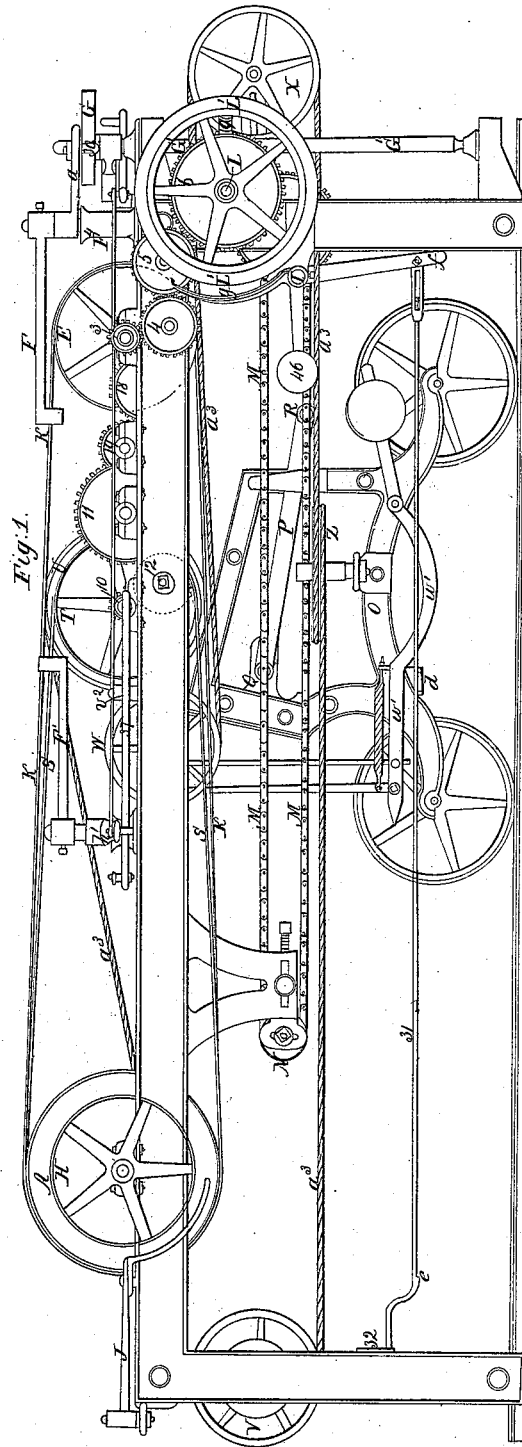
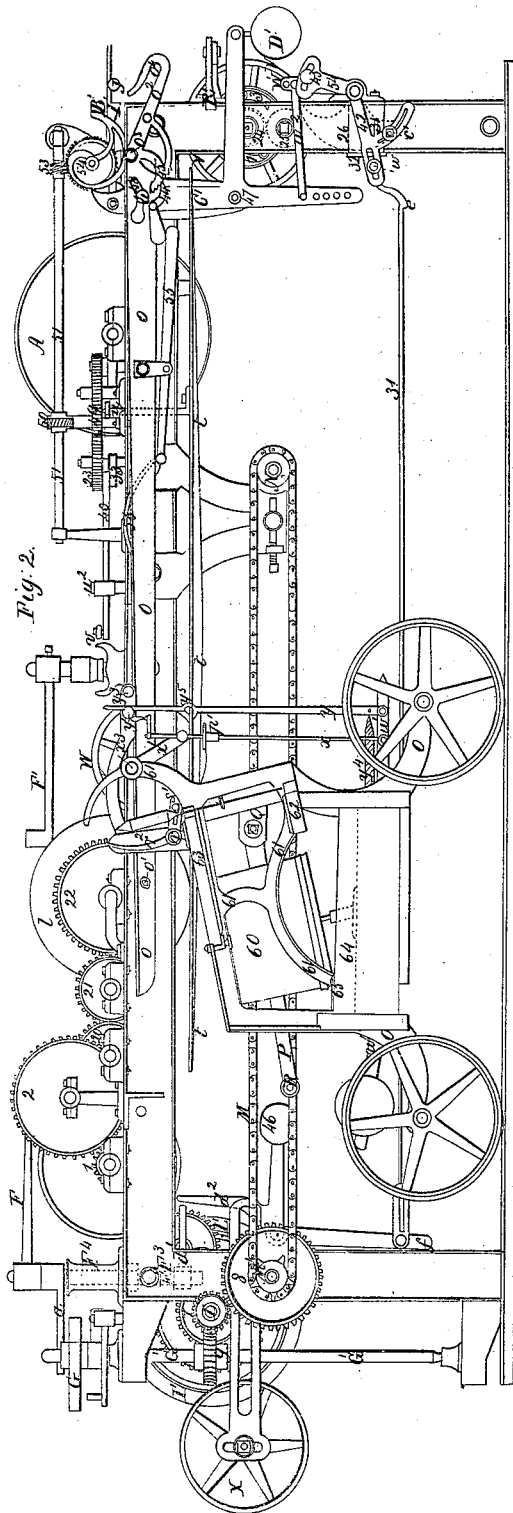


