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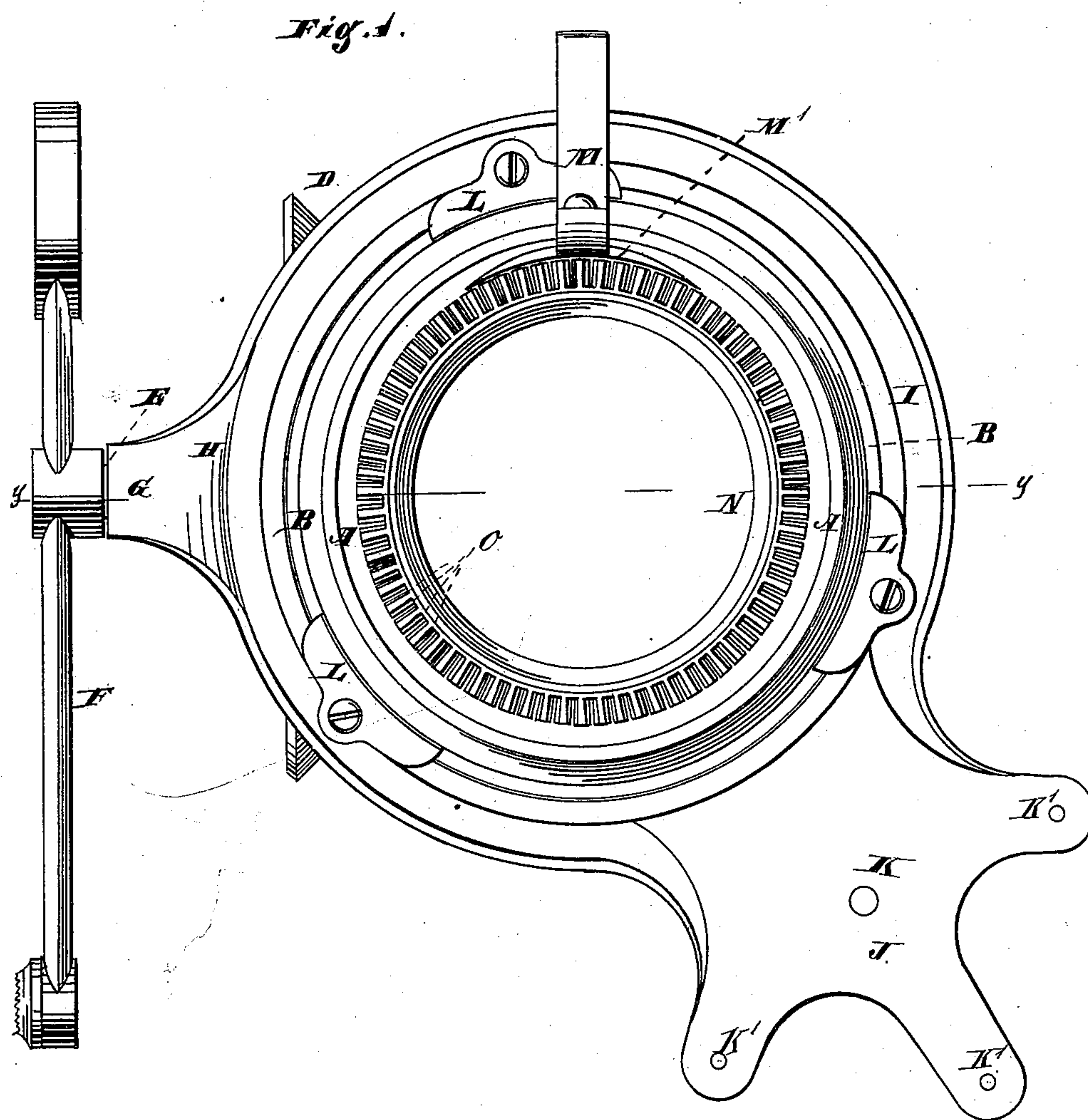
4 Sheets—Sheet 1.

E. R. BRANSON.

KNITTING MACHINE.

No. 333,102.

Patented Dec. 29, 1885.



Witnesses:
Albert H. Adams.
A. W. Bond.

