

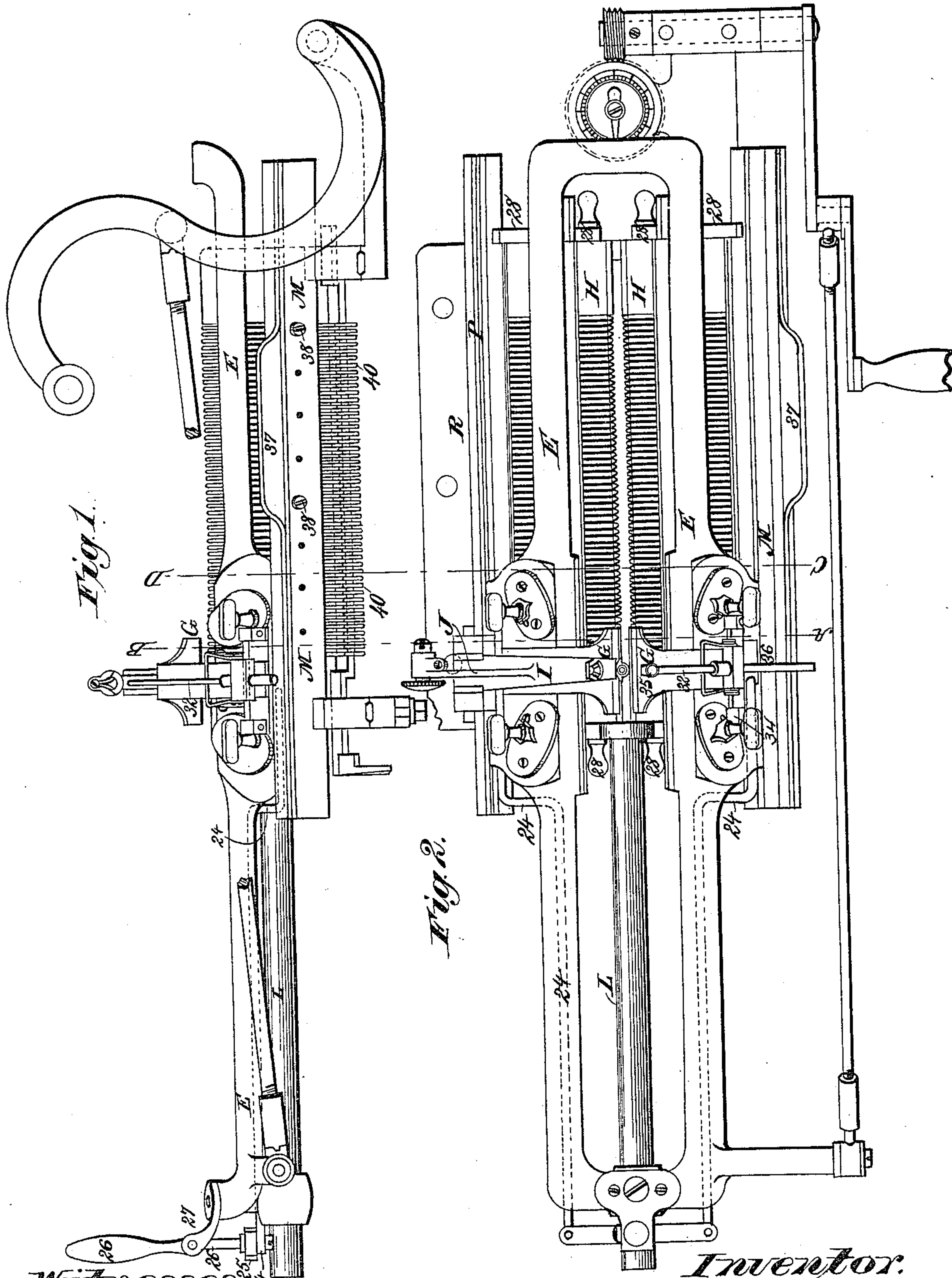
(No Model.)

2 Sheets—Sheet 1.

W. ROTHWELL.  
KNITTING MACHINE.

No. 362,664.

Patented May 10, 1887.



