

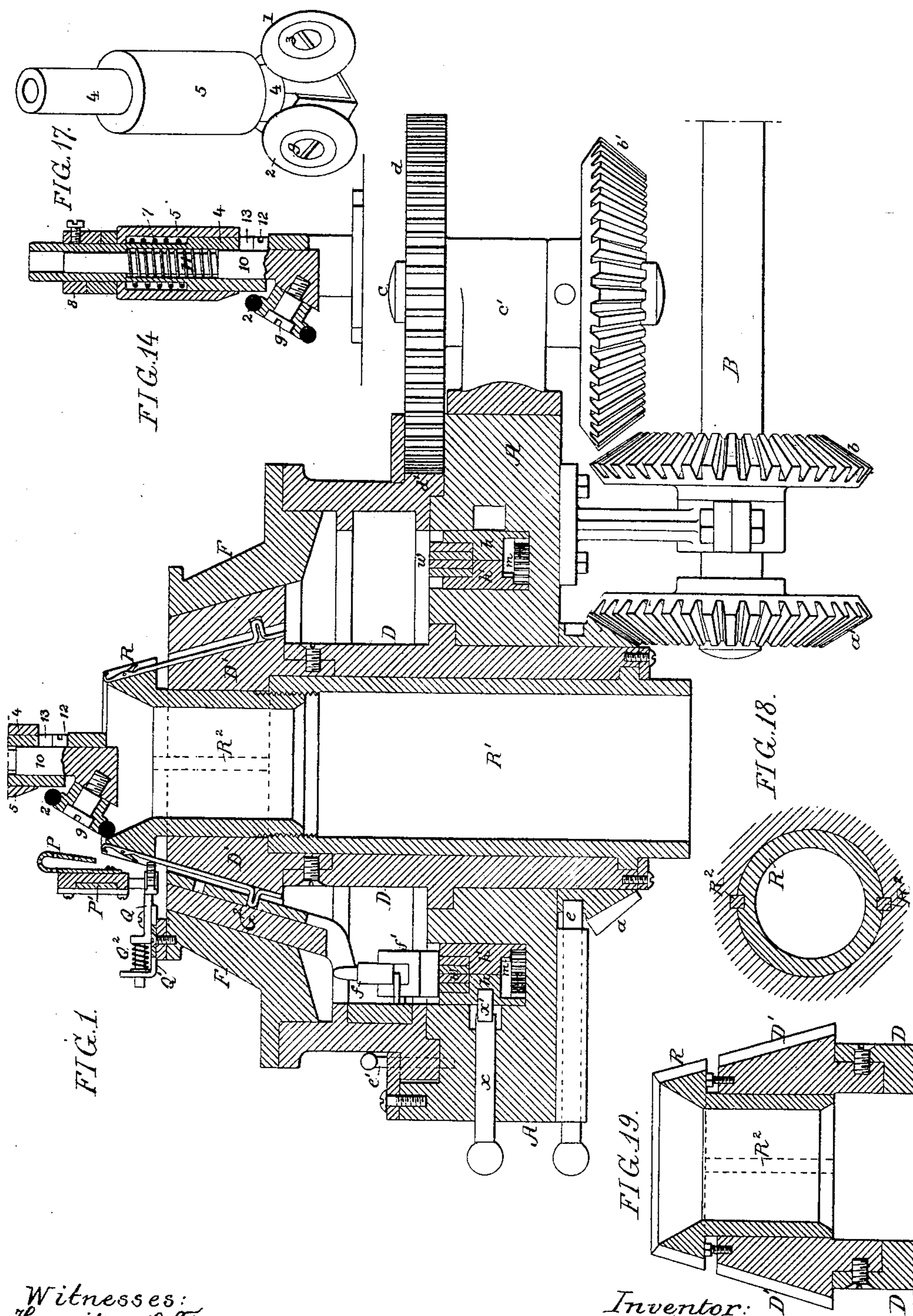
(No Model.)

4 Sheets—Sheet 1.

S. HENSHALL.
KNITTING MACHINE.

No. 386,819.

Patented July 31, 1888.



Witnesses:
Hamilton D. Turner,
Alex. Bankoff

Inventor:
Samuel Henshall
by his Attorneys
Gowson & Sons

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FIG. 2.

