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W. H. PEPPER & A. T. L. DAVIS.

STRIPING MECHANISM FOR KNITTING MACHINES.

No. 464,586. Patented Dec. 8, 1891.

Fig. 1.

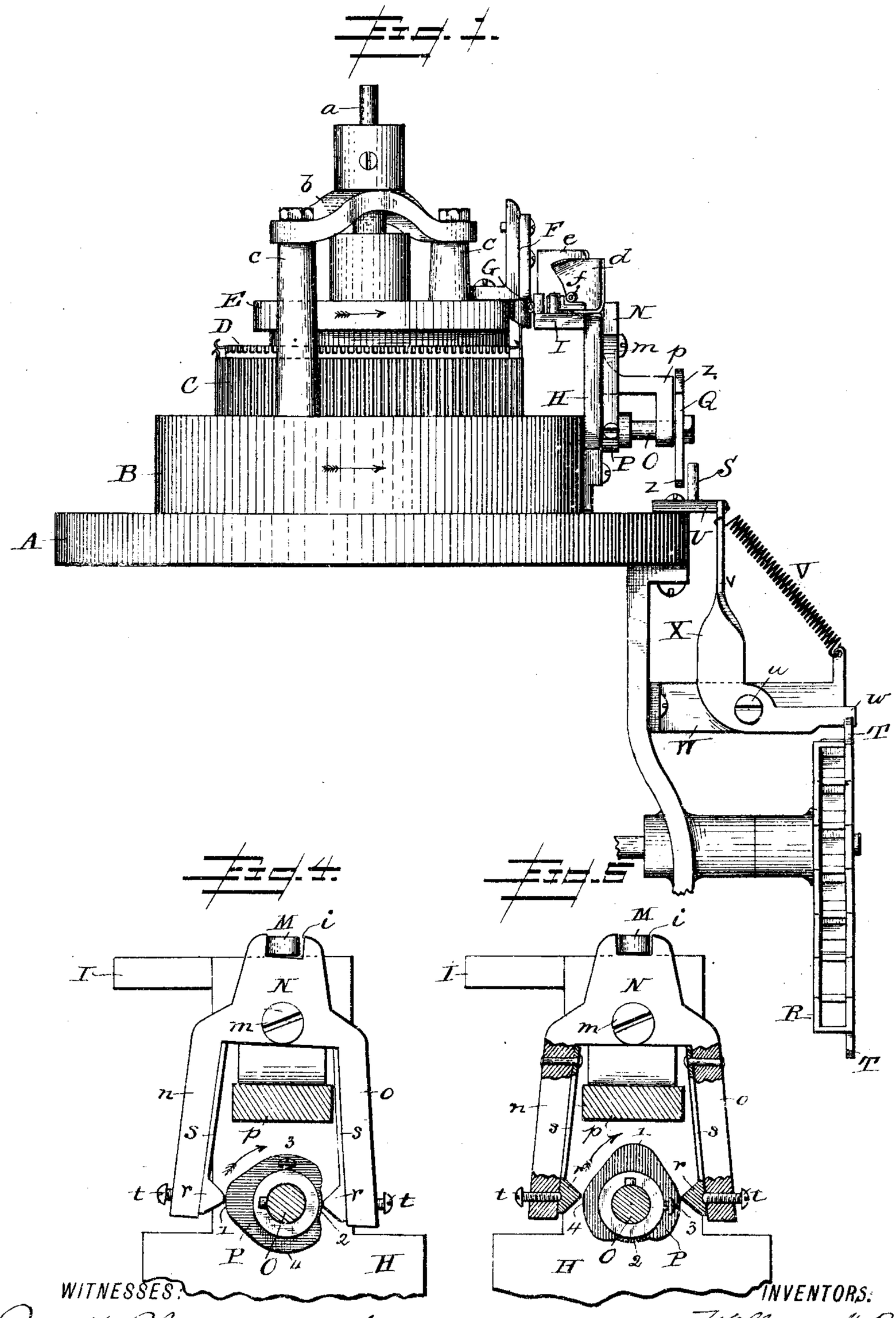

Fig. 4.

Fig. 5.

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Fig. 4.

