

No. 617,820.

Patented Jan. 17, 1899.

W. SPIERS.
KNITTING MACHINE.

(Application filed July 27, 1897.)

3 Sheets—Sheet 1.

(No Model.)

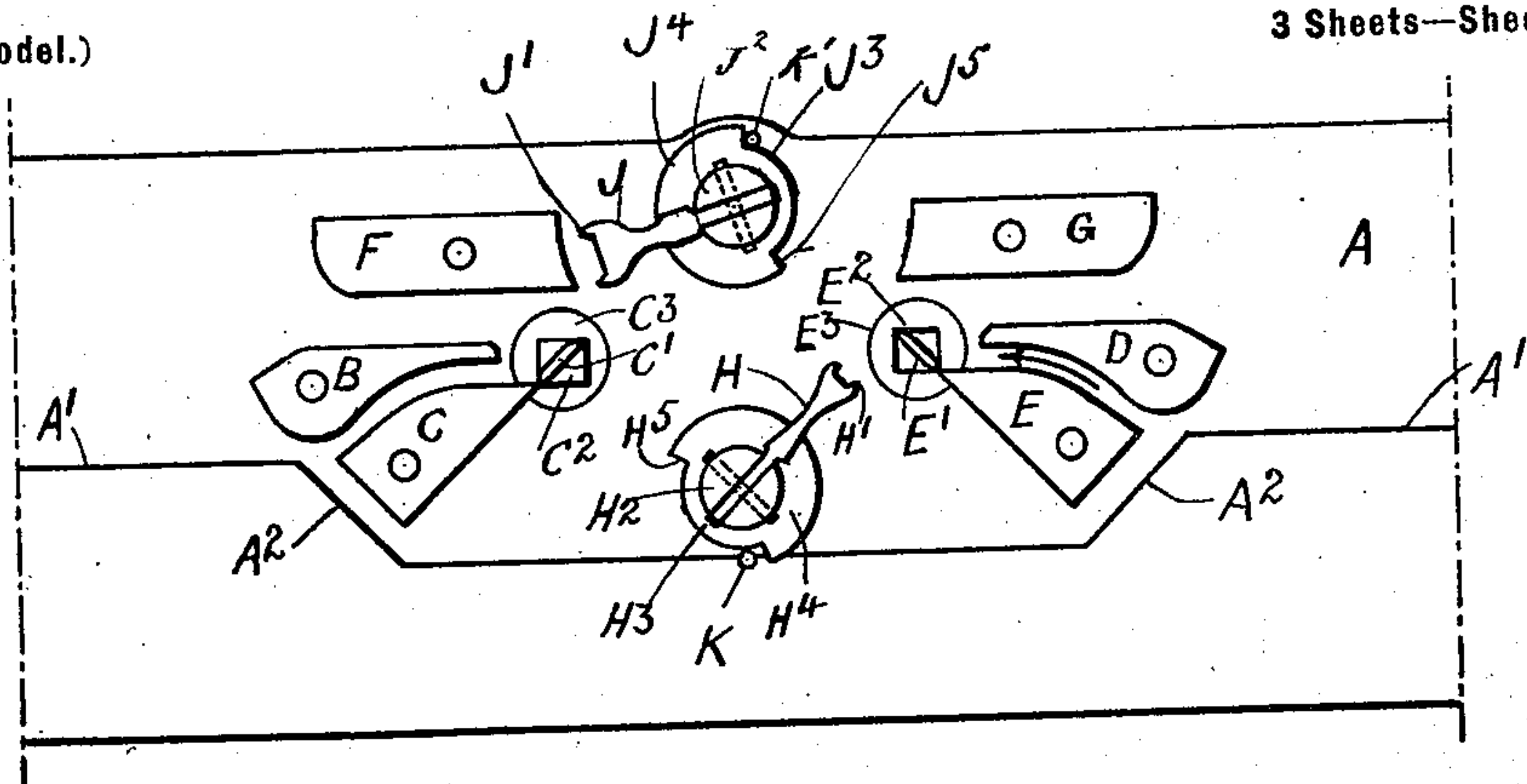


Fig. 1.

