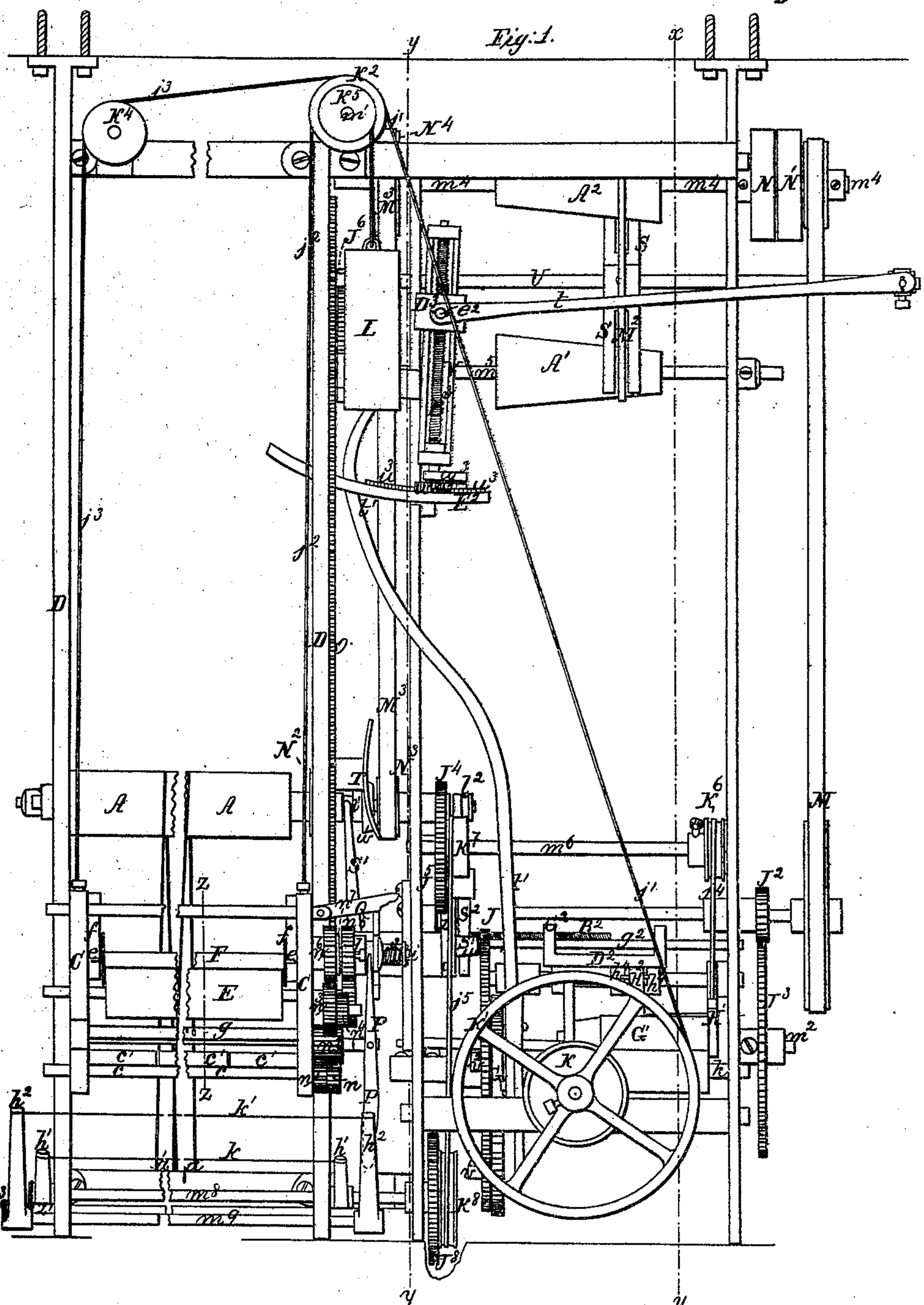
Sheet 1- 5 Sheets.

J. Goulding.

Spinning Jack and Mule.

No. 47,547. Patented May 2, 1865.

Fig: 1.



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Inventor;
John Goulding
by his Attorney
C. S. Renwick

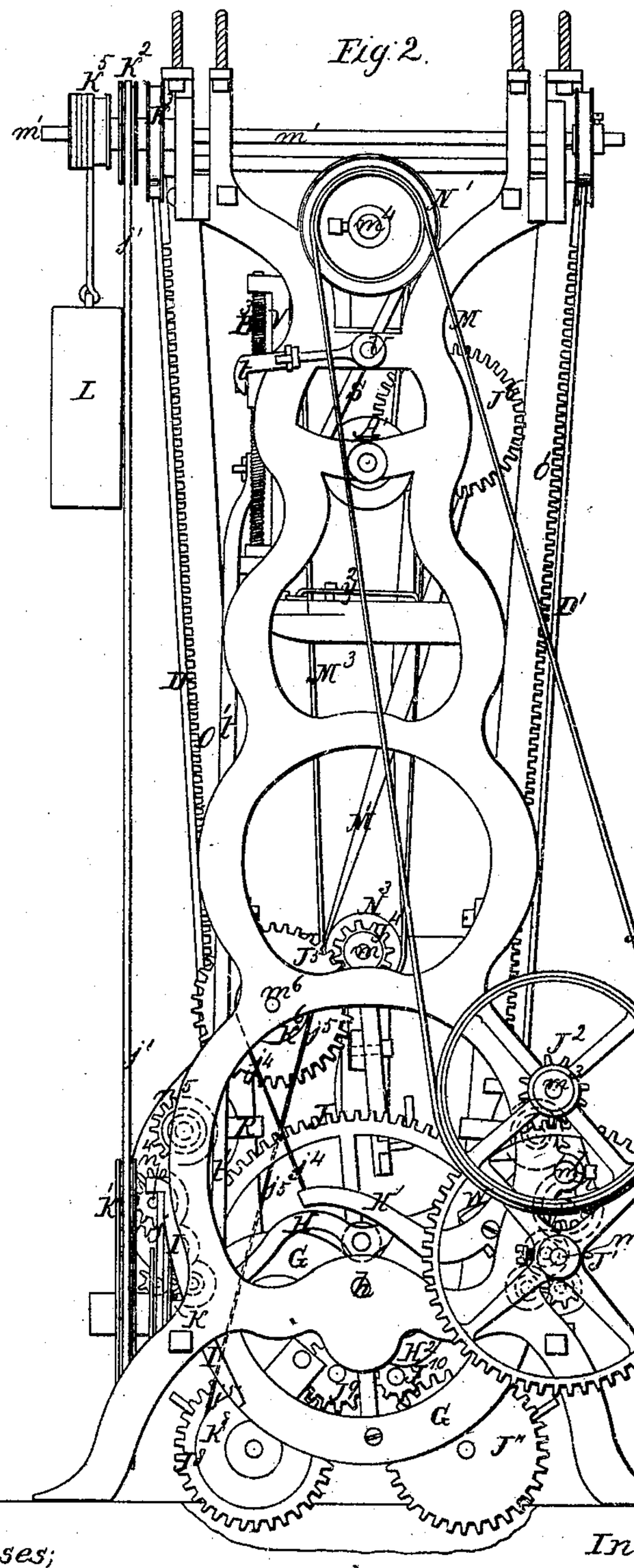
Sheet 2 - 5 Sheets.