W. Mason.
Self-Acting Mule for Spinning.

N^o. 1,801.

Patented Oct. 8, 1840.



UNITED STATES PATENT OFFICE.

WILLIAM MASON, OF TAUNTON, MASSACHUSETTS.

CONSTRUCTION OF SELF-ACTING MULES FOR SPINNING.

Specification of Letters Patent No. 1,801, dated October 8, 1840.

To all whom it may concern:

Be it known that I, WILLIAM MASON, of Taunton, in the county of Bristol, in the State of Massachusetts, have invented a new and improved manner of constructing machines or engines used in the spinning of cotton and which may be applied to the spinning of other fibrous material, denominated a "self-acting mule;" and I do hereby declare that the following is a full and exact description thereof.

In the accompanying drawings, Figure 1 represents a side view of the head-stock of my mule, and also an end view of the carriage thereof, in the position of about one-fourth of a stretch. Fig. 2, is a view of the opposite side of the head-stock, with a cross section of the carriage. Fig. 3, is a plan of the mule, showing the connections of the carriage and rollers with the head-stock, together with the arrangement of most of the pulleys, and of the gearing to be seen in this view of the machine. Fig. 4, is a view of the back end of the head-stock. Fig. 5, a front view of the same. Fig. 6, a longitudinal section of what I denominate the friction box, and some of its most important appurtenances. The remaining figures represent certain parts in detail, and which will be duly described.

The drawings in the respective figures, excepting where mention is made to the contrary, are of a scale of two inches to the foot.

The motions of this machine, I will, for the purpose of description, divide into three series, which are subdivided by three changes, or transitions from one to the other, in the action of the apparatus.

The first series consists of the drawing out of the carriage, the revolving of the drawing rollers, and the whirling of the spindles for twisting the yarn. The second series of motions are those concerned in the backing off, or the uncoiling of, the threads from the points of the spindles, down to the tops of the cops, and the turning down, or depressing, of the front faller. The third series includes the putting in of the carriage, the winding on of the yarn, and the proper shaping of the cops.

The carriage, the rollers, the spindles, and many other parts, used by me are similar, in their general construction, to those used in the ordinary mule, and in other self-acting mules; but the manner of actuat-

ing them through the intermedium of the machinery employed for that purpose differs materially from any heretofore used.

The drum A, Figs. 1, 2, 3, is the main driver, from which all the operating parts of the mule receive their motions. While the mule is in action, this drum runs continuously in the same direction, the motive power being applied to it by means of a belt on the pulleys H, H', which are on the same shaft with it. The necessary motions are communicated to the drawing rollers and carriage by the strap, or belt, K, K, Fig. 1, which runs from the drum A, to, and over, the pulleys B, C, D, and E, Fig. 3, in which latter figure the belt is not shown, it being omitted in order to represent the other parts the more distinctly. While the mule is performing its first series of operations, this belt runs on the two narrow pulleys B, and C. The pulley B is loose upon the shaft, as are also the pulleys D, and E. The pulley B has a tubular stem, or hub, on which is affixed the pinion 1, which meshes into the spur wheel 2, affixed on the end of the shaft of the first drawing roller, and consequently drives the series of rollers, which are geared in the ordinary way. The pulley C, being tight on the shaft, gives motion, by means of the pinion 3, to the back shaft L, L, L, through the intermedium of the wheels 4, 5, and 6, the position and arrangement of these wheels being distinctly shown in Figs. 1, and 3. On the back shaft L, L, to which the wheel 6 is fastened, are two pinions 7, 7, meshing into wheels 8, 8, Figs. 2, 3, and 4. On the hubs of the wheels 8, 8, are gearing pulleys, M', M', made of plates of metal, or otherwise formed, or put together, in such a manner as to act as pinions, by meshing or gearing into the links of the endless chain band M, M. This chain band is shown, of full size, in Figs. 8 and 9. The chain bands are drawn tight at either end of the carriage by running around trucks, or pulleys, N, which are capable of being regulated by tightening screws, as seen in Figs. 1 and 2, and are well known to machinists. To the chains M, M, the carriage O, O, Figs. 1, 2, 3, is attached, by the arms, or sweeps, P, P; these sweeps work at one end on studs Q, Q, projecting from the carriage, and at the other on studs R, R, projecting from the chains M, M, parts of them being shown of full size at Figs. 8 and 9. It will be seen, therefore, that when the

