(No Model.)

3 Sheets—Sheet 1.

S. SCHOLFIELD.

MACHINE FOR INSPECTING YARN OR THREAD.

No. 370,713. Patented Sept. 27, 1887.

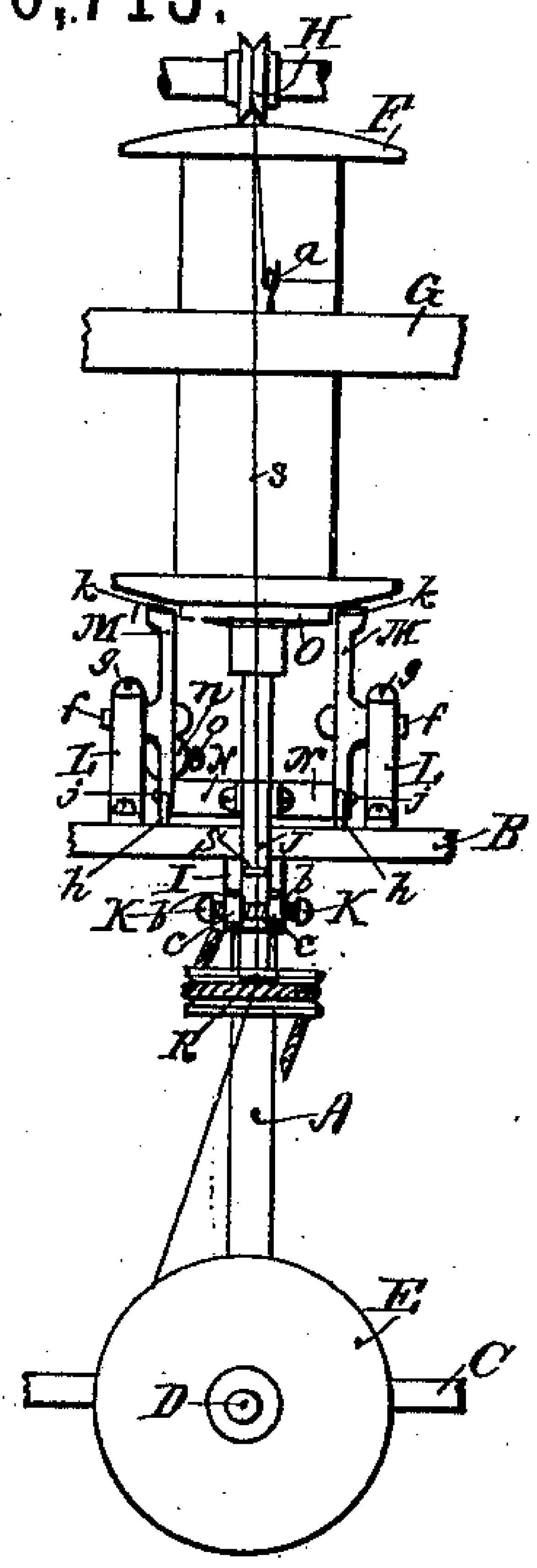

Fig. 1.

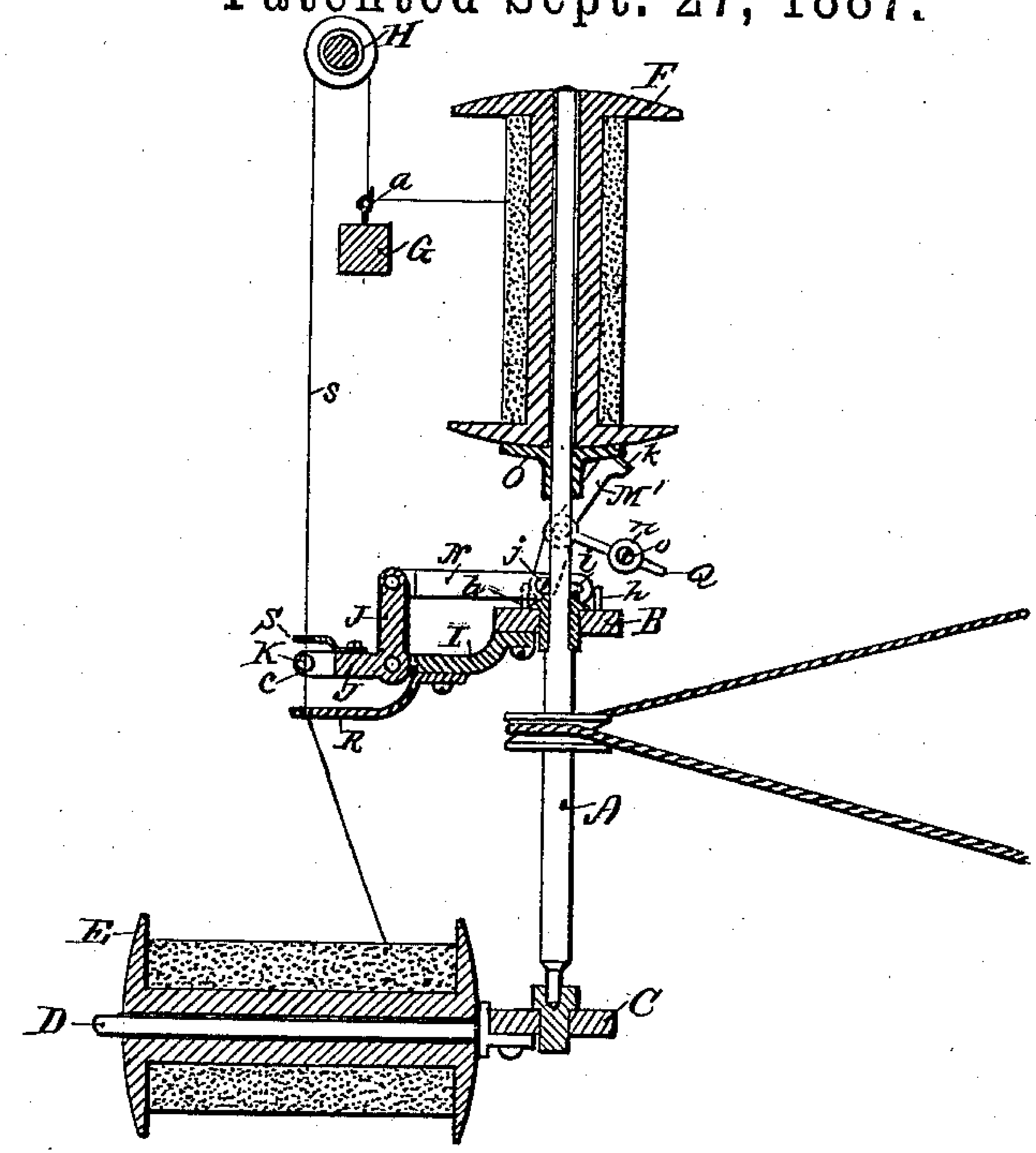

Fig. 2.

