(No Model.) 3 Sheets—Sheet 1.

# B. M. DENNEY.

## CIRCULAR KNITTING MACHINE.

No. 541,425. Patented June 18, 1895.

Fig. 1.

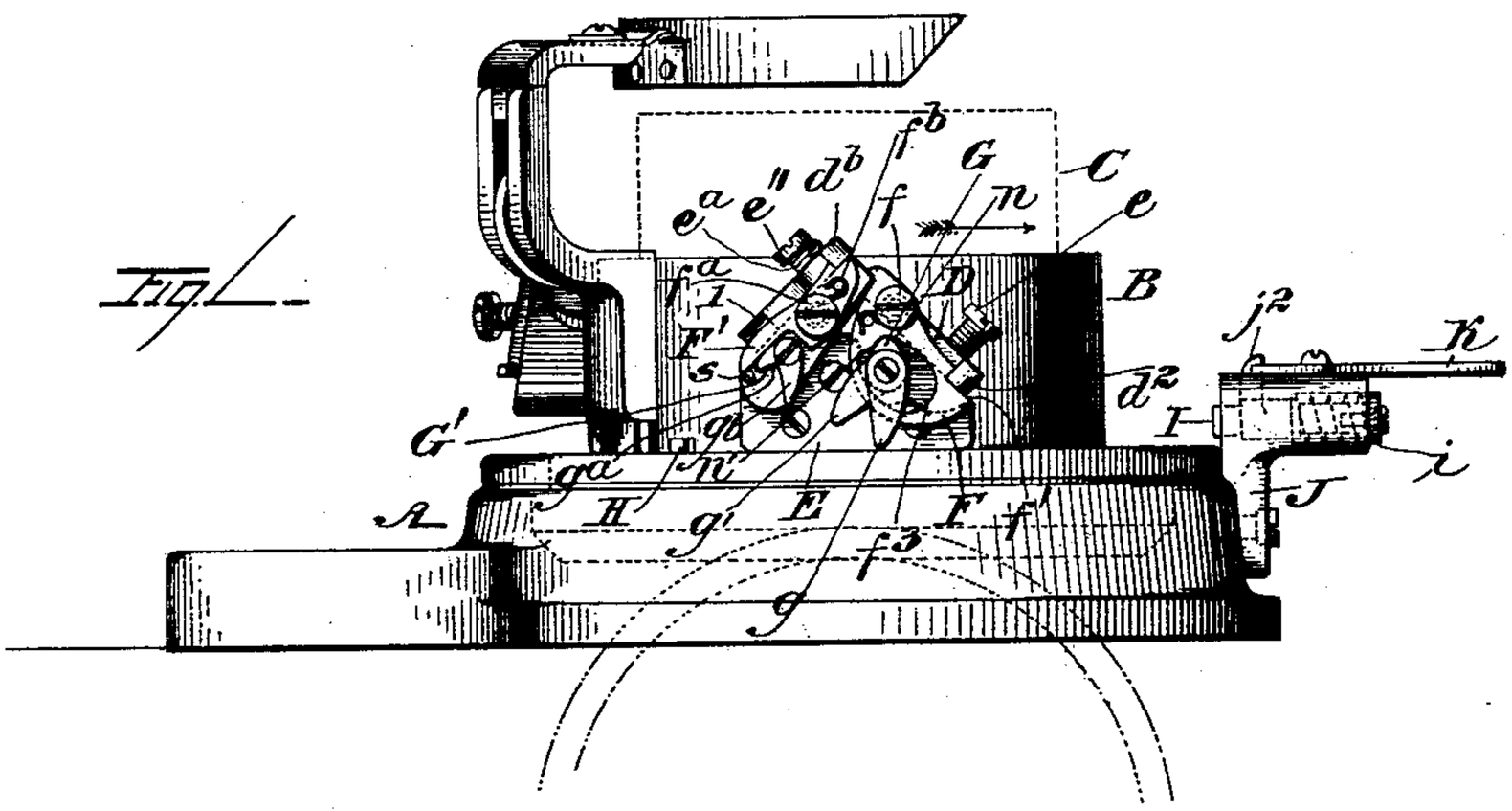
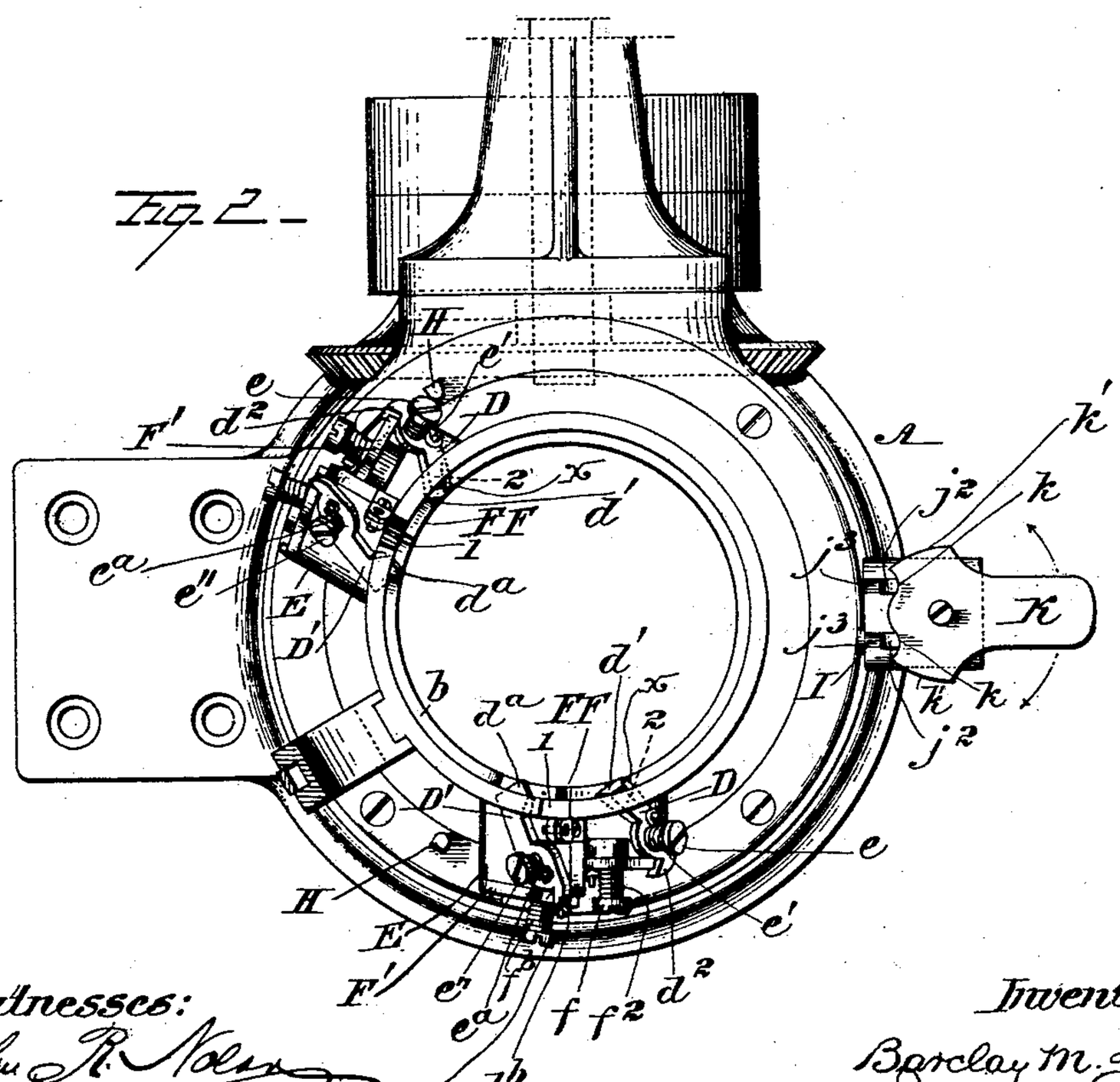