Inventor:
Edwin R. Branson

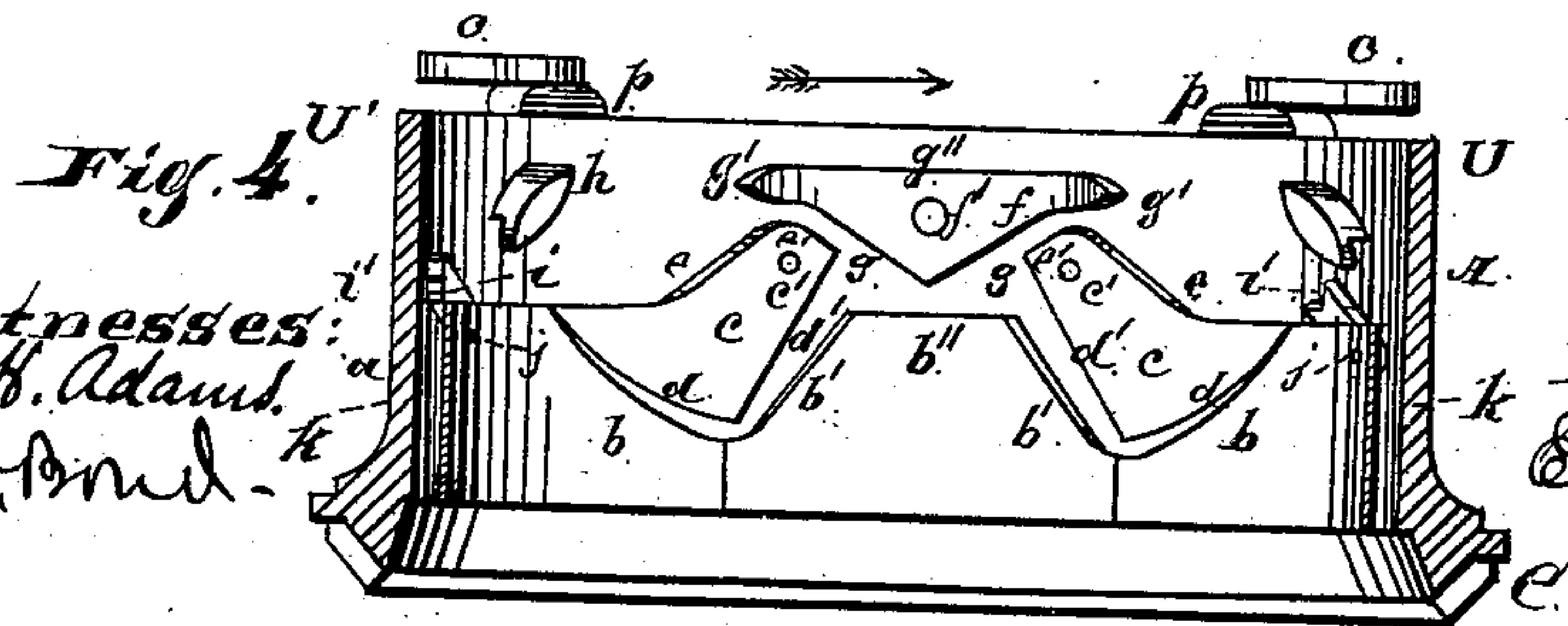
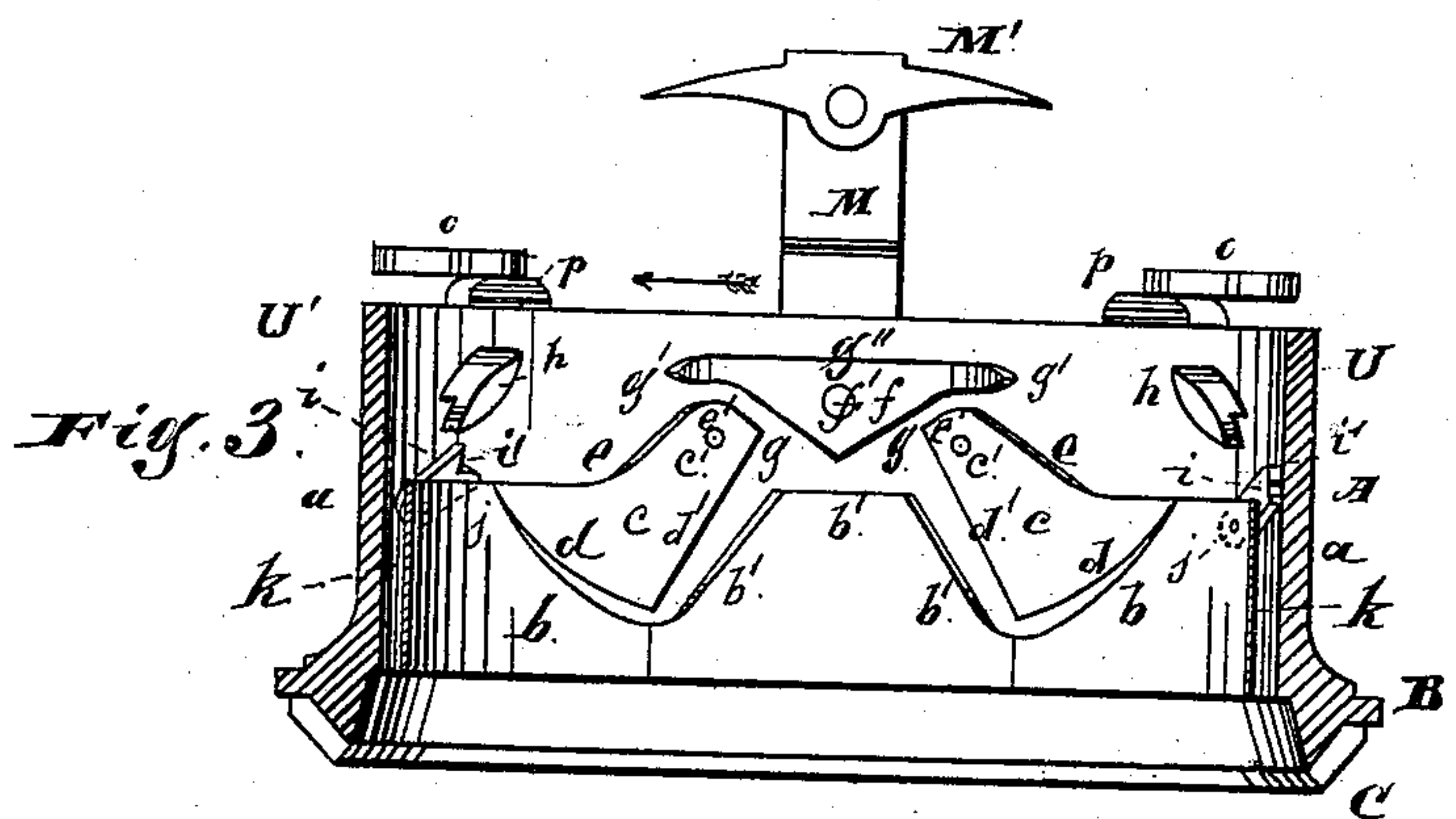
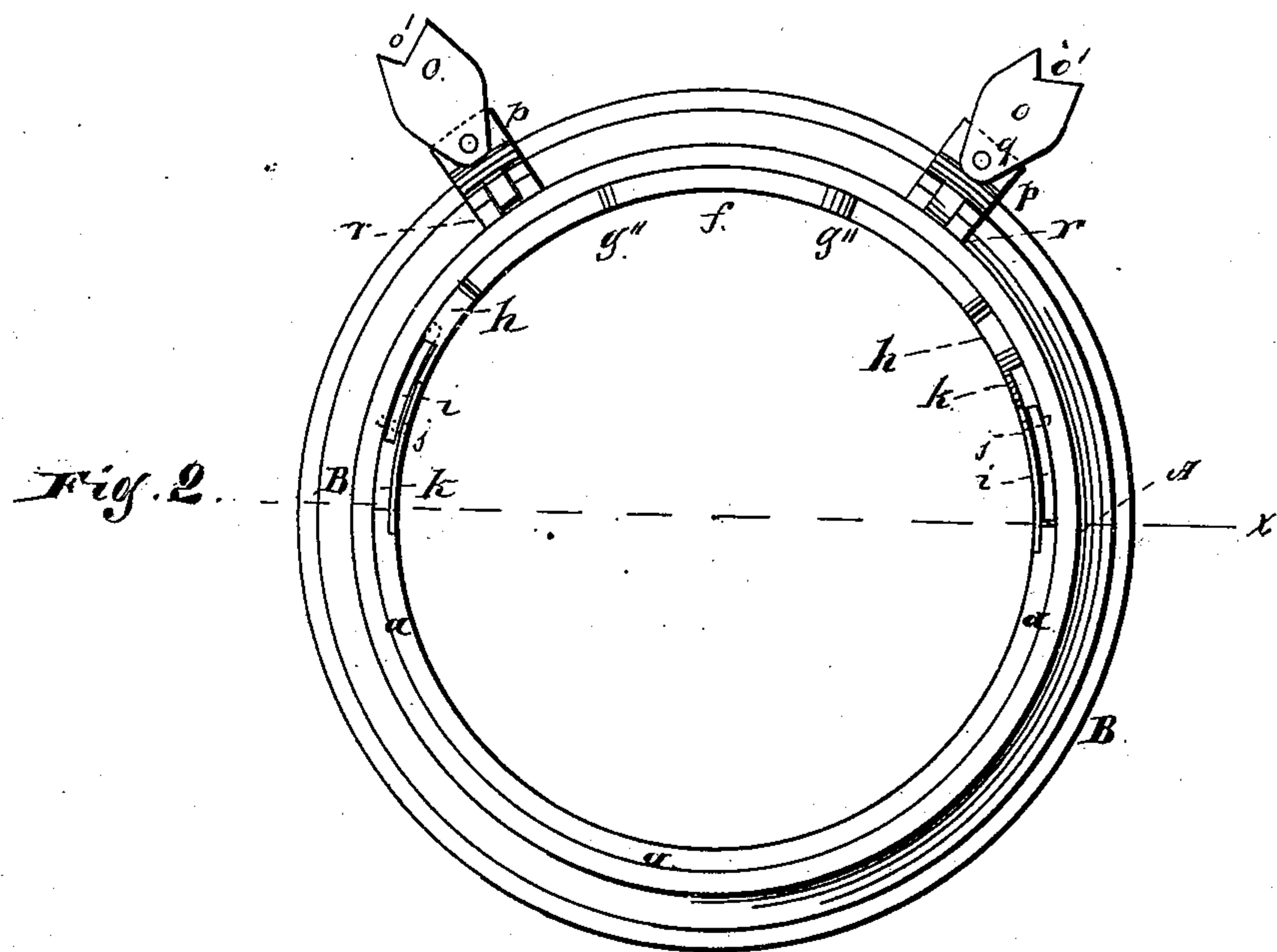
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