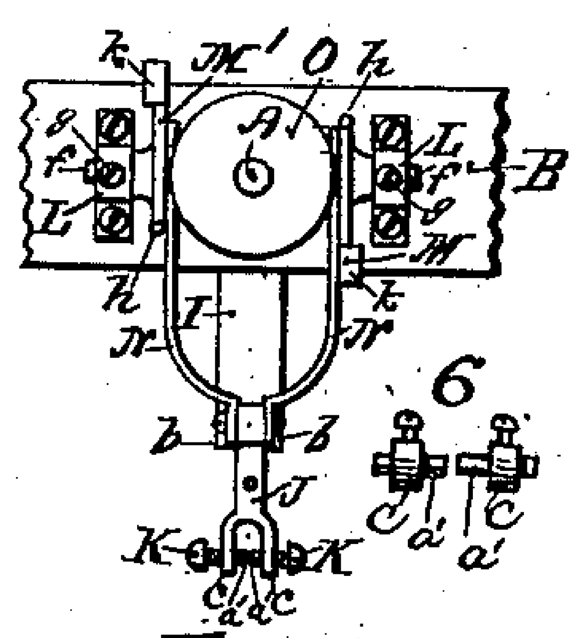

Fig. 3.

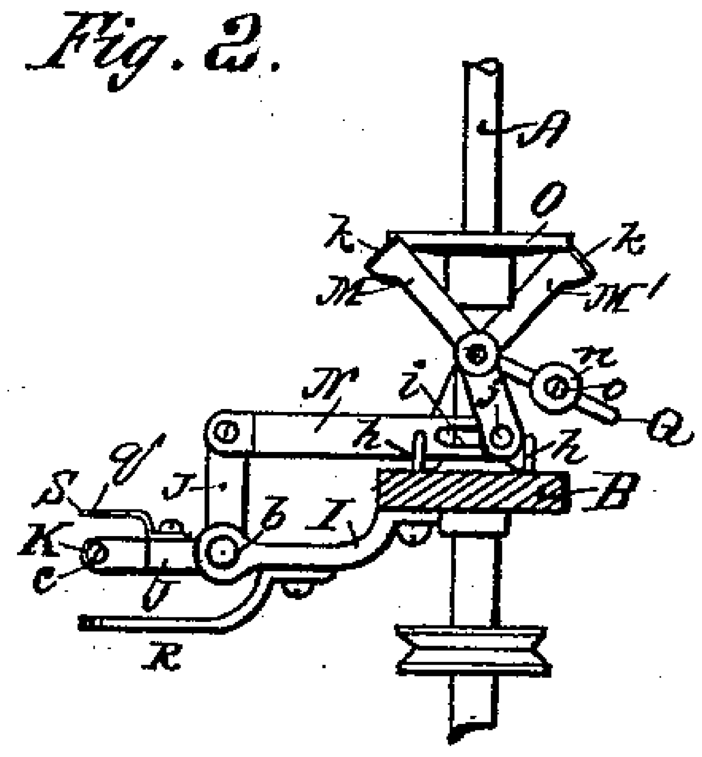

Fig. 4.

Fig. 6.

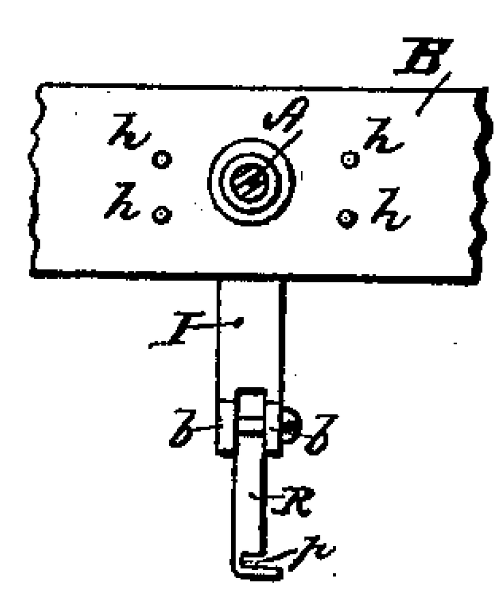

Fig. 5.

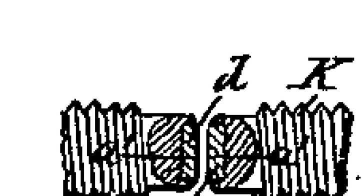

Fig. 7.

Witnesses.
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(No Model.) 3 Sheets—Sheet 2.

S. SCHOLFIELD.

MACHINE FOR INSPECTING YARN OR THREAD.

No. 370,713. Patented Sept. 27, 1887.

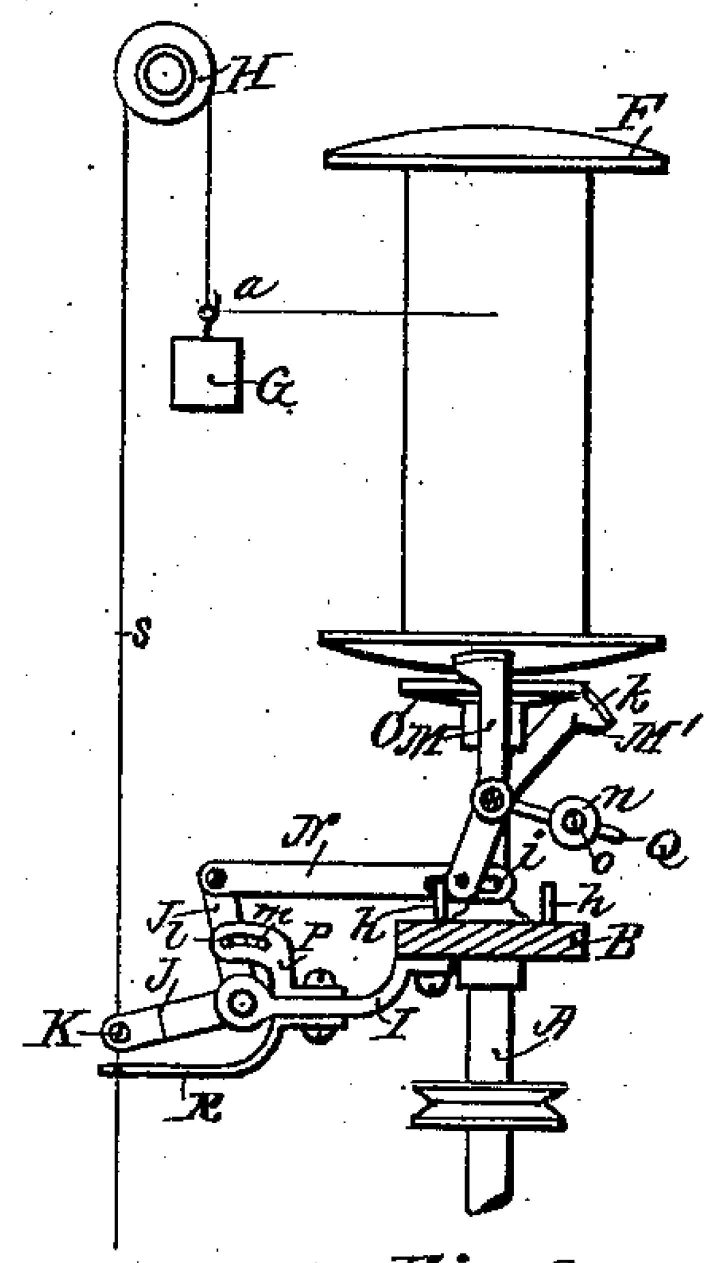

Fig. 8.