Fig. 2.




Witnesses:
John R. Nolan
F. Norman Dixon

Inventor:
Barclay M. Denney,
per Joshua Pusey
Attorney.

(No Model.) 3 Sheets—Sheet 2.

# B. M. DENNEY.

## CIRCULAR KNITTING MACHINE.

No. 541,425. Patented June 18, 1895.

Fig. 3.

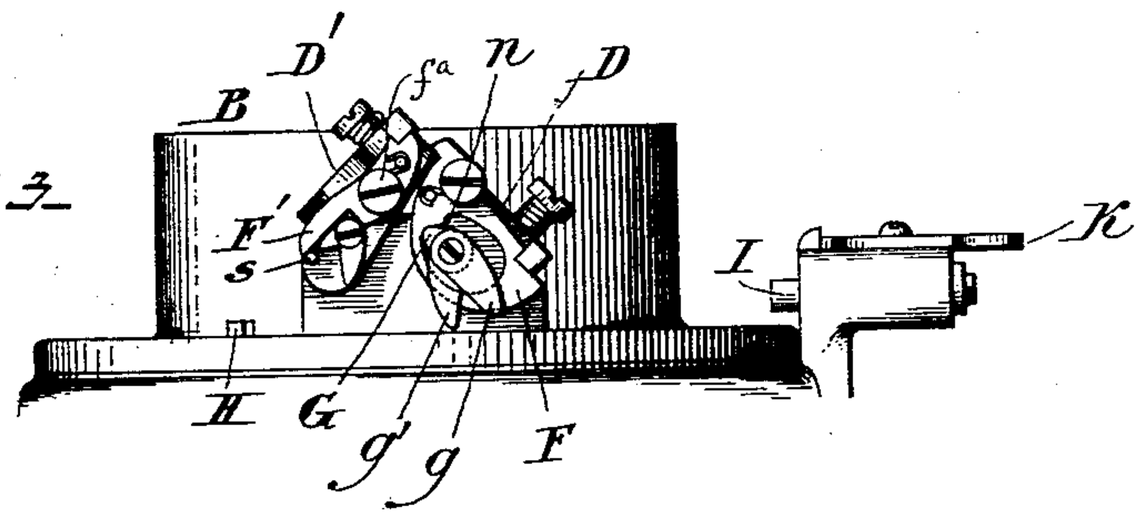



Fig. 4.