J. Goulding.

Spinning Jack and Mule.

No. 47,547. Patented May 2, 1865.

Fig: 2.



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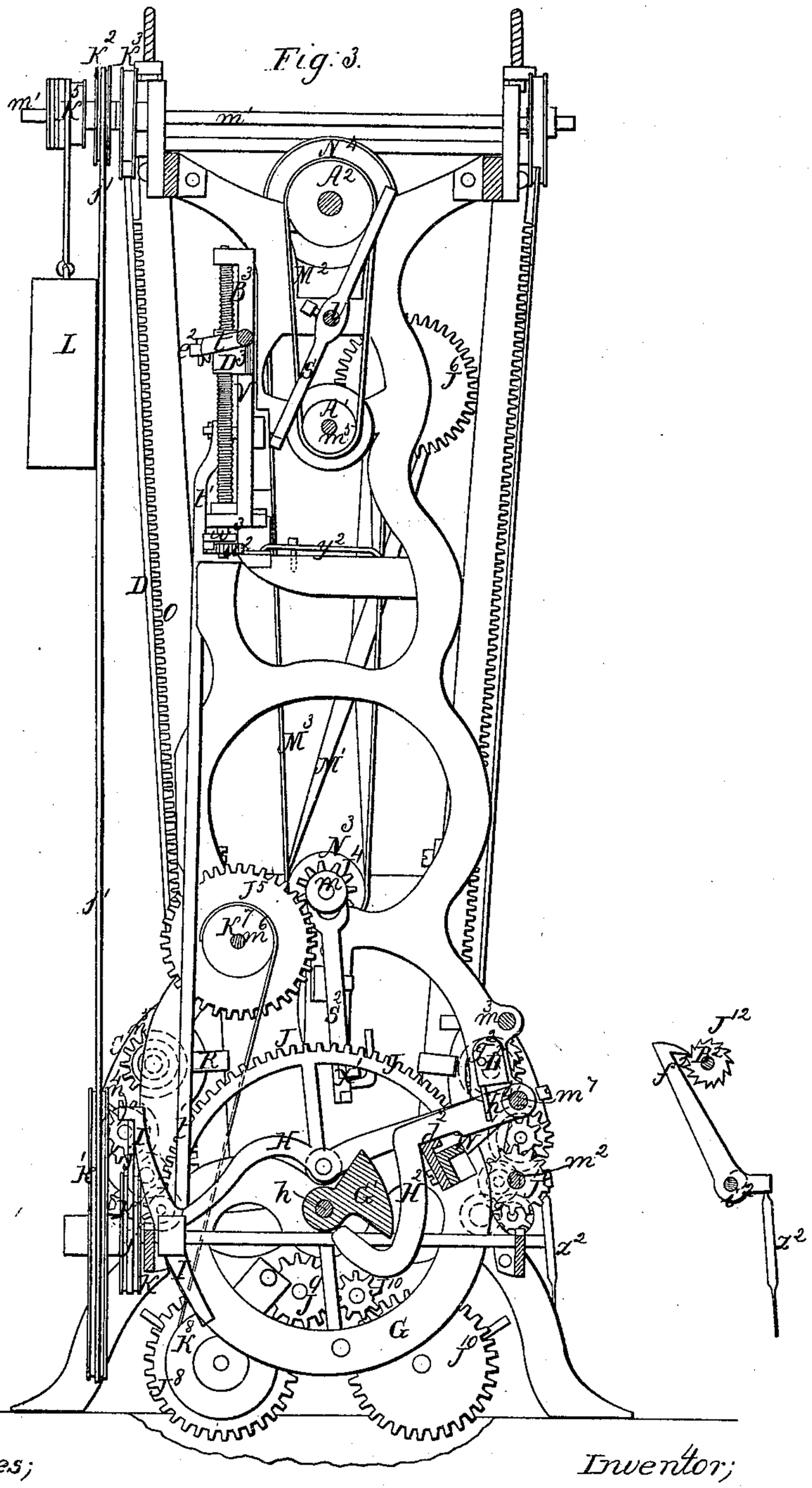
Sheet 3 - 5 Sheets.

J. Goulding.

Spinning Jackand Mule.

No. 47,547. Patented May 2, 1865.

Fig. 3.



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Sheet 4 - 5 Sheets.

J. Goulding.

Spinning Jack and Mule.

No. 47,547. Patented May 2, 1865.

Fig. 4.

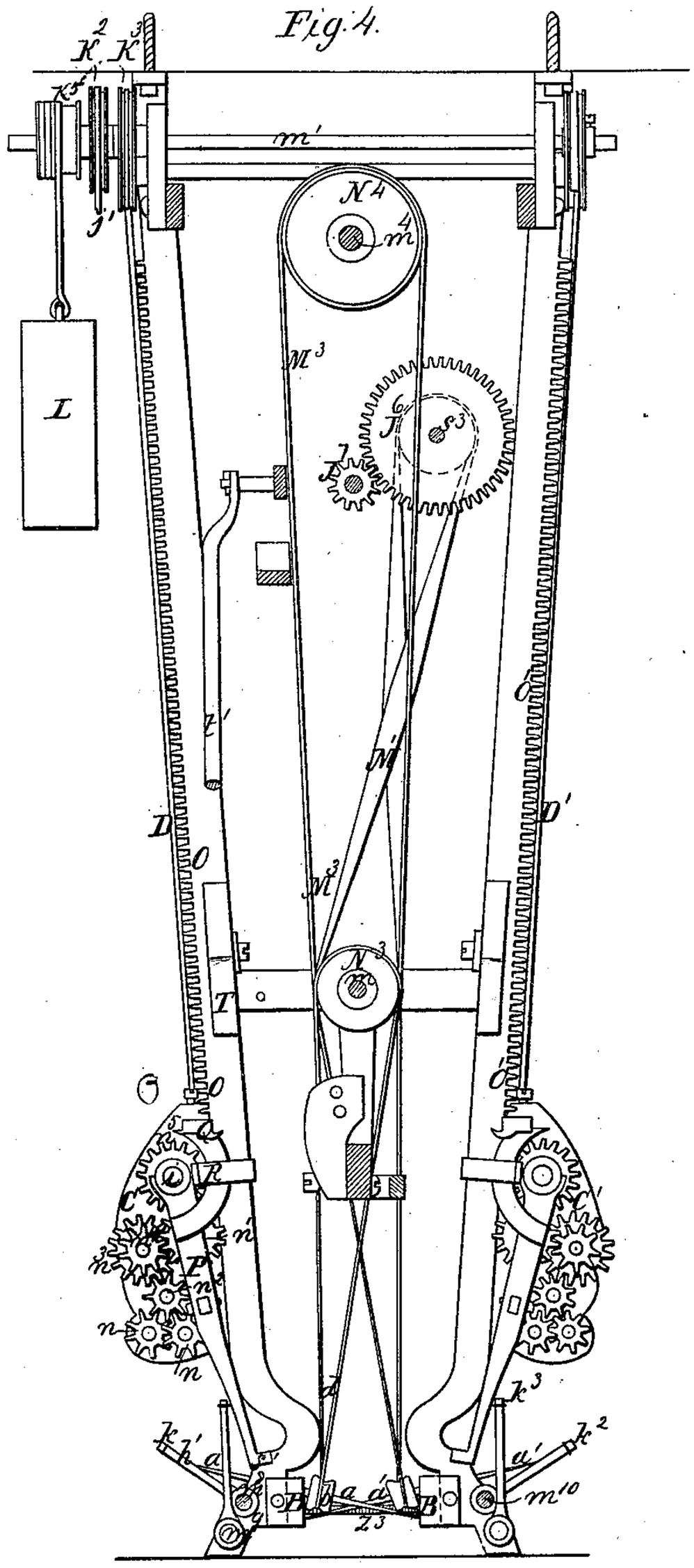
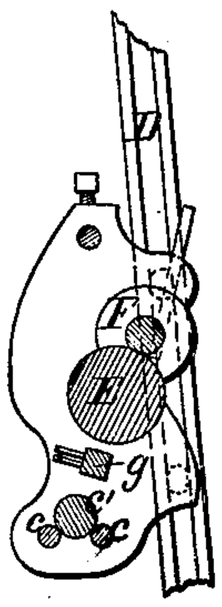