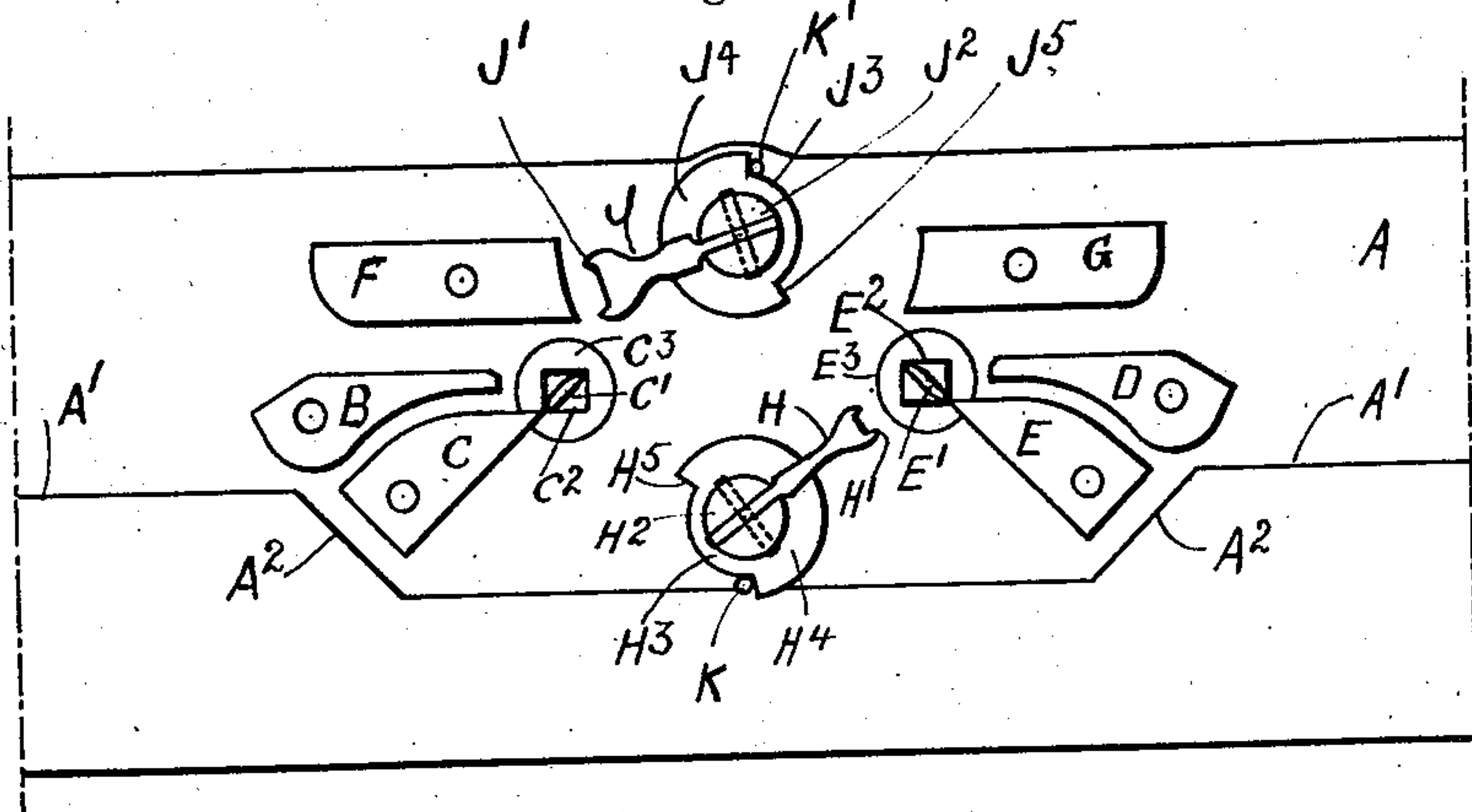
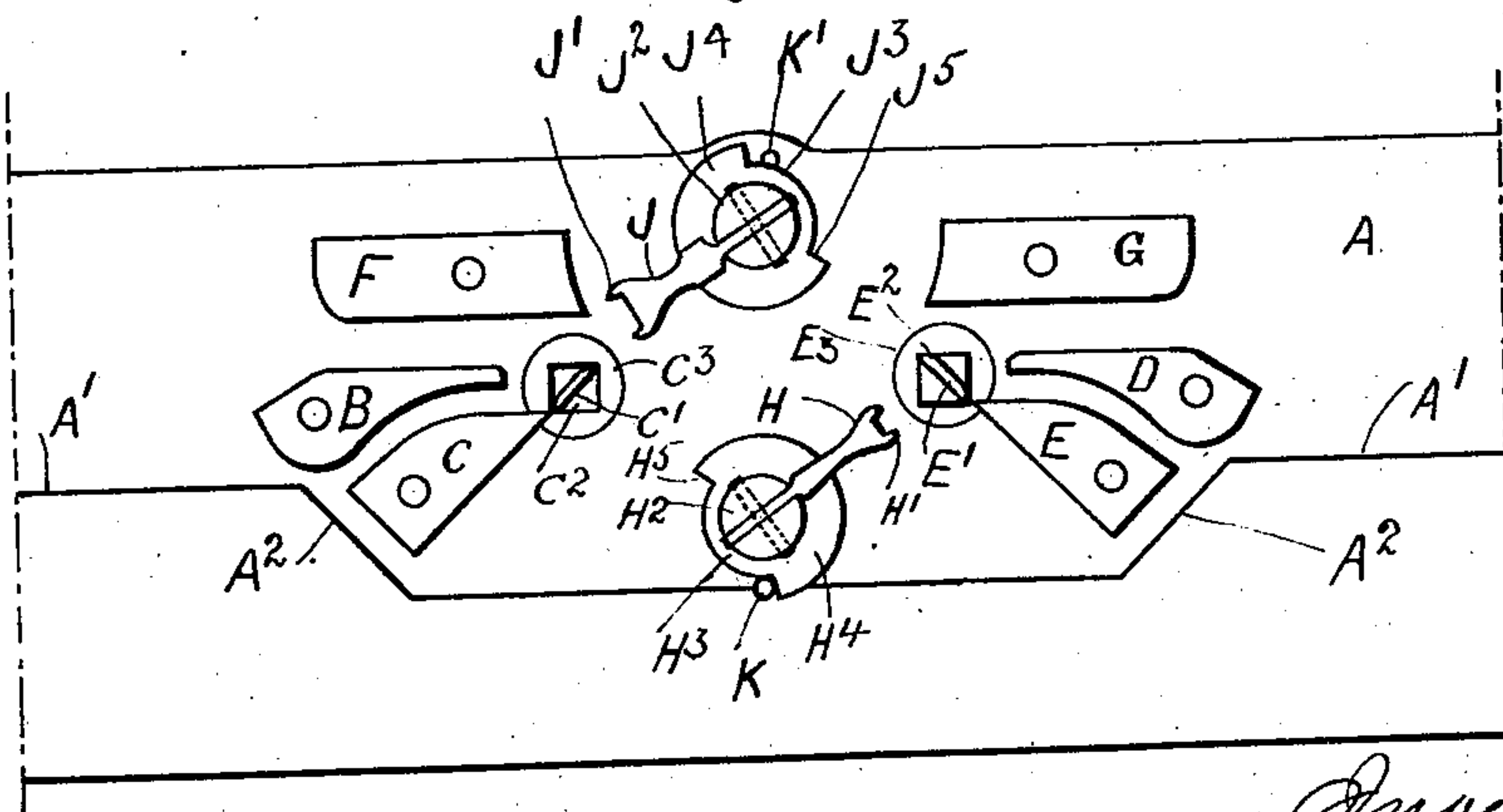


Fig. 3.



Witnesses
H. K. Boulter
E. H. Hump

Fig. 2.

Inventor
William Spiers
By H. K. Boulter
attorney

No. 617,820.

W. SPIERS.

Patented Jan. 17, 1899.

KNITTING MACHINE.

(Application filed July 27, 1897.)

(No Model.)

