No. 735,996. PATENTED AUG. 11, 1903.

T. McAULIFFE.

ANTISNARLING MOTION FOR SPINNING MULES.

APPLICATION FILED APR. 23, 1903.

NO MODEL

4 SHEETS—SHEET 1.

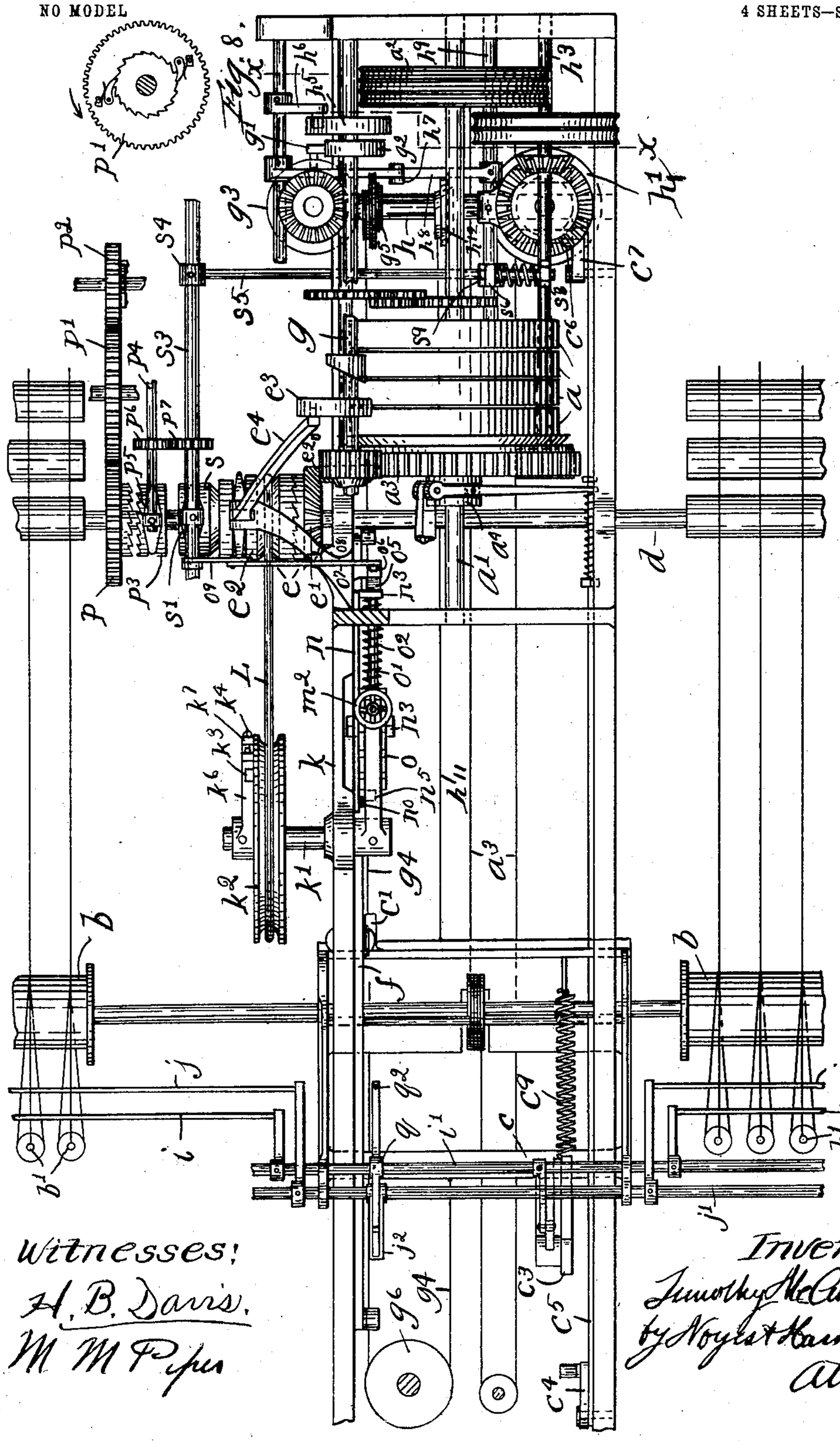

Fig. 1.

Witnesses:
H. B. Davis.
W. M. Pyles

Inventor:
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by Noyes & Hammond
Attys

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NO MODEL 4 SHEETS—SHEET 2.