Fig. 4.a



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Inventor;
John Goulding
by his attorney
C. S. Kenwick

Sheet 5 - 5 Sheets.

J. Goulding.

Spinning Jackand Mule.

No. 47,547. Patented May 2, 1865.

Fig: 5

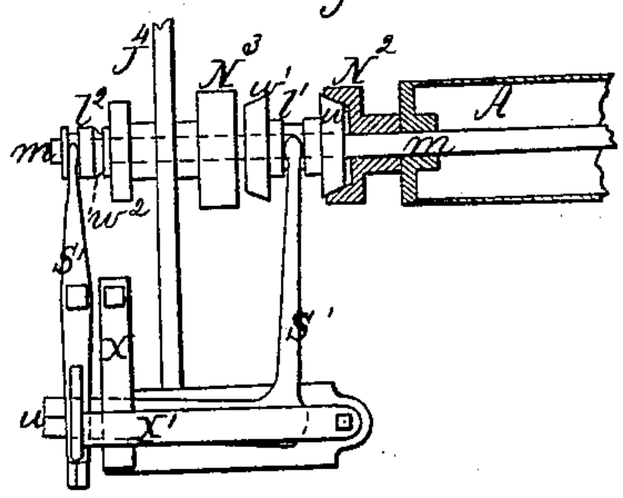


Fig: 6.

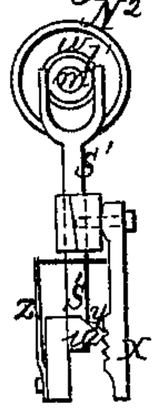


Fig: 7

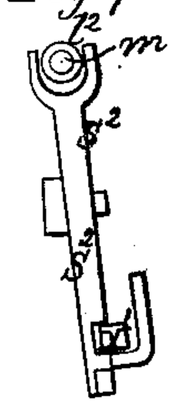


Fig: 8.

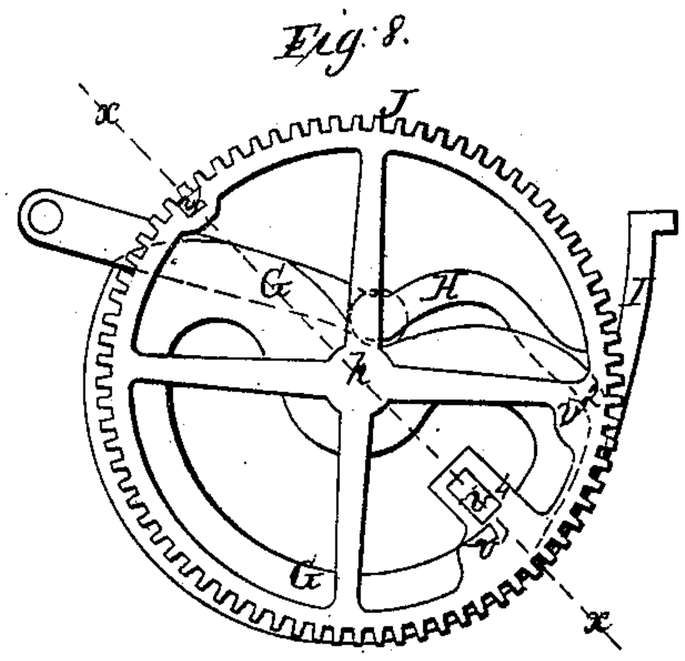


Fig: 9.

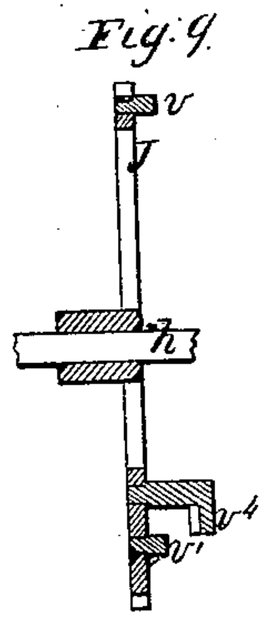


Fig: 10.

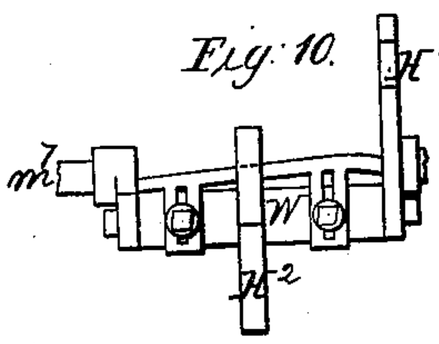
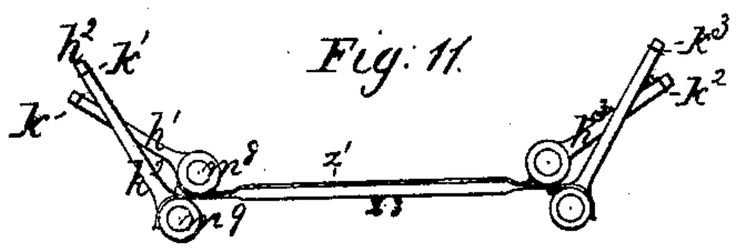


Fig: 11.



