

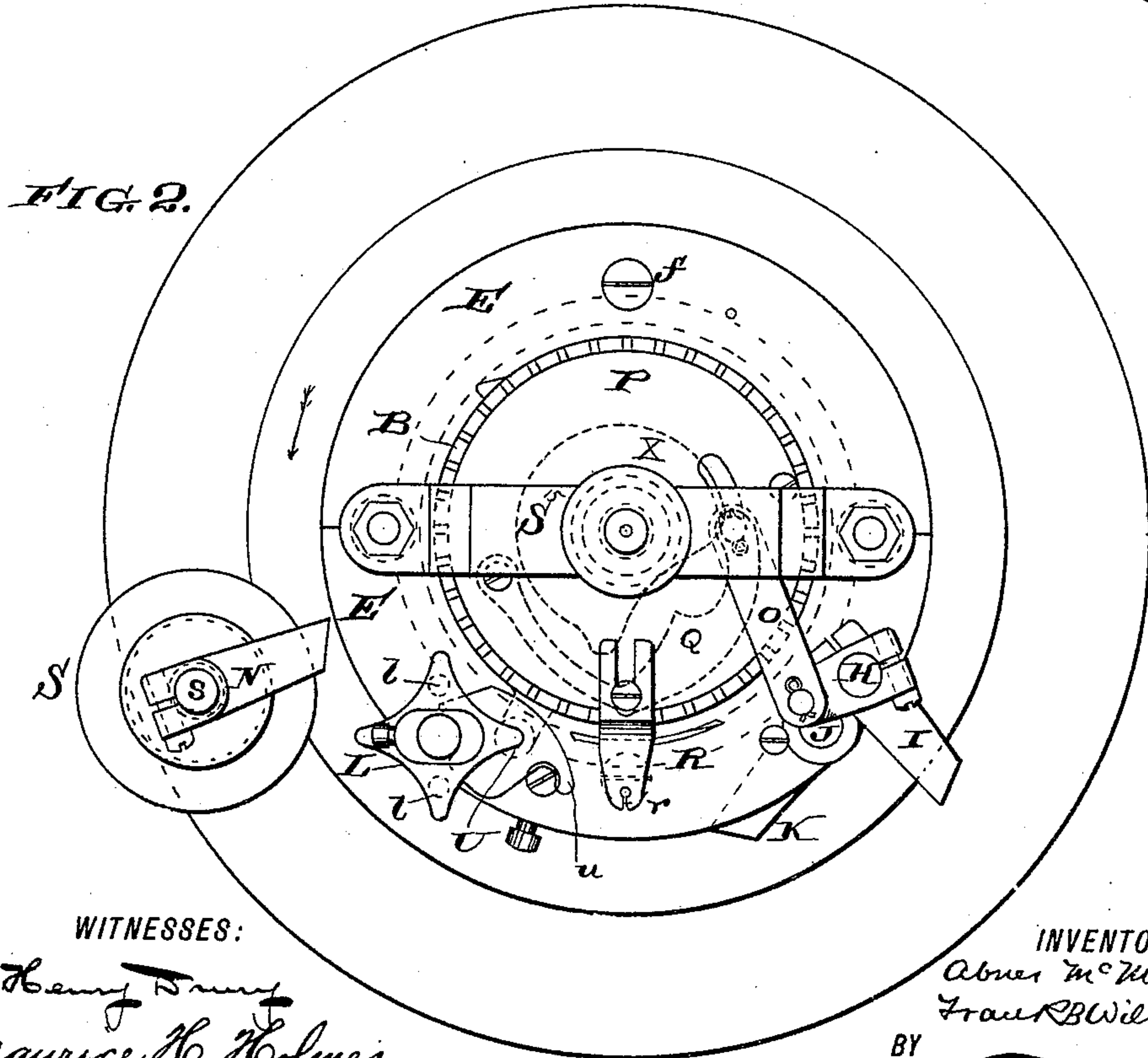
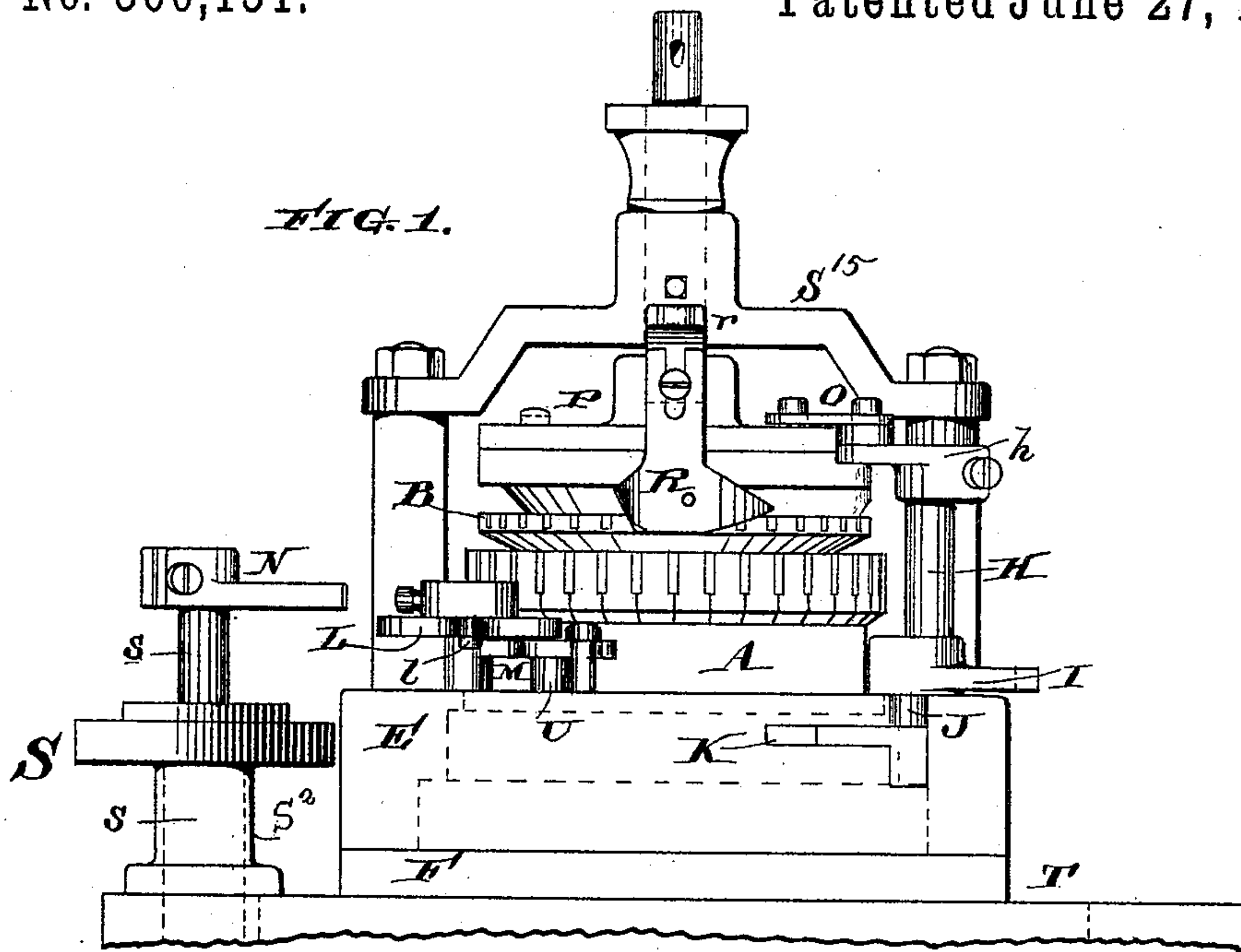
(No Model.)