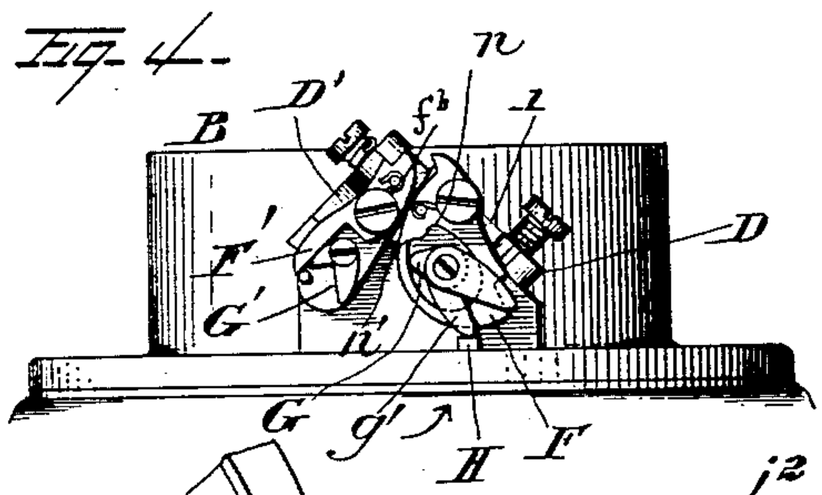



Fig. 5.

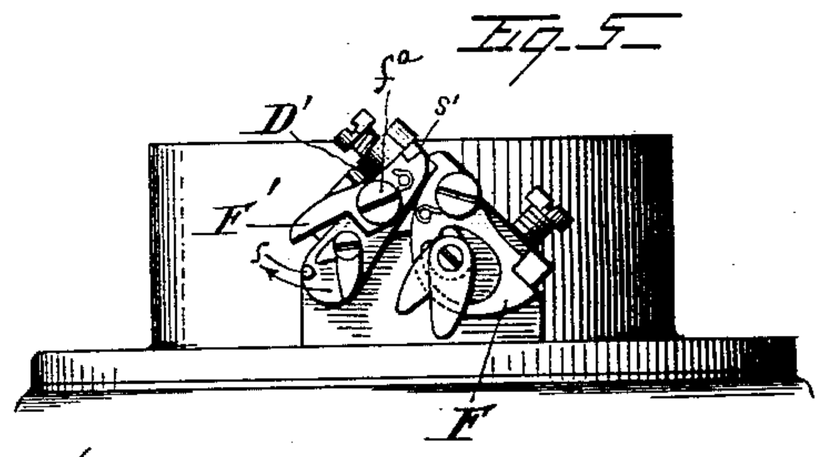



Fig. 11.

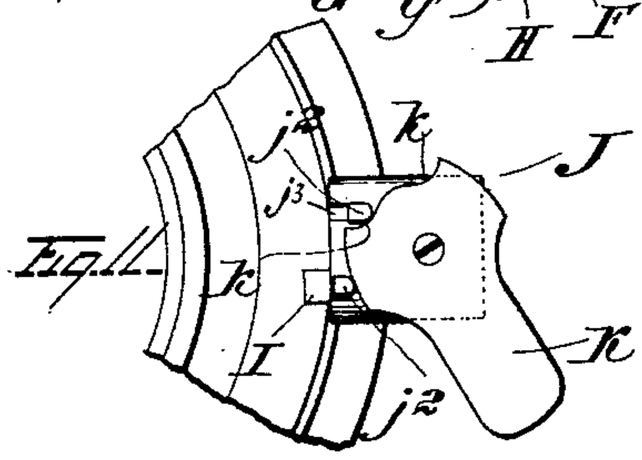



Fig. 13.

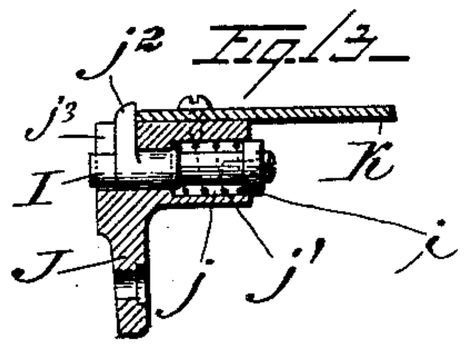



Fig. 12.

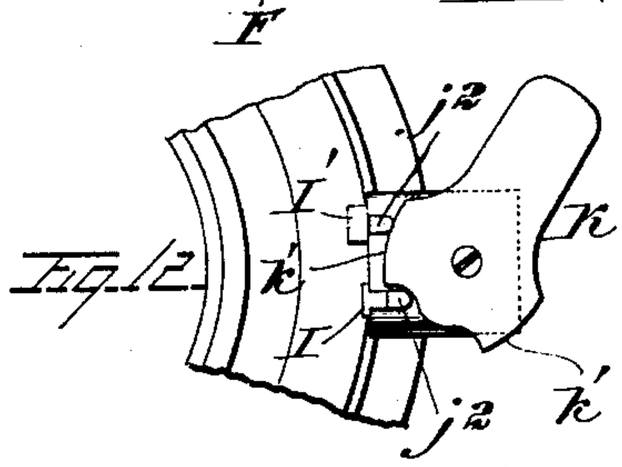
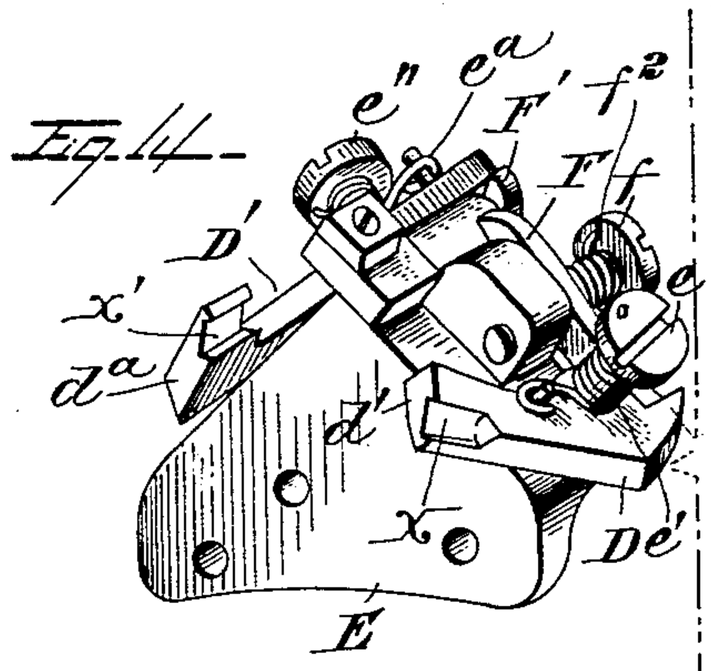