Witnesses:  
*Robert Everett.*  
*Geo. W. Rea.*

Inventor:  
*William Rothwell.*  
By *James L. Norris.*  
*Atty.*

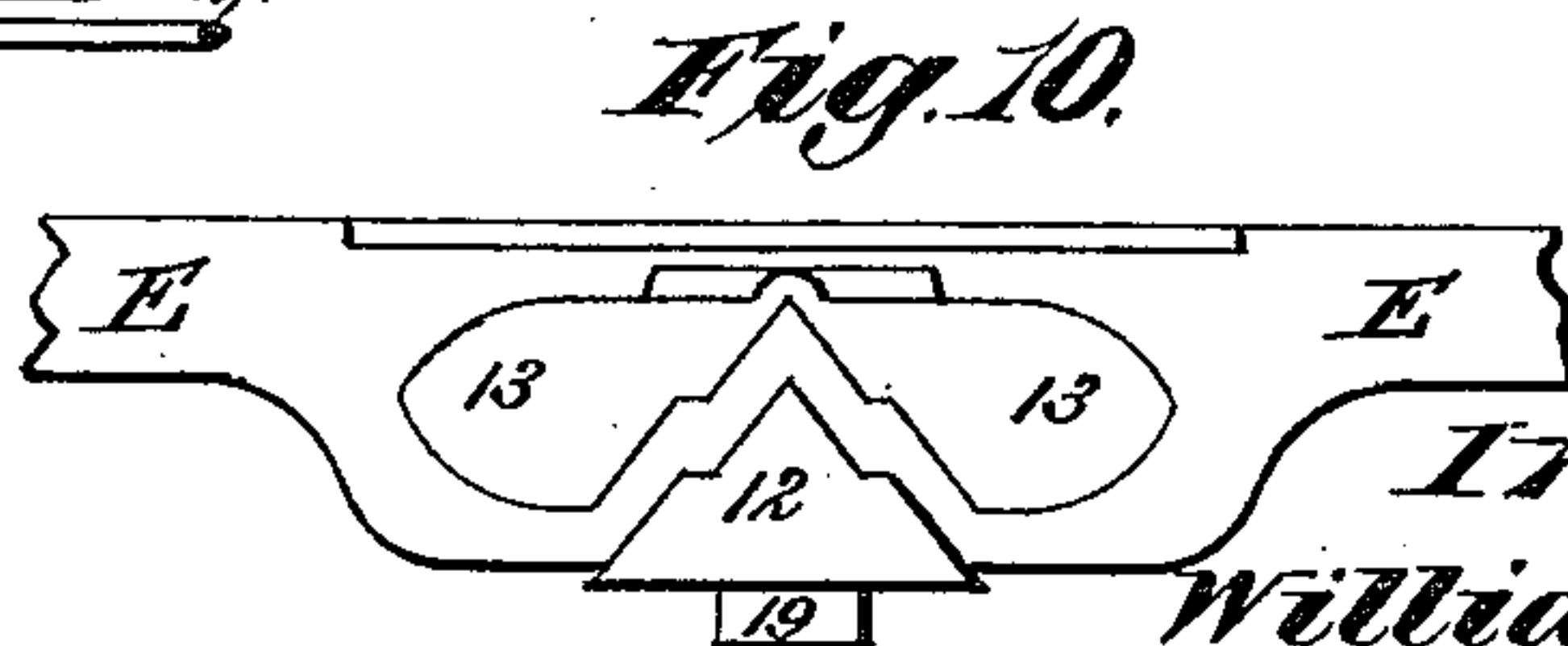
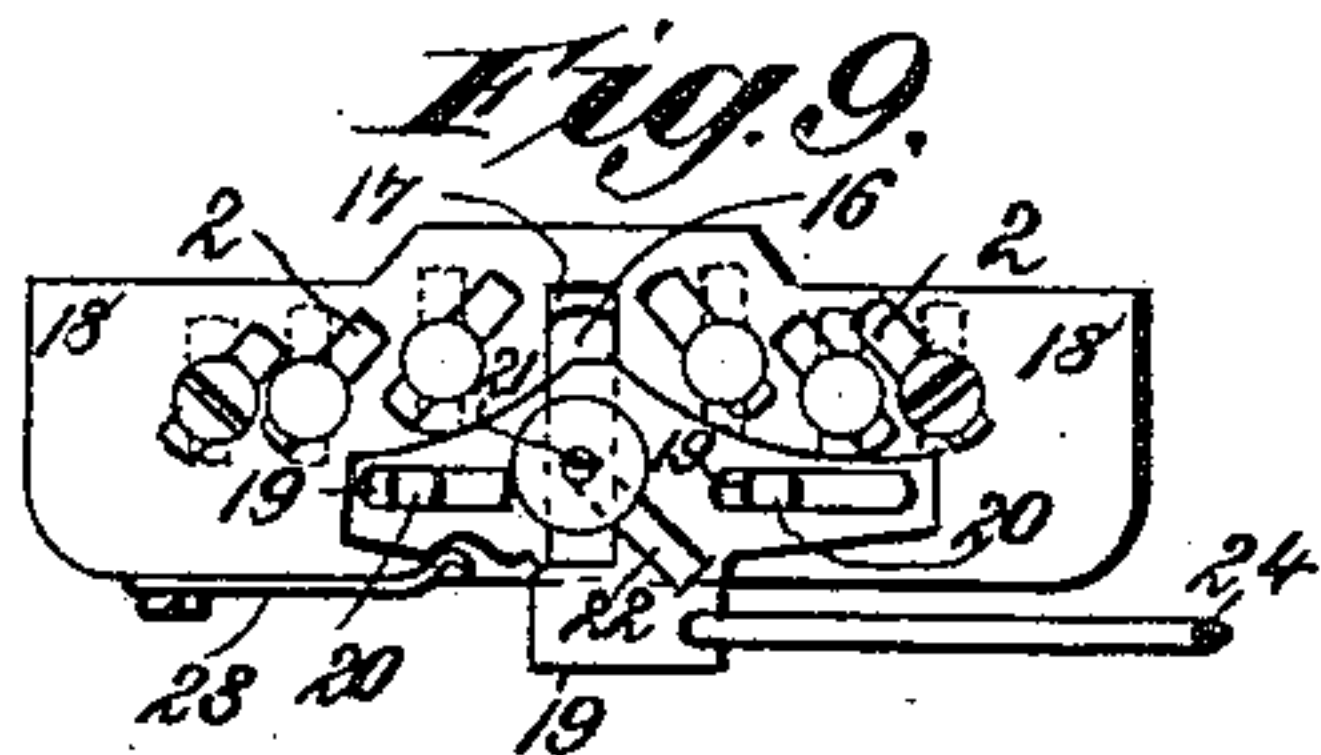
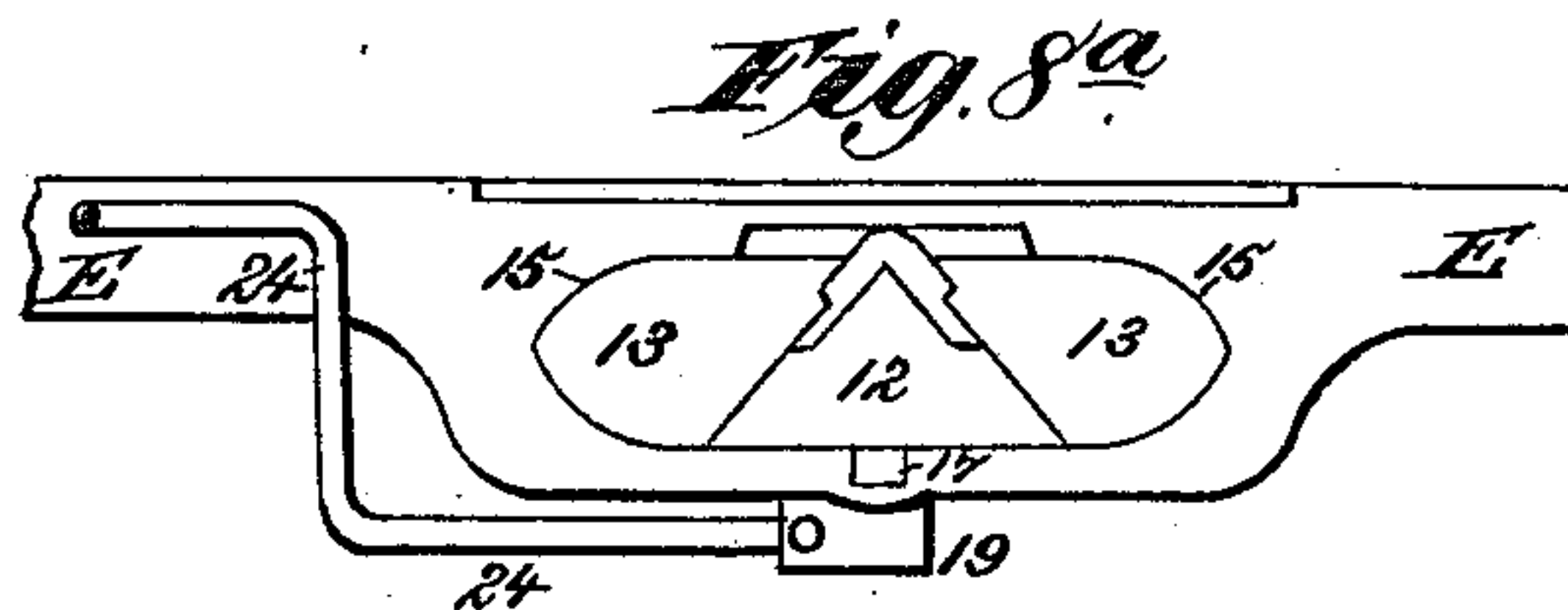
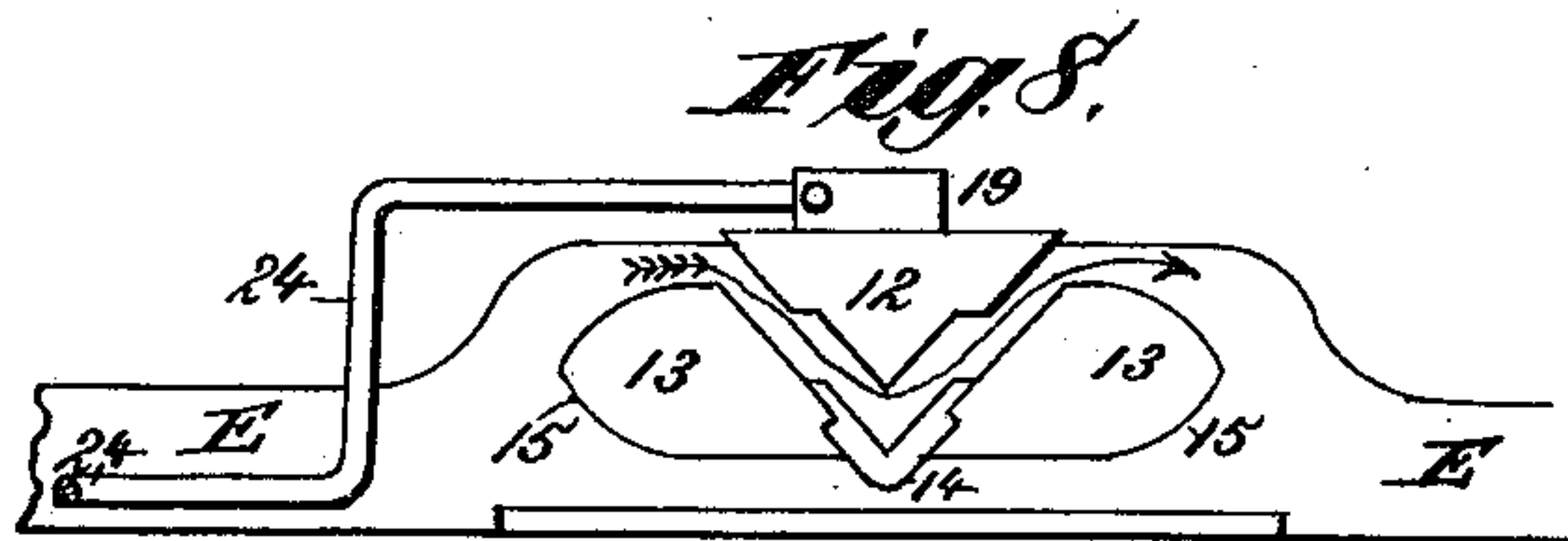
