(No Model.)

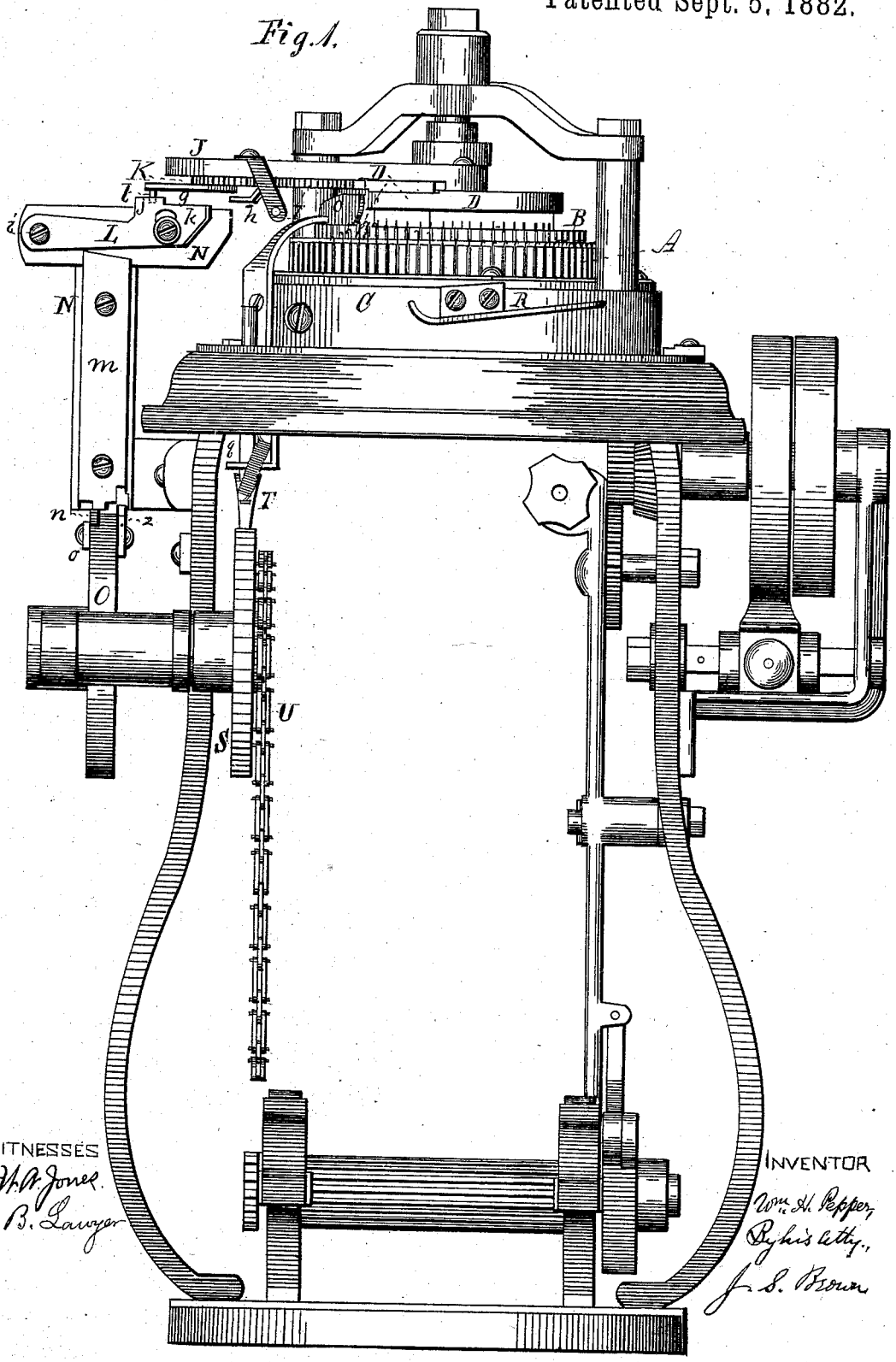
5 Sheets—Sheet 1.

W. H. PEPPER.

CIRCULAR KNITTING MACHINE.