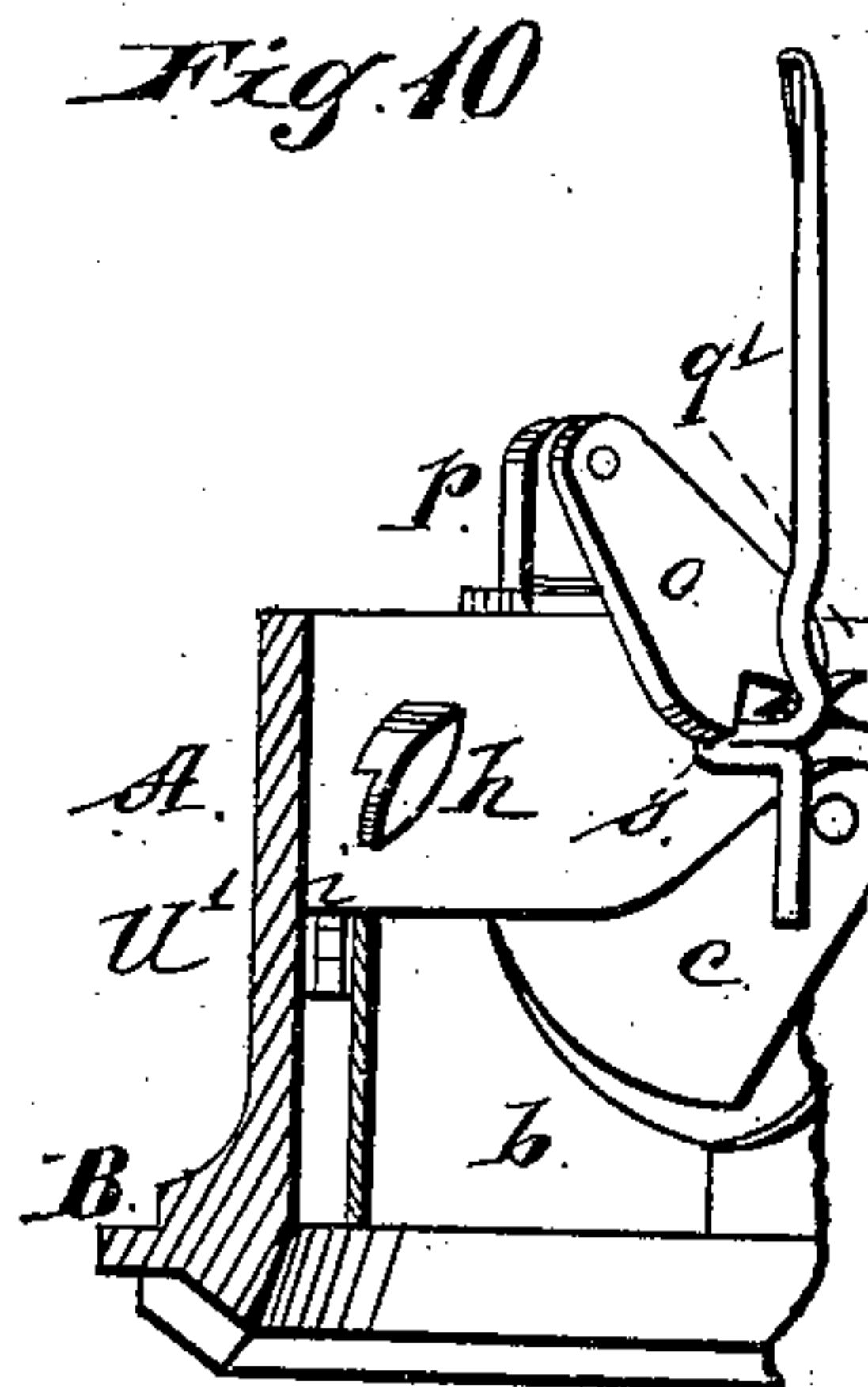
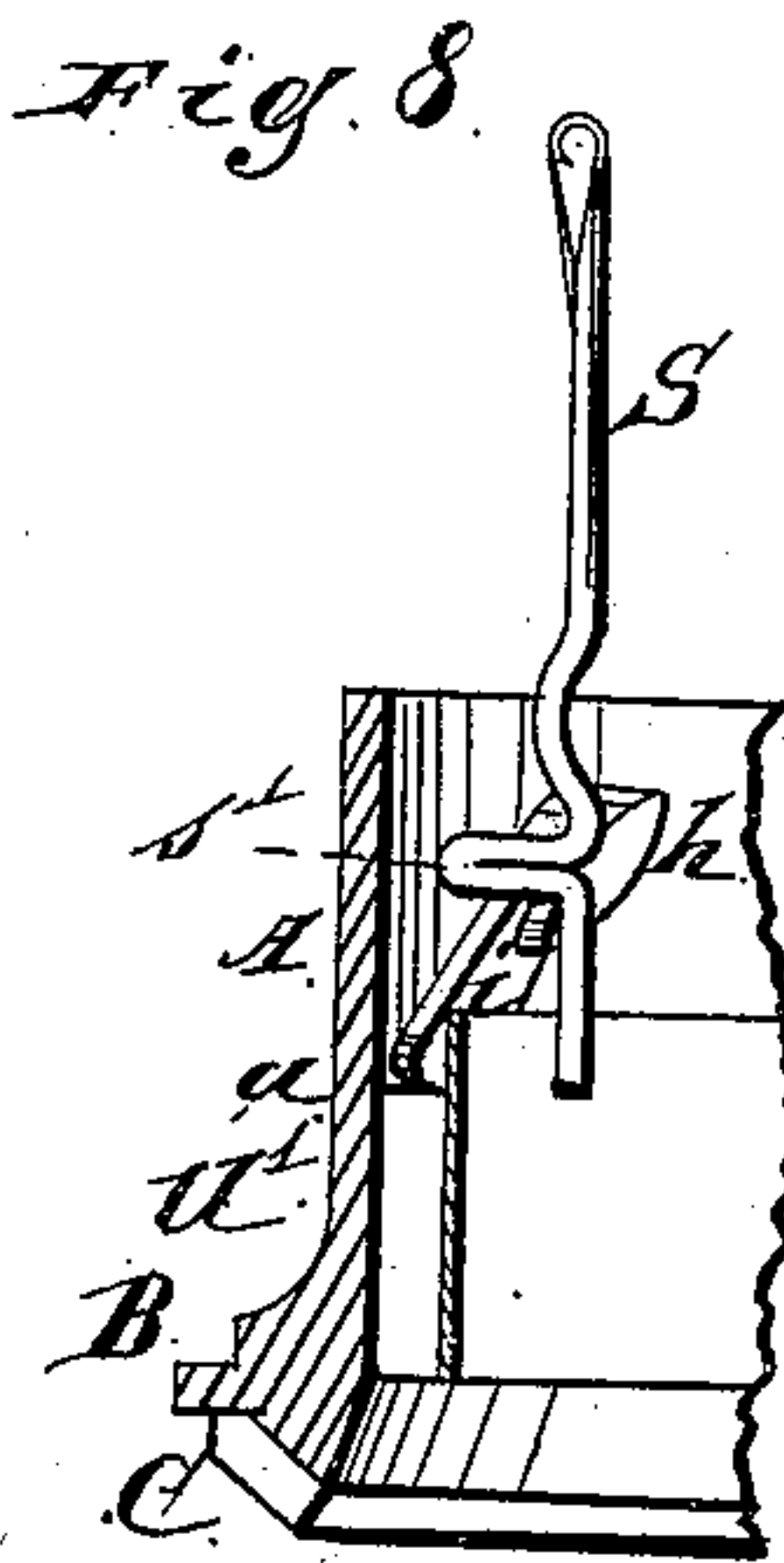
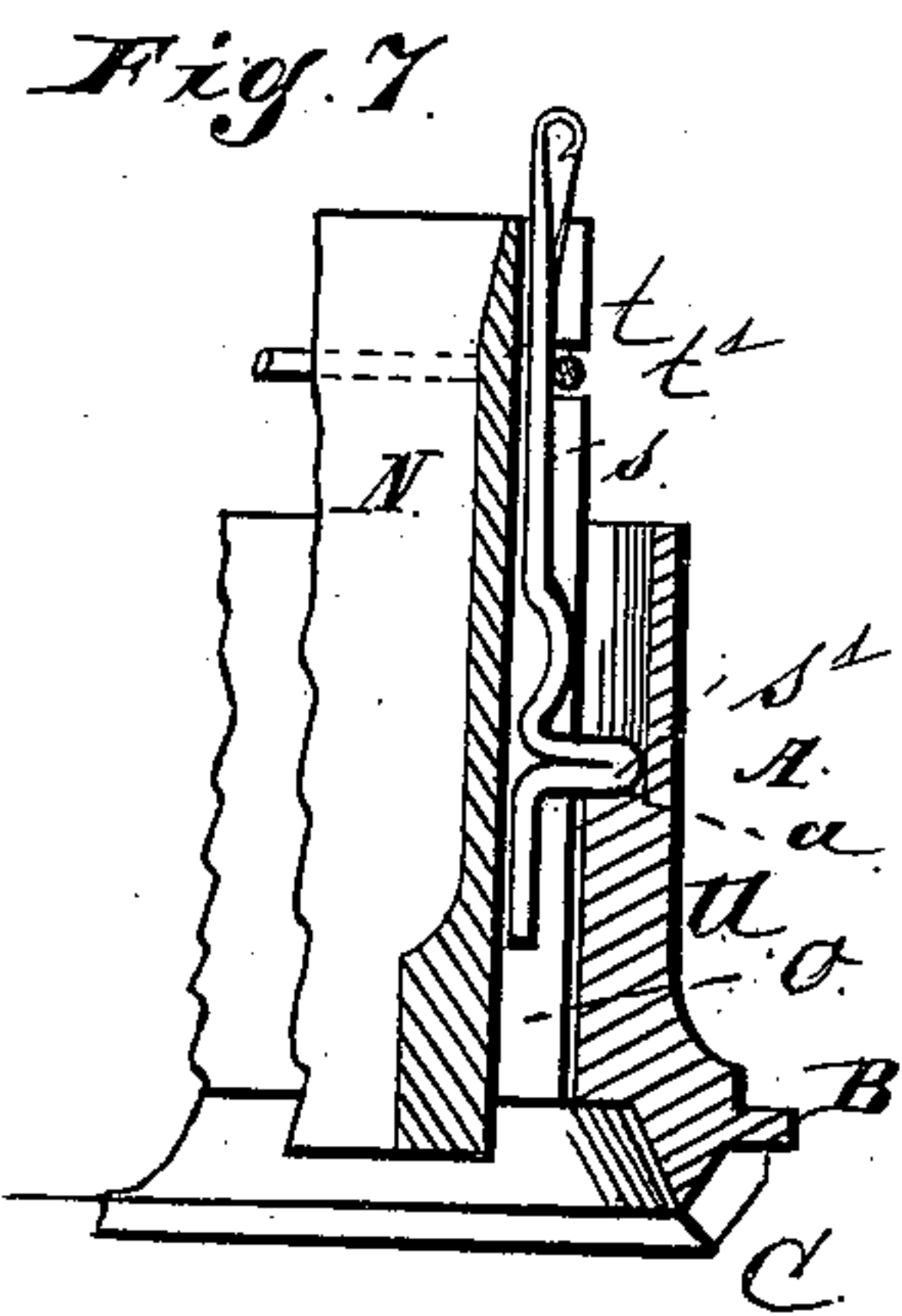
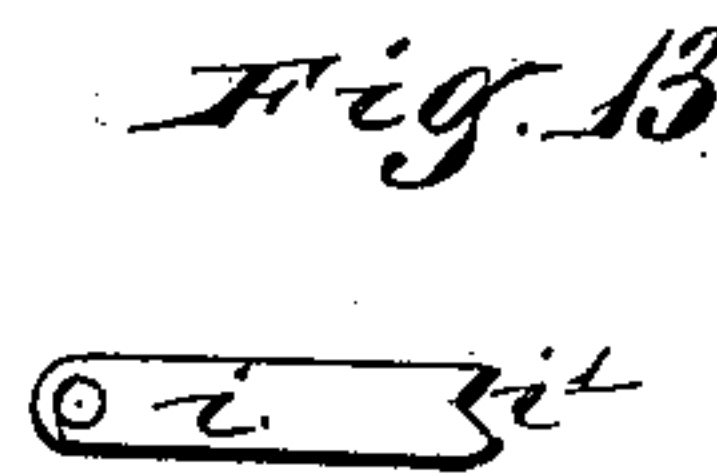
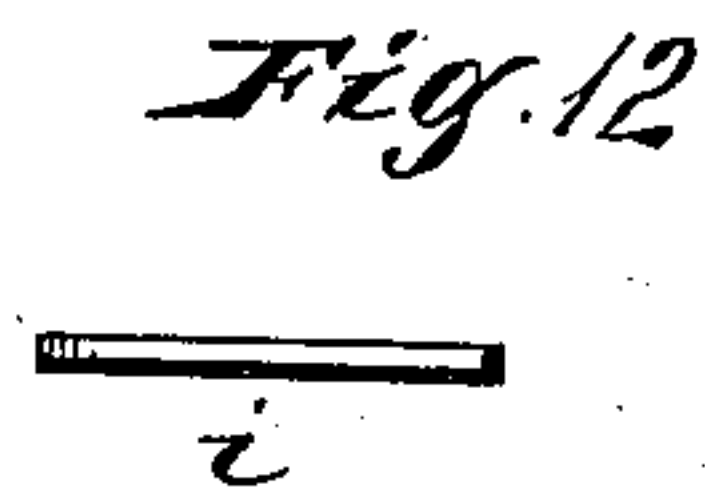
