Sheet 1. 2 Sheets.

# W. Hackley.
# Spinning Mule.

No. 102,537. Patented May 3, 1870.

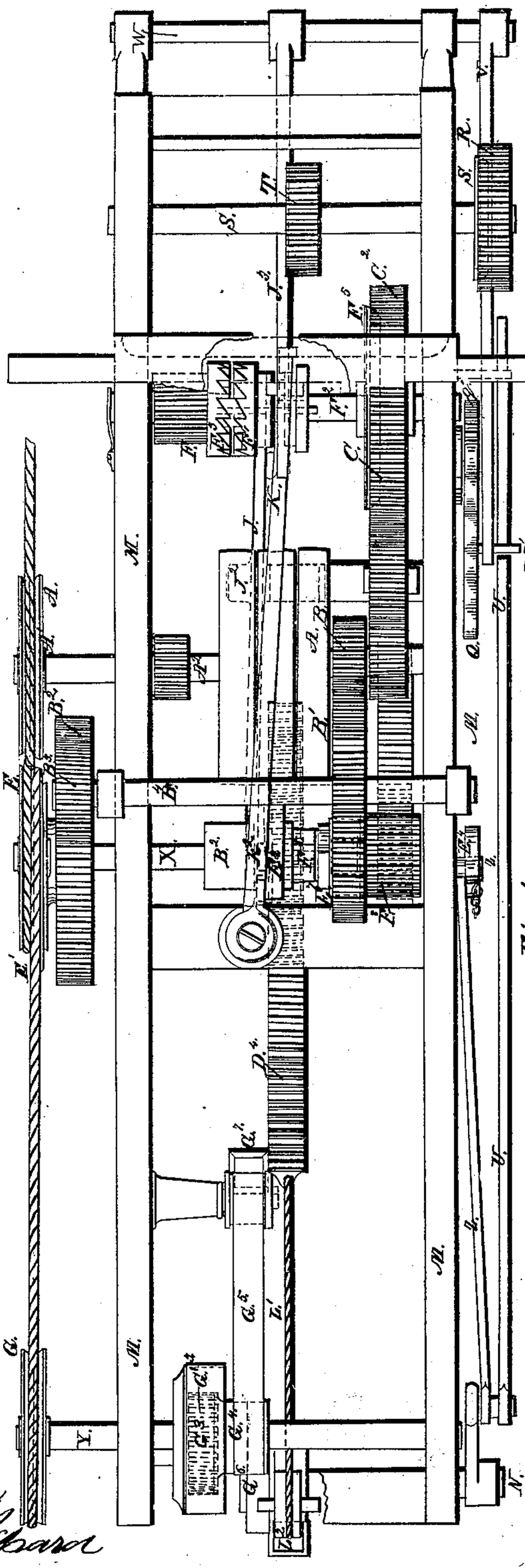

Fig. 1.

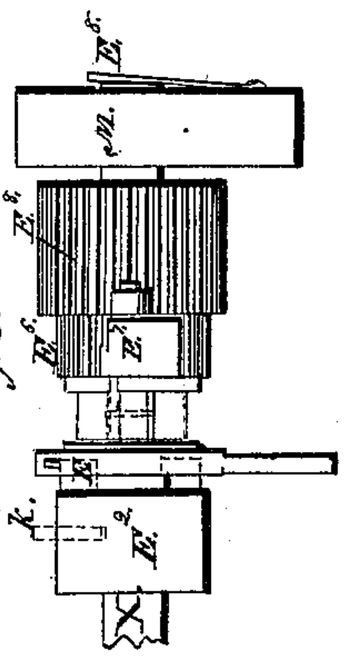

Fig. 3.

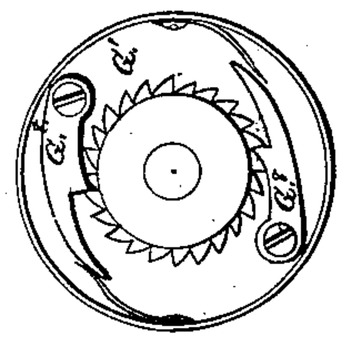

Fig. 4.

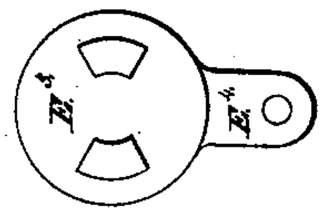

Fig. 5.