3 Sheets—Sheet 1.

A. McMICHAEL & F. B. WILDMAN.  
AUTOMATIC RIB KNITTING MACHINE.

No. 500,151.

Patented June 27, 1893.



WITNESSES:  
*Henry D. ...*  
*Maurice H. Holmes.*

INVENTORS  
*Abner McMichael*  
*Fran B Wildman*  
BY *[Signature]*  
ATTORNEY.

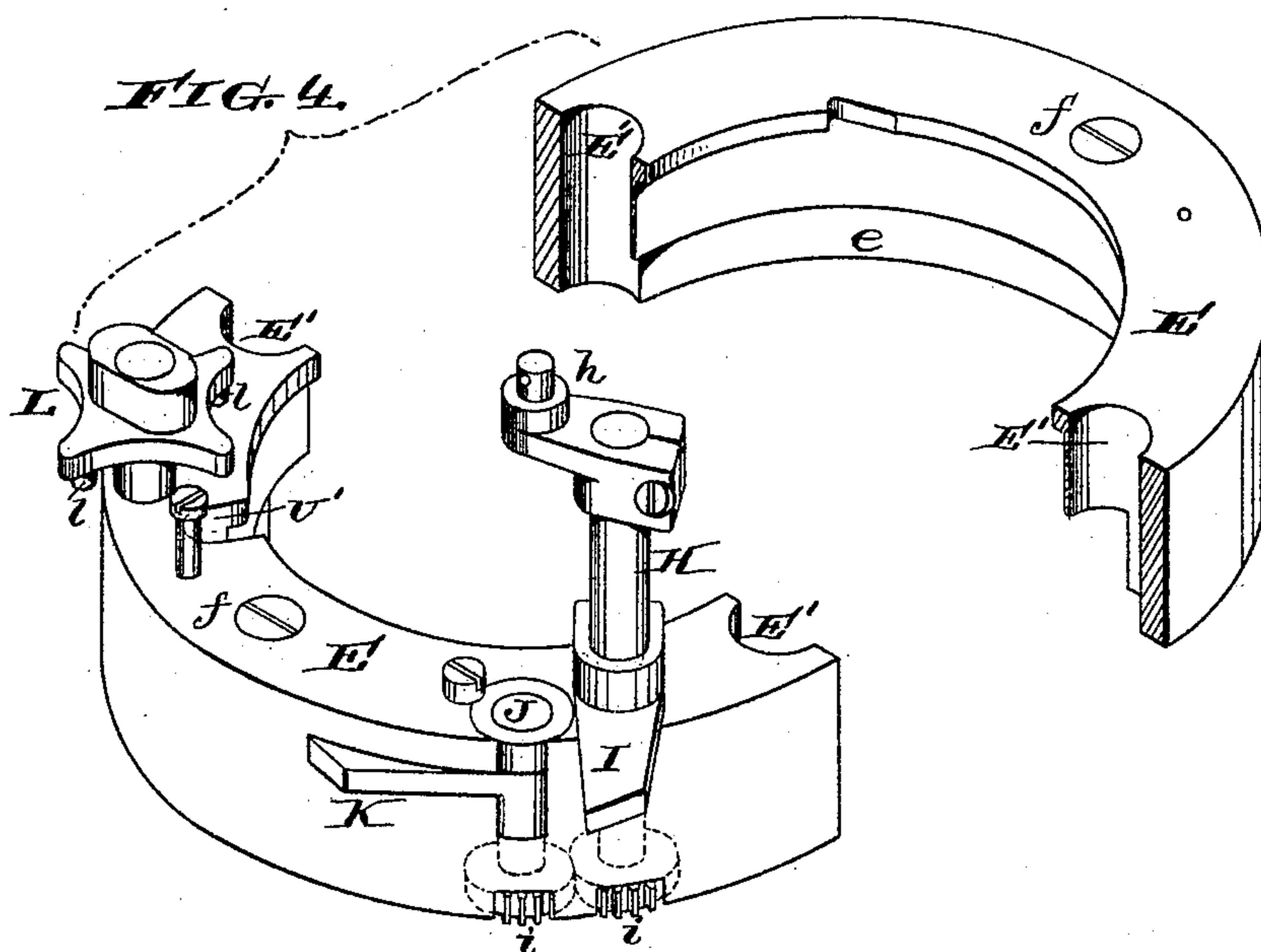
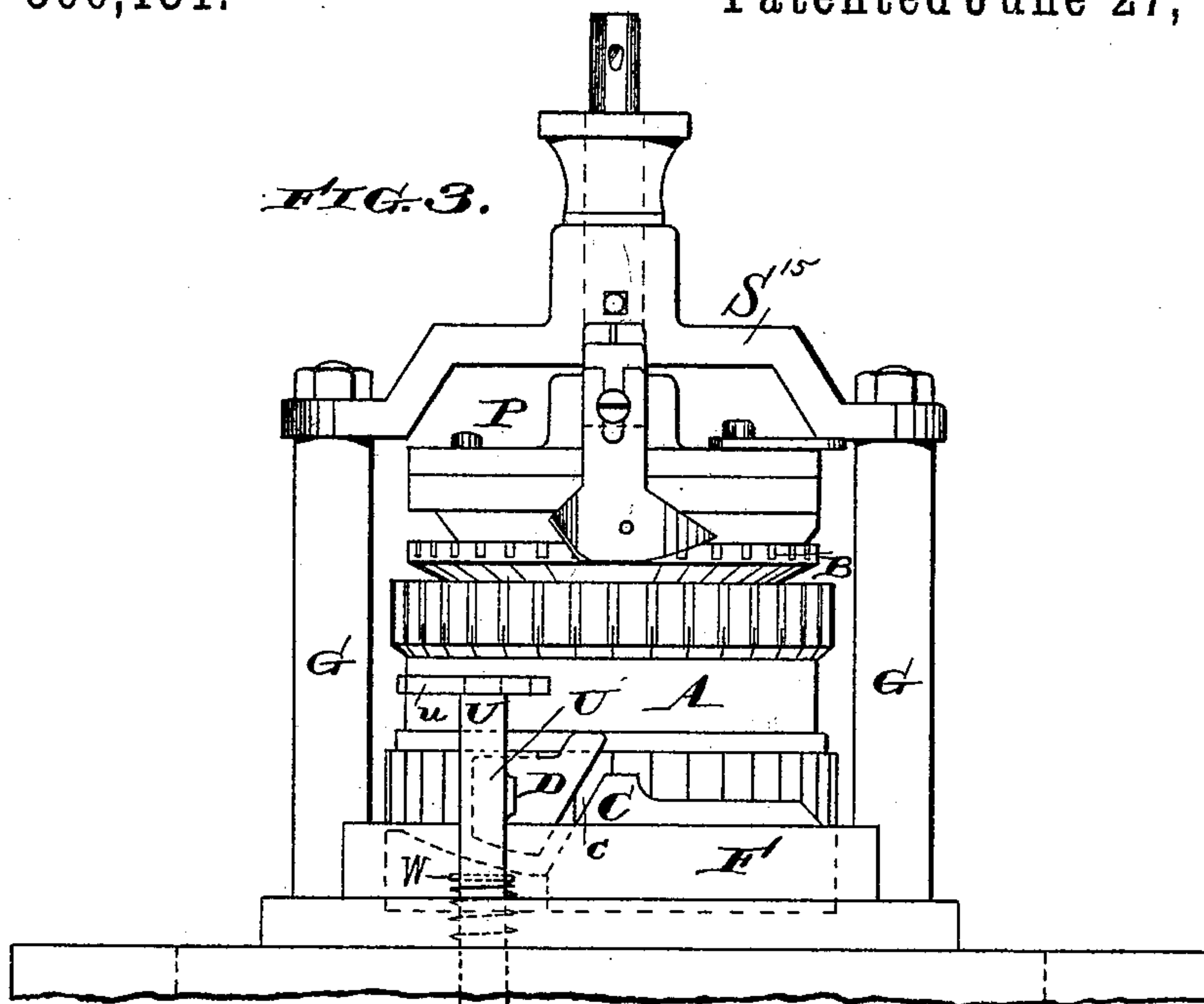
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3 Sheets—Sheet 2.