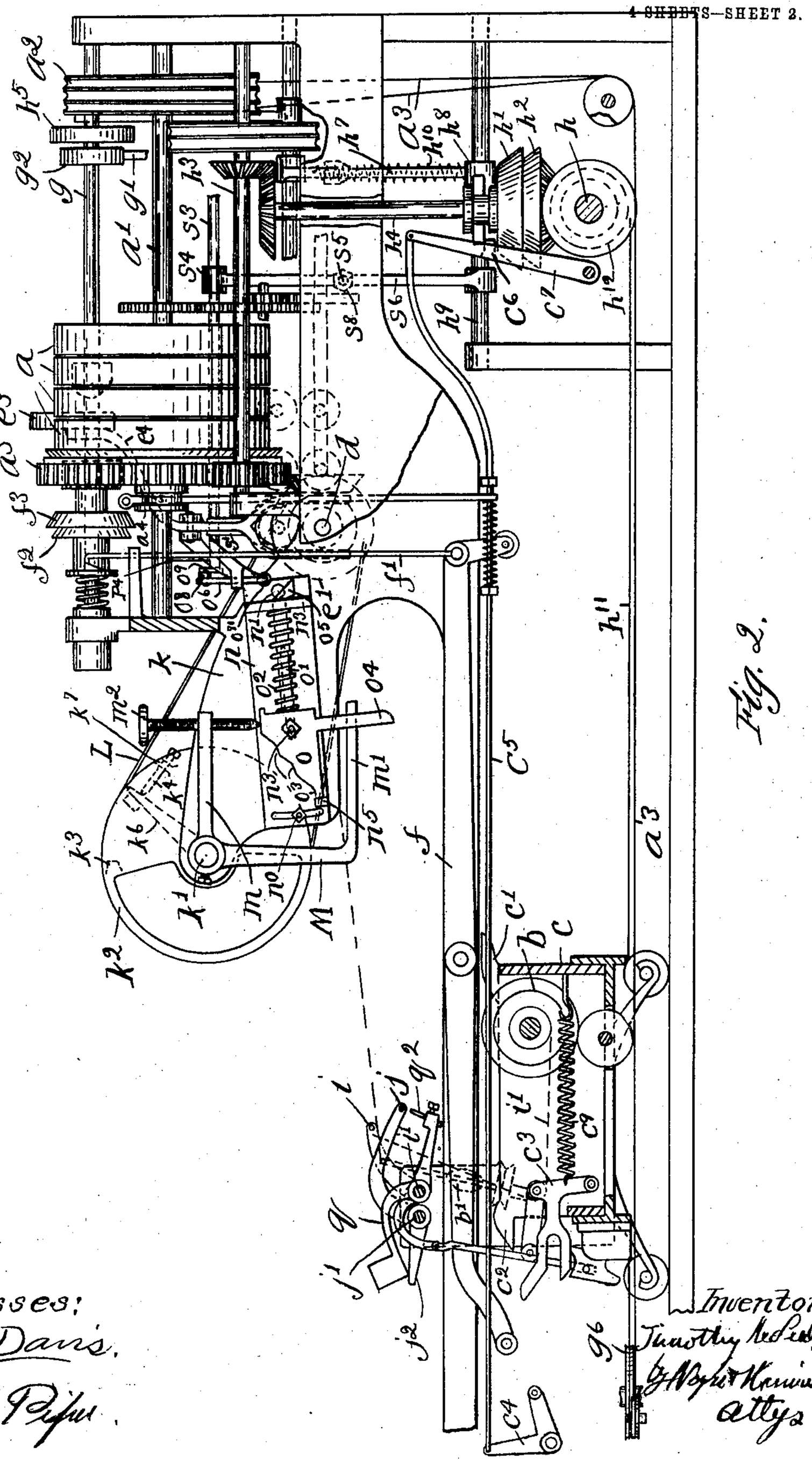

Fig. 2.

Witnesses:
H. B. Davis.
W. W. Dyrenforth.

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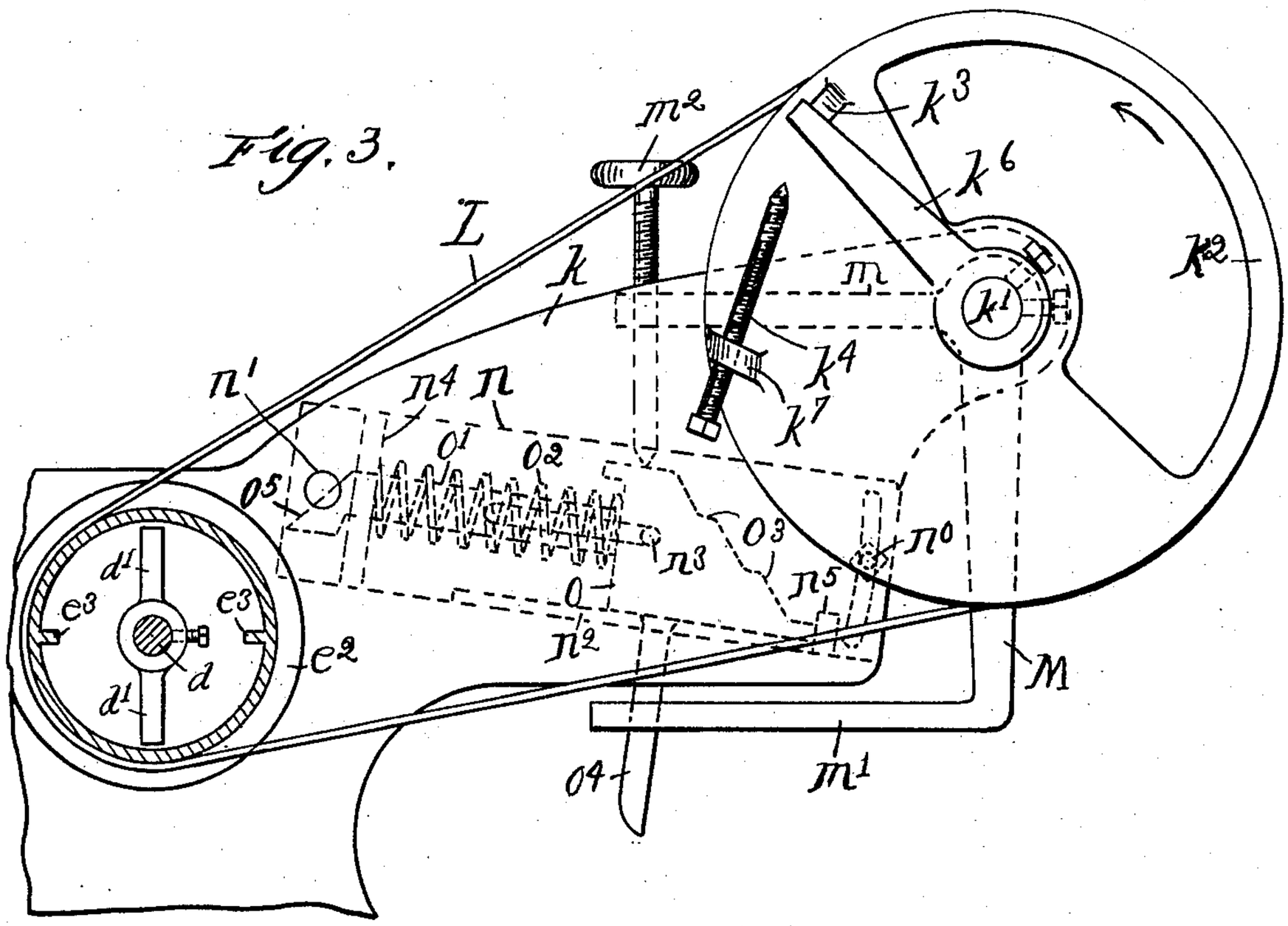
NO MODEL. 4 SHEETS—SHEET 3.

Fig. 3.



