Aug. 9, 1927. 1,638,338

H. A. JACOBS ET AL

MULTIPLE NEEDLE HEMSTITCHING MECHANISM

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Fig. 1

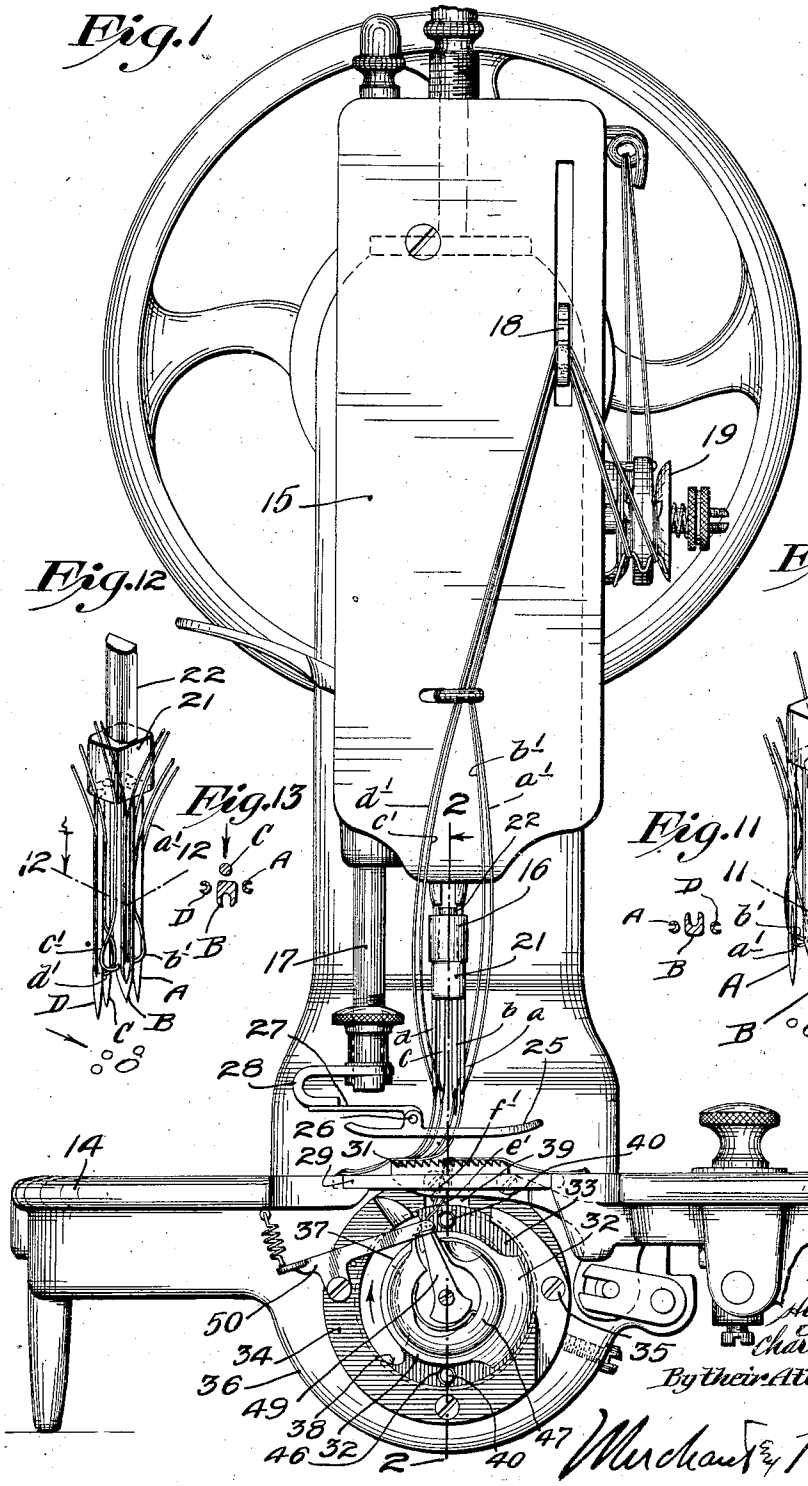


Fig. 12

Fig. 13

Fig. 10

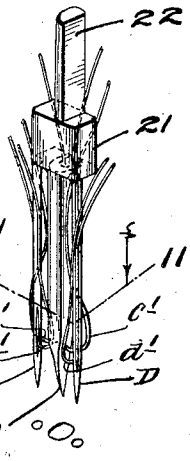


Fig. 11

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MULTIPLE NEEDLE HEMSTITCHING MECHANISM

