(No Model.)

3 Sheets—Sheet 1.

B. ARNOLD.

MACHINE FOR MAKING INTERLOCKED CORDAGE.

No. 353,396. Patented Nov. 30, 1886.

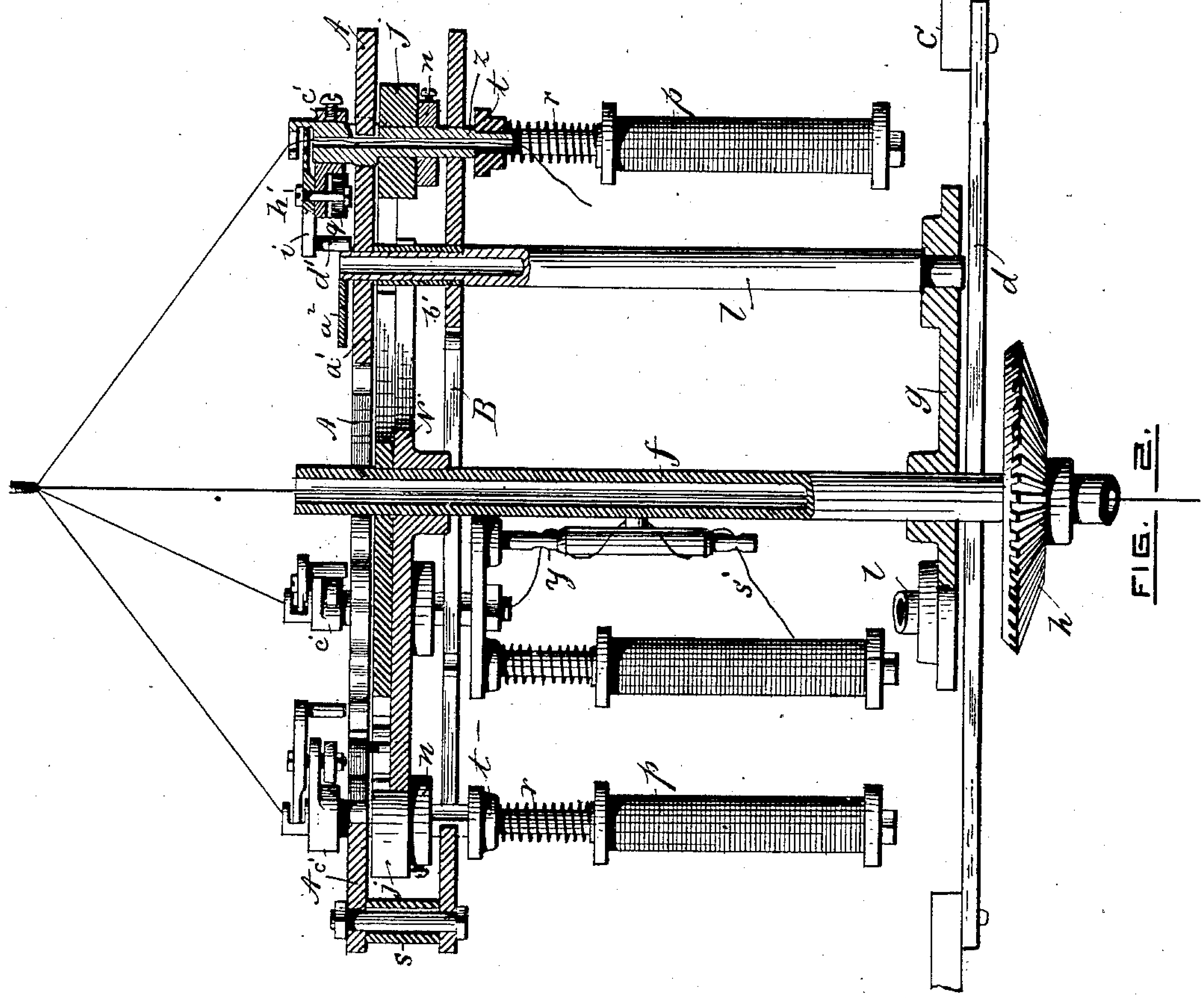

FIG. 2.