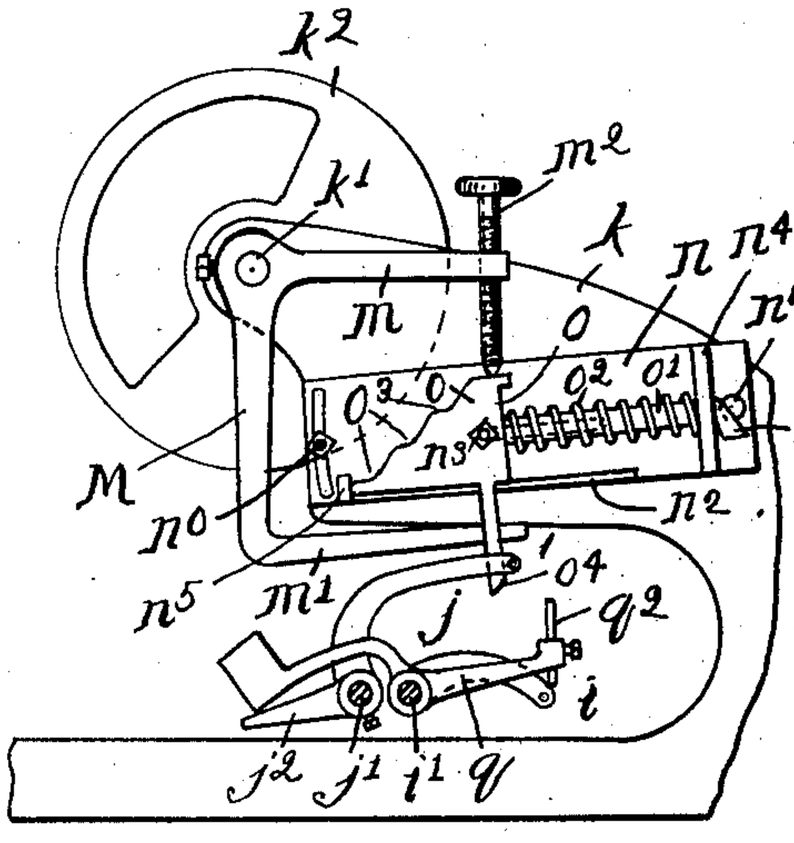


Fig. 4.

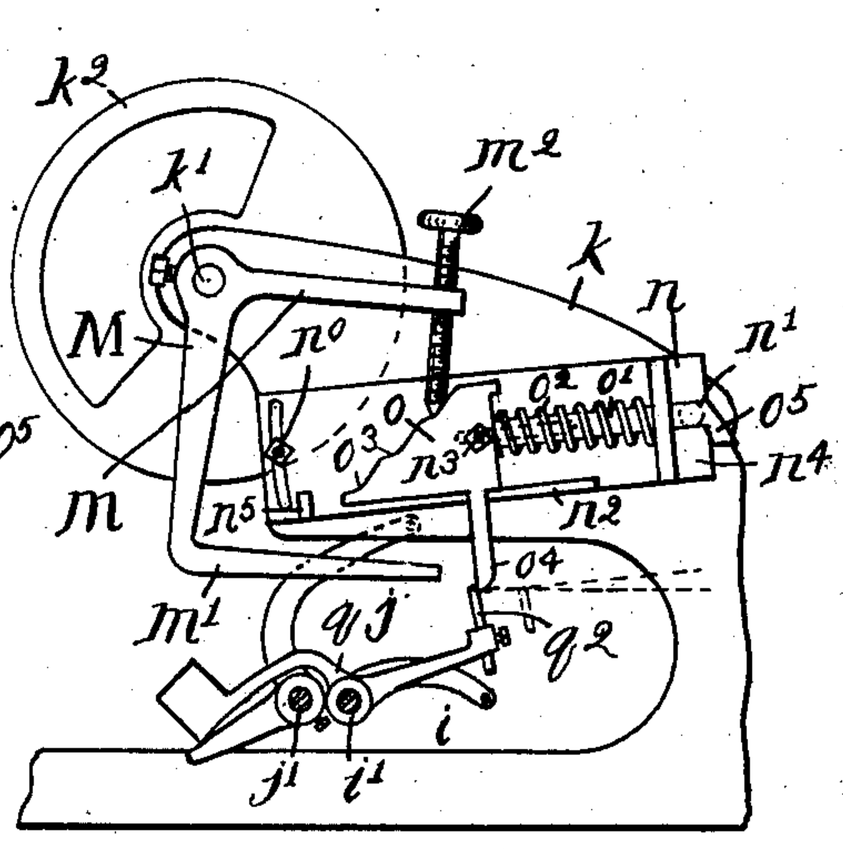


Fig. 5.

Witnesses:
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No. 735,996. PATENTED AUG. 11, 1903.

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ANTISNARLING MOTION FOR SPINNING MULES.

APPLICATION FILED APR. 23, 1903.

NO MODEL. 4 SHEETS—SHEET 4.

Fig. 6.