No. 263,720. Patented Sept. 5, 1882.

Fig. 1.



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J. B. Lawyer

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J. S. Brown

(No Model.)

5 Sheets—Sheet 2.

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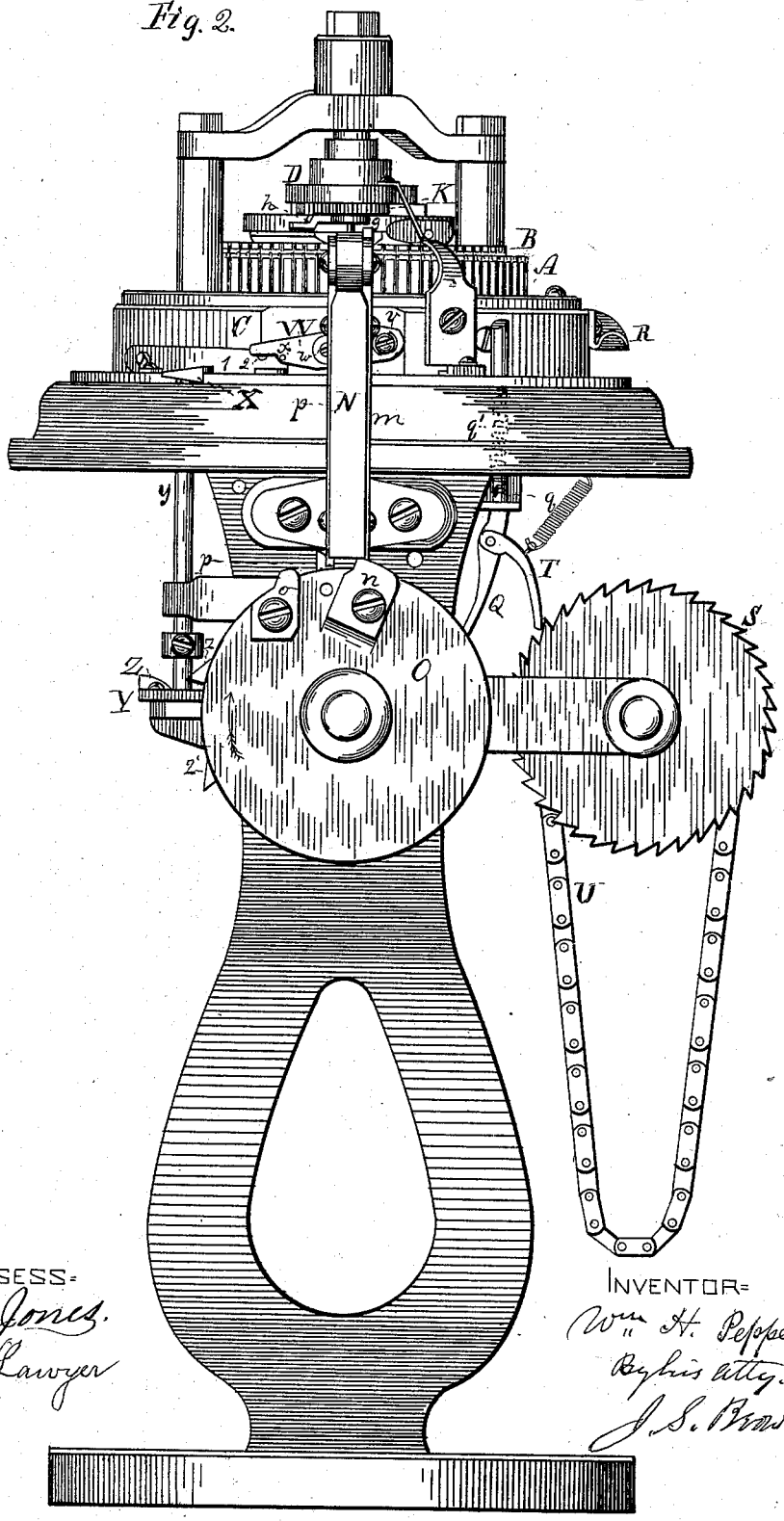
CIRCULAR KNITTING MACHINE.

