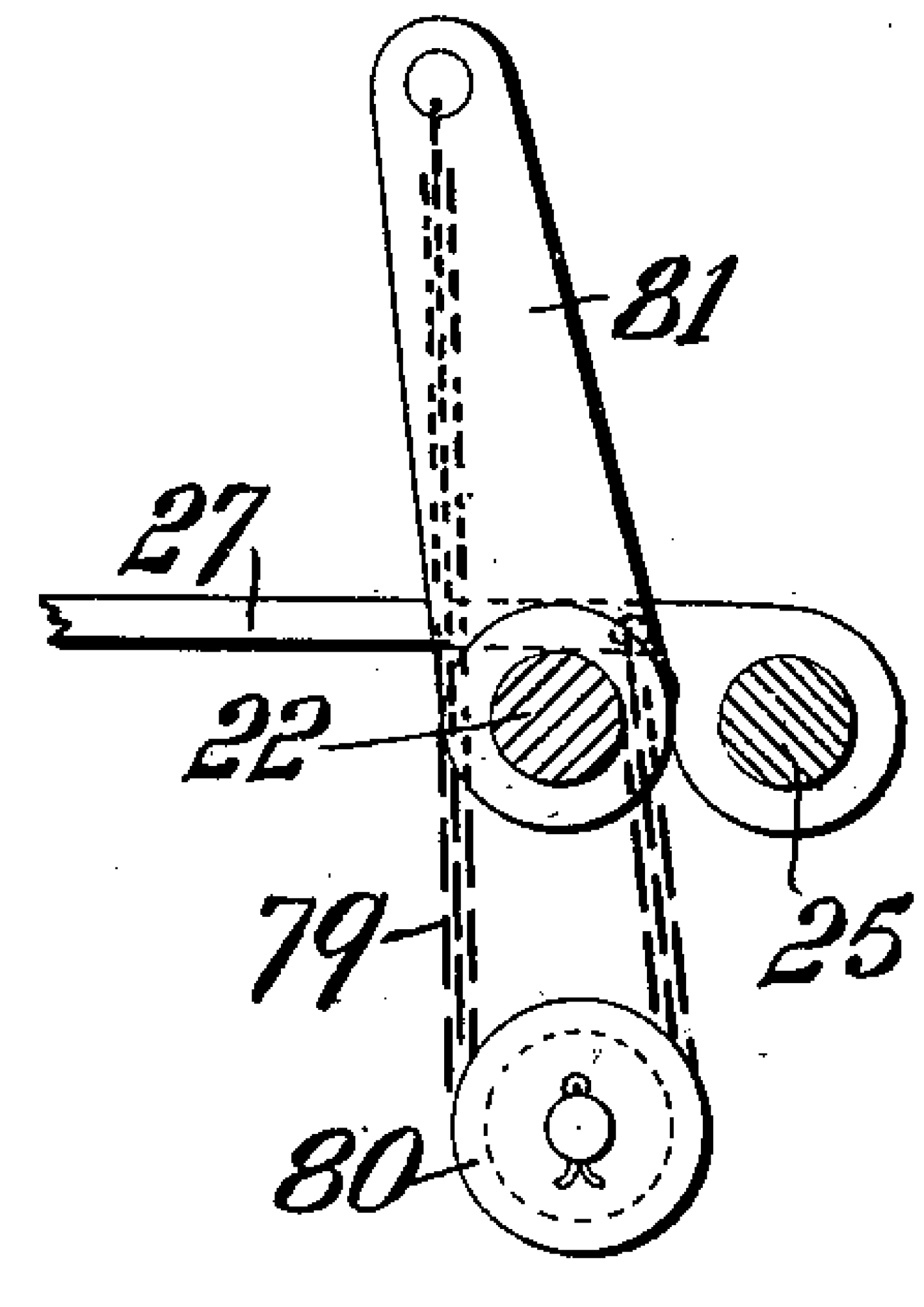


Fig. 9.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOE RAMSDEN, ARTHUR TURTON TAYLOR, AND JAMES RAMSDEN, OF BIRSTALL, ENGLAND.

SELF-ACTING MULE.

SPECIFICATION forming part of Letters Patent No. 626,094, dated May 30, 1899.

Application filed October 18, 1898. Serial No. 693,874. (No model.)