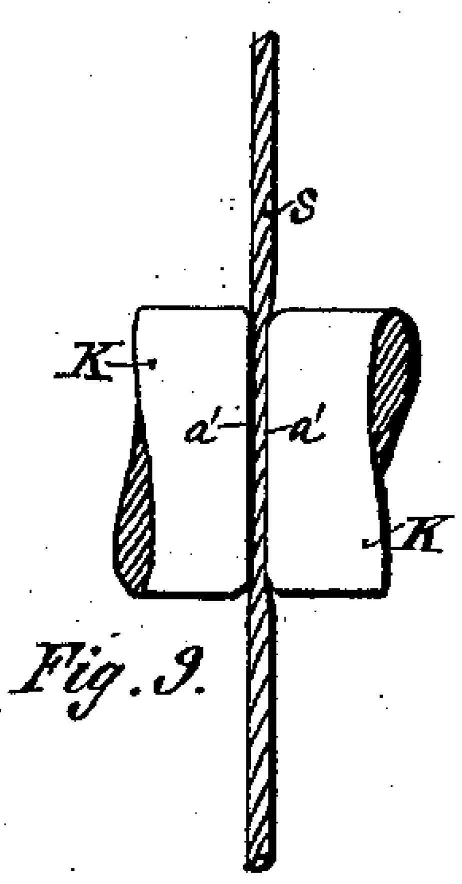

Fig. 9.

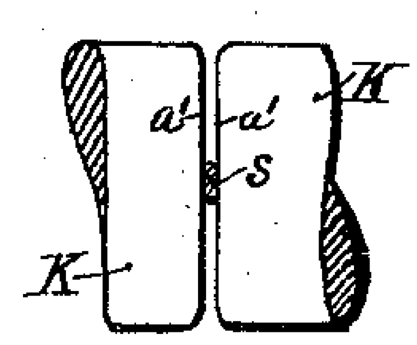

Fig. 10.

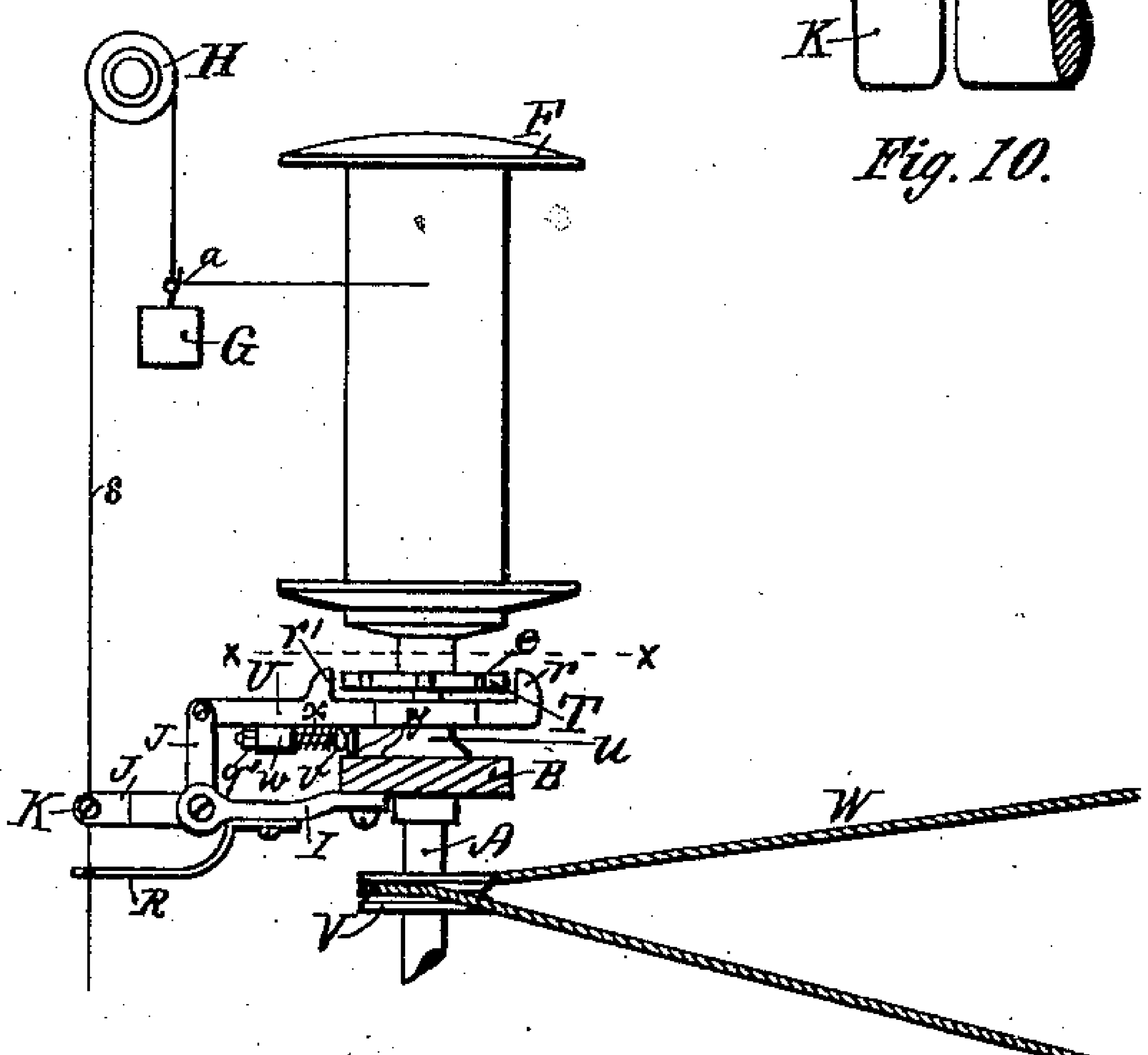

Fig. 11.