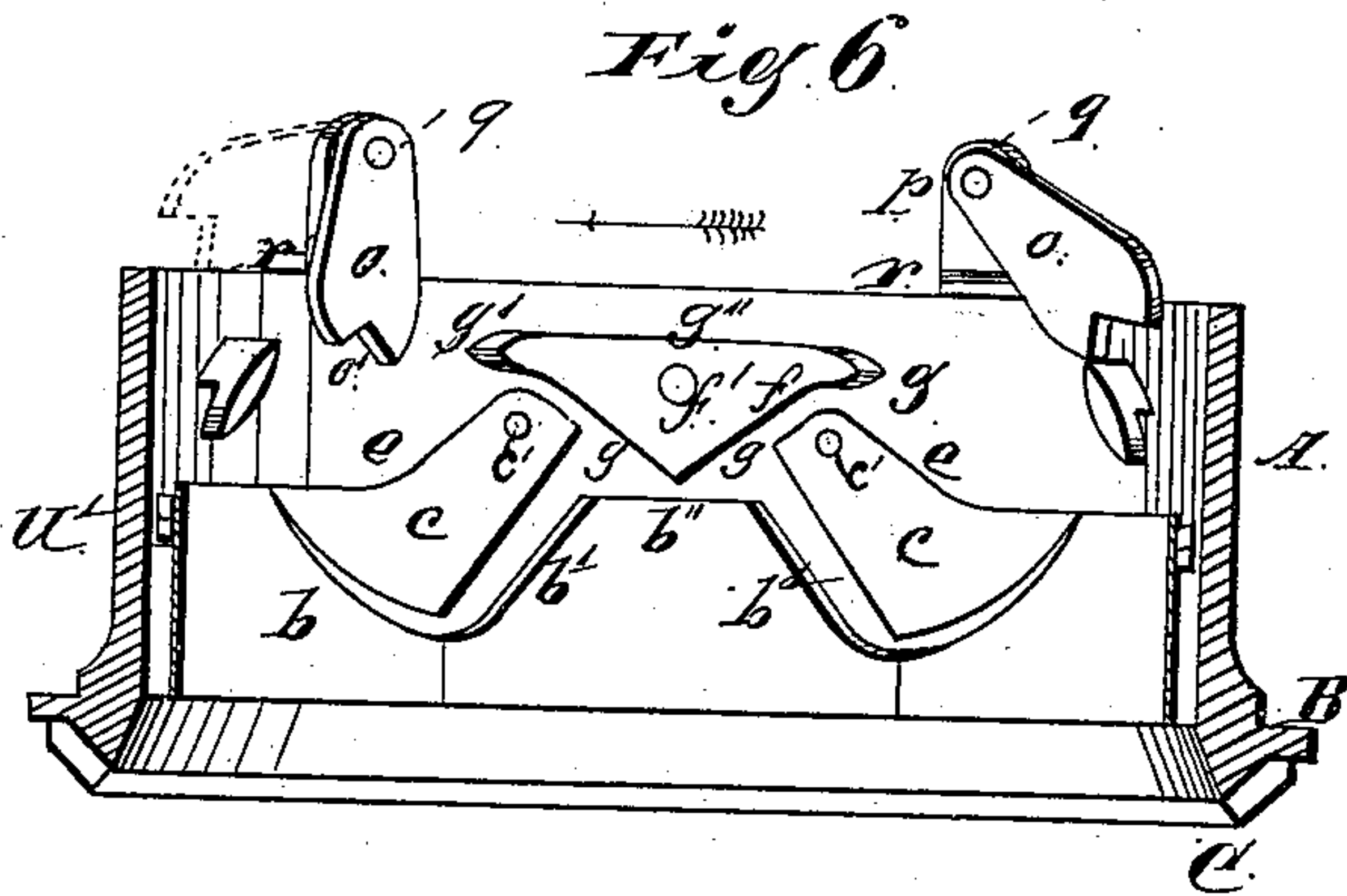
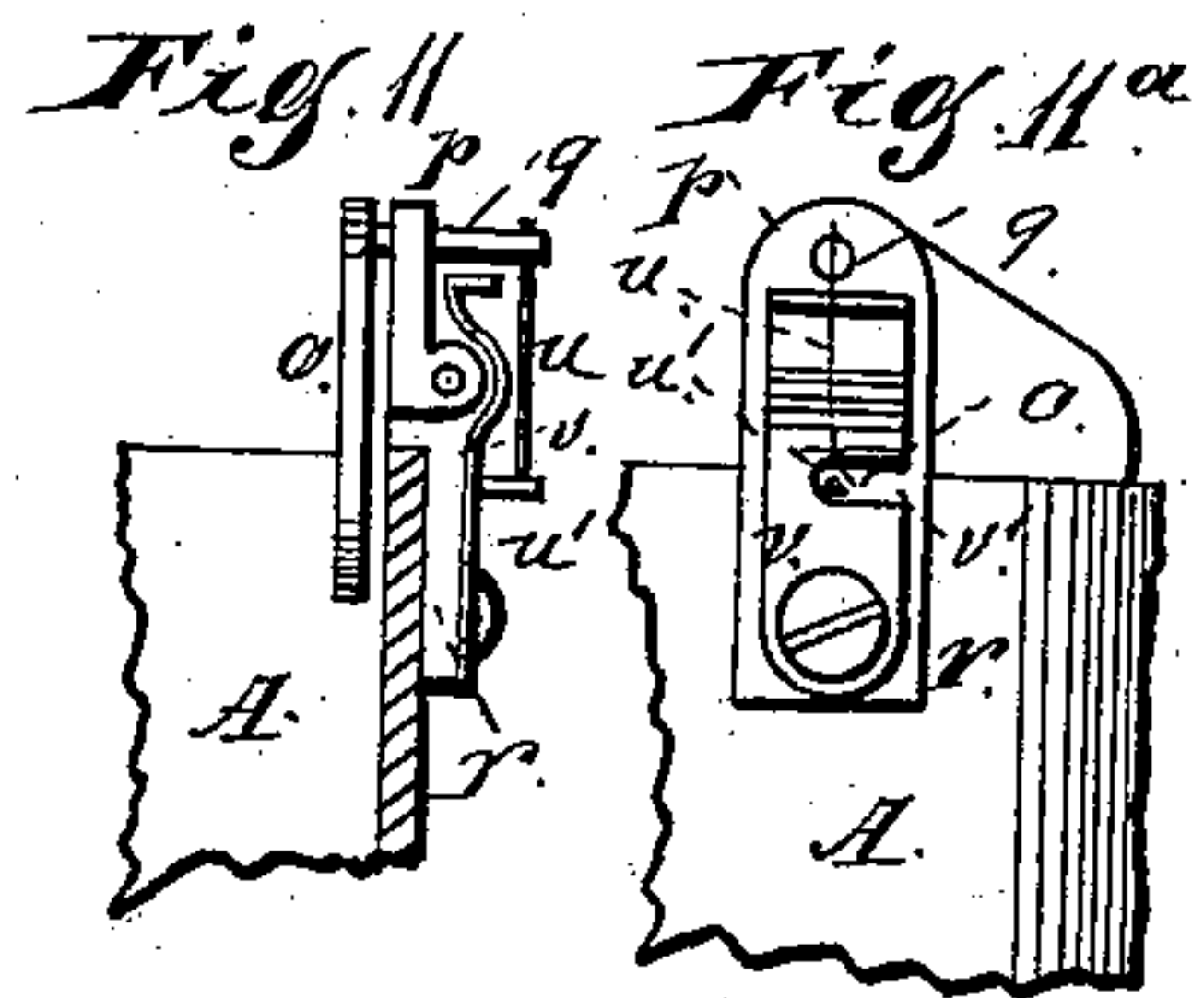
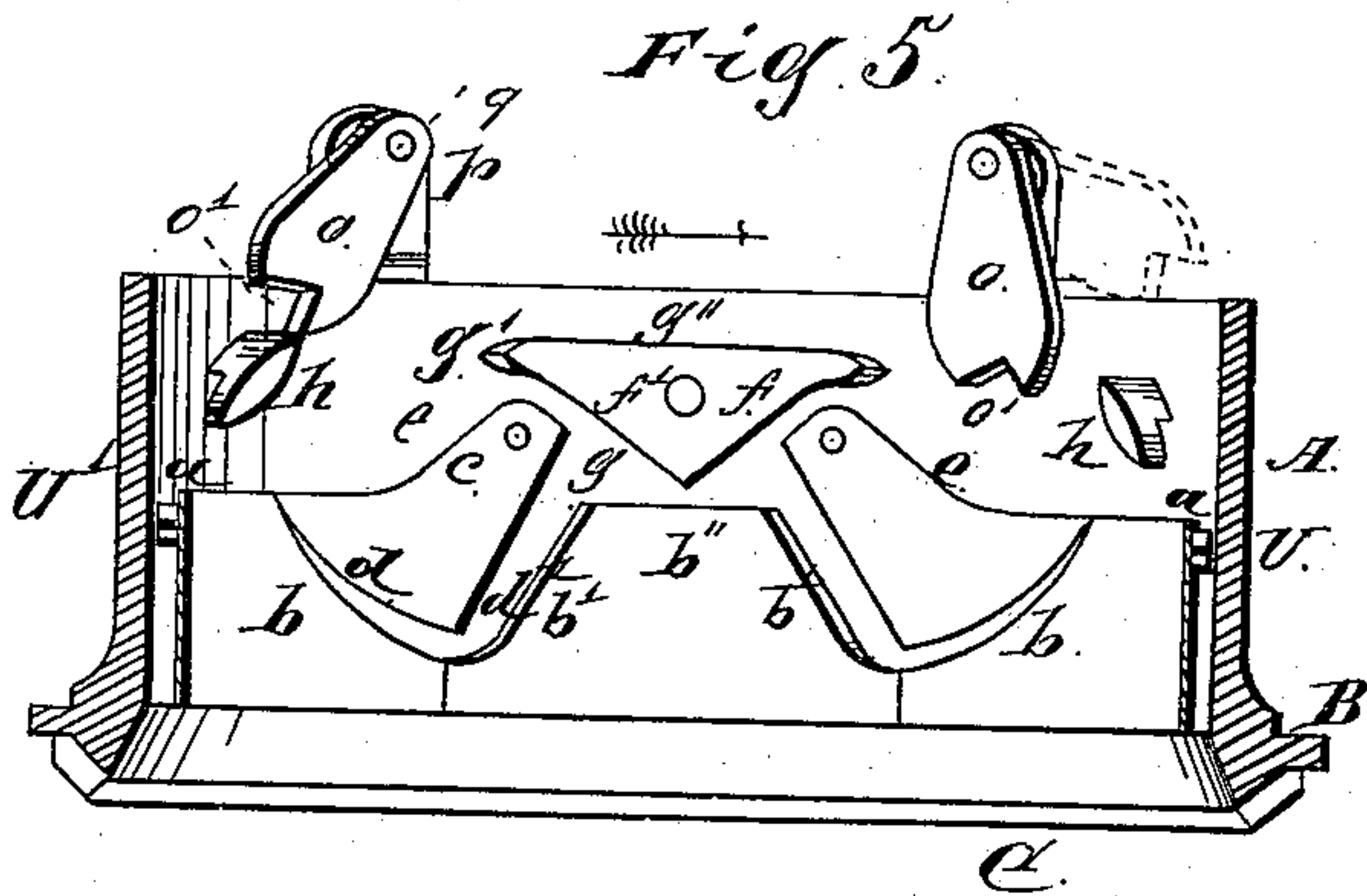
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4 Sheets—Sheet 3.