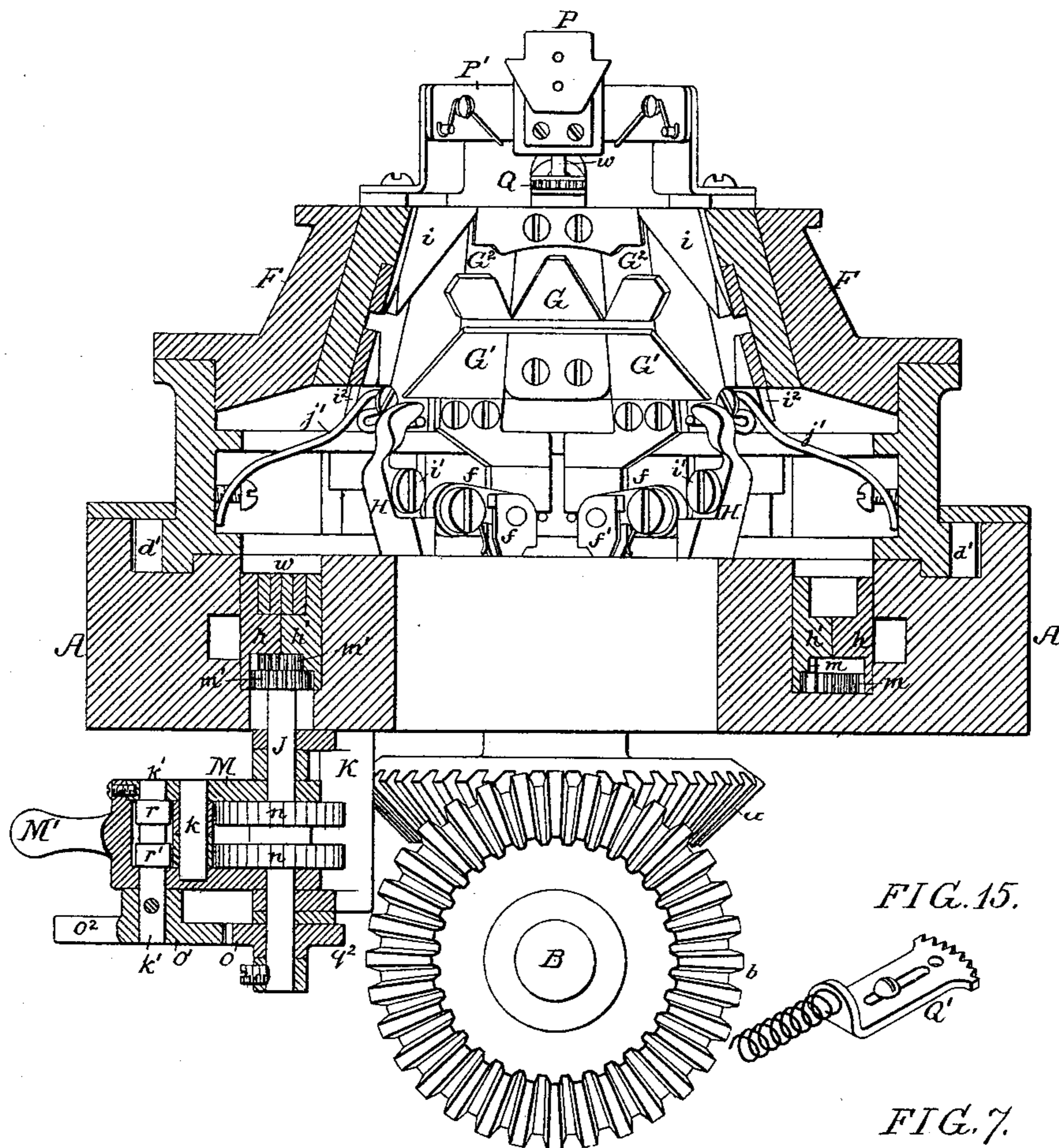
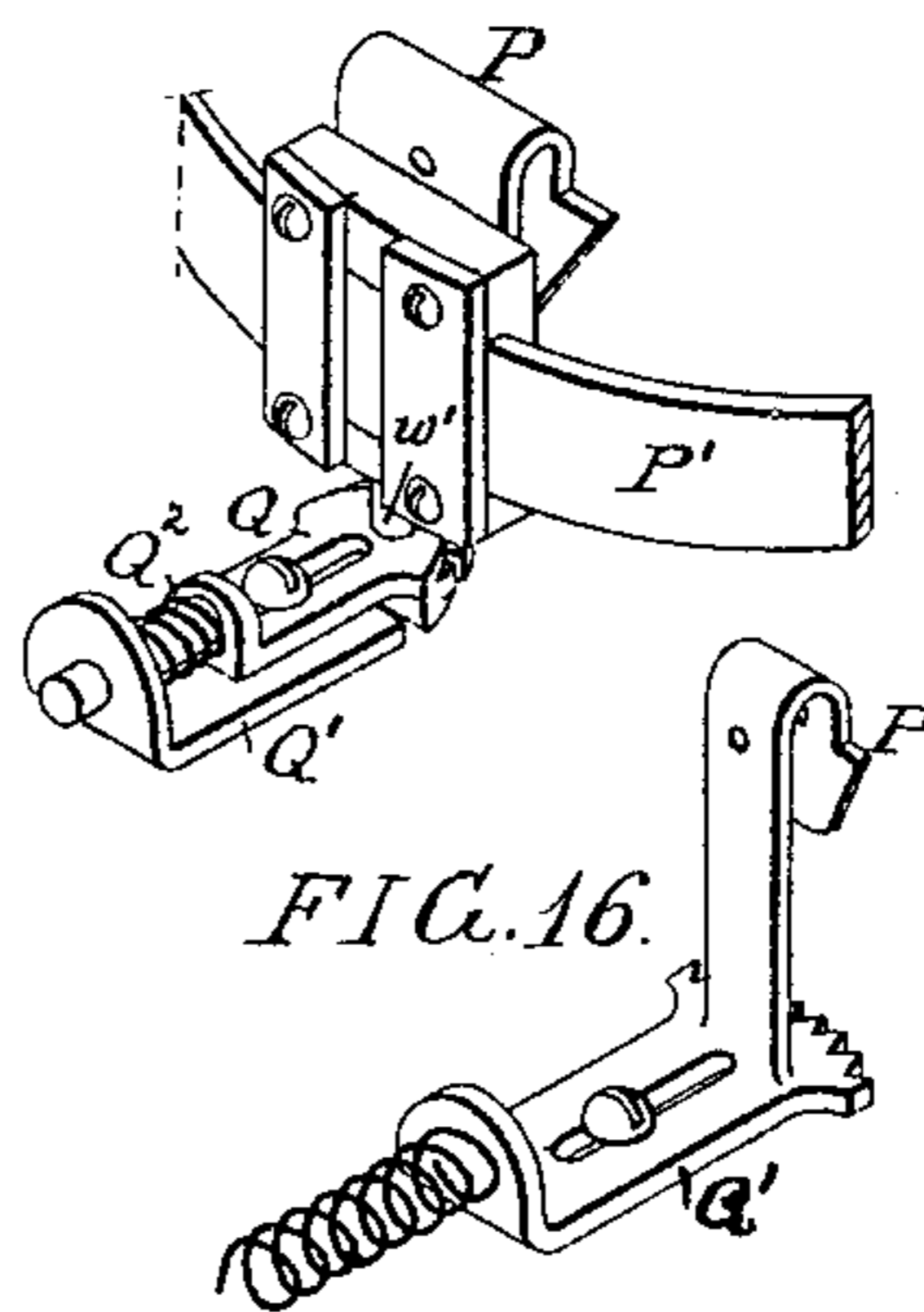
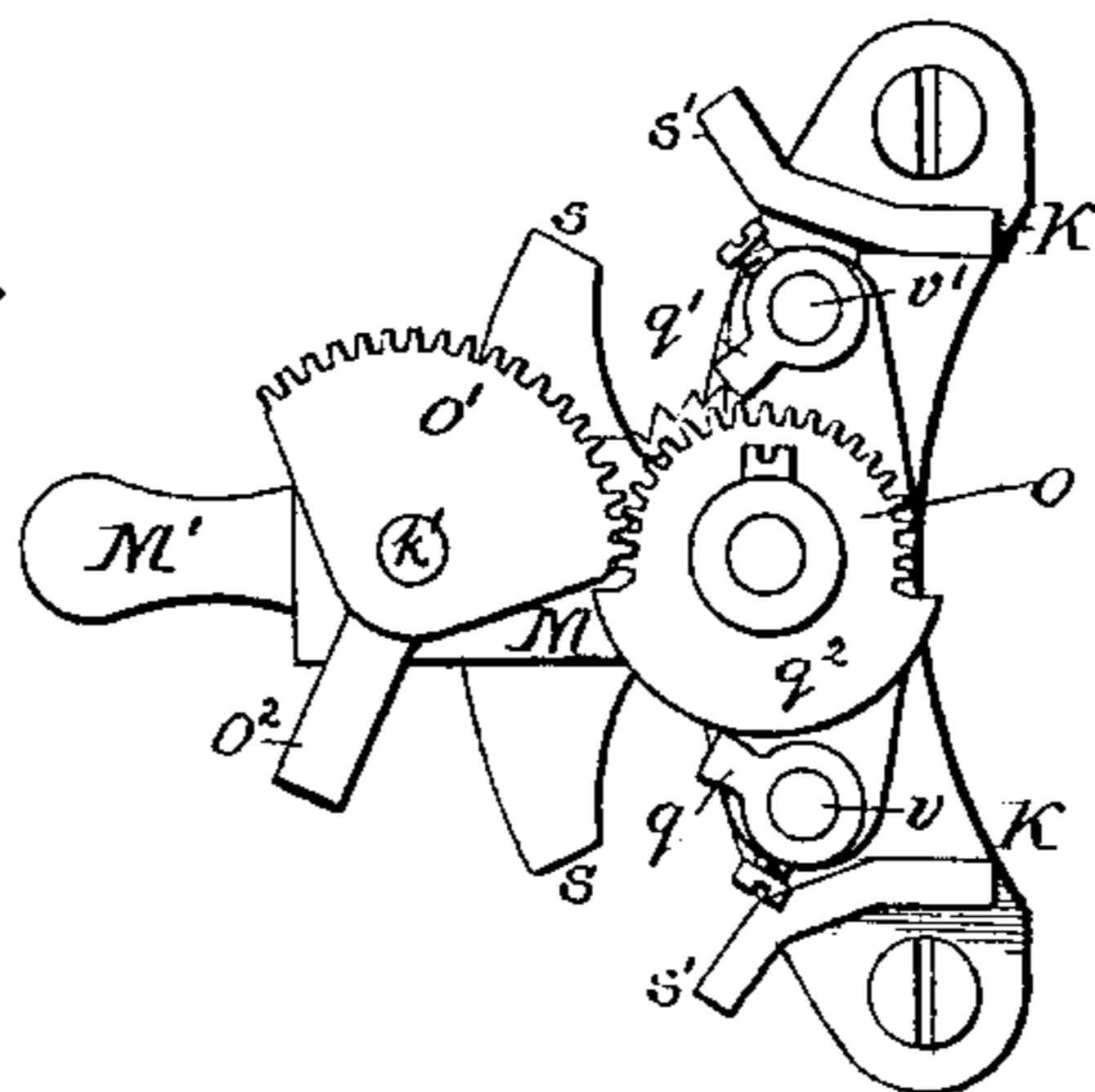
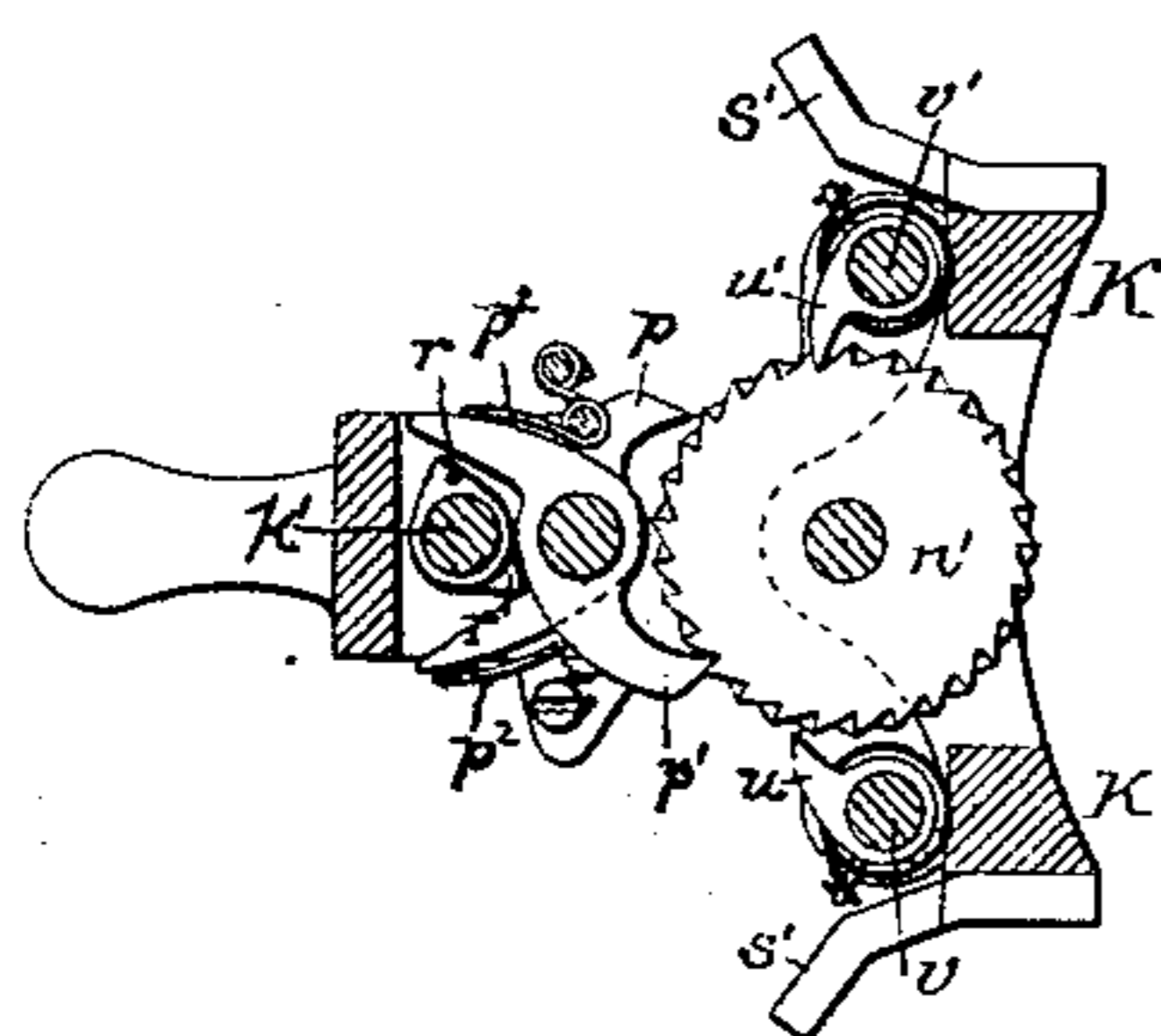