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Fig. 2

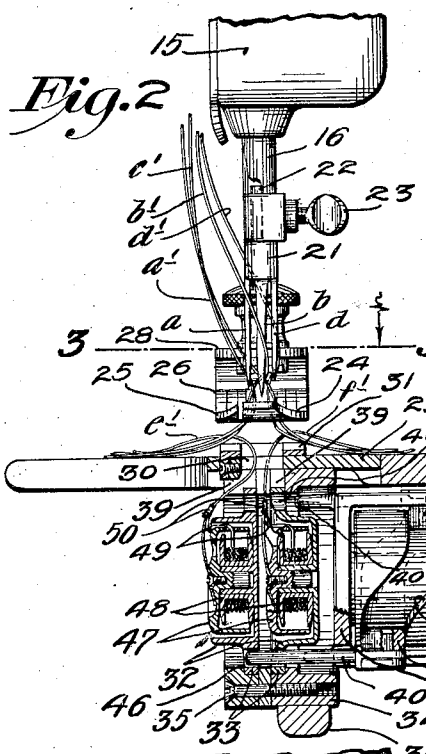


Fig. 3

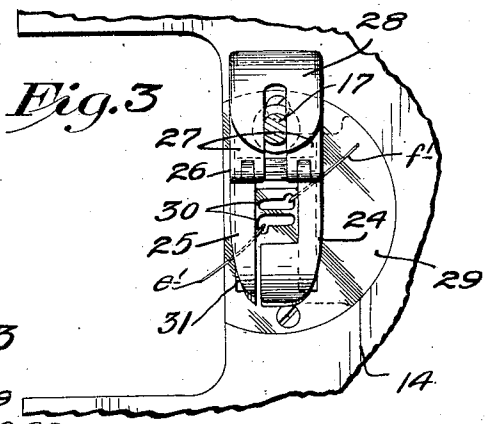


Fig. 4

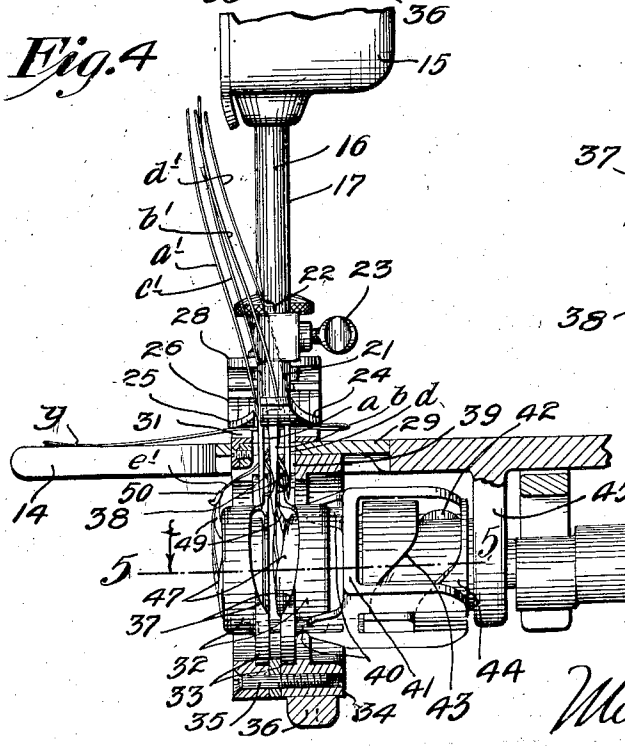
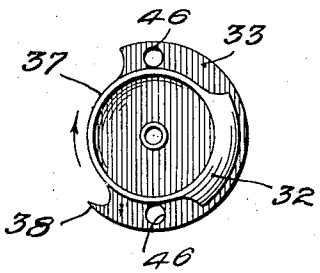


Fig. 1a



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MULTIPLE NEEDLE HEMSTITCHING MECHANISM