pulley C is put in motion, it communicates motion to the chains at both ends of the carriage; and that by running the chain belts continuously in the same direction, the carriage will be drawn out when the studs R, are on the under sides of the chain belt, and that it will be drawn in when they pass to the upper side, or vice versa; the arms P, P, leaving the studs R, R, at liberty to pass around the gearing pulleys, M', M', and also around the guide and tightening pulleys N, N.

The spindles are driven by a belt, or band, S, Fig. 1, leading to the twist pulleys T, T', Figs. 1 and 3. From thence the motion is communicated to the spindle-drums by means of a drum band a^3 plying into a groove, or score, on the plate pulley U, Figs. 1 and 3; from thence, said band passes to and around the grooved pulley V, at the front end of the head-stock, thence it passes on to the double pulley Z, thence around the scores in the spindle drums, in the ordinary way. From the double pulley Z, it passes to the tightening pulley X, thence to the binder pulley W, which holds it against the plate pulley U, by causing it to lap around the larger part of its circumference. The manner of causing this band to act upon the spindle drums needs no explanation, as it does not differ from that in ordinary use. The action of the parts above described constitutes the first series of motions.

The belts K and S, pass through belt guides F, F', Figs. 1, 2, and 3. The changes by the guide F are effected through the cam G, which is carried by the perpendicular shaft G', G'; said shaft being made to revolve by an endless screw, or worm, on the shaft L, which takes into the worm wheel 9, must be such as to give the shaft and cam one revolution, while the carriage runs out and in, or, which is the same thing, while the endless chain performs one revolution. There is a lever a , Figs. 1, 2, and 4, affixed on the same shaft with the pulley guide F, which lever carries a stud, or pin, 30, Figs. 1, 3 and 4, which bears upon the cam G; a weight b , attached by a chain to another lever on the shaft, shown at c , Fig. 3, and by dotted lines in Fig. 4, serves, by its action over a pulley, to keep the stud, or pin, 30, against the cam; said stud bears against the larger part, or outside, of the cam; while the mule is performing its first series of movements and this part being the segment of a circle of which its shaft is the center, it holds the guide F, stationary, in the position shown in Fig. 3, while the carriage is running out. When the carriage has completed the stretch, the studs R, R, in the chains will each have arrived at the guide pulleys N, Figs. 1, 2, and 3.

No. 31, Figs. 1, and 2, is a rod which extends along from one end of the head-

stock to the other, in the position shown in the drawing; this rod is capable of sliding forward, and also of rising up in a slot in a guide plate 32, into which one of its ends passes. When the carriage is nearly out, a fixed stand, or projecting piece, d , Fig. 1, attached to it will come into contact with the catch at e , on the rod 31, and cause it to slide forward; this rod is connected, at its opposite end, with the lever f , which has its fulcrum at I, and its upper end constitutes a friction arm, or brake, g , which by the foregoing action is made to come into contact with, and to press against, the balance wheel L', on the end of the shaft L; the stud 30, on the lever a , at the same time escapes from the end of the cam G, and the weight b , will then shift the belt from the pulley B, C, to the pulley D, where it is arrested by a stop lever on the lower end of the belt guide shaft F³; said lever being marked d' , on the dotted lines Fig. 3. The belt guide shaft passes through, and is sustained by, the socket F⁴. In Fig. 2, this shaft is hidden by the shaft G', being behind, and in a line with it; but its situation is shown by the dotted lines passing through, and below, F⁴, Fig. 2, the stop lever being shown at d' , and a corresponding stop lever d^2 , affixed on the shaft I, of the brake. When the brake is in contact with the balance wheel L', these stop levers engage with each other, but when the brake is moved off, they are no longer in contact, which is their situation in Fig. 2; they are also shown, in part, in Fig. 4.