3 Sheets—Sheet 2.

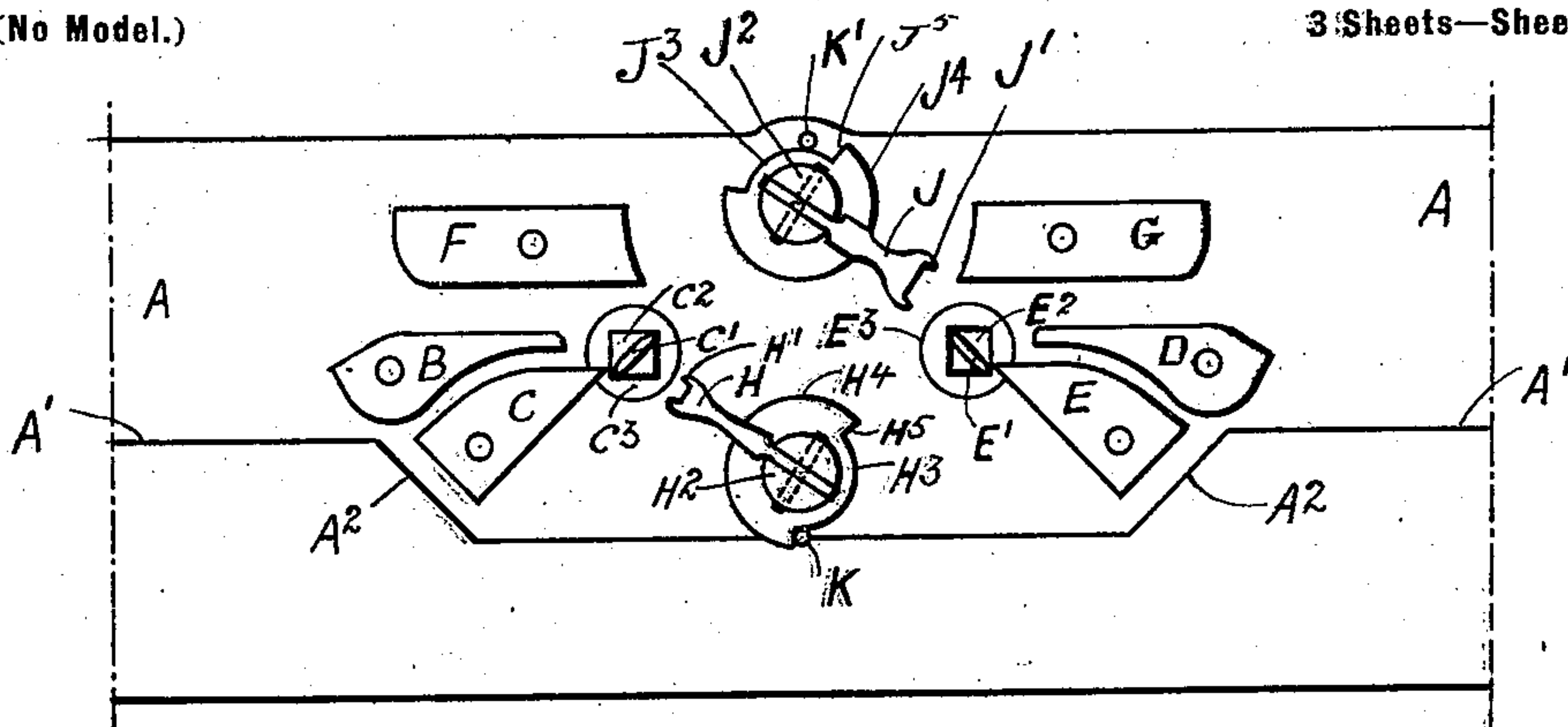


Fig. 3a

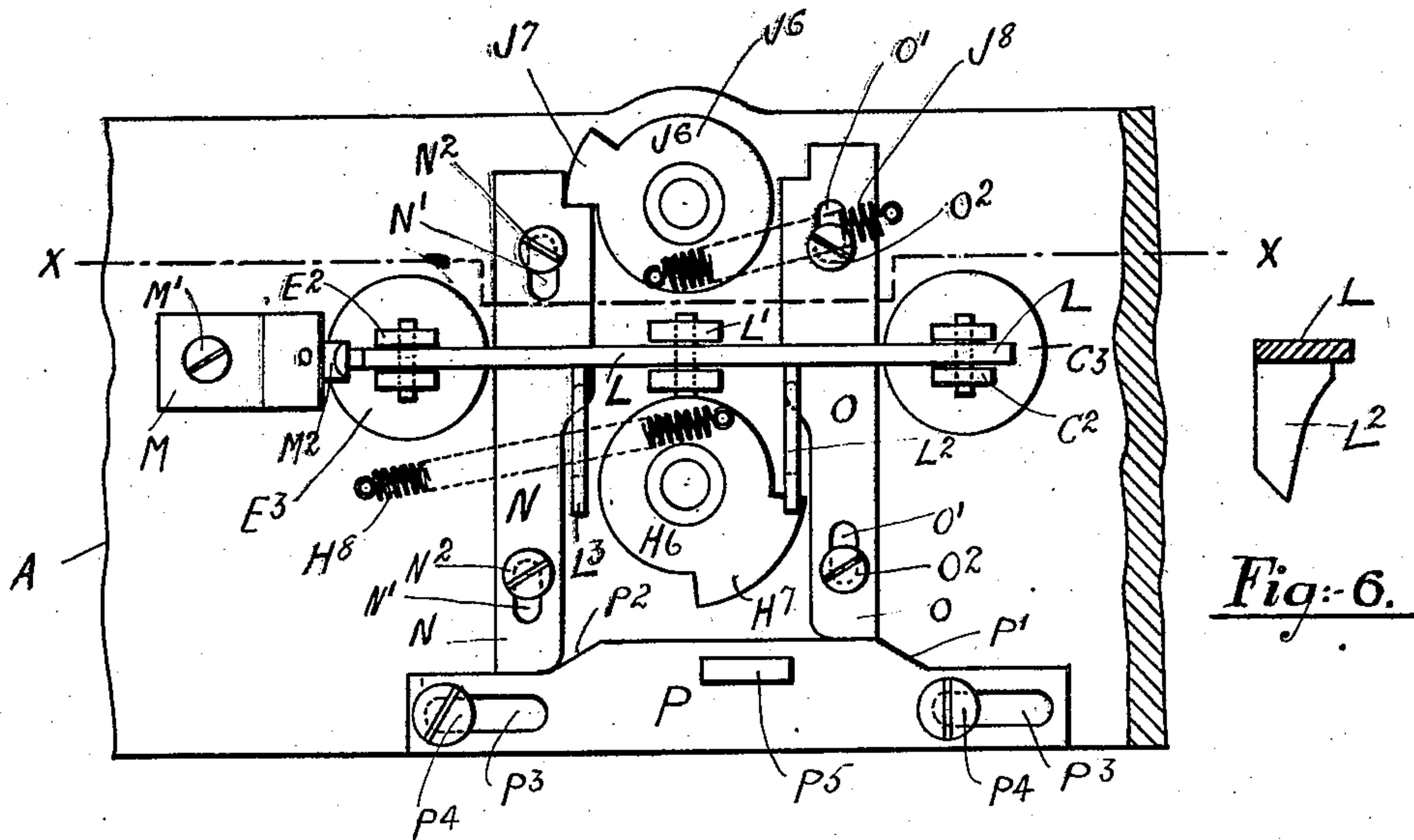


Fig. 6.

Fig. 4.

