4 Sheets--Sheet 1.

# F. M. COMSTOCK.

## Improvement in Knitting Machines.

No. 125,543. Patented April 9, 1872.

Fig. 1

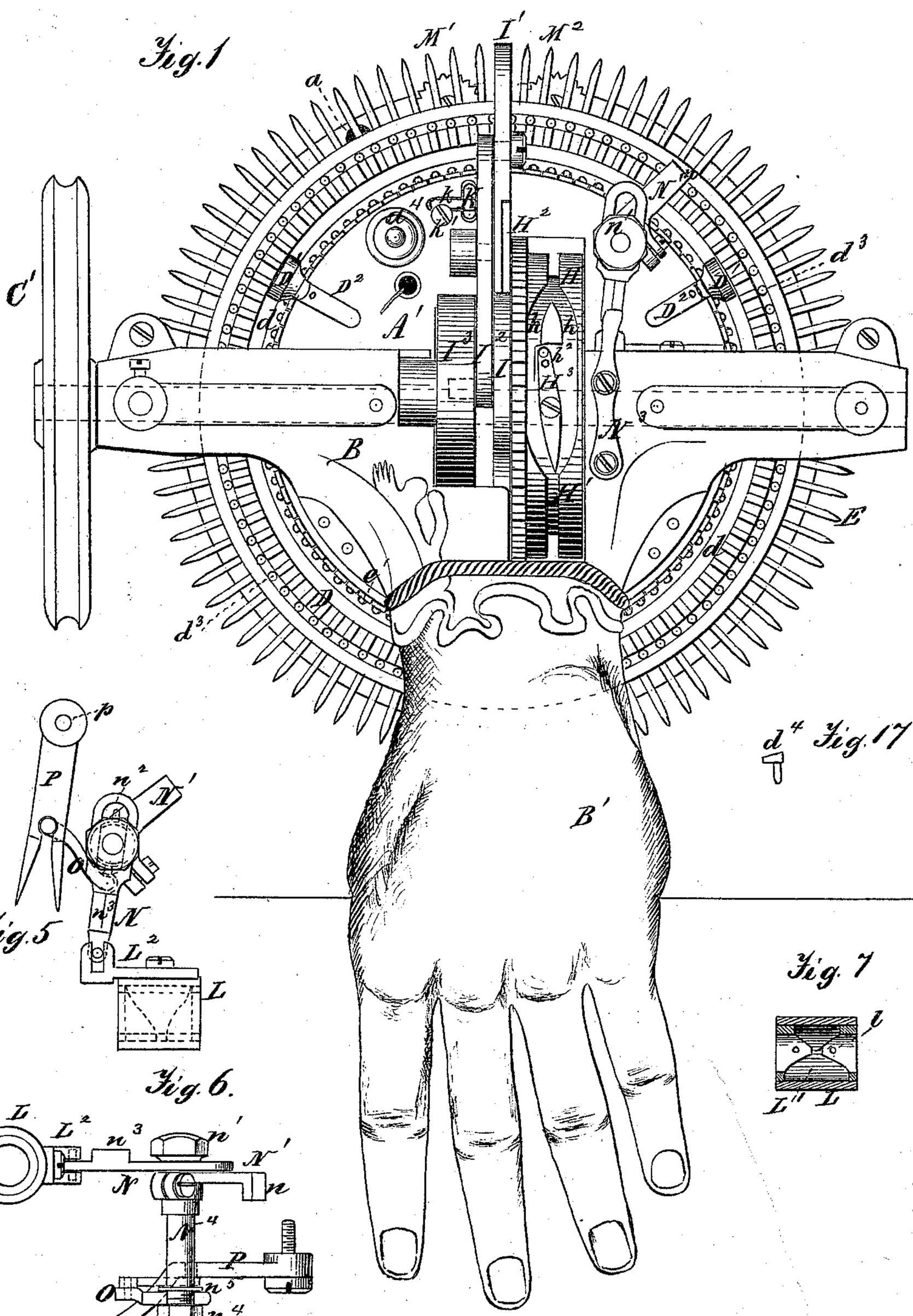


Fig. 17

Fig. 5




Fig. 6.




Fig. 7




Witnesses.
A. Ruppert.
Edw. J. Gibs

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F. M. Comstock.

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# F. M. COMSTOCK.

## Improvement in Knitting Machines.

No. 125,543. Patented April 9, 1872.