Witnesses;
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W. L. Bennett

Inventor;
John Goulding
by his attorney
C. L. Kenrick

UNITED STATES PATENT OFFICE.

JOHN GOULDING, OF WORCESTER, MASSACHUSETTS.

IMPROVEMENT IN JACKS AND MULES FOR SPINNING YARNS.

Specification forming part of Letters Patent No. **47,547**, dated May 2, 1865.

To all whom it may concern:

Be it known that I, JOHN GOULDING, of the city and county of Worcester, and State of Massachusetts, have invented certain new and useful Improvements in Jacks and Mules for Spinning Yarns; and I do hereby declare that the following is a full, clear, and exact description of my invention, reference being had to the accompanying drawings, in which—

Figure 1 represents a front elevation of the principal parts of a jack embodying my invention. Fig. 2 represents an end elevation of the same. Fig. 3 represents a transverse section of the same at the line *x x* of Fig. 1. Fig. 4 represents a transverse section of the same at the line *y y* of Fig. 1; and Fig. 4 *a*, *a*, a similar section of the carriage at the line *z z* of Fig. 1. Fig. 5 represents a side view of the shifting mechanism of the drum-shaft with parts thereof in section. Fig. 6 represents an end view of parts of the same. Fig. 7 represents an end view of other parts of the same. Fig. 8 represents a view of certain parts of the machine detached from the remainder and viewed from the end of the machine opposite that represented in Fig. 2. Fig. 9 represents a section of the cog-wheel at the line *x x* of Fig. 8. Fig. 10 represents a view of parts of the machine detached from the remainder; and Fig. 11 represents a view of the arms of the faller and counter-faller viewed from the end of the machine opposite that represented in Fig. 2.

The invention which constitutes the subject-matter of this patent relates to those spinning-machines known as "jacks," and "mules," in which the spinning and winding of yarn are effected alternately and intermittently. In such machines it has been customary to arrange the spindles in upright positions upon a carriage which is caused to move horizontally from and toward jaws, from which the rovings to be stretched and spun are delivered. Machines with this arrangement occupy not only the space on the floor of the factory required for the machinery, but also the additional space requisite to permit the carriage to stretch the rovings, while the actual space occupied by the moving parts of the machine is but a small portion of the entire space. Moreover, as the rovings are stretched in horizontal directions they sag, and their own weight tends to break them; and when yarns are broken the attendant is compelled to lean forward over the carriage in an inconvenient and difficult position to piece them.

The object of the present invention is to enable spinning by the system of alternate and intermittent stretching and winding, to be effected automatically in a much less space horizontally, so that a greater number of machines can be operated in the same factory, also to facilitate the attendance upon the machine and secure greater uniformity and evenness in the yarn produced.

To this end the first part of the invention consists of the combination of a series of prostrate spindles for alternately twisting and winding yarn, with roller-jaws to deliver or feed continuous rovings to the spindles, a movable carriage to effect the stretching of the rovings and to render up the yarn during winding, and upright guides to direct the carriage in its movement, all these members being operated in such manner that the rovings are delivered, stretched, and twisted and the yarns rendered up for winding while in upright positions.

The second part of the invention consists of the combination of the first part thereof with a turning-spool support for supporting and unwinding the rovings from their bobbins or spools, so that the rovings are delivered to the jaws of an upright machine without strain, and consequently the risk of the rovings being broken between the spool and jaws in an upright machine is prevented in whole or in part.

The third part of the invention consists of the combination of the rising and descending carriage and the roller-jaws carried by it, with upright guides and a cog-rack, or its equivalent, operating upon gearing applied to the roller-jaws on the carriage in such manner that the roller-jaws are turned to deliver rovings by the movement of the carriage along the upright guides.

The fourth part of the invention consists of the combination of the rising and descending carriage, the roller-jaws and the turning-spool support carried by it, with upright guides and a cog-rack, or its equivalent, operating upon gearing applied to the roller-jaws and the turning-spool support on the carriage in such manner that both the roller-jaws and the spool.

support are turned to unwind rovings from the spool or bobbin and deliver them for spinning by the movement of the carriage along the upright guides.

The fifth part of the invention consists of the combination of the rising and descending carriage, the roller-jaws, and the gearing which transmits motion to them, with instrumentalities for disconnecting said gearing from the control of the upright rack, or its equivalent, during the movement of the carriage in such manner that the delivery of rovings by the roller-jaws ceases when a certain predetermined length of rovings has been delivered for stretching and twisting.

The sixth part of the invention consists of the combination of the rising and descending carriage, turning-spool support, roller-jaws, and gearing which transmits motion to the turning-jaws and turning-spool support, with instrumentalities for disconnecting said gearing from the control of the upright rack, or its equivalent, in such manner that the unwinding of the rovings and their delivery by the jaws both cease when a certain predetermined length of rovings has been delivered for stretching and twisting.

The seventh part of the invention consists of the combination of a series of prostrate spindles with two trains of driving mechanism (the one for impelling them at the required speed during the stretching of the rovings and the other for impelling them at a variable speed during the winding of the yarn) and with shifting mechanism to put the spindles in connection with one or other of said trains of driving mechanism, and to disconnect them therefrom at the required times during the operation of the machine.

The eighth part of the invention consists of the combination of a series of prostrate spindles with a train of mechanism for reversing their motion, and with a shifting mechanism to put them in connection with said train and to disconnect them therefrom at the required times during the operation of the machine, so that the prostrate spindles may be made to "back off" the yarns extending along their bodies from the cops of yarn to their points previous to winding.

The ninth part of the invention consists of the combination of the series of prostrate spindles and the train of reversing or backing-off mechanism with mechanism for varying the extent of the retrograde or backing-off movement of the spindles, so that the amount of backing off is reduced as the cops of yarn upon the spindles increase in size.

The tenth part of the invention consists of the combination of the train of backing-off mechanism and the mechanism for operating the faller (which determines the position of the yarn during winding) with devices for varying the extent of the operation of these two mechanisms so that the operations of backing off and of directing the yarn for winding upon the spindles may be effected with the requisite variation by the operation of a single cam.

The eleventh part of the invention consists of the combination of the series of prostrate spindles and the train of driving mechanism for impelling them with varying speed during the winding of the yarn with mechanism for changing the varying speed in such manner as to form the conical bases of yarn or the feet of the cops at the butts of the spindles.

The twelfth part of the invention consists of the arrangement of two series of prostrate spindles, carriages, and upright guides for the carriages, back to back, and the combination of this arrangement with one set of driving mechanism.