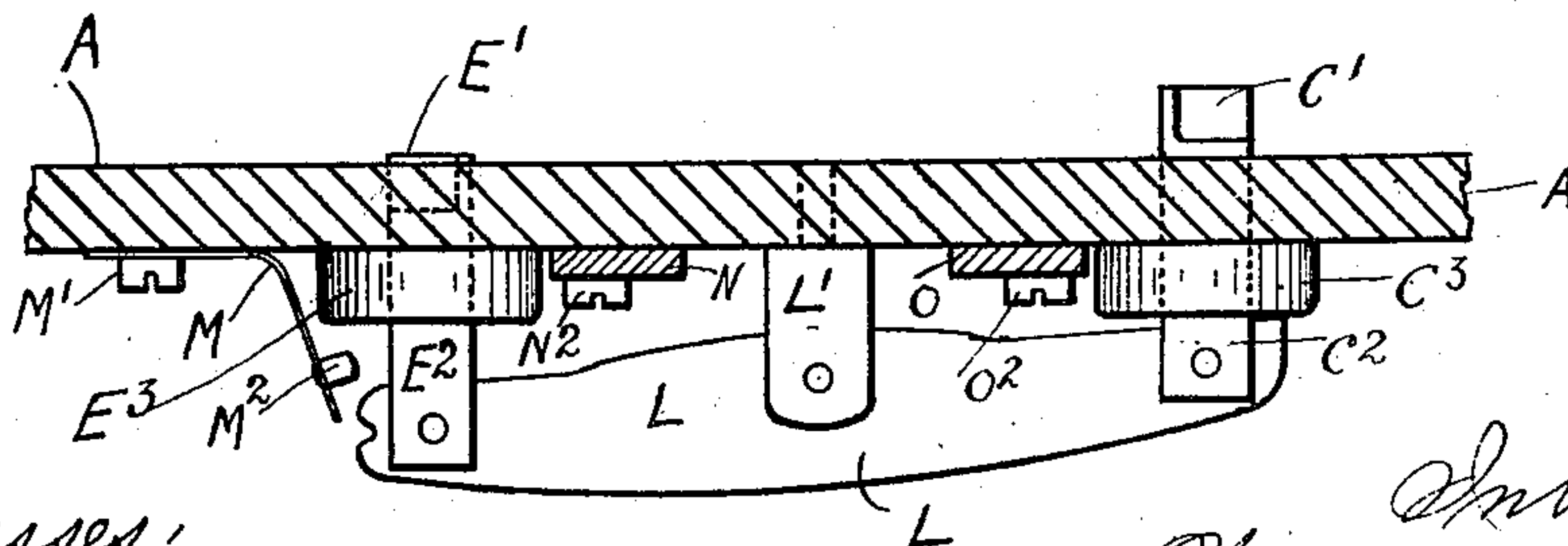


Fig. 5.

Witnesses:
J. K. Boulter
C. Northup

Inventor
William Spiers
By J. K. Boulter
attorney

No. 617,820.

Patented Jan. 17, 1899.

W. SPIERS.
KNITTING MACHINE.

(Application filed July 27, 1897.)

(No Model.)

3 Sheets—Sheet 3.

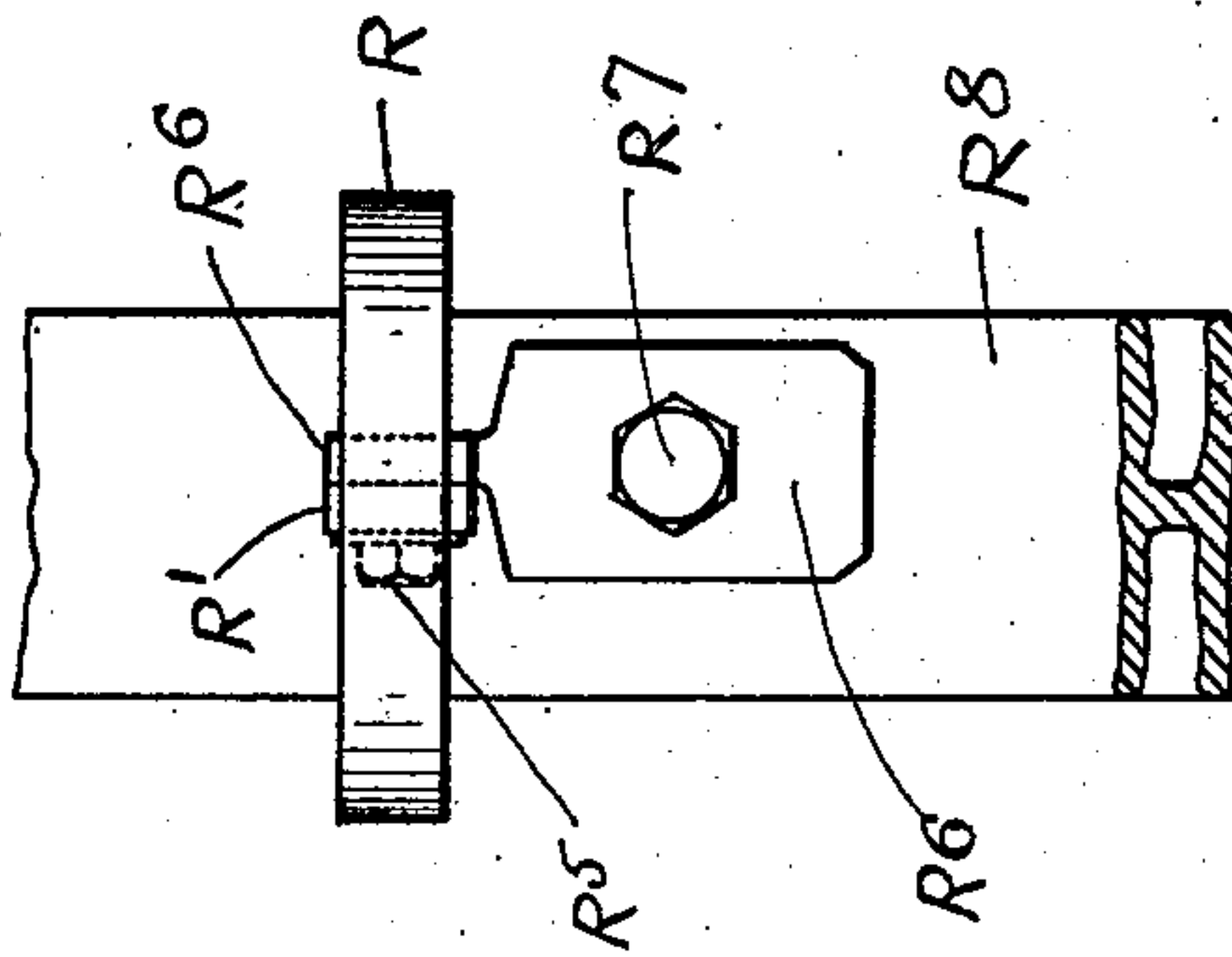


Fig:-10.