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Fig. 5

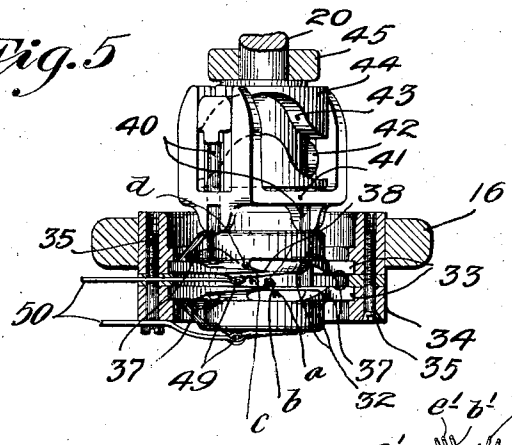


Fig. 9

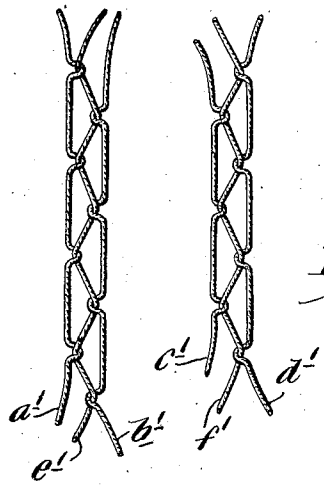


Fig. 8

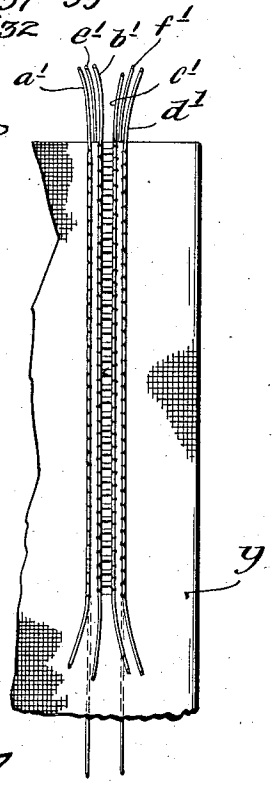


Fig. 6

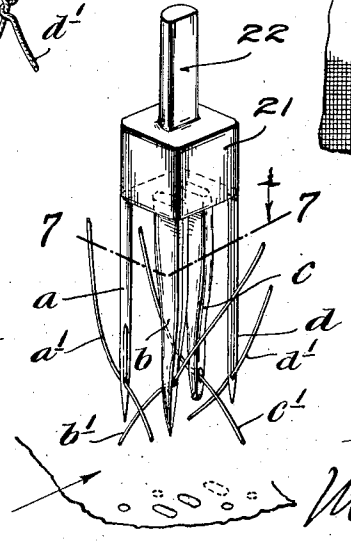
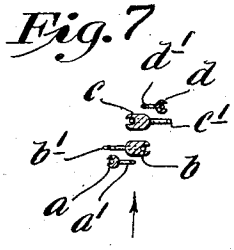


Fig. 7



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UNITED STATES PATENT OFFICE.

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MULTIPLE-NEEDLE HEMSTITCHING MECHANISM.

Application filed January 27, 1923. Serial No. 615,229.

Our present invention relates to multiple needle hemstitching mechanism of the general type disclosed and claimed in our Letters Patent of the United States No. 1,445,956, issued of date February 20, 1923.

The mechanism disclosed in the drawings of our prior patent was designed for a type of hemstitching wherein a three-thread stitch was formed on one side of the openings, but the present mechanism is designed to simultaneously apply parallel three-thread stitches along both sides of the row of openings. In the accomplishment of this later improvement, we employ a plurality of needles, cooperating twin or duplex rotary shuttles or hooks, and other highly important novel devices and combinations of devices hereinafter described and defined in the claims. The mechanism is capable of a wide range of modification, but in the accompanying drawings, wherein like characters indicate like parts throughout the several views, we have illustrated what is at present believed to be the preferred embodiment of our invention.

Referring to the drawings:

Fig. 1 is a side elevation illustrating our invention applied to a machine well known to the trade as the Standard sewing machine;

Fig. 2 is a vertical section taken approximately on the line 2—2 of Fig. 1, some parts being shown in full and some parts being broken away;

Fig. 3 is a horizontal section taken approximately on the line 3—3 of Fig. 2;

Fig. 4 is a view with some parts sectioned on the same line as Fig. 2, but with the shuttles and certain other parts shown in full elevation;

Fig. 5 is a horizontal section taken on the line 5—5 of Fig. 4;

Fig. 6 is a perspective showing the multiple needle used in the mechanism illustrated in Figs. 1 to 5, inclusive;

Fig. 7 is a horizontal section on the line 7—7 of Fig. 6;

Fig. 8 is a plan view illustrating the construction of a completed hemstitch produced by the use of this improved mechanism;

Fig. 9 is a diagrammatic or segregated view showing the two three-thread stitches on an enlarged and exaggerated scale;

Fig. 10 is a perspective showing a modified form of multiple needle;

Fig. 11 is a section on the line 11—11 of Fig. 10;

Fig. 12 is a perspective illustrating a still further slightly modified form of multiple needle;

Fig. 13 is a section on the line 12—12 of Fig. 12; and

Fig. 1^a is an elevation corresponding to Fig. 1 in the direction in which it is viewed, showing in detail one of the rotary shuttles removed from the machine.