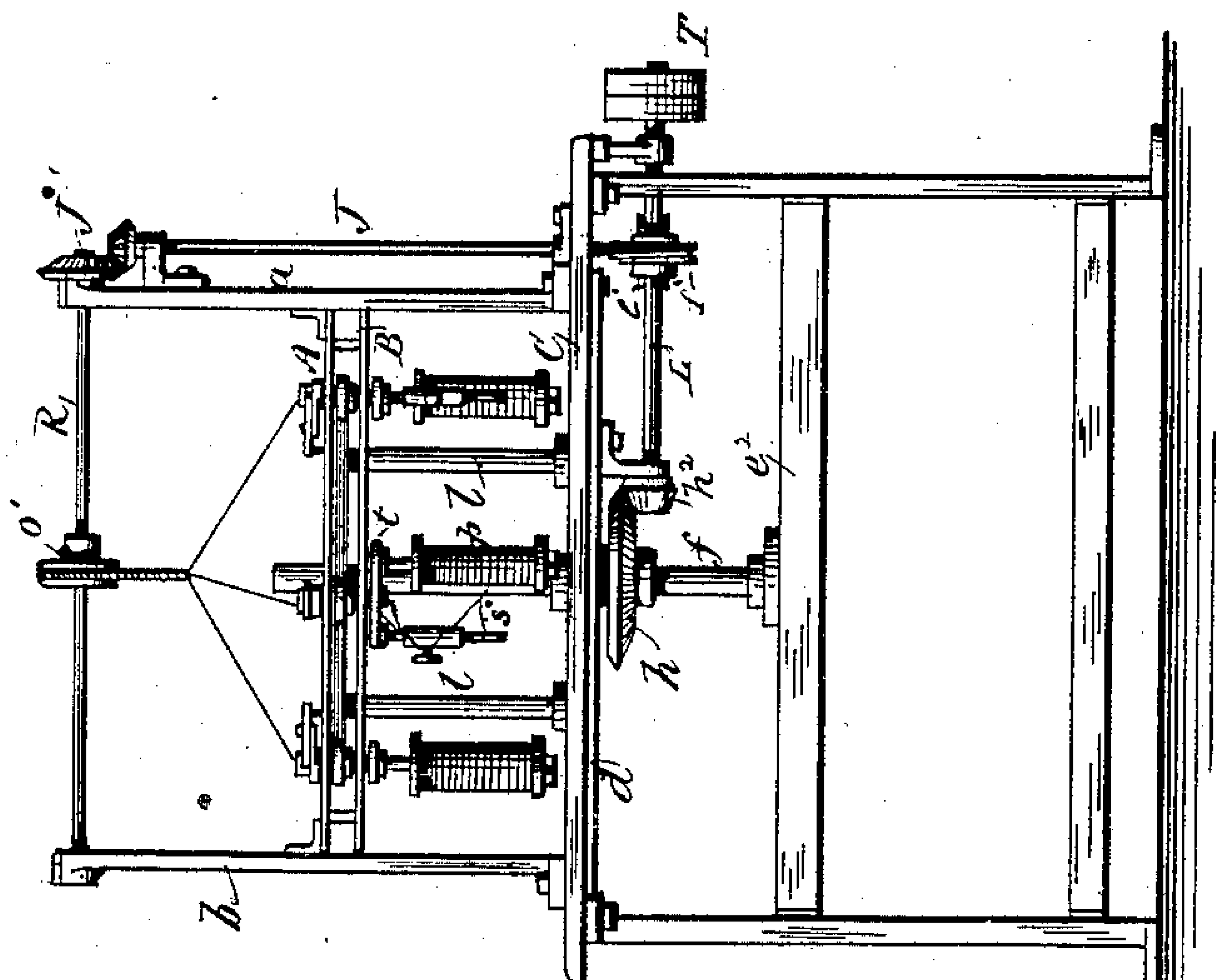

FIG. 1.

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(No Model.)