The pulley D, being loose upon its shaft, the carriage and rollers are left at rest while the belt is upon it; and the momentum of the carriage being checked by the brake, is held firmly during the second series of operations, but the spindles continue to run, and when the yarn has received sufficient twist, the belt S is thrown on to the loose pulley T', Fig. 3, by the belt guide F'. This is effected by a cross lever h , which is connected by a rod to the lever i , the end of which is operated upon by a cam (No. 33, Fig. 2,) on the underside of the stud wheel 23, which wheel receives its motion through the train of wheels leading to it from the endless screw, or worm, k , on the shaft of the main drum A. In Fig. 3, the belt guide is represented as having assumed the position by which the belt is thrown on to the loose pulley T'. The second series of motions commences on the arrival of the belt in this position. On the hub of the pulley T', Figs. 1 and 3, there is a pinion No. 10, from which motion is communicated to the wheel 11, through the intermedium of the stud wheel 12. The wheel 11, and the bevel wheel 13, are both fast upon the same tubular hub, which is loose upon the axle of wheel 21; the combined wheel 14, consisting

of a spur and bevel wheel, is also loose upon the same shaft, the cross studs upon which the two intermediate bevel wheels run are firmly connected to the said shaft. The wheel 14, has motion communicated through a train of wheels connected with the hub of the pulley E; No. 17, being a pinion attached to this hub; this pinion meshes into the stud wheel 18, and this again into wheel 19, which is fast upon the same shaft with, and drives, wheel 20, this latter meshes into the spur portion of wheel 14, and, consequently, gives motion to the system of planet wheels. The wheel 21, is fast upon the shaft of the planet wheels, and gearing into the wheel 22, which is fast to the plate *l*, of the friction box, gives motion to it. This friction box, and its appurtenances constitute an important part of my apparatus, and is now to be described: Fig. 6, is a section through the friction box, consisting of the plate pulley U, and friction plate *l*, and also through pulleys T, T', and their appendages, along the axis of the shaft upon which they are sustained. The principal intention of the friction box is to regulate the tension of the yarn in winding it upon the spindles, so as to form the cops. In Fig. 6, the parts represented are shown on a scale double that of Figs. 1, 2, and 3; U, is the grooved plate pulley which receives the drum-band, as already described. The friction plate *l*, is of the same diameter with the plate pulley against which it is to be made to press; its inner surface is covered with leather or other soft substance, which is to be brought into contact with the flat face of U, said plate pulley being forced against it during the second and third series of motions, they running independently of each other during the first. The pulley T, and the plate pulley U, are fast to the shaft 34; *m*, *m*, are the journals of this shaft, which have their bearings in two steel tubes 35, 36, which are received, and secured, in the boxes *n*, *n*, seen in Fig. 3. On one of these tubes runs the loose pulley T', with its pinion 10; and on the other the friction plate *l*, having attached to it the wheel 22, both being independent of the shaft. At *p*, *p*, there are grooves into which are received forked pieces of metal, or tongues, which being attached to the frame of the machine hold the pulley T', and the friction plate *l*, in their proper places on the tubes, a device well known to machinists. Two steel pins *q*, *q'*, are fitted to, and play loosely in, the tubes 35, 36. A spring *q*², Fig. 3, presses against the wire *q*; and this, bearing against the journal *m*, in contact with it, prevents the pulley U from touching the friction plate *l*, until a lever 37, Figs. 1 and 3 is made to bear with sufficient force upon the end of the opposite steel wire *q'*, this it does at the commencement of the

second series of motions, holding the pulley U against the leather on the plate *l*, until the third series is completed.