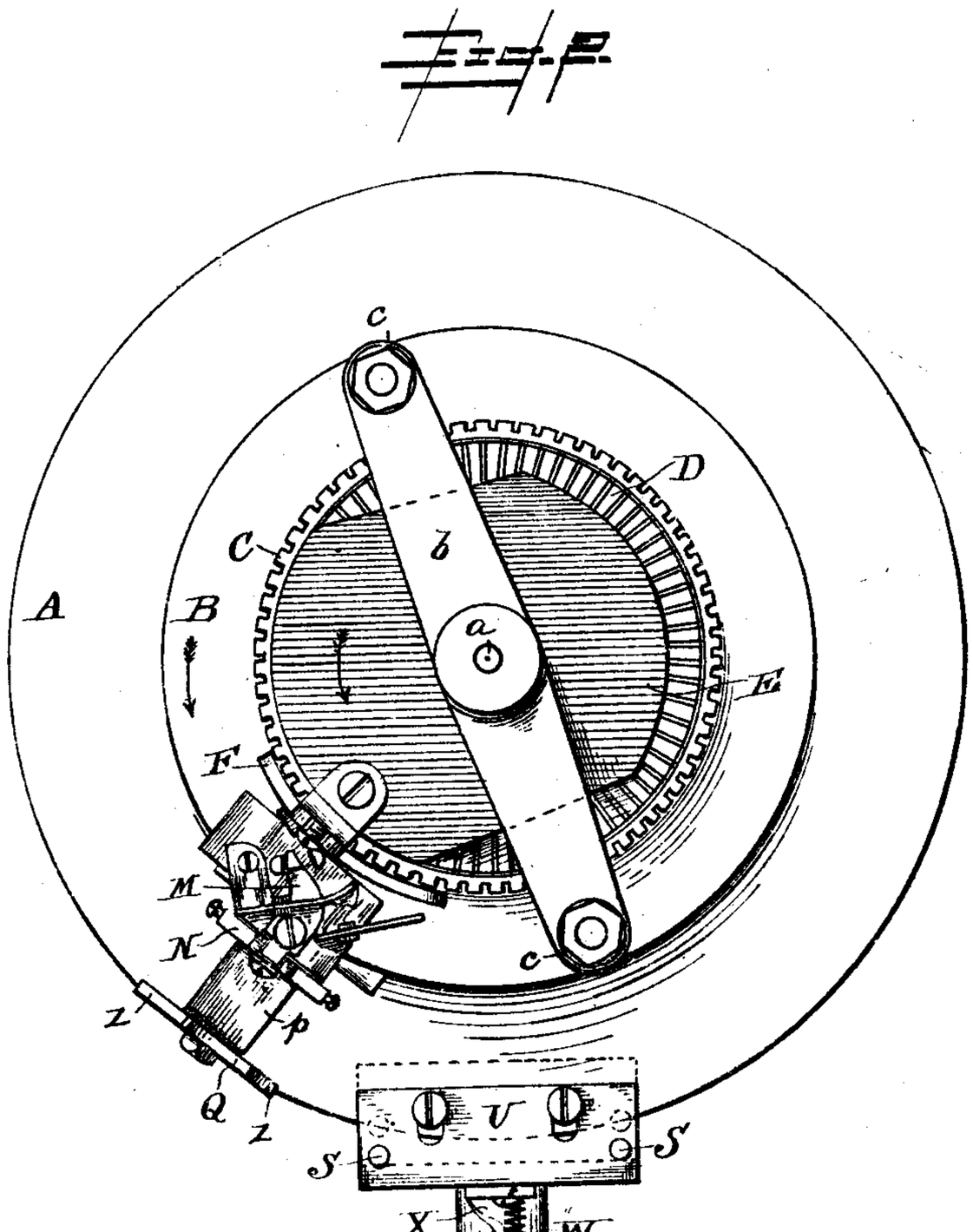


Fig. 5.

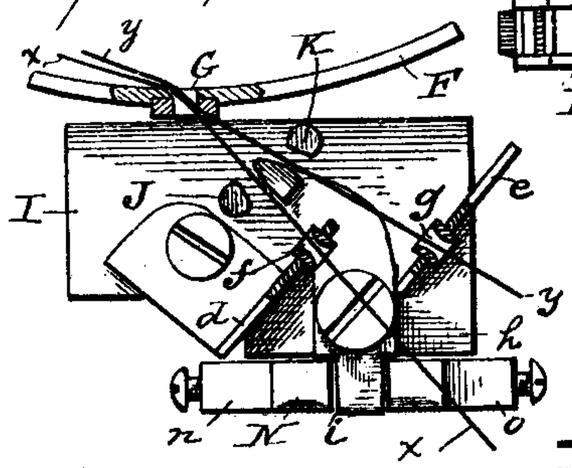


Fig. 7.