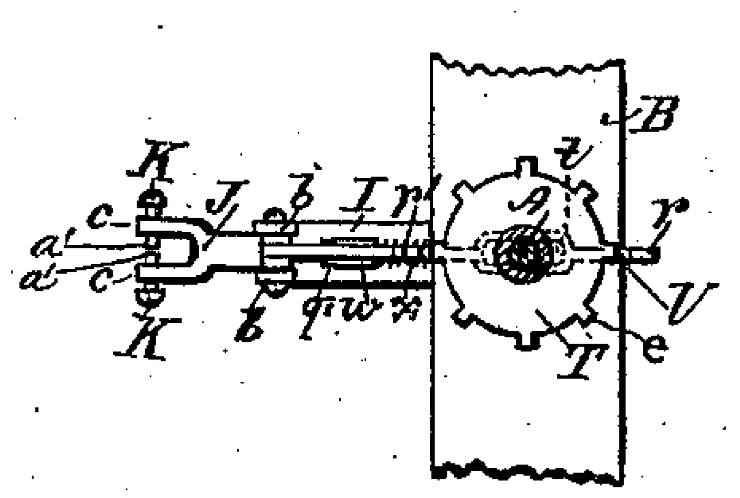

Fig. 12.

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S. SCHOLFIELD.

MACHINE FOR INSPECTING YARN OR THREAD.

No. 370,713. Patented Sept. 27, 1887.

Fig. 13.

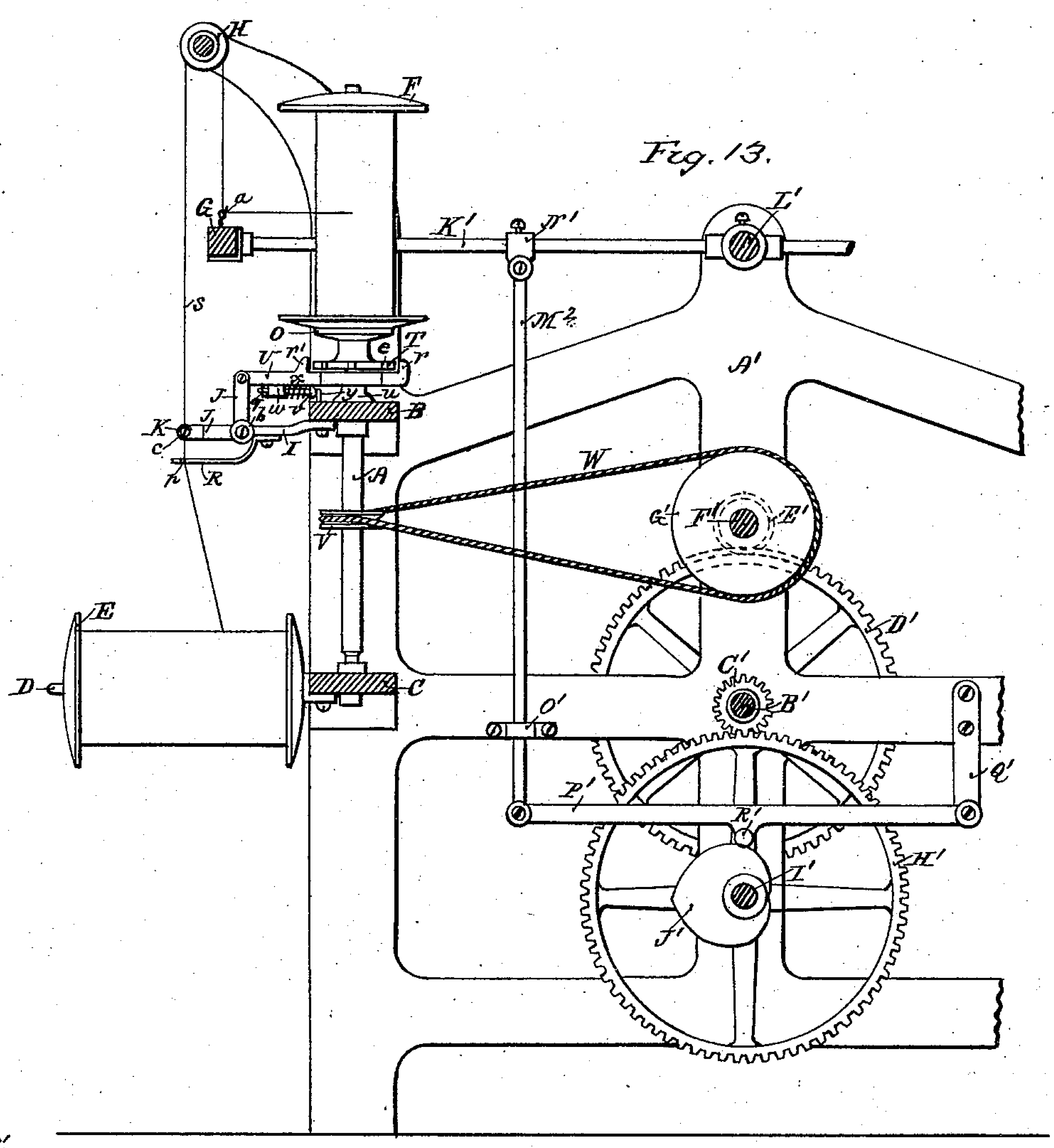


Fig. 16.

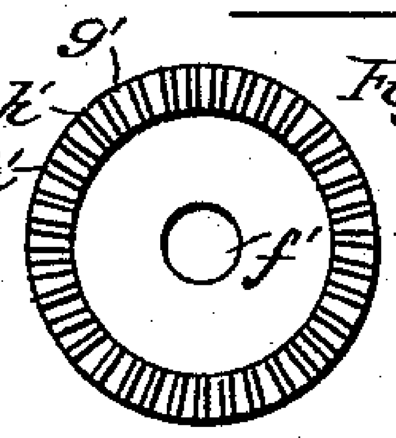


Fig. 14.