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(No Model.)

4 Sheets—Sheet 4.

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Fig. 9

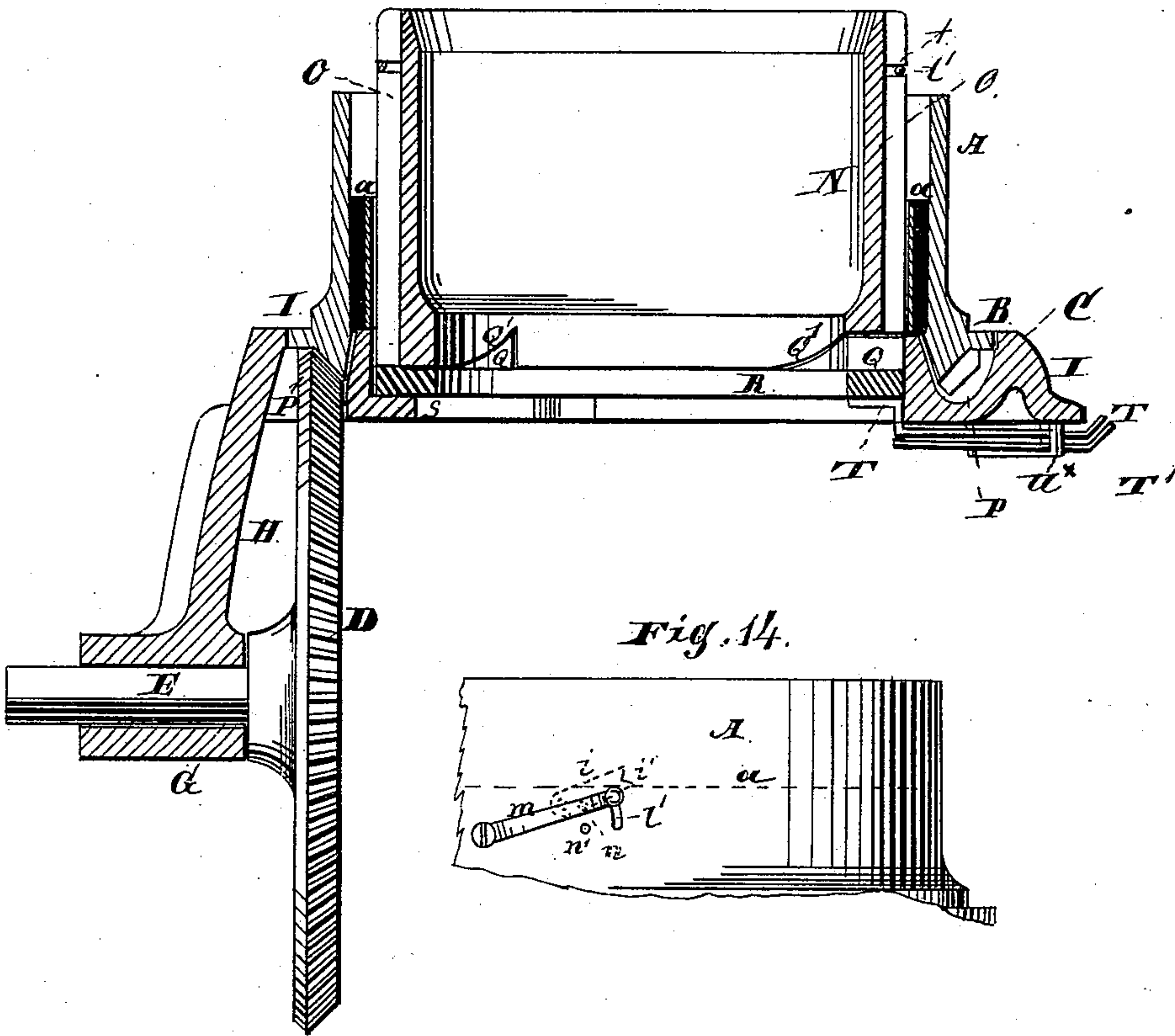


Fig. 14.