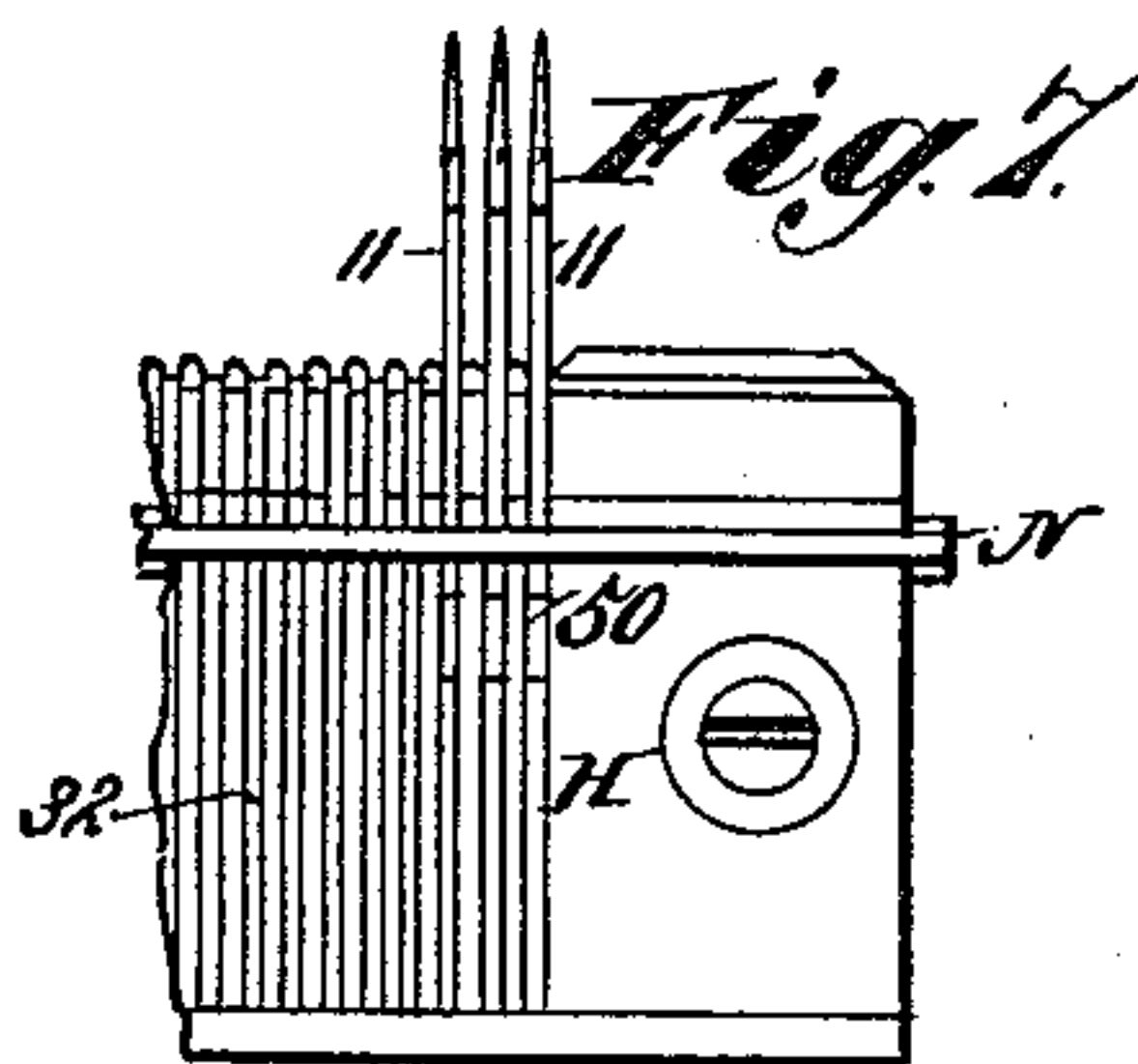
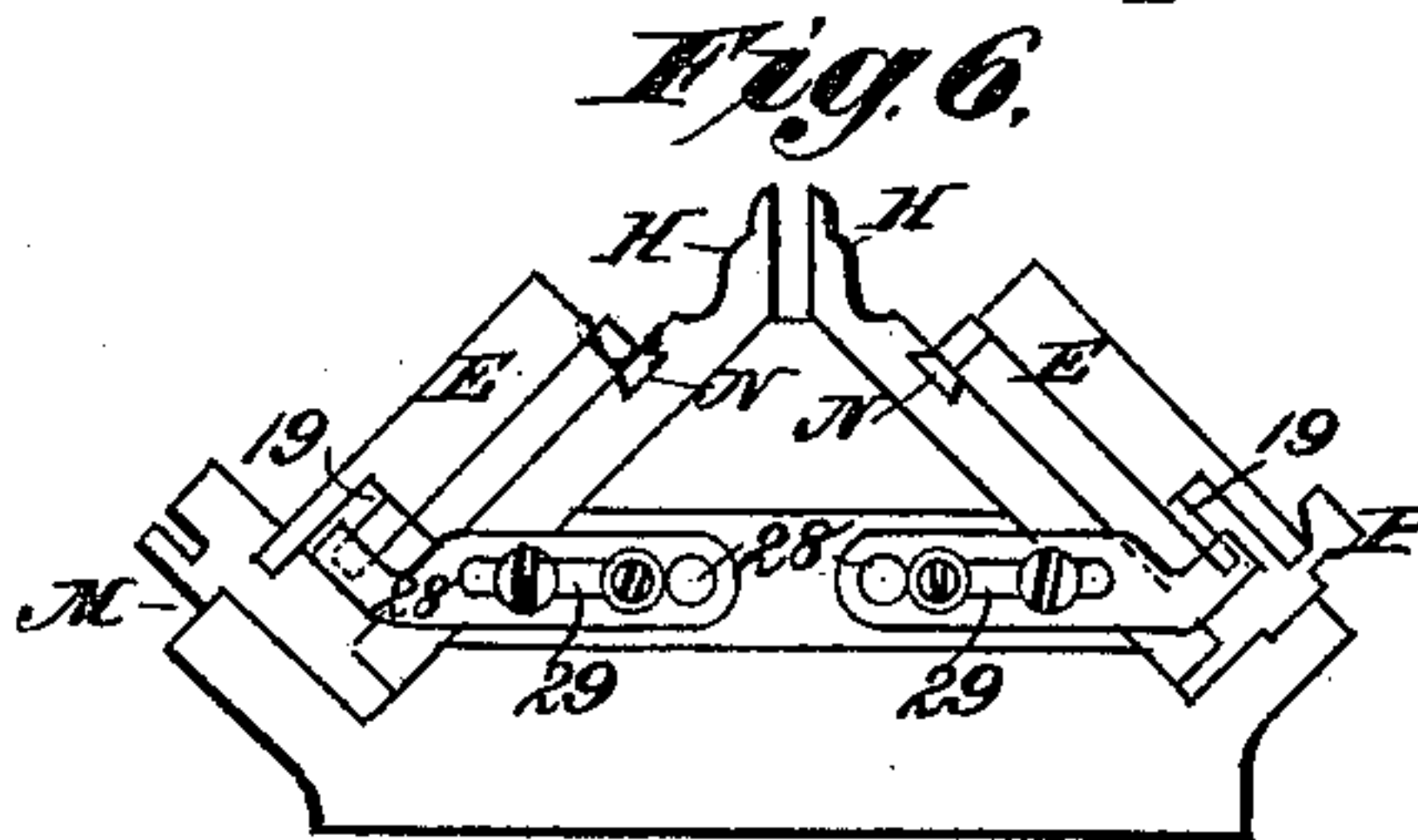
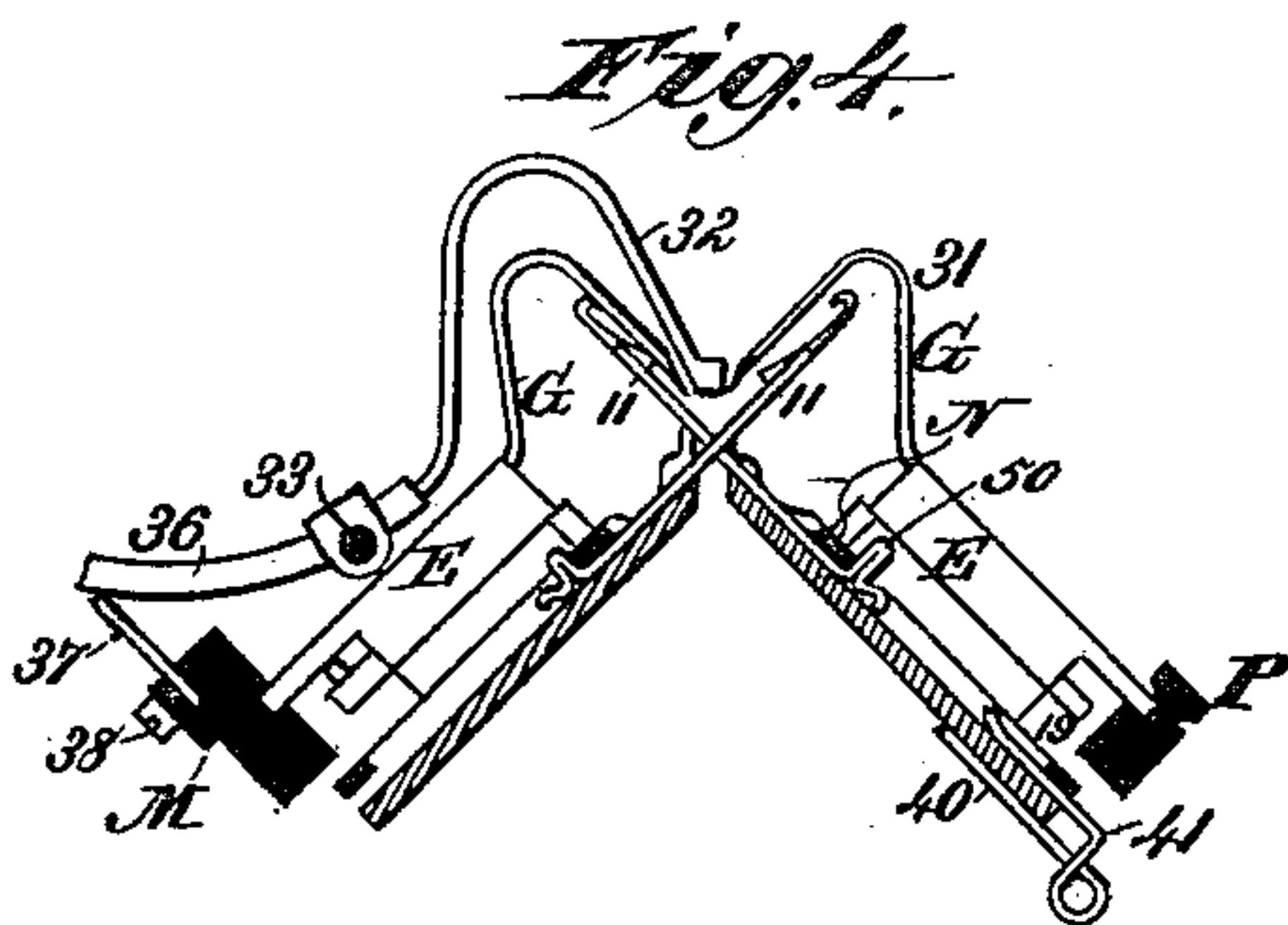