A. McMICHAEL & F. B. WILDMAN.  
AUTOMATIC RIB KNITTING MACHINE.

No. 500,151.

Patented June 27, 1893.



WITNESSES:

Henry D. Dwyer  
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3 Sheets—Sheet 3.

No. 500,151.

Patented June 27, 1893.



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# UNITED STATES PATENT OFFICE.

ABNER McMICHAEL AND FRANK B. WILDMAN, OF NORRISTOWN,  
PENNSYLVANIA.

## AUTOMATIC RIB-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 500,151, dated June 27, 1893.

Application filed February 10, 1890. Serial No. 339,836. (No model.)

*To all whom it may concern:*

Be it known that we, ABNER McMICHAEL and FRANK B. WILDMAN, both of Norristown, county of Montgomery, and State of Pennsylvania, have invented an Improvement in Automatic Rib-Knitting Machines, of which the following is a specification.

Our invention relates to circular rib knitting machines, and consists of certain improvements which are fully set forth in the following specification and are shown in the accompanying drawings which form a part thereof.

The object of our invention is to provide the machine under the influence of a pattern chain or suitable pattern governing mechanism, to insure the proper formation of loops in the fabric for making welts, and loose courses, when described.

In the drawings:—Figure 1 is a side elevation of the head of a knitting machine embodying our improvements. Fig. 2 is a plan view of the same. Fig. 3 is a view similar to Fig. 1 with the inclosing case for the lower cams removed. Fig. 4 is a perspective view showing said case with its connections. Fig. 5 is a side elevation of our improved knitting machine, illustrating the mechanism for controlling the pattern, having a portion of the main frame broken away; and Fig. 6 is a sectional plan view of a portion of the same on the line *xx* of Fig. 5.