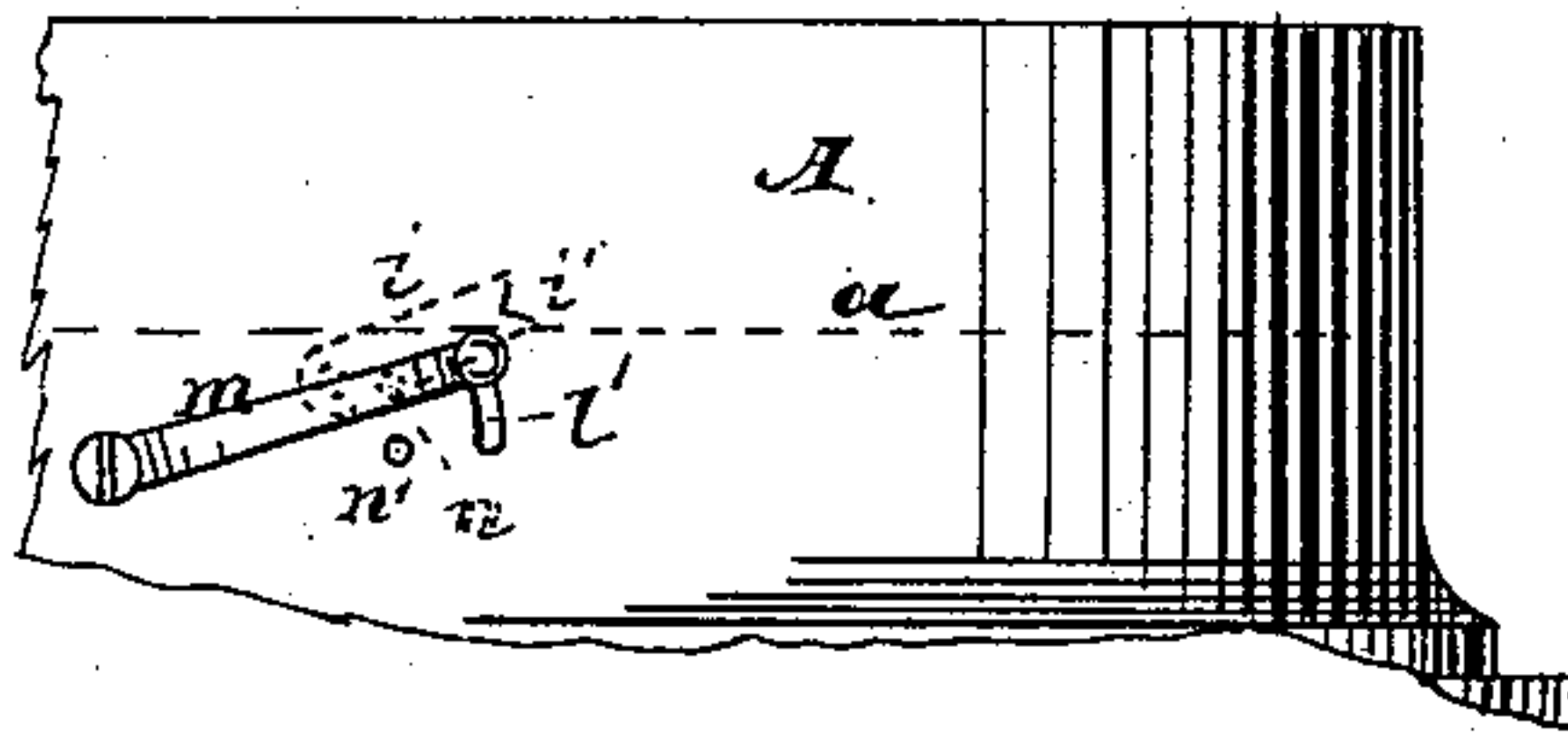


Fig. 15

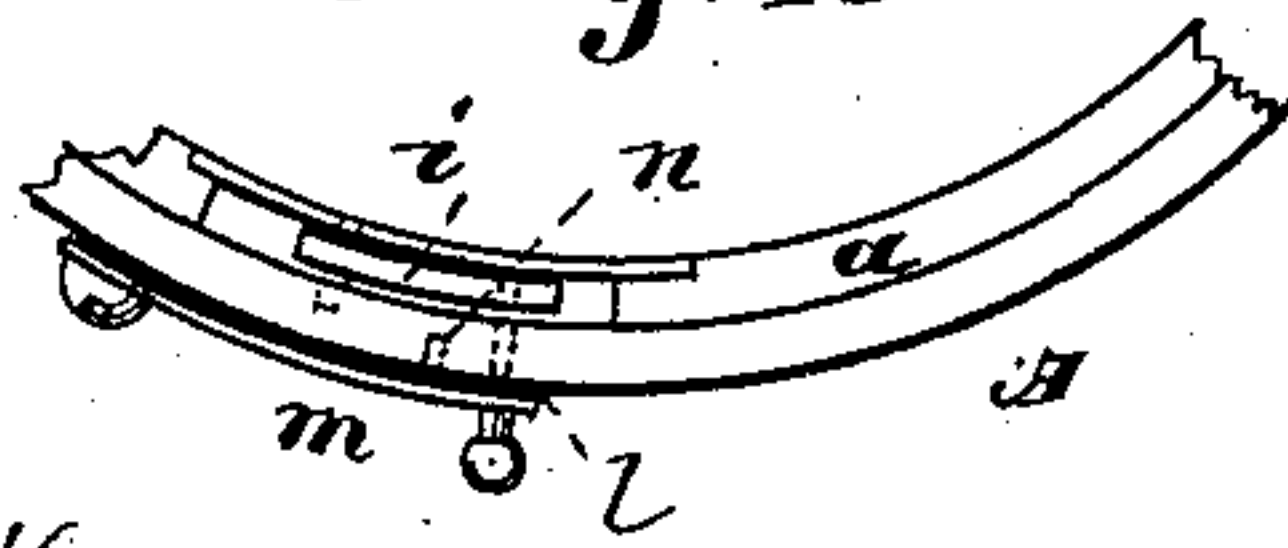
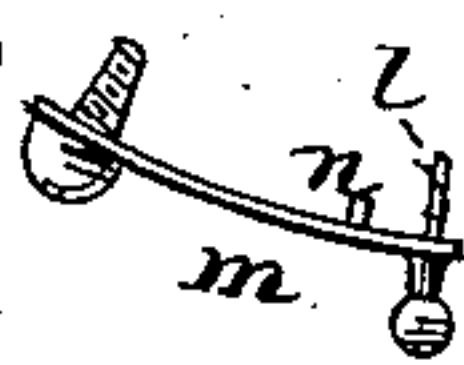


Fig. 16



Witnesses:

Albert H. Adams.
Chas. Bond.

Inventor:

Edwin R. Branson

UNITED STATES PATENT OFFICE.

EDWIN R. BRANSON, OF CHICAGO, ILLINOIS.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 333,102, dated December 29, 1885.

Application filed January 17, 1882. Serial No. 50,409. (No model.)

To all whom it may concern:

Be it known that I, EDWIN R. BRANSON, residing at Chicago, in the county of Cook and State of Illinois, and a citizen of the United States, have invented new and useful Improvements in Knitting-Machines, of which the following is a full description, reference being had to the accompanying drawings, in which—

Figure 1 is a top or plan view with the yarn-guide and the spindles removed; Fig. 2, a top or plan view of the cam-cylinder with the yarn-carrier removed, showing the elevating or raising levers in use and the depressing or lowering levers out of use; Fig. 3, a section on line *xx* of Fig. 2, showing the raising and lowering levers, as in Fig. 2; Fig. 4, a section similar to Fig. 3, showing the elevating or raising levers in the reverse position, respectively, from that shown in Fig. 3; Fig. 5, a section similar to Fig. 3, showing the depressing or lowering levers in position for use; Fig. 6, a section similar to Fig. 3, showing the depressing or lowering levers in the reverse position, respectively, from that shown in Fig. 5; Fig. 7, a detail in section of the cam-cylinder and needle-cylinder, showing the needle in position; Fig. 8, a detail in section showing the cam-cylinder and the position of the elevating or raising levers in carrying the needle to its non-acting position; Fig. 9, a section on line *yy* of Fig. 1, showing the base-plate, cam-cylinder, needle-cylinder, and driving mechanism in their several relations to each other; Fig. 10, a detail showing the position of the depressing-levers as the needle passes therefrom; Figs. 11 and 11^a, details showing the hinged support which carries the depressing-lever, Fig. 11 being a side elevation and Fig. 11^a a rear elevation thereof; Figs. 12 and 13, details showing a form of raising or elevating levers; Figs. 14, 15, and 16, details showing a form of retaining devices for the raising or elevating levers.

This invention relates to devices primarily designed for use with what are known or termed "circular-knitting machines;" but it can be applied and used with other forms of knitting-machines for the purpose of narrowing or widening the knitted fabric, the special object for which it is intended in connection

with a circular-knitting machine being to work the heel and toe of a stocking.

The object of the invention is to automatically raise or lower a needle at each side or end of the series of working - needles, as required to decrease or increase the number of working-needles in narrowing and widening; and the invention consists in the novel construction and combinations of parts herein- after fully described, and then specifically set forth in the claims.

In the drawings, A represents the cam-cylinder of a circular-knitting machine.

B is the flange at the lower end of the cam-cylinder.

C is the beveled gear on the edge of the flange B. These parts A, B, and C may be cast or otherwise formed in a single piece, as shown, or they may be otherwise formed.

D is the driving-wheel, meshing with the driving gear or ring C, for rotating or operating the cam-cylinder.

E is the shaft on which the wheel D is mounted.

F is the crank or other device attached to the shaft E, for applying the power to rotate the shaft and operate the wheel D.

G is the bearing of the shaft E.

H is the bracket or arm depending from the base and bed plate and supporting the bearing G.

I is the base or bed plate.

J is the side extension of the bed-plate, furnishing the means, in connection with set-screws, all as usual, for attaching the machine to a table or other support, and also forming a base for the reception of the bobbin-spindles and the yarn-guide, which devices are not shown, but may be of any of the usual and well-known forms of construction and arrangement. These parts G, H, I, and J are cast or otherwise formed from a single piece, as shown; but they may be otherwise formed.

K is the opening for the rod or support of the yarn-guide.

K' are the openings for the bobbin-spindles.

L are clamps or locking-plates for holding the cam-cylinder in position on the base or bed plate, so that it can revolve freely, each clamp being attached to the bed-plate by a

screw or otherwise, and projecting over the edge of the flange B, coming in contact therewith, as shown in Fig. 1. Other known devices than these plates can be used for holding the cam-cylinder in place.

M is the support for the yarn-carrier, attached at its lower end to the side of the cam-cylinder, so as to move therewith, and having its upper end extending over to be in line, or nearly so, with the circumference of the needle-cylinder.

M' is the yarn-carrier, attached to the upper end of the support M.

N is the needle-cylinder.

O represents the needle-grooves in the cylinder.

P is the groove in the base or bed plate for the flange B and cogged ring or gear C.

P' is the opening through the bed-plate into the groove P in line with the gear-wheel D, for the passage of the gear-wheel to engage with the gear C.

Q represents the cams or inclines for raising the needle-cylinder.

Q' represents the openings in the end or base of the needle-cylinder for the cams or inclines Q.

R is the movable ring on which the cams or inclines Q are located.

S indicates the ears or flanges on the base or bed plate, forming a support for the ring R.

T is the lever or finger-piece for moving the ring R.

T' is the spring for holding the lever or finger-piece in engagement with the rack bar or plate.

The lever or finger-piece T is rigidly attached to the ring R, on which the inclines Q are located, and by moving this lever it will be seen that the ring R will turn and cause the cams or inclines Q to act against the inclined faces of the opening Q', so as to raise or lower the needle-cylinder, as may be required for use. This finger-piece or lever T is arranged to engage with notches in a rack-bar, by means of which it will be locked in whatever position it is adjusted, to hold the ring R firmly in place.

U^x is the rack bar or plate, attached to the base or bed plate I.