FIG. 15.

FIG. 7.

FIG. 5.

FIG. 6.



Witnesses:
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(No Model.)

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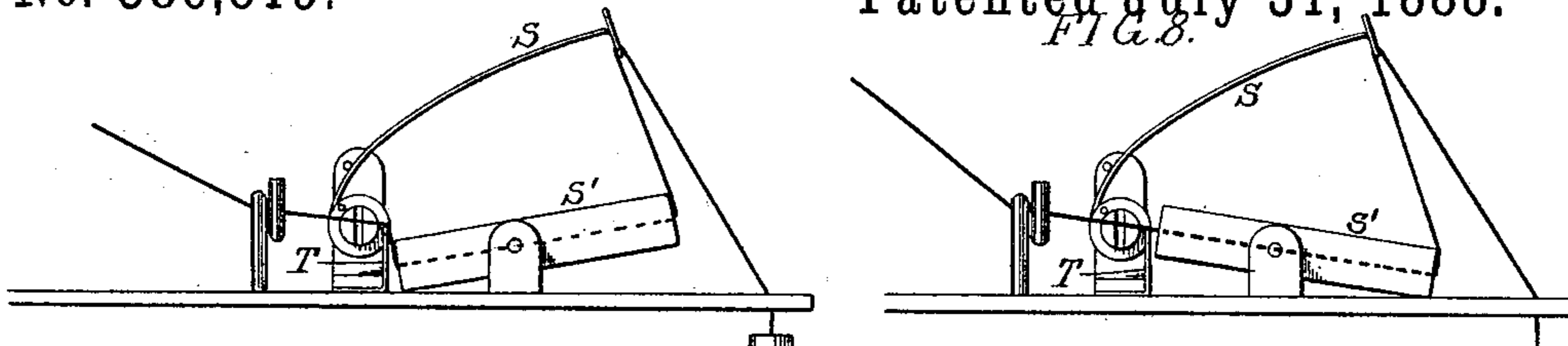


FIG. 3.

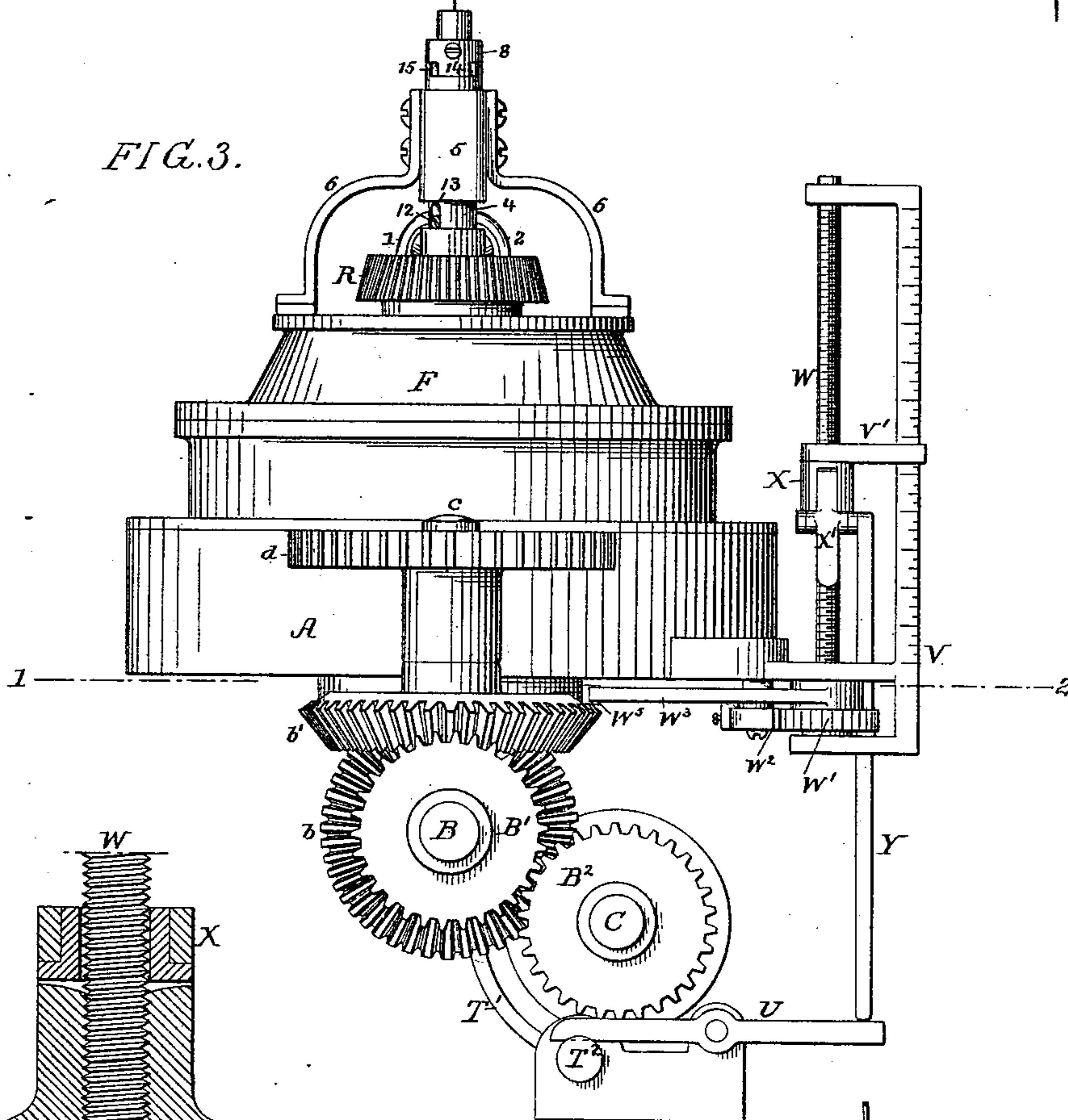


FIG. 10.