3 Sheets—Sheet 2.

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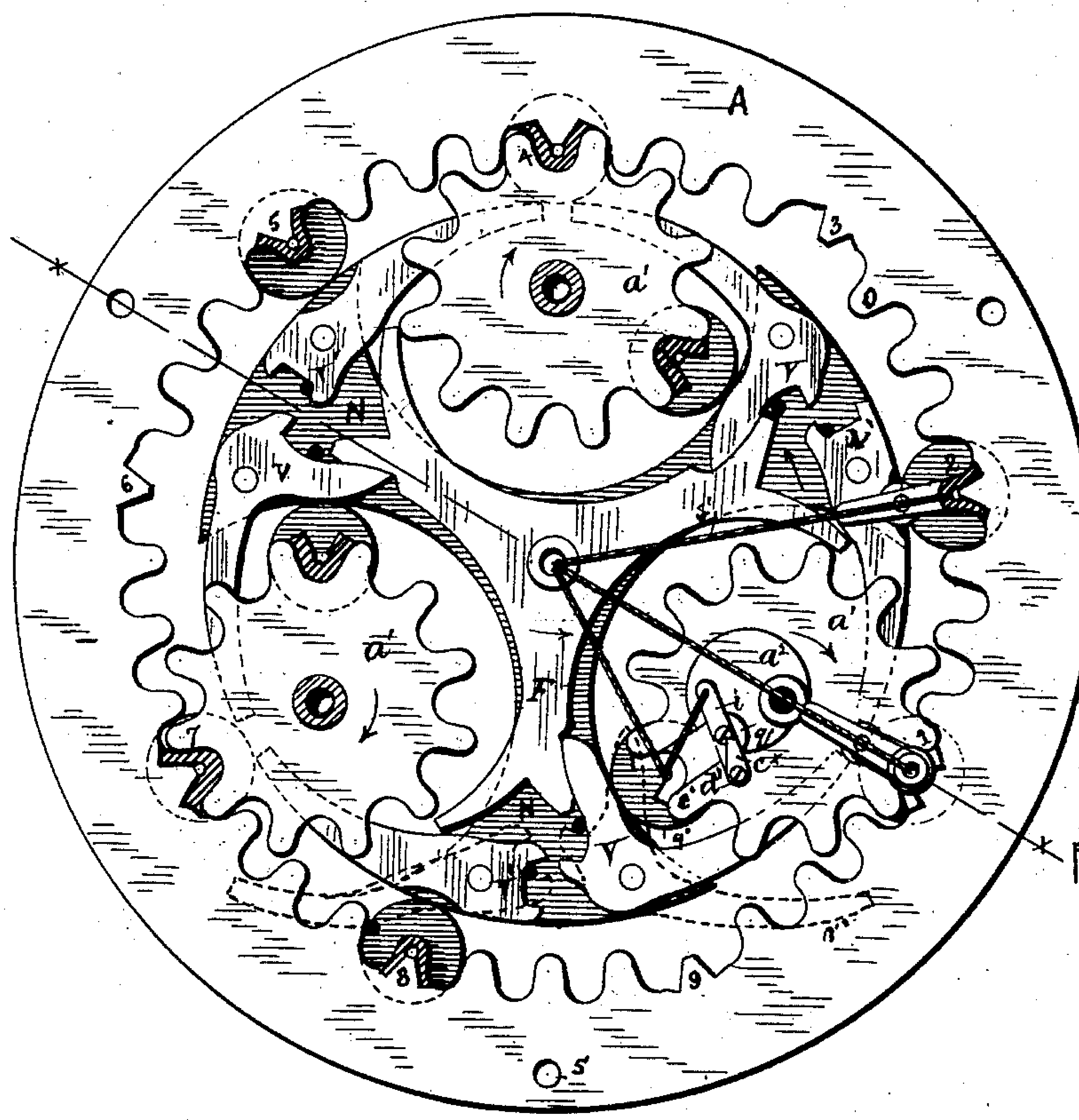

FIG. 3.

