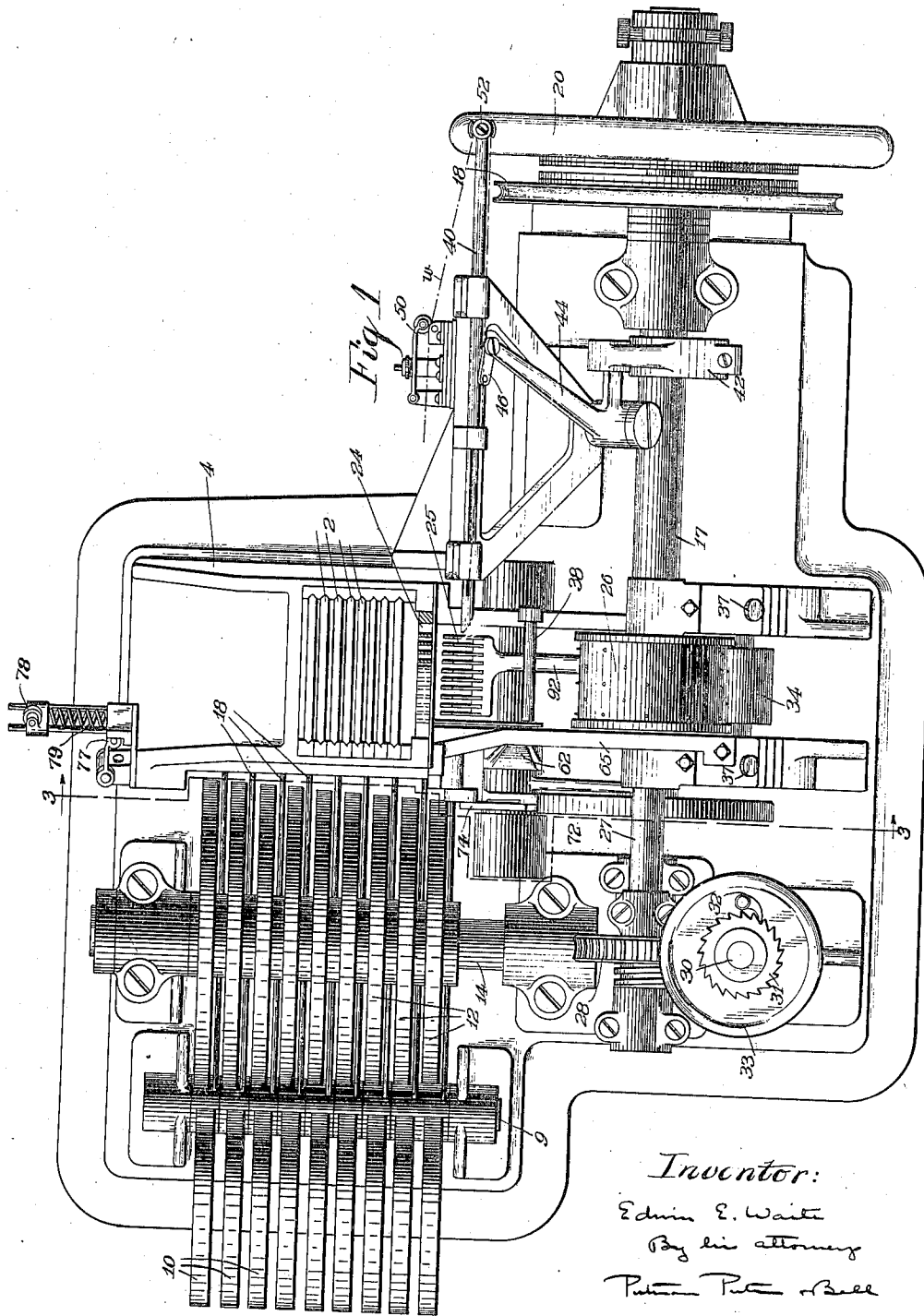


1,296,025.

E. E. WAITE.
NEEDLE LOOM.
APPLICATION FILED OCT. 25, 1915.

Patented Mar. 4, 1919.
4 SHEETS—SHEET 1.