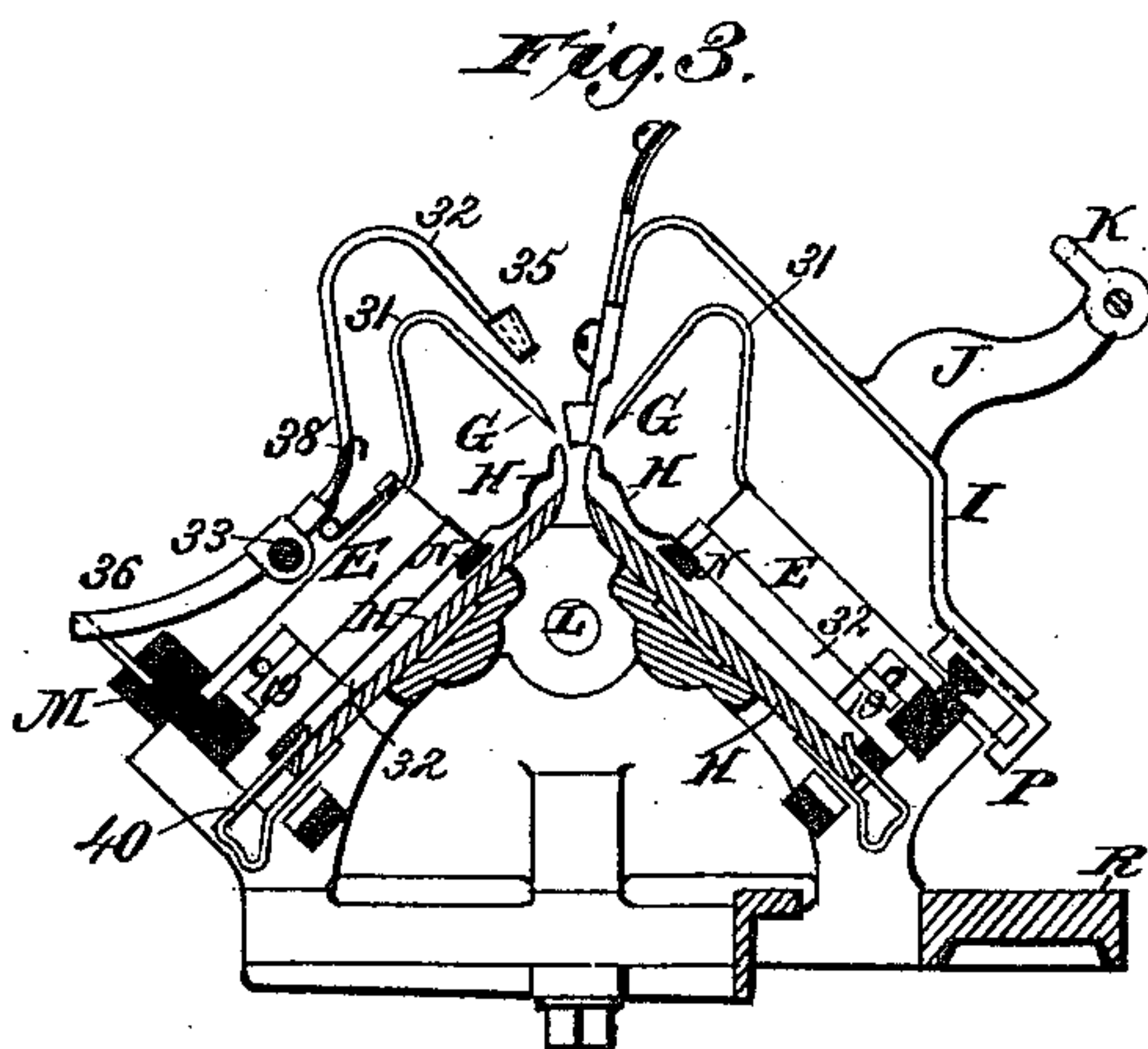
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# UNITED STATES PATENT OFFICE.