Witnesses:
William Dyer
Jno. L. Shepard

Inventor.
his
William X Hackley
mark.

Sheet 2. 2 Sheets.

# W. Hackley.
# Spinning Mule.

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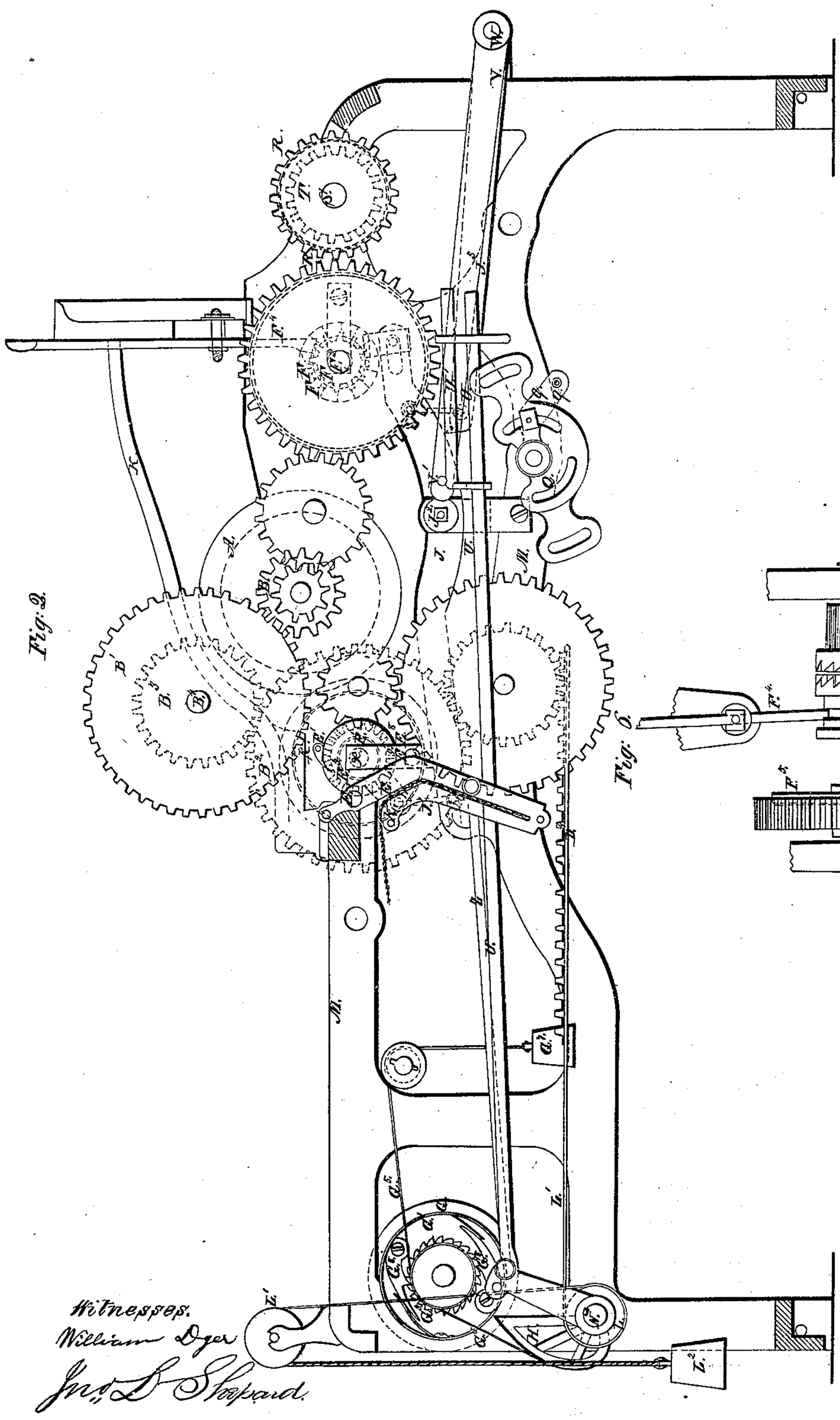

Fig. 2.