*Fig. 2.*

*Fig. 18*

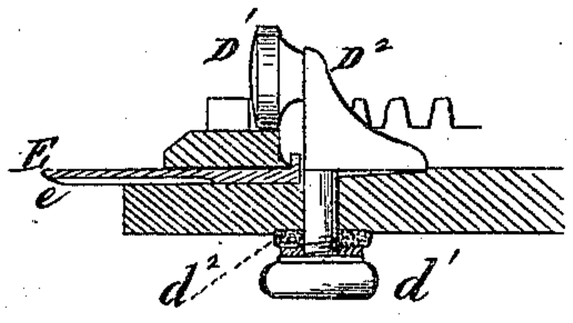
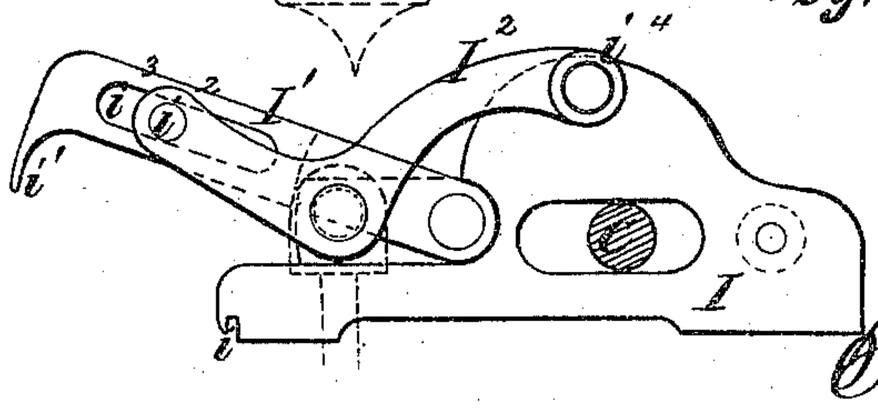






*Fig. 8.*




*Witnesses.*
A. Ruppert.
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4 Sheets--Sheet 3.

# F. M. COMSTOCK.

## Improvement in Knitting Machines.

No. 125,543. Patented April 9, 1872.

*Fig. 9.*

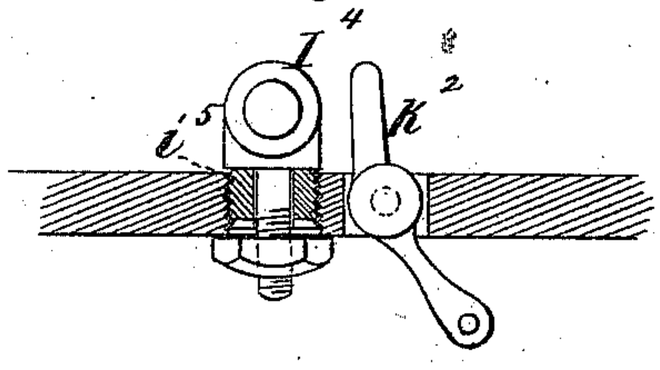


*Fig. 3.*




*Fig. 10.*




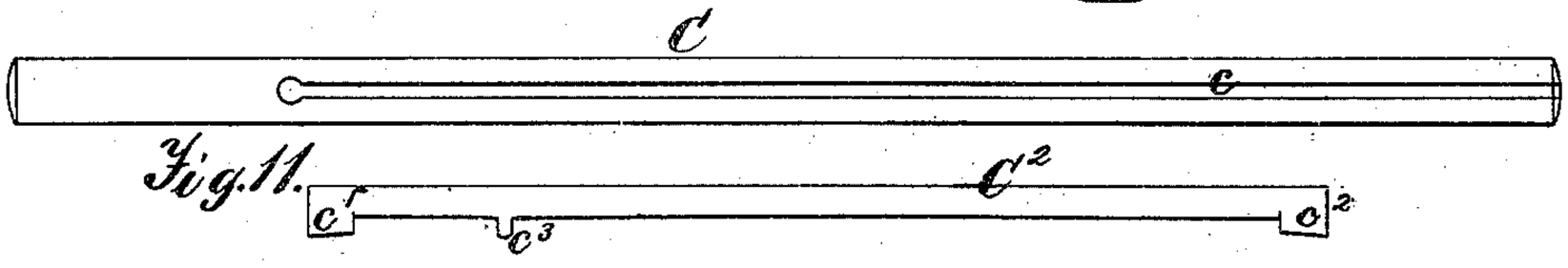


*Fig. 11.*

*Witnesses.*
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F. M. Comstock

4 Sheets--Sheet 4.

# F. M. COMSTOCK.

## Improvement in Knitting Machines.

No. 125,543. Patented April 9, 1872.