WILLIAM ROTHWELL, OF BOLTON, COUNTY OF LANCASTER, ENGLAND.

## KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 362,664, dated May 10, 1887.

Application filed September 3, 1886. Serial No. 212,618. (No model.) Patented in England July 24, 1885, No. 8,946.

*To all whom it may concern:*

Be it known that I, WILLIAM ROTHWELL, residing at Nos. 1, 3, and 5 Market Street, Bolton, in the county of Lancaster, England, have  
5 invented new and useful Improvements in Knitting-Machines, of which the following is a specification.

This invention relates to an improved machine for use in manufacturing or knitting  
10 stockings, socks, gloves, and other similar articles, which is so constructed as to permit the whole operation of knitting such articles to be performed entirely in machines of the type known as the "Lamb," patented in England  
15 May 27, 1865, No. 1,445.

A method at present adopted in knitting stockings and socks is to form the leg-piece in what is known as the "Rothwell Flat-Web Machine," patented in England June 4, 1884, No.  
20 8,570, from whence it is transferred to the "Griswold Round Machine," patented in England July 1, 1879, No. 2,669, to knit the heel and foot, after which it is again replaced in the aforesaid Rothwell machine to finish the  
25 toe part; or the toe may be formed on the Griswold and stitched by hand, which is a very expensive operation.

In a Lamb or flat-rib knitting-machine, with my improvements applied thereto, the arti-  
30 cles before described may be manufactured without removal from the machine, and at one operation. In working with such improved machine the narrowings in the leg-piece are performed entirely on one end of the machine by  
35 the employment of a single-eyed or other narrowing comb with a corresponding increase in speed and production. After the leg-piece is completed the heel and the under side of the foot are formed or knitted without removing  
40 or changing the position of the stocking or sock by putting a necessary quantity of needles out of action. Then, as each course is knit, or otherwise, the needles are raised singly or otherwise on each side alternately until  
45 sufficiently narrowed to form the heel, and when the latter is completed the action or process is reversed until all the raised needles are again put into operation, singly or otherwise and alternately, as before described, when the  
50 needles that were out of action are restarted to form the foot and toe, the narrowings for the latter being formed in the usual manner,

thus completing a stocking or sock entirely in one machine. This invention also allows the heels and the under side of the feet of stock-  
55 ings and socks to be spliced at any desired point; also, the knees and other parts. The cams or locks mounted on the carriage of the machine are so constructed as to allow the needles, singly or otherwise, to rise out of ac-  
60 tion when requisite for forming the heel, the needle-beds being provided with lengthened slits or slots to admit of the operation of the same. To prevent the needles slipping  
65 into the cavity or space between the wing-cams when open, the top sides of the latter are fitted with an angular or other filling-piece constructed to allow the upthrow-cam to op-  
erate in the usual manner. If desired, the wing-cams can be connected so as to dis-  
70 pense with the angular or other filling-piece before described. The top sides of the cams are curved or otherwise to facilitate the movement of the needles when being lifted out of  
75 action. The upthrow-cams are operated by striking against suitable stops mounted on each end of the bed of the machine.

To allow the needles to rise out of action, the knives or latch-openers are provided with ex-  
80 tended curved ends sufficiently long to allow the needles when raised to pass underneath the same, the edges being made perfectly square with the needles, by which the action of the latter is insured.