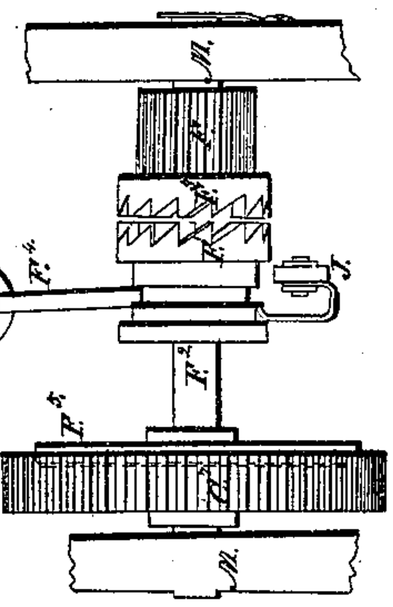

Fig. 3.

Witnesses:
William Dyer
Jno. L. Shepard.

Inventor:
his
William X Hackley.
mark

# United States Patent Office.

WILLIAM HACKLEY, OF MOOSUP, CONNECTICUT, ASSIGNOR TO HIMSELF AND CHARLES T. ALMY, OF SAME PLACE.

*Letters Patent No.* 102,537, *dated May* 3, 1870; *antedated April* 25, 1870.

## IMPROVEMENT IN SELF-ACTING MULE FOR SPINNING.

The Schedule referred to in these Letters Patent and making part of the same.

*To all whom it may concern:*

Be it known that I, WILLIAM HACKLEY, of Moosup, in the town of Plainfield, county of Windham, and State of Connecticut, have invented certain new and useful Improvements in the Mason Self-acting Spinning-Mule, so-called; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings making a part thereof, in which—

Figure I represents a vertical, and

Figure II, a side view of the improvements, with so much of the mule and its arrangements as are necessary to show said improvements.

Figure III represents the shaft X, with the clutch-gear $E^2$ $E^3$, the bent bar $E^5$, the ratchet $E^6$, the pawl $E^7$, the loose gear $E^8$, and the spring $E^9$.

Figure IV shows the fast rim-pulley $G^1$, containing the ratchet $G^3$, and the pawls $G^8$.

Figure V, the openings on the disk of the clutch $E^3$.

Figure VI, the catch-gear $F^1$ $F^3$, the finger $F^4$, the end of the lever J, and the friction-clutch $F^5$ $C^2$ on the shaft $F^2$.

The same parts in the different figures are indicated by the same letters.

The invention relates to the backing-off and winding-on motions of the mule, and which are in operation from the time the driving-belt is transferred to the second driving-pulley A until it is carried back to the first, and includes, also, modes of regulating the starting of the mule-carriage in running in or out.

It consists in improving and simplifying the apparatus now employed, in part, by substituting new devices and, in part, by dispensing with the regulator and other arrangements heretofore considered essential in running said mule.

By dispensing with the machinery hereinafter mentioned, the amount of power required to run the mule, its liability to derangement and breaking down, and the expense of repairs as well as the loss in time and production, are lessened.

By my alterations the mule is improved in these respects, viz: that while in the present Mason mule the motions above mentioned are not always certain, and the apparatus sometimes gets out of order and breaks, under the plan hereinafter described the first are made exact and positive, and the machinery seldom fails, if ever, to operate accurately.

Whatever be the speed of the mule-carriage, the backing-off and winding-on motions always act and work in conformity and simultaneously with the follower and rack. The follower does not move until the yarn is in readiness to back off, nor will the rack run in until the yarn is in position to be wound on.

As a further advantage, the improved mule, when backing off or winding on, can be stopped at any position or point in the operation, and then be started up from that point, to continue and finish the operation without breaking the yarn or deranging the machinery.

The backing off and winding on can, besides, be effected more rapidly, thereby enabling the mule to produce more yarn.

The improvements do not affect nor alter the apparatus or gearing connected with the movement of the carriage, except to bring the running-in motions into gear promptly, and to modify and graduate the motion of the carriage so as to prevent a violent and abrupt starting when commencing to run in or out; or, the apparatus now used to regulate the speed of the spindle to the size of the cop in winding on, or the position of the cop-rail for the same purpose, but are confined to the mode of operating the friction-band pulley E, its shaft and connections, with the usual upper rack $D^4$, the cop-rail shaft N, the shaft $F^2$, usually known as the scroll-clutch shaft, and a friction-gear, S′, on the shaft S.

In general terms these may be enumerated as follows, viz:

The band-pulley E and the band are stopped and the reverse motion effected by friction alone. When the friction is removed the pulley is simultaneously connected with the rack $D^4$, so that they are operated alike by the same power and run in correspondence while the yarn is winding on.