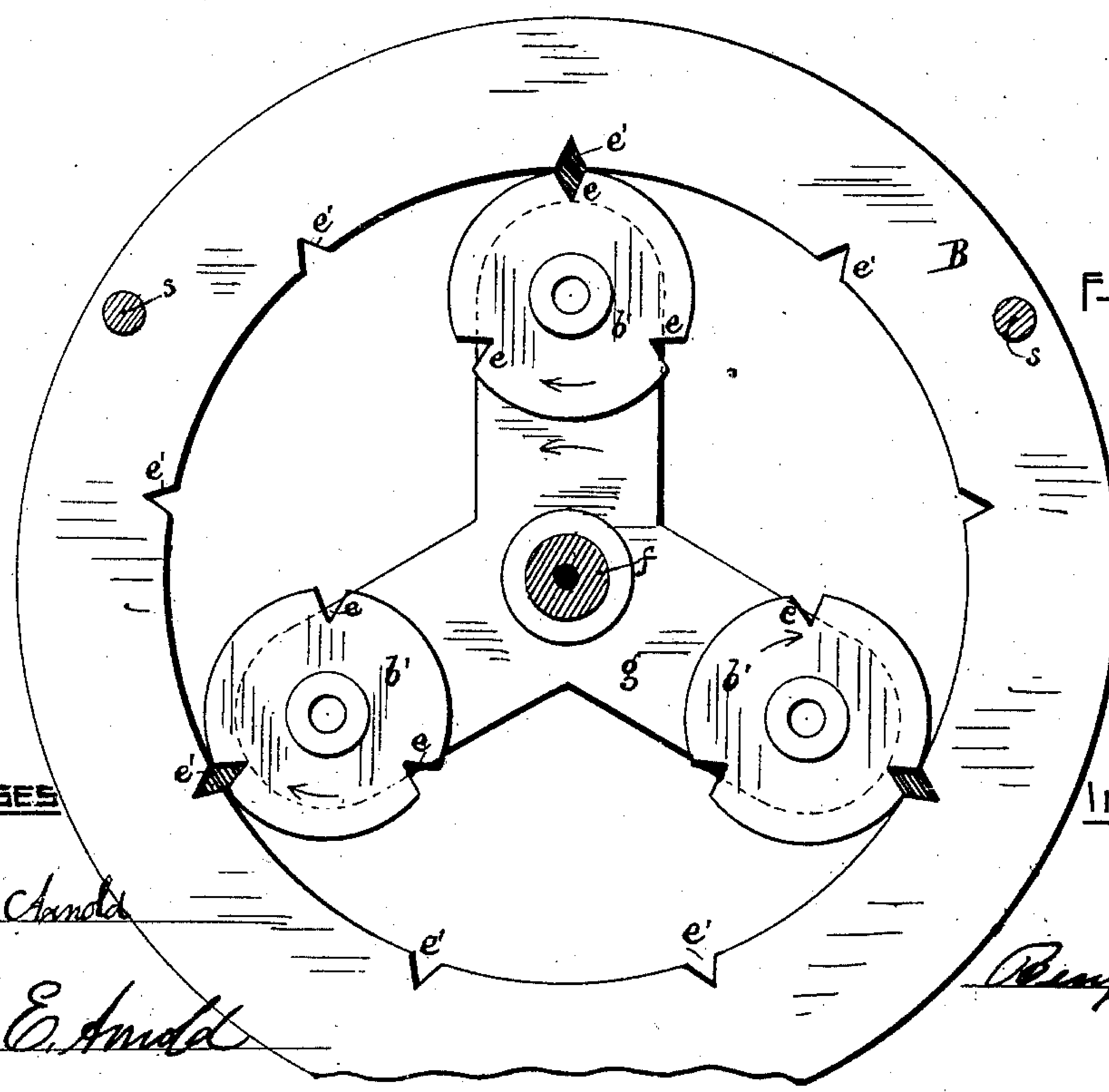

FIG. 4.

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(No Model.)

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Fig. 5.