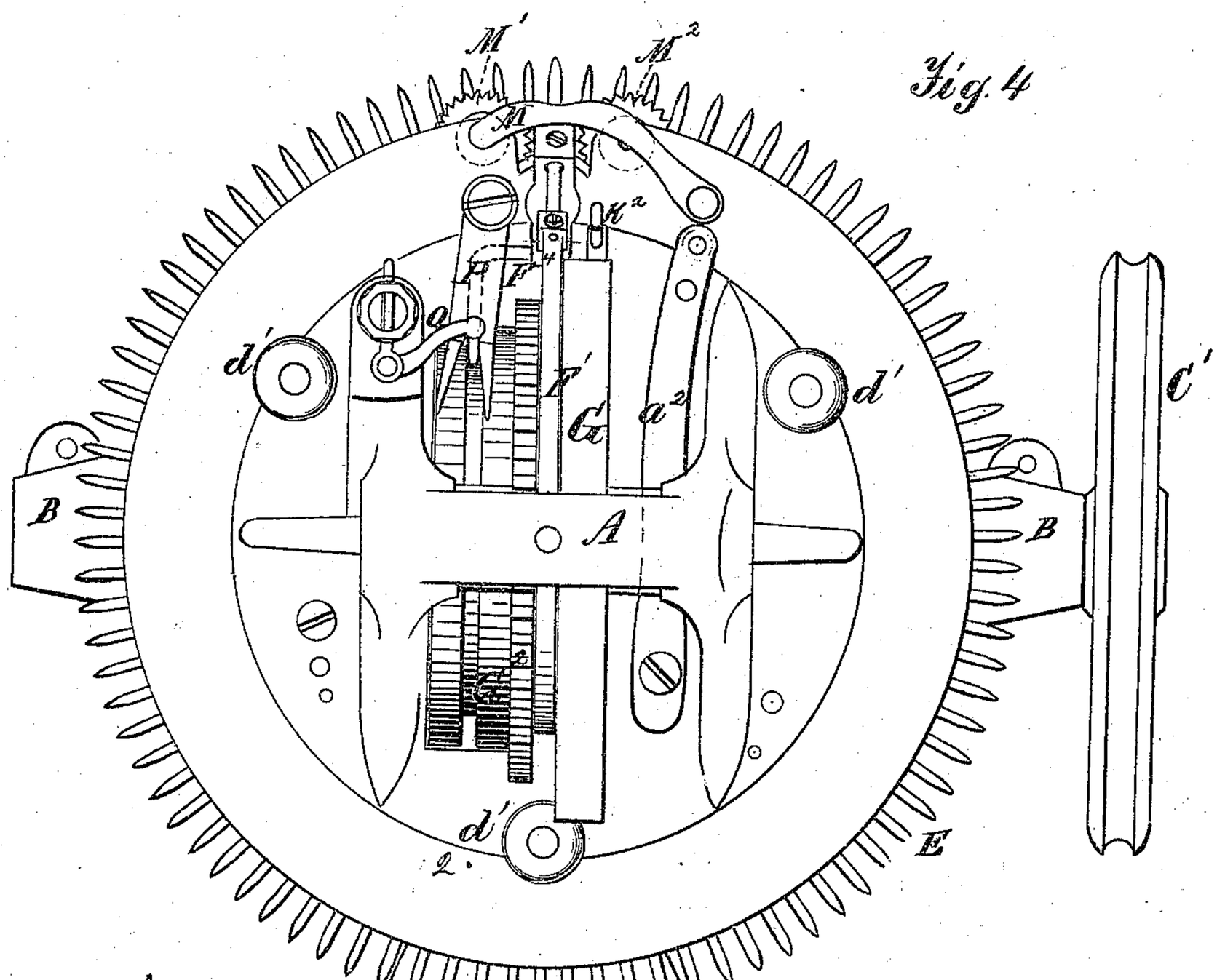


Fig. 4




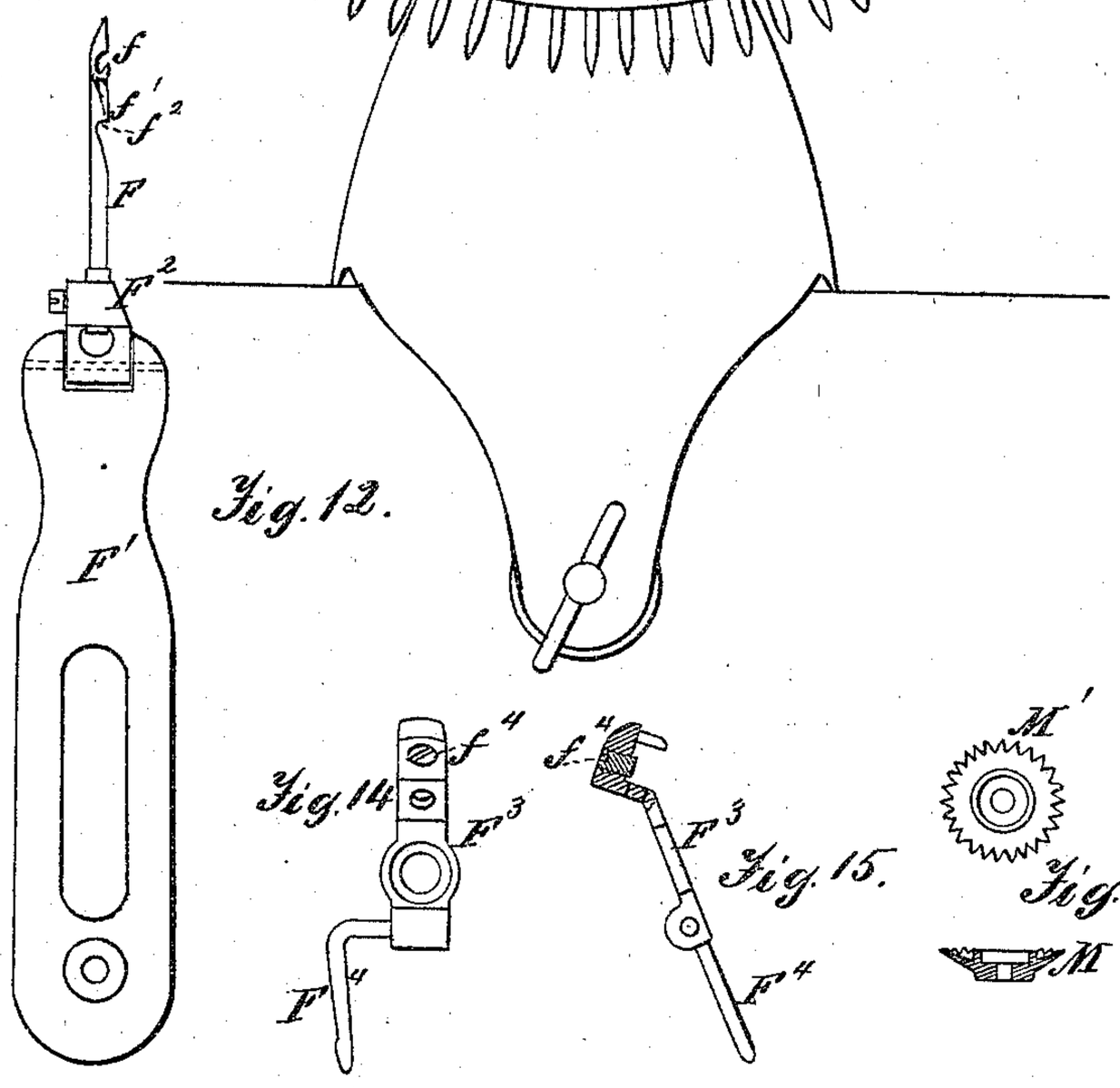


Fig. 12.

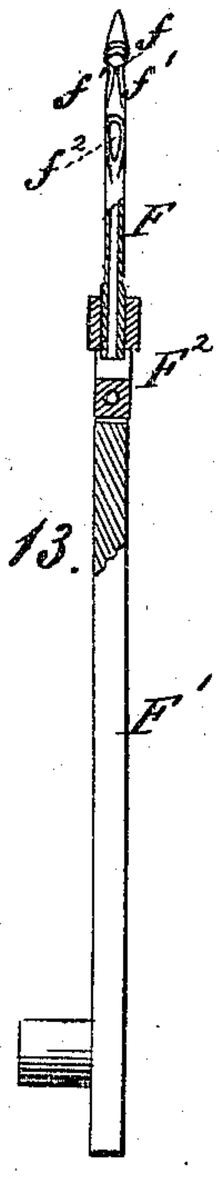


Fig. 13.




Fig. 14




Fig. 15.




Fig. 16.