As an exact and positive action is thus produced, and the backing off no longer obliges the friction-band pulley to move the rack $D^4$ when its motion is reversed, as in the Mason mule, the apparatus on the rock or cop-rail shaft N for bringing back the rack and regulating said movement before the winding on commences, including also the chain so far as it is constructed to gear into the spur-gear, is dispensed with as no longer necessary.

The rock or cop-rail shaft N is operated by the band-pulley G instead of the usual mode, and the clutch and clutch-gear are for the same reason dispensed with.

In order to make the connection more exact and certain between the gear F during the running-in motion, and the second driving-pulley A, instead of the scroll-clutch gear, catch-gear $F^1$ $F^3$ is used, and a different mode is employed to keep these from coming into contact, and to regulate them after the belt has been thrown onto the pulley A, and while the backing-off is taking place.

To produce a steady starting motion when the carriage is about running in or out, instead of making gear $C^2$ fast to the shaft $F^2$, or the gear R to the shaft S, each is allowed to run loose on its shaft, and the connection of the gear $C^2$ to the running-in gear, and that of gear R to the running-out gear, is produced by bringing the face or disk of a friction-pulley, adjusted and made fast on the shaft, into contact with the face

or disk of said gear, and the motion is effected by the friction of the two, the necessary amount being practically ascertained and preserved by the adjustment.

The regulator, with its connections for governing the ball-lever, as well as the break which acts upon the first driving-pulley, are found to be no longer necessary, and are dispensed with.

The following is a description of the improvements claimed as my invention, reference being made to the drawings making part of this specification.

On the main shaft $A^2$ is added a gear, B, running loosely on the shaft with and attached to the second driving-pulley A.

Gear $B^1$, on shaft $B^4$, meshes with B, and on the other end of this shaft is gear $B^2$, which plays into and operates gear $B^3$, attached to the friction-pulley $E^1$, both running loosely on shaft X.

The shaft X also carries a band-pulley, E, and the ratchet-gear $E^6$, both secured upon it, and a loose gear, $E^8$, which, through a train of wheels, connects with the upper rack $D^4$; also a pair of clutch-boxes, $E^2$ and $E^3$, and a bent bar, $E^5$, around the collar of the clutch $E^3$, (one end of which bar is secured by a pin to the pawl $E^7$,) all likewise loose. The shaft slides endwise in its bearings.

On the other end of the shaft is applied the end of a spring, $E^9$, secured to the mule-frame, and of sufficient strength to press the band-pulley away from the friction-pulley and destroy the friction caused by its contact with the friction-pulley when no counter-force is in action.

The pawl $E^7$ is pivoted to a pin on the side of the loose gear $E^8$, and is arranged to hang over the ratchet-gear $E^6$, and to turn on its bearing. The rear end of the pawl has a lip which by the pin is connected with the bent bar $E^5$.

The clutches $E^2$ and $E^3$ are confined within certain limits, viz: $E^2$ by a pin, $K^2$, let down from the shipper K, and by the arm $E^4$.

$E^3$ is attached through a rod, $J^1$, to the arm of the lever J.

Clutch $E^2$ has two projections, and $E^3$ has corresponding openings of the shape and size to receive them.

The band-pulley G, instead of revolving on a stud, is set fast upon a revolving shaft, Y, upon which a fast pulley, $G^1$, is also set, having a hollow rim.

To the under surface of this rim are secured several pawls $G^8$ $G^8$ playing loosely, so that when the shaft and rim-pulley turn in one direction these pawls pass over the teeth of a ratchet-gear, $G^3$, (which is placed loosely on the shaft and within the rim,) without catching them, but when turned in the other direction they enter and carry the ratchet and the pulley $G^4$, to which it is attached, with the chains $G^5$ and $G^6$, fastened at one end to the periphery of the pulley $G^4$, in the same direction.

One of these chains $G^5$ acts simply to keep the other chain $G^6$ taut, and for this purpose is carried over a loose pulley, and has a weight, $G^7$, suspended from it. The other, $G^6$, passes down over the periphery of a half-heart cam, H, and is fastened to it where the radius is diminished.

The cam H is set on the cop-rail or rock-shaft N, which is turned in its bearings by the chain $G^6$ in one, and by the weight of the cop-rail in the other direction.

This shaft has, besides the arm connecting it with the cop-rail, the pulley L, (made without the pins or spurs,) around which the chain $L^1$, connecting the rack $D^4$ and the weight $L^2$, passes, and also an arm to which the rod *Z*, connecting the curved arm *Z'* and the rod or bar U, are attached.