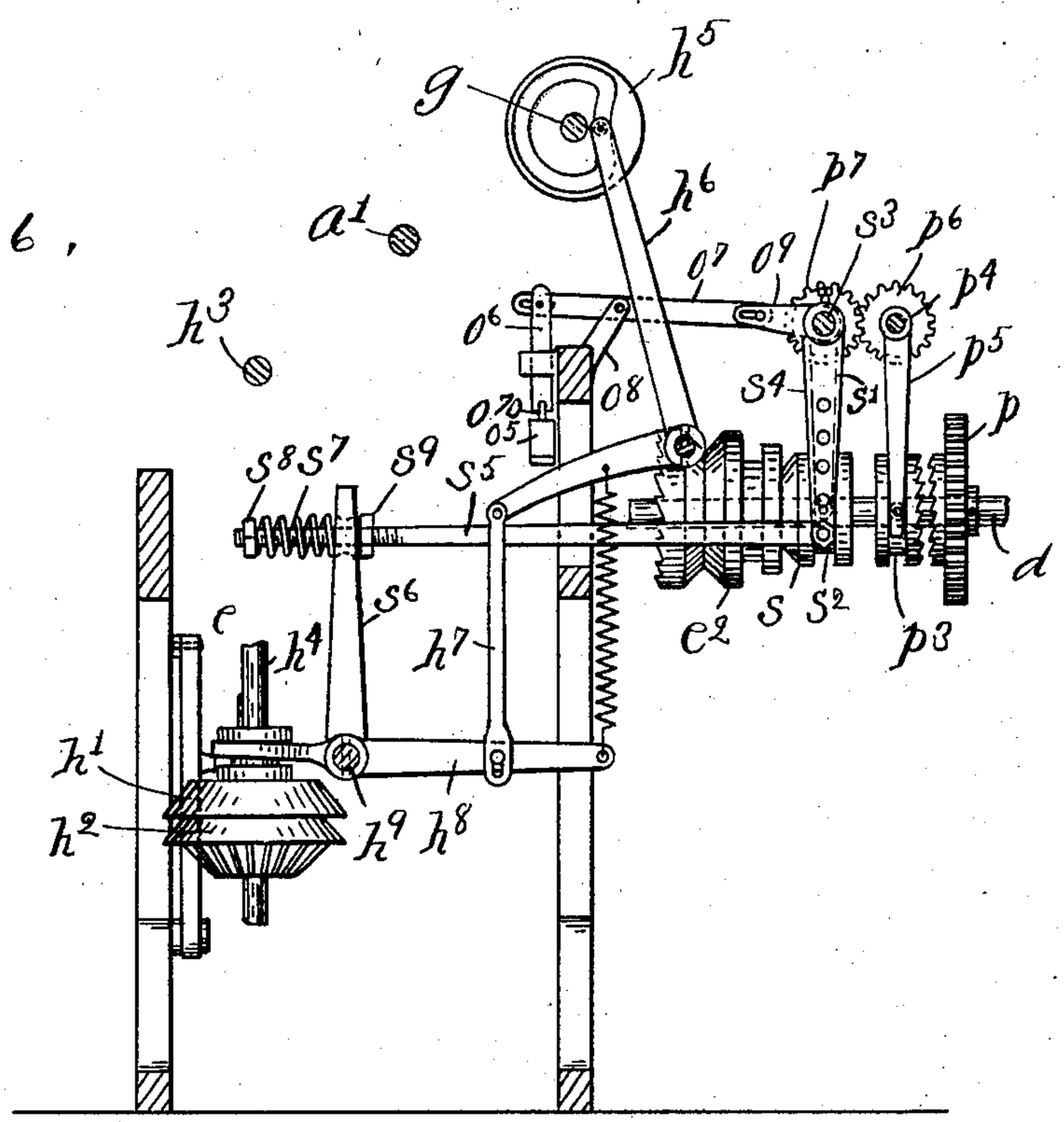
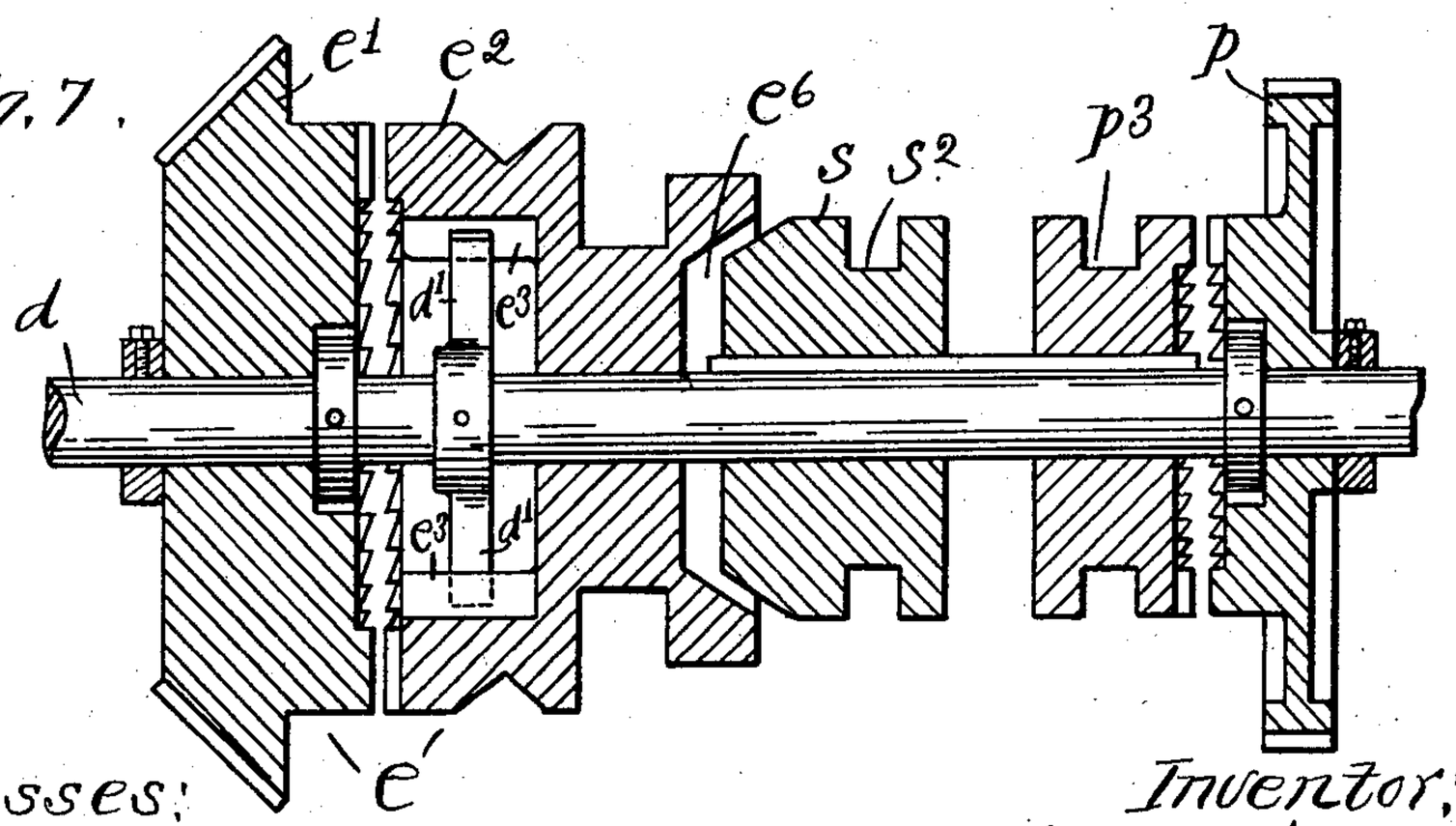


Fig. 7.



Witnesses:
H. B. Davis.
M. M Pepus.

Inventor:
Timothy McAuliffe
By Noyes & Thomson
Attys.

No. 735,996. Patented August 11, 1903.

UNITED STATES PATENT OFFICE.

TIMOTHY McAULIFFE, OF LAWRENCE, MASSACHUSETTS.

ANTISNARLING-MOTION FOR SPINNING-MULES.

SPECIFICATION forming part of Letters Patent No. 735,996, dated August 11, 1903.

Application filed April 23, 1903. Serial No. 153,903. (No model.)

To all whom it may concern:

Be it known that I, TIMOTHY McAULIFFE, of Lawrence, county of Essex, State of Massachusetts, have invented an Improvement in Antisnarling-Motions for Spinning-Mules, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to spinning-mules, and more particularly to devices which are designed to prevent the formation of kinks or snarls in the yarn as it is fed from the feed-rolls to the spindles, such devices being known as "antisnarling-motions." During the complete cycle of operations of the mule the yarn should be slightly under tension, so as to prevent kinking of the yarn, which will always occur the instant the yarn becomes slack. During the "running-out" or "drawing-in" of the carriage little difficulty is found in maintaining the yarn at proper tension, as the speed of the feed-rollers and spindles may be made to correspond exactly to the speed of the carriage. As the carriage finishes the running-in motion, the faller-wires, which have been holding the yarn out of its direct course as it is drawn from the feed-rolls to the spindles on which the yarn is wound, must be changed, so that the spinning operation may again take place. This change in position of the faller-wires gives off a certain amount of slack yarn which varies from an amount which is almost inappreciable to an inch or more. For this and other reasons it is necessary to start the feed-rollers practically on the instant that the carriage begins its outward run; but unless some provision is made to take up this extra slack yarn which is usually given off, kinks will appear in the yarn which will later become wound upon the cop and finally become woven into the cloth. Various methods have been employed to take up this slack yarn, a usual method being to delay the starting of the rollers until after the carriage has moved out a short distance. This has been accomplished by causing the clutch member between the driving-shaft and the roller-shaft, which is normally held to rotate with the roller-shaft, to be set back a short distance from the position in which it was at the end of the running-out motion, so that it will be rotated a short distance by the driven clutch member before it moves into operative connection with the roller-shaft.

