

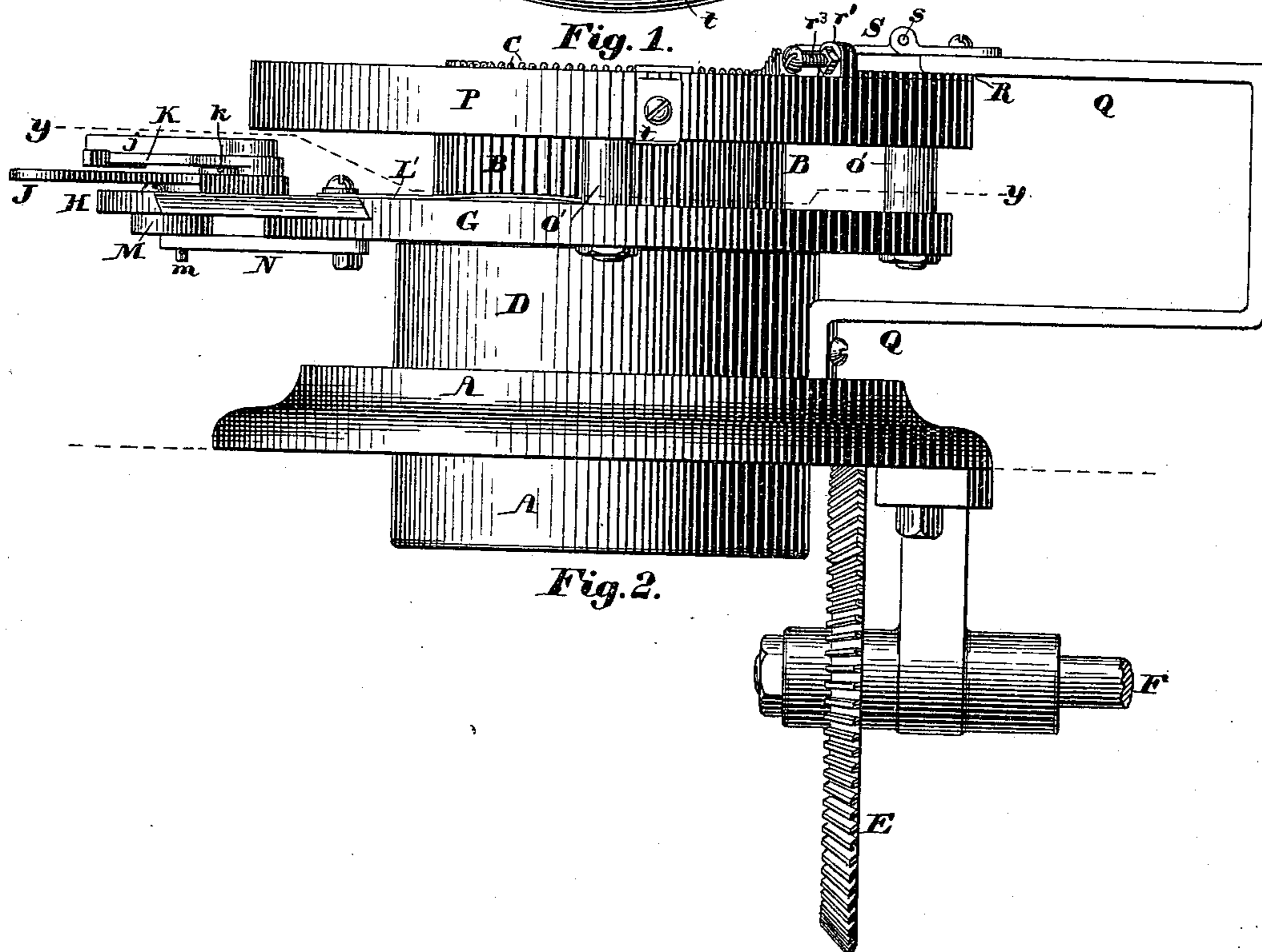
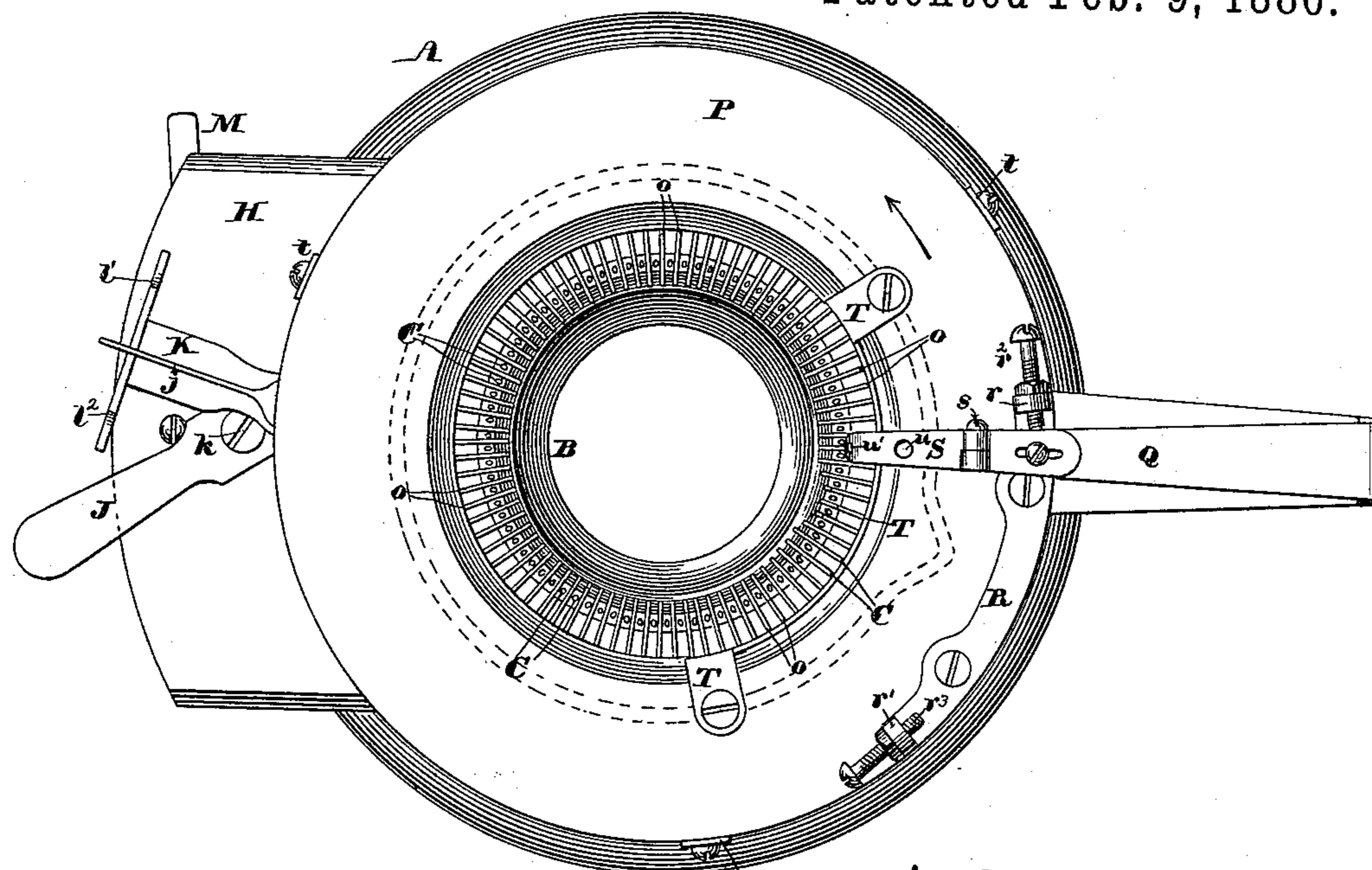
(No Model.)

4 Sheets—Sheet 1.

W. D. HUSE.
KNITTING MACHINE.

No. 335,587.

Patented Feb. 9, 1886.



Witnesses:
Walter E. Lombard.
Geo. H. Snow

Inventor:
Warren D. Huse,
by N. C. Lombard
Attorney.

(No Model.)

4 Sheets—Sheet 2.

W. D. HUSE.
KNITTING MACHINE.

No. 335,587.

Patented Feb. 9, 1886.