The other apparatus now used to regulate and operate the rack $D^4$ on this shaft, and connected with it, is removed as useless, and leather or other straps of sufficient strength may be substituted for the chains $L^1$, $G^6$, and $G^5$.

On the shaft $F^2$, catch-gear $F^1$ $F^3$ are substituted for the scroll-clutch, so called.

$F^3$ is attached to the gear F.

$F^1$ slides endwise on the shaft, and is operated by finger $F^4$ from the shifting apparatus. It is made with projecting shoulders or collars, which, when the end of the lever J is in contact with the gear, prevent the two from closing.

The shaft also carries the loose gear $C^2$, which is connected by intermediate gear with the pulley A, and a friction pulley, $F^5$, made fast on the shaft, fitting into the face or disk of $C^2$, and which is pressed against it by a suitable spring fixed on the frame, and acting on the end of the shaft which, for the purpose slides, endwise.

On the shaft S carrying the gear T, which through intermediate gear operates to run the carriage out, instead of a fast gear, I introduce a loose-gear, R, and a fast friction-pulley, $S^1$, arranged to run face to face, and adjustable so that, while the ordinary power is operating, the contact will produce the friction to drive the shaft S as effectually as if the gear R was fast upon the shaft; but, should any derangement of machinery produce an unusual strain, the friction will yield to the excess of power and preserve the machinery from breaking.

The lever J, one end of which is connected by the rod or bolt $J^1$ to the arm $E^4$ of the clutch $E^3$, has its fulcrum on the stud $J^2$, and is carried beneath the gearing and driving-pulleys, and, at the other end, is terminated by a broad face, flattened to be pressed against the recess formed by the shoulders of catch-gear $F^1$.

To this last arm of the lever J is connected, by a slotted rod confining a bolt secured to it, the arm $J^3$ set upon shaft W.

This shaft rotates on bearings secured to the frame M, and carries also the arm V. On the end of the arm V is a pin, *v'*.

The rod U, above mentioned, is extended beyond the arm Q. Near its extremity a short adjustable bar, U', is set, and secured by a set-screw upon it. The arm or piece connecting the two forms a right-angle with the lower bar, and answers as a hook to hold the pin *v'*, and may be rounded off at the corner of the upper bar.

The ends of the two bars pass through and slide in holes in a stand on the frame M that acts as a guide and support. To the arm Q is adjusted and secured a short arm, *q*, carrying a pin, *q'*.

This arrangement, while serving other purposes, enables me to dispense with the use of the pin in the curved arm Z, the hooked lever or bar operating on the pin, and the arm and pin on the arm Q, which operates the bar.

The mode of operating my improvements may be thus described:

When the driving-band is shifted from the first to the second driving-pulley A, the following operations take place:

Through the gear B and its connections, the friction-cone $E^1$ is put in motion in a direction the reverse of that of the band-pulley E.

At the same time the pin $K^2$, from the shipper K, moves the clutch $E^2$, whose projections press against the face or disk of clutch $E^3$, and forces it and its collar against the ratchet $E^6$, which, as already stated, is set fast on the shaft, and, by a further pressure, forces the shaft itself endwise, and thus brings the band-pulley E into contact with the friction-cone. This, moving in the reverse direction, acts upon the pulley E, at first stopping and then carrying it with the spindle-band, which is no longer driven by the band-pulley $A^1$

on the main shaft, sufficiently far to reverse the motion of the spindles and loosen the yarn, so that the follower can come down without breaking it, preparatory to winding on.

The band, thus carried in the reverse direction, carries with it the band-pulley G and its shaft. This enables the beaks of the pawls $G^8$, attached within the rim of the pulley $G^1$, to enter the teeth of the ratchet-gear $G^3$, and this, put in motion, winds up on the pulley $G^4$, the chain or strap $G^6$, and turns the rock or cop-rail shaft N, to which the half-heart cam H is made fast, and operates the cop rail and the rods *z* and U.

The arm to which the rod U is attached, by the movement of the rock-shaft, pushes forward the rod, so that, as soon as the movement comes to an end, it has reached the point where the upper rod terminates and the pin *v'*, resting upon it, is ready to descend to the lower one.