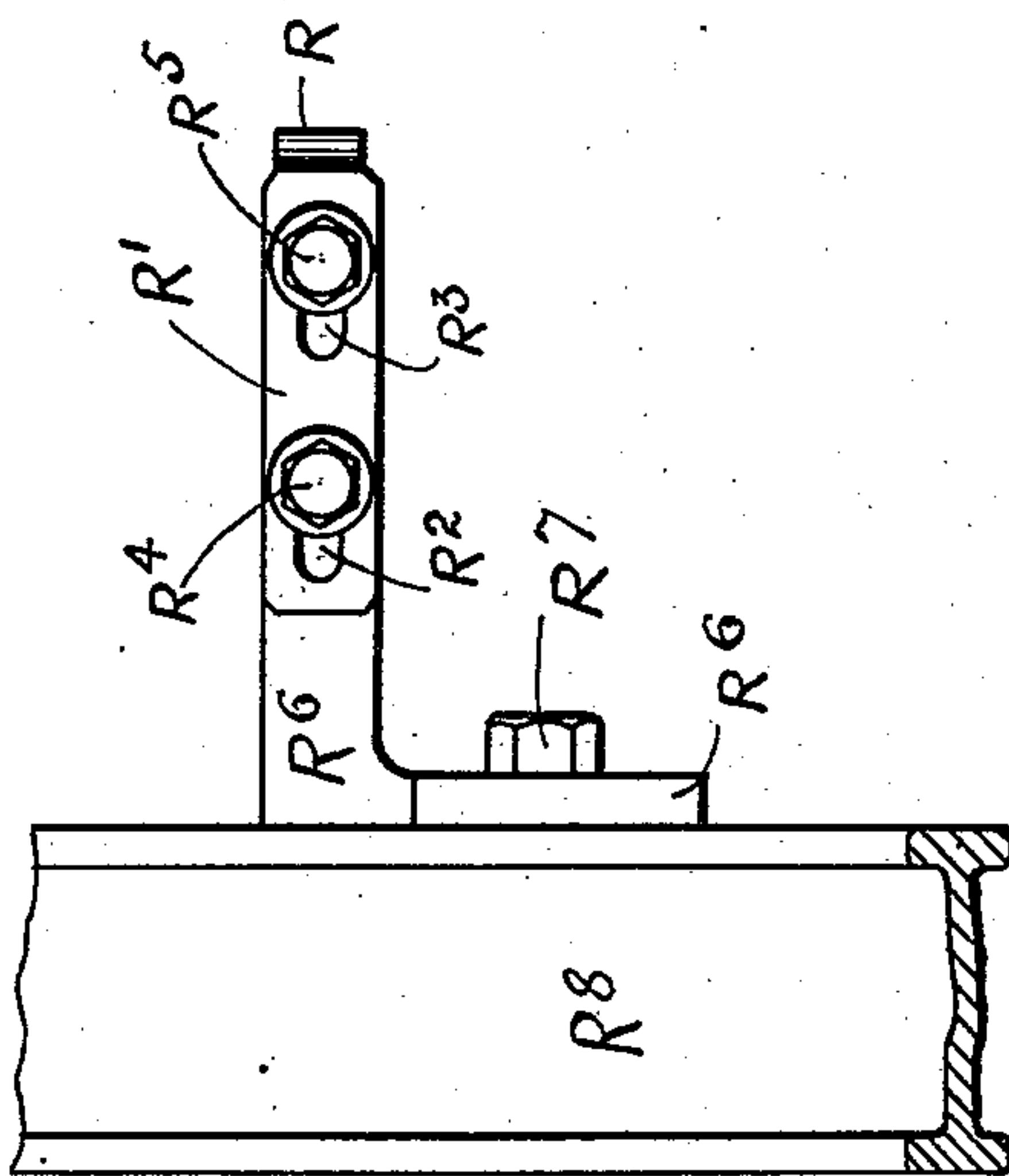


Fig:-9.

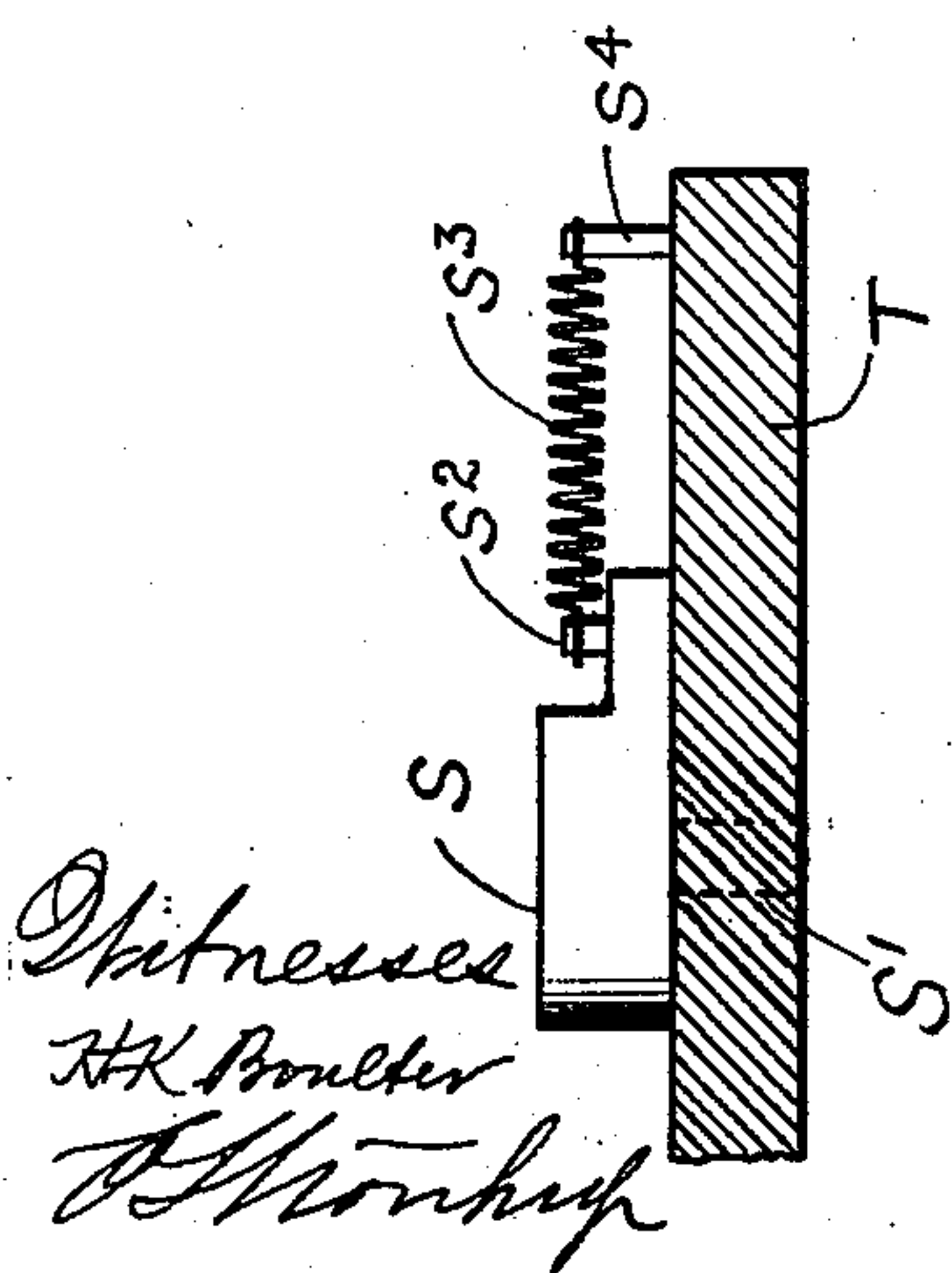


Fig:-7.