The forming of the heel can be performed at  
85 either end of the machine by the application of apparatus for opening and closing the upthrow-cams as desired, which is accomplished by attaching suitable rods or other equiva-  
90 lents to the upthrow-cams, the opposite ends being connected to a cross-bar. This cross-bar is connected by a universal joint with a suitable lever and handle for operating the same, the fulcrum of the lever being attached  
95 to the carriage.

For the purpose of splicing and strengthening  
100 stockings and socks or other knitted articles, a suitable yarn guide or carrier is mounted on a center or pin secured to the front of the carriage of the machine, being operated in the movement of the carriage by the outer end of  
the same coming in contact with a raised guide or projection secured to the front guide of the machine, in which the carriage slides. The



ends of the guide or projection are constructed in taper or other convenient forms, to throw the yarn-carrier into position for feeding the splicing yarn in the easiest possible manner at the desired time. This guide or projection is of sufficient length to operate on one-half the width of the machine, and can be fixed or made adjustable, the adjustment being effected by screws or other equivalents. If desired, two guides or projections can be mounted on the front of the machine, by which either can be used according to the position of the articles being made therein, in which case they are mounted to allow of being operated vertically or otherwise. The yarn-guide is lifted when out of engagement with the said guides by a suitable spring.

By the application of my improvements to the Lamb or flat-web knitting-machine, stockings, socks, gloves, and other knitted articles can be finished and fashioned entirely in one machine, thereby dispensing with the disadvantages arising from the system of dropping, repinning, and stitching the heels and toes of stockings and socks, which reduces the cost of production and time required to a minimum, at the same time increasing the quality and value of the articles manufactured.

In the accompanying drawings, Figure 1 is a side elevation of so much of a flat-web knitting-machine as is necessary to illustrate my present invention, with my improvements applied thereto for the purpose of knitting stockings, socks, gloves, "Tam O'Shanter" hats, tuck-patterns, and other articles of hosiery. Fig. 2 is a plan of Fig. 1. Fig. 3 is a sectional elevation through line A B in Figs. 1 and 2. Fig. 4 is a part sectional elevation through line C D of Figs. 1 and 2, showing the needles when raised out of action. Fig. 5 is a front view of one of the knives or latch-openers. Fig. 6 is a part end view of the machine, showing the sliding stops for operating the cams. Fig. 7 is a part front view of the needle-bed, with extended slits or slots, in which are shown three needles raised out of action. Fig. 8 is a plan of the under side of the carriage, showing the upthrow-cam open to allow knitting to be performed. Fig. 8<sup>a</sup> is a plan of the under side of the carriage, showing the upthrow-cam closed when the opposite side in Fig. 8 is open. Fig. 9 is a part plan of one of the cams, showing how the upthrow-cams are operated. Fig. 10 is a part plan of the under side of the cams, showing the wing-cams and filling-piece made in one.

In all these figures the same letters and numerals are used to indicate corresponding parts.

When knitting stockings and socks on a machine constructed as herein shown and described, the leg-piece, with its narrowings, is knitted on one end of the machine, the narrowings being performed by transferring the stitches from one needle to another, as requisite, after which the needles from which the stitches are removed are drawn down out of

action, as usual. After the leg-piece is completed the heel is formed or knitted without removing or changing the position of the stocking or sock, which is accomplished by putting a necessary quantity of the needles 11 out of action by raising them, as shown in Fig. 4. Then as each course is knit the needles 11 are raised singly, or the requisite number alternately on each side of the machine, until the heel is sufficiently narrowed. The remaining half of the heel is formed by putting the needles into action on each side alternately as raised when forming the first half of the heel, as before described. When the heel is completed, the remaining raised needles are then put into action as the case demands, by which the needles that were out of action are restarted to form the foot and toe, the narrowings for the toe being formed in the usual manner by transferring the stitches from one needle to another, thus completing a plain circular or seamless full-fashioned stocking or sock with what is known as the "Niantic heel," fashioned gore, and toe in one operation.

A "Niantic heel" is a term applied by the trade to a stocking-heel that usually has been formed only on what is known as the "Griswold Round Machine," and is constructed by putting one-half the needles out of action on completing the ankle, the remaining needles being raised out of action one at a time, with one course knit between, until about one-sixth of the needles only remain raised, when the action is reversed, and the raised needles are put into action one at a time, with one course knit between each, until one-half the needles containing stitches are in action, which completes the heel. The remaining half are then put into action all at once, when the rest of the foot can be knitted.

The heel can be knitted at either end of the machine, as desired, and is accomplished by employing apparatus for opening and closing the upthrow-cams 12, as follows: The wing-cams or locks 13 are mounted on the carriage E in the usual manner, and between them the angular filling-piece 14 is fixed, to prevent the needles slipping into the cavity or space between them when the upthrow-cams 12 are open, as in Fig. 8. The angular filling-piece 14 is, as will be seen from the drawings, constructed to allow the upthrow-cams 12 to operate in the usual manner. The top sides, 15, of the wing-cams 13 are curved, to facilitate the movement of the needles when being lifted out of action. The upthrow-cams 12 are each provided on the back side with the projection 16, which fits and slides in the slot 17 in the cam-guiding plate 18. The sliding bar 19 is mounted on the pins or stops 20, and is connected to the upthrow-cam by the screw 21. The screw 21 passes through the inclined slot 22 in the sliding bar 19, by which the motion of the upthrow-cams 12 is effected when desired. The sliding bar is secured and firmly held in position by the spring 23, which locks the same until operated by the hand-lever 26 or the



stops 28. To the sliding bars 19 are connected the rods 24, extending on the under side of the carriage E, or in any other convenient manner to the cross-bar 25. The cross bar 25 is operated by the handle and lever 26, attached to the sliding carriage E of the machine by the fulcrum-fixing 27, the said lever serving as a support for the cross-bar and outer ends of the rods 24.