Fig. 14.



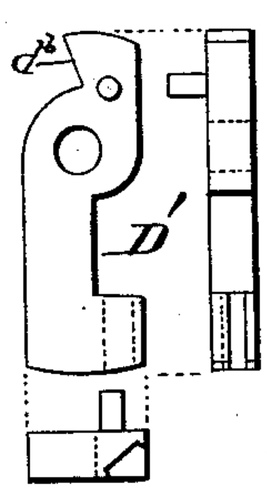
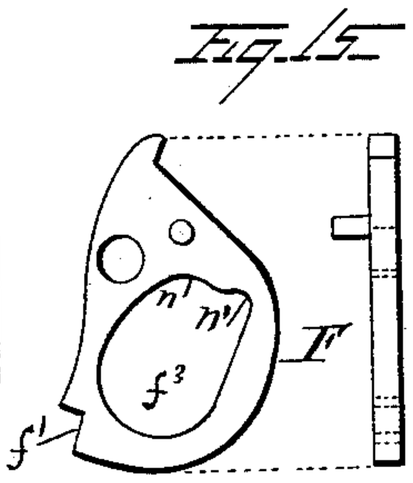
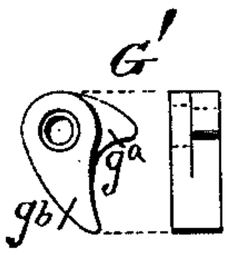



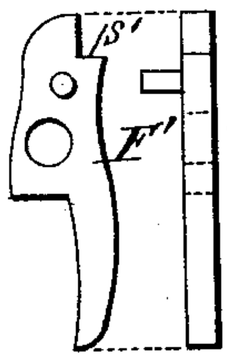


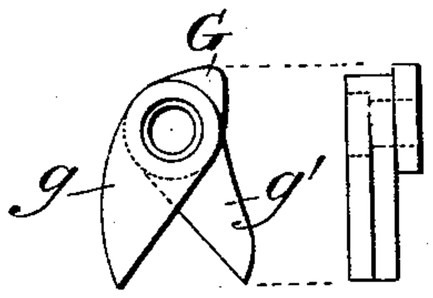


Fig. 15.




Witnesses:
John R. Nolan
F. Norman Dixon.

Inventor:
Barclay M. Denney,
per Joshua Pusey
Attorney.

(No Model.) 3 Sheets—Sheet 3.

# B. M. DENNEY.

## CIRCULAR KNITTING MACHINE.

No. 541,425. Patented June 18, 1895.

Fig. 6.

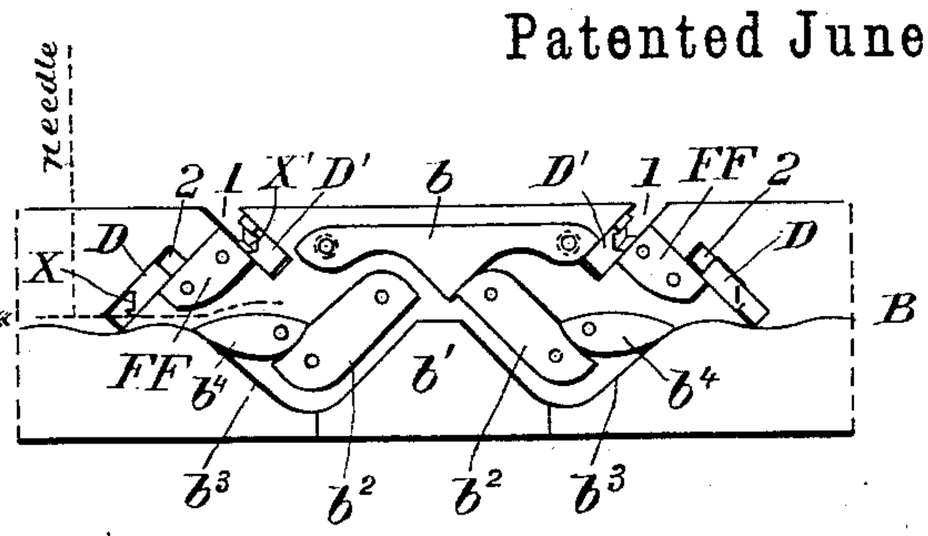



Fig. 7.