Witnesses.
A. Ruppert
B. Edwards

Inventor.
F. M. Comstock

125,543

# UNITED STATES PATENT OFFICE.

FRANCIS M. COMSTOCK, OF CLEVELAND, OHIO.

## IMPROVEMENT IN KNITTING-MACHINES.

Specification forming part of Letters Patent No. 125,543, dated April 9, 1872.

Specification describing certain Improvements in Knitting-Machines, invented by FRANCIS M. COMSTOCK, residing at Cleveland, in the county of Cuyahoga and State of Ohio.

This invention relates to a knitting-machine for which Letters Patent of the United States were granted to me on the 20th day of September, A. D. 1870; and the improvements consist in various modifications in construction and combination of some of the parts, which will be generally explained in the ensuing description and specifically pointed out in the claims.

Figure 1 represents a plan view of the improved machine. Fig. 2 is a front elevation thereof. Fig. 3 is a side elevation. Fig. 4 is a bottom view. Figs. 5 to 18 are views of details of the machine, hereinafter more fully referred to.

The same letters of reference are employed in all the figures in the designation of identical parts.

The frame-work of the machine is composed of two parts, A and B, the former of which is disposed vertically and terminates at its upper end in a circular disk, A′, while the latter is constructed with a horizontally projecting hand, B′, for securing the machine to the ledge of a sewing-machine table or other table, as best seen in Fig. 3. The driving-shaft C turns in bearings in the part B of the frame above the disk A′, passing diametrically across the same, and carrying on its overhung end a band-wheel, $C^1$, intended to be turned by a belt or band from the fly-wheel of a sewing-machine, but which may be revolved by hand or power derived from some other source. The shaft C is provided with a long slot, *c*, for the reception of a sliding key or feather, $C^2$, (see Fig. 11,) which feather is, for the greater portion of its length, entirely embedded in the slot *c*, but has at each end a projection or tooth, $c^1$ and $c^2$, one or the other of which, according to the position of the feather, engages, during the rotations of the shaft, with the teeth of the circular ring D, which is placed concentrically upon an offset in the upper surface of the disk A′. This offset extends to the periphery of the disk A′, and between it and the cogged-ring D are confined the pins E, which, being of semi-circular form in cross-section, lie with the flat surface upon the smooth offset in the disk A′, and enter with the rounded surface corresponding shallow concave grooves in the under side of the ring D, so that they will move with the latter upon such offset. There is a sufficient number of these pins, which are ranged radially and equidistant from each other, to extend entirely around the disk A′, from which they protrude about half an inch, more or less. The projecting ends of the pins are pointed, and a groove, *e*, Fig. 18, is formed in the under side from the point to about the periphery of the disk A′. The butt end of the pins has an upturned head, $e^1$, which, being confined between the inner edge of the ring D and the shoulder in the disk A′, as best seen in Fig. 10, prevents the accidental endwise motion of the pin. At a point, *a*, a recess is formed in the offset of the disk A′, extending from near the periphery to the shoulder, where it terminates in a hole passing entirely through the metal of the disk. This hole is entered by a short stud, $a^1$, which is fastened to the end of a spring, $a^2$, secured to the under side of the disk A′. The upper end of the stud $a^1$ is beveled, as shown in Fig. 10, and its highest point is flush with the upper surface of the offset in the disk A′, so that ordinarily the position of the pins in passing over it will not be affected. Near the stud $a^1$ an upwardly-projecting bolt, $a^3$, is fastened to the spring $a^2$, passing through an aperture in the disk A′, and provided with a nut on its protruding upper screw-threaded end. By turning this nut $a^4$ down on the disk the spring will be drawn firmly up against the under side, preventing any vertical motion of the stud $a^1$; but by unscrewing said nut and pressing the bolt $a^3$ down, the stud $a^1$ will be partially extracted from its hole, so that the head of a pin, E, may pass under the ring D through the recess *a*, for the purposes of either withdrawing or inserting pins. Upon the inner side of the cogs on the ring D a track, *d*, is formed on it to run under the anti-friction rollers $D^1$, of which three are employed to hold the ring in proper position. These rollers are hung upon overhanging pins on brackets $D^2$, the base of which is provided with a round shank passing through a hole in the disk A′ to receive a nut, $d^1$, on the under side of the disk. The shank of the bracket is encircled by a rubber or other spring, $d^2$, between the nut and disk A′—a re-