No. 263,720. Patented Sept. 5, 1882.

Fig. 2.



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(No Model.) 5 Sheets—Sheet 3.

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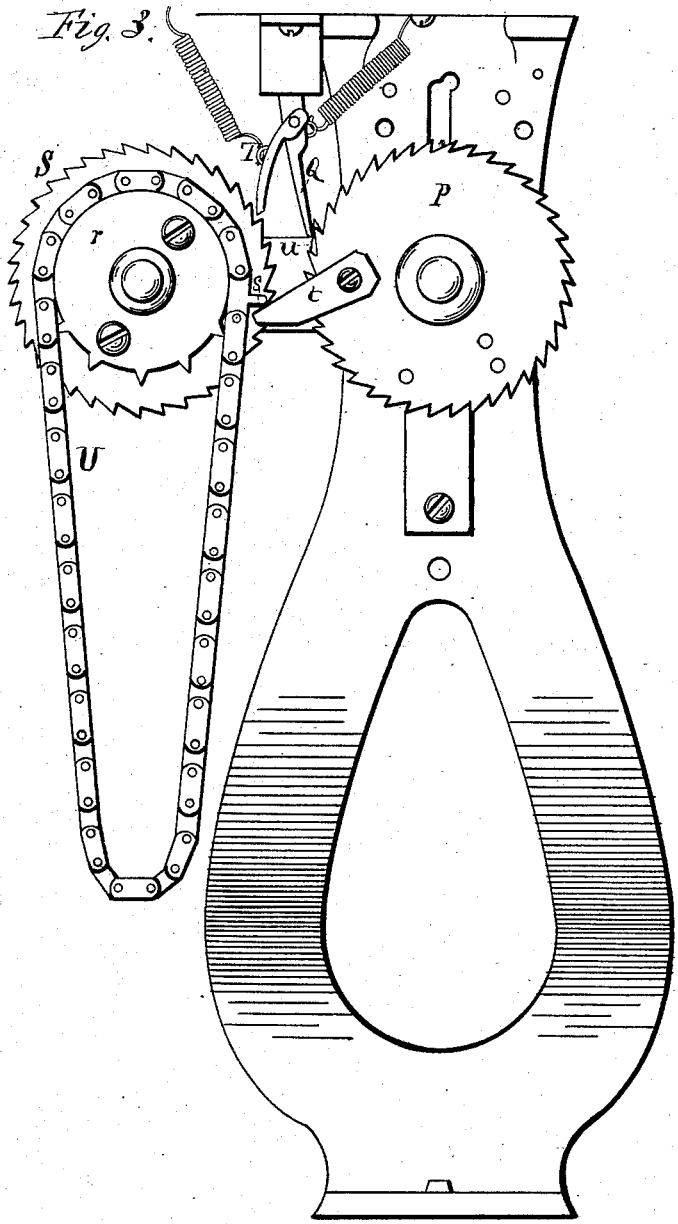
CIRCULAR KNITTING MACHINE.

No. 263,720. Patented Sept. 5, 1882.

Fig. 3.



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CIRCULAR KNITTING MACHINE.

No. 263,720. Patented Sept. 5, 1882.

Fig. 4.

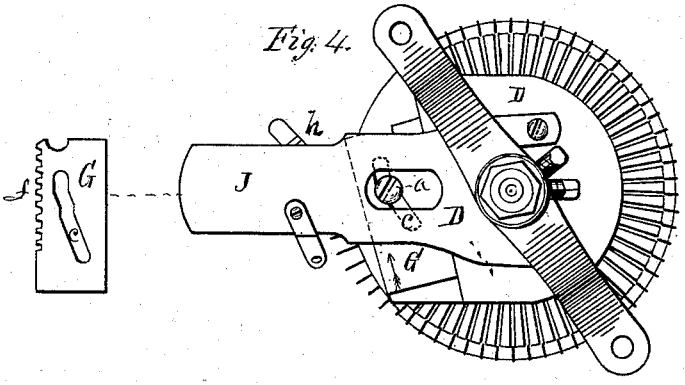


Fig. 5.