The several parts represented by the letters from A to U^x, inclusive, may be of the form of construction and arrangement shown, or they may be of any of the well-known forms of construction and arrangement of that class of knitting-machines known as or termed "circular," and need not be, therefore, more specifically described. The needle-cylinder is stationary. The cam-cylinder revolves.

a represents the shoulder or rest for the heel of the needle, formed in the cam-cylinder by enlarging the upper portion of the interior thereof or otherwise.

b b' b'' represent the bottom cam.

c indicates the stitch or side cams.

c' is the pivot of the stitch-cams.

d d' e e' are the faces of the stitch-cams.

f is the top or V-shaped cam.

f' is the rivet or screw for attaching the cam f.

g g' g'' are the faces of the cam f.

h indicates the guides for passing the needle from the elevating or raising levers to their elevated position.

i represents the elevating or raising devices.

i' is the notch or opening in the end of the devices or lifters i shown.

j is the pivot of the devices or lifters i.

k represents the openings or slots in the cam-cylinders for the elevating devices shown.

l is the stop-pin.

l' is the slot in the cam-cylinder for the passage of the pin l.

m is the spring or arm carrying the pin l.

n is the retaining pin or point.

n' indicates the openings for the pin n.

o indicates the depressing or lowering devices.

o' is the notch or opening in the end of the devices or droppers o.

p is the hinged or pivoted portion of the support for the devices or droppers.

q indicates the pivots of the devices or droppers o.

r is the stationary part of the support for the devices or droppers o.

s is the needle.

s' is the heel of the needle.

t is the elastic or yielding band for holding the needles in their slots.

t' is the groove for the band t.

u is the spring for retaining the droppers o in their elevated position.

u' is the stop or pin against which the end of the spring u rests.

v is the spring for holding the hinged section of the dropper-support in its acting position.

v' is a slot in the spring v for the pin or stop u'.

The lower cam, b b' b'', may be of the form and arrangement shown, or other form and arrangement suitable for the purpose of forming the stitch in the usual manner, the rotation of the cam-cylinder causing the heel of the needle to travel over the edge or face of the depressed portions b b' of the cam, to raise and lower the needle, and over the edge or face of the portion b'' of the cam, maintaining the stem of the needle in the same horizontal plane as when traveling over the ledge or shoulder a.

The side cams, c, may be of the form shown, to coact with the lower cam, b b' b'', shown, or of any other form suitable to coact with some other form of lower cam, and they are located and arranged—one on each side—so that their lower ends will lie within the opening formed by the depressed portion b b' of the lower cam, as shown in Figs. 3, 4, 5, and 6, their upper ends being attached to the face of the cylinder A, above the ledge or shoulder a, by suitable pins or pivots, c', so that they are free to swing on such pivots. The lower edge or face, d, of each cam is curved, and the edge or face d' adjacent to the portion b' of the lower cam is straight, the remaining edges being formed, as shown in Figs. 3, 4, 5, and 6, so as to have an edge or face, e, curved at

its lower end and inclined at its upper, and an edge or face, e' , formed of a straight and curved portion. The lower end of each of these cams c is broader than the upper, and is so formed
 5 that when the cam is down the extreme lower end of the face or edge e will be in line with the shoulder or ledge a .

The upper or V-shaped cam may be formed, as shown, to coact with the form of side cams
 10 and lower cam shown, or of other form suitable to coact with other forms of side cams and lower cams. This cam is located above the side cams, and is attached to the interior face of the cylinder by means of a suitable
 15 screw or rivet, f' , so as to be held firmly in position. This cam has two lower inclined faces, g , and its ends g' are curved on each side or edge, and its upper face, g'' , is straight, and this face g'' is on a plane in line with the
 20 heel of the needle when elevated to be out of operation. This series of cams b b' b'' , c , and f , with their respective edges or faces, are located and arranged in the usual manner to give the needles the line of travel required to
 25 produce the stitch by the engagement of the heel of the needle therewith as the cam-cylinder is rotated or moved, the heel of the needle traveling in the groove or path formed by the coacting faces of the cams.

30 The guides h are located—one on each side of the needle-cams above the shoulder or ledge a —a sufficient distance for the elevating or raising devices to pass back of their lower ends, and each guide is secured to the interior
 35 face of the cylinder by means of a screw or otherwise, so as to be firm and unyielding. Each guide, as shown, is of an elliptical shape, the ends coming to a point, and is arranged so as to be inclined, with its upper end in line,
 40 or nearly so, with the upper edge of the top cam, f .

The lifters i , as shown, are located one on each side of the needle-cams in suitable recesses or slots, k , formed in the portion of the
 45 cam-cylinder below the ledge or shoulder a , and are held in position by means of a suitable pin or pivot, j , passing through the inner face of the cylinder and the end of the lifter into the outer face of the cylinder. Each
 50 lifter is pivoted, and is of such length that its free end will describe an arc of a circle just within the lower end of the guide h , and this free end is provided with a notch or recess, i' , to receive the heel of the needle, and when
 55 turned inward or toward the needle-cams such outer or free end will be in line, or nearly so, with the point on the shoulder a where the portion b of the lower cam starts, and will rest on the edge of the ledge or shoulder at
 60 that point, with its free end slightly raised above the plane of the shoulder or ledge, as shown in Figs. 3 and 4.

Each guide h , as shown, has a portion of its face adjacent to the cam-cylinder cut away to
 65 form a slot or passage for the travel of the end of the lifter between the point of the guide and the face of the cylinder, and the length of

the lifter and location of the guide on each side in relation to the shoulder a and the needle-cams are such as to allow the lifter to
 70 swing over in either direction and in proper relation to the needle-cams and the guides to be engaged with the hub of the needle as the cam-cylinder is rotated or moved, and be
 75 thereby carried over toward or away from the needle-cams.

The slot k , in which the lifters or levers i are pivoted, is on its rear side of greater length than the length of the lifter, so that the lifter
 80 can drop therein and come below the face of the ledge or shoulder a and be out of the way.

As shown, the free end of the lifter is held up, when in its backward position, by a pin, l , extending across the slot or opening k , and
 85 passing through a slot, l' , in the outer portion of the cam-cylinder, which pin is located on or secured to a spring or arm, m , the other end of which is attached to the exterior face of the cam-cylinder by a set-screw or other-
 90 wise. This pin l can be adjusted so as to stand higher or lower in the slot, to bring the end of the lifter i into position for use or drop it out of use, and, as shown, this adjustment is made
 95 by means of a secondary pin or point, n , located on the spring or arm m , and arranged to engage with openings n' in the face of the cam-cylinder, which openings are so arranged
 100 that when engaged with the upper one the pin l will hold the free end of the lifter i elevated or above the plane of the shoulder or flange a , and when engaged with the lower opening the pin l will allow the end of the lifter to drop below the plane of the shoulder or flange a and out of use.

The droppers or lowering devices, as shown, 105 are located one on each side of the stitch-cams, and above the top or V-shaped cam, and between the ends of such cam and the upper end of the guide h , so as to swing in the arc of a circle between the guide h and the
 110 adjacent end of the cam f . Each dropper is pivoted at its upper end by means of a suitable pin or pivot, q , so as to swing freely, and its lower or free end, as shown, is provided with a notch or recess, o' , to receive the heel
 115 of the needle, and these droppers may be of the form shown, or of any other form adapted to be located between the needle and cam cylinders, and above the needle-cams, and perform the required work, as hereinafter speci-
 120 fied. Each dropper is of such length and its pivotal point is so arranged that the circle described by its lower or notched end will be just within the points of the guide h and the end of the cam f , between which the dropper
 125 is pivoted, and when these droppers are in their elevated position they are held and retained in such position by the engagement of a spring, u , with a stop or rest, u' , one end of
 130 the spring being attached to the projecting end of the pivot q of the dropper, and the other resting on the stop or rest u' , as shown in Figs. 11 and 11^a; and, as shown, the stop or rest u' is of a triangular shape, to present a flat face

on each side for the end of the spring to rest on, and at the same time not interfere with the turning of the dropper readily when engaged by the heel of the needle.

As shown, each dropper is pivoted at its upper end to the face of a hinged support or plate, *p*, by the pin or pivot *q*, which plate or support is pivotally connected at its lower end with the upper end of a plate or support, *r*, secured to the face of the cam-cylinder by screws or otherwise, the plate or support *p* being so pivoted or hinged that it can be turned outward and carry with it the droppers *o* into a position where they will be non-acting or out of use.

As shown, the upper or carrying section, *p*, of the dropper-support is pivoted to the stationary section *r* at a point just above the top of the cylinder, and a spring, *v*, is provided, pivoted at its lower end so as to swing sideways, which spring, when turned up, has its upper end bearing against the rear face of the hinged section *p*, so as to lock and hold that section in position for the droppers to operate, and by swinging this spring *v* sideways, so as to remove its free end from engagement with the hinged section *p*, such section can be turned outward or dropped down, throwing the dropper out of operative position, as shown in Figs. 3 and 4.

The needles *s* are of the usual form of construction for needles of this class, except that the lower end of the shank or stem is extended farther below the heel *s'*, to prevent forward tipping, the heel *s'* and the needle proper being formed from a single piece, as shown in Fig. 7. The needles are retained in position at the upper end of the needle-cylinder by an elastic band, *t*, located in a groove, *t'*, formed in the periphery of the cylinder, as usual.

In practice, when the lifters are acting, the droppers are turned so as to be non-acting, and when the droppers are acting the lifters are dropped down so as to be non-acting, and Figs. 3 and 4 show these devices *i* and *o* in the position they occupy when the lifters *i* are acting, and Figs. 5 and 6 show these lifters in the position they occupy when the droppers are acting.

In knitting the heel and toe of a stocking with this class of machines the usual custom is to raise one half the entire series of needles into position where they are out of use and work with the half remaining, by raising a needle at each side or end of the series, so as to be out of use at each movement of the cam-cylinder, the cam-cylinder being given an oscillating or reciprocating movement for this purpose of sufficient extent for the working-needles to pass through the needle-cam.