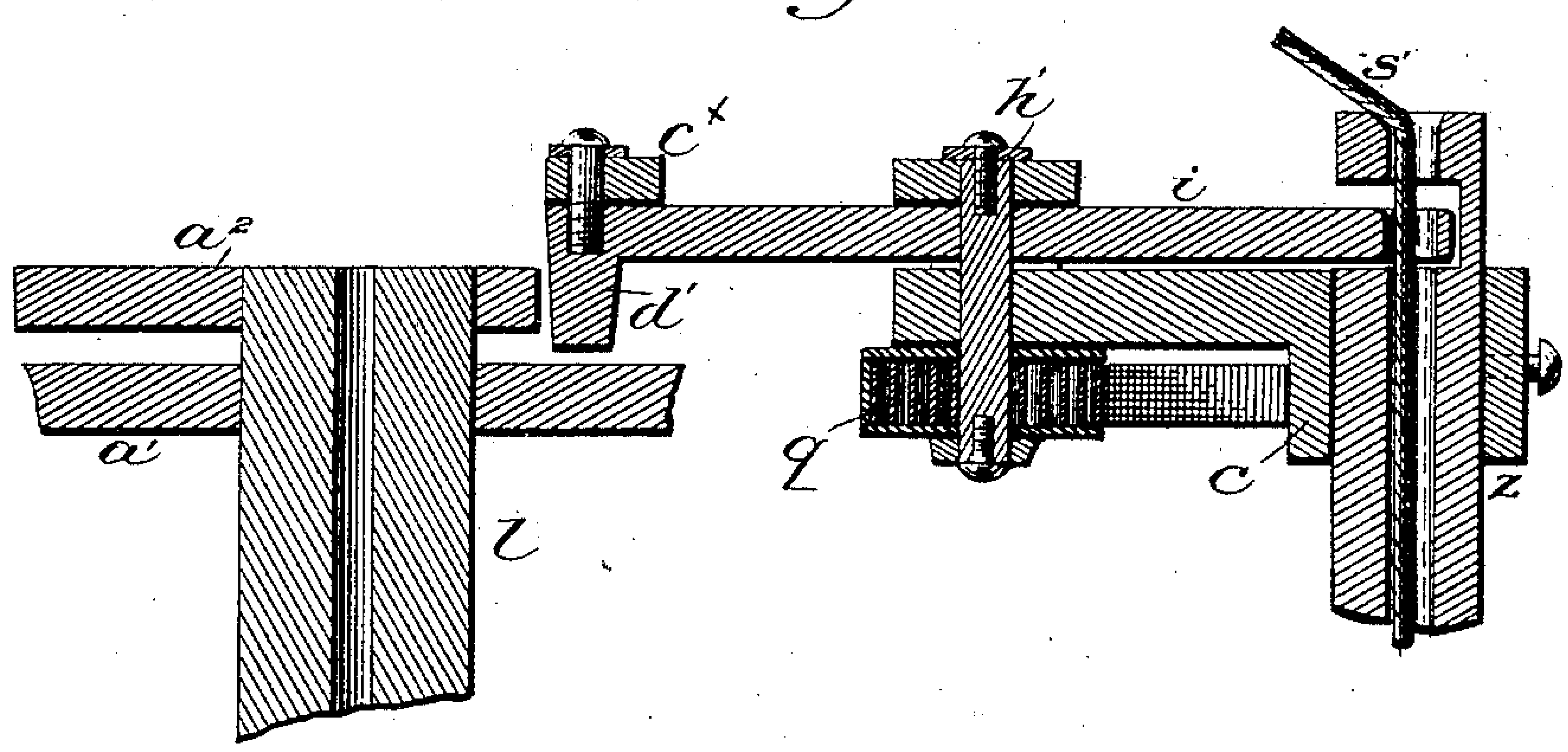
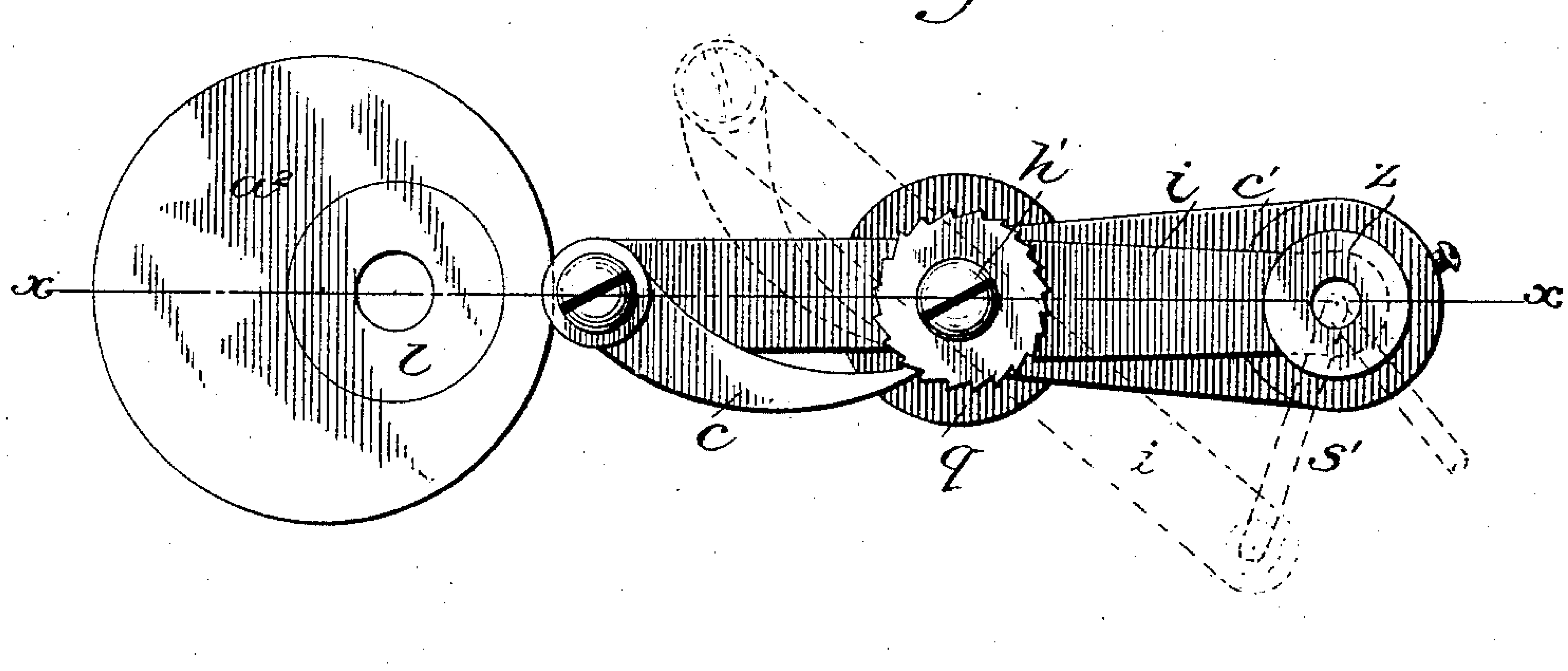


Fig. 6.