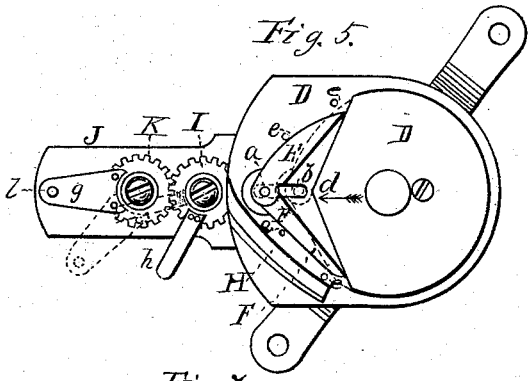
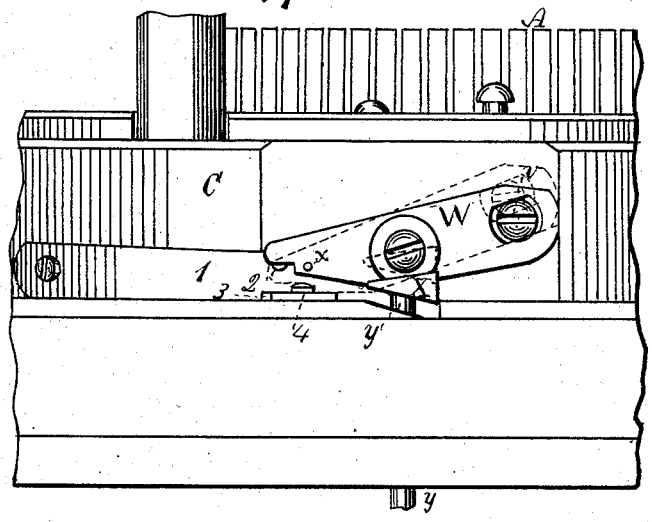


Fig. 7.



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(No Model.) 5 Sheets—Sheet 5.

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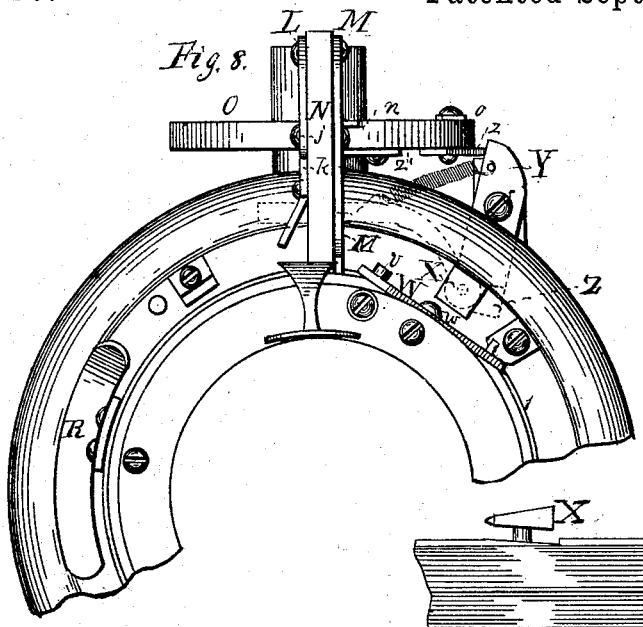
CIRCULAR KNITTING MACHINE.

No. 263,720. Patented Sept. 5, 1882.

Fig. 8.



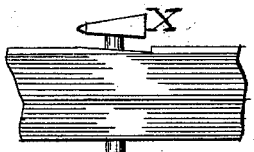


Fig. 10.

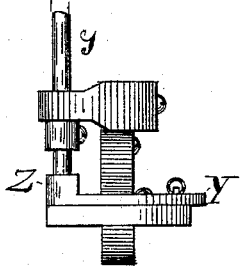


Fig. 9.

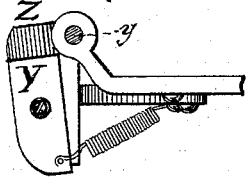
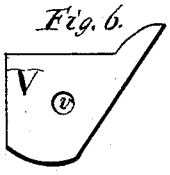


Fig. 6.



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UNITED STATES PATENT OFFICE.