All of the improvements are embodied in the machine represented in the accompanying drawings. In this machine the series of prostrate spindles (but one of which, *a*, is represented in the drawings in order to avoid confusion) are arranged in a row, and are supported in suitable bearings in two rails, B B, near the floor of the room in which the machine is operated, and each spindle is fitted with a whirl, *b*, to receive the cord *d*, by which the rotary motion is imparted to it from a drum, A. The spindles are arranged in sets or gangs of about twenty each, as in the horizontal machines in common use, and a drum is used for each set. All these drums are mounted upon one shaft, *m*, which extends through the machine, is supported at intervals by bearings, and is operated in turn by each one of three trains of driving mechanism hereinafter described, one for impelling the drums, and consequently the prostrate spindles which they operate upon, at a suitable speed during the delivery of the lengths of rovings to be spun and during the winding of the yarn; the second train for impelling the spindles at the proper speed during the stretching of the rovings and until they are twisted to the requisite hardness, and the third for turning the spindles backward, so that they may "back off" the yarn extending from the cops of thread to the points of the spindles. A carriage, C, composed, mainly, of two end frames connected by cross-bars, is arranged to move up and down above the series of prostrate spindles, so that it alternately recedes from them and approaches them. This carriage is guided in its movement by two upright guides, D D, which for better security are connected at their upper and lower ends with the floors of the factory. The carriage holds the jaws which deliver and hold the rovings during spinning, and the turning-spool support for supporting the bobbin or spool of rovings and for unwinding them, so as to deliver the rovings. The rotary jaws consist of two rollers, *c c*, which are turned to deliver rovings, and of the loose rollers *c' c'*, which lie upon the rovings, press them in contact with the turning-roller *c c*, and grip them by pressure, so that the rovings are clamped

fast when the rollers *c c* cease to turn. The turning-spool support consists of a cylinder, E, which is arranged parallel with the rotary jaws upon which the long bobbin or spool of rovings F lies, so that it is turned by friction. The spool is retained in its proper position over the cylinder E by a pair of guides, *f f*, against which the end gudgeons, *e e*, of the spool rest. In order that the rovings may be caused to maintain their proper positions opposite the spindles by which they are spun, a guide-rail, *g*, is inserted between the rotary jaws and the turning-spool support, and is provided with a pair of guide-pins for each spindle (but one pair of which are represented in the drawings) between which the rovings are conducted. The carriage is drawn upward from the prostrate spindles, and is permitted to descend by gravity, so as to approach the prostrate spindles by means of a cam, G, secured to a revolving shaft, *h*, and operating upon the carriage through the following mechanism: The cam operates directly upon a friction-wheel secured to an arm, H, whose end is provided with a segment, I, which is connected with a steel band, *j*, wound upon a pulley-wheel, K. The pulley-wheel K is secured to a transverse shaft, to which a second pulley-wheel, K′, of larger size, is secured, and this second pulley-wheel is connected with a steel band, *j*, which is wound upon a pulley-wheel, K^2, secured to a counter-shaft, *m′*, above. The counter-shaft is provided with another pulley-wheel, K^3, which is connected with the two end frames of the carriage C by means of two steel bands, j^2 j^3 one of which passes over a pulley, K^4, so that the upward movement of the arm H by the cam G draws off the band *j* from the pulley-wheel K, and thereby causes it and the larger pulley-wheel, K, to turn, and the turning of this pulley-wheel draws the band *j′* from the pulley-wheel of the traverse-shaft, *m′*, and, causing it to turn, effects the winding up of the bands j^2 j^3 and the consequent rise of the carriage C. When, on the other hand, the cam in its revolution permits the arm H to descend, the weight of the carriage causes it to descend and turn the pulley-wheels and shafts in the opposite direction, and the speed at which the carriage descends is regulated by the form of the cam.

In order that the power required to operate the machine may be equalized, the weight of the carriage and its appurtenances is counterbalanced in part by a counter-weight L, which is suspended from a band wound upon a pulley-wheel, K^5, secured to the counter-shaft *m′*. The cam G is secured to a shaft, *h*, to which a cog-wheel, J, is also secured. This cog-wheel engages with a pinion, J′, on a shaft, m^2, which is driven from a shaft, m^3, by means of a pinion, J^2, and cog-wheel J^3. The shaft m^3 is fitted with a belt-pulley, which receives a belt, M, leading from a belt-pulley, secured to the driving-shaft m^4 of the machine, and the driving-shaft is fitted with a fast pulley, N, and a loose pulley, N′, to one or other of which the driving belt is applied, according as the machine is to run or to remain at rest.

In order that the rotary jaws and turning-spool-support may be turned to deliver the rovings for spinning, the ends of their respective shafts are extended through one of the end frames of the carriage, and are provided with cog-wheels *n n n′*. The cog-wheels *n n* of the rotary jaws are connected with the cog-wheel *n′* of the cylinder E by means of intermediate cog-wheels, n^2 n^3 n^4, so that all turn together, and the cog wheel *n′* of the cylinder engages with a cog-wheel, n^5, fitted to turn loosely upon a stud, *i*, secured to the end frame of the carriage. A second cog-wheel, n^6, is fitted to turn upon this stud, with its teeth engaging in the teeth of a stationary upright rack, O, so that the cog-wheel is caused to turn by the action of the rack whenever the carriage is raised or lowered. The face of the cog wheel n^6 is provided with a clutch-wheel, n^7, and a bayonet-clutch, *l*, is arranged to slide upon the stud *i*, with its pins passing through the cog-wheel n^5 into positions to engage with the teeth of the clutch-wheel n^7. The pins of the clutch are pressed toward the clutch-wheel n^7 by means of a spring, *s*, so that whenever the clutch-pins are permitted to engage with the teeth of the clutch-wheel n^7 the cog-wheel n^5, upon which the clutch operates and the train of gearing composed of the cog-wheels *n′* n^4 n^3 n^2 *n n* and the cylinder E and roller jaws *c c c′*, upon which this gearing operates, are all caused to turn simultaneously with the cog-wheel n^6. When, on the other hand, the clutch-pins are disengaged from the clutch wheel n^7, the train of gearing, cylinder, and jaws cease to turn. As rovings are delivered for spinning during the rising of the carriage for a certain period preliminary to the stretching, the clutch-pins are engaged with the clutch-wheel when the carriage is in its lowest position, and remain so engaged until the carriage has moved the required distance to extend the lengths of rovings to be spun between the roller-jaws and the spindles, after which the clutch-pins are withdrawn from the clutch-wheel n^7, thereby disengaging the gearing from the cog-wheel n^6 and stopping the turning of the cylinder E and roller-jaws *c c c′*. In order to so withdraw the clutch-pins the hub of the clutch *l* is grooved to receive the fork of a shifting-lever, P, which is pivoted to the end frame of the carriage, and the lower end of the shifting-lever is provided with a projection, *s′*, which by the upward movement of the carriage is brought in contact with an inclined plane, T. Hence as the carriage rises the shifting-lever is caused to turn by the action of the inclined plane upon its lower end and its fork disengages the clutch-pins. In order to hold them so disengaged during the remainder of the upward movement of the carriage and during its descent, a latch, Q, is provided, to engage with the upper end of a projection secured to the shifting-lever and prevent its movemen

until the latch is disengaged at the end of the descending movement of the carriage by a stop, R, upon which it strikes as the carriage approaches its lowest position, whereupon the clutch is permitted again to be engaged by its spring s^2. As the turning of the roller-jaws and spool-support cease when the clutch is disengaged by the action of the inclined plane T, the position of this instrument determines the length of the rovings delivered by the jaws for spinning; hence by setting this instrument nearer to or farther from the spindles the length of the rovings delivered is proportionally shortened or lengthened, and as the rovings are stretched during the entire remainder of the upward movement of the carriage the amount of stretch is correspondingly increased or diminished.