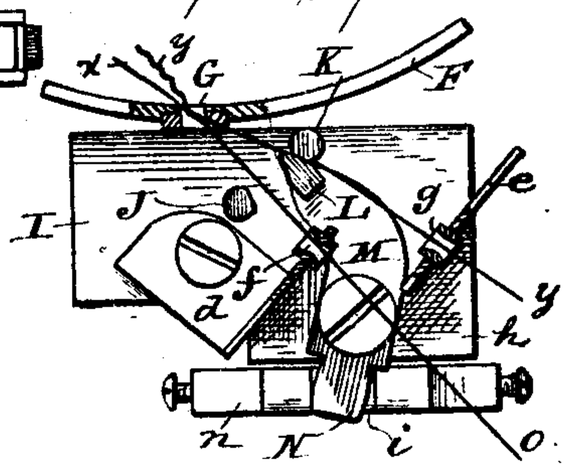
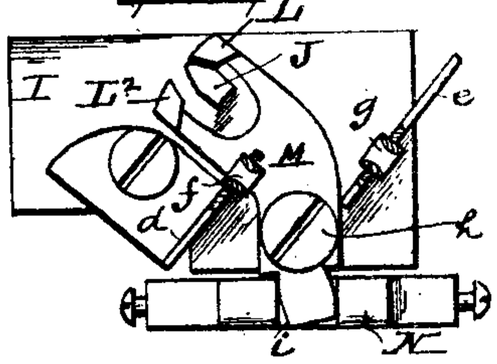


Fig. 11.



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STRIPING MECHANISM FOR KNITTING MACHINES.

No. 464,586. Patented Dec. 8

Fig. 3.

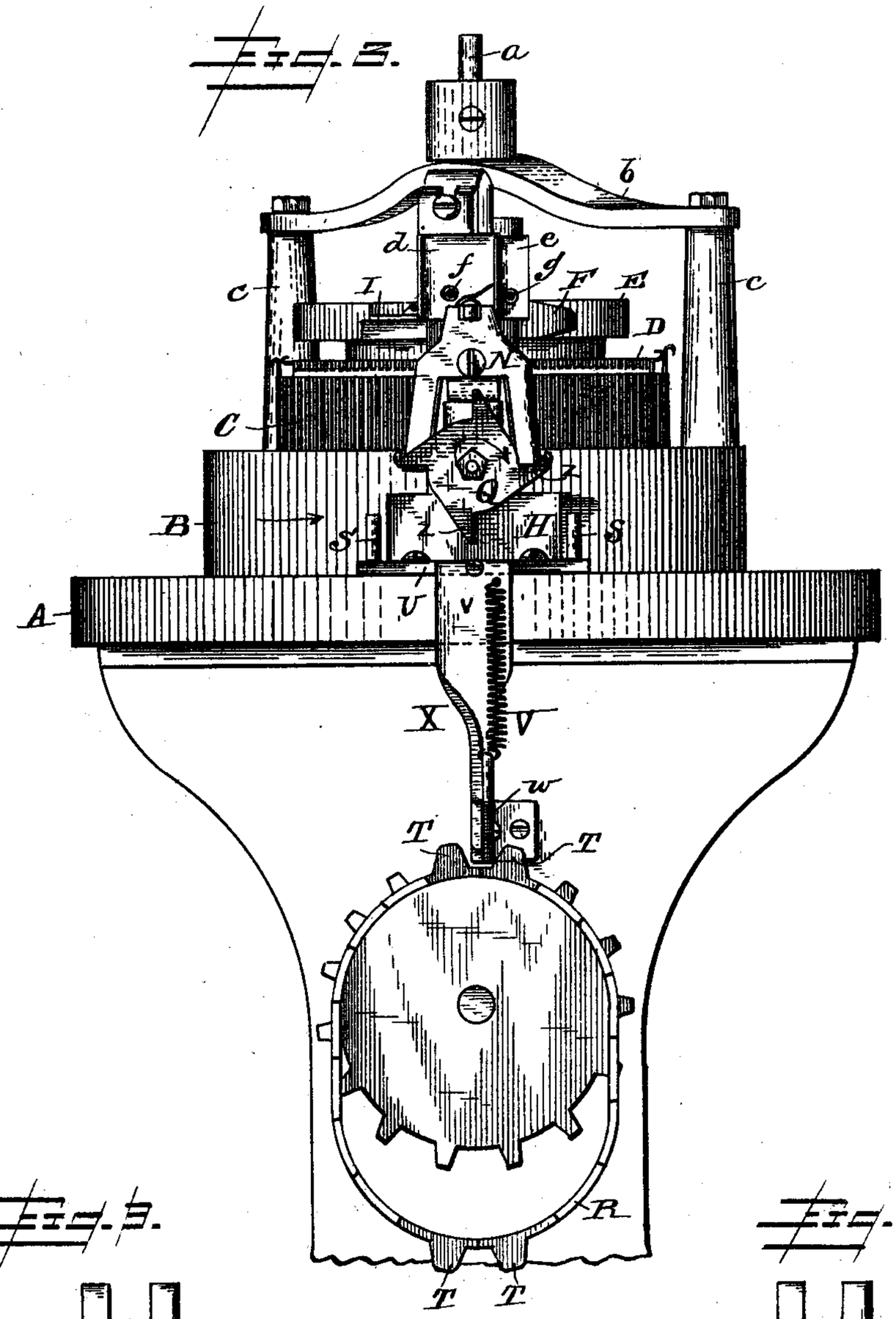


Fig. 5.