In the ordinary operation of a spinning-mule it often happens that the tension faller-wire is raised to different heights at the beginning of the winding-on operation, with the result that when the faller-wires change at the end of the winding motion more or less slack yarn will be given off, which will only be taken up partially by the antisnarling-motion, which must be set to take up no more than the normal amount of slack yarn which is given off when the tension faller-wire is moved to its normal position. In spinning-mules it is also common to rotate the feed-roller shaft at a relatively low speed during the running-in or winding-on operation in order to increase the production and for other reasons which need not be here explained, the mechanism which is employed to accomplish this additional movement of the feed-roller shaft being known as the "roller-motion while winding." In case this motion is employed and if it were also desired to use the antisnarling-motion above referred to, the rotation of the shaft while winding would practically set the clutch member back to its maximum limit and render the antisnarling-motion ineffective, and, so far as I am aware, an antisnarling-motion of the character above referred to has never been combined with the roller-motion during winding.

One of the objects of my invention is to provide a form of antisnarling-motion which may be set positively, so as to take up a minimum length of slack yarn at each operation, and then be adjusted by the spinner as the spinning operation continues to take up more slack yarn, as the conditions may require.

A further object of my invention is to automatically vary the extent to which the starting of the feed-rollers will be retarded, according to the position to which the tension faller-wire may be moved at the beginning of the winding operation, so that if the faller-wire is moved above the normal, thereby giving off more yarn than it does during its normal operation, then the roller-shaft will be correspondingly retarded in its starting movement, so that the additional amount of slack yarn which is given off under such abnormal

condition will be taken up and if the tension-wire be moved to its normal position upon the next motion the roller-shaft will simply be retarded to its normal extent, so that there will be no danger of the yarn being broken by the roller being retarded to too great an extent.

A further object of my invention is to provide means for setting back the clutch member, which is connected to the roller-shaft during the operation of backing-off, and then to lock the same upon the roller-shaft in precisely the position to which it has been moved by the previous motion, so that when the roller-shaft is rotated forward to give off additional yarn during the winding operation the extent to which the clutch has been set back with relation to the shaft will not be changed and the starting of the roller-shaft will be retarded to the same extent at the beginning of the next spinning operation as it would if the shaft had been held stationary during the entire winding operation.

I accomplish these objects by the means and mechanism hereinafter explained, and illustrated in the accompanying drawings, in which—

Figure 1 is a plan view illustrating the main parts of an ordinary form of spinning-mule to which my invention is applied. Fig. 2 is a side view of the head and certain parts of the carriage. Fig. 3 is a view of one side of the motion comprised by my invention. Figs. 4 and 5 are views of the opposite side of the apparatus illustrated in Fig. 3, showing the parts in different positions. Fig. 6 is an end view, partly in section, on line $x\,x$ of Fig. 1. Fig. 7 is a central longitudinal sectional view through the feed-roller clutch mechanism. Fig. 8 is a detail view of one of the roller-motion gears.

The operation of a spinning-mule of the type illustrated in Figs. 1 and 2 may be described in a general way as follows: Four pulleys a are mounted on the rim-shaft a', two of said pulleys being loose and two fast on the shaft and being driven by a pair of belts in the usual manner. The rim-shaft is provided with a wheel a^2, about which the cable a^3, which drives the drums b on the carriage c, passes, said drums driving the spindles b' in the usual manner. The front feed-roller d is driven through a clutch e, the loose member e' of which is constantly driven by the gear e^{20}. As the carriage finishes its running-in motion a lug c' thereon passes over a roller at the inner end of the long lever f, drawing down a rod f' and liberating the fast member f^2 of a clutch on the cam-shaft g, causing the cam-shaft to make half a rotation before rod f' is again liberated, the loose member f^3 of the cam-shaft clutch being constantly driven by the gear a^3. This movement causes the cam e^3 on the cam-shaft to operate the forked lever e^4 and throw the fast member e^2 of the roller-clutch e, usually termed the "catch-box," into gear, starting the roller-shaft. The same movement of the cam-shaft operates a clutch-lever g' by means of the cam g^2 thereon, throwing the clutch g^3 into gear with the scroll-shaft h, thereby winding cable g^4 onto the scroll g^5, said cable passing about pulley g^6 and being connected to the front side of the carriage, so that the carriage is then drawn outwardly. During the outward run of the carriage the faller-wires i and j will be held out of contact with the yarn and the yarn will be twisted in the usual manner. At the end of the outward run the lug c^2 on the carriage will pass under the roller at the outer end of the long lever f, tilting the lever and again permitting the fast member f^2 of the cam-shaft clutch to move into gear with the driven member, causing the cam-shaft to be rotated another half-turn, throwing the clutch g^3 out of gear and stopping the carriage, and also separating the clutch members e' e^2 and stopping the feed-roller. The back shaft h^3 is constantly driven by gear a^3, and this shaft in turn drives the vertical shaft h^4, on which the friction-clutch member h' is splined, the other member h^2 having a bevel-gear secured thereto, which meshes with a corresponding gear on the scroll-shaft h. During the outward run of the carriage the cam h^5 on the cam-shaft g holds the bell-crank lever h^6 in the position shown in Fig. 6, said lever acting through the loosely-connected link h^7 to press down the lever h^8, which is pivoted on the rock-shaft h^9, so as to lift the clutch member h' out of engagement with member h^2. As the cam-shaft is rotated at the end of the outward run the lever h^6 is moved to draw up the link h^7 and throw clutch h' h^2 into gear; but just before this occurs an inclined portion of the jaw-lever c^3 presses down a roll on lever c^4, forcing the backing-off rod c^5 rearwardly and moving a lug c^6 on lever c^7 beneath the forked end of lever h^8, thereby preventing such action. This movement also throws clutch a^4 on the rim-shaft a' into gear and at the same time the belts on the pulleys a are shifted and the rim-shaft is rotated rearwardly, causing the spindles to be reversed and the backing-off motion to be accomplished. The backward rotation of the drum b draws down the copping faller-wire i through the chain (indicated in dotted lines at i') and at the same time the tension faller-wire j is thrown upwardly by any suitable means usually employed for this purpose. This motion releases the lever c^3, so that it may be drawn back by its spring c^9, throwing the backing-off rod c^5 forwardly, so that the lever c^7 is drawn forward, liberating the lever h^8 and clutch member h' and permitting it to be quickly forced into engagement with the member h^2 by spring h^{10}, thereby causing the scroll-shaft h to be reversed, so that the cable h^{11} is wound on the scroll h^{12} and the carriage starts to run in. At the beginning of the running-in motion of the carriage the backing-off motion will have ceased and the spindles will have again been

reversed, so that the winding-on process takes place. As the mechanism for accomplishing this is well known and not specially related to the present invention a further description thereof is unnecessary. When the cam-shaft is again rotated at the latter part of the running-in motion, lever h^6 is again moved to the position shown in Fig. 6 and the member h' is lifted out of gear. This movement is practically simultaneous with the movement which throws the clutch members e^2 and g^3 into gear.