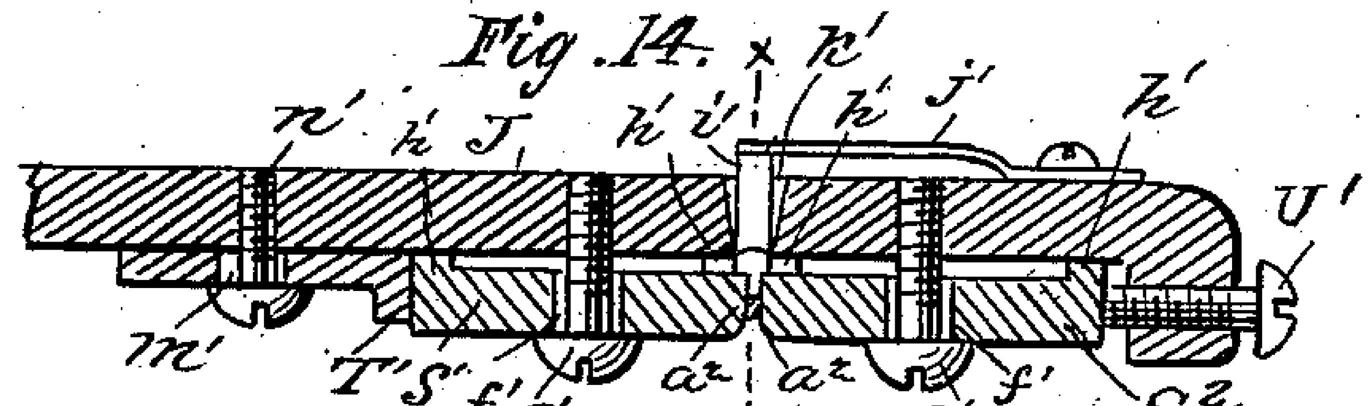
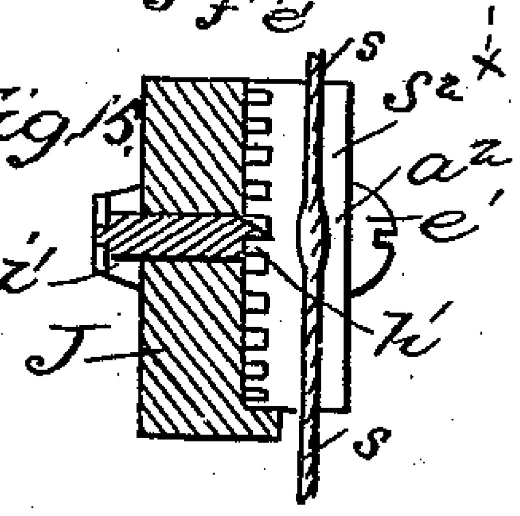


Fig. 15.



Witnesses.

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UNITED STATES PATENT OFFICE.

SOCRATES SCHOLFIELD, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO HIMSELF AND JOSEPH J. SCHOLFIELD, OF SAME PLACE.

MACHINE FOR INSPECTING YARN OR THREAD.

SPECIFICATION forming part of Letters Patent No. 370,713, dated September 27, 1887.

Application filed July 30, 1886. Serial No. 209,589. (No model.)

To all whom it may concern:

Be it known that I, SOCRATES SCHOLFIELD, of Providence, in the State of Rhode Island, have invented a new and useful Improvement in Machines for Inspecting Thread or Yarn, of which the following is a specification.

In the manufacture of the finer qualities of woven textile fabrics it is very important to have the threads, whether of warp or filling, each of uniform size with the adjoining threads of the web, and also to have them freed from irregularities and imperfections throughout their length; and it is the object of my invention to provide a device which will automatically indicate to the operator of the machine the increased or diminished size of the passing thread from that of the desired standard, and also operate to stop the further forward movement of the imperfect thread, in order to allow the same to be properly corrected or removed from the machine; and it consists in a movable detector provided with parallel testing-surfaces adapted for adjustment to various distances from each other to suit the different sizes of thread or yarn, and in the combination of the same with means for drawing the thread between the adjustable surfaces of the detector and a medium for resisting the forward movement of the detector from the indicating-point for the standard size of the thread, also with means for automatically stopping the forward movement of the thread upon its undesirable departure from the proper standard of size.

In the manufacture of yarn or thread from carded wool it is found in practice that the thread spun from roving received from the upper doffer of the carding-machine varies in size from that produced from the roving of the lower doffer, and that the end rings of each doffer are liable to produce roving different in size from that produced from the intervening rings, and in the carding process particles of wool will often so adhere to the rings of the doffers as to rob the adjoining doffer of its due share of the carded material, thus producing unevenness in the product. In many factories the rovings from the upper and lower doffers are kept for separate spinning, and are not used in the same web; but mistakes will often occur, so that the size of the spun yarn or thread is, by the inadvertent substitution of a different spool of roving, suddenly increased or diminished from the standard size without the knowledge of the spinner, and such thread, when woven into a web, will produce unevenness in the finished goods, whereby their quality and selling price will be injuriously affected, and it is highly desirable to be able to distinguish the variable from the standard threads and to eliminate the discrepancies arising from imperfections in the manufacture of the thread and from the careless mixing of the same on the part of the operatives. It is difficult to detect the different sizes of thread by the eye, as has been the general practice heretofore, and the trouble and cost of such inspection often falls upon the weaver, who is subjected to fines for imperfections in his work arising from the inadvertent weaving of imperfect and unsuitable threads as received from the spinning-room.

In carrying out my invention the parallel surfaces of the detector are so adjusted that the thread, when of standard size, will be somewhat flattened in its passage between them, and the friction thus produced between the surface of the standard thread and the adjacent parallel surfaces will cause the detector to assume a certain intermediate position, from which it will move forward against the reverse action of the resisting medium to cause a stopping of the movement of the thread in its passage between the parallel surfaces of the detector upon the occurrence of an undesirable increase in size, thus indicating the fact of such increase to the operator, and in this case, upon the proper removal of the specific imperfection, as indicated, the thread can be again started for further testing between the parallel faces of the detector; but when the thread is of smaller size than the standard it will cease to be flattened, and thus to engender friction between its surface and the parallel plane surfaces, so that the detector will move backward through the force of gravity or the resilient action of a spring and cause the stopping of the movement of the thread, thus indicating to the operator the lessened size of such thread, for which proper correction is required, by cutting out or removal.

My improvement is also adapted for inspecting worsted threads, which are often very irregular in size and are liable to have their broken and joined ends badly tied by the operatives engaged in the manufacture of the thread, so that worsted threads as now in the market require to be closely inspected by the purchasing manufacturer prior to their insertion or use in the web, and threads made of other materials may be advantageously inspected and corrected by means of my improvement.