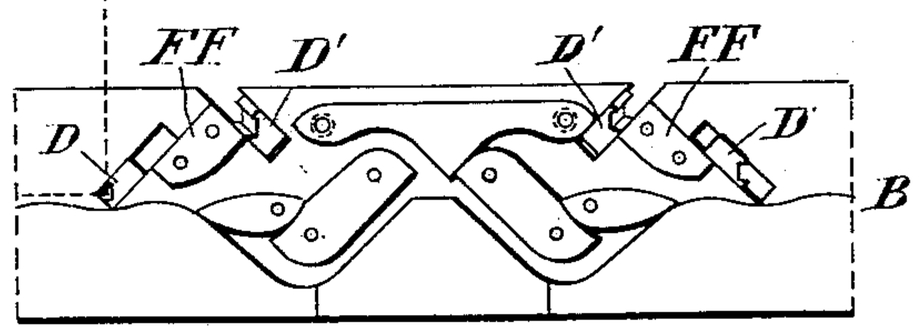



Fig. 8.

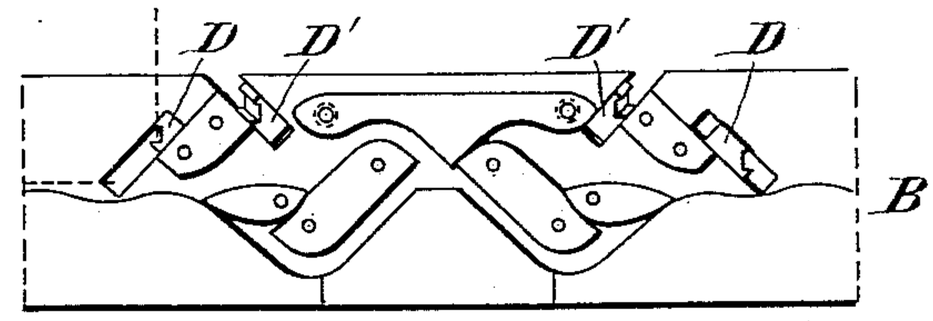



Fig. 9.

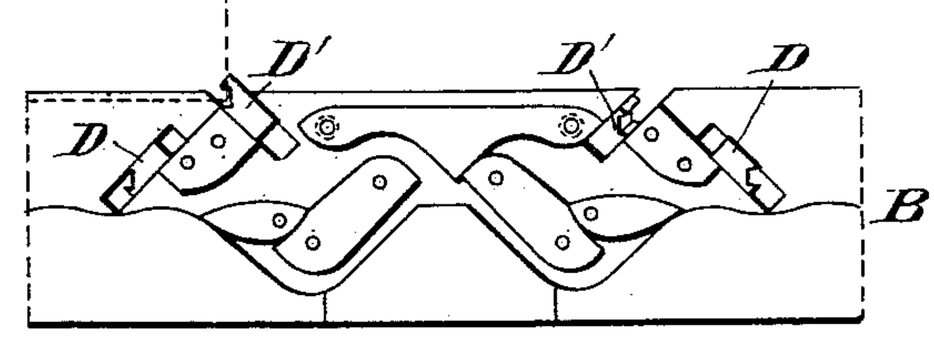
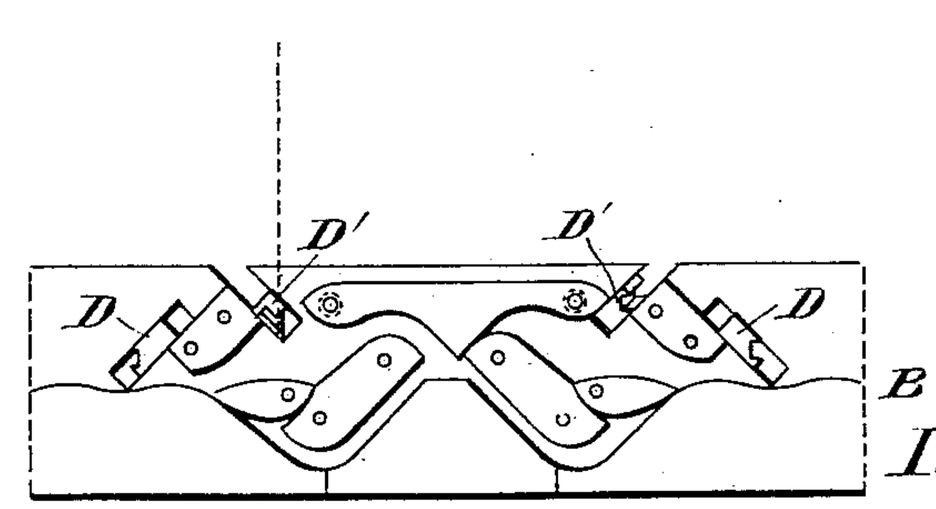



Fig. 10.




Witnesses:
Walter C. Pusey.
Chas. F. Nolan

Inventor:
Barclay M. Denney.
per Joshua Pusey, atty

# UNITED STATES PATENT OFFICE.

BARCLAY M. DENNEY, OF CAMDEN, NEW JERSEY.

## CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 541,425, dated June 18, 1895.

Application filed October 8, 1891. Serial No. 408,082. (No model.)