A is the needle cylinder which may be formed in the ordinary way and secured to a stationary frame in the usual manner.

F is the rotating cam ring to which is secured the cam C for operating the vertical needles in the cylinder A.

B is the stationary dial adapted to carry the radial needles.

G G are two uprights secured to the cam ring F, upon which is the cross bar S carrying the cam plate P.

X and Q are the cams located on the plate P for operating the radial needles of the dial B. The cam X is fixed to the plate P, while the cam Q (shown in dotted lines in Fig. 2) is pivoted thereto, and by means of the mechanism hereinafter described, the cam Q may be moved in and out to control the needles for

the purpose of producing the variations in the knitting desired.

R. is a rotary thread guide for the thread of the knitting machine secured to an arm *r* carried by the head P, and rotating with it and with the cams X and Q.

The mechanism so far described is of ordinary construction and constitutes the machine to which our improvements are applied.

E E is a casing made in parts, as shown in Fig. 4, encircling the cylinder A and fastened to the cam ring F by screws *ff*, so as to rotate with it and with the cam C. These semi-ring casings E E are provided on the edges which abut when the casings are placed upon the machine with vertical rests E' adapted to fit upon the vertical studs G. This enables the ring casing to be centered and fit tightly about the machine to keep out all dust and dirt from the lower portion thereof.

H and J are two shafts journaled in the casing E and connected together by means of spur wheels or segmental gears *i*, so that when the one is rotated in one direction the other rotates in the opposite direction. The shafts H and J are provided respectively with lateral arms I and K, so disposed with reference to one another that when the arm K is turned out, the arm I is turned in and vice versa. Thus the movement of either arm affects the position of the other. Secured to the shaft H is a crank *h*, connected by a link O with the pivoted cam piece Q of the dial. The movement of the arms I and K will thus produce a movement of the cam piece Q.

Arranged on one side of the machine is a vertically movable shaft *s*, which slides vertically in a stationary part S<sup>2</sup> secured to the main frame of the machine. The shaft *s* is operated in the ordinary way by means of a pattern chain to produce the vertical movements. Carried by the shaft *s* is an arm N, and a disk S having portions of different diameters. The disk is so situated with reference to the arms I and K that by raising and lowering it, through the action of the pattern chain, either portion may be caused to strike and move either arm I or K. It may also be brought into a position in which it will not strike either arm during the rotation of the



head. The disk S is loosely sleeved upon the vertically movable shaft s and rests upon a shoulder S' thereof when the shaft is raised to move the disk away from the support of the part S<sup>2</sup>. When the shaft s is lowered the disk rests upon the part S<sup>2</sup>, and at that time it will not change the arms I and K from their adjustment for ordinary knitting. While the disk S is thus supported on the part S<sup>2</sup>, the shaft s may be lowered farther to bring its arm N in a lower position. The shaft s may be vertically reciprocated by a crank device, consisting of an arm S<sup>4</sup> secured to a rock shaft S<sup>3</sup>, having an arm S<sup>5</sup> which works in connection with a pattern chain S<sup>6</sup>, intermittently moved with a wheel S<sup>7</sup>. The wheel S<sup>7</sup> is intermittently rotated by means of a ratchet wheel S<sup>8</sup> and a pawl S<sup>9</sup> pivoted to a slide S<sup>10</sup> reciprocated in one direction by a spring 3 and in the other direction by a lever S<sup>11</sup> and a cam t, which latter is secured to and is carried by the rotating part F of the needle head. With every revolution of the needle head, the slide S<sup>10</sup> is reciprocated and moves the pattern chain the distance of one link. This produces and controls the operation of the shaft s.

While we have described one form of pattern mechanism, it is evident that other forms of pattern mechanism may be employed to operate the shaft s.

D is a movable cam, adapted to act upon the vertical needles in the cylinder A, and is supported by a stud U, and movable vertically for the purpose of causing the needles to be depressed a greater or less degree. The stud U is received in a vertical guideway in the frame F, and is pressed upward by a spring W, (shown in Fig. 3.) This spring thus tends always to move the cam D to its most elevated position except when the stud is depressed in the manner hereinafter described.