Figure 1 is a front elevation showing a single spindle provided with my improvement. Fig. 2 is a vertical section of the same with the spindle in elevation. Fig. 3 is a detail plan view showing the rotary spindle, the levers for stopping the movement of the winding-spool, and the detector, the thread-guides being removed. This figure also shows a modified manner of holding and adjusting the testing-surface. Fig. 4 is a side elevation of the same with the stand for holding the fulcrum-stud of the spool-stopping lever removed, the bolster-rail being shown in section. Fig. 5 is a detail plan view showing the bolster-rail, the stop-pins for limiting the movement of the spool-stopping levers, the bracket for holding the detector, and a stationary thread-guide located below the detector. Fig. 6 is a plan view of a thread-guide which is to be attached to the detector, as shown in Fig. 4. Fig. 7 is a detail view showing the adjacent points of the adjusting-screws of the detector, which are broken away at their side in order to show the inserted plates of hard wearing material, between the parallel surfaces of which the thread is to be drawn. Fig. 8 is a side elevation with the stand for holding the fulcrum-stud of the spool-stopping lever removed, the spool being shown as stopped by the lever, and the bolster-rail being shown in section. Figs. 9 and 10 are enlarged views of the adjacent ends of the adjusting-screws of the detector, the end of the screws being provided with plane surfaces, which are parallel to each other and adapted to slightly flatten the thread when drawn between them. Fig. 11 is a side elevation showing another form of my improvement. Fig. 12 is a section taken in the line $x\ x$ of Fig. 11, the stationary thread-guide being removed. Fig. 13 is a partial section of the full machine, showing the connection of the spindle and wave-motion bar with the driving-shaft. Fig. 14 is an enlarged detail section of a modified form of the detector, the section being taken in a horizontal plane through the center of the opposite testing-surfaces. Fig. 15 is a transverse section of the detector, taken in the line $x\ x$ of Fig. 16. Fig. 16 is a side elevation showing the inner side of one of the adjustable guides of the detector, between two of which the thread to be tested is made to pass.

In the accompanying drawings, A is the rotary spindle; B, the bolster-rail; C, the step-rail; D, the fixed spindle upon which the spool E, from which the thread is to be drawn for inspection, is placed. F is the spool upon which the thread is to be wound. G is the wave-motion bar. H is a roller over which the thread is carried before it passes through the guide-eye a of the wave-motion bar.

Having reference to the construction shown in Figs. 1 to 10, to the bolster-rail B is secured the bracket I, provided at its outer end with the ears $b\ b$, between which is loosely pivoted the detector J, which is made in bell-crank form and provided at its lower outer end with the ears $c\ c$, in which are threaded the screws K K, preferably provided with the inserted tips $d\ d$, (shown in Fig. 7,) which may be made of plates of iridium or other durable metal, the adjacent surfaces of the plates being made parallel to each other, or a properly-faced agate stone or diamond may be inserted into the recessed end of the adjusting-screws, so as to form two adjacent parallel surfaces, between which the thread is to be drawn and tested.

To the stands L L, secured to the upper side of the bolster-rail, Figs. 1 and 3, are loosely pivoted the friction-levers M M' by means of the pivot-studs f, which may be firmly secured to the stands by means of the set-screws g. The levers M M' are limited in their movement in either direction by means of the stop-pins $h\ h$, which are set in the bolster-rail B at opposite sides of the lower ends of the levers, and the levers M M' are connected with the detector J by means of the curved connecting-bars N, each provided with a slot, i, which receives the holding-stud j at the lower end of the levers M M'. The upper ends of the levers M M' are preferably covered with rubber, k, or other friction material, adapted to operate upon the head of the spool F to stop the momentum of its revolution, and when the detector J is held at its indicating position for the thread of standard size, as shown in Figs. 1, 2, 3, and 4, the upper corners of the levers M M' will be located below the plane of the upper surface of the cup O, upon which the spool F rests during its revolution with the spindle A, so that while the detector is in this position, thus indicating that a thread of standard size is passing between the parallel testing-surfaces $a'\ a'$ of the detector, neither of the levers M M' will be in engagement with the head of the spool F; but whenever the outer end of the detector is caused to move downward by reason of its weight and the lessened friction of the passing thread s, owing to a marked decrease in the size of the same, then the movement imparted to the connecting-bar N and lever M will cause the upper or rubber-covered end of the lever M to engage with the head of the revolving spool, and upon such engagement it will be suddenly carried by the momentum of the said spool to contact with the stop-pin h, as shown in Fig. 8, and the movement of the upper end of the lever M, which describes a rising arc, will, upon contact with the head of the spool, cause the spool to be raised from its seat upon the friction-cup O, and thus stop the further movement of the spool with the spindle, the spindle A still continuing its revolution. The slot *i* allows a sudden movement of the lever M to be imparted by the revolving spool F without imparting a corresponding movement to the detector J. The detector may be provided at one side with a stop-pin, *l*, Fig. 8, which enters the curved slot *m* in the limiting-guide P, attached to the bracket I, as shown in Fig. 8, and by means of the pin *l* and slot *m* the movement of the detector may be restricted within the limits desired; but in lieu of the pin and slotted guide any suitable stop may be employed for this purpose. When the spool F has been brought to rest by means of the stopping-lever M, as shown in Fig. 8, and the defective portion of the thread *s* removed by the attendant operator of the machine, a slight pull of the thread from the spool will cause the spool to be brought by the consequent backward movement of the same and the lever M again to its seat upon the cup O, the friction of which will cause the rapid rotation of the spool with the spindle, as before, thus again drawing the thread *s* between the testing surfaces *a' a'* of the detector; and in case the thread should be increased beyond the standard size, then the increased friction produced between the thread and the testing-surfaces will cause the upward movement of the detector from the intermediate position, (shown in Fig. 2,) thus causing the forward movement of the upper end of the lever M' in the direction of the rotary movement of the spool, and upon contact of the friction end of the lever M' with the bottom of the spool F the lever will be suddenly brought against its stop-pin *h*, consequently raising the spool from its seat upon the friction-cup O, as before, thus preventing the further rotation of the spool with the spindle, when upon the removal of the enlarged portion of the thread, as indicated, by the detector the spool can be started into revolution with the spindle by simply turning the spool and lever M' slightly backward, as before described.

In order to provide a slightly-resisting medium of some kind for the purpose of resisting the movement of the detector from its position for indicating the standard size of the thread, I attach to the lever M' an arm, Q, upon which is placed an adjustable weight, *n*, held upon the arm Q by means of the screw *o*. Thus a considerably-increased degree of friction will be required to cause the upward movement of the detector from its position for indicating the thread of standard size; but instead of employing a gravitating force for the resisting medium any suitable spring may be employed.

The thread *s* for inspection is drawn from the spool E, which is loosely held upon the fixed spindle D, and wound upon the spool F, passing from the spool E to the stationary thread-guide R, which is secured to the bracket I, of which a plan view is shown in Fig. 5, the thread-opening *p* of the thread-guide being arranged at about right angles with the plane of the open space between the parallel testing-surfaces of the detector. From the thread-guide R the thread passes between the parallel testing-surfaces of the detector, which I preferably form upon the end of two adjusting-screws, K K, which may be either made of steel and hardened at their points to prevent excessive wear from the friction of the passing thread, or provided with an attached tip of a specially-adapted hard material, as before described. The steel points of the adjusting-screws are shown enlarged in Figs. 9 and 10, the thread or yarn *s* being shown in elevation in Fig. 9 and in section in Fig. 10. From the testing-surfaces of the detector the thread *s*, as shown in Figs. 1 and 2, passes through the opening *q* of the guide S, which is attached to the detector I, and moves therewith, thus serving to hold the thread in proper line with the testing-surfaces at the adjacent points of the screws K K. From the guide S the thread passes over the roller H and through the guide-eye *a* of the wave-motion bar G onto the spool F, upon which it is wound.