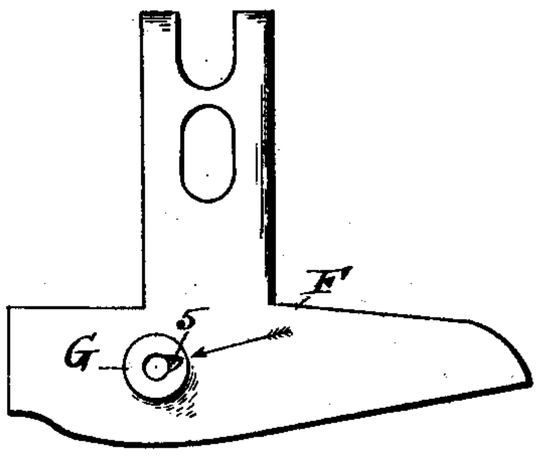


Fig. 9.

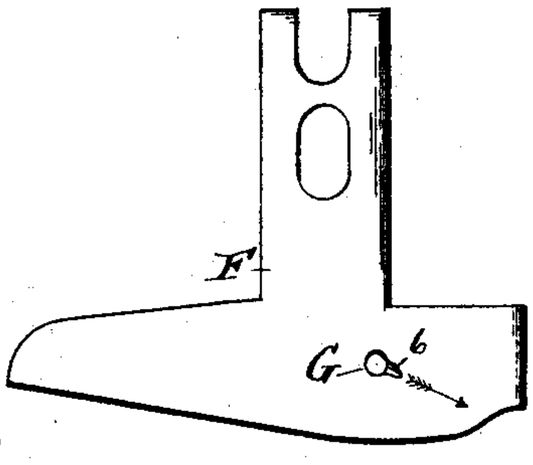
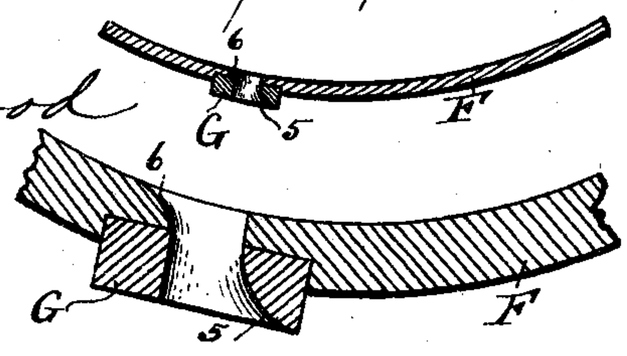


Fig. 10.



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UNITED STATES PATENT OFFICE.

WILLIAM H. PEPPER AND ALBERT T. L. DAVIS, OF LAKE VILLAGE, NEW HAMPSHIRE.

STRIPING MECHANISM FOR KNITTING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 464,586, dated December 8, 1891.

Application filed April 14, 1891. Serial No. 388,917. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM H. PEPPER and ALBERT T. L. DAVIS, of Lake Village, in the county of Belknap and State of New Hampshire, have invented certain new and useful Improvements in Striping Mechanism for Knitting-Machines, of which the following is a specification.

The present invention relates to improvements in circular-knitting machines which knit fabrics with peripheral stripes of solid colors. In knitting fabrics of this character it has been a usual and common practice to first knit with a thread or yarn of one color and then with a thread or yarn of a different color, one thread or yarn being broken off as the other is fed in. The result is that solid colored stripes alternate with each other.

The present improvements consist in mechanism for feeding in the threads or yarns and for breaking off one thread or yarn when the other thread or yarn is fed in.