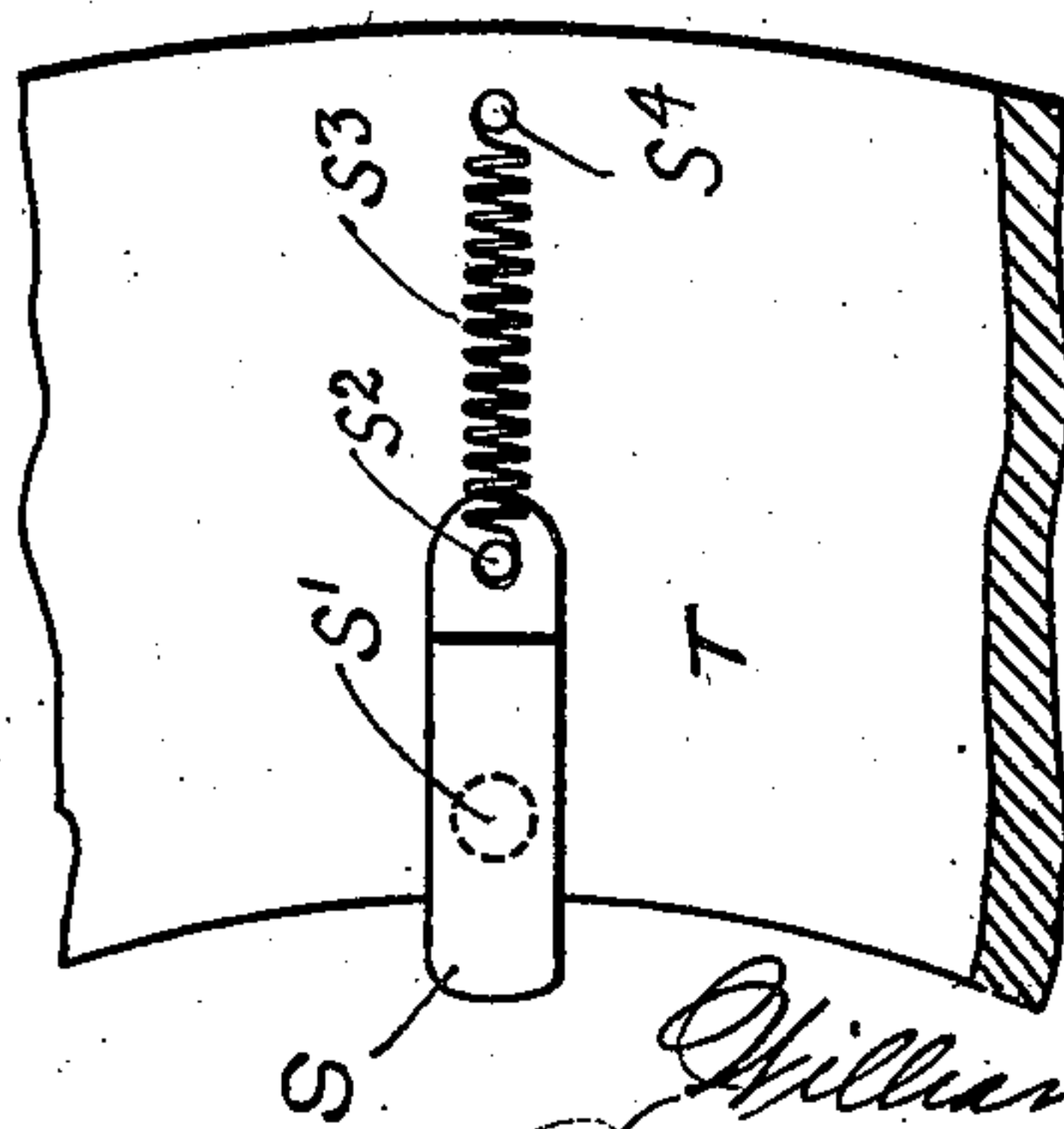


Fig:-8.

Witnesses
H. K. Boulter
J. H. Monahan

Inventor
William Spiers
By H. K. Boulter, attorney

UNITED STATES PATENT OFFICE.

WILLIAM SPIERS, OF LEICESTER, ENGLAND.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 617,820, dated January 17, 1899.

Application filed July 27, 1897. Serial No. 646,128. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM SPIERS, a subject of the Queen of Great Britain, residing at Leicester, England, have invented certain new and useful Improvements in Knitting-Machines, (for which I have received Letters Patent in Great Britain, No. 23,560, dated December 9, 1895, and applied for other Letters Patent in Great Britain, No. 1,752, dated January 22, 1897,) of which the following is a specification.

This invention has reference to certain improvements in knitting-machines, as hereinafter fully set forth.

The invention has special reference to the type of knitting-machines employed in the production of what is known as "seamless" hosiery and in which the formation of the heel and toe is effected by commencing to knit the same upon one-half, or thereabout, of the full complement of needles concerned in the knitting of the leg and reducing the number of needles in action at each course until a minimum number remain and then reintroducing the said inactive needles into action, whereupon when all the said needles are again in work a pouch or pocket suitable for the heel or toe has been knitted.

The invention is designed to produce devices simple and efficient in construction and operation to automatically select the needles and place the same successively out of action during the narrowing operation and also to automatically select and successively bring again into action during the widening operation the needles rendered inactive during narrowing.

According to this invention there are two devices for selecting the needles—viz., one for elevating them during narrowing and the other for depressing them during widening—each device being similar in construction and operation.

The invention comprises needle-selecting devices forked or bifurcated at their operative ends, each being connected to a rotatable head, sleeve, boss, or equivalent, movably located in the usual cam-ring or cam-carrier, so as to travel therewith.

In the reciprocation of the cam-carrier during the narrowing or widening operations the end needle or needles of the series abuts

against the needle-selector, causing the latter to rotate on its axis, in doing which it either raises or depresses one or more needles out of or into action, and at the same time moves the needle-selector into the proper position for selecting the needles upon the return movement of the cam-carrier.

The length of each member of the bifurcation or forked end of the needle-selector determines the number of needles to be raised or lowered, and the action of the needles themselves varies the position of the needle-selector, so that it is always in operative position.

The needle-selector or its rotatable head or attachment may be suitably spring-controlled or equivalently governed or combined with cam-surfaces in such a manner as to prevent it accidentally getting out of position.

The details of construction may be varied in several different respects without departing from the scope of the invention.

In the accompanying drawings the needle-selecting devices are shown located between the two sets of knitting-cams, so that as the needles pass between one set of cams the first needle or needles is taken by either the narrowing-selector or the widening-selector, as the case may be, and either raised out of action or lowered into action, the contact with the needles causing the selector to turn on its axis over against the other set of cams, where it is in position, as hereinafter described, to repeat the operation when the cam-carrier reverses its direction of motion.

Referring to the accompanying drawings, Figure 1 is an elevation of part of the cam-carrier, developed, of a circular-knitting machine for the manufacture of seamless hosiery, showing the needle-selectors in the positions they occupy for the narrowing operation. Fig. 2 is a similar view to Fig. 1, showing the needle-selectors in the respective positions they occupy for the widening operation. Fig. 3 is a similar view to Figs. 1 and 2, showing the needle-selectors in the inoperative positions they occupy during leg or tubular knitting. Fig. 3^a is a similar view to Figs. 1 and 2, but showing the needle-selectors in their opposite positions after the one has lowered its needles into action and the other raised its needles out of action. Fig. 4 is an elevation

of the opposite side of the cam-carrier, showing the mechanism for placing the needle-selecting devices in operative positions at the reversal of the cam-carrier and also for actuating the auxiliary cams. Fig. 5 is a horizontal section on the line X X of Fig. 4, and Fig. 6 is a detail of the lever L and lugs L² L³. Figs. 7 and 8 are details of the bed-plate, showing the flexible stop S in elevation and plan, respectively; and Figs. 9 and 10 are detail views illustrating the fixed plate R in front and side elevations.