The lever 37 is made to act upon the wire *q'*, and through it upon the pulley U or friction box in the following manner: The rod *r*, *r*, of the counter faller, *r*², Figs. 2 and 3, has a small arm at each end, marked S, and S'; to the arm S, is attached a spiral spring, the end of which is seen at S², or instead of a spring, a weight may be used, the design of either being to draw the arm down. The arm S', carries a stud, or pin, S², shown most distinctly in Fig. 10; this stud bears and runs upon a straight guide bar *t*, *t*, Figs. 2, 3 and 10, an end view of it being given at Fig. 11. This straight guide bar is connected to a shaft 38, by cross bars 39, Fig. 10, the shaft 38 being sustained on journals *t'*, *t'*, seen also in Figs. 3, 10, and 11, the latter being an end view. The straight bar *t*, *t*, and the shaft 38 are nearly in the same horizontal plane, but the former rises and falls to a short distance, by the play of the journals *t'*, *t'*; *u*, is the foot of an upright stand *u*, Figs. 10 and 11, the upper end of which is seen at *u*, Fig. 3, pressing against a lever 40, which has its fulcrum at *u*². Upon the under side of the wheel 23, there is affixed a segment of a circular rim, standing out below said wheel, and between it and the cam 33, before described, its place being shown by the dotted lines on the upper face of said wheel; against this segment the lever 40, is borne, which then holds the straight bar *t*, *t*, up, but allows it to fall to a small distance when the wheel 23, has turned to a sufficient distance to carry the segment away from the lever 40, which takes place immediately after the removal of the belt on the pulley T'. The falling of the straight bar *t*, *t*, causes the end of the stand *u*, to force out the lever 40, and this through the intermedium of the connecting rod leading from *v*, to *v'*, forces the lever 37, having its fulcrum at *v*², against the steel wire *q'*, pressing the plate pulley U against the leather upon the friction plate *l*, by its action upon the shaft 34, which carries that plate. The contact of U and *l* will not only arrest the motion of the spindles, but will reverse it, causing them to turn backward in consequence of the reversing of the motion of the friction plate, which will carry with it the pulley U. This reversing of the motion of the friction plate is effected by the pinion 10 on the hub of T', which meshing into wheel 12, and this into 11, as before described, will carry around the planet wheels 15 and 16, together with their shaft and the wheel 21, upon it, and the latter meshing into 22, attached to the friction plate, will, it will be seen, produce the effect referred to. The train of wheels actuated by the pinion 17, consisting of wheels 18, 19, 130

20, and 14, is at this time at rest. The use of the steel tubes 35, 36, is to render the action of the friction box always equal, by keeping it independent of all sources of disturbance from the tightening of bands, or other causes.

The front faller x^2 , is turned down by a motion communicated to it through an apparatus connected with the band pulley V, Figs. 1, 2, and 5, and shown separately on the larger, or double, scale, at Fig. 7. The band pulley carries pawls, or catches, 1, 2, 3, 4, which, when said pulley is in motion during the process of twisting swing out by centrifugal force, and do not touch the teeth of the catch wheel 41; but when this motion is arrested, one, or more, of them will drop on the catch wheel, and as it turns backward will carry it, and the pinion 24, which is attached to it, as long as this reverse motion continues. Pinion 24, gears into pinion 25, running on a stud, and this latter pinion into a segment or wheel of about half a circle, No. 26; the back only of this segment is seen in Fig. 5, but its curved face is designated by the dotted lines 26, Fig. 2. The hub of the segment wheel 26, is fast upon a shaft f' , f'' , which passes through, and turns in a box f^2 , the outer end of this shaft carrying the arms 42, 54, Fig. 2, which arms are in one piece. The arm 42, carries a stud, or pin, w , which projects out from its face; this stud takes under the end of the lever w' , on the carriage, when it is run up to it, and as the machine backs off the stud is raised, and this, consequently, raises the lever w' , which is attached to the faller by the rod x , Fig. 2. The upper end of the rod x , is connected by a swivel joint to the arm x' , which carries the faller rod x^3 , and consequently, the faller x^2 , which is attached to it, is depressed. To the lever w' , is attached, by a joint pin, the hook rod y , the hook of which when the lever w' is raised catches on a projecting stud, or pin, y' , extending forward from a lever, or arm, which works on a joint pin, y^2 , at its opposite end where it is sustained by the carriage; the hook y^5 , of the hook rod y , is drawn and held onto the stud y' , by the action of a spiral spring y^4 . A stud, or pin, y , Figs. 2 and 3, projects out from the side of the arm opposite to y' , and slides upon the surface of the inclined plane of what is denominated the shaper, or coping rail o , o , o . The principal action of the shaper o , o , o , takes place in the third series of motions, but it is, in part concerned in the transition from the second to the third, and should, therefore, be now described.