More specifically the present invention consists in improvements upon the striping-thread-feed mechanism set forth in the British Patent No. 4,293, dated December 10, 1875, granted to Nathaniel Marshall and Edwin Hewitt. In that patent two differently-colored threads from which the stripes are formed are conducted to the needles between two stationary gripping-jaws and an intermediate automatically-controlled movable gripping-jaw, the two threads passing on opposite sides of the movable jaw, and thence through a leading-in thread-eye common to both of the needles. Ordinarily one of the threads (hereinafter called the "striping-thread") is clamped between the movable jaw and one of the fixed jaws, so that only the other thread (hereinafter called the "main thread") is fed to the needles. When, however, a stripe is to be formed, the movable gripping-jaw is caused to move at the proper instant, (by the action of constantly-moving mechanism,) so as to release the striping-thread and immediately thereafter to clamp the main thread against the other stationary jaw. A brief interval occurs between the release of the striping-thread and the clamping of the main thread, during which both of the threads are free to be fed to the needles. During this interval a rotary twister, through which both threads pass in traveling from the leading-in thread-eye to the needles, acts. This rotary twister causes the two threads to be twisted together, so that the striping-thread is carried to the needles by the main thread. As soon as the striping-thread is being taken by the needles the further feeding of the main thread is stopped by its being gripped by the action of its stationary jaw and the movable jaw. The main thread is then broken off by the action of the knitting-machine between the jaws and the needles. When a sufficient width of stripe has been knitted with the striping-thread, the movable jaw is automatically moved in the opposite direction, so that the main thread is released and again fed to the needles and the striping-thread is clamped and broken off. Subsequently to the date of this Marshall and Hewitt British patent it was discovered that the employment of a rotary twister is unnecessary in order to insure the feeding in of the threads, since it was found that under proper conditions one thread will be carried into the needles by the frictional contact therewith of the other thread. The frictional contact between the threads can be alone relied upon if the threads or yarns are of a high grade of wool, having a rough fibrous surface, and if the threads are of inferior grades of wool or are of smooth fiber it is sufficient to slacken the thread to be fed in, and thus relieve it of tension, to insure one thread being fed in by the frictional contact therewith of the other thread. Examples of circular-knitting machines wherein frictional contact and frictional contact aided by slackening are relied upon to feed in threads to the needles may be found described and set forth in British Patent No. 4,685, dated November 19, 1878, and granted to Henry Clarke, and in British Patent No. 1,788, dated January 19, 1884, and granted to John H. Cooper and William J. Ford. Now the present improved feed mechanism employs the movable and stationary jaws of the Marshall and Hewitt British patent and after the release of one thread carries it to the needles by the frictional contact therewith of the other thread.

The improvements consist in the construction of the feed mechanism, the central fea-

ture of which is that the movable jaw does not pass directly and by a single movement from the position where it clamps one thread to the position where it clamps the other thread, but makes a dwell or pause between these two positions, so that ample time and opportunity is given for the moving thread before it is clamped to carry in to the needles the previously stationary and inactive thread. The movable jaw takes two distinct steps in passing from one clamping position to the other clamping position.

The present improved feed mechanism may be applied to any type of circular-knitting machine; but for convenience of illustration and description they will be set forth as applied to an ordinary circular-knitting machine for knitting tubular ribbed fabrics wherein latch-needles are employed and wherein the needle-holders are stationary and the needle-actuating cams rotate.

The present improvements are illustrated in the accompanying drawings, wherein—

Figure 1 is a side view of the head of a circular-knitting machine equipped with the present improvements, only so much of the usual parts of the machine being shown as will enable the improvements to be clearly understood. Fig. 2 is a plan view of the same. Fig. 3 is a side view of the same, looking at the machine in a direction at right angles to the point of view in Fig. 1. Figs. 4 and 5 are details of the mechanism which immediately effects the operation of the movable jaw, two different positions of the parts being represented. Figs. 6 and 7 are detail views of the gripping-jaws, different positions thereof being represented. Fig. 8 is an outside view of the guide-plate carrying the leading-in thread-eye. Fig. 9 is an inside view of the same. Fig. 10 is a horizontal section thereof. Fig. 11 is a detail view showing a modification of the gripping-jaws.

Referring to Figs. 1 to 10 of the drawings, A is the usual head-plate of the machine. B is the constantly-rotating cylinder or ring which operates the cylinder-needles. C is the stationary needle-cylinder. D is the stationary dial needle-plate, and E is the constantly-rotating dial cam-plate which actuates the dial-needles and which moves in unison with the cam ring or cylinder B by reason of its rigid connection therewith through the spindle *a*, cross-bar *b*, and pillars *c c*. F is the thread-guide plate provided with the leading-in thread-eye G, said plate being rigidly secured on, so as to rotate with, the dial cam-plate E.