In order to have a clear understanding of the operation of the machine, the sides of the cylinder *A* in Figs. 3, 4, 5, and 6 are lettered *U U'*, and an arrow is placed on each figure, showing the direction of movement of the cylinder.

Heretofore the common practice has been to raise and lower the successive needles, as required, by hand; but by using devices or levers *i o* such raising and lowering will be automatically performed.

For raising, the respective sets of devices are arranged as shown in Figs. 3 and 4, the acting ones *i* being thrown up into working position by the devices provided for that purpose, the position shown in Fig. 3 being the one in which the lifter on the side marked *U* will receive in its notch the heel of the first needle as the cam-cylinder is moved in the direction indicated by the arrow in said Fig. 3, and the position shown in Fig. 4 being the one in which the lifter on the side marked *U'* will receive in its notch the heel of the first needle as the cam-cylinder is moved in the direction indicated by the arrow in said Fig. 4.

The operation is as follows: The lifters being in the position shown in Fig. 3, and the cam-cylinder having been turned so as to bring the last needle on the left hand of the series beyond the end of the lifter, the movement of the cam-cylinder in the direction indicated by the arrow of Fig. 3 brings the heel of the first needle into engagement with the notch *i'* of the lifter, and the continued movement of the cylinder in this same direction turns the lifter on its pivot and raises its free end, and with it the needle. The free end of the lifter in this movement describes an arc of a circle passing back of the lower end of the guide *h*, and as the heel of the needle with the lifter reaches the lower end of such guide the heel will pass from the notch *i'* onto the upper face of the guide, and thence over the guide, being raised thereby to its elevated position or out of use, the lifter, as the heel of the needle passes onto the guide *h*, having been carried over, so that its free end is beyond the center of gravity, so that it will drop by gravity into the position shown in Fig. 4, this free end resting on the ledge or shoulder at the edge of the slot *k* next to the needle-cams, in which position the remaining needles of the series, as the cam-cylinder is rotated in the direction indicated by the arrow of Fig. 3, will pass over the end of the lifter onto the face *l* of the cam *c*, and up such face over the end or face *e'*, down the inclined faces *g* of the cam *f*, adjacent to the end *e'*, and thence over to the face *d'* of the left side cam, *c*, down such face, and up the face *b* of the lower cam, raising the cam *c* in its passage, and thence onto the ledge *a* on the opposite side of the needle-cams from where they started, the first needle of the series striking the under face of the lifter on the side *U'* and raising such lifter, carrying it over to the position shown in Fig. 4, the remainder of the needles passing over the end of the lifter in succession until all of the series have been carried beyond the end of the lifter. A reverse movement is then given to the cam-cylinder, as indicated by arrow in Fig. 4, causing the heel of the first needle of the series on this reverse movement to engage with the notch of

the lifter i' on the side U' , and raising such lifter and passing therefrom onto the guide h into its elevated position, in the manner just described, the lifter dropping by gravity into the position shown in Fig. 3, so that the heel of the remaining needles of the series will pass there-
 5 over as the cylinder moves in the direction of the arrow of Fig. 4 onto the face e of the cam c , thence over the end e' of such cam down the incline g of the cam f to the face d' of the opposite side cam, c , and up the face b of the lower cam, the heel of the first needle engaging the under face of the lifters on the side U , and carrying it over into the position shown in Fig. 3, so
 10 that the other needles will pass thereover. These movements of the cam-cylinder in the directions indicated by the arrow of Figs. 3 and 4 are continued until the required number of needles have been raised to the elevated
 20 position, each movement raising the first needle of the series successively. When the required number of needles have been raised, the lifters i are dropped down into position to be out of use, and the droppers o are brought
 25 into position for use, as shown in Figs. 5 and 6, the position shown in Fig. 5 being the one in which the dropper on the side U' will receive in its notch the heel of the needle, and the position shown in Fig. 6 being the one in
 30 which the dropper on the side U will receive in its notch the heel of the needle. The operation of these droppers o is substantially the same as that of the lower lifter, each oscillating movement of the cam-cylinder lowering
 35 the first needle at each end of the series of raised needles in succession, the movement of the cam-cylinder in the direction of the arrow, Fig. 5, causing the notch o' of the dropper on the side U' to engage with the heel of the first
 40 elevated needle of the series, and such dropper will be carried over by such engagement, throwing the heel of the needle down in its movement, so that as the movement of the cam-cylinder continues, the point g' of the cam f will pass
 45 thereover, and the incline g will come in contact therewith, depressing or lowering the needle, and the continued movement of the cam-cylinder will bring the face d' of the cam c , which lies in the direction of the movement
 50 of Fig. 5, in contact with the heel, which, passing down such side face, is engaged by the face b of the lower cam, and, passing up such face, comes to its normal position on the ledge a . The engagement of the first needle carries the
 55 dropper over out of the way, so that the heels of the remaining needles of the elevated series will not engage therewith, but will pass above the cam f , the heel of the first needle of the series of elevated needles striking the drop-
 60 per on the side U , and throwing it up until the series is passed, when it drops into the position shown in Fig. 6, in which position the notch o' thereof will engage with the heel of the first needle of the series of elevated needles as the cam-cylinder is turned in the di-
 65 rection of the arrow, Fig. 6, and will, as the cam-cylinder is rotated, carry such needle

down in its movement, bringing the heel into position for the end g' of the cam f to pass thereover, the continued movement of the cyl-
 70 inder causing the incline g to engage the heel of the needle, throwing it down into position to be engaged by the side or edge d' of the cam c , which lies in the direction of movement, down which edge it passes, and thence
 75 up the edge of the lower cam, b , onto the ledge a into its normal position, and these movements of the cam-cylinder will each lower an elevated needle, and will be continued until the entire series of elevated needles are
 80 lowered, the droppers on either side being swung out of the way by the engagement therewith of the heel of the next needle of the elevated series after the first one for the pas-
 85 sage of the heels of the needles in their elevated position.

The guides h shown are for the purpose of assisting the elevating or raising devices to pass the needle to its elevated position; but with some styles of machines such side guides could
 90 be omitted, the lowering and raising devices being arranged and operating to do the elevating in and by themselves.

The devices shown for raising and lowering the needles act in the nature of levers. 95

The lowering or depressing devices shown, after taking the first needle of the series and carrying it down, are swung over out of use by the succeeding needles of the series, as
 100 shown in Fig. 10, such figure showing the dropper on the side U' of Fig. 5 carried over by the movement of the cam-cylinder to bring the heel of the needle which has been caught in the notch of the dropper into its depressed
 105 position to pass beneath the point g' of the cam f , and after the heel of the caught needle has passed beneath the point g' the heel of the next succeeding needle strikes the edge of the dropper and elevates such dropper, so that
 110 the heels of the succeeding needles of the series will pass above the upper edge of the cam f , and when all the needles of the series have passed the dropper will fall into a vertical position, as shown in Fig. 6, which figure shows
 115 the dropper on the side U' of Fig. 5, and such dropper will remain in this position until the return movement of the cam-cylinder, on which movement it will be engaged by the
 120 heel of the first needle of the series of elevated needles remaining on such reverse movement after the one depressed by the action of the
 125 dropper on the side U of Fig. 6, and be swung or carried outward or away from the needle-cams, so as to drop into position to engage the heel of the first needle on the next rotation of
 130 the cam-cylinder in the direction of the arrow, Fig. 5.

This description applies to the dropper shown on the side U' of Fig. 5; but the same movements occur when the dropper on the
 130 side U , Fig. 6, comes into operation. These droppers may be arranged so as to be held in working position by friction or suitable springs and stops, u u' , as shown in Figs. 11 and 11^a,

or other means may be used to retain them in such position.

Fig. 7 shows a needle the shank or stem of which has a curve above the heel, and Fig. 8 shows a needle the shank or stem of which is left straight, both forms being those which are commonly used in knitting-machines of different styles or makes, and either of which can be used in connection with the lifters and droppers to be automatically raised and lowered.

What I claim as new, and desire to secure by Letters Patent, is as follows:

1. The combination, with the needle-cylinder, needles, cam-cylinder, and needle-operating cams, of levers or lifters located below said cams, and levers or droppers located above said cams, said levers or lifters and levers or droppers being constructed to raise and lower the needles successively to render them acting and non-acting, substantially as described.

2. The combination, with the needle-cylinder, needles, cam-cylinder, and needle-operating cams, of the levers or lifters *i*, having notched ends and located on each side of the needle-operating cams, and the guides *h*, having notched ends and located above said levers or lifters, substantially as described.

3. The combination, with the needle-cylinder,

needles, cam-cylinder, and needle-operating cams, of the levers or lifters located one on each side of the needle-operating cams, a stop or retainer for the levers or lifters to rest against, and means for adjusting the stop or retainer, substantially as described.

4. The combination, with the needle-cylinder, needles, cam-cylinder, and needle-operating cams, of a lever or depressor located above and at one side of the needle operating cams, for automatically depressing or lowering the needles successively, substantially as described.

5. The combination, with the needle-cylinder, needles, cam-cylinder, and needle-operating cams, of the levers or droppers located one on each side of the needle-operating cams, for automatically engaging the heel of the elevated needles in succession and depressing them, substantially as described.

6. The combination, with the needle-cylinder, needles, cam-cylinder, and needle-operating cams, of the levers or droppers *o* and a retaining spring or catch therefor, substantially as described.

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Witnesses:

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O. W. BOND.