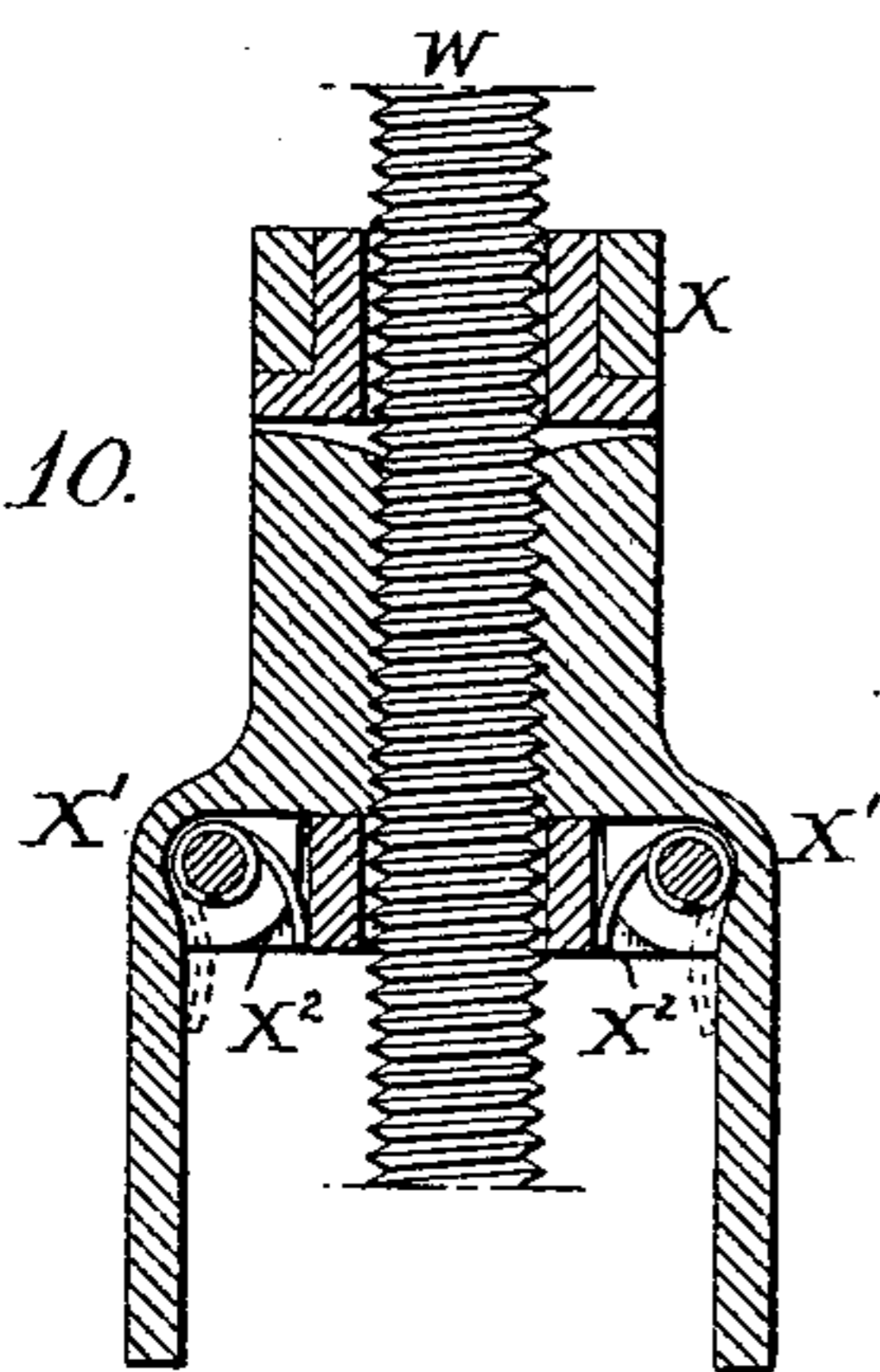


FIG. 11.

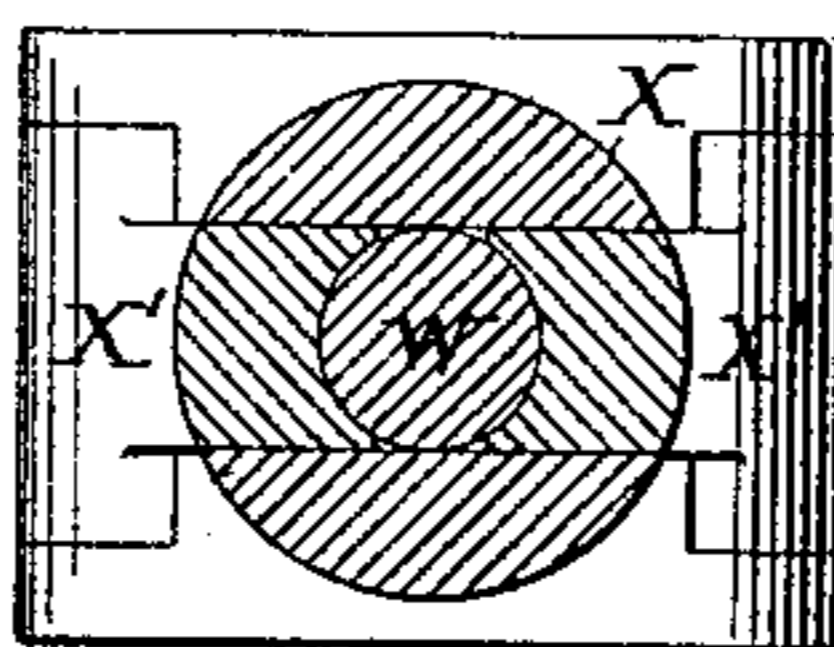
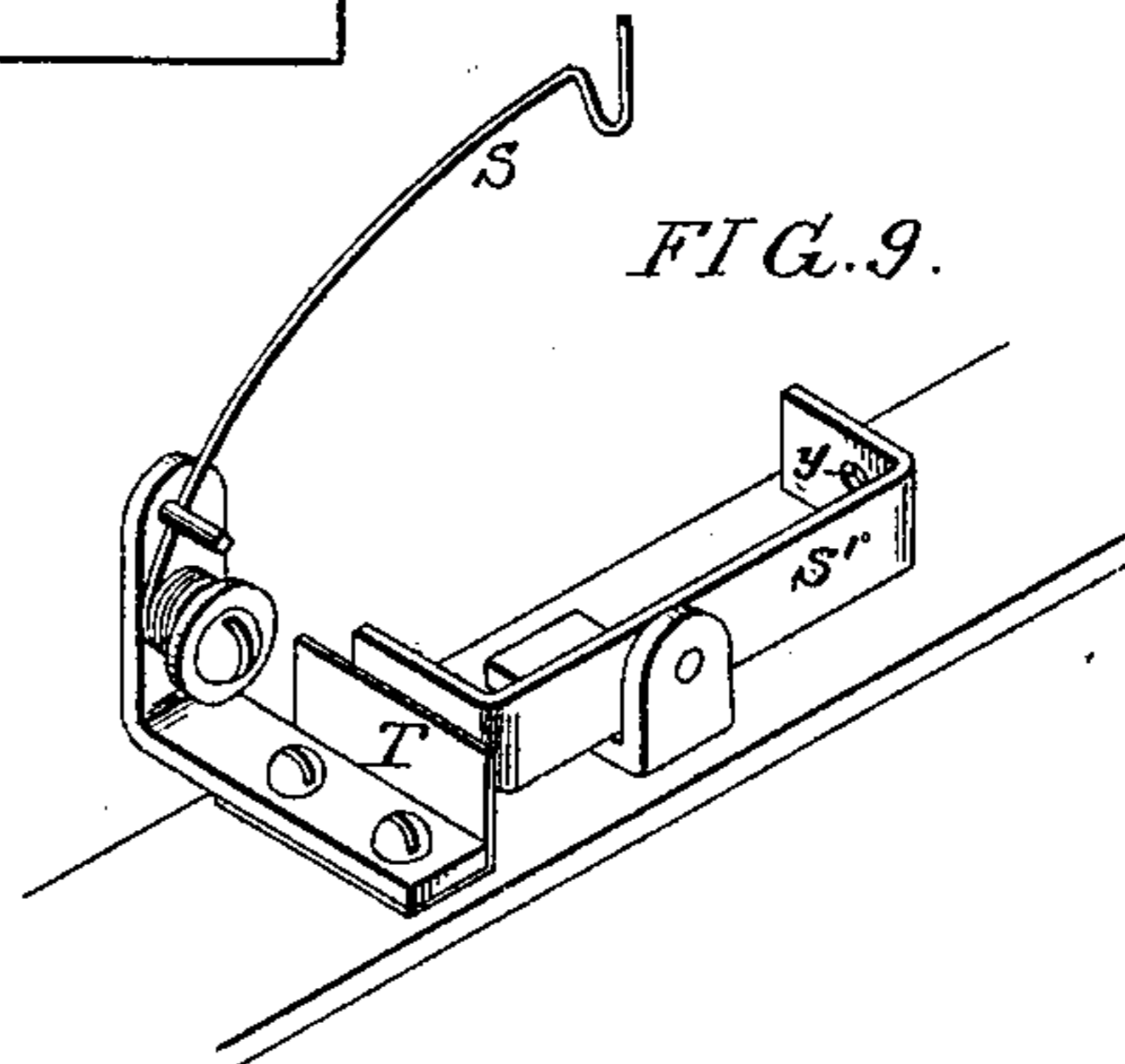


FIG. 9.