cess in which latter the spring may enter—permitting the roller to yield slightly to inequalities. The base of the bracket enters a corresponding recess in disk A′, the bottom of which it touches only at the end furthest from the shank and roller, so that by adjusting the nut the roller may be made to bear with greater or less pressure upon the track *d* of the ring D. The needle F is carried by a bar, $F^1$, arranged obliquely across the face of a disk, G, which is fastened upon a counter-shaft, G′, located beneath the disk A′ of the frame. The disk G has a cam-groove in its face, which is entered by a projecting stud and roller on the bar $F^1$, and gives the required endwise movements to such bar and its needle, the bar having an elongated slot where the shaft G′ passes through it, as best seen in Fig. 3 in dotted lines. The needle is secured by a set-screw in a socket, $F^2$, which is pivoted in a fork in the upper end of the bar $F^1$ so that it may be oscillated thereon, the socket being provided with an eye through which to pass the thread or yarn into the heel of the needle. The latter is made tubular from the heel to the eye *f*, which is near the point, and directly in rear of the eye it is somewhat reduced, as at $f^1$ $f^1$, (Figs. 12 and 13,) so that there will be a narrow space formed between the yarn and the needle, which may be entered by the point of a pin, E, in passing through the loop formed in the yarn by the retraction of the needle. It will be seen that in this manner the pins E are bound to pass between the needle and the yarn even though the loop be somewhat imperfectly formed. In its retraction the needle takes the loop from the pin directly above it and must carry it downward to the needle-guide, by which it is pushed off the needle. A recess, $f^2$, is formed into the upper side of the needle, into which the loop taken from one of the pins E is drawn, to be retained on the needle until the appointed time for its discharge by the needle-guide. Without such recess the loop is apt to slip forward to the point of the needle, closing the eye of the new loop just formed, and interfering with the proper action of the pins E. The needle-guide $F^3$ is pivoted under the disk A′, and is a short lever, one arm of which terminates in a bent end, as best seen in Fig. 15. The needle plays through holes in this bent end, sliding over the foot of the set-screw $f^4$, which is used to press the needle against its bearings in the guide and prevent slack at that point. This end of the needle-guide is located under a notch cut in the edge of the disk A′ in such a position that as the needle is projected its point will enter the groove in a pin, E, (which is being retracted simultaneously with the projection of the needle,) behind the loop thereon, and takes the latter from the pin. The opposite arm of the needle-guide is constructed with an angular finger, $F^4$, which projects into a groove, $H^1$, formed in the edge of the disk H. The latter is secured to or forms part of a spur-wheel, $H^2$, which is keyed to the driving-shaft C, and, extending through a suitable opening in the disk A′, meshes into a spur-wheel, $G^2$, on the counter-shaft $G^1$. The groove $H^1$ is branched at a certain point of its circumference, as at *h* $h^1$, into either of which branches the finger $F^4$ of the needle-guide may be turned by a switch, $H^3$. As the finger $F^4$ enters either of these branches of the groove $H^1$, the needle-guide will be oscillated on its fulcrum, so as to carry the upper end of the needle to one side or the other of the pin E above it and allow the latter to be projected by the side of the needle to pass through the loop of the yarn. The pins E, as they successively arrive opposite or over the needle, are brought in line with the bar I, the outer end of which has a notch, *i*, cut in its lower edge to receive the head $e^1$ of the pin. This bar slides in a groove formed in the upper surface of the disk A′, and is at the proper times reciprocated by means of a cam-groove in the side of the spur-wheel $H^2$, which cam-groove operates upon a roller on a projecting stud of the said pin-bar as it is turned. The stitch-retainer $I^1$ is pivoted to the pin-bar, and is oscillated to bring its foot $i^1$ down upon the pin in front of the loop to retain the latter on the pin while being retracted, and until the needle has completed its outward movement, by means of a lever, $I^2$, one arm of which has a projecting stud, $i^2$, playing in an elongated slot, $i^3$, in the stitch-retainer, while the other arm carries a roller, $i^4$, on a similar stud entering a cam-groove in the disk $I^3$ on the driving-shaft C. The motion of the lever $I^2$ with reference to the pin-bar I is such that the stitch-retainer will be pressed down upon the pin before the latter begins to be retracted, and lifted just before the point of the pin is drawn under the ring D; it being held in the mean while in such a position as to cause the foot $i^1$ of the stitch-retainer to remain in contact with the pin during its inward movement. The lever $I^2$ is fulcrumed upon the standard $I^4$, Fig. 9, the base of which is supported upon the upper end of a sleeve, $i^5$, screwed into the disk A′ so as to project a little above the same. The standard has a screw-threaded shank passing through the sleeve and receiving a nut to secure it. By adjusting the sleeve $i^5$ up or down and thus affecting the position of the lever $I^2$, the stitch-retainer may be made to press down upon the pins E with more or less pressure. The yarn in its passage from the spool to the needle is drawn through the eye of an adjustable lever, K, which is termed the loop-regulator; it passes through an aperture in the disk A′, the arm with the eye extending below the same and the other arm above it, as best seen in Fig. 9. It has a journal, *k*, on one side, which enters an open recess in the top of the disk A′, and is clamped thereto by the head of a screw, $k^1$, bearing on its upper side. (See Fig. 1.) This loop-regulator is so arranged that the eye is located above the lowest point reached by the heel of the needle where the yarn enters, and upon the side of such needle, so as to throw the yarn into an angle. In this