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UNITED STATES PATENT OFFICE.

BENJAMIN ARNOLD, OF EAST GREENWICH, RHODE ISLAND.

MACHINE FOR MAKING INTERLOCKED CORDAGE.

SPECIFICATION forming part of Letters Patent No. 353,396, dated November 30, 1886.

Application filed January 30, 1885. Serial No. 154,402. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN ARNOLD, of East Greenwich, in the county of Kent and State of Rhode Island, have invented certain new and useful Improvements in Machines for Making Interlocked Cordage; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to that class of cordage-machines used in making interlocked cord, in which the yarns forming the strands are changed from one strand to another in the process of twisting, thereby interlocking the strands with each other.

A machine embodying my invention is illustrated in the accompanying drawings, in which Figure 1 shows a front elevation of the machine. Fig. 2 shows a partial section of a part of the machine, taken through the line *x x*, Fig. 3. Fig. 3 is a top view of the plate A, showing the spool-carriers partly in section. Fig. 4 is a top view of the under plate, B, showing the lower disks, *b'*, and radial plate *g*, that supports them. Figs. 5 and 6 show enlarged sectional views of the tension devices on the top of one of the carriers, and coacting parts.

A is an annular plate made with gear-teeth *o* on its inner edge, some of which teeth are cut down to an inverted-V shape, 1 to 9, Fig. 3. The plate B, Fig. 4, is made like the plate A, except that instead of having gear-teeth it has V-shaped notches *e'* made in its inner edge at certain intervals agreeing with the points 1 to 9 in plate A.

The two plates A B are secured to each other at a certain distance apart by means of studs or bolts *s s*, and the top plate, A, is fastened at each side to the standards *a b*, that extend up from the table C. A round opening nearly the size of the plates A B is made directly under those plates and concentric with them. (See Fig. 2.) A bar, *d*, is placed across this opening in the table C, and fastened to the table at each end. A hole in the middle of this bar forms a bearing for the hollow shaft *f*, which also has another bearing on the bar e^2 below. A plate, *g*, consisting of a center piece and three radial arms equidistant from each other, is secured to the hollow shaft *f*, and a bevel-gear, *h*, is also made fast to the same shaft below the bar *d* for the purpose of driving it. A hollow vertical stud, *l*, is secured in the end of each arm of the plate *g*, and two disks, *a' b'*, are fitted to turn on the top of each of these studs. These disks *a' b'* are made fast to each other at the same distance apart that the plates A B are, and the upper disk, *a'*, of each pair has gear-teeth made on its periphery agreeing with the gear teeth *o o* in the plate A. The studs *l l* are placed in the arms of the plate *g*, so that the teeth of the disks *a'* shall engage and run in the teeth in the plate A. The lower disk, *b'*, of each pair is made just large enough to have its periphery meet the inner edge of the plate B, and has V-shaped notches *e e* made in its edge agreeing in the spaces between them with the notches *e' e'* in the plate B. (See Fig. 4.)

A guide-plate, N, is made fast to the hollow shaft *f* at such a distance from its top that the plate will come about midway between the plates A B in height. This plate N has semi-circular openings made in it, agreeing with the disks *a' b'*, and is placed so that the openings, which are larger than the disks, will be concentric with them, Fig. 3.

The spool-carrier that is used in the plates and disks consists of a center piece, *z*, (shown in section in Fig. 2,) one side of which, where it comes between the plate A and disks *a'*, is made in the shape of one of the teeth of the plate A, and is recessed on the opposite side, so as to fit on one of the inverted-V-shaped points 1 2, &c., of the plate A, and when in this position serves as a tooth in that plate, as seen in Fig. 3, in which some of the carriers are shown in section just above the plate A. When the carrier leaves the point in the plate and goes around a disk, it fits closely between two of the teeth, as seen in Fig. 3. That part of the center piece of the carrier that stands between the plates A B is made round, and has a friction-roll, *j*, Fig. 2, fitted to turn on it and run against the edge of the guide-plate N and the dogs *v v'*. Below the friction-roll *j* the carrier-center is made diamond-shaped to fill the space made when the V-shaped notches *e'* and *e* in the plate B and disk *b'* come together. (See Fig. 4.) A cross-bar, *t*, is attached to the carrier-center just below the plate B, at one end of which is a spindle, *r*, to hold the spool *p*, and at the other end of the bar a small rod, *y*, is placed to hold a tension-regulating device. A small hole is made in the lower end of the rod *y*, through which the thread *s'* passes from the spool *p*, and another hole near the upper end of the rod, which guides the thread, after it has passed the tension-regulating device, to the hole through the center of the carrier. (See Fig. 2 in section.) On the top of the carrier is a device for taking up the slack made in the thread between the top of the carrier and the finished cord when the carrier leaves the plate A and passes in around one of the disks *a'*. It consists of an arm, *c'*, attached to the carrier just above the plate A, on the outer end of which a lever, *i*, is pivoted near its center by pivot *h'*. One end of this lever is made just long enough to swing through a notch made in one side of the carrier, so that when the end of the lever is in the notch a hole in its end will agree with the hole through the center of the carrier.