*To all whom it may concern:*

Be it known that I, BARCLAY M. DENNEY, a citizen of the United States, residing in the city and county of Camden, in the State of New Jersey, have invented certain new and useful Improvements in Circular-Knitting Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, of which—

Figure 1 is a side elevation of a knitting-machine embodying my invention, only so much of the machine being shown as is necessary to illustrate the improvements. Fig. 2 is a plan view. Figs. 3, 4, and 5 are side elevations of the cam-cylinder and adjuncts, the needle-controlling devices being respectively represented in the positions which they are successively caused to assume during the widening and narrowing operations. Figs. 6 to 10, both inclusive, are diagrammatic views of the knitting-cams as equipped with my improved lifting and depressing devices, showing the action of the latter upon the needles at various stages of the work. Figs. 11 and 12 are plan views of certain stud or tripping devices hereinafter referred to. Fig. 13 is a vertical section through one of said devices. Fig. 14 is a perspective view, enlarged, of the needle lifting and depressing devices detached from the machine. Fig. 15 represents separate views of the fingers, latches, and cam-levers of the needle lifting and depressing devices.

This invention relates to that well-known type of knitting machines by which stockings and other hosiery are produced; and it has especial reference to those devices whereby certain needles are automatically moved into and out of action at predetermined intervals during the formation of the heel and toe parts of the stockings.

The nature and scope of my improvements will be understood from the following description and claims, reference being had to the annexed drawings, wherein—

A represents the bed of the machine, in which is supported the usual rotatable cam-cylinder B and the fixed needle-cylinder C. The latter is merely indicated in dotted lines for illustrative purposes. The knitting cams on the inner periphery of the cylinder B, are the same as formerly, comprising the upper depressing cam *b*; the central raising cam *b'*; the lateral depressing cams $b^2$; the lateral raising cams $b^3$, and the pivoted switch-cams $b^4$, (Fig. 6.)

1, 2, are oppositely inclined slots which are formed in the cam cylinder at or adjacent to each end of the knitting cams. Projecting through these slots into the cam-cylinder are peculiarly-constructed needle-controlling devices, which are pivoted upon suitable supporting frames, E, fixed to the exterior of the cylinder. There are thus two sets of these devices working in relation to the respective ends of the cams. These devices are identical in construction and operation, save that, in view of their opposite locations, the positions of the like parts in the two sets are reversed. Consequently, a description of one set will suffice in this connection.

I shall proceed to describe the needle-controlling devices on the leading end of the knitting cams, it being assumed that the latter are moving in the direction indicated by the arrow in Fig. 6.

The slot 1 is cut into the top of the cylinder so as to incline downwardly toward the knitting cams, this slot extending near to and below the nose of the upper cam *b*. The slot 2 is cut in the body of the cylinder so as to incline upward in a direction opposite to that of the slot 1; the slot 2 being formed adjacent to the summit of the lateral raising cam $b^3$.

F F is an inclined cam which is fixed to the inner wall of the cam-cylinder coincident with the inclined edges of the slots. This cam is so disposed that its lower corner does not obstruct the entrance of the needles to the knitting cams in ordinary tubular knitting. Its top corner is on a line with or slightly above the upper edge of the cam *b*.

Fixed to the exterior of the cylinder, so as to lie between the inclined slots, is the supporting frame E, the upper portion of which is Λ-shaped in accordance with the positions of said slots.

Pivoted at a suitable point on one of the inclined faces of the frame, by means of a screw-pin *e*, is a finger D, one end *d'* of which extends into and beyond the slot 2. The forward corner of this in-projecting end is notched or recessed as seen at *x*. Encircling

the pin *e* is a spiral spring *e'*, one end of which is fixed to the head of the pin and the other end fixed to a stud on the finger, whereby the tension of the spring acts to force the notched end of the finger to the bottom of the slot. The outer end of the finger is formed with a tail-piece $d^2$.

Pivoted on the front of the frame, by means of a screw-pin *f*, is a latch-plate F, one corner of which is recessed or offset, as at *f'*, in such manner that the tail-piece on the finger D is engaged with said corner under certain conditions so as to lock the finger in the normal or idle position. When the finger is in this position its recessed end *x* lies above the line or track of the needle-heels so as not to interfere with the latter in the usual process of knitting. This is represented in Fig. 6 of the drawings. The latch-plate is maintained in engagement with the finger by means of a torsional spring $f^2$ which encircles the screw-pin *f*, one end of the spring being secured to the pin-head and the other end to a pin on the face of the latch-plate. In the body of this plate is formed a cam-shaped opening $f^3$. Pivoted to the frame E so as to lie within this opening and take against the edge thereof, is a cam-head G, from the outer face of which depend two diverging arms *g*, *g'*, that constitute, in effect, an angle-lever. It will be observed that these arms are not in the same vertical plane, the arm *g* being in front of the arm *g'*. The contour of the edge of the opening is such that when the arms are turned in the direction indicated by the arrow in Fig. 4, the cam-head bears against the opposed edge of the opening and forces forward the latch-plate so as to free its recessed corner from the engaged end of the finger D, whereupon the action of the torsional spring upon the finger is such as to throw its recessed end down to the line of the needle-heels. See Fig. 7. During the rotation of the cam-cylinder, this recessed end abuts against the first needle-heel in its path, which heel, in the onward movement of the cylinder, thrusts up the end of the finger, and is thereby conducted into the path of the fixed cam F F. This done, the latter directs the needle-heel above the nose of the upper cam *b*, that is, out of action.