One part of the ring casing E is provided with a rest U' which is adapted to receive the vertically movable stud U. This rest is so shaped that it opens to the interior or inner edge of the casing and permits the attachment of the casing about the head, without moving the stud U or interfering in any way with its connection with the cam D.

Fastened to the upper end of the stud U is a cam u. L is a star wheel journaled adjacent to the cam u and having upon its under side two diametrically arranged pins l. When the star wheel L is rotated these pins are forced above the cam u and thus depress the stud U and with it the cam D. When the star wheel L is moved to bring the pins l away from the cam u, (into the position shown in dotted lines in Fig. 2) the stud U is lifted by the spring W and thus raises the cam D. The star wheel L is operated by the arm N of the shaft s. When the shaft is raised, as in the position shown in Fig. 1, the arm N is also raised and the star wheel may pass freely under it when the needle head is rotated. If, however, the shaft s is lowered by the action of the pat-

tern mechanism, the arm N may be brought into position to strike the star wheel L and rotate it.

The casing E being made in parts as shown may be readily removed to expose the needles, cams and needle cylinder, without dismantling the machine.

By making the casing in two parts and of solid metal as illustrated in Fig. 4 great rigidity is obtained and at the same time the said parts are enabled to be fitted about the studs without absolute accuracy, and the said studs G fitting into the recessed portions E' of the casing sections causes them to be properly centered and adjusted about the cylinder head. This permits quick and accurate adjustment and at the same time provides a firm support for the various devices which are adapted to actuate the cams and which are subjected to impact with the operating parts S and N.

We do not limit ourselves to the mere details of construction as they may be modified without departing from our invention.

We will now describe the operation of the mechanism in carrying out the objects of our invention for the purpose of forming welts, and loose courses, referring first, however, to the operation of the machine in ordinary plain rib knitting.

For ordinary knitting, the cam Q is adjusted to assume a position between its extreme outward and inward positions. This adjustment is obtained by turning the arm I into an intermediate position. The pattern mechanism is then thrown out of action and the machine will operate in the usual manner, the radial needles knitting at each course.

Now suppose the pattern mechanism to be thrown into operation, and it is desired to make loose courses. Through the action of the pattern mechanism the shaft s is depressed and the arm N is lowered so as to operate the star wheel L in the manner heretofore described. This operation of the star wheel L causes the cam D to be depressed, thereby drawing down the vertical needles and producing a course of loose loops of what is known as a loose course in the face of the fabric. Upon the next rotation of the head, the arm N, (if not previously raised by the pattern mechanism) will strike the star wheel L and rotate it a distance sufficient to move the pin l from above the cam of the stud U, allowing the stud and cam D to rise into position for ordinary knitting. This forms a loose course upon the vertical needles only. The radial needles may be similarly operated through the pattern mechanism which will lift the shaft s so as to move the larger diameter of the disk S into a position to strike the partly moved out arm I. The disk S will force the arm I entirely in, thereby moving the cam piece Q inward to its greatest limit, so that the radial needles after they have been forced out by the cam X will be drawn inward to the greatest extent so as to form



longer loops and thereby produce loose courses. To restore the cam Q to its intermediate position for ordinary knitting the pattern mechanism will reciprocate the shaft s to bring the small diameter of the disk S into position to strike the arm K, (which is moved to its extreme outward position when the arm I is moved entirely in,) thereby moving the arm K partly in and correspondingly moving the arm I partly out and restoring the cam Q to its intermediate position for ordinary rib knitting. The loose courses it will be seen are formed by the greater inward movements of the needles which draw the thread farther through the loop making thereby a series of longer loops.

To form a welt the vertical needles are allowed to operate normally without any depression of the cam D, and the pattern mechanism lifts the shaft s until the larger diameter of the disk S is in a position to strike the arm K forcing that arm entirely in and correspondingly moving the arm I entirely out and the cam Q into its extreme outward position as shown in Fig. 2. Now after the radial needles have been forced out by the cam X it is apparent that they will be drawn in only to a slight degree by the cam Q, and this amount of inward movement is not sufficient to carry the latch of the needle through the previously formed loop. The radial needles will therefore not knit during this course but will simply hold the thread while the vertical needles will knit as before, which may be for as many courses or rotations of the head as may be desired. The effect of this is to obtain a protuberance or welt in the fabric. To restore the cam piece Q to its intermediate position for ordinary knitting, the pattern mechanism operates the shaft s to bring the small diameter of the disk S in position to strike the arm I moving it partly in and restoring the cam Q to its intermediate position.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a knitting machine, the combination of a stationary dial carrying the needles, a rotary cam for operating said needles and having one portion thereof movable for the purpose of varying the amount of reciprocation of the needles, a crank shaft rotating with said movable part of said cam, rotatable supports for the cam and crank shaft, connections between said cam and crank of the crank shaft whereby the latter moves the former, a second shaft geared to the first mentioned shaft and adapted to rotate simultaneously in an opposite direction, arms secured to the respective shafts at different elevations so that when one is thrown in the other is thrown out, pattern mechanism, and projecting parts moved by the pattern mechanism for bringing said parts into the path of either of the arms for operating said arms respectively at different times.