An involute spring, *q*, Figs. 2 and 5, is put on the pivot of the lever *i*, under the arm that holds it. The inner end of the spring is made fast to the pivot *h'*, and the outer end is held by the hub of the arm *c'*. The head of the pivot *h'* has ratchet-teeth cut in it, into which a pawl, $c^{\times}$, Figs. 3 and 6, pivoted to the end of the lever *i*, catches to hold it. This arrangement is for the purpose of increasing or lessening the tension of the spring by winding it up on the pivot or unwinding it. The tension of the spring *q*, exerted through the pivot and pawl *c*, causes the end of the lever *i* to swing away from the carrier-center and draw out any slack of the thread made above the carrier.

A stud, *d'*, is put on the end of the lever *i*, on the under side, to bear against the cam-plate a^2, which is fastened to the top of the stud *l*, and is to be so shaped as to give a positive tension on the thread by moving the lever *i* more or less at any particular point in the course of the carrier around the disk *a'*.

The guide-plate N has a pair of dogs, *v* and *v'*, for each pair of disks *a' b'*, pivoted to it to govern the course of the carriers. The dogs *v'* serve to lengthen out the curved points of the plate N, to support the carriers in the plates A B and disks *a' b'*. The dogs *v* change the courses of the carriers from the plates A B to the disks *a' b'* and back. A plate, F, consisting of three prongs is placed loosely on the shaft *f*, and lies on the top of the plate N. (See Fig. 3.) The ends of the prongs are forked, and one part of each fork lies back of the end of one of the dogs *v*, while the other part of each fork projects over the edge of the plate N toward the disk *a'*, so as to be pushed back when a carrier passes it, and operate the dogs *v* in one direction by the other part of the fork. The dogs *v* are operated in the other direction by the carriers pushing against the inner ends of the dogs as they pass by them. The position of the dogs when it is desired to twist the cord in the other direction is changed by putting the dogs *v* in the places of the dogs *v'* and the latter in the places of the dogs *v*, and both the dogs and plate F are turned the other side up.

Any of the feed or take-up motions for braiding or cordage machines may be used with the mechanism above described. The one shown in the drawings consists of a horizontal shaft, R, held in bearings on the upper ends of the standards *a b*, to which is secured a grooved pulley, *o'*, placed on the middle of the shaft, so that its front edge will be over the center of the plate A. A vertical shaft, J, connects the shaft R with the driving-shaft L by means of the bevel-gears *j'* at the top of the shaft J, and a worm-gear, *l'*, fast on the lower end of the same shaft, which engages in a worm, *f'*, secured to the driving-shaft L. When the carriers are not between the plates A B, the disks *a' b'* thereof are held in their places between the teeth of the disks *a'*, or on the points of the plate A, by the friction-rolls *j j*, Fig. 2, which bear against the edge of the plate N, and also against the dogs *v v'*, where the plate N does not reach. This plate, where it partly surrounds the disks, supports the friction-roll for the same purpose.

To operate the machine, the spools of thread *p p* are placed on the carrier-spindles *r r*, and the thread *s'* carried through the hole in the lower end of the bar *y*, thence up over the tension-regulating device, through a hole in the upper part of the same bar to the hole up through the center of the carrier. The threads pass through the holes in the ends of the levers *i*, near the top of the carriers, and from the top of the carriers to the center over the hollow shaft, where, being joined together, they are carried up around the grooved pulley *o'* and off to a reel. Motion is then given to the upright shaft *f* through the driving-shaft L and the bevel-gears *h* h^2 by a belt on the pulleys T. With the shaft *f* revolves the plate *g*, carrying the studs *l l*, with the disks *a' b'*, also the plate N, carrying the dogs *v v'* and the plate F. As the disks *a' b'* revolve around the common center in the direction shown by the arrow on plate N, their teeth engaging in the stationary plate A causes them to revolve in the direction shown by the arrows on the disks *a'*, Fig. 3. This causes the disks *a'* to transfer the carriers from one point in the plate A to another point in the same plate, one-third of the circle away, each carrier in this transfer passing inside of two others. As all the disks operate in like manner, one with its carriers is taken to describe, that it may be more readily understood.