Of the standard parts of the sewing machine illustrated, it is desirable for the purposes of this case only to particularly note the bed plate 14, arm head 15, a needle bar 16, a presser foot bar 17, a thread take-up arm 18, a thread tension device 19, and a main driving shaft 20. The needle bar 16 will, of course, be vertically reciprocated by the usual or any suitable mechanism.

As already stated, our invention contemplates the use of a plurality of needles, certain of which are of relatively large cross-section and serve to form the hemstitch openings between the two three-thread stitch lines. These needles and piercers may be arranged in quite a number of different ways and are preferably all secured to a common head 21 having a flattened stem 22 that is detachably securable to the needle bar 16 by a set screw 23, (see particularly Figs. 2 and 4). In the arrangement of the multiple needle illustrated in Figs. 1 to 6, inclusive, the head 21 is rectangular and is provided with two needles a and d and two combined needles and piercers b and c. The needles a and d depend from diagonally opposite corners of the head 21, while the needle-acting piercers b and c depend from the central portion of said head. In respect to the direction of feed of the material, the piercer c is located in line with but back of the piercer b and the needle d is offset at the right of said piercers and back of both thereof, while the needle a is offset at the left and is located ahead of both of said piercers. In cross-section, the piercers b and c are flat and of a size to properly form the openings in the hemstitching produced in the cloth y. Both of the needles a and d have sharp points and the piercer b, which enters the cloth ahead of the piercer c, also has a sharp point, while the latter may have a blunt point.

Threads a^1 and d^1 are threaded through

the eyes of the needles *a* and *d*, while threads b^1 and c^1 are threaded through the eyes of the needle-acting piercers *b* and *c*. Said four threads just noted are passed through suitable guides in the thread take-up arm 18, are passed through the tension device 19, and through suitable guides to thread spools, not shown but suitably mounted on the machine.

As an important feature, we provide a bifurcated or two-part presser foot comprising two foot sections 24 and 25, both of which sections are intermediately pivoted at 26 to the free ends of short spring arms 27, which arms, at their other ends, are secured to a common bracket 28 that is rigidly but detachably secured to the lower end of the presser foot bar 17. The presser foot sections 24 and 25 are so formed that there is a rectangular opening through which all of the needles and piercers may freely pass, (see particularly Fig. 3).

Just below the presser foot, the needle plate 29 is formed with transverse slots or elongated perforations 30 through which the needles and piercers may pass with ample clearance, but without much waste clearance space. The needle *a* and piercer *b* pass through the front slot 30, while the piercer *c* and the needle *d* pass through the rear slot 30, (see Fig. 3, by reference to which it will also be noted that the presser foot section 24, at its free end, extends in front of all of the needles and piercers, so that it will press the cloth directly fed to the needles and piercers, while the foot section 25 may adjust itself independently either to the thicker or thinner folds of the cloth at the left-hand side of the needles). The numeral 31 indicates the usual feed teeth that work through the needle plate in the usual way.

Below the needle passages 30 of the needle plate 29 is a pair of rotary shuttles or hook-acting members slightly spaced apart and arranged to rotate on a common axis. In the construction illustrated, these hook-acting members are in the form of rotary shuttles 32 having peripheral flanges 33 rotatively seated in a multi-section annular bearing 34, the sections of which are shown as connected by screws 35 and one of which sections is rigidly secured in a depending flange 36 of the bed plate 14. The shuttle flanges 33 are cut away through approximately forty-five degrees to form a reduced portion 37 and forwardly projecting narrow hooks 38 at the rear portions of said cut-away portions, the terms "forwardly" and "rear" being used in respect to the direction of rotation of the shuttles, said direction of rotation being in a clockwise direction in respect to Figs. 1 and 1^a.

The shuttle bearing 34, at its top, is cut away to afford a quite large passage 39. As will hereinafter be noted, the needles are passed freely through the passage 39, the thread loops from the needles are projected within said passage, and the hooks 38 sweep past said passage 39 and catch the reversely projected loops.