The special office of the shaper is to regulate the formation of the cop in a way to be presently described. Its situation on the side of the head-stock is shown at o , o , o , and as its outer end is to rise and fall to a short distance, it is made to work upon a

joint pin at o' , attached to the head-stock. The outer end of the shaper is made capable of being raised and lowered, and is shown at o^2 ; it is hook-formed at its extremity, is jointed to o , o , at o^3 , and carries a segment rack 45 by which its position is to be regulated. When the carriage is run out, the lever w' passes over the stud or pin, w , Figs. 2 and 5, and the carriage remains in this position while the yarn is being twisted by the spindles. When the stud y^3 passes the joint o^3 in the shaper, and enters on to the hooked portion o^2 , which is represented as inclined downward, it will descend upon or pass along it, so as to occupy the situation o^4 , where the jointed portion of the shaper is hook-formed, the space between the face and the bend above it being just sufficient to admit the stud y^3 , and it will be evident, therefore, that if said stud is raised, it will carry the portion o^2 with it, and this portion will be latched by the action of the latch 44, on the segment rack 45. The operation of twisting the yarn continues as long as the segment of the circular rim on the underside of wheel 23 bears against the lever 40, which is determined by the gearing employed between the worm k and the wheel 23; but as soon as the lever 40 is relieved from the pressure of the segment on that wheel, the weight of the straight, or guide, bar t , t , together with the action of the springs on the counter fallers, will cause the stand u , Figs. 3 and 11, to press it out; the place of the stud u is shown by dotted lines on Fig. 2. This throwing out of the lever 40, will cause the lever 37 to press upon the steel wire q' , which will actuate the friction box, retard the spindles, and reverse their motion; this takes place at the time that the belt is carried by F' , from T , to T' , by the action of the cam 33, on the hub of wheel 23, which operates upon lever i , as already explained.

The motion of the plate pulley U, being reversed, the band a^3 , reverses that of the pulley V, and the catches upon it engage with the catch wheel 41, carrying the pinion 24, and this in its turn the pinion 25; this latter, gearing into the segment wheel 26, moves it around, with the arms attached to its shaft. The stud w , raises the lever w' , upon the carriage, and with it the rods x and y ; the raising of the rod x , depresses the faller x^2 . The rod y , is raised until it is brought up to the stud y' , upon which it catches by the action of the spring y^4 , its subsequent rise causes the stud y^3 to raise the hooked portion o^2 of the shaper. The hooking of the rod y , upon the stud y^3 is rendered certain by the depression of the latter on the inclined part o^2 of the shaper, which it has to lift. When the stud w has raised the lever w' , to the proper position, a stud o' , which projects in an opposite direction from w , as shown distinctly in Fig. 5, raises the

rod 31, and disengages the stud d (Fig. 1) from the hook e , and consequently relieves the wheel L' , from the action of the brake g , the weight 46, removing it off. When the brake g , falls back from the balance wheel, the stop d' is thereby disengaged from d^2 , as seen in Fig. 2, which allows the belt K , to be shifted on to the pulley E , by the action of the weight b , which is the change that commences the third series of motions. The pinion 17, being put in motion by the pulley E , communicates motion to the back shaft L , L , through the stud wheels 27 and 28 to the wheel 29 on said shaft (Fig. 3), causing the carriage to be drawn in at a speed more rapid than that at which it was drawn out, say at double the speed, the exact proportion depending, of course, on the gearing employed. The pulley E also gives motion to the train of wheels from pinion 17, to wheel 14, which is carried in a direction opposite to that of wheel 13, the difference of speed being such as to give to the friction plate a motion sufficiently rapid to wind the yarn on the bare spindles as the carriage is run in. As the cops grow larger, the friction plate of the friction box yields, or slips around, to accommodate itself to the winding of the threads. The tension of the threads is regulated by their own operation upon the back, or counter, faller, as shown at Fig. 12, which represents a thread passing over the wire of the counter or back faller, and under that of the front faller, on to a spindle. Should the threads draw too tight, this draws the counter faller back, counteracting the force of the spring at S , Fig. 3, and eases up the stud S' on the bar t , t , and thus takes the pressure from the friction box to such extent as to render it more easy. If the threads are winding slack, the whole effect is reversed, the action of the friction box being proportionately increased.