manner the yarn will be drawn from the spool during the down stroke of the needle, and the amount of yarn drawn each time may be regulated by adjusting the eye of the loop-regulator with reference to the needle, and thus the size of the loop determined. The notch in the edge of the disk A′, through which the needle passes up and down, is spanned by a bar, M, secured to its under side, and projecting up over the edge of the disk for some distance of its length. The fabric as soon as knit is discharged over this bar, assisted by the rag-wheels $M^1$ and $M^2$, arranged one upon each side of the notch in the disk, under the pins E. They project a little beyond the edge of the disk A′, and also into the notch therein, as best seen in Fig. 4, so that on feeding the ring D forward the fabric engaging their teeth will rotate the rag-wheels and cause the one nearest the pin that has received the last loop or stitch from the needle to take hold of this loop and push it outward on the pin far enough to clear the edge of the disk A′. Without this bar M and the rag-wheels $M^1$ $M^2$, the loop or stitch just received by the advancing pin would be liable to being drawn under the ring D and interfere with the proper action of the machine.

With a machine constructed as thus far described, tubular goods may be knit by using all the pins, and giving the ring D a continuous intermittingly-rotating movement by a continuous revolution of the driving-shaft. The operation of forming the stitches by the eye-pointed reciprocating-vibratory needle and the reciprocating pins is essentially as explained in my said Letters Patent, dated September 20, 1870, to the specification of which reference is here made for a more full description thereof. Plain or flat goods may also be knit upon this machine by giving an intermittingly-oscillating motion to the ring D, to accomplish which with precision and accuracy I have added the following devices: The feather or key $C^2$ in the slot or groove of the driving-shaft has a projection or stud, $c^3$, which plays in a cam-groove, $L^1$, in the interior surface of the sleeve L, through which the driving-shaft C passes.

The greatest width of this cam-groove is somewhat more than the length of the cogs $c^1$ and $c^2$ combined, so that the stud $c^3$, moving along either edge of the cam-groove toward its greatest contraction at *l*, Fig. 7, will cause an endwise movement of the feather sufficient to disengage either of the cogs $c^1$ or $c^2$ from the cogs of the ring D and engage the other therewith, thus reversing the movement of the ring. The sleeve L is connected to one arm, N, of a jointed lever by means of a pin in the arm and a slot in the bar $L^2$ adjustably secured on the sleeve, as best seen in Figs. 5 and 6. The other arm $N^1$ of this lever extends outward, and terminates in a down-turned lip, *n*, overhanging the cogs on the ring D. (See Fig. 1.) Opposite each tooth on the ring D a hole, $d^3$, is bored, in which a headed pin, $d^4$, Fig. 17, may be inserted.

In knitting flat goods one of these pins, $d^4$, is inserted at the proper point in the ring D, on one or both sides of the arm $N^1$, the overhanging lip *n* of which is struck by the pin or pins, alternately, on each side, so as to turn the arm, which causes the other arm N of this lever to slide the sleeve L on the shaft. This takes place while the stud $c^3$ of the feather $C^2$ is moving in the widest part of the cam-groove $L^1$, and the stud $c^3$ is not acted upon by the edge of said cam-groove until the ring has become stationary. At that moment the stud begins to be pushed toward the contracted throat *l*, on arriving at which the feather has been moved the proper distance to disengage one of its teeth and throw the other in gear. The movement of the sleeve in either direction is limited; and to prevent an accidental turning of the jointed lever N $N^1$ a knife-edge, $n^3$, is formed on the arm N, which, in turning the lever to reverse the action of the machine, passes under and lifts the downwardly-projecting end of a stiff spring, $N^3$, fastened on the frame B. (See Figs. 1 and 2.) The arm $N^1$ is clamped firmly to the fulcrum-pin $N^4$ beneath the arm N, which is in turn clamped firmly to the arm $N^1$ by means of the nut $n^1$. The upper end of the fulcrum-pin, being screw-threaded for the reception of the nut $n^1$, as shown in Figs. 5 and 6 most clearly, passes through an elongated slot, $n^2$, in the arm N, so that the effective length of said arm may be varied and the throw of the sleeve L be regulated.