WILLIAM H. PEPPER, OF LAKE VILLAGE, NEW HAMPSHIRE.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 263,720, dated September 5, 1882.

Application filed February 17, 1882. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. PEPPER, of Lake Village, in the county of Belknap and State of New Hampshire, have invented certain Improvements in Circular-Knitting Machines; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making part of this specification.

The drawings represent a circular-knitting machine having a set of cylinder or vertical needles and a set of dial or horizontal needles, and show my improvements attached thereto.

Figure 1 represents a front elevation of the machine with the principal moving parts in a certain position; Fig. 2, an elevation of the machine at right angles to the view in Fig. 1 as to the stationary parts, but showing the principal moving parts in a different position from that shown in the former figure; Fig. 3, an elevation of certain parts of the machine, looking in the opposite direction toward the said parts in relation to the view of the same shown in Fig. 2, and showing some of the moving parts in a different position therefrom; Fig. 4, a top view of certain parts of the machine; Fig. 5, an under side view of the said parts; Figs. 6, 7, 8, 9, and 10, views of parts detached.

Like letters designate corresponding parts in all of the figures.

The parts of the machine not relating specially to my improvements being of usual construction or well known to those skilled in the art, it is unnecessary here to describe their construction or specify their operation, except so far as proper for clearly setting forth the construction and operation of the new parts added by me. Thus it will be sufficient, at the outset, to make reference to some of the main parts of an ordinary machine of this kind.

Let A designate the needle-cylinder bearing the vertical set of needles; B, the dial-plate bearing the horizontal set of needles; C, the cam-ring, which surrounds the needle-cylinder and produces the movements of the cylinder-needles; and D, the cam-plate, which is over the dial-plate and produces the movements of the dial-needles. In this machine the needle-cylinder A and dial-plate B are stationary, while the cam-ring C and cam-plate D revolve; but my improvements are also applicable to machines wherein the needle-cylinder and dial-plate revolve and the cam-ring and cam-plate are stationary.

My first feature of improvement consists in the construction and means of operating the cams borne by the cam-plate D, whereby, in addition to their usual function of throwing out the dial-needles for regular knitting, they operate to make a close welt in the fabric for the binding of stocking-tops, &c. This welt is formed by knitting in two or more threads in a round of stitches to give additional strength, closeness, and firmness thereto. These cams are specially shown in Fig. 5, which represents the under side of the cam-plate D and the said cams E F in place against the face thereof, and other parts or adjuncts borne by the said cam-plate. The cams are pivoted together at their adjacent ends, one of the ends being enlarged and provided with a screw-threaded hole or otherwise constructed to receive and bear the lower end of a pin, *a*, which extends therefrom upward, first through a radial slot, *b*, in the cam-plate, and then through a slot, *c*, in a plate, G, which slides in a groove or way on the upper side of the cam-plate, as seen in Fig. 4. The other ends of the cams E F are spread apart and diverge toward and partially embrace a V-shaped ledge or shoulder, *d*, on the under side of the cam-plate, and move along in contact with or proximity to the same as the pivoted ends of the cams are adjusted out and in. Small projections or studs *e e* outside of the cams prevent their getting out of proper position, and to keep them nearly or quite in contact with the ledge *d*. These studs project only a little distance, not far enough to be struck by the butts of the needles. Farther out on the dial-plate is a stationary cam, H, which may be of ordinary construction, for pushing in the needles after they have been moved out by the cam E to take stitches. The movable cam F serves rather as a limit to the inward movement of the needles while they are operated upon by the cam H than as an active cam. The outward and inward movements of the cams E F, the outward being indicated by the arrow in Fig. 5 and the inward being the reverse thereof, to effect the purpose of making welts by my invention, are directed immediately by the form of the slot *c* in the slide-plate G, as shown

in Fig. 4, the said slot acting as a cam to guide the movements of the pin *a*, which carries the cams. This cam-slot has three portions: the portion farthest from the center of the dial-plate acting to throw the cams E F out to their outer limit for taking the thread by the needles and moving the loops already thereon inside of their latches; the middle portion of the slot having a different direction to retain the needles in a position far enough out to take the thread, but not to move the loops or stitches over the latches, so that they are not cast off, but the thread is duplicated in the hooks; and the inner portion of the slot not throwing the cams out far enough to cause the needles to take the thread at all, so that the vertical needles only continue to knit while the cams E F are thus held. Then when the slide-plate G is moved to carry the pin *a* again to the outer portion of the slot *c* to throw the needles out for regular knitting, the double-thread loops and the vertical-needle web just previously knit are combined to form the welt.