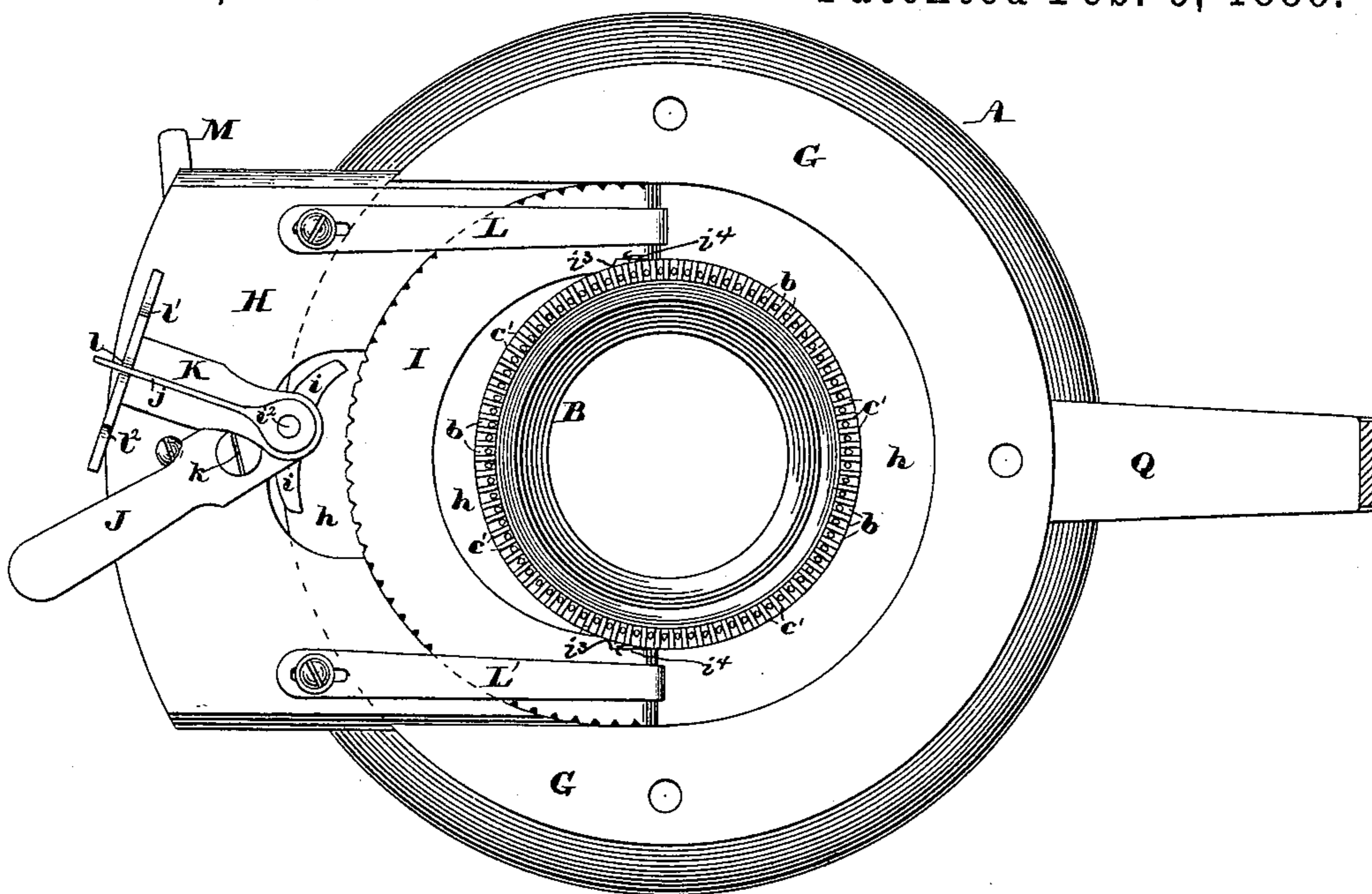


Fig. 3.

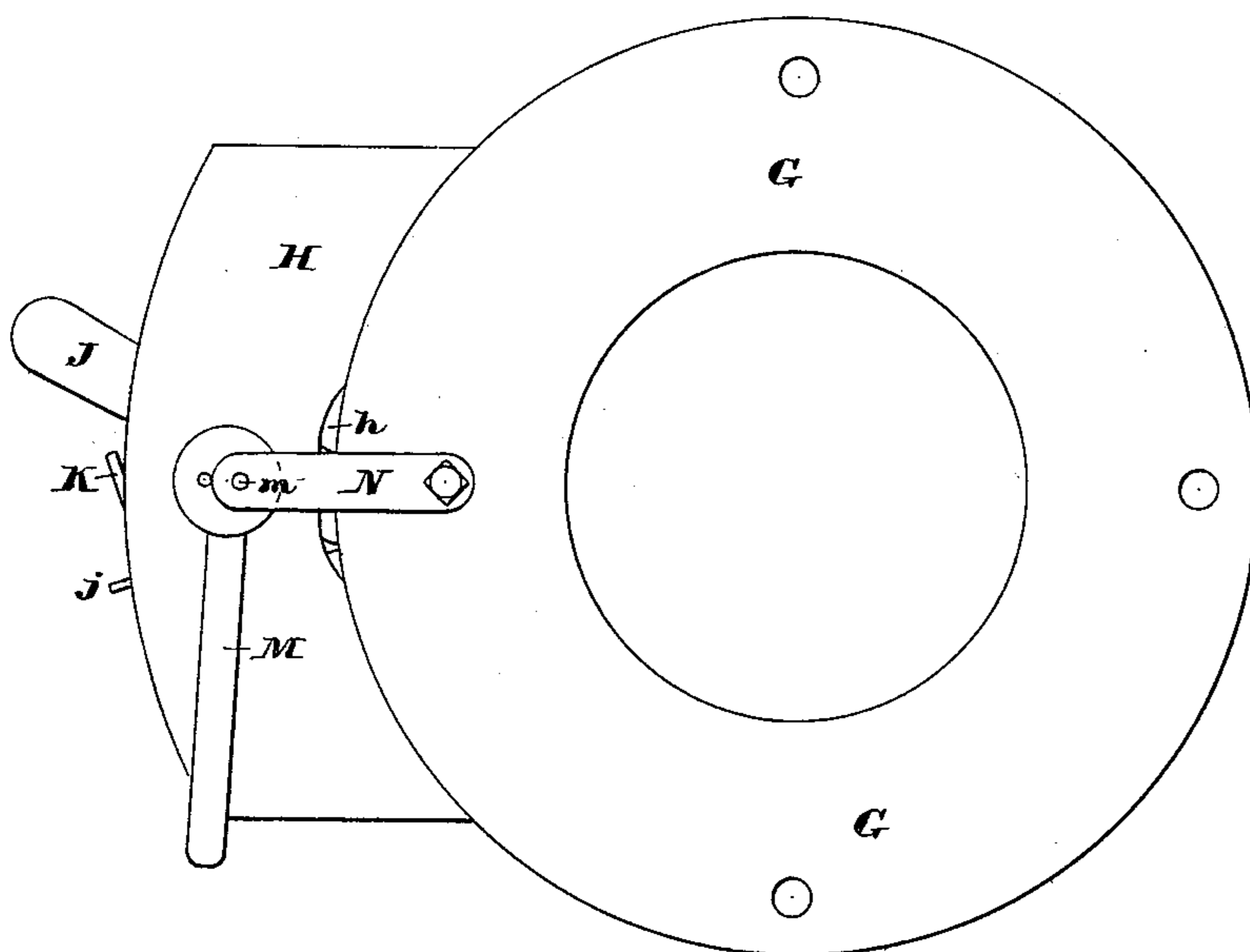


Fig. 4.

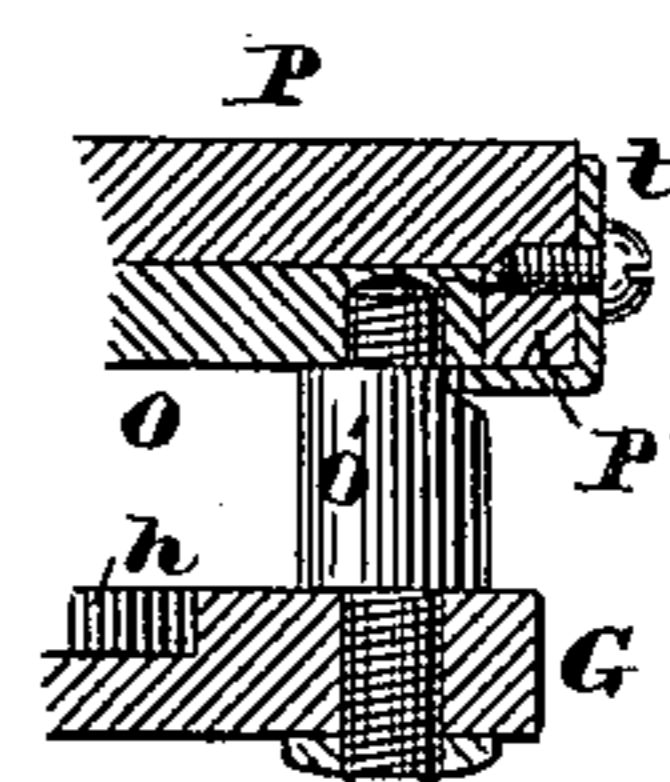


Fig. 20.