Similar letters of reference represent corresponding parts throughout the drawings.

A represents the cam-carrier of a circular-knitting machine, provided with a ledge A', upon which the butts of the working-needles rest and ride. The said cam-carrier is also provided with inclines A², guard-cams F G, and two sets of knitting-cams—viz., B C and D E—the construction and purpose of which are well understood and as they form no part of the present invention need not be further described. When knitting is taking place, the active needles pass between either the cams D E and downward under the cams C' C or between the cams B C and downward under the cams E' E, according to the direction in which the cam-carrier A is moving, and the inactive needles during narrowing and widening pass between the cams G D and F B.

H J are the needle-selecting devices, the former of which is in action during the narrowing operation and the latter during the widening operation. Each of the said needle-selectors comprises a finger bifurcated at its extreme end, so that it is provided with two lips H' J'. At its other end it is loosely pivoted in a saw-cut in the end of a boss H² or J², projecting from a circular rotatable head H³ or J³, located in a circular opening in the cam-carrier.

The normal or operative position of the bifurcated end of the lower needle-selector H during narrowing is in the path of the needles which pass through or between either of the two sets of knitting-cams D E or B C and opposite the groove or passage between the latter. It is shown in this position relatively to the cams D E in Fig. 1.

The normal or operative position of the upper needle-selector J is in the path of the needles which pass between either the cams F B or G D during widening. It is shown in this position relatively to the cams F B in Fig. 2 and to the cams G D in Fig. 3^a.

Referring to Fig. 1, suppose the needles are traveling between the cams D E in the direction of the arrow during the narrowing operation. The first needle of the series of active needles will abut against and be intercepted by the needle-selector H and turn the latter on its axis, which rotary movement thereof will cause the selector to raise and deliver such needle into the idle groove between the cams F B, whereupon the said selector will be moved into a position over against the

other two cams B C, as shown in Fig. 3^a, so that the following needles can strike the cam C' and be deflected downward under the knitting-cam C. The selector when in this position will, as hereinafter described, be moved slightly on its axis when the cam-carrier is reversed, so as to be again in the path of the needles ready to raise the first needle which passes between the cams B C.

In order to insure the selectors at each rotary movement stopping in close proximity to the path of the needles between the cams, a stop or pin K K' is fixed in the cam-carrier and the rotary head furnished with a segmental flange H⁴ or J⁴, the ends or shoulders H⁵ or J⁵ of which are arranged to abut against this said pin when the complete movement or stroke of the selector is effected.

When the upper needle-selector J is in its normal position (illustrated in Fig. 2) during widening, the first of the series of inactive needles traveling through the idle groove between the cams F B strikes against the bifurcated end of the selector, causing the latter to rotate on its axis and lower the needle or needles in engagement therewith in front of the cams E' E and at once place it or them in action again. This contact with the needle or needles rotates the selector on its axis, so that it is moved over against the cam G in the same relative position thereto as it is shown in connection with the cam F in Figs. 1 and 3, so that it is out of the path of the following needles, which will pass between the cams G D. Immediately the cam-carrier reverses its motion the said selector will be moved slightly on its axis into the position shown in Fig. 3^a, so as to intercept the first needle passing through the said cams G D.

Adjacent to the apex of each fixed cam C E is a supplementary horizontally-movable plate or auxiliary cam C' E'. These auxiliary cams are movable horizontally into and out of the wall of the cam-carrier A, and when moved forward—that is, projecting from the cam-carrier—they block the passages between the fixed cams B C or D E, so that needles which have already passed between one pair of the said cams cannot pass between the other pair also, but will be deflected downward and under either of the stitch-cams C or E, and when either of the said auxiliary cams is moved into its inward position it opens the said passage, so as to allow the needles which have already entered the passage at the opposite end to continue their travel between the cams and allow the first needle to encounter the selector, as hereinbefore described. The cam E' is shown in the inward position on the right hand of Fig. 1 and the cam C' in the outward position on the left hand of the same figure. These said cams are never both in either the in or out positions together, but are moved alternately and simultaneously, the one in and the other out, and vice versa. When either of the said auxiliary cams is in its innermost position, nee-

dles can pass through the passage between the adjacent knitting-cams, as hereinbefore described, and will strike against the other auxiliary cam and be deflected downward under the knitting-cam C or E. At the reversal of the cam-carrier these auxiliary cams will be caused, as hereinafter described, to reverse their respective positions. The stalks or rearward parts C² E² of these diagonal auxiliary cams are of square section and pass through bosses C³ E³ in the cam-carrier, projecting from the exterior of the latter.

In the terminal end of each stalk is a bifurcation, in which is pivoted one end of a connecting-rod L, Figs. 4 and 5, the latter being also centrally fulcrumed on a forked plate L', the shank of which is screwed into the cam-carrier. This connecting-rod at each reciprocal movement of the cam-carrier collides with a fixed plate R, hereinafter referred to, and is thereby moved on its fulcrum, so as to withdraw one of the auxiliary cams C' E' and project the other forward, as hereinbefore described.

An angular flat steel spring M is fixed, by a screw M', to the cam-carrier and provided with a projecting lug M², the convex end of which bears frictionally against the end of the connecting-rod L and prevents any accidental or unintentional movement thereof.

When the needle-selectors during either narrowing or widening have raised a needle out of action or lowered a needle into action, the selector upon finishing its rotary stroke, with the flange H⁴ or J⁴ abutting against the pin K or K', is in a position just immediately out of the path of the remaining needles, so that the latter are free to pass it and thence under the knitting-cams in the narrowing operation and into the idle groove in the widening operation. In Figs. 1 and 3 the upper or widening selector is shown in this position, and in Figs. 2, 3, and 3^a the lower or narrowing selector is shown in this position. Before, however, these selectors can again take the needles when the cam-carrier reverses its movement they have to be shifted into what is hereinbefore termed their "normal" positions, as shown, the widening-selector in Figs. 2 and 3^a and the narrowing-selector in Fig. 1. This alteration in their position takes place just immediately the cam-carrier is reversed and is effected by means of the following mechanism, (shown in Figs. 4 to 10:)

On that end of each selector-spindle which is on the exterior of the cam-carrier there is mounted a disk, as H⁶ or J⁶, having a segmental lug or projection, as H⁷ or J⁷, the movement of the same being controlled by a spiral spring H⁸ or J⁸, connected one end thereto and the other end to a pin projecting from the cam-carrier. On either side of the disk is a vertical slide N or O, furnished with slots N' or O', which allow it a free up-and-down movement on headed screws N² or O², which pass into the cam-carrier. These said

vertical slides rest on a horizontal slide P, provided on its upper surface with inclines or cams P' P² and also furnished with slots P³ and screws P⁴, passing through the latter into the cam-carrier, so as to allow the said slide a lateral movement. This slide has projecting from it a lug P⁵, which at each reversal of the cam-carrier comes into contact with a yielding stop S, normally located in its path, and moves the said slide from right to left, or vice versa, according to the direction of movement of the cam-carrier, and, as is obvious, such movement causes one vertical slide to ride up one of the inclines and to be raised thereby, and simultaneously the other slide descends the opposite incline and is lowered thereby.