My next feature of improvement consists in the means employed for automatically effecting the movements of the slide-plate G, and consequently of the cam-moving pin *a*, and for timing the said movements, so as to form the welts at the desired intervals in the continuous tubular web. For this purpose the slide-plate G is provided with a rack, *f*, at its outer edge, into which rack a pinion, I, (entire or segmental,) gears, the said pinion being pivoted on and sustained by the under side of an arm, J, which projects from the cam-plate D. The pinion also gears into another similar pinion, K, similarly pivoted and sustained on the under side of the arm J, outside of the pinion I. Each of these pinions has a projecting arm extending radially from and somewhat below the same, so that each may strike some fixed stop below the pinions, and by the motion of their carrying-arm J, being on the revolving cam-plate D, cause them to be turned back and partially revolve their respective pinions, which in turn move the slide-plate G. Thus, when the outer pinion-arm, *g*, strikes such a stop the effect is to move the slide-plate in the direction shown by the arrow in Fig. 4, and thereby to move the cams E F inward and lessen the outward throw of the dial-needles; and when the inner pinion-arm, *h*, strikes a stop the opposite movement of the said parts is effected. Therefore a proper arrangement of such stops will produce the desired effect on the said needle-cams to knit welts at the proper intervals, as above set forth. To this end I mount stops L and M upon (each being pivoted by an arm at *i* to) a standard or holder, N, secured to a fixed part of the machine, as represented, or otherwise. The stop L for the outer pinion-arm, *g*, has two parts, *j k*, one higher than the other, and against these a downwardly-projecting finger, *l*, on the pinion-arm *g* successively strikes for the purpose of producing two successive movements of the cams E F—first, to cause the dial-needles to take the thread only, but not to allow the casting off of their stitches; second, to cause the said needles not to be thrown out far enough to take the thread at all. The higher part, *j*, is first to be raised sufficiently to be struck by the finger of the pinion-arm, which is only partially turned thereby, as indicated by dotted lines in Fig. 5, and then slips by the inner end of the said part of the stop over the other (lower) part, *k*, of the stop. Before the dial-plate completes the next revolution the lower part of the stop is to be raised high enough to be struck by the finger *l*, whereby the said pinion-arm and its pinion have their movement completed and the innermost position of the cams E F is attained. The stop L is lifted successively to these two positions through means of a vertically sliding or moving bar or rod, *m*, or equivalent connection, by a single cam, *n*, on a revolving cam-wheel, O, the cam being of such form and length as to raise the stop L at one step in the cam-wheel's motion to its first position, and at the next step of the cam-wheel's motion to raise the stop to its second position. At the next succeeding step of the cam-wheel's motion the cam *n* is carried out from under the connecting-bar *m* and allows the stop L to descend by its own gravity to its normal position, and not act on the pinion-arm at all. After another step or two of the cam-wheel's motion another cam, *o*, thereon passes under another vertically-moving bar or connecting-rod, *p*, to lift the stop M to act on the pinion-arm *h* and bring back the pinions, the slide-plate G, and the needle-cams E F to their normal positions.

The cam-wheel O is mounted in a suitable bearing or bearings, and on its shaft is a ratchet-wheel, P, each tooth of which is designed to move the cam-wheel one step in its revolution above referred to. With this ratchet-wheel a pawl, Q, engages and moves it, the pawl being actuated once at each revolution of the cam-ring C by being attached to a vertically-sliding rod, *q*, projected up by a counter-spring, *q'*, as shown in Fig. 2, into a position to be struck and depressed by a cam, R, attached to the said cam-ring C.