The spindle D, upon which the spool E is held, and shown in a horizontal position in the drawings, may in practice be placed in an upwardly-inclined position, and, if so desired, a loose spindle may be employed to hold the spool E, as is common in spooling-machines.

A form of my invention in which a sliding catch is substituted for the oppositely-set levers M M', is shown in Figs. 11, 12, and 13, which show a spur-wheel, T, attached to the spindle A and a sliding catch, U, jointed to the upwardly-extending arm of the detector J. The catch U is provided with the engaging-spurs *r r'*, which are located at opposite sides of the spur-wheel T, so that the movement of the catch U in either direction will cause one of the said spurs to engage with the teeth of the spur-wheel T, and thus stop the rotation of the spindle A and spool F by causing the driving-band W to slip on the surface of the whirl V. The catch U is provided with a slot, *t*, which embraces the spindle A, as shown by the dotted lines in Fig. 12, being thus prevented from lateral movement, and also rests loosely between the spur-wheel T and the bolster *u*, as shown in Fig. 11. The catch U is provided with a medium for resisting the movement of the detector with the thread, consisting of the sliding bolt *v*, which is held in the lug *w* upon the under side of the catch U, and the spring *x*, which is held between the head of the bolt *v* and the adjacent side of the lug *w*, the position of the head of the bolt *v* relatively to the catch U and to its bearing-pin *y*, held in the bolster-rail B, being capable of adjustment by means of the nut *q'* of the bolt.

The detector J is so arranged that when the thread *s* is of less size than the required standard the weight of the outer end of the detector will cause the same to fall, thus drawing the spur *r* of the catch U into engagement with one of the teeth e of the wheel T, and thus stopping the rotation of the spindle A and spool F; but when the thread is of increased size the increased friction caused thereby between the surface of the thread and the testing-surfaces a' a' of the detector will cause the detector to move with the thread against the slightly-resisting force exerted by the spring x until the spur r' of the catch U engages with one of the teeth e of the wheel T, thus stopping the rotation of the spindle and spool, as before. Thus the movement of the detector in either direction serves to stop the further movement of the thread between the testing-surfaces of the same.

The connection of the spindle A and wave-motion bar G with the operating-shaft of the machine is shown in Fig. 13, in which A' is a portion of the end frame of the machine; B', the driving-shaft, upon which are secured the gears C' and D', the larger gear, D', engaging with a pinion, E', (shown by the dotted lines,) upon the drum-shaft F', from the drum G' of which connection is made with the whirl V of the spindle A by means of the band W. The pinion-gear C' upon the driving-shaft B' engages with the gear H' upon the shaft I', and upon the same shaft is also secured the heart-shaped cam J', which serves to impart the desired uniform reciprocating movement to the wave-motion bar G, which is held at the opposite ends of the machine by means of arms K', which are secured to a rock-shaft, L', so that both ends of the wave-motion bar G will be firmly held in a horizontal position for reciprocation. Operative connection is made from one of the arms K' to the heart-shaped cam J' by means of the vertical bar M^2, pivoted to a sleeve, N', on the bar K', and held loosely at its lower end in a fixed guide, O', attached to the frame A' of the machine, and also jointed to the horizontal lever P', which is pivoted to a bracket, Q', secured to the frame A', and also provided with a bearing pin or roller, R', which rests upon the periphery of the heart-shaped cam J'.

Instead of firmly attaching the cup O and wheel T to the spindle A, the same may be held to the spindle by frictional contact, the wheel and cup being joined firmly to each other, so that upon the engagement of the catch U with the spurs of the wheel T to stop the spool the spindle A will still continue its revolution, and in this case wear of the driving-band W will be avoided.

Heretofore in machines employing a movable detector such detector has been provided with a circular or elongated aperture, through which the material to be operated upon was drawn, said material being wholly surrounded and constricted by the said aperture; but I am not aware that in any machine heretofore constructed a detector has been employed having parallel adjustable surfaces between which the material was drawn and tested by flattening without constriction.

I have preferred to employ in my improved detector two oppositely-set adjusting-screws provided at their adjacent ends with parallel plane surfaces, and in this case the proper adjustment of the distance between the testing-surfaces can be made by turning either of the screws, as desired, and by changing the position of the screws in the detector by the backward movement of one and the forward movement of the other the thread will be made to cross the testing-surfaces in a new track, thus prolonging the use and durability of the testing-surfaces. It is evident, however, that one of the testing-surfaces may be held in a fixed or stationary manner, the opposite surface only being made adjustable in order to properly gage the different sizes of thread upon which the machine is to be employed; and, instead of forming the testing-surfaces upon the ends of adjusting-screws, the same may be formed upon the ends of two cylindrical bars held in the ears of the detector and taking the place of the said screws, the adjustment of the testing-surface of one of the bars with relation to the position of the adjacent testing-surface of the other bar being made by means of a screw or otherwise, as shown at 6, Fig. 3.

In carrying out my invention the surfaces between which the thread is to be drawn either may or may not be made parallel throughout their whole extent—as, for instance, in the case of two cylindrical surfaces, which can be set parallel to each other when their axes are located in the same plane, and such curved surfaces, though liable to wear on account of the comparative shortness of the bearing upon the thread, might be employed to some advantage when made of an extremely durable substance; but a longer bearing-surface upon the thread is desirable, in order to obtain an average of the size of its flattened twists, and this result can be easily secured by the employment of plane testing-surfaces, which are readily formed and kept in repair.

By employing the detector having its testing-surfaces fixed at a distance apart equal to less than the standard size of thread the constant tendency of the moving thread of this size is to raise the detector, and this tendency is not resisted until the detector has reached a point intermediate between the limits of its movement, as in Fig. 1. Here the action of the resistance commences, and further movement of the detector is prevented until a larger or smaller size yarn is brought into action. This operation is permitted in the form shown in Fig. 1 by slotting the arm N at i. When the detector has reached the point referred to, the wall of the slot bears upon the pin of the arm M', and further movement of the detector from the indicating-point for the standard-size thread will be resisted by the weight until a larger-size thread is brought into play. The arrangement of the devices described in the modification also secures this result.

Instead of the testers k k, arranged with their plane surfaces opposite, as shown in Figs. 3 and 7, I may employ oppositely-positioned cylindrical surfaces adapted to be moved so as to present different portions of their peripheries to the action of the thread, and this modification is now to be described, being shown in the details views Figs. 14, 15, and 16.

