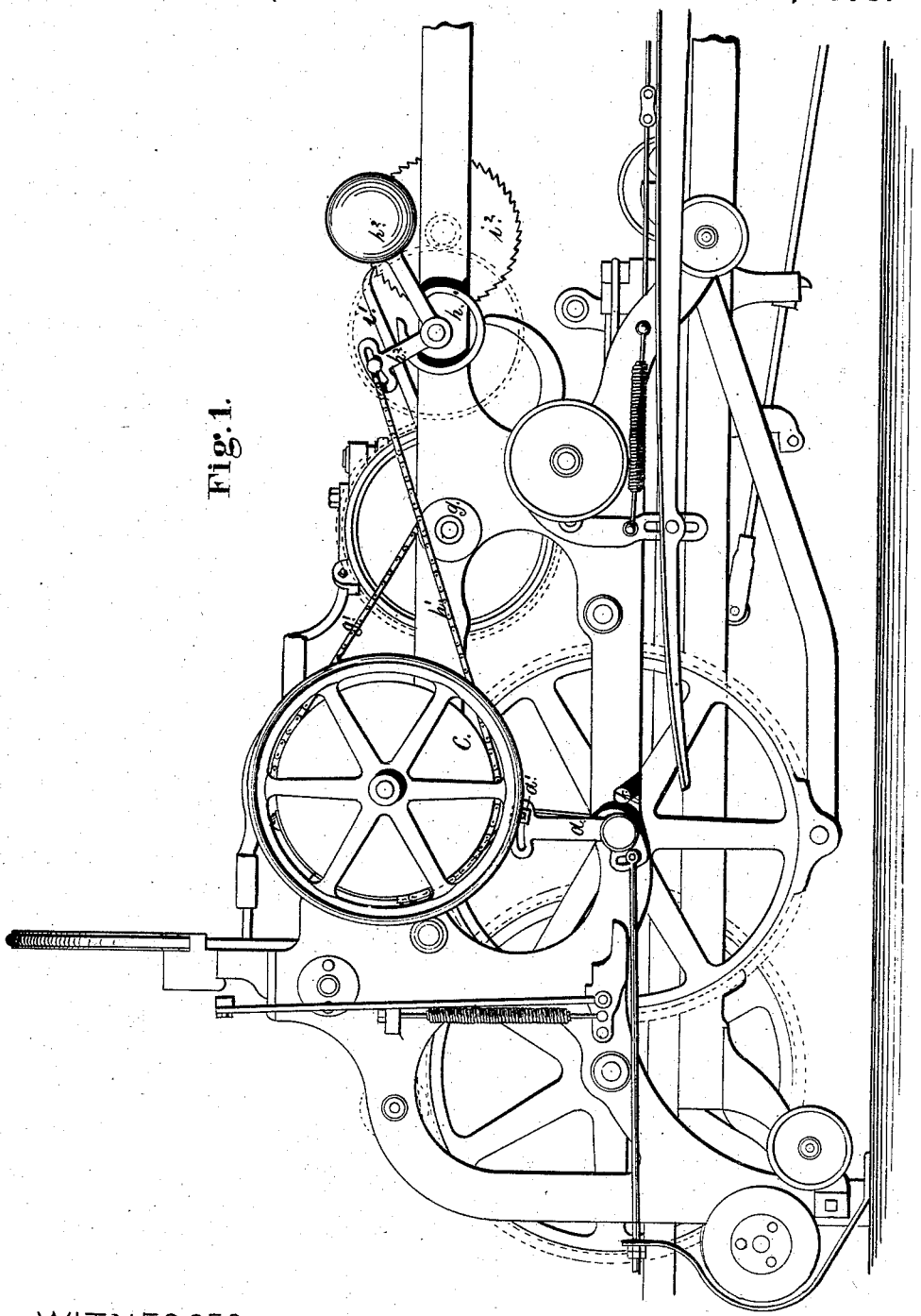
4 Sheets—Sheet 1.

J. HACKALEY.

Spinning-Mule.

No. 205,380. Patented June 25, 1878.

Fig. 1.



WITNESSES.

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Joseph A. Miller Jr.

INVENTOR.

John Hackaley

by Joseph A. Miller Attorney

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Spinning-Mule.