Witnesses:

Walter E. Lombard.
Geo. H. Knowlton

Inventor:

Warren D. Huse,
by N. C. Lombard
Attorney.

(No Model.)

4 Sheets—Sheet 3.

W. D. HUSE.
KNITTING MACHINE.

No. 335,587.

Patented Feb. 9, 1886.

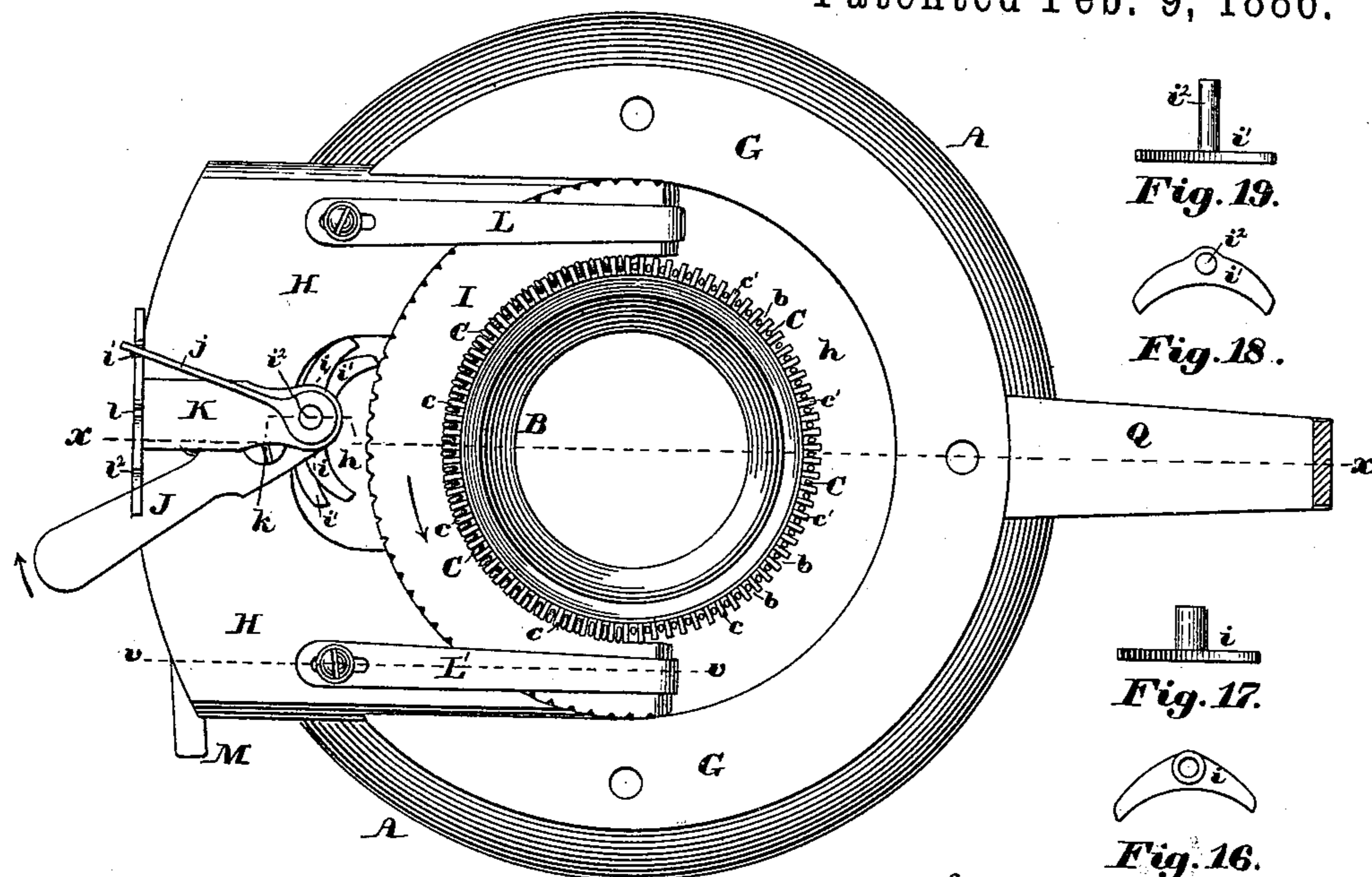


Fig. 19.

Fig. 18.

Fig. 17.

Fig. 16.

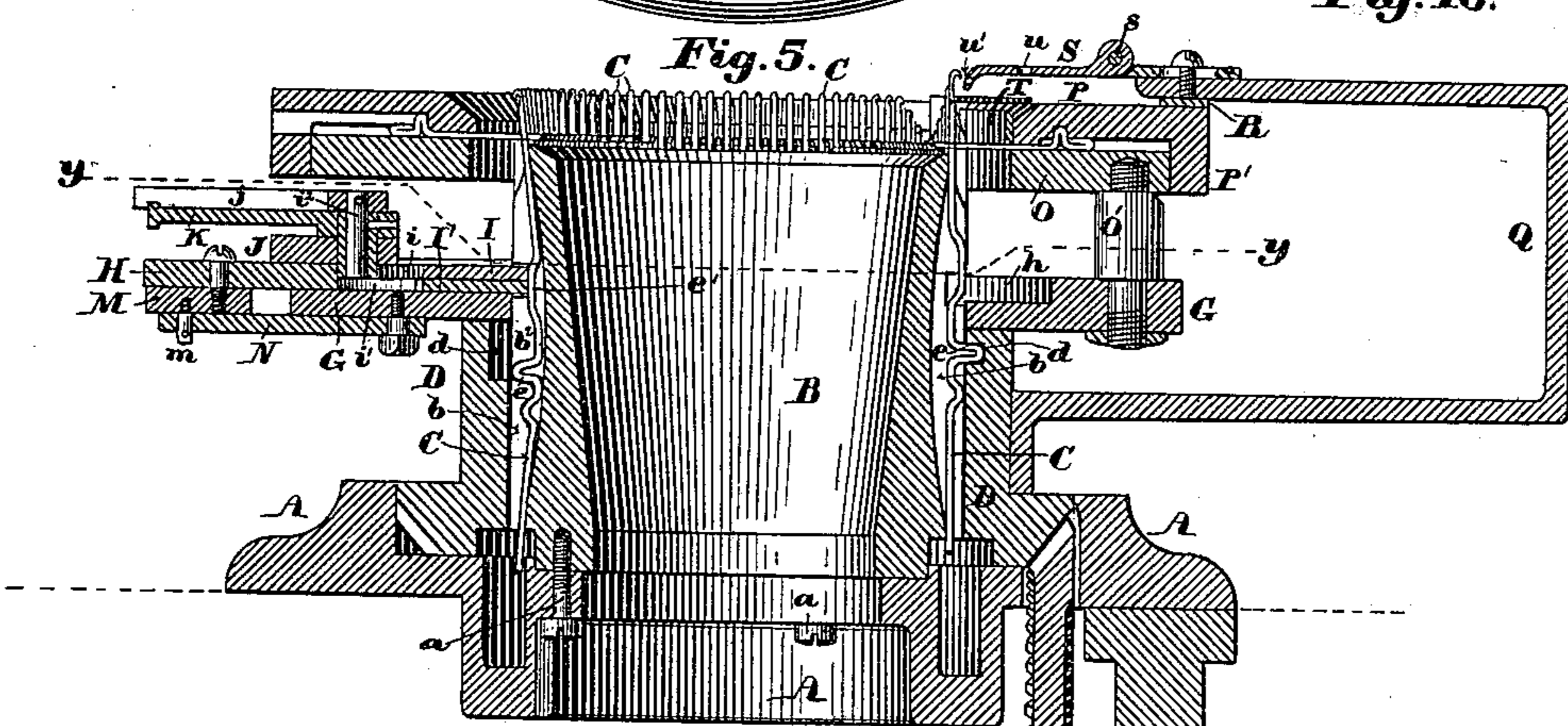


Fig. 6.