By the above-specified construction and means of operating the cam-wheel O the movement for knitting a welt would be repeated at each complete revolution of the said cam-wheel, and the number of rounds of stitches knit in the web would be determined by the number of teeth on the ratchet-wheel P; but it would be inconvenient to have a ratchet-wheel large enough to knit the necessary length of web generally required between the welts. Besides, the number of rounds of stitches required for different sizes and kinds of knit articles varies. To perfectly accomplish the whole purpose of my invention I combine with the ratchet-wheel P another ratchet-wheel, S, which is most conveniently placed in the same plane as the former ratchet-wheel, at the same height, and with its adjacent periphery near

thereto, substantially as shown in Figs. 2 and 3, so that a second pawl, T, pivoted to or carried by the same sliding rod, *q*, as the pawl Q, and operated simultaneously therewith by the same means, may act upon this second ratchet-wheel, the teeth of which in distance properly correspond with the teeth of the former ratchet-wheel. On a sprocket-disk, *r*, attached to or connected concentrically with the ratchet-wheel S is mounted a Jacquard chain, U, of any required number of links, there being a projection, *s*, on one of the links, which, when brought round into position, as shown in Fig. 3, will strike a projection, *t*, on the ratchet-wheel P and move the said ratchet-wheel to the extent of one tooth thereof. In connection with this projection *t* there is a cover, *u*, to one of the teeth of the ratchet-wheel P, which prevents the pawl Q from acting on the ratchet-tooth, and therefore at every time when the ratchet-wheel has made a revolution and this covered tooth meets the pawl the ratchet-wheel P stops, and cannot start again till the projection on the chain strikes the projection on the ratchet-wheel and moves it one step and brings the acting teeth thereof into engagement with the pawl. The ratchet-wheel P may stop in any convenient part of the cam-wheel's revolution after its cams have all acted in turn, as represented, or otherwise. With the Jacquard chain combined with the intermittent ratchet-wheel P, the chain ratchet-wheel S moving continually, all the movements are timed by the length of the chain alone, and this is readily taken off and another put on the sprocket-wheel, so that it is easy to obtain any length of knitting between the welts which may be desired. The number of teeth on the ratchet-wheel P is of no consequence if less than the number of steps of the chain required to bring its starting projection into action again.

My next feature of improvement consists in the means by which the rounds of loose stitches knit in the web, to cut off tops and pick on footing-stitches by, are automatically produced and timed. The sliding cam V, (shown in the detail view, Fig. 6,) located in the cam-ring C of the machine, determines the length of the loops made by the cylinder-needles, and consequently the closeness or looseness of the stitches in the knit web, by being adjusted downward or upward, and thereby depressing the vertical needles more or less in their grooves in the usual manner. If it sinks the hooks of the needles but slightly in their grooves, the loops are made short and the knit web is close; if the cam depresses them considerably in the grooves, the stitches are loose correspondingly. Therefore, to give this cam the desired downward adjustment momentarily for this purpose to knit single loose courses, I mount the cam on a pin, *v*, which projects out through a vertical slot in the side of the cam-ring C, so that it can be either raised or lowered by the movement of a lever, W, one end of which embraces the pin by a slot or notch, its middle being pivoted at *w* to a face of the cam-ring, and its other end provided with a projecting pin, *x*, that is to be acted on both to raise and depress that end of the lever by a double cam, X, mounted on the upper end of a vertically-sliding rod, *y*, held in the stationary supporting-rim of the machine. Ordinarily this cam rests just above the rim. It has, also, two raised positions. The first (shown by full lines in the detail or partial view, Fig. 7) is such as by its upper cam-face to lift the pin *x* and that end of the lever W sufficiently to depress the cam V to a position for knitting the required loose stitches. The second (shown by dotted lines in the same figure) is still higher, and is such that its lower cam-face will act on the pin *x* and bring the lever and its cam V back again to their normal positions. The position of the lever W after this movement is shown by dotted lines in Fig. 7. This double movement of the cam X is simply effected by a single cam, *z*, on the cam-wheel O, Fig. 2, which acts against a cam-lever, Y, (shown especially in the detail views, Figs. 8, 9, and 10,) bearing a cam, Z, that is thereby moved under the lower end of the cam-rod *y*. This actuating-cam *z* is long enough to continue its action and that of the cam Z during two successive steps in the motion of the cam-wheel corresponding to two revolutions of the cam-ring C, at the first revolution of which the cam X is raised to its first described position, and at the second revolution of the cam-ring the said cam is raised to its second position above set forth. Then the cam *z* passes out of action, the cam-lever Y is brought back to its ordinary position of rest by a counter-spring, and the cam X, with its rod, descends by its own gravity. The lever W, at its cam-actuated end, has a frictional spring, 1, behind it to keep it in the positions in which it is left by the cam X. In order to hold the lever accurately in the position by which the needle-cam is lowered for depressing the needles to knit the loose courses and prevent its return, the spring, just at the close of the lifting action of the cam X, pushes out under the lever a slightly-projecting stud or shoulder, 2, Fig. 7, borne by the said spring, the said stud ordinarily bearing against the back side of the lever. The lever then cannot be again depressed till the spring 1 is pushed back to allow the lever to descend in front of the said stud. This movement of the spring is automatically effected, as the cam-ring C comes around the next time, by means of a cam-projection, 3, on the spring striking a fixed stop, 4, as shown in Fig. 8. After the cam *z* has caused the knitting of a loose course of stitches, as above set forth, a few rounds are knit, and then another similar cam, *z'*, on the cam-wheel causes another loose course of stitches to be knit in the web in the same manner, both a picking-on and a cutting-off course being wanted.