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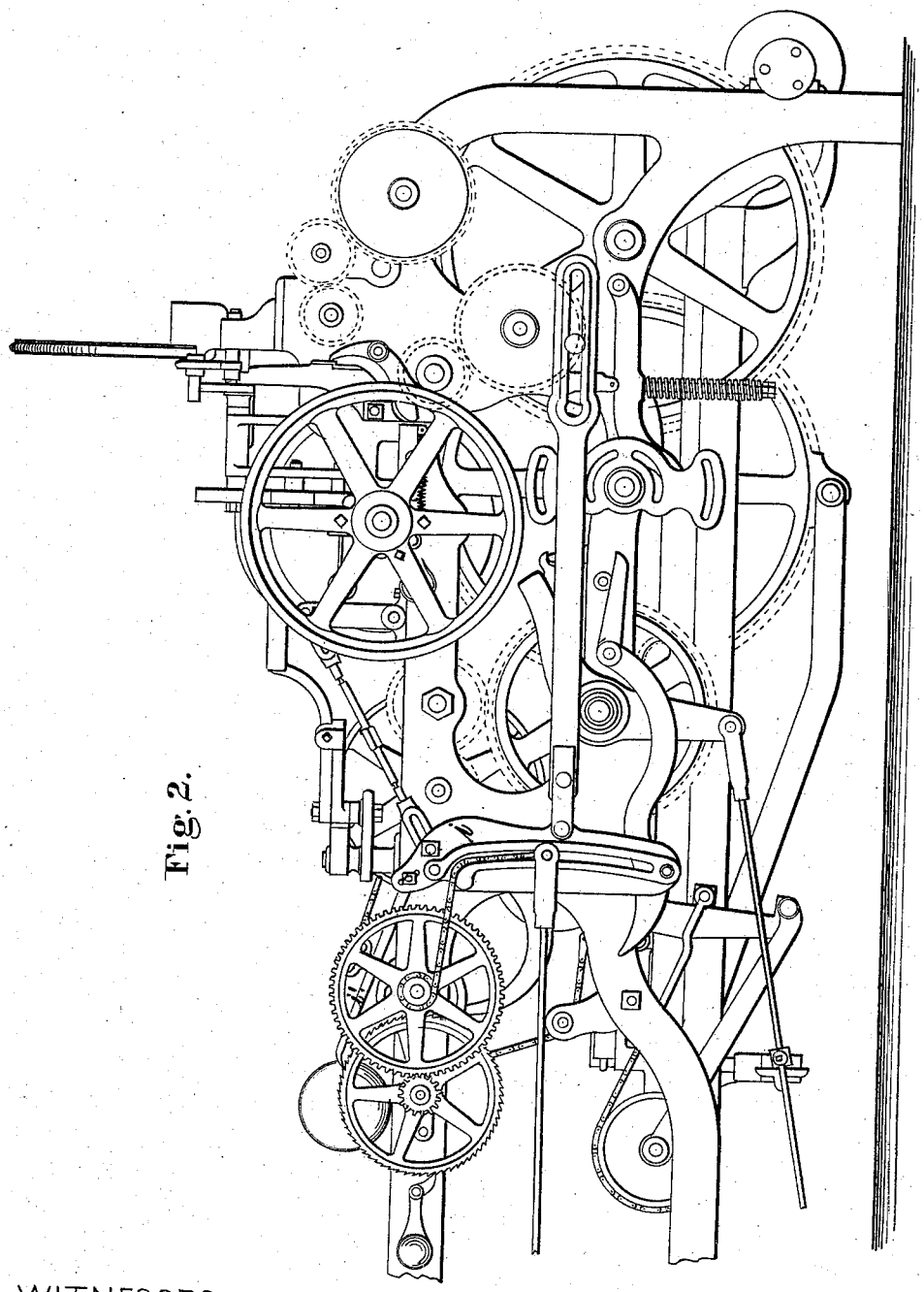

Fig. 2.

WITNESSES.

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4 Sheets—Sheet 3.

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Spinning-Mule.

No. 205,380. Patented June 25, 1878.

Fig. 3.