Referring to Fig. 3, the carrier 9', that was on the point 9 of plate A, is shown in the disk *a'*, and as its friction-roll presses against the tail of the dog *v*, it causes the other end of the dog to move over toward the disk *a'* and keep the carrier at the point 1 on plate A, which has just been around the disk in the plate A. When the carrier 9' in the disk *a'* has reached the opposite side of the disk, its roll will press against the prong of the plate F on that side and push it back, causing the other part of the prong to push the tail of the dog v toward the disk a', and move the other end of the dog under the plate A, as shown by the dotted lines r'. By this time the disk a', by revolving around the common center, will have arrived opposite the point 2 in plate A, and the dog v, in the position just described, and shown by the dotted lines, will transfer the carrier on point 2 from the plate A to the disk a', and when this last carrier has arrived at that place in the disk that is occupied by the carrier 9′ from the point 9 this latter carrier will be deposited at point 3 in like manner to the carrier at point 1, already described, and will have passed inside of the carriers on the points 1 and 2.

The dogs v' serve as extensions to the points of the guide-plate N, for when a carrier in a disk a' comes to one of these dogs the friction-roll simply pushes it back, so that the curve of its inner edge becomes a continuation of the circle of the plate N around the disk, and being held in this position by a pin in a recess at its end, it holds the carrier up firmly to the disk until it reaches the plate A, after which it is held in the plate A by the outer curve of the dog v until it is reached by the guide-plate N. When the plate N has passed and another of the dogs v' reaches the carrier, the dog is pushed in until the curve of its outside forms a continuation of the outer circle of the plate N, and in this position holds the carrier firmly in the plate A until the disk a' reaches it. It will be seen by this that the carriers are held firmly at all times, either on the points in plate A and notches in plate B, or in the disks a' b', by their friction-rolls resting against the edge of the guide-plate N or the dogs v v'. By means of the friction-rolls the carriers may be held much more firmly in position, as they remove nearly all the friction on the guide-plate and dogs.

The greatest difficulty to be overcome in machines for this purpose is to obtain the necessary tension on the thread forming the strands without increasing the strain on the spool-carrier, so as to interfere with its freedom of motion, and, consequently, with the speed of the machine. By placing the spools below the points of the supports of the carrier and bringing the delivery of the thread from the carrier down nearly to the plates that support it, and by putting a friction-roll on the carrier to run against the plate N and dogs, this difficulty is entirely overcome, and I am enabled to apply all the tension on the thread up to any degree below its breaking-point without interfering with the freedom of the motion of the spool-carrier. By means of the lever i and the spring q the slack in the thread when the carrier passes in around the disk a' is quickly taken up at the highest speed for light work, and for heavy work the cam a^2 will operate the lever i, so as to take up the slack and keep a positive equal strain on the thread at all times, and the tension may be increased at any point, if desired, by increasing the size of the cam at that place. The outward motion of the dogs v is made positive by the plate F, thereby avoiding one of the uncertainties which limit the speed of machines that use springs to move the dogs in one direction.

The shape and position of the carrier when on one of the points in the plate A is the same as one of the solid teeth of that plate, and it serves as such, being held in place by the point, and also prevented from turning by the diamond shape of the part that is held between the plate B and disk b' in the **V**-shaped notches e e', Fig. 4.

What I claim as my invention is—

1. An independent spool-carrier consisting of a perforated central body, by which it is supported and actuated in the machine, and a spindle located below the central body and its supports, for the purpose of holding the spool, substantially as and for the purpose specified.

2. The combination, with a spool-carrier, of the arm c, lever i, pivot h', and spring q, substantially as and for the purpose specified.

3. The combination of the spool-carrier, arm c, lever i, cam-plate a^2, and stud l with means for rotating the carriers around the cam-plate, substantially as and for the purpose set forth.

4. The combination of the plates N F, dogs v v', and spool-carriers with the plates A B and disks a' b', and mechanism for rotating the disks around the central axis of the machine, substantially as set forth, and for the purpose specified.

5. A spool-carrier shaped on one side, at the place where the plate A holds it, like a tooth of that plate, and having an inverted-**V**-shaped recess in its opposite side, in combination with the plate A, having teeth cut away to fit into the inverted-**V** shaped recesses, disk a', and stud l, substantially as and for the purpose set forth.

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Witnesses:

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