It will be understood that as the end of the finger is swung upward by the thrust of the needle-heel, said end traverses an arc which intersects the slot 2. Thus, the needle-heel is freed from the recessed finger head upon the latter entering the slot. When the thrust of the needle is removed, the finger-head is pressed down by the action of the spring, but the instant the outer projection of the finger reaches the recessed corner of the latch, this corner is thrown into engagement with the projection so as to lock the finger in the normal or idle position ready for a succeeding action.

As is well-known to knitting artisans, it is the practice in forming heels and toes, to lift up out of action a sufficient number of needles (usually one-half of the whole number in the cylinder) to permit of the reciprocation of the knitting cams. During each stroke of the cams in the reciprocating operation, a course of stitches is knit, and at the end of each course thus knit a needle is thrown up out of action, thereby narrowing the fabric. After the narrowing has been completed, the up-thrown needles are depressed in inverse order to their elevation, during the knitting of the successive courses of stitches, thereby widening the web correspondingly with the narrowing, and in that manner forming a heel or toe pouch. To form the tubular portion of the stocking, the first up-thrown series of needles are pressed into action, and the knitting cams are rotated.

As a means whereby the like fingers D on the opposite ends of the knitting cams shall be successively brought into action so as to raise the needles at alternate ends of the courses of stitches as they are successively formed, I mount at proper points upon the fixed ring or annulus of the bed-plate, two up-projecting studs H that intersect the path traversed by the inner depending arms *g'*, when the latter occupy the position shown in Fig. 3. During the reciprocation of the cam-cylinder, these arms *g'* are alternately caused to assume this last-mentioned position, by means of a trip-stud I which is projected into the paths of the outer depending arms *g* preparatory to the reciprocation of the knitting cams. This stud and the preferred means for operating the same will be presently described.

In the upper edge of the cam-opening $f^3$ there are two notches *n*, *n'*, the function of which is to maintain the depending arms in the two positions which they are caused to assume while the recessed lifting finger is in its idle or intermediate position. Normally, the cam-head is in engagement with the notch *n* so as to maintain the inner depending arm in an elevated position to enable it to clear the studs H during the rotation of the cam-cylinder; but when the lateral trip-stud I has been projected, as above mentioned, the outer depending arm *g*, during the onward stroke of the cylinder, abuts against said stud, which stud draws back the arm *g*, and, perforce, turns down the inner arm *g'*. In this movement the cam-head is disengaged from the notch *n*, and engaged with the other notch *n'*, the latter maintaining the arms in the last-mentioned position. Of course, the movement of the latch while the cam-head is passing from one notch to the other is not sufficient to unlatch the needle-lifting finger. As the cylinder continues its stroke, the arm *g'* impinges against the stud H in its path, which stud forces back the arm and thereby unlatches the needle-lifting finger as previously described. It will be noticed that when the outer end of the unlatched finger moves upward (upon the descent of its inner end) this outer end bears upon the opposed edge of the

latch and temporarily maintains the latter in the unlatching position. When the arm $g'$ has ridden over the stud, the parts, namely, the two arms and the cam-head assume, by gravity, their first position, that is, the position illustrated in Figs. 1 and 5. Continuing the onward movement of the cams until the stroke is completed, that is, until the knitting cams have cleared the needles, the direction of movement of the cam-cylinder is reversed. In this reverse stroke, of the knitting cams, the unlatched lifting-finger abuts against the heel of the first active needle in its path and lifts said needle out of action as previously described,—the finger as above mentioned being thereupon returned to its original or idle state. The shape of the cam opening in the latch is such that the cam-head is free to swing therein when, in this reverse stroke, the outer arm strikes the laterally projecting trip-stud. During the stroke, the inner depending arm $g'$ controlling the other needle-lifting finger D, is operated by the up-projecting stud in its path, similarly to the first arm $g$; the finger being unlatched in like manner and assuming the down or active position. Consequently in the succeeding stroke of the knitting cams, the first active needle in their path is thrown out of action by the finger last referred to. Thus during each reciprocation of the cams (namely, two strokes) the lifting fingers are alternately operated, thereby lifting a needle out of action at the alternate ends of the successive courses. When a sufficient number of needles has been moved out of action to effect the desired narrowing the lateral stud I is retracted from the path of the arms $g$, and certain devices for depressing the needles in inverse order to their elevation, are brought into play. These devices are of the following construction:

D′ represents a finger which is pivoted, by means of a screw-pin $e''$, upon the face of the frame E, so that one end $d^a$ of the finger extends into and beyond the upper diagonal slot 1. The forward corner of this in-projecting end is notched or recessed, as at $x'$, similarly to the adjacent end of the finger D, and the outer end of the finger D′ is formed with a projection or tail-piece $d^b$ similarly to said other finger. A torsional spring $e^a$ encircles the screw-pin $e''$, one end of which spring is fastened to the head of the pin and the other end to a stud on the face of the finger D′. The action of the spring is to force upward the inner or recessed end of said finger.

F′ represents a latch which is pivoted to the front of the frame at a point adjacent to the finger D′, by means of a screw-pin $f^a$ encircling which is a spring $f^b$ whose ends are fastened to the pin-head and to the latch respectively, whereby the upper corner of the latter is forced toward the projection or tail-piece on the finger D′. This corner is recessed to receive said projection and lock it in place. The lower end of the latch takes against a stop-pin $s$. Pivoted to the frame E at a point adjacent to this end of the latch is a small angle-lever G′, one arm $g^a$ of which rests normally against the edge of the latch, the other or longer arm $g^b$ extending downward. That portion of the frame to which the lever is pivoted projects outwardly beyond that portion to which the levers $g\ g'$ are pivoted, so that the former lever is somewhat in front of the latter lever.