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(No Model.)

4 Sheets—Sheet 4.

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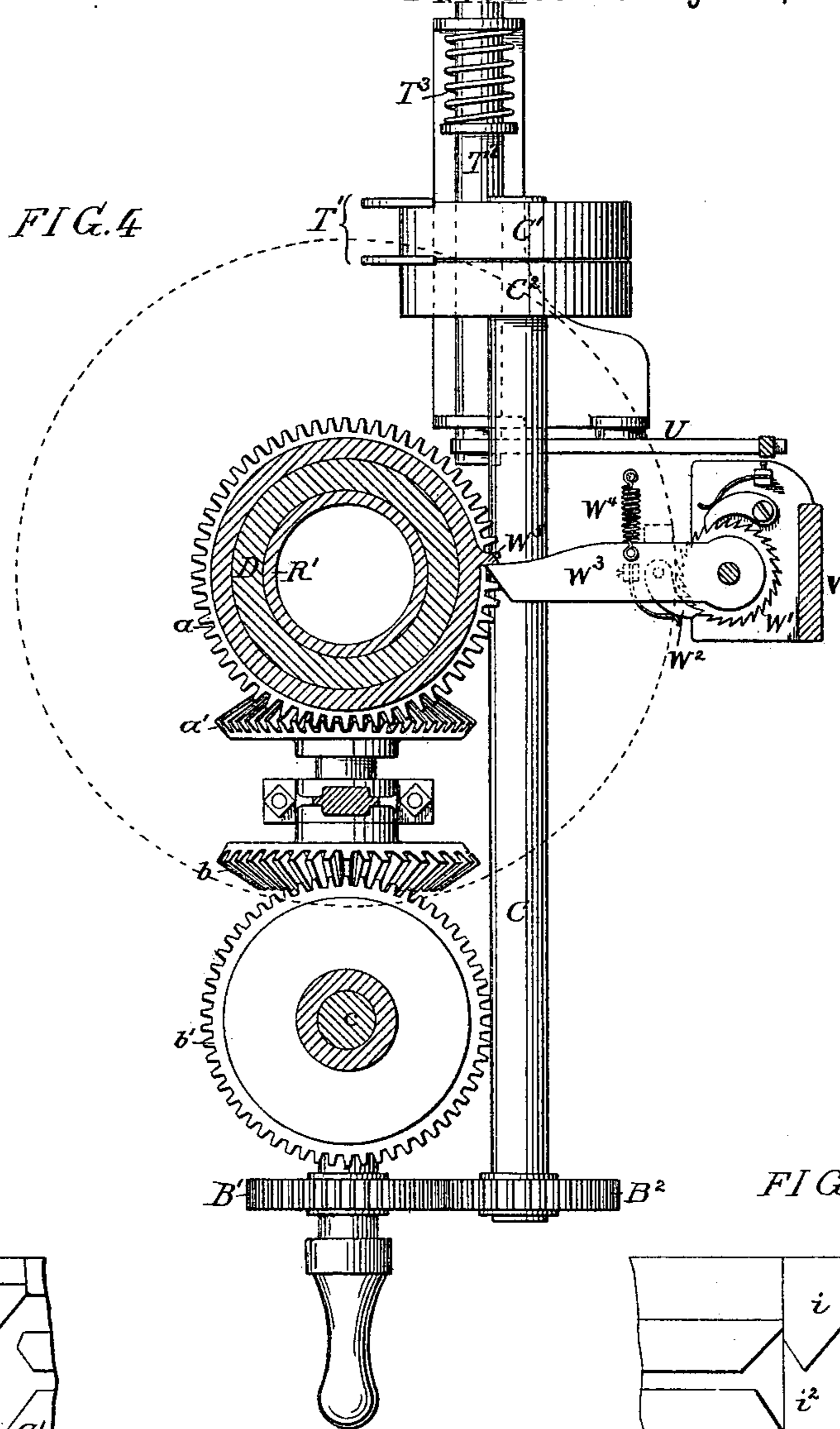
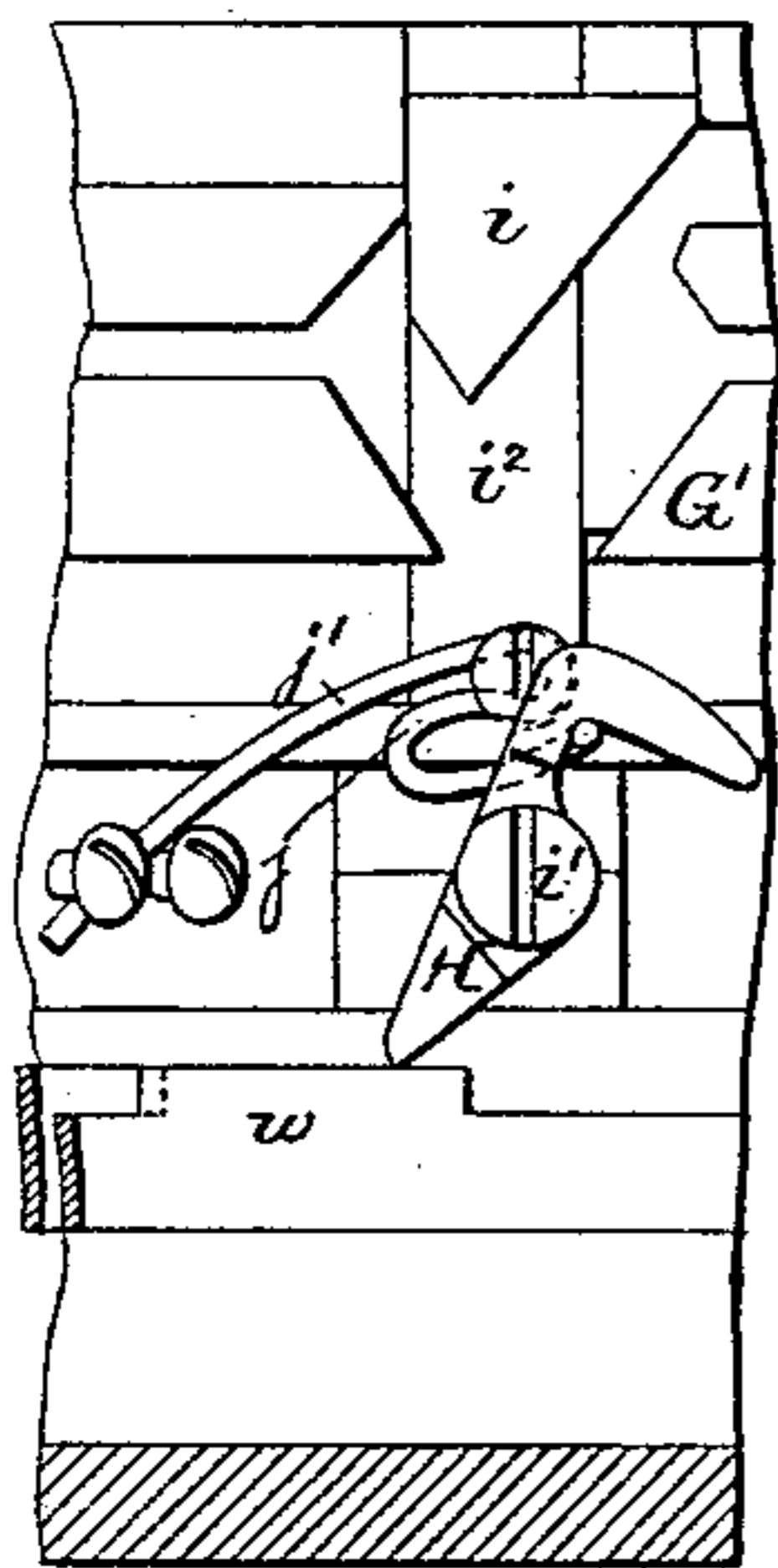
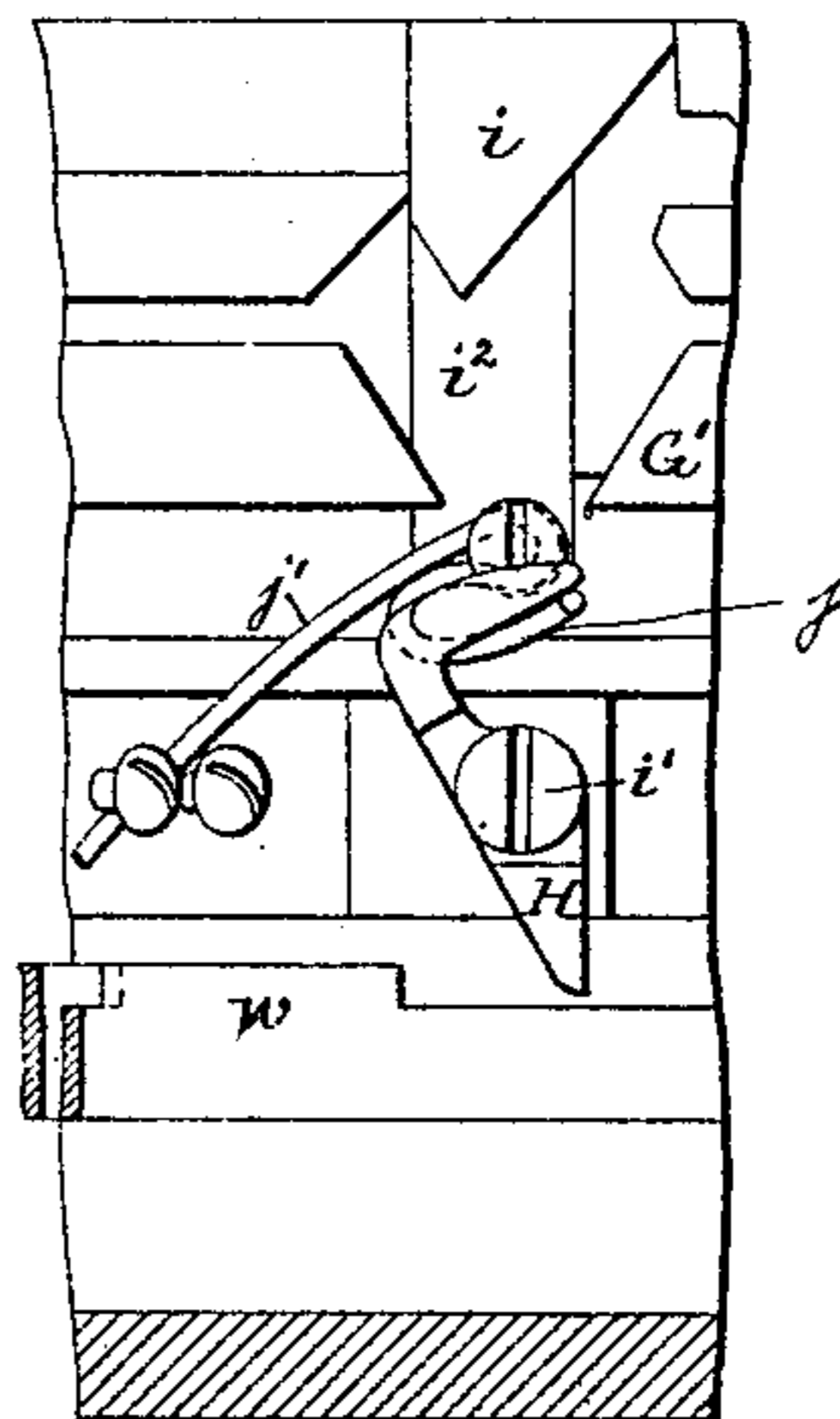