To all whom it may concern:

Be it known that we, JOE RAMSDEN, ARTHUR TURTON TAYLOR, and JAMES RAMSDEN, subjects of the Queen of Great Britain, residing at Birstall, near Leeds, in the county of York, England, have invented certain new and useful Improvements in Self-Acting Mules; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to the winding-on and copping or building motions of self-acting mules.

The object of our invention is to provide simple and effective copping or building mechanism for cross-winding the yarn in winding on such mechanism by the removal therefrom of the parts for giving reciprocatory motion to the front or acting faller and the substitution of the ordinary copping-rail, being adapted also for winding on the yarn in the ordinary way. Combined with the cross-winding motion we provide means for automatically stopping the cross-winding just before the carriage reaches the "beam" or rollers on its return or inward stretch in order that two or more plain turns of yarn may be wound on the spindles. We also provide a locking device for locking the front and counter fallers together when they return to their positions of rest at the termination of each winding on and dispense with the chains heretofore employed for locking the front faller.

Our invention consists in certain novel features of construction and operation of parts for the purposes above stated, as will be hereinafter fully described.

Referring to the drawings, Figure 1 is a side sectional elevation of the "end piece" of the head-stock of a self-acting mule, showing in conjunction therewith, in section taken through the "square" or iron plate which connects the two parts of the carriage together at the head-stock, the mule-carriage in a position part way on its return stretch to the beam or rollers when the winding on is taking place. Fig. 2 is a sectional plan of the long arm of the quadrant, showing the mode of reduplication of the winding-chain for modifying the action of the quadrant and giving a uniform wind. Fig. 3 is a side elevation of the faller-leg and parts and the means for giving oscillatory motion through same to the front faller-wire for cross-winding the yarn, the faller-leg being shown disengaged from the "rocker." Fig. 3^A is a detail side view of a modification of the lower end portion of the faller-leg. Fig. 4 is a front view, partly in section, of the parts shown in Fig. 3, looking in the direction of arrow *a*, same figure. Fig. 5 is a plan view taken on line *b c* of Fig. 3. Fig. 6 is a side elevation of catch-lever and parts for effecting the premature stoppage of the cross-winding motion. Fig. 7 is a front elevation of the parts shown in Fig. 6, looking in the direction of arrow *d*, same figure. Fig. 8 is a plan of the device for locking the fallers, looking in the direction of arrow *e*, Fig. 4. Fig. 9 is a cross-section through the faller-shafts, showing a detail hereinafter referred to. Fig. 10 is an elevation of the combined copping-rail for cross and plain winding. Figs. 3 to 9 are drawn to an enlarged scale.

The same numerals refer to corresponding parts in all the figures.

In the drawings, 1 represents the end piece of the head-stock of a self-acting mule, and 2 2^a the quadrant, which oscillates upon a stud 3 and has its oscillation given to it by the pinion 4, mounted on the quadrant-drum shaft 5, which is driven by cord 6, passing around the quadrant-drum 7. Within the long arm 2 of the quadrant and extending its entire length is the screw 8, which works the sliding block 9, whereto one end of the winding-chain 10 is attached, the opposite end of said chain being secured to winding-barrel 11. With the exception that the quadrant-drum 7 is of larger diameter than the drum now employed to give a slower and decreased movement and that the chain 10 does not pass direct from the sliding block 9 to the chain-barrel 11 the parts above described comprise the ordinary winding-on motion for revolving the spindles as the mule-carriage travels back to the beam, as will be well understood by those skilled in the art to which this invention refers.

Integral with or secured to the sliding block 9 are lugs 9^a in bearings, in which is journaled a stud 12, upon which are loosely mount-

ed and secured pulleys 12^a 12^b. On a stud 13, carried in a bracket bolted to the framing 1 intermediate of the quadrant and the mule-carriage, are mounted loosely other similar pulleys 13^a 13^b, these, however, being fixed as to position, while the pulleys 12^a 12^b are movable. The winding-chain 10, instead of being attached directly to the sliding block 9, as heretofore, is first passed under and around the near movable pulley 12^a, then over and around the near fixed pulley 13^a, under and over the second movable pulley 12^b, and finally over and under the second fixed pulley 13^b, from whence it is taken and the end thereof made secure to the stud 12 or to the sliding block 9. This combined system of movable and fixed pulleys and the mode of reduplication of the winding-chain enables the arc of movement of the quadrant to be minimized, so that it does not get beyond or much beyond the dead-center or vertical position at the farthest, and therefore the constantly-changing angular position of one point of connection of the winding-chain with the other point of connection thereof, as is the case with the ordinary winding motion, does not occur, and there is consequently a greater uniformity in the winding on of the yarn.