Rigidly secured to the rotating cam cylinder or ring B is a bracket H, having an outwardly-extending horizontal plate I, the upper flat face of which is in substantially the same plane as the thread-eye G. This plate I carries two thread-guide plates *d e*, having thread-guide eyes *f g*, respectively, for the two threads. The thread *x*, which passes through the eye *f*, will be hereinafter considered and called the "main thread," while the thread *y*, which passes through the eye *g*, will be considered and called the "striping-thread." These distinguishing terms, however, are used merely for convenience and for clearness and definiteness in description, since it will be obvious that stripes are formed by both threads as a matter of fact, and it is quite immaterial with which thread the broader or the narrower stripes are formed. Each of the thread-eyes *f g* is shown as located in a separate guide-plate. This is not essential, but is a convenient arrangement as preventing the threads from becoming entangled on their way from the thread-bobbins to the needles. As shown in Figs. 6 and 7, the two threads extend from their respective eyes *f* and *g* to the leading-in thread-eye G at an acute angle to each other, and both threads enter the thread-eye G at an acute angle to the thread-guide plate F, so that each thread in passing through the thread-eye is drawn over one at least of the marginal edges of the thread-eye.

In passing in a direct line from the eye *f* to the eye G the main thread *x* (see Fig. 6) passes alongside and in the vicinity of the gripping-face of the outer stationary gripping-jaw J, and the striping-thread *y* in passing in a direct line from the eye *g* to the eye G passes alongside and in the vicinity of the gripping-face of the inner stationary gripping-jaw K. Consequently when either thread is free to be fed in to the needles it suffers no retardation or friction by reason of passing over and in contact with an edge of its corresponding stationary gripping-jaw. Located between these two stationary gripping-jaws J and K and movable from one to the other is a movable gripper L, having two gripping faces or jaws, one of which co-operates with the gripping-face of the jaw J and the other of which co-operates with the gripping-face of the jaw K. The two gripping faces or jaws of the movable gripper constitute in effect two independent gripping-jaws, one of which coacts with the jaw J and the other with the jaw K. As a matter of convenience both movable jaws are formed on opposite faces of a single moving part—that is, on the gripper L. The movable gripper L has three positions: first, an outer position when it is in contact with the outer gripping-jaw J, as shown in Fig. 2; second, an inner position when it is in contact with the inner gripping-jaw K, as shown in Fig. 7, and, third, an intermediate position when it is out of contact with both gripping-jaws, as shown in Fig. 6. When in the first or outermost position, one gripping-jaw of the movable gripper grips and clamps the main thread *x*, preventing it from being fed to the needles. When it is in the innermost position, its other gripping-jaw grips and clamps the striping-thread *y*, preventing it from being fed to the needles; but when it is in its intermediate position it is out of contact with both threads, so that both threads are free to be fed to the needles and neither comes in contact with the movable

jaw. This relative arrangement of the thread-eyes and gripping-jaws so that each thread when released by the movable gripper passes from the outer eye (*f* or *g*) to the leading-in eye G without being drawn over an edge of one of the jaws and without the presence of a special moving mechanism for effecting this result constitutes one of the features of the present invention. It will be seen that the effect of the movement of the jaws on the threads is to cause them to be fed alternately to the needles, each thread carrying the other in to the needles in turn, the mode of operation in these respects and the resultant effect upon the fabric being the same as in the Marshall and Hewitt British patent above referred to.

The movable gripper L is carried on the inner end of a horizontally swinging or oscillating lever-arm M, which is pivoted at *h* to the plate I. The outer end of this movable gripper-arm fits and rests in a notch or recess *i* in the upper end of a vertically swinging or oscillating lever N, which is pivoted at *m* to the bracket H. The lever N below its pivot *m* is branched or forked, having, as shown, two separate branches or arms *n* and *o*. Between these two arms is a short rotary shaft O, which extends horizontally and radially to the axis of the machine. This shaft is journaled in the bracket H and in an arm *p*, extending outwardly and downwardly therefrom, as shown in Fig. 1. Carried by this shaft and rotating therewith is a cam R, which is located directly between the two arms *n* and *o*. Co-operating with the outer cam-shaped periphery of the cam P are two bearing-studs *r*, carried on the inner faces of the arms *n* and *o*, respectively. Each stud *r* is carried on the lower end of a flat spring *s*, which is riveted at its upper end to the arm and the lower end of which is adjustable to and from the cam P by means of a set-screw *t*, whereby wear on the lug or on the cam may be taken up. The shaft O, and consequently the cam P, rotates only in a single direction and is moved step by step, a quadrant at a time, (by instrumentalities hereinafter described,) so that the cam occupies four different positions, one of these positions being shown in Fig. 4 and the next succeeding position in Fig. 5. The cam has four principal points 1, 2, 3, and 4. Point 1 is farthest from the center or axis of the shaft. Point 2 is diametrically opposite point 1 and is nearest to the center, while points 3 and 4 are diametrically opposite to each other, equidistant from the center, and at a distance from the center between the distances of the points 1 and 2. When the cam occupies the position shown in Fig. 4, the lug of arm *n* rests on point 1 and the lug of arm *o* rests on point 2, and consequently the movable gripping-arm M occupies the position shown in Fig. 2, with the movable gripper L in contact with the outer fixed gripping-jaw J. When the cam is moved one step or quadrant, it then occupies the position shown in Fig. 5, with the two lugs *r* resting on or opposite to the two intermediate points 3 4 of the cam. The movable gripper-arm M then occupies the intermediate position shown in Fig. 6, with the movable gripper L between the fixed jaws J and K. The next step of the cam, it will be understood, brings the point 1 against the lug on arm *o*, thereby causing the movable jaw to come in contact with the inner fixed jaw K, as shown in Fig. 7. The third step reverses the position of the cam shown in Fig. 5, so that the movable jaw again occupies its intermediate position, while the fourth and last step brings the parts back to the position shown in Fig. 4. The construction and mode of operation of the cam therefore cause the movable jaw L to take two distinct steps in passing from one fixed jaw to the other. The cam also holds the arms *n* and *o* positively in their several positions, so that the movable jaw cannot be moved accidentally, but only by the rotation of the cam, whereby the threads are firmly clamped and prevented from being accidentally fed to the needles at improper times.