FIG. 12.

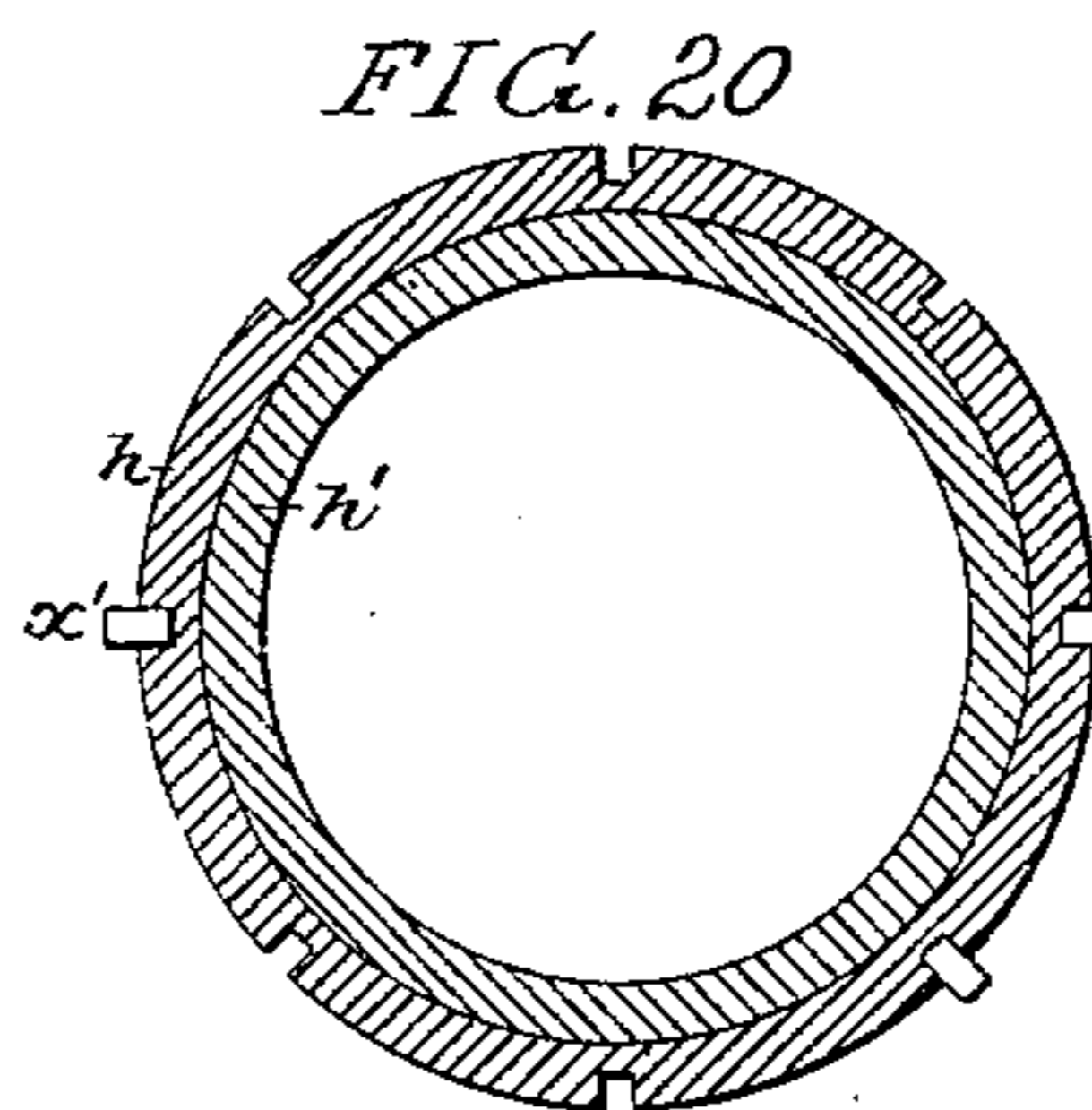


Witnesses:
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FIG. 13.



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UNITED STATES PATENT OFFICE.

SAMUEL HENSHALL, OF PHILADELPHIA, PENNSYLVANIA.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 386,819, dated July 31, 1888.

Application filed November 21, 1885. Serial No. 183,526. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL HENSHALL, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Knitting-Machines, of which the following is a specification.

My invention relates to a knitting-machine of the same general character as that for which I filed application for Letters Patent of the United States on the 6th day of October, 1884, Serial No. 144,957; renewed March 12, 1886, Serial No. 195,038.

The objects of my present invention are to simplify, in a measure, the construction of the machine and to perfect the operation of certain portions of the same.

In the accompanying drawings, Figure 1 is a longitudinal section of a circular-knitting machine with my improvements; Fig. 2, a transverse section of the same without the needle-cylinder; Fig. 3, an end view of the machine on a reduced scale and illustrating features of the invention not shown in Figs. 1 and 2; Fig. 4, a sectional plan on the line 12, Fig. 3; and Figs. 5 to 20, inclusive, detached views illustrating the construction of certain portions of the machine.

A is the fixed frame of the machine, on which are suitable bearings for the main or driving shaft B and for the needle-cylinder D and cam-box F.