It is to be observed that the cams *z z'* for producing loose courses of stitches are at-

tached to the same cam-wheel, O, as the cams which cause the knitting of the welts; and since the relative positions of the welts and loose courses are or may always be the same, it is easy to arrange these cams on the cam-wheel so as to place the said welts and loose courses where they are required; and the use of one timing mechanism, as above described, serves for both purposes. Thus, as represented in the drawings, directly after the second cam, *z'*, has caused the knitting of the second loose course of stitches the cam *n* comes into action and causes the knitting of the welt.

It is to be understood that while I intend to retain substantially the same organization of devices to fulfill the purposes as above set forth, yet I do not confine myself to precisely the specific parts and construction and arrangement thereof as described, but that any equivalent thereof may be employed instead without departure from the invention which I desire to secure to my use.

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

1. The combination, with the cams E F and pin *a*, of the slide-bar G, having the cam-slot *c*, as described, and the two pinions I K, substantially as and for the purpose herein specified.

2. The combination of the cams E F, pin *a*, cam-slotted slide G, pinions I K, provided respectively with arms *g h*, stops L M, and mechanism for raising the said stops, substantially as and for the purpose herein specified.

3. The combination, with the cam-slotted slide G, the pinions I K, and their respective arms *g h*, of the double stop L, the stop M, the cam-wheel O, provided with cam-projections *n o*, connecting-rods *m p*, and mechanism for operating the said cam-wheel, substantially as and for the purpose herein specified.

4. The combination of the cam-wheel O, ratchet-wheel P, provided with the projection *t*, the pawl Q, the ratchet-wheel S, the pawl T, the Jacquard chain U, having the projection *s*, and mechanism for actuating said pawls, substantially as and for the purpose herein specified.

5. The combination of the ratchet-wheel P, provided with the projection *t* and tooth-cover *u*, and the pawl Q, with the Jacquard chain U, provided with the projection *s*, the ratchet-wheel S, pawl T, and means for actuating the said pawl, substantially as and for the purpose herein specified.

6. The combination, with the needle-cam V and its pin *v*, of the lever W, double-faced cam X, and mechanism for operating the said cam X, substantially as and for the purpose herein specified.

7. The combination of the cam V and its pin *v*, the lever W, the cam X, lever Y, bearing the cam Z, and the cam-wheel O, provided with a cam, *z*, and mechanism for actuating the said cam-wheel, substantially as and for the purpose herein specified.

8. The combination of the lever W, spring 1, stud 2, cam-projection 3, and stop 4, substantially as and for the purpose herein specified.

WILLIAM H. PEPPER.

Witnesses:
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S. C. CLARK.