In order that the spindles may be turned with the proper speeds at the proper times in the operation of spinning, the drum A, as before stated, is operated upon by three trains of mechanism. For this purpose the drum-shaft is provided with two belt-pulleys, N^2 N^3, and with a cog-wheel, J^4, all of which are fitted to turn loosely upon it. The belt-pulley N^2 constitutes the last member of the train of mechanism for impelling the spindles at the speed required for winding the yarn on the spindles and for turning them also during the delivery of rovings prior to stretching. It is driven by a belt, M′, which receives motion from a belt-pulley secured to the hub of a cog-wheel, J^6, which revolves upon an axle-arm, s^3, secured to the frame of the machine. The teeth of this cog-wheel engage with those of a pinion, J^7, secured to a counter-shaft, m^5, which has a conical drum, A′, mounted upon it, and this drum receives motion through a belt, M^2, from a corresponding conical drum, A^2, secured to the driving-shaft m^4 of the machine. The belt M^2 passes between the forks of a belt-shifter, S, which is carried lengthwise with the conical drums by a slide-rod, U, on which it is mounted, and to which motion is imparted by the swinging arm V through the connecting-rod *t*. The swinging arm is also connected by a rod, *t′*, with the arm H, operated by the cam G, so that as this arm H moves its movement is propagated through the connecting-rod *t′*, swinging arm V, connecting-rod *t*, and slide-rod U to the belt-shifter S, which moves the belt M^2 along the conical drums, and thereby effects the variation in the speed of the spindles as the winding of the yarn takes place upon the larger or smaller portions of the cops.

The pulley-wheel N^3 constitutes the last member of the train of mechanism for turning the spindles at the speed required for twisting during the stretching of the rovings. It is driven by a belt, M^3, leading directly from a pulley, N^4, secured to the driving-shaft m^4 of the machine.

The cog-wheel J^4 constitutes the last member of the train of mechanism for turning the spindles backward to cause them to back-off from the yarn previous to winding. Its teeth engage with those of a cog-wheel, J^5, which is secured to a shaft, m^6, and this shaft has a pulley-wheel, K^6, secured to it, upon which a band, j^4, is wound. One end of the band is secured to an arm, H′, which projects from a rock-frame, W, that is arranged to rock upon the shaft m^7. This rock-frame is provided with a second arm, H^2, whose end projects within the range of a cam, G′, secured to the shaft *h*, so that as the said shaft revolves the cam G′, acting through the arms H′ H^2, band j^4, pulley-wheel K^6, and cog-wheel J^5, imparts motion to the cog-wheel J^4, running on the shaft *m* of the drum which drives the spindles.

In order that the drum-shaft may be connected with either of the three trains of mechanism, it is provided with two sliding friction-clutch sleeves, *l′* and l^2, which are connected with it by feathers, so that when either one of them is turned the shaft is compelled to turn correspondingly. The sleeve *l′* is provided with two friction-cones, *w w′*, and the pulleys N^2 N^3 are provided with corresponding hollow cones, so that when the clutch-sleeve is moved to its extreme range to the right or to the left the friction-cone *w*, at one of its ends, or the friction-cone *w′* at the other of its ends, is engaged with the pulley N^2 of one train of mechanism, or with the pulley N^3 of the other train of mechanism, and the sleeve *l′*, drum A, and spindles are caused to revolve correspondingly. When, on the other hand, the clutch-sleeve *l′* is at an intermediate position, neither of its friction-cones are engaged with the pulleys N^2 N^3, and consequently the spindles are not then driven by them. The second clutch-sleeve, l^2, is provided with a friction-cone w^2, and the hub of the cog-wheel J^4 is provided with a corresponding hollow cone, so that when the clutch-sleeve l^2 is moved toward the cog-wheel J^4 its cone is engaged with that of the cog-wheel, and the drum A and spindles are caused to revolve in correspondence therewith; but when the sleeve l^2 is separated from the hub of the cog-wheel J^4 the drum and spindles are not driven thereby.

In order that the clutch-sleeve *l′* may be moved to engage with one or other of the pulleys N^2 N^3, and to disengage it therefrom, it is operated by the fork of an elbow-formed shifting-lever S′, which is pivoted to the frame of the machine, with its horizontal arm *u′* in close proximity to the face of the cog-wheel J, and the adjacent face of this wheel is provided with three inclined projections, *v v′* v^2, Fig. 8, for moving the end of the shifting-lever and thereby changing the position of the clutch-sleeve *l′*, as required, to engage the drum A and spindles with one or other train of driving mechanism, or to disengage it from either. One of these projection, *v*, is so set in reference to the cam G that it bears upon the upper side of the end of the arm of the shifting-lever S′ at the time the requisite length of rovings for one stretching operation has been delivered by the jaws, and it is of

such size that it moves the clutch-sleeve l' sufficiently to disengage one friction-cone from the pulley N^2 and engage the other with the pulley N^3, so that the drum A and spindles are disconnected from one train of driving mechanism and immediately re-engaged with the second train. The next projection, v', is so set in reference to the cam G that it bears against the under side of the end of the arm of the shifting-lever S′ at the time the spinning of the lengths of rovings is completed, and it is of such size that it moves the clutch-sleeve to its intermediate position, so that the drum and spindles are then disengaged from either of the two trains of mechanism for turning them forward. The third projection, v^2, is so set in reference to the cam G that it bears against the under side of the end of the arm of the shifting-lever S′ at the time the spindles are to commence winding the yarn, and it is of such size that it moves the clutch-sleeve l' from its intermediate position until its cone w is engaged with the hollow cone of the pulley N^2. The drum and spindles are thereby engaged with the train of mechanism for turning the spindles during the winding of the yarn and the delivery of the lengths of rovings to be stretched and twisted, and remain engaged with it until the first projection v is again carried by the wheel J into contact with the arm of the shifting-lever. As the projections thus described are only large enough to move the shifting-lever to the desired positions, it must be held in each position until a change is to be made. This is effected by a latch, X, having three notches, in one or other of which a tooth, y, on the shifting-lever engages when the sleeve is in one or either of the three required positions. The latch is pressed toward the shifting-lever by a spring, z, which is of sufficient strength to hold the lever from moving of itself, but yields when the lever is moved by the projections v v' v^2 and permits the disengagement of the tooth.