The lower end of the needle-cylinder is provided with a bevel-wheel, *a*, gearing into a bevel-pinion, *a'*, on the shaft B, which is also provided with another bevel-pinion, *b*, adapted to gear into a bevel-wheel, *b'*, on a shaft, *c*, which has a bearing in a bracket, *c'*, on the frame A, and is provided with a spur-wheel, *d*, gearing into an annular rack, *d'*, on the cam-box F. The shaft B is movable in its bearings, so that either of the pinions thereon may be thrown into gear with its respective bevel-wheel, and rotary movement may thereby be imparted either to the needle-cylinder or cam-box, a bolt, *e*, serving to lock the cylinder to the fixed frame when the cam-box is being rotated, and a bolt, *e'*, serving to lock the cam-box to the fixed frame when rotary movement is being imparted to the cylinder. The machine has a central fixed cam, G, and opposite cams, G', carried by guided slides G², which are acted on by arms *f*, each provided with a pivoted toe, *f'*, under control of ribbed

bars *w*, carried by rings *h h'*, adapted to a recess in the lower portion of the frame A, the rings and bars being operated so as to expand and contract the rib, and thus determine the operation of the needles, as in my former machine above alluded to. In the former case, however, the rings were adapted to a recess in the needle-cylinder and rotated with the same, so as to cause friction even when the ribbed bars were not in action—as, for instance, when the cylinder was rotated continuously in the same direction in the production of a knitted tube. In the present machine the rings have no rotating movement with the cylinder, the latter being thrown out of action when it is desired to form a heel or toe upon a knitted tube, and a reciprocating movement being imparted to the cam-ring, so as to carry the toes *f'* of the arms *f* over the ribbed bars, instead of moving said bars beneath the toes, as in the former machine.

In order to prevent the stretching of the work upon the needles not in action when forming the toe or heel upon a knitted tube, I provide for the automatic release of the drawing-down cams *i i* after they have effected the proper downward movement of the last needle of the set which is in action, this automatic release of the drawing-down cams being effected by placing the same under the control of levers H, hung to pins *i'* on the cam-box and acted upon by the ribbed bars which act upon the toes of the arms *f*. As long as the lever is under control of the rib, the drawing-down cam will be held in the depressed position, as shown in Fig. 12; but as soon as the lever passes from under the control of the rib it permits the elevation of the cam *i*, by reason of its spring *j'*, as shown in Fig. 13.

The lever may act upon a pin projecting directly from the slide *i'* of the cam *i*; but it is preferable to cause the lever to act upon a projecting end of the cam-spring *j'*, as shown, so that if there is any obstacle to the descent of the cam the spring will yield and prevent breaking of the parts.

The rings *h h'*, which carry the ribbed bars for operating the cams, are, as in the former machine, provided with racks *m*, gearing into spur-wheels *m'* on a shaft, J, the rack of one ring being internal and that of the other external, so that as the shaft J is rotated movement in opposite directions will be imparted

to the two rings, this movement effecting the expansion or contraction of the bars carrying the rib for operating the cams, as fully set forth in my former application.

5 The shaft J is adapted to bearings in a frame, K, which is screwed or otherwise secured to the under side of the frame A, the opening in the latter being large enough to permit the spur-gears m' to be passed up from below into
10 gear with the racks m , so that no accurate fitting is required, such as would be necessary if the shaft J had a bearing in the frame A.

The frame K in the present machine is simply secured to the frame A in the position
15 which it assumes when the spur-gears are properly meshed with the racks of the rings $h h'$. The frame K also carries the gearing whereby movement is imparted to the shaft J for the purpose of operating the rings $h h'$.

20 To the shaft J are secured two ratchet-wheels, n and n' , one right-handed and the other left-handed, and hung to the shaft is a swinging frame, M, having an operating handle, M' , and having a pin, k , to which are hung two
25 pawls, $p p'$, one for the wheel n and the other for the wheel n' , each pawl being acted upon by a spring, p^2 , which tends to keep it in engagement with its respective ratchet-wheel. The frame M also carries a pin, k' , on which
30 are two cams, $r r'$, the former being adapted to act on a toe of the pawl p , while the cam r' is adapted to act upon a toe of the pawl p' , the effect of this action being to remove the pawl from engagement with its ratchet-wheel, but
35 the cams being such that when one pawl is under control of one of said cams the other pawl will be free from the control of the other cam.

The frame M is vibrated by the attendant to an extent permitted by the contact of projec-
40 tions s upon said frame with stops s' upon the frame K, so as to impart movement to a like extent to one of the ratchet-wheels $n n'$, the direction of the movement thereby imparted to the shaft J depending upon which of the
45 pawls $p p'$ is in engagement with its ratchet-wheel, and this in turn being determined by the adjustment of the pin k' .

The ratchet-wheel n has a retaining-pawl, u , and the wheel n' a similar pawl, u' , these
50 pawls being carried, respectively, by shafts $v v'$, adapted to bearings in the frame K, and having arms $q q'$, acted upon by a cam, q^2 , free to turn on the lower portion of the shaft J, this cam having a segmental rack, o , which is in gear
55 with a similar rack, o' , secured to the lower end of the pin k' , and provided with a handle, o^2 , by which it may be operated, the effect of this construction being to throw the retaining-pawl into gear with each ratchet wheel as the
60 operating-pawl is thrown into gear therewith.

In order to properly feed the thread to the needles of the machine, it is necessary that the thread-guide should be in advance of the needles as they rise to take the thread; hence it
65 is necessary to shift the position of the thread-guide at the commencement of each reciprocating movement of the machine when the lat-

ter is forming the heel or toe portion upon a knitted tube. I therefore mount the guide P
upon a segmental bar, P' , secured to the cam-
ring F, a pin, w' , on the guide being under
70 control of a bar, Q, which is guided on a pivoted plate, Q' , and is acted upon by a spring, Q^2 , the tendency of which is to maintain the
75 toothed front end of the bar in engagement with the notched head R of the needle-cylinder. As a result of this construction, the lever formed by the sliding bar Q and pivoted
plate Q' will be shifted in one direction or the
80 other on each change in the direction of movement of the machine, and the thread-guide P will be moved on the bar P' , so as to keep the
thread constantly in advance of the rising needles on either movement.

It is not necessary that the lever controlling
85 the thread-guide should be formed of a sliding bar and pivoted plate, as the plate Q' itself may, if desired, constitute a lever controlling the thread-guide, the inner end of the plate being
acted upon directly by the needle-cylinder, and its outer end forming a bearing for
90 the spring Q^2 , the plate being slotted for the reception of the pivot-pin, as shown in Fig. 15; or the plate constructed in this way, so as to constitute a lever, may itself carry the
95 thread-guide, as shown in Fig. 16; but the use of an independent thread-guide carried by a segmental bar is preferred.

The work is prevented from rising on the needles by means of rollers 1 2, one of which
100 acts on the work in advance of the ascending needles and the other in the rear of the descending needles. The roller 1 is carried by a stud, 3, on a sleeve, 4, which is guided in a
tube, 5, supported by brackets 6 above the
105 needle-cylinder, the sleeve being acted upon by a spring, 7, which tends to depress the same to an extent permitted by contact of a collar, 8, on the sleeve with the upper end of the tube 5.
The roller 2 is carried by a stud, g , on a rod, 10, which is guided in the sleeve 4, and is acted
110 upon by a spring, 11, vertical play of the rod in the sleeve to an extent limited by a pin, 12, and slot 13 being thus permitted. The collar 8 has a lug, 14, adapted to a recess, 15, in the
115 tube 5, the recess being of slightly greater width than the lug, so as to provide for lost motion on each change in the direction of movement of the machine, thus permitting the
roller which follows the descending needles on
120 one movement of the machine to assume a proper position in respect to the ascending needles on the succeeding movement in the reverse direction. The rollers are preferably
125 clothed with rubber or other yielding material, and are independent of each other in their pressing action, owing to the yielding connection between the rod 10 and sleeve 4. The
needle-cylinder D is tapered, as in the former
130 machine, so as to provide ample room for the cam-operating devices below the cam-ring without corresponding coarseness in the gage of the machine. If the cylinder is in one
piece, however, as in the former machine, there

can be no adjustment for the purpose of regulating the slackness of the work; hence I provide the cylinder in my present machine with an independent head, R, which can be
 5 adjusted vertically in respect to the main cylinder, this adjustment being effected in the present instance by the engagement of the threaded lower end of said head with the threaded upper end of a sleeve, R', vertically
 10 confined to the cylinder D, but free to turn therein, the head R being prevented from turning by splines R², as shown in Figs. 1 and 18, so that the rotation of the sleeve R' will effect the raising or lowering of said head R. I do
 15 not, however, desire to limit myself to this particular means of adjusting the head, as other means of adjustment are available; for instance, the head R may be adjusted by means of set-screws, as shown in Fig. 19, or other
 20 means of adjustment, such as will readily suggest themselves to those familiar with this class of machinery, may be employed.