During this time the lever J has, by its attachment at one end to the clutch-gear $E^3$, kept that gear in such a position that the projections of gear $E^2$ cannot enter the cavities in the former, and, by the intervention of the other end, has prevented the catch-gear $F^1$ and $F^3$ from closing. The lever itself has been kept in position by the arm $J^3$ acting through the rod or bolt and slot upon it, and the arm $J^3$ is maintained in its position by the pin *v'* resting upon the upper bar of U, as before mentioned; and the pressure of the clutch $E^2$ upon $E^3$ has also been such that the bar $E^5$, bent on the collar of the latter, and one end of which is attached to the rear of the pawl $E^7$, has prevented the beak from entering the teeth of the ratchet $E^6$.

When, therefore, the pin *v'* is at the point above mentioned, the friction alone has been sufficient to back off the yarn, which is now in readiness to be wound onto the spindles.

The further pushing of the rod U leaves the pin *v'* without support, and, by the weight of the arm V, made sufficiently heavy for that purpose, it drops onto the lower bar.

This movement brings down the end of the arm $J^3$, and with it the arm of the lever J to which it is connected, and which has presented an obstacle to the closing of the gear $F^1$ $F^3$. These gears being thus freed, close immediately, and the connection is formed whereby the pulley A puts in motion the gear for running the carriage in.

At the same time the other arm of lever J rotates the clutch $E^3$, so that its openings are brought opposite to the projections of $E^2$, which, under the pressure before mentioned, enter at once into them, and the pressure ceases. The shaft thus relieved is forced by the spring $E^9$ endwise, removing the band-pulley E from contact with the friction-cone $E^1$, and the friction is destroyed. By the movement of the clutch $E^3$ the rear of the pawl $E^7$, connected to the bent bar $E^5$, is tripped, and the beak is put into gear with the ratchet $E^6$; this gearing of the pawl into the ratchet connecting the gear $E^8$ with the band-pulley E, and through a train of wheels with the rack $D^4$. Motion to the band-pulley is given by and through the rack $D^4$, the reverse of that given by the friction, and in conformity with the speed of the rack, fast or slow.

The spindle-band thus driven, acting upon the band-pulley G, releases the pawls $G^8$ from the ratchet $G^3$, and the pulley $G^4$, no longer exerting any tension on the strap $G^6$, leaves the cam H, with its shaft, to resume, by the weight of the cop rail, its proper position when the carriage is running out. But the rod U, held fast by the pin *v'* on the lower bar, where it answers the purpose of a hook, does not allow the cop rail yet to move until the carriage is in, when the pin *q'*, by the rotation of the arm Q, is brought up under the arm V, and with it, raises the pin *v'* sufficiently high to release its hold, and, by the weight of the cop rail, the rod is drawn back. The pin *v'* then, released from the action of the pin *q'*, rests upon the upper bar.

At this moment the shipper K transfers the belt to the first pulley, causing the clutch $E^2$, through the pin $K^2$, to leave the clutch $E^3$, and, at the same time, by the movement of the arm $J^3$, caused by the lifting of the arm V by the pin *q'*, the clutch $E^3$ is turned on the shaft, and the end of the lever is brought up under the catch-gear $F^3$. This completes the winding-on motion, and the carriage is now ready to run out.

Having thus fully described the nature of my improvements and the mode of operating them,

What I claim therein as new, and desire to secure by Letters Patent, is—

1. The loose pulley $E^1$, connected with and driven from the main pulley A, in the manner substantially as and for the purpose of reversing the spindle in the mason, or other similarly-constructed self-acting mules.

2. The mechanism, substantially as described, for detaching the friction-pulley $E^1$ from the band-pulley E and connecting the latter with the loose gear $E^8$, for the purpose described.

3. The band-pulley G, connected with and operating the rock-shaft and its connections, substantially as described.

4. The arms J, $J^3$, and V, operated simultaneously by the pin *q'* at the completion of the inward run of the carriage, to hold the running-in catch-gear $F^1$ apart, and place the part of the clutch $E^3$ in proper position to be operated upon, as described, at the completion of the outer run of the carriage to close the friction-pulleys and back off.

5. The combination with the arm of the rock-shaft N, of the arms U $U^1$, and arm V, provided with pin *v'*, operating substantially as described, for the purpose specified.

6. The clutch $F^1$ $F^3$ for running in the carriage, when constructed and operated substantially as described, from the backing-off mechanism.

his
WILLIAM × HACKLEY.
mark.

Witnesses:
WILLIAM DYER,
JNO. L. SHEPARD.