This apparatus operates as follows: When forming or knitting the heel before each double course or stroke of the machine, the handle and lever 26 is operated in one or the other direction, by which the upthrow-cam on the side on which the needles are intended to operate is opened, as in Fig. 8, whereas the upthrow-cam on the other side is closed by the same operation as in Fig. 8<sup>a</sup>, the latter being opened by reversing the handle and lever 26 for the next double stroke of the carriage, the former in that instance being closed. If desired, the wing-cams 13 and the angular filling-pieces 14 can be connected or formed in one piece, as in Fig. 10, in which case they slide vertically instead of diagonally, to effect which the angular slots 2 will run vertically or parallel with the slot 17, as shown by dotted lines, to one of the slots, instead of diagonally, as shown by full lines in Fig. 9, the said cams being worked in the usual way and by the usual means. When other parts of stockings or socks are being knitted, the sliding bars 19 are operated and reversed at each stroke by striking against the adjustable sliding stops 28, mounted on each end of the machine, as shown in Fig. 6. The stops 28 are provided with the slots 29, which allow them to be moved sidewise, and in or out of action, as desired. When the needles are raised out of action for forming the heel, the cams pass under the ends or stops 50. When the needles are in action and the upthrow-cams closed, they pass over the said ends or stops. When in action and knitting, the needle ends or stops 50 pass through the passages between the wing and upthrow cams, as indicated by the arrow in Fig. 8.

To allow the needles to be raised sufficiently high to put them out of action, the curved ends 31 of the knives or latch-openers G are extended, as shown in Figs. 3 and 4, which allows them to pass over the needles when at their highest point without interfering with the action of the carriage E. In consequence of the increased upward movement required by the needles when raised out of action, the needle-beds H are provided with the lengthened slits or slots 32.

For the purpose of splicing and strengthening the heels, knees, and other parts of stockings and socks, also other parts of knitted articles, at any desired point, I mount the yarn-guide 32 on the center 33, the latter being supported in the fixings or bearings 34, secured to the carriage E of the machine. The splicing and strengthening yarn is fed in any con-

venient manner into the eye 35 of the yarn-guide 32, which when in action is as shown in Fig. 4, being operated by the movement of the carriage E, placing the tail end, 36, of the yarn-carrier 32 on the raised guide or projection 37. The guide or projection 37 can be of any convenient length, and is secured to the slide-bar or front guide, M, in which the carriage E slides, by the screws 38, or their equivalents. If desired, two guides or projections, 37, can be mounted on the front of the machine. When the tail end, 36, of the yarn-carrier 32 is out of action with the guide or projection 37, the yarn-carrier 32 is lifted by the spring 38, as shown in Figs. 1, 2, and 3.

If it is desired to adjust or move the guide 37, it is released by unscrewing the screws 38, then moving the guide, and again applying the screws through some of the other screw-holes indicated in Fig. 1.

To give greater elasticity and firmness to the sliding action of the needle stops 40, which serve to retain the needles 11 within the grooves or slots 32 of the needle-beds H, I prefer to form them, in the manner shown in Fig. 4, with the loop or curl 41. The way in which they have hitherto been formed is as shown in Fig. 3.

In knitting gloves on my improved machine I divide the work after the formation of the hand-piece into five sections, each being knitted separately, during which the other sections are stopped by putting their respective needles up out of action, as before described, thus holding a portion of the work on the needles while knitting is being performed. The narrowings of the fingers are performed in the usual manner. When the first section or finger is completed, the needles that performed the operation are all thrown out of action by dropping them, after which the needles of the next section or finger are dropped into action, the narrowings being performed as usual, and so on until the glove is complete.

In knitting Tam O'Shanter hats at one operation on my machine, the needles are thrown out and into action as the work decreases and increases in width, respectively.

In knitting tuck-patterns and other articles of hosiery, the operation is performed by putting one or more needles out of action at intervals, according to the pattern of fashioning desired, until all the needles in action have knitted one, two, or more courses. Then the raised needles are dropped into action, and so on, which may be manipulated in a variety of ways, too numerous to mention.

Having thus described my invention, what I claim is—

1. The combination of the needle-bed formed with the lengthened slits, as described, for the needles, the needles operating in said slits, the reciprocating carriage, the wing-cams mounted thereon on each side of the needle-bed and provided with the angular filling-pieces, the upthrow-cams on each side



of the needle-bed, rods and means connecting them with said cams, means connecting said rods together, and means for moving said rods to close one upthrow-cam and open the other, 5 substantially as described.

2. The combination of the needle-bed formed with the lengthened slits described for the needles, the needles operating in said slits, the reciprocating carriage, the wing-cams 10 mounted thereon on each side of the needle-bed and provided with the angular filling-pieces, the upthrow-cams on each side of the needle-bed, rods and means connecting them with said cams, means connecting said rods 15 together, means for moving said rods to close one upthrow-cam and open the other, and the latch-openers extended, as described, to pass over the needles when the latter are raised, substantially as described.

20 3. The combination, with the needle-bed, the upthrow-cams 12, and sliding carriage E, of the rods 24, means for connecting said rods with said cams, cross-bar 25, connecting said

rods with each other, a lever, 26, for operating said rods, and a fulcrum-connection, 27, between said lever and the sliding carriage, substantially as described. 25

4. The combination, with the needle-bed and the sliding carriage, of the yarn-guide pivoted to the carriage, and provided with a tail, 30 36, and a guide or projection, 37, for said tail to engage with to tilt the yarn guide, substantially as described.

5. The combination, with the needle-bed, sliding carriage, and yarn-guide pivoted to 35 the carriage, and provided with a tail, 36, of a slide-bar, M, an adjustable guide, 37, and means securing said guide to said slide-bar, substantially as described.

In testimony whereof I affix my signature in 40 presence of two witnesses.

WILLIAM ROTHWELL.

Witnesses:

JOHN BRYNING HARPER,  
EDMUND CHADWICK.