When the widening-selector J is in the operative position represented in Figs. 1 and 3, hereinbefore referred to, the disk J⁶ on the opposite end of its spindle is in the position shown in Fig. 4, with one edge of the segmental projection J⁷ resting on a shoulder in the upper part of the slide N. Now to lower the said selector into its operative position, as in Fig. 2, the lug P⁵ on the slide P when the reversal of the cam-carrier takes place strikes against the yielding stop S and moves the slide to the left. The vertical slide N is thereupon raised by the incline P² and slightly rotates the said disk J⁶, the action of which moves the needle-selector from the position shown in Figs. 1 and 3 into the position shown in Fig. 2. In this latter position the first needle which passes through the groove between the cams F B will come into contact with the selector and be lowered in front of the cams E' E, and thus be again restored into action. Now for the purpose of communicating a similar action to the narrowing-selector a similar disk H⁶, with segmental projection H⁷, is mounted on the external end of its spindle and is actuatable by two lugs L² L³, with inclined ends, as shown, in Fig. 6, depending from the connecting-rod L. Assuming the cam-carrier to have completed its stroke in the left-hand direction, the narrowing needle-selector, as hereinbefore mentioned, will be in the lowered or inoperative position just out of the path of the needles and as indicated in Fig. 3, so that all needles following the one just raised out of action will pass down under the auxiliary and knitting cams E' E. To place the said needle-selector again in its operative position, as shown in Fig. 1, so that it can engage the first needle passing through the groove between the cams D E, the connecting-rod L immediately upon the cam-carrier reversing its movement collides with the fixed plate R, so as to withdraw the right-hand supplementary cam E' and project the left-hand cam C', as shown in Fig. 5. Simultaneously with this movement of the auxiliary cams the inclined edge of the lug L² presses against the segmental projection H⁷ and partly rotates the disk H⁶, the effect of which is to again raise the selector H into its

operative position in the path of the needles, as shown in Fig. 1.

It will be observed from a comparison of the two needle-selectors H J that the latter is much broader at its operative end than the former. The effect of this arrangement is that the needle-selector J, which, as hereinbefore described, is only in action during the process of widening, lowers two needles into work at each reciprocal stroke of the cam-carrier, and in order that the whole of the needles may not be lowered into action again in a different order and in a shorter time from that in which they are raised out of action the narrowing-selector H is allowed to continue in action during the process of widening also and raises a needle out of action at each stroke of the cam-carrier. It is obvious, therefore, that as during narrowing the needles are raised out of work one at each reciprocal stroke of the cam-carrier, then during widening are reintroduced into work two at a time and one of these again lifted out of action at each reciprocal stroke of the cam-carrier, the whole of the needles will get in to work at the proper time and in their usual order.

R represents the fixed plate located in the path of the connecting-rod L, against which the said rod L collides to change the respective positions of the two auxiliary cams E' C', as hereinbefore described. The said plate has a rearward extension R', furnished with slots R² R³, through which screws R⁴ R⁵ pass to fix it rigidly to an arm R⁶, fixed by screw R⁷ to an upright R⁸, forming part of or connected in any suitable manner to the framing of the machine.

S is the flexible stop with which the lug P⁵ collides at each reciprocal movement of the cam-carrier, as hereinbefore stated. This stop is provided with a downwardly-depending spindle S', loosely fitting within a circular opening in the bed-plate T of the machine, and it is also furnished with a pin S², to which is connected one end of a spiral spring S³, the other end of which is attached to a pin S⁴ in the bed-plate. The flexible stop, as is obvious, is capable of moving freely on its spindle S' under the governance of the spring S³, the power of the spring being arranged so that the stop offers just sufficient resistance to the lug P⁵ to cause the latter to move the slide P in one direction or the other, as hereinbefore stated, whereupon the stop resumes its normal position, as shown, where it is always in the path of the said lug.

The hereinbefore-mentioned flexible stop S and fixed plate R are fixed at diametrically opposite positions on the machine.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In a knitting-machine, the combination with two sets of knitting-cams, of two rotatable needle-selecting devices located between the said cams and normally opposite the pas-

sages between one set of cams, one of the said devices being located in the track of the inactive needles and adapted upon contact with the latter to lower them into action, the other of the said devices being located in the track of the active needles and adapted upon contact with the latter to raise them out of action, the said devices in each case being moved by the needles from against one set of cams to over against the other set of cams in position to repeat the operation when the motion of the cam-carrier is reversed, substantially as described.

2. In a knitting-machine, the combination with two sets of knitting-cams, of two rotatable needle-selecting devices located between said cams, one of the said devices being arranged to lower two needles into action and the other device to raise a needle out of action at each reciprocal stroke of the cam-carrier, the said selecting devices being moved by the said needles from against one set of cams and adjacent to the other set of cams preparatory to repeating the operation when the movement of the cam-carrier is reversed, substantially as described.

3. In a knitting-machine, the combination with two sets of knitting-cams of two rotatable needle-selecting devices located between the said cams and arranged one to intercept one of the needles and raise it out of action and the other to intercept two needles and lower them into action and to be moved by the said needles adjacent to the other set of cams and out of the path of the remaining needles, of means for returning the said selectors into the path of the needles upon the reversal of the motion of the cam-carrier, substantially as described.

4. In a knitting-machine the combination with two sets of knitting-cams, and rotatable needle-selecting devices interposed between the said cams and operating as described, of two auxiliary cams C', E', arranged to govern the passages between the said cams, a rocking connecting-rod attached to the said auxiliary cams, and means for moving the said rod on its pivot to withdraw one of the said auxiliary cams and project the other auxiliary cam relatively to the knitting-cam, substantially as and for the purpose described.

5. In a knitting-machine, the combination with two sets of cams, of a rotatable needle-selecting device as H located between the said cams and arranged to intercept the active needles and raise them out of action during the narrowing operation as described, a rotatable head as H² located in a circular opening in the cam-carrier A, a segmental flange H⁴ and stop-pin K to limit the movement of the rotatable selector, a spring-governed disk as H⁶ H⁷, and actuating-lugs L² L³ for the latter, a rocking connecting-rod L to which said lugs are attached, and means for moving the said rod to and fro on its center, for the purpose specified.

6. In a knitting-machine the combination

with two sets of cams, of a rotatable needle-selecting device, as J, located between the said cams and adapted to intercept the inactive needles and lower them into action, during the widening operation, as described, a rotatable head as J² located in a circular opening in the cam shell or carrier, a segmental flange as J⁴, and stop-pin as K', to limit the rotary movement of the selector, a spring-controlled disk as J⁶ J⁷, vertical slides

N O and horizontal cam-slide P and means for actuating the said slides for the purpose described.

In testimony whereof I have hereunto set my hand in the presence of the two subscribing witnesses.

WILLIAM SPIERS.

Witnesses:

GEORGE BLAKESLEY,

E. N. LEWIS.