The movements of the cam are effected properly and at the proper intervals by means of a star-wheel Q, fixed to the shaft O, an intermittently-moving pattern-chain R, the movements of which are timed with those of the knitting mechanism, and two tappet-pins S S, which are moved into and out of the path of the star-wheel by the pattern-chain and intermediate devices.

The pattern-chain is operated by any of the well-known means which are capable of giving to it an intermittent step-by-step movement, and it carries a series of cam projections T, suitably disposed so as to impart the desired pattern to the knit web.

The two tappet-pins S S are both carried by a horizontally-sliding plate U, which is capable of sliding to and from the axis of the machine. This plate has two positions—an outer (normal) position, in which the pins S S are out of the path of the star-wheel Q, as shown in Fig. 1 and in full lines in Fig. 2, and an inner position, in which the pins S are in the path of the star-wheel, as shown in dotted lines in Fig. 2. The plate U is maintained in its outer normal position and is moved thereto when displaced by means of a spring V, and it is moved to its inner position by the operation of the cam projections T on the pattern-chain. Pivotally connected at *u* with a fixed bracket W is an elbow-lever X, the upper arm *v* of which is connected with the plate U, while its lower horizontal arm *w* extends into the path of the cam projections T on the traveling pattern-chain. When one of the cam projections T encounters the arm *w* of lever X, the two tappet-pins S are moved into the path of the star-wheel Q.

The star-wheel has four projecting and substantially radial arms *z*. When the star-wheel in its rotation encounters the tappet-pins S, one of the arms *z* encounters the first

pin, whereby the star-wheel and cam P are moved one quadrant or step. An interval then occurs, the duration of which is determined by the distance between the two pins S, and then the next arm *z* encounters the second pin S, thus moving the cam P another quadrant or step. Each cam projection T on the pattern-chain has a flat upper surface, on which the arm *w* of the lever X rests, and the speed of the pattern-chain is such that when the plate U is moved inward both pins S S remain in the path of the star-wheel until both have been encountered by arms of the star-wheel, and the pins are again moved out of the path of the star-wheel by the action of the spring V before the star-wheel again approaches the vicinity of the pins S. The result of this arrangement is that the star-wheel is always moved two steps, one after the other, there being a dwell or pause between these two steps. The motion of the star-wheel is communicated to the movable gripper, (as hereinbefore set forth,) so that the movable gripper when moved is always moved two steps in passing between the two fixed jaws, and there is a dwell or pause while the movable jaws occupy their intermediate position. During this dwell or pause both threads are free to be fed in to the needles, and the pause is of sufficient duration to enable the moving thread to carry the hitherto idle thread to the needles. This pause is always of uniform duration, so that the thread being fed in is carried in with certainty and uniformity.