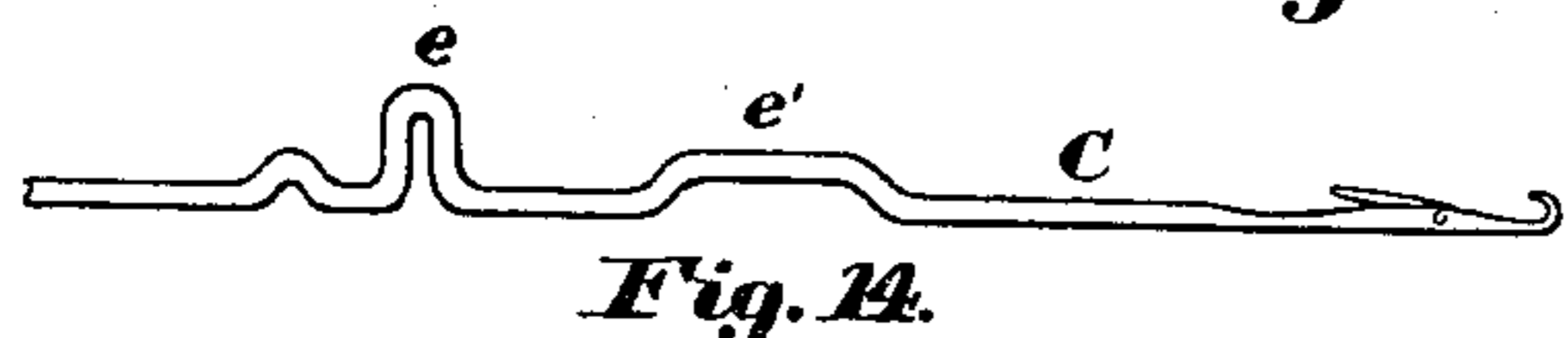


Fig. 14.



Fig. 15.

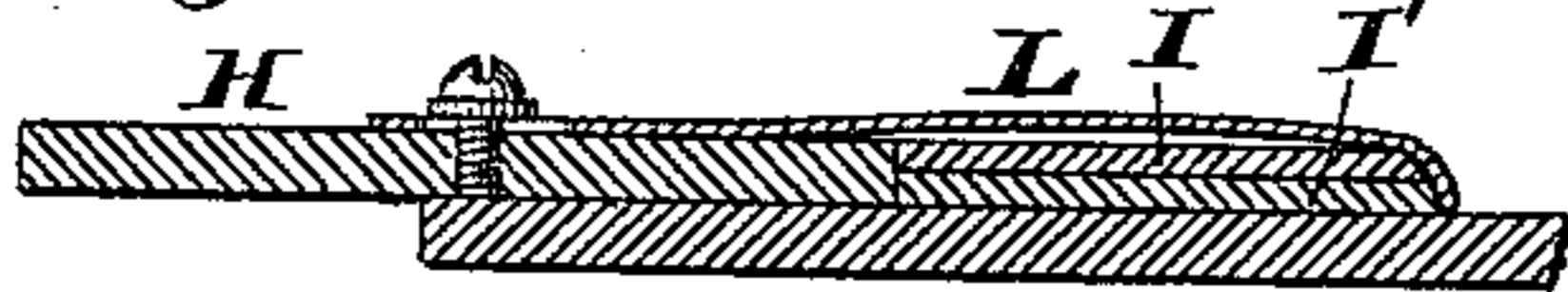
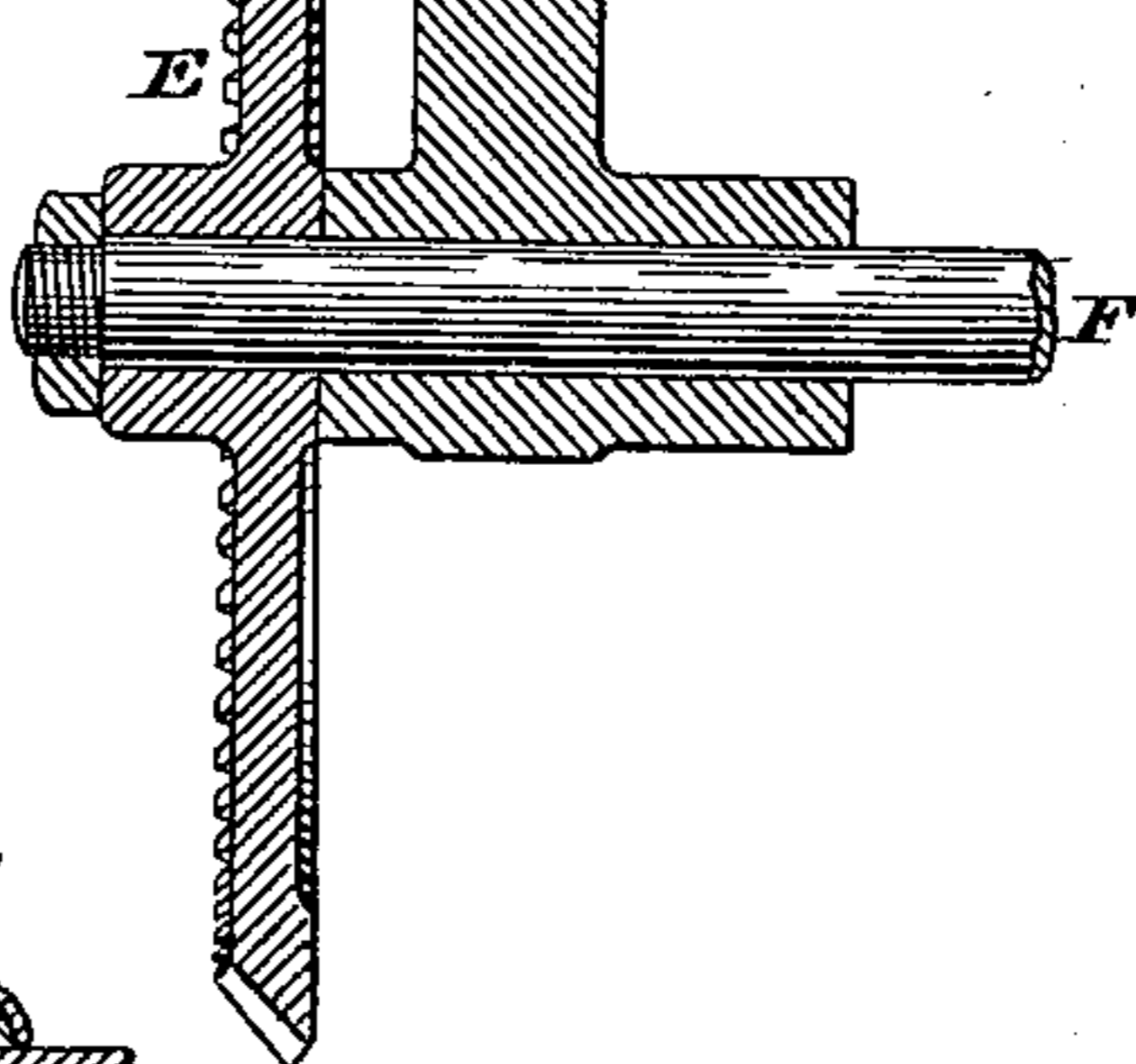


Fig. 13.



Witnesses:
Walter E. Lombard.
Geo. H. Snow

Inventor:
Warren D. Huse,
by N. C. Lombard
Attorney.

(No Model.)

4 Sheets—Sheet 4.

W. D. HUSE.
KNITTING MACHINE.

No. 335,587.

Patented Feb. 9, 1886.