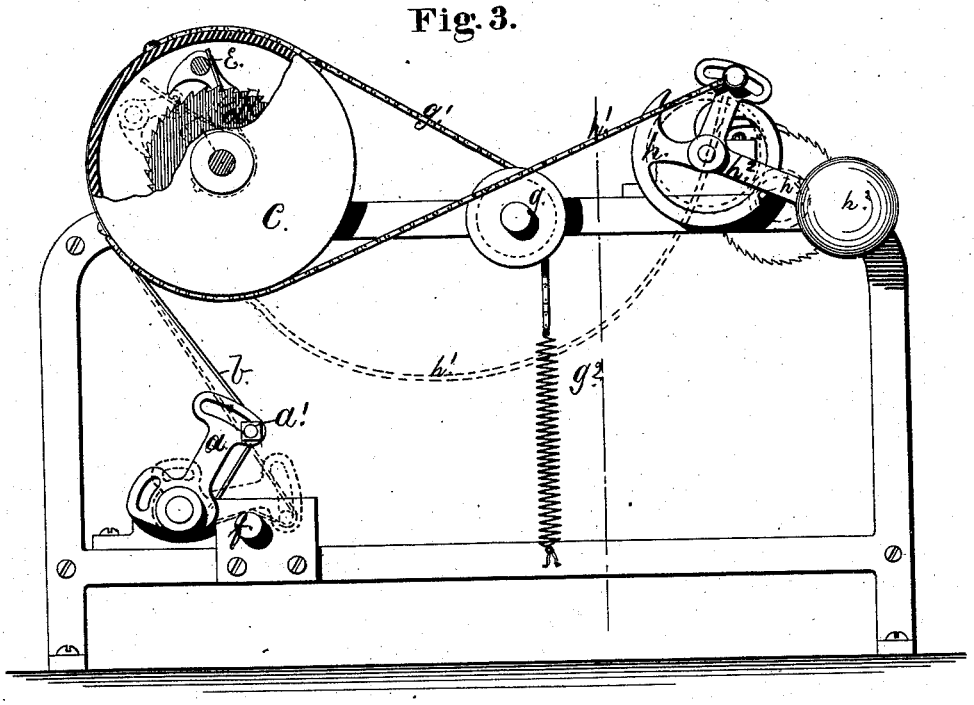


Fig. 4.

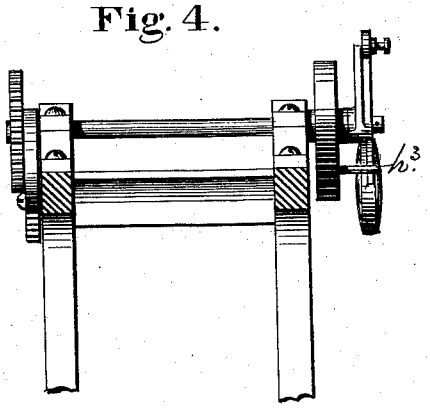
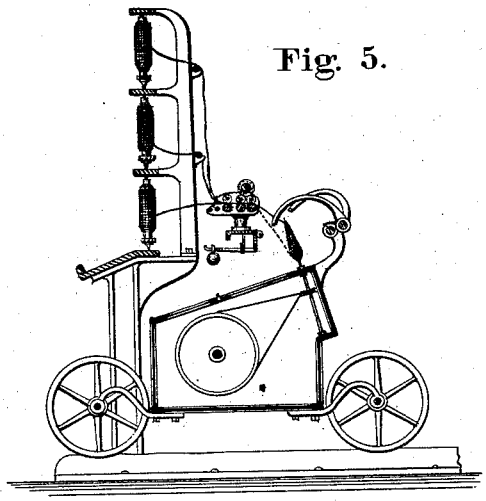


Fig. 5.



WITNESSES.

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4 Sheets—Sheet 4.

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Spinning-Mule.

No. 205,380. **Patented June 25, 1878.**

Fig. 7.