As shown in Fig. 3, the fast clutch member or catch-box e^2 on the feed-roller instead of being splined on the shaft in the usual manner, as when an antisnarling-motion is not employed, is provided with a pair of lugs e^3, which are arranged within a circular recess formed in its end next the other clutch member. The shaft of the feed-roller d has a pair of arms d' rigidly secured thereto in a position to engage the lugs e^3 on the catch-box e^2. This arrangement permits nearly a half a rotation of the catch-box on the shaft d before the arms d' and lugs e^3 come into engagement.

A bracket k is secured to the frame of the machine and a shaft k' is journaled therein. A wheel k^2 is journaled on the shaft k', one side of said wheel being made heavier than the other, as indicated, so that in certain positions it will tend to rotate in the direction of the arrow in Fig. 3. The wheel k and catch-box e^2 are each provided with a belt-groove in which a belt L is arranged. Secured to the shaft k' is a dog M, having at one end two stop-arms $m\ m'$, which extend approximately in the same direction.

A plate n is secured by bolts $n^0\ n'$ to the bracket k, the bolt n^0 passing through an arc-shaped slot in the plate permitting a swinging adjustment thereof on bolt n'. Said plate has on its side an adjusting-block o, which is slidably supported on a projecting rib n^2 on the side of the plate and is held in place by a bolt n^3, which passes through a slot in the bracket, as indicated in Figs. 2 and 3. A guide-rod o' is secured to the block o and passes through a lug n^4 on the plate n, and a spring o^2 is arranged on said rod between said block and said lug. The upper surface of said block is provided with a series of steps, as indicated at o^3, the surface of the block between each step extending obliquely, as shown. A depending finger o^4 is rigidly secured to the block o. A lug n^5 on the plate n acts to limit the forward movement of the block o, said block being normally held against said stop by the spring o^2. An adjusting-screw m^2 is threaded in the arm m and is adapted to rest on the upper side of the block o. The lower arm m' extends directly beneath the bracket k, so that it may engage the same and limit the rotation of the shaft k' in one direction. A stop-finger k^6 is secured to the opposite end of shaft k' from dog M and is arranged between a stop-lug k^3 on the wheel k^2 and the end of a set-screw k^4, which is threaded in a lug k^7 on the wheel.

The tension faller-shaft j' has an arm j^2 secured thereto, and a lever q is loosely pivoted on the copping faller-shaft i' or at any other convenient point on the carriage, the outer end of said lever q being weighted and resting on the upper side of the arm j^2. The inner end of the lever q is provided with a vertically-extending adjustable finger q^2.

The operation of the motion thus far described is as follows: During the outward run of the carriage the catch-box or fast member e^2 of the roller-clutch will be driven so that its lugs e^3 will be moved against the arms d' of the roller, causing the latter to rotate and give off yarn in the manner previously described. This action drives the belt L and causes the wheel k^2 to rotate, moving the end of the screw k^4 into engagement with the stop-finger k^6. This movement causes the shaft k' to rotate to such an extent that the lower arm m' is brought into engagement with the under side of the bracket k, preventing further rotation of the shaft and also of the wheel k^2. The belt L will then slip about the wheel during the remainder of the outward run. At the finish of the outward run the roller-clutch members are separated, stopping the roller, and the instant these members are disconnected the weighted side of the wheel k^2 will move downwardly, causing the wheel k^2 to rotate in the direction of the arrow in Fig. 3. This rotation continues until the lug k^3 is moved against the stop-finger k^6. During this rotation the clutch member e^2 will be rotated rearwardly, so that the lugs e^3 will be moved back out of engagement with the fingers d', as indicated in Fig. 3, with the result that when the clutch member e^2 is again thrown into engagement with the driven member the member e^2 must make a part of a revolution before its lugs e^3 engage the arms d', thereby delaying the starting of the feed-roll with relation to the starting of the carriage on its outward run. It will be observed that the extent to which the clutch member e^2 will be set back in the manner just described will depend on the distance which the wheel may rotate before lug k^3 engages finger k^6, and this depends, first, on the position of the finger k^6, and, second, upon the distance between the end of the stop-screw k^4 and the lug k^3. The greater the distance between the end of the screw k^4 and finger k^6 when the lug k^3 is resting against said finger, the greater will be the arc through which the wheel k^2 may be rotated during the running-out motion, and therefore the greater the arc through which the clutch member e^2 will be rotated rearwardly when it is liberated at the finish of the outward run. The weight of the arms $m\ m'$ and the adjusting-screw m^2 are such that the end of the screw m^2 will always rest on the upper side of the block o except when it is lifted therefrom by the rotation of the wheel k^2 in the opposite direction from the arrow in Fig. 3 during the running-out motion. It will be seen, therefore, that if the

adjusting-screw m^2 is unscrewed or turned up both the arm m and stop-finger k^6 will be swung downwardly, moving the latter away from the lug k^3 and permitting the wheel k^2 to rotate in the direction of the arrow in Fig. 3 through a greater arc, thereby setting back the catch-box to a great extent and correspondingly further delaying the starting of the roller with relation to the starting of the outward run of the carriage. If also the block o were moved rearwardly, so as to compress the spring o^2, the end of the screw m^2 would fall down on one of the steps o^3 of the block, thus lowering the finger k^6 and correspondingly delaying the starting of the roller, as before explained.

The means employed in many instances for lifting the tension faller-wires at the beginning of the running-in motion does not always lift said wires to the same elevation, and it is necessary to adjust the apparatus described so that the slack yarn which is given off by the changing of the faller-wires will be taken up by the mechanism for setting back the catch-box just described, when the faller-wires give off practically the minimum amount of thread at the end of the running-in motion. If, however, the tension faller-wire is thrown up above the normal, a proportionate amount of additional slack yarn will be given off, which will not be taken up in the manner described, and will therefore run into kinks or snarls.