The foregoing described depressing devices are brought conditionally into action by means of a laterally-projecting stud I′ which is projected into the path traversed by the depending arms of the lever G′ during the operation of the cam-cylinder. This stud and its operating devices will be hereinafter explained. The stud projects far enough to engage said depending arm, but not sufficiently far to interfere with the latch-operating lever of the lifting finger. In the first stroke of the cams, the depending arm of the lever G′ strikes against the trip-stud I′, which latter forces the arm forward (*i. e.*, in the direction indicated by the arrow in Fig. 5) and causes its shorter arm to throw outward the upper end of the latch F′, thereby releasing the outer or engaged end of the finger D′. This done, the torsional spring moves the said finger so as to throw its inner or recessed end upward into the position represented at the the left of Fig. 9. Continuing the stroke, this end of the finger abuts against the opposed heel of the first needle in the inactive series, which heel is thereupon directed by the finger below the adjacent nose of the upper cam $b$, that is, into active position. The heel is freed from the finger in a manner similar to that above described in regard to the lifting operation—that is to say, by the end of the finger swinging into the slot 1. When the finger is being thus turned, its out-projecting end passes over the shoulder $s'$ of the latch, which latch immediately assumes its original or locking position. Hence when the released finger is turned by the torsional action of the spring $e^a$, the projection on the finger engages the recessed end of the latch, and thereby locks said finger in the first or inactive position in readiness for a succeeding operation. The onward stroke of the cam-cylinder is continued until the knitting cams have cleared the active needles, whereupon a reverse stroke is imparted to the cylinder. In this reverse stroke the first needle acted upon by the knitting cams is the one last thrown into action. During the stroke the other needle-depressing devices are brought into play similarly to the like devices just described; the first opposed inactive needle toward the end of the reverse stroke being in the same manner pressed into action. Thus, during every two strokes of the knitting cams the needle-depressing fingers are alternately actuated so as to depress a needle into active position at the alternate ends of the successively-formed courses. When all the up-thrown needles have been brought into action, the trip-stud I′ is re-

tracted, and the knitting of tubular work proceeded with.

As a simple and efficient means whereby the studs may be alternately moved into and out of action or simultaneously moved out of action, as occasion may require, I have devised the construction illustrated most clearly in Figs. 11, 12 and 13 of the drawings, although, of course, other devices to the same end might be employed. This construction is as follows: J represents a suitably-shaped bracket which is bolted firmly to the forward side of the base-plate of the machine. The head of this bracket rises above the base-plate. The studs I, I′ are mounted in properly-disposed holes *j* in the bracket head. These holes are shouldered as shown, and they contain spiral springs *j′* which encircle the studs I I′ and bear against heads *i* on their outer ends, the action of the spring *s* thus being to retract the studs. The latter are provided with vertical pins $j^2$ which project through suitably-located slots $j^3$ in the bracket-head. These pins abut against the ends of the slots, and in that way limit the rearward movement of the studs. Pivoted upon the top of the bracket-head is a small lever K, the inner end of which is cam-shaped as seen—that is to say, it has two end notches *k* and two diverging lateral edges *k′*. When the lever is in the central position illustrated in Fig. 2, the pins $j^2$ register with the notches *k*. These notches are so disposed as not to interfere with the backward movement of the studs. The latter are thus in the retracted or inactive position. When the lever is moved alternately into the positions represented in Figs. 11 and 12, the edges of the notches, together with the lateral edges of the lever arm abut against and force outward successively the opposed pins on the studs I I′, thereby expelling the latter—that is to say, when the lever is moved into the position shown in Fig. 11, the stud I is projected, without affecting the position of the stud I′; and when the lever is moved into the position shown in Fig. 12, the stud I′ is projected, the other stud (I) thereupon resuming its normal or retracted position.

It will be observed that by the peculiar construction of the lever, it is locked by the action of the spring in the positions it may be caused to assume.

Having thus described my invention, I claim—

1. The combination with the cam carrier and its cams, of a movable finger provided with a needle-engaging portion, that normally projects into the carrier, a latch provided with a cam surface and mounted on the carrier, an independent latch-operating device mounted on the carrier and adapted to act upon said cam surface, and the trip studs, substantially as described.

2. The combination with the cam carrier and its cams, of a movable finger provided with a needle engaging portion that normally projects into the carrier, a latch mounted on the carrier and provided with a cam-shaped opening therein, a cam-head in said opening, arms depending from said cam-head, and trip studs adapted to actuate said arms, substantially as described.

3. In a knitting machine, trip mechanism of the character described, the same consisting of the combination, with a bracket or support, of two spring-controlled normally-retracted studs therein, a cam lever pivoted to the bracket and provisions whereby the said lever is adapted to act upon said studs to move them alternately into action, or to permit them to be retracted simultaneously, substantially as specified.

In testimony whereof I have hereunto affixed my signature this 8th day of August, A. D. 1891.

BARCLAY M. DENNEY.

Witnssses:
JOHN R. NOLAN,
F. NORMAN DIXON.