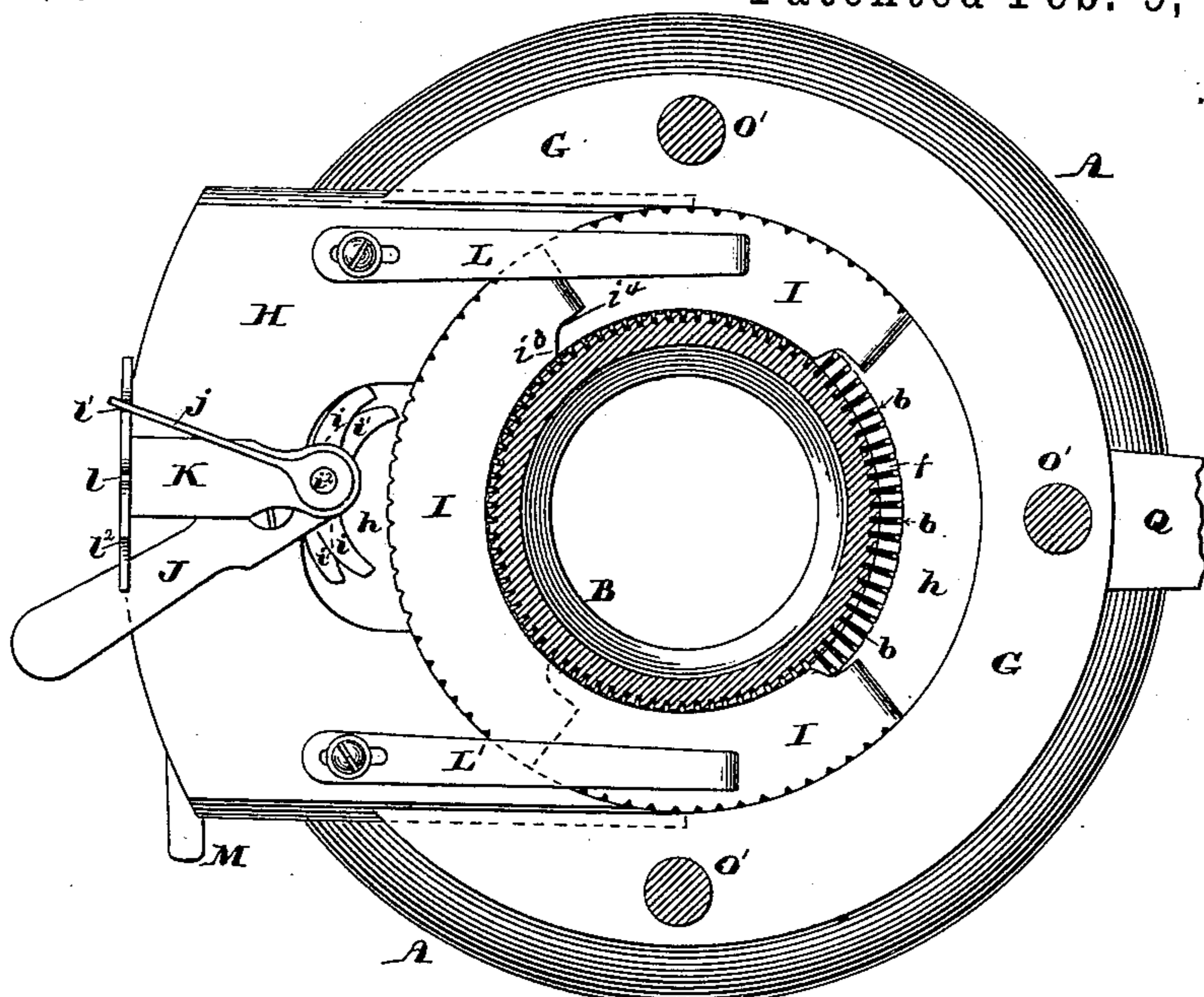


Fig. 7.

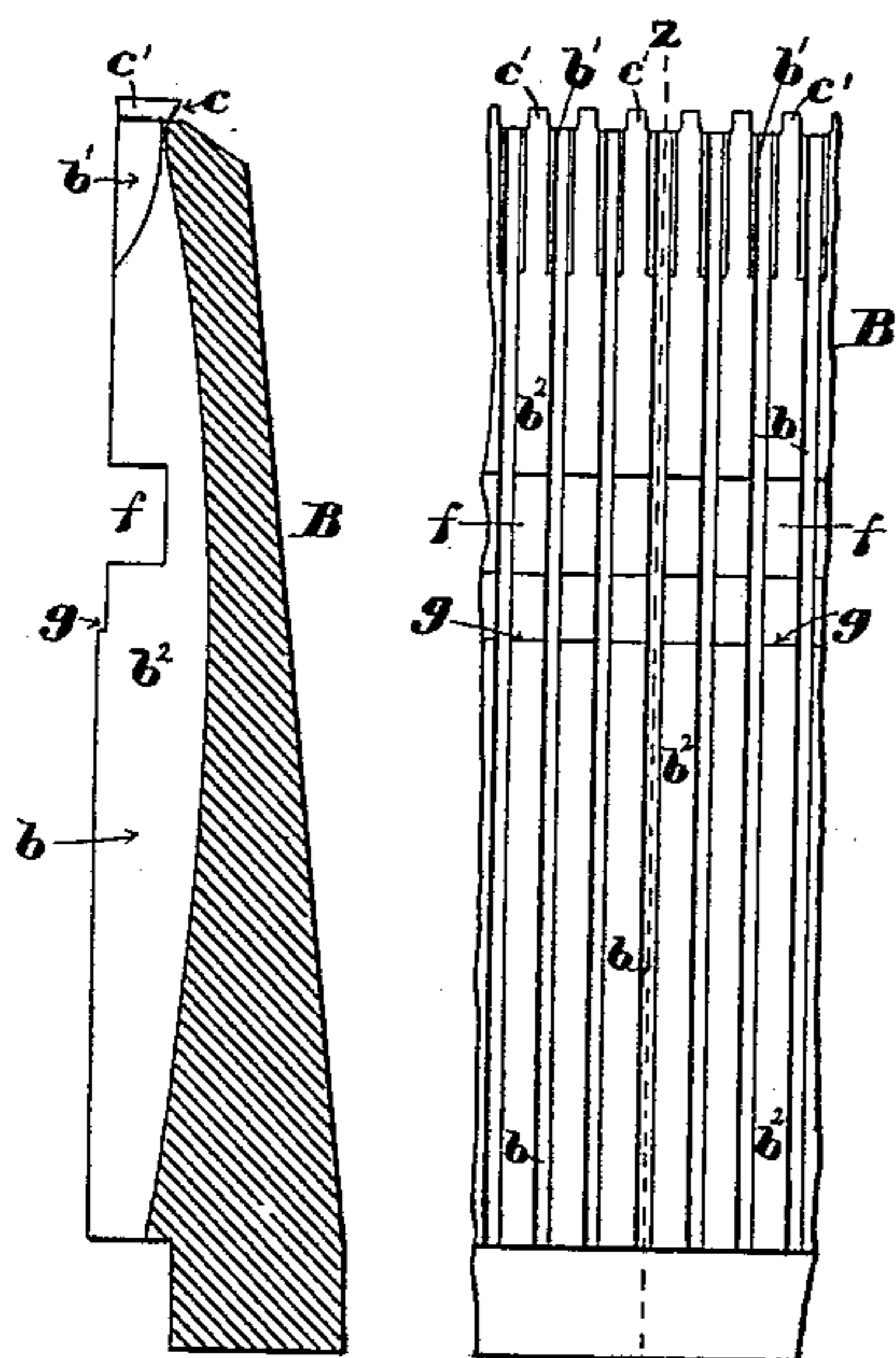


Fig. 10.

Fig. 9.