The grinding of the faller to give the proper shape to the cops is effected by the sliding of the stud y^3 on the top of the shaper o , o ; the surface of said shaper being sufficiently inclined to give the proper length to its upper cone; this inclination must be successively increased until the double cones, or bottoms, of the cops are finished, and is then to be decreased until the set is full. The raising and lowering of the shaper is effected in the following manner.

C' , is a lever working on a fulcrum at 47, and carrying a weight D' , on its horizontal arm; it has on it a stud a' , which passes through a slot 48, in the shaper o , o ; the form given to this slot is such that the action of the stud a' , upon it, as the lever C' , is moved, will cause it to be raised and lowered in the degree necessary to effect its purpose. The lever C' , is made to vibrate by the action of a cam B' , on its upper end. The

cam B' , must be so geared as to perform one revolution in making a set of cops; and the end of the lever C' , upon which it acts, escapes from the point B' , of the cam when it assumes a position for beginning a new set. The cam B' , receives its motion from the train of wheels between the worm k , and the wheel 23, Fig. 3. The pinion 49, carries an endless screw, or worm, which meshes into a worm wheel 50, on shaft 51, the elevation of which is shown in Fig. 2. This shaft carries an endless screw, or worm, 53, which meshes into the wheel 54, to which the cam B' , is attached.

There still remain some particulars to be explained, touching the building of the cops. It will be seen that on the lower end of the rod x , Fig. 2, there is represented a screw cut thereon; this screw may be five or six inches long, and it is tapped into a swivel stud on the lever w' , in which it turns freely.

Toward the upper end of this rod there is a wheel p' , with ratchet teeth, and as the carriage is run out this ratchet wheel is brought into contact with the hook or finger, R' , (Figs. 3 and 2,) which turns it to the distance of one tooth, and thus by the action of the screw it raises the faller as the cops fill. The number of teeth in the wheel p' must be varied to suit the count of the yarn and the size of the cops. When the set of cops is completed, this screw is to be turned back by means of the winch on the upper end of the rod x . Before the carriage is run back, the raising of the lever w' raises the ratchet wheel p' above the finger R' , and it therefore returns without touching it. A screw arranged in a manner very similar to the foregoing has been previously used for a like purpose, and is known to machinists.

In Figs. 2 and 5, W' , is a lever, the lower end of which plays loosely upon the shaft f' , and its upper end is connected to the lever c' , by the rod w^2 . The arm 54, of the piece 42, 54, carries a stud 43, which bears against the arm, or lever W' , and thus prevents the stud w , from descending too low. As the cam B' , works the lever C' , the arm W' is pushed back by its action, and the stud w , is thereby gradually raised, the effect of which is to back off less in proportion to the advance of the cops toward the points of the spindles, while it at the same time turns the faller down less and less as the cops continue to rise. As the carriage is run back, the end o^2 of the shaper is suffered to fall by the unlatching of the segment 45, leaving it in a situation to be again raised by the action of the latch rod y on the stud y^3 on the return of the carriage. The unlatching of 45 is effected by the depressing of the hinder end of the lever 55, which raises the catch 44. The stud y^3 , as it passes back, depresses a projecting piece 56, attached to the lever 55, and forces it down.

As the carriage arrives at the roller beam, the hook rod y , is disengaged from the stud y' , by the contact of its upper end with a projecting stud b' , Fig. 3, when the lever w' , Fig. 2, descends, and the faller resumes its former position.