The widening and narrowing operation can be performed upon either half or upon both
 25 halves of the tube which is formed in the machine. Thus after performing the operation upon one half of the tube the cam-ring may be released from the driving-shaft and the needle-cylinder unlocked from the fixed frame,
 30 turned to the extent of half a revolution, and again locked to the frame by the engagement of the bolt e with an opening opposite the first. (See Fig. 1.)

The frame A carries an adjustable pin, x, the inner end of which projects into an annular recess in said frame, and serves by contact
 35 with pins x', carried by the outer ring, h, to limit the extent of movement of said ring, and consequently determine the limits of the widening and narrowing operation, and these limits
 40 may be governed by adjusting the pins nearer to or farther from each other, the ring h being provided with a number of openings for this purpose. (See reduced view, Fig. 20.)

In order to provide for taking up the slack of the thread when the machine is being reciprocated to effect the widening or narrowing of the toe or heel portion of the tube, I use
 45 an ordinary spring take up, S; but in order to prevent said take-up from drawing from the spool instead of taking up the slack at the feeder, I combine with the same a lever, S',
 50 having opposite bent ends, in which are eyes for the passage of the thread, the latter first passing over a plate, T, adjacent to one end of the lever.

So long as there is proper tension on the thread between the spool and the plate T, the lever S' is held in the position shown in Fig.
 60 8, and thus provides a straight course for the thread; but as soon as the latter commences to run loose from the spool the lever assumes the position shown in Fig. 3, causing an abrupt
 65 bend in the course of the thread from the plate T to the eye in the inner end of the lever and imparting such tension to said thread that the

spring will not draw upon the same in preference to taking up the slack at the feeder.

It is advisable to provide for the automatic stoppage of the machine after a certain length
 70 of plain tubular fabric has been produced and a point has been reached where the formation of a toe or heel portion upon the tube is necessary. This automatic stopping of the machine I effect by means of devices shown in
 75 Figs. 3, 4, 10, and 11.

The driving-shaft B of the machine is driven by spur-gears B' and B² from a counter-shaft, C, on which are the usual fast and loose pulleys, C' and C². A belt-shifter, T', is carried
 80 by a rod, T², suitably guided on the fixed frame of the machine and acted upon by a spring, T³. When the machine is running, this rod T² is held in the position shown in Fig. 4, so as to direct the driving-belt to the fast pulley C',
 85 a catch-lever, U, engaging with a notch in the end of the rod T² to retain it in this position. When the lever U is tripped, however, so as to release the rod, the spring T³ drives said rod
 90 inward and the shifter T' carries the belt from the fast pulley to the loose pulley, thus stopping the machine.

In order to effect the automatic tripping of the lever U, I mount in bearings in a frame, V, at one side of the machine a screw-shaft,
 95 W, a ratchet-wheel, W', on which is acted upon by a pawl, W², carried by an arm, W³, hung loosely to the screw-shaft and acted upon by a spring, W⁴, and by a toe, W⁵, on the needle-cylinder, so that on each rotation of the latter
 100 the ratchet-wheel will be moved to the extent of one or more teeth.

Free to slide on the screw-stem W is a sleeve, X, having levers X', the upper arms of which are threaded for adaptation to the screw-shaft
 105 W, these levers being acted upon by springs X², which tend to keep the threaded arms in engagement with said screw-shaft. By depressing the lower arms of the levers, however, the threaded upper arms of the same are
 110 removed from engagement with the screw-shaft, so that the sleeve X can be adjusted by hand to any desired position thereon, the threaded arms of the levers forming in effect a releasing-nut. The sleeve descends the
 115 screw-shaft W as the latter is turned by the action of the pawl-and-ratchet mechanism under control of the needle cylinder, this movement continuing until at a certain point in the descent a bar, Y, carried by the sleeve, strikes
 120 the lever U and trips the same, so as to release the shifting-rod. The length of plain fabric produced by the machine therefore depends upon the position to which the nut is
 125 adjusted above the knocking-off point, and for the guidance of the attendant in effecting this adjustment the frame V is graduated and the sleeve X has a pointer, V', as shown in Fig. 3.

It will be observed on reference to Fig. 1 that the upper portion, D', of the cylinder D
 130 is not in one piece with the lower portion, but secured thereto by means of bolts. By this

means the upper portion of the cylinder, in which are the grooves for the guidance of the needles, can be made of steel or other metal capable of resisting wear, while the lower portion of the cylinder may be made of cast-iron.

I claim as my invention—

1. The combination of the fixed frame of the machine, the needle-cylinder, and cam-box, each capable of rotation, a cam-controlling rib guided in the fixed portion of the frame, means for expanding and contracting said rib, devices whereby the rib is caused to act upon the cams, and gearing whereby either the needle-cylinder or cam-box can be rotated, all substantially as specified.

2. The combination of the needle-cylinder and its needles, the cam-box and its needle elevating and drawing down cams, a cam-controlling rib, and means for expanding and contracting the same, and devices, substantially as specified, whereby said rib is caused to act upon both the lifting and drawing-down cams, all substantially as set forth.

3. The combination of the rings h h' , the frame K , the shaft J , having pinions m' and right and left ratchet-wheels n n' , and the swinging frame M , having pawls adapted to said ratchet-wheels, and cams for acting upon said pawls to throw them out of gear, as specified.

4. The combination of the shaft J and its right and left ratchet-wheels, the frame K , retaining-pawls for the ratchet-wheels, the swinging frame M , having operating-pawls therefor, cams for acting upon the operating and retaining pawls, and gearing for operating said cams in unison, all substantially as specified.

5. The combination of the needle-carrier and cam-box of the machine, the shifting thread-guide, a slotted operating-lever connected to said thread-guide and engaging with the needle-carrier, a spring acting on said lever, and a pivot-pin adapted to the slot of the lever, all substantially as specified.

6. The combination of the needle-cylinder, the segmental guide-bar adjacent thereto, a thread-guide adjustable on said bar, a slotted lever connected to said guide and engaging with the needle-cylinder, a spring acting on said lever, and a pivot-pin adapted to the slot in the lever, all substantially as specified.

7. The combination of the needle-cylinder, the segmental guide-bar adjacent thereto, a thread-guide adjustable on said bar, a guide-operating lever comprising a pivoted plate and a bar engaging with the cylinder and having a slot for the reception of the pivot-pin, so that it is free to slide on the plate, and a spring acting on said bar, all substantially as specified.

8. The combination of a tapered needle-carrier with a head separate therefrom and with means for adjusting said head longitudinally on the carrier without turning it in respect thereto, all substantially as specified.

9. The combination of the tapered needle-

cylinder, the head R , free to move vertically therein and having a threaded end, a sleeve, R' , threaded for adaptation to the head R , and means for confining said sleeve vertically to the cylinder and for preventing the head from turning in the cylinder, all substantially as specified.

10. The combination of the drawing-down cam, a spring connected thereto for elevating the same, a depressing-lever acting on the spring, a rib for operating said lever, and means for adjusting the rib, all substantially as set forth.

11. The combination of the needle-carrier, needles, and thread-guide with the presser, consisting of two rollers, one in advance of the other, a presser-carrier hung to the frame, but free to swing thereon, and means for limiting the extent of movement of the carrier, all substantially as set forth.

12. The combination of the needle-carrier, needles, and thread-guide with a presser, consisting of two rollers, one in advance of the other, and an independent spring support for each roller, as set forth.

13. The combination of the expanding rib and the rings h h' , carrying the same and having studs x' , means for moving said rings, and a stop pin, x , for the studs, as specified.

14. The combination of the tension-spring for the thread with the plate T , over which the thread passes, and a lever, the opposite arms of which form guides for the thread, one of said arms being adjacent to the plate T , all substantially as specified.

15. The combination of the driving-gear, the belt-shifter, and the catch therefor, with the screw-shaft and its operating mechanism, and a nut constructed to engage with or be released from said shaft and having a tripper, all substantially as set forth.

16. The combination of the driving-gear of the machine, the belt-shifter and the catch therefor, the screw-shaft arranged vertically at one side of the machine, operating mechanism for said screw-shaft, a nut carried by said shaft, and having a tripper and a pointer, and a gage-bar serving, in connection with the pointer, to regulate the adjustment of said nut, as set forth.

17. The combination of the tapered needle-cylinder, the cam-box fitted on the surface of said tapered cylinder, cams guided in said box and free to slide in an inclined plane parallel with the surface of the tapered cylinder, a cam-operating rib contained in a chamber beneath the cam-box, means whereby said rib is caused to act upon the cams, and mechanism for expanding and contracting the rib, all substantially as specified.

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

SAML. HENSHALL.

Witnesses:

WILLIAM F. DAVIS,
HARRY SMITH.