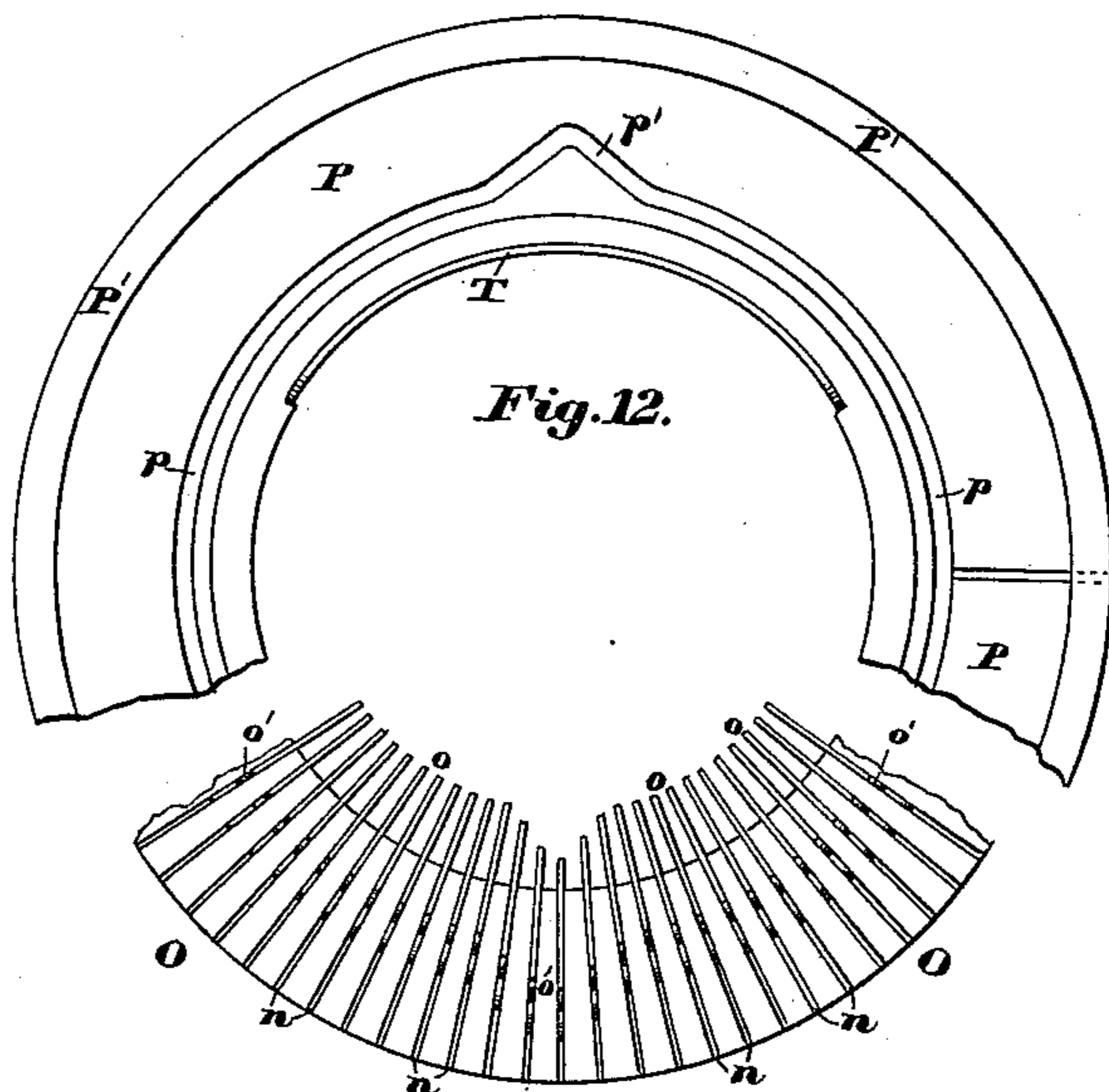


Fig. 11.

Fig. 12.

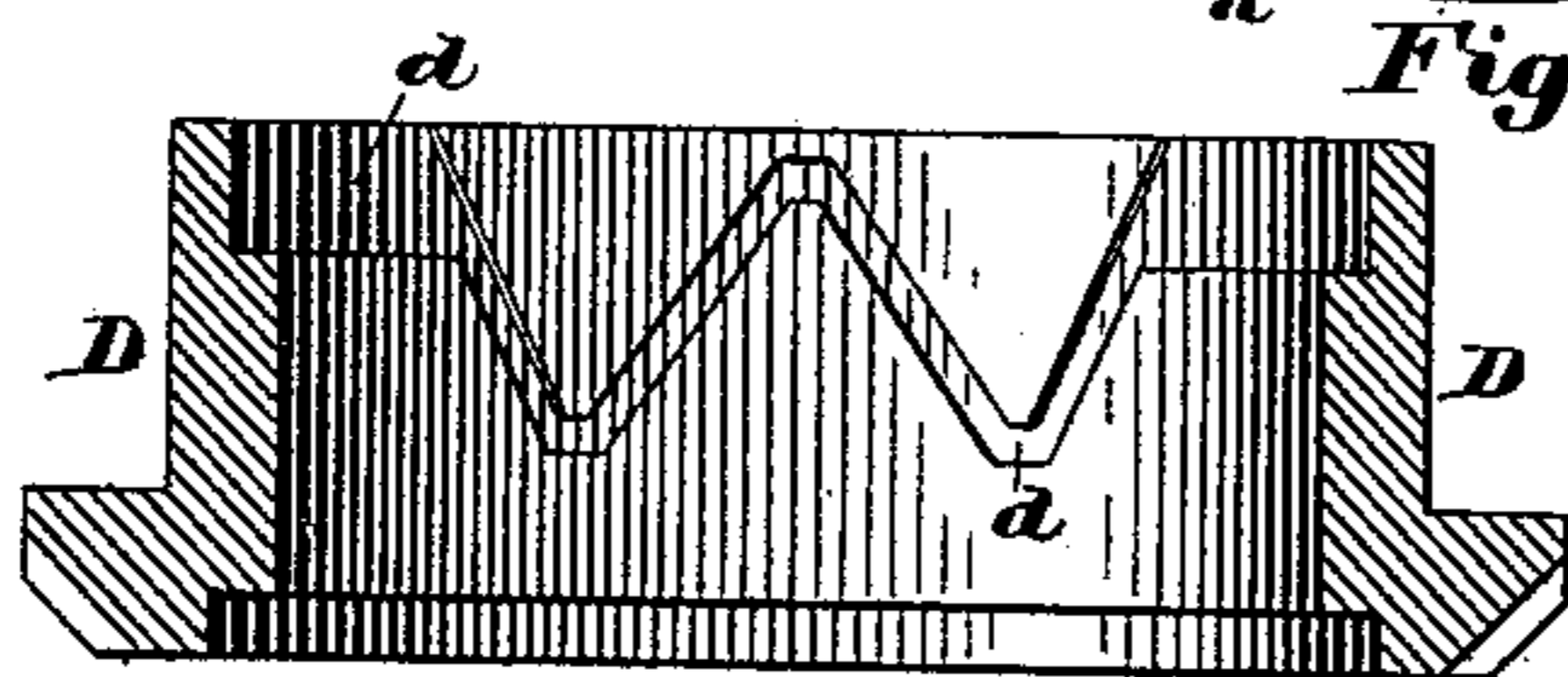


Fig. 8.

Witnesses:

Walter E. Lombard.
Geo. H. Snow

Inventor:

Warren D. Huse,
by N. P. Lombard
Attorney.

UNITED STATES PATENT OFFICE.

WARREN D. HUSE, OF LACONIA, ASSIGNOR TO ORISON TWOMBLY, OF LAKE VILLAGE, N. H., AND THOMAS S. NOWELL, OF BOSTON, MASS.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 335,587, dated February 9, 1886.

Application filed July 21, 1884. Renewed November 19, 1885. Serial No. 183,289. (No model.)

To all whom it may concern:

Be it known that I, WARREN D. HUSE, of Laconia, in the county of Belknap and State of New Hampshire, have invented certain new and useful Improvements in Knitting-Machines, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to that class of knitting-machines known as "circular," in which a series of latch-needles are arranged in a circle, and are moved up and down by a revolving cam to form the stitches which constitute knitting; and it consists in certain novel constructions, arrangements, and combinations of parts, which will be readily understood by reference to the description of the drawings and to the claims to be hereinafter given.

Figure 1 of the drawings is a plan of so much of a machine as is necessary to illustrate my invention. Fig. 2 is a side elevation of the same. Fig. 3 is a plan of the same with the loop-cast-off carrying-ring and the cast-off operating-cam removed and the yarn-guiding stirrup-arm cut in section. Fig. 4 is an inverted plan of the segment carrying flange G and plate H, and showing the mechanism for moving the plate H and segments connected therewith. Fig. 5 is a plan similar to Fig. 3, except that the plate H and the segments carried thereby are shown in a position to throw one-half of the needles out of action with the needle-operating cam-path of the cam-cylinder. Fig. 6 is a vertical section on line *xx* on Fig. 5. Fig. 7 is a horizontal section on line *yy* on Figs. 2 and 6, and showing the cam-segments in position to throw one-half of the needles out of action with the cam. Fig. 8 is a central vertical section of the needle-operating cam-cylinder. Fig. 9 is an elevation of a small section of the needle-cylinder, drawn to an enlarged scale. Fig. 10 is a vertical section on line *zz* on Fig. 9. Fig. 11 is a plan of a portion of the series of radial cast-offs and their supporting-ring. Fig. 12 is an inverted plan of a portion of the cast-off operating-cam. Fig. 13 is a vertical section on line *vv* on Fig. 5. Fig. 14 is an elevation of the needle. Fig. 15 is an elevation of one of the loop-cast-off fingers. Figs. 16 and 17 are respectively a

plan and a side elevation of the double acting pawl for operating the upper segment for throwing the needles out of action. Figs. 18 and 19 are similar views of the double-acting pawl for operating the lower segment for throwing the needles out of action, and Fig. 20 is a detail to be hereinafter referred to.

A is the base-ring, which may be secured upon a bench or table, as indicated by dotted lines in Figs. 2 and 6; or it may be mounted upon a post or standard, firmly secured to said ring one side of the center thereof.