The present improvements also include means for insuring the drawing in of one thread by the other. Three methods have heretofore been adopted. The frictional contact of one thread upon the other alone has been utilized; but this is reliable only when rough-fiber yarns are employed. For smoother threads the twister of the Marshall and Hewitt British patent has been used, and a third method has been to slacken the thread to be fed in so that it may be drawn in by frictional contact, as in the Cooper and Ford British patent. Now the present invention provides for certainty in feeding in the idle thread by frictional contact therewith of the moving thread, by a special shaping of the leading-in thread-eye G, and the location of the thread-guide eyes *f* and *g* relatively thereto. The construction of the thread-eye is shown in detail in Figs. 8, 9, and 10. The thread-eye G is formed with a groove 5 on its outer edge and with a similar groove 6 on its inner edge. These two grooves are diametrically opposite each other and are so arranged relatively to the direction of the threads that the threads pass along and in the groove 5 in entering the thread-eye and along and in the groove 6 in emerging from the thread-eye. Consequently, since both threads lie in these grooves and are thereby always close together, the moving thread always carries the idle thread in when the latter is released. By reason of the grooves in the thread-eye and the location of the thread-eyes *f* and *g* relatively thereto and to each other the outer thread *x* is drawn over the inner thread *y* in the groove 5, while the inner thread *y* is drawn over the outer thread *x* in the groove 6. Consequently each thread is equally efficient in drawing in the other to the needles.

In Fig. 11 a slightly-modified construction of the gripping-jaws is shown. In this modification the central jaw J, having two gripping-faces, is stationary, while the two outer jaws L′ L² are carried by the movable gripping-arm M and are each in turn brought into contact with the central fixed jaw. The mode of operation is identical with that of the arrangement of the jaws already described.

We claim as our invention—

1. The thread-guide plate of a knitting-machine, having a leading-in thread-eye, through which two threads pass, and movable and fixed gripping-jaws for each of said threads, said movable jaws acting to release one thread, then to dwell or pause to permit the feeding in of one thread by the other, and then to grip the other thread, in combination with means for causing said movable jaws to take two distinct steps in passing from the position where one thread is gripped to the position where the other thread is gripped, substantially as set forth.

2. The thread-guide plate of a knitting-machine, having a leading-in thread-eye, through which two threads pass, and movable and fixed gripping-jaws for each of said threads, the movable jaws or gripping-faces being carried by a movable gripping-arm, which takes two distinct steps in passing from the position where one thread is gripped to the position where the other thread is gripped, in combination with means for imparting to said movable gripping-arm a step-by-step movement, substantially as set forth.

3. The thread-guide plate of a knitting-machine, having a leading-in thread-eye, through which two threads pass, two stationary gripping-jaws, and a movable gripping-arm having two gripping faces or jaws coacting with said stationary gripping-jaws, the two pairs of jaws thus formed acting upon said threads, respectively, said movable arm being movable from one fixed jaw to the other and said movable arm taking two separate and distinct steps in passing from one fixed jaw to the other, in combination with means for giving to said movable gripping-arm a step-by-step movement, substantially as set forth.

4. The movable gripper-arm M and the forked lever co-operating therewith, in combination with the rotary cam having a step-by-step rotary movement, located between the arms of said lever, substantially as set forth.

5. The movable gripper-arm M and the forked lever co-operating therewith, in combination with the rotary cam having a step-by-step rotary movement, each movement or step being through a quadrant of a circle, and

said cam having points 1, 2, 3, and 4, as described, whereby said arm M is moved back and forth two steps at a time, substantially as set forth.

6. The movable gripping-arm M, the forked lever N, the rotatable shaft O, the cam P on said shaft and between the arms of said lever, and the star-wheel Q on said shaft, said star-wheel having four arms *z z*, in combination with the two tappet-pins S S, which are moved simultaneously into and out of the path of said star-wheel, and means for moving said pins into and out of the path of said star-wheel, substantially as set forth.

7. The leading-in thread-eye G and the two thread-guide eyes *f* and *g*, so located that the threads pass from said guide-eyes to said leading-in eye G at an acute angle, substantially as set forth.

8. The thread-guide plate of a knitting-machine, having a leading-in thread-eye, and the two thread-guide eyes *f* and *g*, so located that the threads pass therefrom to the leading-in thread-eye at an acute angle to each other and to the thread-guide plate, in combination with gripping-jaws located between said threads, and a gripping-jaw on the opposite side of each thread, substantially as set forth, whereby when neither thread is gripped both threads pass directly from the guide-eyes to the leading-in eye without any friction due to the gripping-jaws, substantially as set forth.

9. A thread-guide plate for a knitting-machine, having a leading-in thread-eye, and thread-guide eyes located so that the threads pass therefrom to the leading-in thread-eye at an acute angle to the guide-plate, and said leading-in eye having grooves 5 and 6 on its outer and inner faces in the path of the threads, whereby said threads are maintained in said grooves in contact with each other, substantially as set forth.

In testimony that we claim the invention above set forth we affix our signatures in presence of two witnesses.

WILLIAM H. PEPPER.
ALBERT T. L. DAVIS.

Witnessess:
LEROY M. GOULD,
HARRIE D. BROWN.