The weighted end of the lever q rests on the arm j^2, and the finger q^2 is so adjusted that when the tension faller-wire is raised to its minimum or normal height it will pass directly beneath the depending finger o^4 on the block o without touching the same, so that the normal amount of slack yarn will be taken up. If, however, the tension faller-wire is thrown up above the normal, the weighted end of the lever q will swing down a corresponding distance, lifting the finger q^2, so that as the carriage runs in and approaches the finish of the running-in motion said finger q^2 will engage the depending finger o^4, as shown in Fig. 5, and will push said block o rearwardly, permitting the screw m^2 to drop onto one of the steps o^3 and swinging the finger k^6 downwardly, thereby permitting wheel k^2 to move back the clutch member e^2 from the position in which it was set at the beginning of the running-in motion, so that the additional slack yarn which will be given off upon the changing of the faller-wires at the end of the inward run will be taken up by correspondingly delaying the starting of the roller.

It will be observed that the plate n is arranged obliquely to the horizontal, so that as the block o is moved to the rear it also slides upwardly, and as the end of the finger q^2 moves in an exactly horizontal path it follows that as the block o is pushed rearwardly it will also be lifted slightly, so that if the tension faller-wire has only been thrown slightly above the normal the block will be pushed back only a short distance, permitting the screw m^2 to fall upon the first step, as shown in Fig. 5; but if the faller-wire is thrown considerably above the normal the screw m^2 may drop upon the lowest step, thereby causing the apparatus to retard the starting of the roller to the maximum extent. As the roller-clutch is thrown into gear and is rotated forward the wheel k^2 will also be rotated forwardly, moving the end of the screw k^4 into engagement with the stop-finger k^6. This will cause the arms m m' to be swung upwardly, lifting the screw m^2 out of engagement with the block, and as the screw no longer prevents the block o from being moved forwardly the spring o^2 will push the block forward to the position shown in Fig. 4. In this way the parts will be returned to their normal position, so that if upon the next motion the faller-wire is simply thrown up to its normal height the normal amount of slack yarn will be taken up at the beginning of the running-out operation.

It is common in spinning-mules, particularly with certain classes of work, to provide a gear p on the roller, which may be constantly driven by the gear p' p^2, the latter having a pawl-and-ratchet connection with its driving-shaft, said gears acting to drive the front feed-roller slowly when the clutch members e' e^2 are separated, thereby giving off a certain amount of thread during the winding operation, this action being known as the "roller-motion" during winding. When the mule is provided with this motion, the roller will be rotated forward during the running-in motion, thus swinging the arms d' thereon forward into engagement with the opposite lugs from those with which they were in engagement during the feeding motion while the spinning operation was taking place, unless means were provided to prevent such action. This would therefore have the effect of causing the roller to be retarded nearly half a revolution at the beginning of the running-out motion, and it would consequently render the entire operation previously described ineffective. To prevent the clutch member e^2 from being moved from the position on the shaft to which it was turned at the end of the running-out motion, I provide a mechanism which I will now describe.

The end of the clutch member e^2 opposite its toothed end is provided with a conical-shaped cavity e^6, and a clutch-sleeve s is splined on the roller-shaft, as shown in Fig. 7. The end of said sleeve next the member e^2 is made conical and provided with a conical face, preferably covered with leather, and said sleeve is also provided with an annular groove s^2 in its surface. A forked lever s' (shown in dotted lines in Fig. 6 and in Figs. 1 and 2) engages the groove s^2 in said sleeve and is secured to a horizontal shaft s^3. Said shaft is journaled in rigid bearings on the head and is provided with an arm s^4. A link s^5 is pivoted to the

arm s^4 at one end and passes loosely through an arm s^6, which is rigidly secured to rock-shaft h^9. A spring s^7 is arranged on link s^5 between a nut s^8 and arm s^6, and a nut s^9 is provided on said link at the opposite side of arm s^6 from said spring. The operation of this part of the mechanism is as follows: At the end of the running-out motion the roller-clutch is thrown out of gear, and the clutch member e^2 thereon is almost instantly set back, as before described, this operation being completed while the backing-off motion is taking place. The backing-off rod c^5 is then drawn forwardly, releasing the lever h^8, rotating the rock-shaft h^9, and putting the clutch $h' h^2$ into gear to start the carriage on its inward run. This movement of the rock-shaft will force the arm s^6 against spring s^7, drawing link s^5 to the left, rotating shaft s^3, and swinging forked arm s' so that it moves the sleeve s into engagement with the clutch member e^2, thereby locking the latter upon the roller-shaft. This action will therefore prevent the roller-shaft from rotating within the clutch member e^2 during the running-in motion. As the carriage finishes its inward run the rock-shaft h^9 will be moved in the opposite direction by the cam h^5, so that the clutch-sleeve s will be moved away from the member e^2, so as to unlock the same at the same instant the latter is thrown into gear. As the throwing out of the running-in clutch of the scroll-shaft and the throwing in of the running-out and roller clutch must be practically simultaneous, it would be practically impossible to employ the locking mechanism j, just described, in connection with the means for varying the starting of the feed-roller according to the position of the tension faller-wire, which operates toward the end of the running-in motion, without additional mechanism. To combine these mechanisms and to prevent all possibility of rotation of the roller-shaft with the catch-box e^2 while it is unlocked, I provide means for throwing the roller-motion out of gear while the catch-box is free to rotate on the roller-shaft. I may accomplish this by the mechanism shown in Figs. 6 and 7, in which I provide the roller-gear p with clutch-teeth and mount the same loosely on the roller-shaft. I also provide a catch-box p^3, which is adapted to engage said teeth and is splined on the roller-shaft. (See Fig. 7.) A shaft p^4 is journaled on the head, and a forked arm p^5 is secured thereto and engages an annular groove in the catch-box p^3. Two intermeshing gears p^6 p^7 are respectively secured to shafts p^4 s^3, so that when the shaft s^3 is rotated to throw the clutch-sleeve s into engagement with the catch-box e^2 the constantly-driven gear p will also be connected to the roller-shaft d, and when the sleeve s is thrown in the opposite direction the gear p will be disconnected. With this arrangement, therefore, the roller-motion will not be thrown into operation until after the catch-box e^2 has been set back at the beginning of the running-in motion, the catch-box e^2 being locked and the roller motion started simultaneously.

As shown in Figs. 1 to 6, the end of rod o' is provided with an inclined or wedge-shaped head o^5, and arranged directly over said head is a vertically-guided bar o^6, having a friction-roller o^{70} at its lower end, which is adapted to rest on the inclined portion of said head when sleeve s is in engagement with catch-box e^2, as hereinafter explained. The upper end of said bar o^6 is pivotally connected to one end of a lever o^7, which is pivoted on a bracket o^8, the other end of said lever being pivotally connected to an arm o^9, secured to shaft s^3. When the faller-wires j are raised too high and the block o is consequently pushed back, as shown in Fig. 5, the wedge-shaped head o^5 will force the bar o^6 upward, swinging lever o^7 so as to force shaft s^3 to rotate, compressing spring s^7, and at the same time throwing sleeve s out of gear with the catch-box e^2 and the catch-box p^3 out of gear with the gear p, thereby unlocking the catch-box e^2, so that it may be rotated rearwardly by wheel k^2, and disconnecting the gear p, so that the roller is instantly stopped. This action takes place just before the change takes place at the end of the running-in motion, which will relieve the tension on spring s^7 and return the parts to the position shown in Fig. 6.