In order that the clutch-sleeve l^2 may be moved to engage it with the cog-wheel J^4, or to disengage it therefrom, it is operated by the fork of a straight shifting-lever, S^2, which is pivoted to the frame of the machine with its lower end near the face of the cog-wheel J. This shifting-lever is moved to engage the clutch-sleeve l^2 with the cog-wheel by a projection, v^4, secured to the face of the wheel J in such a position relatively to the cam G, that the end of the projection acts upon the end of the shifting-lever when the twisting of the stretched rovings is completed, and when the drum A and spindles are disconnected from the train of driving mechanism terminating in the pulley N^3, whereupon the clutch-sleeve l^2 is engaged with the cog-wheel J^4, and consequently the drum A and spindles are turned backward, the effect of which is to cause the spindles to back off or unwind the yarn extending from the cops to the ends of the spindles. When the backing off is completed and winding is to commence, the end of the projection v^2 comes in contact with the opposite side of the end of the shifting-lever S^2, being made long enough for that purpose, and moves it sufficiently to disengage the clutch-sleeve from the wheel J^4, whereupon the drum and spindles are disconnected from the backing-off mechanism immediately before the same projection v^2 acts upon the shifting-lever S′ and connects the drum A and spindles with the train of winding mechanism.

In order that the shifting-lever S^2 may retain the position in which it is placed by the projections v^4 v^2, it is provided with a tooth, which engages in one or other notch of a latch, X′, which is pressed against it by a spring.

In order that the yarns may be shifted from the ends of the spindles to the cops during winding and may be extended to the ends of the spindles during twisting, a wire faller, k, is applied to the machine. This faller is stretched between and supported by two arms, h' h', which project from a rock-shaft, m^8, and, as the faller and backing-off mechanism should operate at the same time, the faller is connected with and operated by the train of backing-off mechanism, terminating in the cog-wheel J^4. The connection is made by means of a band, j^5, whose ends are wound upon and secured to two pulley-wheels, K^7 K^8, the one on the rock-shaft of the faller and the other on the rock-shaft m^6, so that when the latter is moved, as before described, by the action of the cam G′ on the arm H^2 the faller is raised to shift the yarns from the ends of the spindles to the cops. When, on the other hand, the cam G′ passes by the arm H^2, the faller is rocked downward to shift the yarns to the ends of the spindles by a spring, z', operating upon the hub of one of the arms of the spindles. As the position of the conical ends of the cops of yarn on the spindles is gradually changed from their butts toward their points by the progressive accumulations of yarn, the range of motion of the faller and the amount of backing off performed by the spindles must be correspondingly varied. In order that this may be done automatically, the arm H^2 is not fixed to the rock frame W, but is constructed to move along it, and the part d^2 of the frame or support on which the arm rests is inclined to the axis on which the frame rocks, so that as the arm H^2 is moved along the support d^2 from right to left, its end is progressively lowered or moved farther from the axis of the cam G′; hence the cam moves it a less distance, and consequently the movement of the faller and the backing off are progressively lessened. In order that the cam may commence to act upon the arm H^2 at the proper time, notwithstanding this change in the position of the end of the arm, the cam is skewed longitudinally, so that its forward face is more advanced as the end of the arm H^2 is farther withdrawn from its axis. The movement of the arm H^2 along its support on the rock-frame W is effected automatically by means of a screw, B^2, turning in a nut, C^2,

formed in a slide, D^2, which traverses on a guide-rod, g^2, and is connected with the arm H^2 by two pins, h^4. The head of the screw passes through the adjacent frame of the machine, and is fitted with collars, which prevent it from moving endwise. It also projects beyond the frame, and its projecting end is fitted with a ratchet-wheel, J^{12}, (see Fig. 3,) which is acted upon by a hand, f^2, the lower end of which is pivoted upon an eccentric pin, i^2, secured to the end of the shaft m^2, so that as this shaft revolves the hand is alternately drawn down to engage in the teeth of the ratchet-wheel and turn it and the screw B^2, and pushed up to glide over the inclined sides of the ratchet-teeth previous to re-engaging with them. The hand f^2 is held in contact with the teeth of the ratchet wheel by a spring, z^2.

From the foregoing description it will be seen that the train of mechanism for effecting the backing off and that for removing the faller are combined together, and that the variation of the operations of both is effected by changing the position of the arm H^2 relatively to the cam G' by means of the screw B^2 and the inclined support d^2. This combination of these mechanisms admits of the operation of the two by means of the single cam G', and as the arrangement is simple, it may be applied with advantage to jacks and mules spinning upon the horizontal system as well as to upright jacks and mules. The unwinding of the yarn during backing off delivers up a certain amount of yarn, which, if permitted to hangs lack, would tend to produce kinks. Therefore a counter-faller, k', is provided to prevent such slacking. This counter-faller consists of a wire stretched between and supported by two arms, h^2 h^2, secured to a rock-shaft, m^9, and this shaft is acted upon by a spring, z^3, to cause the counter-faller to bear upward under the yarns, so as to take up the slack of the yarns, by deflecting them as fast as they are unwound in backing off. The strength of the spring z^3, which operates this counter-faller, must be proportioned to the number of yarns upon which it acts being just sufficient to take up the slack, but insufficient to bend the yarns materially out of their upright courses during winding and spinning. When the machine has no yarns in it, the counter-faller is raised by its spring, but when the machine is twisting yarns the strain of the yarns upon it depresses it, as shown in Fig. 11. When spinning is commenced with an empty set of spindles, it is important that the winding of the first yarns spun should be effected in such manner as to produce conical masses of yarn at the butts of the spindles to serve as conical bases or feet for the yarns subsequently spun and wound. In order that the first yarns may be wound in this manner, the speed of the winding at that time must be greater proportionally than it is subsequently, and the speed of each succeeding winding must be progressively decreased as the conical feet of the cops increase in size until they are fully formed. In order to effect the progressive decrease of speed automatically, the pin e^2 of swinging arm V, to which the connecting rod t of the belt-shifter S is applied, is not fixed upon the swinging arm, but is attached to a slide, D^3, which is fitted to move longitudinally along said arm toward its lower end, so that the farther it is moved from the center of motion of the arm the greater is the stroke of the belt-shifter, and the farther the distance which the belt M^2 is shifted along the double cones A' A^2 toward the larger diameter of the driven cone A', and consequently the more the speed of the spindles is decreased toward the end of the winding. The slide D^3 is moved along the swinging arm V by means of a screw, B^3, which passes through a nut in the slide D^3, and is prevented from moving endwise along the arm by collars at its ends. The head of the screw is extended through the bearing in which it turns at the end of the swinging arm, and is fitted with an arm, w^3, which has a spring-pawl, w^4, secured to it in a position to bear upon the teeth of a cog-wheel, u^2, fitted to turn loosely upon the end of the screw B^3. This cog-wheel u^2 is carried alternately in opposite directions along a curved rest, E^2, by the movement of the swinging arm V. Upon the curved rest a segment of a cog-wheel, w^3, is secured by means of a clamp, y^2, with its teeth in proper positions to engage with those of the cog-wheel u^2 on the end of the screw; hence, as this cog-wheel is moved to and fro by the swinging arm it is turned alternately in opposite directions by the contact of its teeth with those of the stationary cog-segment. During the movement of the swinging-arm upward the cog-teeth of the cog-wheel slip past the spring-pawl w^4 without engaging with it; but during the downward movement of the swinging arm the teeth of the cog-wheel engage with the spring-pawl and compel it, the arm to which it is secured, and the screw to which the arm is made fast to turn and move the slide D^3 downward. After the feet of the cops are formed it is not necessary to change the varying speed of the winding mechanism, hence the movement of the slide D^3 must be stopped when the conical feet of the cops of yarn are fully formed. This may be effected by removing the cog-segment w^3 by hand at that time, or the screw-thread may be cut away at the place where the slide D^3 should then stand upon the swinging arm, so that the movement of the slide by the screw beyond that place is prevented.