B is the needle-cylinder, secured in a fixed position upon the ring A by means of screws, one of which is shown at *a*, Fig. 6. The cylinder B has formed in its periphery a series of vertical grooves, *b b*, to receive and form guides for the needles C, the inner walls or bottoms of said grooves being curved, so as to make said grooves considerably deeper at the center of their lengths than at their ends, as shown in Figs. 6 and 10, the purpose of which is to enable the needles to be sprung or bent, so as to throw them out of action with the cam which reciprocates them. The upper portions of the grooves *b b* are milled out to a somewhat greater width, as shown at *b'*, Fig. 10, to permit the loops of yarn to be drawn into said grooves as the needles descend, and said grooves are returned across the top of said cylinder in a direction radial to the axis of said cylinder, which has the inner portion of its upper end reduced in height and beveled, as shown in Fig. 10. The partitions *b² b²* between said grooves *b b*, it will be seen, extend above the main body of the cylinder, and have the inner edges thereof, which so project, inclined or undercut, so as to form hooks *c*, the purpose of which will be hereinafter described.

D is a cam-cylinder mounted in a suitable bearing in the upper side of the base-ring A, so as to surround and inclose the lower portion of the needle-cylinder B, and having formed in its inner surface the cam-path *d*, arranged to receive and act upon the outwardly-projecting lugs *e* of the needles C, to impart to said needles a vertically-reciprocating movement in a well-known manner, a rotary motion being imparted to said cam-cylinder by the bevel gear-wheel E, mounted upon the shaft F

and meshing into corresponding bevel gear-teeth formed on the lower end of the cylinder D, also in a well-known manner. The shaft F may be provided with a pulley, and be driven
5 by a belt from any convenient source of power; or it may be supplied with a crank and be driven by hand.

The needle-cylinder B has formed therein the circumferential groove *f*, and just below
10 said groove is provided with the shoulder *g*, Figs. 9 and 10, to form a stop or rest for the annular plate G, secured to the cylinder B by a driving fit. The annular plate G has formed
15 in its upper surface a recess, *h*, semicircular at one end and extending to the circumference of the plate at the opposite end, in which is fitted to slide in a dovetailed bearing formed in the
20 sides thereof the plate H, the inner end of which is curved to an arc of a circle corresponding in radius to the curve of the inner
25 end of the recess *h*, formed in the plate G, so that when the plate H is adjusted to the position shown in Fig. 7, and fills the outer portion
30 of the recess *h*, formed in the annular plate G, a recess, the outline of which is a nearly complete circle concentric with the axis or center
35 of the needle-cylinder, surrounds said cylinder, in which are placed the two segmental cams I and I', placed one upon the other, said segments being of an aggregate thickness equal to
40 the depth of the recess *h* or the thickness of the plate H, as shown in Fig. 6. The plate H has the center of its inner end cut away to form an enlargement of the recess *h*, to receive the two
45 double-ended pawls *i* and *i'*, which engage with notches in the outer edges of the segments I and I', respectively. The double pawl *i'* is formed
50 upon the lower end of and preferably in one piece with the short shaft *i''*, which has its bearing in the hub of the double pawl *i*, and has secured to its upper end the spring-arm *j*. The
55 hub of the pawl *i* has its bearing in the inner end of the lever J, which is pivoted at *k* to the plate H, as shown in Figs. 1, 3, and 7.

To the upper end of the hub of the pawl *i* is firmly secured the T-shaped arm K, in the
60 outer end of which are formed three detent-notches, *l*, *l'*, and *l''*, to receive the outer end of the spring-arm *j*, according to whether one or
65 the other or neither end of the pawl *i'* is to act upon the segment I' when the lever J is vibrated.

The object or purpose of the double pawls *i* and *i'*, and their arrangement in combination with the lever J, the arm K, and the
70 spring-arm *j*, is to enable the operator, by simply vibrating the lever J, to impart to the segments I and I' a step by-step movement
75 in opposite directions, so as to advance them from the positions shown in Fig. 5 to the positions shown in Fig. 7, or vice versa, as will be
80 more fully described. The reason for this step-by-step movement of the segments I and I' is to throw out of action with its cam a single
85 needle at the end of each course, for the purpose of narrowing in the formation of the

first half of a heel or toe bulge, and then by reversing the action to allow a single needle to
90 be brought into action again at the end of each course, for the purpose of widening in forming the last half of the heel and toe
95 bulges. The segments I and I' are made to extend considerably beyond a semicircle in length, and each has formed upon its inner
100 edge at each end a curved cam-surface, as indicated at *i*³ to *i*⁴, (see Fig. 3,) that portion of its inner edge between *i*³ and *i*⁴ comprising
105 just a half-circle of such a diameter that, when said segments are moved toward the needle-cylinder by means of the plate H and lever M
110 to the position shown in Fig. 5, they shall cause just one-half of the needles contained in the needle-cylinder to be bent in at the middle
115 of their lengths to throw their lugs out of action with the cam-path of the cam-cylinder D, as shown at the left-hand side of Fig. 6.

L and L' are two springs secured at their
120 outer ends to the plate H, and having their inner ends bent downward upon the ends of the segments, which are beveled to permit
125 said segments to lift said springs and pass under their ends, which press upon and prevent the segments being lifted as they are being
130 moved about the cylinder B by the action of the pawls thereon, and also to determine when said segments are in their normal positions
135 relative to the plate H, as shown in Figs. 3, 5, and 7. As the segments I and I' are moved around the needle-cylinder from the
140 positions shown in Fig. 5 to the positions shown in Fig. 7, the cam-surfaces *i*³ to *i*⁴ act upon the bodies of the needles to press them
145 inward, as shown in Fig. 6, the partitions between the needles preventing the needles from being carried forward with the segments. A
150 reciprocating movement toward and from the cylinder B may be imparted to the plate H and segments I and I' by means of the lever
155 M, pivoted to the plate H, the crank-pin *m*, carried by said lever, and the link N, pivoted at one end to the under side of the annular
160 plate G, and connected at the other end to the crank-pin *m*, as shown in Figs. 2, 4, and 6.

O is an annular plate or flange supported
165 upon the posts O' O' O', set in the flange G, and having formed in its upper surface a series of radial grooves, *n n*, in which are placed a series of cast-off and work-down holding-fingers,
170 *o*, made from flattened steel-wire bent and shaped as shown in Fig. 15, the upwardly-projecting lug *o'* being designed to be acted
175 upon by the cam-path *p*, formed in the under side of the annular plate P, which is provided with the downwardly-projecting annular
180 flange P', to inclose and have a bearing upon the edge of the plate O, as shown in Fig. 6, said plate P being arranged to rest upon the
185 plate O and be revolved thereon in unison with the needle-operating cam-cylinder D, by means of the U-shaped arm Q, the lower end
190 of which is firmly secured to the cam-ring D, and its upper end extends inward over the

plate P, and is not attached thereto, but rests upon the segment R secured to the upper side of the plate P, and provided with the upwardly-projecting ears r r' , in which are set the adjustable screw-stops r^2 and r^3 , between which the upper arm of said U-shaped lever may vibrate without moving the cam-plate P. The arm Q is operated by hand when it is desired to knit back and forth—as when knitting the heel and toe bulge—and moves with it the cam-plate P after it strikes the screw-stop r^2 or r^3 , according to the direction in which it is being moved. The object of the lost motion between the arm Q and the plate P, due to the movement of the arm Q from contact with one of said screw-stops to contact with the other, is to enable the eye of the thread-guide, which is carried by said arm, to move in advance of the cam-throws which operate the needles and cast-offs, whether said arm and cams are moved in one direction or the other.