In connecting the chain 10 to the quadrant after reduplication around the fixed and movable pulleys the portion of said chain lying between the winding-barrel 11 and the pulley-blocks gives in the ratio of four to one of the arc of movement of the sliding block—that is to say, if the sliding block moves circumferentially through one inch of space each portion of chain around the fixed and movable pulleys will be shortened one inch, and therefore four inches of chain will be actually paid out to the winding-barrel. The smaller the amount of chain paid out—that is, when the sliding block is nearest the center 3—the greater is the unwinding of chain from the barrel 11, and consequently the greater the velocity at which the spindles are driven, while as the sliding block 9 moves farther and farther away from the center 3 so in proportion does the amount of chain paid out increase and reduce the unwinding from the barrel.

If a larger amount of chain is required to be paid out in proportion to the same movement of the quadrant, an additional fixed and movable pulley may be added, giving three fixed and three movable pulleys, which would pay out six times more chain than the extent of movement of the sliding block, or other numbers of pulleys may be used.

The paying out of the chain 10 is exactly proportionate to the extent of circumferential movement of the sliding block 9, and therefore there is perfect uniformity of winding from the commencement of the cops to their completion, the angular variation arising from the increasing distance moved by the sliding block on the screw 8 away from center 3 not affecting the winding motion.

Referring now to the copping or building motion, 14 represents the mule-carriage; 15, the tin cylinder, mounted on shaft 16 and driven by gearing 17 from the winding-barrel 11; 18, the spindles, which are driven by bands (not shown) from the tin cylinder 15; 19, the faller-leg, connected at 20 to the front or acting faller 21, secured on the front faller-shaft 22, to which are also secured arms 23, (one only being shown,) carrying the front faller-wire 24, extending from end to end of the mule-carriage and being actuated by said faller-leg to guide the yarn upon the spindles during the return traverse of the carriage from the extremity of its outer stretch to the beam or rollers; 25, the counter-faller shaft, and 26 the counter-faller wire carried by arms 27, (one only being shown,) all arranged in the ordinary and well-known way.

The faller-leg 19 instead of being in one piece, as heretofore, is made in two parts—that is to say, with a separate foot 19^a, which is provided on its face with a recess or groove 19^b, into which is adapted to enter and slide telescopically the lower end of the faller-leg 19. Secured to the foot 19^a is a nut 28, through which works a screw 29, supported at its upper and lower ends in lugs 19^c 19^d, formed integral with the faller-leg 19.. On the upper end of the screw is fast a ratchet-wheel 30, held in position by a holding-pawl or detent 31, centered at 32 on a lever 33, mounted on the screw-spindle. The screw is actuated each time the carriage arrives at the extremity of the outward stretch or draw by means of a fixed finger 34, (see Fig. 5,) attached to any convenient part of the end piece 1 and in the path of said ratchet-wheel, so that when it comes into contact with the finger the latter engages with a tooth thereof and turns it around a distance equal to one tooth or more, as may be predetermined, the result being that the partial rotation of the screw 29 slightly raises the foot 19^a, and thus shortens the faller-leg, this being repeated each time the carriage reaches the end of its outward stretch and gradually shortening the faller-leg and raising the faller-wire 24 for each successive winding on of yarn to give the proper build to the cop. In thus effecting the building of the cop by a telescopic faller-leg which is shortened for every successive chase we do not require the shaper-plates hitherto employed in mules for altering the height of the copping-rail. Therefore we provide a rail 35, having side ribs 36 36, which engage with the upper sides of a channeled bar 37, resting on the floor. To enable the rail 35 to be used for either cross or plain ordinary winding, we provide it on one side with a perfectly plain level surface 35^a and on the reverse side with the inclined surface 35^b (see Fig. 10) of the ordinary copping-rail. The rail is arranged with the level surface 35^a uppermost, as shown, when cross-winding the yarn, but when ordinary winding the rail is turned over and the surface 35^b presented.

The bar 37 forms a solid support for the rail 35 from end to end, and there is no liability of it springing or giving in the middle, as is the case when supported on shaper-plates at each end only, and consequently faulty building up of the cops is avoided. The pitch of the screw 29 is a varying one, getting coarser from the bottom to the top, so that the changes made in the position of the faller-wire 24 at each successive winding on of yarn will increase as the building of the cops proceeds to give the abrupt taper required and compensate for the difference which the gradual upward movement of the faller-wire away from the spindle makes in the winding.