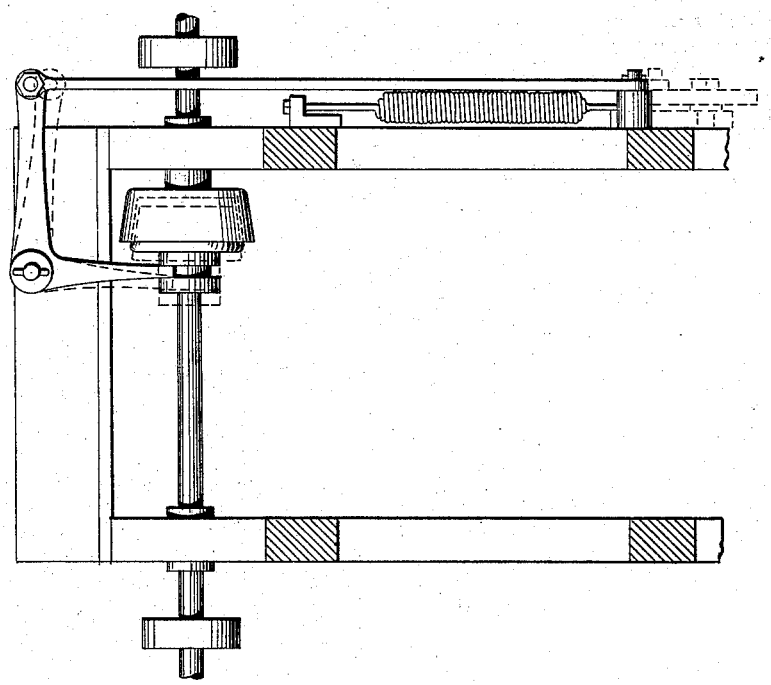
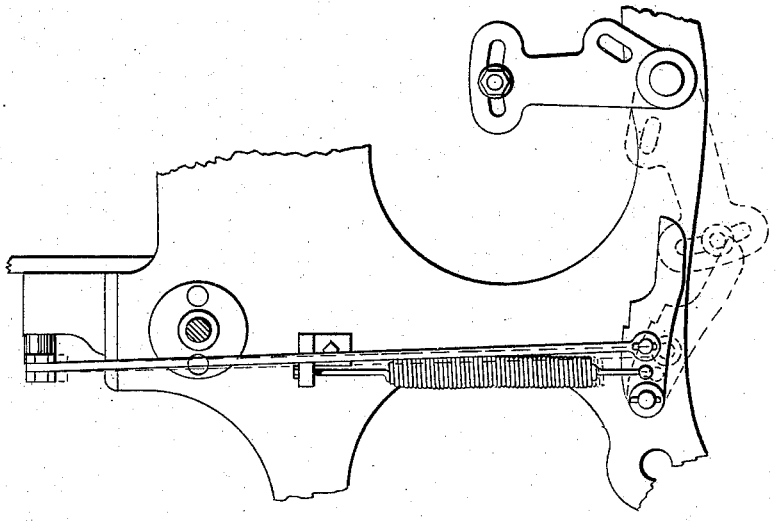


Fig. 6.



WITNESSES:

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INVENTOR:

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UNITED STATES PATENT OFFICE.

JOHN HACKALEY, OF FALL RIVER, MASSACHUSETTS, ASSIGNOR OF ONE-HALF HIS RIGHT TO JAMES P. HILLARD, OF SAME PLACE.

IMPROVEMENT IN SPINNING-MULES.

Specification forming part of Letters Patent No. **205,380**, dated June 25, 1878; application filed February 2, 1878.

To all whom it may concern:

Be it known that I, JOHN HACKALEY, of the city of Fall River, in the county of Bristol and State of Massachusetts, have invented new and useful Improvements in Spinning-Mules; and I hereby declare that the following is a full, clear, and exact description of the same, which, with the accompanying drawings and the letters of reference marked thereon, forming part of this specification, will enable others skilled in the art to make and use the same.

This invention has reference to improvements in power spinning-mules known as the "Mason mules."

The object of the invention is to communicate sufficient motion to the spindles after the carriage has completed its inward traverse, and before the same commences to move outward, so that the slack yarn is wound on the spindle, and all kinking of the same prevented, as will be more fully hereinafter described, and set forth in the claims.

Figure 1 represents the main portion of a mule-head in a side view, the positions of the parts being shown at the moment when the spindle-carriage has reached the limit of its inward traverse, and the roller-clutch arm is about to connect the driving mechanism with the rolls, by which the same commence to deliver the roving before the spindles have commenced the outward traverse. Fig. 2 is a side view of the opposite side of the mule-head, showing the main portion of the mechanism, and particularly the pawl-and-ratchet arrangement by which the variation in the length of slack yarn between the upper and lower portions of the cop is compensated for by a corresponding variation in the revolution of the spindle. Fig. 3 is a side view of a mule-head divested of all mechanism except the parts by which the present invention is illustrated and the desired results produced. Fig. 4 is a partial cross-section, showing the connection between the pawl-and-ratchet mechanism and the cam operating the letting-off mechanism, by means of which the number of turns to take up the slack after the back-faller is raised is regulated. Fig. 5 is a transverse section of the spindle-carriage and rollers, shown in the position when the carriage has reached the limit of its inward traverse and the back-fallers are raised, at which time the additional rotation is imparted to the spindles. Fig. 6 represents a portion of a Mason mule, showing in solid lines the roller-clutch arm, the roller-clutch-operating bell-crank rod, and the holding-spring in the positions occupied when the drawing-rolls are delivering yarn, and in broken lines the positions which they occupy when the clutch is disconnected by the roller-clutch arm. Fig. 7 is a view of the roller-clutch-operating mechanism.