To the inner end of the upper arm of the U-shaped arm Q is secured the yarn-guide S, so as to be adjusted thereon to a greater or less distance from the needles, by means of a screw and slot, as shown in Figs. 1, 2, and 6, said guide being made in two parts, pivoted together at s by a clamping screw and nut, so that its inner end may be adjusted up and down and held in any desired position by friction; or, if desired, the inner portion or the guide proper may be turned back upon the outer portion, so as to be entirely out of the way when putting a ribbed stocking-top upon the needles. The annular plate O is so arranged relative to the needle-cylinder B that the inner ends of the cast-off fingers o o are directly above and rest upon the upper ends of the stationary sinkers c' , or the ribs between the grooves b b , and project inward somewhat beyond the needles and the sinker-hooks c when in their normal positions, as shown in Fig. 1. The cam plate or ring P is so arranged relative to the needle cam that each cast-off finger o is drawn back thereby to its farthest outward position just before the needle immediately in advance of it is drawn below the upper end of the needle cylinder, and is again moved inward to push the loop of yarn just drawn down over the ends of the fixed sinkers off from the upper end of said sinker, and upon the hooks c before the needle rises above the top of said sinker. The cast-off finger remains in said innermost position to hold the knitted fabric down until another stitch is to be formed by the next revolution of the cam. The cast-off fingers o o are reduced in vertical thickness between their inner ends and the lugs o' by cutting away a portion of the wire at o^2 , Fig. 15, to render them more elastic, and a steel segmental rib, T, is secured to the inner edge of the cam plate or ring P upon the side next to the outward throw p' of the cam-path p , and projects slightly below the under surface of the plate P, so as to bear hard upon the cast-offs o o and press them into close contact with up-

per ends of the sinkers c' , when they are being moved inward to cast off the loop of yarn, thereby insuring the casting off of the loop, making it impossible for the cast-off fingers to slide over the loop, the extreme ends of the under edge of said rib T being rounded or curved upward to insure its easy passage over the cast-off fingers o o , even though they may be slightly displaced.

It will be observed that the lugs e of the needles C are formed by bending the wire in the form of a letter, U, with a considerable space between the parallel portions of said U-bend, instead of having said parallel portions brought into close contact by forming a sharper bend in the wire, which has been found very objectionable when the needles were to be thrown out of action with the cam by bending or springing them, as they would often break through said short bend; but by making the bend longer and separating the parallel parts of the lug, as shown, this difficulty is entirely overcome, and I am enabled to mechanically throw out of action one-half of the needles at a single operation by simply reversing the position of the lever M, thereby moving the plate H and segments I and I' from the position shown in Fig. 3 to the position shown in Fig. 5, in which latter position the inner edges of the segments I and I' enter the circumferential groove f , and, pressing upon the needles at the point e' , bend them into the position shown on the left-hand side of Fig. 6, when the lugs e are removed from the cam-path, and the cam-cylinder D may be revolved without moving said needles.

When it is desired to knit a heel, the plate H and segments I and I' are moved into the position shown in Fig. 5, and the cam-ring P and cam-cylinder D are reciprocated through an arc of a circle of requisite length in a well-known manner, and at the end of each course the lever J is moved to the opposite angle from which it stands relative to a radial line drawn through the axes of the cylinder B and the lever J, thereby moving the segments I and I' in opposite directions around the cylinder B in the recess h a distance equal to the distance between two needles, a movement of the lever J in the direction indicated by the arrow causing the pawl i to engage with the notches in the outer edge of the segment I and impart a movement thereto in the direction indicated by the arrow shown thereon and a movement of the lever J in the opposite direction, causing the pawl i' to engage with the notches in the outer edge of the segment I' and impart a movement thereto in the opposite direction, thereby throwing out of action an additional needle after each course first at one side and then at the other side of the cylinder, the spring-arm j being meantime held in the detent-notch z' in the T-shaped arm K, as shown in Fig. 5. When the first half of the heel or toe has been knitted, and it is desired to knit the other half and join the two halves together, it is only necessary to

move the spring arm *j* from the detent-notch *l'* to the notch *l''*, the effect of which is to throw out of action the ends of the pawls *i* and *i'*, which have just been operating upon the segments *I* and *I'*, and cause the opposite ends of said pawls to engage with said segments, and continue the knitting and vibrating the lever *J* after each course, as before, the segments *I* and *I'* being alternately moved in the reverse direction to their previous movement a distance equal to the distance from the center of one needle to the center of the next needle, thereby uncovering a needle first upon one side of the cylinder and then upon the other, and permitting them to spring into the proper position to be engaged by the cam-path *d* at the next movement thereof. When the cam-segments *I* and *I'* have again assumed the position shown in Fig. 5, the heel or toe will be completed, and if a heel, the lever *M* is reversed to move the plate *H* and segments *I* and *I'* into the positions shown in Fig. 3, thus relieving the pressure upon all the needles and permitting them to assume their normal positions, where they will be acted upon by the cam-path *d* to raise and depress them, when the cams will be revolved continuously around the cylinder *B* in the direction indicated by the arrow upon the cam-ring *P*, the upper arm of the U-shaped arm *Q* being in contact with the screw-stop *r''*, and thus compelling said cam-ring *P* to move in unison with the cam cylinder *D*. When knitting the heel and toe, however, in order that the greatest rise of the needles shall precede the backward or outward movement of the cast-off fingers the U-shaped arm *Q* moves from contact with the stop *r''* to contact with the screw-stop *r'''* before the cam-ring *P* begins to move, and vice versa after the completion of each course before commencing another. The cam-ring *P* has secured to its periphery two or more plates, *t t*, having one portion bent at right angles to the other portion, and extending inward across the under edge of the annular lip *P'* and under the plate *O*, as shown in Fig. 20, to secure the cam-ring *P* in position and prevent it being accidentally lifted and thus displaced.

The yarn to be knitted is drawn from a bobbin through or over an elevated guide, (neither of which is shown,) and is passed first through the eye *u* in yarn-guide *S*, and then through the eye *u'*, and is then laid along under the hooks of the needles, by which it is seized as they descend, and is drawn, in the form of loops, over the ends of the sinkers *c'* *c'*, and then pushed off from said tops into the hooks *c*, when the cast-offs pass inward beyond said hooks and prevent said loops from being drawn off from the hooks *c* as the needles rise to seize a new loop.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination of the needle-cylinder *B*, provided with the fixed sinkers *c'* *c*, the needles *C*, the cast-off fingers *o*, and the cam-ring *P*, provided with the path *p*, having the

throw *p'*, and the cam-cylinder *D*, all arranged and adapted to operate substantially as described.

2. The combination of the needle-cylinder *B*, provided with the fixed sinkers *c'* *c*, the cast-off fingers *o*, the cam-ring *P*, provided with the path *p*, having the throw *p'*, and the pressure segmental rib *T*, all arranged and adapted to operate substantially as and for the purposes described.

3. The combination of a needle-cylinder provided with a series of longitudinal grooves in its periphery, made deeper at the middle of their lengths than at their ends, a series of needles located in said grooves, and a reciprocating segment arranged to press against the middle of said needles and bend them into the hollows of said grooves, substantially as shown and described.

4. The combination of the needle-cylinder *B*, provided with the longitudinal grooves *b*, having a greater depth at their centers than at their ends, and with the circumferential groove *f*, a series of needles in said longitudinal grooves, the cam-cylinder *D*, provided with a needle-operating cam-path *d*, the flange or plate *G*, firmly secured upon said cam-cylinder, and provided with the recess *h*, having the parallel portions of its sides dovetailed, the reciprocating plate *H*, fitted to slide in said dovetailed recess, the segments *I* and *I'*, and the crank-lever *M* and the connecting rod or link *N*, connecting said flange *G* and plate *H*, whereby one-half of the needles may be thrown out of action by a single movement of said crank-lever, substantially as described.

5. In combination with the flange or plate *G*, provided with the recess *h*, the plate *H*, and the segments *I* and *I'*, the springs *L* and *L'*, each secured at one end to the plate *H* and having its opposite end bent down over the inner ends of the segments, substantially as and for the purposes described.

6. The combination of the cylinder *B*, provided with the series of longitudinal grooves *b b*, having a greater depth at the center of their lengths than at their ends, and with the circumferential groove *f*, the flange or plate *G*, the plate *H*, the crank-lever *M*, the connecting-rod *N*, the cam-segments *I* and *I'*, fitted to the inner end of said plate *H* and provided with teeth or notches in their outer edges, the lever *J*, the double-acting pawls *i* and *i'*, the T-shaped arm *K*, provided with the detent-notches *l*, *l'*, and *l''*, and the spring-arm *j*, all constructed, arranged, and adapted to operate substantially as and for the purposes described.

7. The combination of the needle-cylinder *B*, the needles *C*, the needle-operating cam-cylinder *D*, the radially-grooved plate *O*, the cast-off fingers *o*, the cam-ring *P*, the adjustable stops *r''* and *r'''*, mounted upon the cam-ring *P*, and the U-shaped arm *Q*, all arranged and adapted to operate substantially as described.

8. The combination, with the U-shaped arm
Q, of the yarn-guide S, made in two parts
pivoted together and adjustably secured upon
the upper branch of the U-shaped arm Q,
5 substantially as and for the purposes de-
scribed.

In testimony whereof I have signed my name

to this specification, in the presence of two sub-
scribing witnesses, on this 12th day of July,
A. D. 1884.

WARREN D. HUSE.

Witnesses:

N. C. LOMBARD,

WALTER E. LOMBARD.