Fig. 3A shows a modification in the application of screw 29 to admit of the present ordinary faller-leg being employed. The screw 29 is supported at its upper and lower ends in lugs 19^c 19^d, integral with a bracket bolted to the rocker 38, and is arranged the reverse way to that previously described, the finer pitch of the thread being at the top and the coarsest at the bottom. The screw works through a nut 28, carrying the stud 60, which at each turn of the ratchet-wheel one tooth around is gradually lowered and causes the faller-leg to be lowered correspondingly to raise the front faller-wire the requisite distance to wind on each successive "chase" of yarn.

To cross-wind the yarn upon the spindles, the rocker 38 is made in the form of a rectangular frame, which is carried, as before, by the lever 39, fulcrumed at 40 on a stud secured to a bracket bolted to the square. In said frame 38 and adapted to slide laterally therein is a block 41, held in the frame by flanges 42 and having a central opening therethrough in which fits a disk 43, which is secured eccentrically on a shaft 44, supported in bearings in brackets 45 45, bolted to the square. The eccentric 43 is provided with a slot 43^a, arranged diametrically of same, by which the position of said eccentric on shaft 44 may be adjusted to reduce or increase its eccentricity for the purpose of varying the length of "nose" according to the counts or equality of yarn being spun. On the near end of the shaft 44 is mounted loosely a small pulley or antifriction-bowl 46, which rests upon and is adapted to ride over the surface of the rail 35 and supports or assists in supporting the parts. On the opposite end of the shaft 44 is secured a barrel or long boss 47, having attached thereto the ends of two separate cords 48 49, the opposite end of cord 48 being connected to a rod or spindle 50, supported in a bracket 51 at the rear of the head-stock, and the opposite end of cord 49 being coiled upon and secured to a stud 52, carried at the end of a lever-arm 53, pivoted on a stud 54, secured to a bracket 55, bolted to the front of the end piece 1 of the head-stock. These cords wind and unwind themselves around and from the barrel 47 as the carriage moves out and in, the cord 49 being wound on the barrel as the carriage travels out by the unwinding of cord 48, and the cord 48 wound on the barrel during the return traverse of the carriage by the unwinding of cord 49.

When the carriage 14 is receding from the beam to the outer extremity of its stretch, the faller-leg 19 is detached from the rocker 38, as shown at Fig. 3, and is idle. After the ratchet-wheel 30 has engaged the fixed finger 34 at the end of the stretch and been moved the distance of a tooth or more to adjust or shorten the faller-leg 19 said faller-leg is acted upon by chain 56, attached at one end to a loose scroll 57 on the tin cylinder-shaft 16, then passed around a guide-pulley 58, carried by arm 58^a, secured to the faller-leg 19, and connected with the pulley 59, carried by arm 59^a, secured to the faller 21, said chain drawing up the faller-leg to the position shown at Fig. 1, the recess at the bottom of the foot 19^a passing over and engaging with the stud 60, secured to the rocker 38, thus insuring a positive movement of the faller-leg with the rocker. The scroll 57 is actuated in the ordinary well-known way to wind on the chain 56 and raise the faller-leg into engagement with the rocker 38. The parts being now in the position shown in Fig. 1, the carriage commences its return traverse to the beam to wind the yarn which has just been drawn and spun onto the spindles. During this return movement the cord 49, being held at its outer end, unwinds itself from the barrel 47, and thereby rotates it and also the eccentric 43, the latter consequently oscillating the rocker 38 and the faller-leg 19 and parts, by which means the faller-wire 24 is constantly oscillated during the winding on of the yarn and crosses the yarn first to right and then to left in building up its chase, thereby building up a firm compact (cross-wound) cop. On the arrival of the mule-carriage at the "beam" the faller-leg is knocked off the stud 60, as ordinarily, and the parts resume the positions shown at Figs. 3 and 4, the succeeding outward stretch of the carriage, by means of cord 48, again winding the cord 49 around the barrel 47 in readiness for the next return traverse of the carriage, when the movements above described are repeated.