The two rotary shuttles may be described as laterally spaced and located face to face, but the expression "face to face" is used in a sense broad enough to include back to back, front to front, or front to back. For rotating these two shuttles in synchronism, we provide an alternating driving clutch including plungers that operate in succession to clutch the shuttles together and to skip the threads. This clutch mechanism includes parallel clutch plungers 40 mounted to slide through a carrying head 41 that is secured to the adjacent end of the main shaft 20. At their outer ends, the plungers 40 are equipped with rollers 42 that work in a peripheral camway 43 formed in a non-rotary cylindrical cam block 44 preferably rigidly secured to a depending flange 45 of the bed plate 14, (see particularly Fig. 2). The plungers 40 are located at diametrically opposite points and are arranged to engage with plunger seats 46 that are aligned in the shuttle flanges 33 at diametrically opposite points.

The form of the camway 43 is such that, under rotation of the shaft 20 and head 41, the plungers 40 will be alternately thrust through the aligned seats 46. Moreover, said cam is such that the plungers 40, as they move through approximately the upper one hundred degrees more or less, will be completely withdrawn from the cooperating aligned seats 46, so that the threads may pass freely over the shuttles. Otherwise stated, the driving of the two shuttles in synchronism will always be accomplished by that particular plunger that is below, say, the upper one hundred degrees of rotation. It is also important that the plungers be of such length and the cam 43 so designed that one or the other of the two plungers will always couple together the two shuttles for synchronous rotation. This clutch mechanism makes it possible to place the two rotary shuttles face to face for rotation on a common axis and with but very slight space between the two shuttles. This is important because the two hooks 38 on the two rotary shuttles should be located so as to pass very closely to the two combined needles and piercers *b* and *c* and between the same and the two needles *a* and *d*.

Within each shuttle is the customary bobbin casing 47, and within each bobbin casing is the usual thread-containing bobbin 48. Moreover, the bobbin casings are provided with the customary radially projecting spring fingers 49 that are detachably engaged and held against rotation by cooperating spring-pressed anchoring devices in the form of resilient arms 50, shown as piv-

oted to the bobbin bearing 34. The cooperative action of the arm 49 and anchor 50 is well understood and, for the purposes of this case, attention is simply called to the fact that the interlocking engagement between the free ends of said members is such as to prevent rotation of the bobbin casings with the shuttles and to permit the threads to slip between the contacting free ends of said members 49 and 50 without releasing the former from the latter. The left-hand bobbin 48, as viewed in Fig. 2, carries an under thread e^1, while the right-hand bobbin carries a thread f^1.

Operation.

When the machine is in action, the four upper threads a^1, b^1, c^1 and d^1 will be carried through the cloth y, respectively, by the needle-acting elements a, b, c and d. The sharp pointed needle-acting piercer b makes the initial opening in the cloth for the hemstitch and the needle-acting piercer c moves into the holes formed by said member b. The needles a and d form their own holes, respectively, at the left and right of the openings made by the needle elements or piercers b and c. Under initial upward movement of the needles, the needle a and the needle-acting piercer b will throw out overlapping loops in the threads a^1 and b^1 and the needle d and needle-acting piercer c will likewise throw overlapping loops in the threads d^1 and c^1. The shuttle movements are so timed that the hook 38 of the left-hand shuttle will pass through the overlapped loops of the threads a^1 and b^1 and the hook 38 of the right-hand shuttle will pass through the loops of the threads c^1 and d^1. Said left-hand hook, after catching the loops of the threads a^1 and b^1, will carry said threads over the left-hand bobbin and under the left-hand under thread e^1, and the right-hand shuttle hook 38, after catching the loops of the threads c^1 and d^1, will carry the same over the right-hand bobbin and under the right-hand under thread f^1, and these operations simultaneously form the two interlocked three-thread stitches shown in Figs. 8 and 9. Of course, simultaneously with the forming of the said two three-thread stitches, the hemstitch openings will be formed by the needle-acting piercers b and c, so that the produced hemstitch will appear substantially as shown in Fig. 8. By reference to Fig. 8, it will be noted that the upper surface of the cloth is given an appearance of having four lines of stitches. This is because the under threads e^1 and f^1 are at the under surface of the cloth and the threads b^1 are separated from the threads a^1, while the threads d^1 are separated from the threads c^1. Hence, it would follow that if the needle-acting elements b and c were reduced to the diameter of ordinary needles, there would be produced the appearance of a four-line stitch rather than that of a hemstitch.