The teeth of some of the cog-wheels of the machine represented in the accompanying drawings are drawn of larger proportionate sizes than they would be in a working machine, as the dimensions of the drawings are so small that it would be difficult to represent the cog-teeth of their proper relative sizes. This difference, however, is not a matter of importance, as the dimensions of the cog-teeth

of the gearing of jacks and mules are well understood by the builders of machines. The relative speeds of the spindles during the delivery of rovings, stretching, spinning, backing off, and winding may be the same as the speeds of the spindles in the horizontal jacks and mules, and, as these are well known to builders of such machines, it is not deemed necessary to state them. The carriage-cam G is of such form that it causes the carriage C to rise at the speed at which the carriage of a horizontal jack or mule is withdrawn from the jaws when the rovings are delivered and stretched. The cam is also of such form that after the stretching is completed by the rise of the carriage to its highest point the carriage is permitted to descend slowly during the continued twisting of the yarns to compensate their shortening by twisting preliminary to backing off and winding. The cam is also so formed that the carriage is permitted to descend during the winding with the proper speed, which may be the same as that at which the carriage of a horizontal jack or mule is moved toward the jaws during winding.

As the carriage of the machine thus described moves up and down it occupies but a small portion of the floor of the factory. In order, however, to economize space still further, a second row of prostrate spindles, a', is arranged behind the first row with the points of the spindles reversed, and this second row is provided with a carriage, C′, and its appurtenances, and with upright guides D′ and a stationary rack, O′, similar to those of the first row, the spindles being operated by the same drum A and the carriage being connected by bands with the same counter-shaft m', so that a duplex spinning-machine is produced, in which twice the ordinary number of spindles can be used in the same length of space with but one set of driving mechanism. The faller k^2 and counter-faller k^3 of this second row of spindles are similar to those of the row first described, and the rock-shaft m^{10} of the faller k^2 is connected with the train of backing-off mechanism by the cog-wheels J^8 J^9 J^{10} J^{11}, so as to be moved simultaneously with the faller of the first row. Both the rows of prostrate spindles thus described are represented in Fig. 1 at the left side of the frame of the driving mechanism. Two other sets of prostrate spindles might, however, be arranged on the right side of the frame of the driving mechanism, so that this frame would occupy a central position between the rows of spindles, and such other sets might be operated by the same driving mechanism if it be made of the requisite strength.

The machine thus described is an upright jack suited to the spinning of wool yarns from continuous rovings produced by carding machinery and wound upon bobbins or spools. An upright mule for extending rovings by drawing-rollers previous to stretching and twisting them may be constructed according to the aforesaid invention by mounting the successive pairs of drawing-rollers, together with the gearing for imparting to them the requisite speeds upon the rising and falling carriage. In this case the rovings delivered from the bobbins or spools will be drawn by the successive action of rollers before being delivered for stretching and twisting, and the last pair of drawing-rollers may act as the jaws whence the rovings pass to the spindles.

Having thus described a machine embodying all parts of my invention, I declare that I do not claim to be the first inventor of the system of spinning the yarns in upright positions by stretching and twisting rovings and winding them alternately and intermittently, as I am aware that attempts have been made to construct hand-machines operating upon that plan; nor do I claim to be the first who arranged spindles in prostrate positions; but

What I claim as my invention, and desire to secure by Letters Patent, is the new combinations of mechanism which I have devised for spinning yarns in upright positions, that is to say—

1. The combination of a series of prostrate spindles, roller-jaws, a movable carriage, and upright guides for the carriage, substantially as set forth.

2. The combination of a series of prostrate spindles, roller-jaws, turning-spool support, movable carriage, and upright guides for the carriage, substantially as set forth.

3. The combination of the rising and descending carriage and roller-jaws with upright guides for the carriage and a rack, substantially as set forth.

4. The combination of the rising and descending carriage, roller-jaws, and turning-spool support, with upright guides for the carriage and a rack, substantially as set forth.

5. The combination of the rising and descending carriage, the roller-jaws, and their gearing with instrumentalities for stopping the revolution of said jaws when the length of rovings required for one spinning operation has been delivered, substantially as set forth.

6. The combination of the rising and descending carriage, the roller-jaws, turning-spool support, and the gearing for transmitting motion to roller-jaws and turning-spool support, with instrumentalities for stopping the revolution of said jaws and spool-support when the length of rovings required for one spinning operation has been unwound and delivered, substantially as set forth.

7. The combination of a series of prostrate spindles with two trains of driving mechanism, and with shifting mechanism to put the spindles in connection with one or other train of driving mechanism and disconnect them therefrom, substantially as set forth.

8. The combination of a series of prostrate spindles with a train of mechanism for turn-

ing them backward, and with shifting mechanism to connect and disconnect the spindles therefrom, substantially as set forth.

9. The combination of a series of prostrate spindles and the train of backing-off mechanism with mechanism for varying the extent of the backing-off movement, substantially as set forth.

10. The combination, in a jack, of the backing-off mechanism, the faller mechanism, and the devices for varying the extent of movement of these two mechanisms, substantially as set forth.

11. The combination of a series of prostrate spindles and the train of driving mechanism for impelling them with varying speed during winding with mechanism for changing the varying speed, substantially as set forth.

12. The combination of two series of prostrate spindles and their appurtenances, arranged back to back, with one set of driving mechanism, substantially as set forth.

In witness whereof I have hereunto set my hand this 8th day of October, A. D. 1864.

JOHN GOULDING.

Witnesses:

MELVILLE BIGGS.

W. L. BENNEM.