To wind on two or more plain turns of yarn for "backing-off" purposes, we automatically stop the oscillation of the faller-leg 19 just prior to the carriage arriving back at the beam, in order that the remaining lengths of yarn may be wound in two or three straight coils on the spindle. The means we employ for this purpose comprise a catch-lever 61, hinged loosely on the stud 52 of lever-arm 53, said lever-arm and a segmental plate 62, secured on a stud 63, carried by the lever-arm 53 and resting on a collar 64 (see Fig. 7) on the stud 52. On the outward stretch of the mule-carriage the lower end of the toothed segment 2^a in its descent engages with the curved periphery of the plate 62 and forces it downward, said plate thus forcing the lever-

arm to the front of the end piece of the headstock, as shown in full lines in Figs. 1 and 6, and drawing the catch-lever forward until its extremity drops down against a shoulder 65, formed in the bed-plate of the end piece, whereby the catch-lever and parts are locked in the positions shown in full lines in Figs. 1 and 6.

The catch-lever 61 is connected by a length of chain 66 to the quadrant 2^a, which allows for nearly the full movement of the quadrant in the direction of the mule-carriage on its return traverse before it is drawn tight, and when this happens the pull on the said chain draws the catch-lever out of engagement with the shoulder 65 and allows the parts to be pulled by the tension of cord 49 into the position shown in dotted line in Fig. 1, thereby slackening the cord 49, which consequently ceases to rotate the barrel 47 and stops the cross-winding of the yarn. The stopping of the motion of barrel 47 is timed to happen when the shorter radii of the eccentric 43 arrive over the shaft 44 and the faller-wire is in its highest position, by which means the remaining portion of yarn will be wound on the top of each chase. In order to take up the slack of cord 48 caused by the stoppage of the rotation of barrel 47 before the carriage 14 arrives fully home, the spindle or rod 50 is surrounded by a spiral spring 67, which is confined between the bracket 51 and a collar 68, secured on the end of said spindle. The pull of the cord 48 when winding onto the barrel 47 compresses the spring 67 by drawing the spindle 50 forward, and when the barrel ceases to rotate, as before explained, the spring expands and takes up the slack of cord 48. The cord 49 can be tightened by rotating the stud 52, which is held when released by a pawl 63^a, which engages the ratchet-wheel 52^a, secured on stud 52.

To change the motion so as to give a plain ordinary wind instead of a cross-wind, the cords 48 49 are disconnected, the shaft 44, with the eccentric and barrel, removed from the mule, the chain 66 detached from the quadrant, and the rail 35 reversed to bring the surface 35^b uppermost. A small pulley or bowl similar to the bowl 46 is then secured on a stud which is passed through the slot 69, formed in the side of the frame or rocker 38 and fastened thereto by a nut, this bowl resting on and riding over the inclined surface 35^b, which gives the ordinary winding action to the faller-wire 24, the building being effected by the shortening of the faller-leg, as before described.

With regard to the eccentric motion for oscillating the faller-leg for cross-winding the yarn, there are equivalent pieces of mechanism, such as a connecting-rod connected eccentrically to a face-plate or a pinion rotated by a toothed rail, which would give the same motion; but we find the eccentric and parts before set forth to give the simplest and smoothest motion and, with the self-adjusting telescopic faller-leg, well adapted to build up a firm and compact cop.

In order to dispense with the several chains which are required to hold the front faller-wire out of the way during the outward traverse of the mule-carriage, we employ a simple device for locking the fallers. On the faller-shafts 22 and 25 are mounted, respectively, levers 70 71, the former at its free end having a chamber 72 bored therein, into which enters the enlarged end 73 of a stud or pin 74, extending through a small opening into said chamber and held in position therein by a collar or head 75. Between the end of the chamber 72 and the part 73 of the pin 74 is confined a spiral spring 76.

The lever 71 is provided on its front side with an opening or recess 77, into which when the said levers are brought together the enlarged end of the locking-pin is adapted to enter and engage the end thereof, as shown in Figs. 3, 4, and 8. The rear portion of the lever 71 is bent or inclined, as shown in plan Fig. 8, so that when the fallers return to a position of rest on the conclusion of each successive winding on the said inclined surface engages with and bears against the end of the locking-pin 74 and forces it back into the chamber 72 until the recess 77 in lever 71 comes opposite thereto, whereupon the spring 76 impels the locking-pin forward into the recess 77 and locks the two levers, and consequently the fallers, together. To release the fallers when commencing the winding on, the chain 56 is lengthened, and instead of being fixed to the pulley 59, as heretofore, it is coiled completely around said pulley, then passed around a pulley 78, carried on a stud secured to the faller 21, and secured at the end to an eyelet formed at the end of the collar or head 75 of the locking-pin 74. On the chain being wound upon the scroll 57 to draw up the faller-leg the pull thereon draws the locking-pin forward clear of the lever 71, thus releasing both levers and allowing the faller-wires to move to their proper positions, the front faller-wire over the yarn in readiness to guide it onto the spindle and the counter-faller under the yarn to put the necessary tension thereon, as shown at Fig. 1. To avoid the counter-faller wire rising too rapidly against the yarn when released, we attach one end of a chain 79 to the counter-faller arm 27, (see detail Fig. 9,) said chain being passed around a fixed pulley 80 and connected at its opposite end to a lever 81, secured on the front faller-shaft 22. This chain initially restrains the upward movement of the counter-faller wire, and as the front faller-wire moves to its position for guiding the yarn onto the spindle the chain slackens and sets the counter-faller wire free to bear fully against the yarn.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