It has been already stated that by the action of the cam G, the belt is shifted from the pulley E, to the pulleys B, and C. The twist belt is at the same time run on, and the third change thus effected, which leaves the mule in a situation to resume its first series of operations; the running on of the twist belt is effected by the action of the cam U', on the same shaft with G, Figs. 3 and 4; this cam comes in contact with the stud z , on the crooked lever upon which it is represented, said lever having its fulcrum at z^1 ; its end z^2 operates the rod z^3 , which extends to the cross lever h' , the moving of which shifts the belt from T¹ to T. While this operation is being effected, it is necessary to relieve the friction box from the action of the lever 37, and this is accomplished by means of a stud 57, on the outer end of the lever h , which bears against a projecting part 59, on the lever, and as it passes over it relieves it from the wire q' . At the time of the escape of the cam B', from the lever C', the main belt is thrown from the tight pulley H to the loose pulley H'. This is effected by the rod I', which is attached by a joint pin to the lever C', and when the latter is forced forward by the weight D', the rod I', is brought into contact with the belt guide J, which shifts the belt; the mule will then stop, for the purpose of doffing.

I have also made an improvement in the manner of constructing the mule carriage, which improvement is applicable to the carriages of every description of mule, whether self-acting, or otherwise. In Fig. 2 a cross section of my improved carriage is shown. In this section, No. 60, is one of the drums within the box; No. 61, 61, is a brace of cast-iron which connects the step rail 62, the bolster, or top, rail 63, and the whole with the girth 64; this girth constitutes a portion of the base, or lower part, of the carriage, which lower part, or base, is similar to those of mule carriages in ordinary use. The brace 61 is screwed to the girth 65, to the step rail 62, and to the bolster rail 63; it also extends up so as to support the faller rod x^3 . By this construction of the brace, the carriage is in fewer pieces, having considerably less framing, and is consequently much more simple, light and durable than those constructed in the ordinary way. The wheels, the ways upon which they run, and certain other parts appertaining to my carriage, are the same as such as are generally used in mules.

Having thus fully described the construction of my self-acting mule, and shown the

manner in which it operates, I claim as my invention, and desire to secure by Letters Patent—

1. The running of the carriage out and in, by means of endless gearing chains, the revolution of which is not reversed, but continues in the same direction, whether the carriage is running out or in, the carriage being connected to said chains by means of arms, or sweeps, working upon studs attached to the chains substantially as described.

2. I claim the manner of governing the action of the friction plate and pulley upon each other by the combined operation of the steel tubes 35, the axis 34, and the wires q , q , arranged and operated upon as described.

3. I claim the general arrangement of the apparatus for reversing the motion of the plate pulley, and the respective pulleys over which its band passes, by the action of the pinion 17, on the hub of the pulley E, said pinion producing this effect through the intermedium of the train of wheels, numbered 18, 19, 20, 14, 21, and 22, or by any combination and arrangement of wheels similar in their arrangement, operation, and effect. In the combination of the wheel work employed for reversing the motion of the plate pulley and its appendages, I employ the planet motion, consisting of the wheels 13, 14, 15, and 16, but I do not make any claim to this combination of wheels taken independently of the parts with which they are immediately connected in my machine, a similar combination of wheels being well known to and frequently used by machinists under the denomination of the differential motion.

4. I claim their employment, therefore, in combination with the other gearing as described, and with which they coöperate in effecting the reversing motion; and it is also to be understood that I do not mean to limit myself to this means of producing the said reverse motion of the friction plate, as the same may be accomplished by other kinds of gearing, but I have adopted and described that which I consider the best in its operation.

5. I claim the manner of constructing the shaper with the hooked joint piece o^2 at its outer end, in combination with the ratchet, the latch, and its other appendages, by which its inclination is altered, and by which it is held in its place and liberated as set forth.

6. I claim the manner in which I have combined and connected the catch wheel contained in the pulley V, with the catch wheel, the pinions 24 and 25, and the segment wheel 26, so as to cause it to turn the filler down through the intervention of the parts concerned in producing that effect, constructed as described.

7. I claim the manner in which I have constructed, arranged, and combined the lever C', with the cam B', so as regularly to alter the inclination of the shaper, to
5 regulate the backing off as the cops fill, and to graduate the turning down of the faller, as herein fully described.

8. I claim, in combination with the self-acting mule, as described, the manner in
10 which I have arranged and combined the pulleys B, C, D, and E, so as to be acted

upon in succession by the same belt, and by which arrangement the striking in of catches or other similar devices usually employed in actuating the rollers and carriage, are 15 entirely dispensed with, and a smooth and easy transition is secured.

WM. MASON.

Witnesses:

THOS. P. JONES,
ELISHA HALL.