In the drawings, *a* is the roller-clutch arm, shown in Fig. 1 in the position occupied when the carriage moves inward toward the rolls, at which time the rolls are stopped and the yarn wound on the spindle; and it is shown in Fig. 3 in solid lines as commencing to connect the clutch with the rolls, and in broken lines in the position it occupies when the rolls are connected.

b is a strap or chain, connected with the roller-clutch arm near the shaft, and to the drum *c*, which is loose on the main driving-shaft of the mule-head, to which the band-pulleys for driving the spinning-spindles are secured. *d* is a ratchet-wheel secured to the driving-shaft, and *e* a spring-pressed pawl hinged or pivoted to the side or disk of the drum *c*.

Considering, now, this portion of the mechanism, its function will be clearly understood when it is observed that at the moment the spindle-carriage has arrived at the limit of its inward traverse the back-faller rises and the roller-clutch arm describes an arc of a circle. Heretofore the yarn at this time formed a slack loop, and as the rolls started a little ahead of the outward motion of the carriage, the slack loop increased, this slack roving kinking as soon as the spindles started, and before the same had produced the proper tension on the yarn. With this improvement, however, the adjustable pin *a'* on the roller-clutch arm *a* comes in contact with the chain or strap *b*, and thus partially pulls the drum *c* around, which, by means of the ratchet and pawl, turns the main driving-shaft. The spindles are driven from this shaft, and as the upper portions of said spindles are thin, and as the yarn

follows the faller, more revolutions of the spindles must be made at this point to take up the slack. For this purpose the pin *f* is secured to the frame of the mule-head, and the band is forced over said pin by the roller-clutch arm, as shown in Fig. 3 in broken lines, and the speed of the spindles is thereby increased, when the winding of the slack is completed and the spindle-carriage is moving out. The essential difference, therefore, is that in mules as heretofore constructed, at the time the carriage has completed the inward traverse and the followers or back-fallers are raised, there is an appreciable slack in the yarn and an appreciable time that the spindles stop, whereas by this improvement the spindles continue to revolve all the time, and maintain a uniform tension on the yarn, thus preventing the kinking of the same.

g is a chain-pulley supported loosely on a stud, and g^1 a chain connecting the drum *c* with the chain-pulley *g*. g^2 is a coiled spring, secured at one end to the frame, and at the other by a chain to the pulley *g*. When, now, the roller-clutch arm returns to its vertical position, the strap or chain *b* is released, and the spiral spring g^2, acting on the chain g^1, returns the drum to its former position.

As there is considerable difference in the amount of slack between the lower and the upper portions of the cop, owing to the varying distances of the same from the rolls, it becomes necessary to adjust the amount of turning of the spindles to the amount of slack, so as to maintain at all points a uniform tension on the yarn, and thus prevent kinks. For this purpose the chain h^1 is secured to the drum *c* at one end, and at the other to the shaper-cam *h*, or to a separate weighted lever, which is operated by the pin h^3, secured to the shaper-cam *h*. Either of these arrangements will work equally well, and a slot can be made in the shaper-cam, so as to regulate the tension on the chain, the same as is shown in the lever h^2. The cam is slowly rotated through the sector *i* by means of the pawl i^1 and ratchet-wheel i^2, connected with the cam-shaft by the usual gearing.

On examination of Fig. 3 it will be observed that the chain h^1 is shown in solid lines as holding the drum *c*, and preventing its turning by the strain of the coiled spring g^2, and in broken lines as hanging loosely, and also that as the cam *h* slowly turns during the forming of the cop, the chain h^1 will allow the drum *c* to turn back farther, and the roller-clutch arm will cause the drum *c*, and with it the driving mechanism, to turn through a greater portion of a circle.

As the spindles are banded, so as to make a great many revolutions to one of the main driving-shaft, a slight variation in the position of the cam will produce a great difference in the number of revolutions made by the spindles at a time when in mules as heretofore constructed the spindles did not move at all.

I do not wish to confine myself to the exact mechanism shown and described, as these are only some of the means that may be applied to produce the result; nor is it necessary that the motion should be imparted through the roller-clutch arm, as other parts of the mechanism can be readily used to communicate the motion to the spindles when the carriage is in and the belt is off the driving-pulley.

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

1. In a spinning-mule, the combination, with the main driving-shaft, band-wheel or drum, and spindles, of the roller-clutch arm and mechanism, substantially as described, whereby said band-wheel or drum is rotated and the spindles turned by the action of the roller-clutch arm to take up the slack of the yarn by the spindles as the carriage approaches the roller-beam, as set forth.

2. The combination of the main driving-shaft, band-wheel or drum, roller-clutch arm *a*, and band *b* with the cam *h*, chain h^1, sector *i*, and the intermediate mechanism, substantially as described, whereby the spindles are varied in their revolutions according to the amount of slack to be taken up, as set forth.

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