As is obvious from the foregoing description, a high grade hemstitch, of the type usually designated as a double seam hemstitch, may be produced in one operation.

The multiple needle is capable of various different arrangements whereby the four upper threads may be thrown into two overlapped loops through which the hooks of the shuttles may be independently passed to carry the threads around or under the two under or bobbin threads. Figs. 10, 11, and 12–13 illustrate modified forms of the multiple needle. In the arrangement illustrated in Figs. 10 and 11, the head 21 is provided with two laterally spaced ordinary needles A and D and with a centrally located piercer B that performs the additional function of a duplex needle. The needles A and D carry the upper threads a^1 and d^1 and the piercer B is channel-shaped and its flanges are provided with laterally spaced eyes that carry the threads b^1 and c^1. This arrangement of needles causes the threads a^1 and b^1 to be thrown in overlapping loops and the threads c^1 and d^1 to be thrown in overlapping loops, substantially as heretofore described in connection with the multiple needle shown in detail in Fig. 6.

The needle shown in Figs. 12 and 13 is like that illustrated in Figs. 10 and 11, except that the head 21 is provided, just in front of the piercer B, with a threadless needle or primary piercer C, the function of which serves to punch the initial openings in the cloth and which openings will be further completed and formed by the piercer B. This arrangement permits the piercer B to have a more blunt point than with the arrangement illustrated in Fig. 10.

In our improved hemstitching mechanism above described and with any or all of the several forms of multiple needle, the feed mechanism produces a feed movement of the cloth for each complete needle reciprocation, the shuttles make one complete rotation for each needle reciprocation, and a complete double hemstitch is produced by each needle reciprocation and shuttle rotation. This gives a maximum speed of work production with a minimum speed of needle and shuttle movement.

In hemstitching mechanism for the production of double hemstitches hitherto devised, it has been necessary, for each cloth feed movement, to give the multiple needle three complete reciprocations and the shuttle or hook mechanism three complete rotations or oscillations for each such cloth-feeding movement. Otherwise stated, in the prior hemstitching mechanism, three needle reciprocations and shuttle or hook rotations

or oscillations were required to produce one complete double hemstitch and, hence, the necessary high speed of the needle and shuttle or hook in respect to the cloth-feeding mechanism. It would, of course, follow that with our improved stitching mechanism, the hemstitching for a given speed of needle reciprocation would produce hemstitch work at three times the speed of the older mechanism. In practice, it is not probable that quite such increase in the work production would be attempted, but the speed of the work production may be very materially increased and, at the same time, may be very greatly increased, say one hundred percent, with the needle and shuttle or hook movement materially slower than that required with the older mechanism for the slower work production.

Probably, the most desirable form of multiple needle herein disclosed is illustrated in Figs. 10 and 11, wherein the channel-shaped member B performs the function not only of a piercer but of two needles. With this channel-shaped combined piercer and needle, it is impossible for the threads b^1 and c^1 to throw loops in the wrong direction, to wit: toward the interior of the said member B, and this insures the throwing of the proper loops outward therefrom.

Attention may be further called to the fact that the clutch plunger 40 should remain coupled to and active on the shuttles through a longer period of time and rotary distance of travel while moving in the lower than while moving in the upper part of their circular travel. This is made possible by the cam action and, in practice, the camway 43 of the non-rotary cam 44 is designed to accomplish the above result. In the structure illustrated, the plungers will be kept coupled to the two shuttles during slightly more than the lower 180° of travel, will be given their in and out movements and retracted periods of travel.

The term "shuttle or hook-acting member" is herein used in a broad and liberal sense to include any kind of a hook-acting member that rotates either completely or to and fro and which will operate to carry the lower thread around or into interlocking engagement with the upper needle-carried threads.

What we claim is:

1. In a stitching mechanism, the combination with a multiple needle and means for reciprocating the same, said multiple needle including a piercer-acting member operative to produce openings for hemstitching, and needle-acting members operating to carry four threads and to throw two pairs of overlapping thread loops, of a pair of co-axial laterally spaced shuttles having hooks movable through the overlapped thread loops, lower thread-carrying bobbins associated with said shuttles and carrying lower threads around which the looped upper threads are arranged to be carried by the hooks of said shuttles.

2. The structure defined in claim 1 in further combination with a rotary power-driven shuttle-driving means having circumferentially spaced shuttle-driving members engageable therewith in succession for rotating said shuttles.

In testimony whereof we affix our signatures.

HUGH A. JACOBS.
CHARLES E. JACOBS.