1. In a spinning-mule, the combination, with a pivoted faller, of driving mechanism connected with the leg of the faller and operating to oscillate it, a screw of variable pitch arranged longitudinally of the said faller-leg, and tappet mechanism operating to turn the said screw periodically and to an equal extent at each operation, thereby varying the effective length of the faller-leg and adjusting the position of the faller-wire to an unequal extent at each operation, substantially as set forth.

2. In a spinning-mule, the combination, with a pivoted faller, and a frame operatively connected with the leg of the faller; of an eccentric engaging with the said frame and operating to reciprocate it, a barrel connected with the said eccentric, a longitudinally-slidable carriage supporting all the said parts, a flexible connection wound on the said barrel, and means for anchoring one end of the said connection, whereby the said eccentric is revolved when the said carriage is moved longitudinally, substantially as set forth.

3. In a spinning-mule, the combination, with a longitudinally-slidable mule-carriage, and driving mechanism for oscillating the faller-wire supported by the said carriage; of a stationary foundation-bar, and a reversible bar supported by the said foundation-bar and provided with a horizontal edge and an inclined edge for guiding the said driving mechanism, substantially as set forth.

4. In a spinning-mule, the combination, with a channeled foundation-bar, of a reversible guide-bar provided with a horizontal edge on one side and an inclined edge on the other side, either edge being free to engage with the said channeled bar, said guide-bar being also provided with lateral projections which rest on the top of the said channeled bar, substantially as set forth.

5. In a spinning-mule, the combination, with a longitudinally-slidable barrel for controlling the cross-winding mechanism, and a flexible connection wound on the said barrel; of a stationary shaft having one end of the said connection wound on it, a catch normally preventing the said shaft from revolving, and means for releasing the said catch as the said barrel approaches one end of its longitudinal traverse, thereby permitting the said connection to move longitudinally with the said barrel, substantially as set forth.

6. In a spinning-mule, the combination, with a longitudinally-slidable barrel for controlling the cross-winding mechanism, and a flexible connection wound on the said barrel; of a stationary frame, a quadrant pivoted to the said frame and provided with means for oscillating it, a shaft journaled in the said frame and having one end of the said connection wound on it, a catch secured to the said shaft, means for setting the catch operated by the said quadrant when moving in one direction, and means for releasing the said catch operated by the said quadrant when moving in the reverse direction, the said shaft being free to revolve and to pay out the flexible connection on the release of its catch, substantially as set forth.

7. In a spinning-mule, the combination, with a longitudinally-slidable barrel for controlling the cross-winding mechanism, and flexible connections wound on the said barrel and extending in opposite directions; of a catch normally anchoring the end of one of the said connections, a spring-anchor attached to the end of the other said connection, and means for releasing the said catch as the barrel approaches one end of its longitudinal traverse, thereby permitting the said spring-anchor to move both the said connections longitudinally, substantially as set forth.

8. In a spinning-mule, the combination, with the fallers, and their shafts; of lever-arms secured on the respective faller-shafts and working crosswise of each other, one of the said lever-arms being provided with a recess, a spring-actuated locking-pin carried by the other said lever-arm and engaging automatically with the said recess when the lever-arms come together, and means for retracting the said locking-pin, substantially as set forth.

9. In a spinning-mule, the combination, with the fallers, and their shafts; of a lever-arm secured on one faller-shaft, a guide-pulley, and a flexible connection connected to the said lever-arms and to the counter-faller and passing over the said pulley, thereby preventing the counter-faller from moving suddenly, substantially as set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

JOE RAMSDEN.
ARTHUR TURTON TAYLOR.
JAMES RAMSDEN.

Witnesses:
HAMILTON TURNER,
J. H. WHITAKER.