2. In a knitting machine, the combination

of a stationary dial carrying the needles, a rotary cam plate having a cam for operating said needles of the dial and having one portion of the cam movable for the purpose of varying the amount of reciprocation of the needles, a crank shaft rotating with said movable part of said cam, a rotating support for the cam plate, a connection between said cam and crank of the crank shaft whereby the latter moves the former, a second shaft mechanically connected to the first mentioned shaft and adapted to rotate simultaneously in an opposite direction, arms or projections secured to the respective shafts at different elevations so that when one is thrown in the other is thrown out, pattern mechanism, and projecting parts moved by the pattern mechanism for bringing said parts into the path of either of the arms for operating said arms respectively at different times, and a removable ring piece adapted to rotate with the cam and carry the said shafts.

3. In a knitting machine, the combination of a stationary needle head, a rotating cam therefor having a movable part for varying the reciprocations of the needles, a vertically movable part projecting from the movable portion of the cam, an intermittently rotatable star or wheel having projections adapted to move over the movable part connected with the cam so as to move it at stated intervals, pattern mechanism, a circular rotatable support for the movable part connected with the cam, a spring to move the movable part against action of the star or wheel, and devices controlled by the pattern mechanism for actuating the intermittently rotatable star or wheel.

4. In a knitting machine, the combination of a stationary needle head, a rotating cam therefor having a movable part for varying the reciprocations of the needles, a vertically movable part projecting from the movable portion of the cam, an intermittently rotatable star or wheel having projections adapted to be moved over the movable part connected with the cam so as to move it at stated intervals, pattern mechanism, a circular rotatable support for the movable part connected with the cam, a spring to move said movable part against the action of the star or wheel, devices controlled by the pattern mechanism for actuating the intermittently rotatable star or wheel, and a removable ring piece for supporting the intermittently rotatable star or wheel detachably secured to the machine and rotating with the cam so as to be readily moved therefrom for exposing the said cam when desired.

5. In a knitting machine, the combination of a stationary head having vertical and horizontal grooves for two sets of needles movable at an angle to each other, a cam for each part of said needle head having a movable part adapted to reciprocate the needles to a greater or less extent, mechanism for operating each of the movable parts of the cams in-



dependently of the other and having extending portions, rotatable means to support the cams and said mechanism, pattern mechanism, and projecting parts carried by a common shaft and movable in a stationary support secured to the main frame of the machine adapted to be actuated by the pattern mechanism to be projected into the path of either of the extending parts of the cam operating mechanism for operating either of said mechanisms for the purpose of moving said movable parts of said cams.

6. In a knitting machine, the combination of a stationary head having vertical and horizontal grooves for two sets of needles movable at an angle to each other, a cam for each of said needle heads having a movable part adapted to reciprocate the needles to a greater or less extent, mechanism for operating each of the said movable parts of the cams independently of the other consisting respectively of an intermittently rotating star or wheel provided with projections acting upon an extension of one cam, and an intermittently movable rock

shaft having a crank and an operating arm, and a second shaft having an operating arm and connected to the first mentioned rock shaft by a mechanical connection to rotate the shafts simultaneously in opposite directions, and a link connection between the crank and movable part of the other cam, rotatable means to support the cams and said mechanisms, pattern mechanism, and parts movable in a stationary support secured to the main frame of the machine adapted to be actuated by the pattern mechanism to be projected into the path of either the star wheel or arms of the rock shafts for operating either of said mechanisms for the purpose of moving said movable parts of said cams.

In testimony of which invention we have hereunto set our hands.

ABNER McMICHAEL.  
FRANK B. WILDMAN.

Witnesses:

EUGENE D. EGBERT,  
ABM. L. HALLMAN.