The set-screw k^4 is set so that the roller will be retarded according to the staple, twist per inch, &c., of the yarn to be produced, and this adjustment is not to be changed by the spinner while these conditions exist. As the cops are filled an increasing amount of slack yarn is given off at the end of each spinning operation, and for this reason the spinner should from time to time unscrew the screw m^2, thereby retarding the roller to a still greater extent. When the cops are doffed and the operation is started again, the screw m^2 will be turned back to its original position, this being readily determined by the position of the arm m' with relation to bracket k.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a spinning-mule, the combination with the feed-roller, a clutch therefor and means for driving one of the members of said clutch, means permitting limited backward movement of the other clutch member with relation to said roller, a weight-actuated wheel, a belt passing about said wheel and the clutch member last named, a stop-finger, and stops on said wheel at opposite sides of said finger, one of said stops being adjustable, substantially as described.

2. In a spinning-mule, the combination with the feed-roller, a clutch therefor and means for driving one of the members of said clutch, means permitting limited backward movement of the other clutch member with relation to said roller, a weight-actuated wheel, a belt passing about said wheel and the clutch

member last named, an adjustable stop-finger, and stops on said wheel at opposite sides of said finger, one of said stops being adjustable, substantially as described.

3. In a spinning-mule, means for varying the time of starting the feed-roller with relation to the starting of the carriage, comprising a stop, clutching and roll-actuating mechanism controlled thereby, the tension faller mechanism and means for automatically varying the position of said stop with relation to the position of said faller mechanism, substantially as described.

4. In a spinning-mule the combination with the feed-roller, a clutch through which said roller is driven, means permitting limited rotation of the fast clutch member with relation to the roller, means for rotating said fast clutch member backwardly when it is separated from the driven member, a stop for limiting the extent of such backward movement, the tension faller mechanism, and means controlled thereby for varying the position of said stop, substantially as described.

5. In a spinning-mule the combination with the feed-roller, a clutch through which said roller is driven, means permitting limited rotation of the fast clutch member with relation to the roller, means for rotating said fast clutch member backwardly when it is separated from the driven member, a stop for limiting the extent of such backward movement, a movable support for holding said stop in different positions, the tension faller mechanism, the carriage, a finger carried thereby, connections between said finger and said faller mechanism for varying the position of said finger according to the position of the faller mechanism and means for causing said finger to engage said support when the finger is moved from its normal position, substantially as described.

6. In a spinning-mule, the combination with the feed-roller, a clutch through which said roller is driven, means permitting limited rotation of the fast clutch member with relation to the roller, means for rotating said fast clutch member backwardly when it is separated from the driven member, a stop for limiting the extent of such backward movement, the tension faller mechanism, and means controlled thereby for varying the position of said stop, said means comprising a sliding block having a series of supporting-faces arranged adjacent each other at different elevations, a weighted arm resting on one of said faces and connected to said stop, a finger on the carriage, means connected to the tension faller mechanism for varying the position of said finger according to the position of said faller mechanism, means for causing said finger to engage said block and to change the position thereof and permit said weighted arm to move onto a different face, substantially as described.

7. In a spinning-mule, the combination with the carriage movable to and from the mule-head, the feed-roller, a clutch therefor and means for driving one of the members of said clutch, means permitting limited backward movement of the other clutch member with relation to said roller, means for rotating the latter clutch member backward when said members are separated at the end of the outward run of the carriage, and means for locking said latter member on the roller in its retracted position and for driving the roller independently during the running-in motion of the carriage, substantially as described.

8. In a spinning-mule, the combination with the carriage movable to and from the mule-head, the feed-roller, a clutch therefor and means for driving one of the members of said clutch, means permitting limited backward movement of the other clutch member with relation to said roller, means for rotating the latter clutch member backward when said members are separated at the end of the outward run of the carriage, and means for locking said latter member on the roller in its retracted position, comprising an oscillating arm and means for moving the same in opposite directions at the end of each movement of the carriage, a locking-clutch on the roller adapted to lock the feed-roller-clutch member in different positions with relation to the roller, connections between said arm and said locking-clutch for moving the latter to lock and unlock said roller-clutch member at the beginning and end of the running-in motion of the carriage, and means, independent of said roller-clutch, for rotating the roller, substantially as described.

9. In a spinning-mule, the combination with the carriage movable to and from the mule-head, the feed-roller, a clutch therefor and means for driving one of the members of said clutch, means permitting limited backward movement of the other clutch member with relation to said roller, means for rotating the latter clutch member backward when said members are separated at the end of the outward run of the carriage, and means for locking said latter member on the roller in its retracted position, comprising an oscillating arm and means for moving the same in opposite directions at the end of each movement of the carriage, a locking-clutch on the roller adapted to lock the feed-roller-clutch member in different positions with relation to the roller, yielding connections between said arm and said locking-clutch for moving the latter to lock and unlock said roller-clutch member at the beginning and end of the running-in motion of the carriage, and means, independent of said roller-clutch, for rotating the roller, substantially as described.

10. In a spinning-mule the combination with the carriage movable to and from the mule-head, the feed-roller, actuating mechanism therefor operating during the running-out motion of the carriage, retarding mechanism for said actuating mechanism, and means for setting the same at the end of the running-

out motion, means for locking said retarding mechanism after it has been set and during the running-in motion, and means for driving said roller independently of its said actuating mechanism during the running-in motion, substantially as described.

11. In a spinning-mule the combination with the feed-roller, a clutch therefor and means for driving one of the members of said clutch, means permitting limited backward movement of the other clutch member with relation to said roller, a weight-actuated wheel, a belt passing about said wheel and the clutch member last named, and stops for limiting the rotation of said wheel in either direction, substantially as described.

12. In a spinning-mule, the combination with the feed-roller, a clutch therefor and means for driving one of the members of said clutch, means permitting limited backward movement of the other clutch member with relation to said roller, a weight-actuated wheel, a belt passing about said wheel and the clutch member last named, an adjustable stop-finger, and stops on said wheel at opposite sides of said finger, substantially as described.

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

TIMOTHY McAULIFFE.

Witnesses:

LOUIS H. HARRIMAN,

H. B. DAVIS.