Upon one side of the outer portion of the bar-lever J of the detector are placed the cylindrically-formed testing-guides S′ S^2, which are secured to the lever by means of the screws e′ e′. The testing-guides S′ S^2 are provided with a central perforation, f′, considerably greater in diameter than the shank of the clamping-screw e′, and at their inner side with the toothed annular flange g′, the teeth h′ of which are adapted for engagement with the pawl i′, which is rigidly attached to the flat spring j′, secured to the opposite side of the detector-lever. The pawl i′ passes loosely through the conical perforation k′ in the detector-lever, as shown in Fig. 14, and the point of the pawl is preferably beveled, so as to admit of the ready rotation of the testing-guides from tooth to tooth in one direction, while movement in the opposite direction, or in the direction of the movement of the passing thread, will be prevented.

To the side of the detector-lever J, and bearing against the back edge of the testing guide S′, is secured the stop-guide T′, provided with the slot m′, adapted to receive the screw n′, which serves to hold the stop-guide adjustably against the side of the detector-lever. The screw U′, located at the outer end of the detector-lever, is also arranged to bear against the periphery of the testing-guide S^2, for the purpose of properly adjusting the said testing-guide with respect to its distance from the adjacent peripheral surface of the opposite testing-guide, S′.

The cylindrical testing-guides S′ S^2, between the peripheries of which the thread s is to be drawn, may be properly adjusted for operation by first setting the stop-guide T′ in the proper position to locate the curved testing-surface a^2 of the guide S′ at or near the line of the axis of the pawl i′, as shown in Fig. 14, and firmly securing the said stop-guide in position by means of the clamping-screw n′. The guide S′ is then to be secured to the side of the detector-lever, with its rear edge resting against the face of the stop-guide T′, by means of the clamping-screw e′. A removable sheet-metal gage, of the required thickness as experimentally determined, being then placed between the adjacent surfaces of the firmly-clamped guide S′ and the loosely-held guide S^2, the said guide S^2 is to be forced firmly against the side of the removable gage by means of the adjusting-screw U, and then firmly clamped in place by tightening up the screw e′, and upon the removal of the said sheet-metal gage, by means of which the proper adjustment was effected, the thread s may be passed between the adjusted cylindrically-curved testing-surfaces a^2 a^2 of the detector, the said thread, when of standard size, being somewhat flattened by contact with the testing-surfaces, as shown in Figs. 14 and 15. After running the thread s between the curved testing-surfaces a^2 a^2 for a certain length of time, which is to be determined by the liability of injurious wear to the same, the guides S′ S^2 are to be turned simultaneously downward one tooth past the beveled end of the spring-pawl i′, which engages with the teeth of both of the said guides, thus bringing fresh testing-surfaces to bear upon the opposite sides of the thread, and this rotary adjustment may be repeated until the complete periphery of the guides S′ S^2 has been utilized for testing the size of the thread. The said guides may then be removed from the detector-lever and taken to a grinding-machine to be trued up for repeated use.

I claim as my invention—

1. In combination, a detector provided with parallel testing-surfaces fixed in position at a distance apart equal to less than the average thickness of the thread to be tested, whereby the average or standard size of thread will be measurably flattened when drawn between them, means for drawing the thread between said surfaces, means for resisting the forward movement of the detector during the passage of the standard size of thread, and devices, substantially as described, controlled by the detector adapted to automatically stop the thread-moving mechanism upon the passage of a thread above or below the average size, substantially as described.

2. The combination of the detector provided with parallel adjustable surfaces adapted to measurably flatten the thread when drawn between them, with the rotating spindle for drawing the thread between the adjustable surfaces of the detector, the means for slightly resisting the forward movement of the detector from the indicating-point for the standard size of the thread, the pivoted friction-arm adapted to stop the rotation of the winding-spool, and a connection between the detector and the pivoted friction-arm, substantially as described.

3. The combination of the testing-surfaces having a fixed position in relation to each other, whereby the standard size of yarn will be measurably flattened when drawn between them, said surfaces being carried upon a movable arm, means for drawing the thread between the said surfaces, means, substantially as described, for slightly resisting the forward movement of the testing-surfaces and their supporting-arm, and the thread-guide carried upon the movable arm, whereby it is adapted to guide the thread in its passage between the surfaces, substantially as described.

4. In combination, a detector provided with parallel testing-surfaces, mechanism, substantially as described, for moving the thread, devices adapted to engage with the thread-moving mechanism upon the movement of the detector in either direction, and positive connections between said detector and said devices, substantially as described.

5. In combination, a detector provided with

parallel testing-surfaces, means for drawing the thread between said surfaces, means for resisting the forward movement of the detector, and devices, substantially as described, in positive connection with said detector for automatically stopping the thread-moving mechanism upon the passage of a larger or smaller size of thread, substantially as described.

6. A movable detector provided with the adjusting-screw having a plane surface at its end perpendicular to its axis, in combination with an opposite parallel adjusting-surface, substantially as described.

7. A movable detector provided with parallel testing-surfaces formed at the adjacent ends of oppositely-set adjusting-screws, substantially as described.

8. In combination, the detector having the parallel surfaces fixed in position at a distance apart equal to less than the thickness of the average-size thread, whereby the detector will be moved to the indicating-point for the standard size of thread upon the passage of a thread of standard size, and means for resisting the further movement of the detector from this point during the passage of the average-size thread, substantially as described, and for the purpose set forth.

9. In combination, the oppositely-placed parallel testing-surfaces adjustable to and from each other, and each adjustable relatively to the path of the thread, whereby different points may be presented to the frictional action of the thread, substantially as described.

10. In combination, a pivoted lever, testing-surfaces carried in one end thereof, thread-moving mechanism, devices, substantially as described, for engaging with the thread-moving mechanism, and connections between the opposite end of the lever and the said devices, substantially as described.

11. In combination, a pivoted arm, parallel testing-surfaces carried in one end thereof, having a fixed position in relation to each other, whereby the average or standard size thread will be flattened when drawn between them, means for drawing the thread between said surfaces, and means for resisting the movement of the arm during the passage of a thread of standard size, substantially as described.

12. In combination, the detector having parallel surfaces fixed in position at a distance apart equal to less than the average-size thread, whereby the detector is moved from its lowest position by the passage of said thread, thread-moving mechanism, a resisting means acting upon the detector when it has reached a point intermediate between the limits of its movement, and devices, substantially as described, controlled by the detector for stopping the thread-moving mechanism upon the movement of the detector in either direction from its intermediate position, substantially as described.

13. In combination, the detector-lever provided with the testing-surfaces having a fixed relation to each other to flatten the average-size yarn, the slotted arm N, the levers M′ and M, and the weight, substantially as described.

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Witnesses:
JOHN S. LYNCH,
JAMES W. BEAMAN.