By changing the throw of the sleeve the motion of the sliding feather in the driving-shaft is regulated, causing its teeth to enter between the teeth of the ring D for a greater or less distance. The length of the teeth on the feather is greater at the outer than at the inner end, as clearly shown in Fig. 11, and the teeth of the ring are beveled in a reverse direction, so that the further the teeth on the feather enter between the teeth on the ring the greater will be the extent of movement of the latter.

In this manner a very simple and effective means is provided for taking up lost motion caused by the wear of the teeth on the feather and ring, and for preserving the required accurate action of the ring with its pins with reference to the needle and pin-bar.

The fulcrum-pin passes through the disk A′, protruding downward some distance, to have attached to it an angular adjustable arm, O, the outer end of which is pivoted to the bifurcated bar P. The fork of this bar P is flaring, (see Figs. 4 and 5,) and lies directly in the path of the switch $H^3$, which rotates over it. The switch has a projecting stud, $h^2$, which plays through the fork in the bar P, sliding along one tine or the other, and by turning this bar on its pivot *p* the switch $H^3$ may be shifted so as to cause the finger of the needle-guide $F^3$ to pass into the other branch of the groove $H^1$ and throw, in consequence, the needle upon the opposite side of the pins E. The bar P is oscillated simultaneously with sliding the

sleeve L, to reverse the machine, by the angular arm O, the latter being adjustably fastened in a slot in the fulcrum-pin $N^4$, between the nut $n^4$ and washer $n^5$, for regulating the throw of the bar P. The forked end of the latter is curved, as best seen in Fig. 6, corresponding with the curvature of the cam-disk H. The spool or yarn-bobbin R turns on a horizontal spindle of the yarn-stand S above the disk A′, the tension of the yarn being regulated by an adjustable spring, R′, bearing against one end of the yarn-bobbin.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The needle F, reduced in width at $f^1$ $f^1$, and provided with a transverse recess at $f^2$, substantially as and for the purposes specified.

2. The combination of the needle F, needle-guide $F^3$, and set-screw $f^4$, substantially as and for the purpose set forth.

3. The pins E, in combination with the recess $a$, stud $a^1$, and spring $a^2$, substantially as and for the purposes set forth.

4. The track $d$ on the ring D, in combination with the rollers $D^1$ when the latter are hung to adjustable brackets $D^2$, the shanks of which are encircled by springs $d^2$ between the disk A′ and the nuts $d^1$, substantially as and for the purpose specified.

5. The combination, with the pins E, of the reciprocating pin-bar I, stitch-retainer $I^1$ pivoted thereto, and the independent oscillating lever $I^2$, the stud $i^2$ of which plays in the slot $i^3$ of the stitch-retainer, all operating relatively as and for the purpose set forth.

6. The combination, with the stitch-retainer $I^1$ and oscillating-lever $I^2$, of the standard $I^4$ and vertically-adjustable sleeve $i^5$, substantially as and for the purpose specified.

7. The combination of the driving-shaft, sliding feather C having teeth $c^1$ and $c^2$, and cogged ring D, substantially as and for the purpose set forth.

8. The combination, with the pins E, of the bar M and rag-wheels $M^1$ and $M^2$, substantially as and for the purpose specified.

9. The ring D, having holes $d^3$ for the insertion of a detachable pin or pins $d^4$, in combition with the lever N $N^1$, sleeve L with cam-groove L′ $l$ in its interior surface, and stud $c^3$ on the feather $C^2$ $c^1$ $c^2$ of the driving-shaft C, operating substantially in the manner and for the purpose specified.

10. The combination of the ring D having the beveled teeth, with the adjustable feather C having the reversely-beveled teeth, operating substantially as and for the purpose specified.

11. The combination of the fulcrum-pin $N^4$, which turns with the reversing-lever N $N^1$, angular arm O, forked bar P, and stud $h^2$ on the switch $H^3$, substantially as and for the purpose specified.

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

FRANK M. COMSTOCK.

Witnesses:

D. P. HOLLOWAY,

C. F. CLAUSEN.