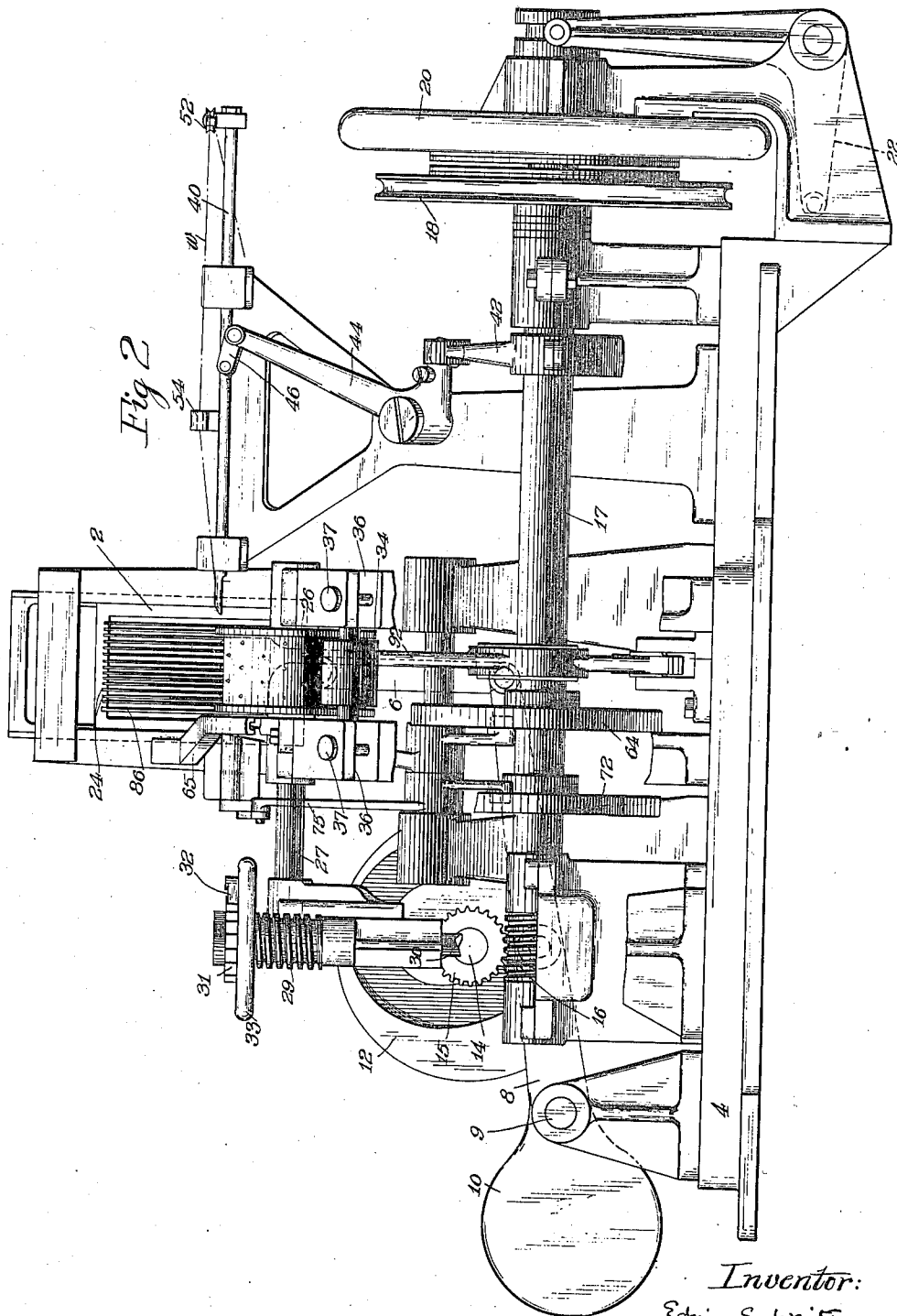


Inventor:
Edwin E. Waite
By his attorney
Patten, Patten & Bell

E. E. WAITE.
 NEEDLE LOOM.
 APPLICATION FILED OCT. 25, 1915.

1,296,025.

Patented Mar. 4, 1919.
 4 SHEETS—SHEET 2.

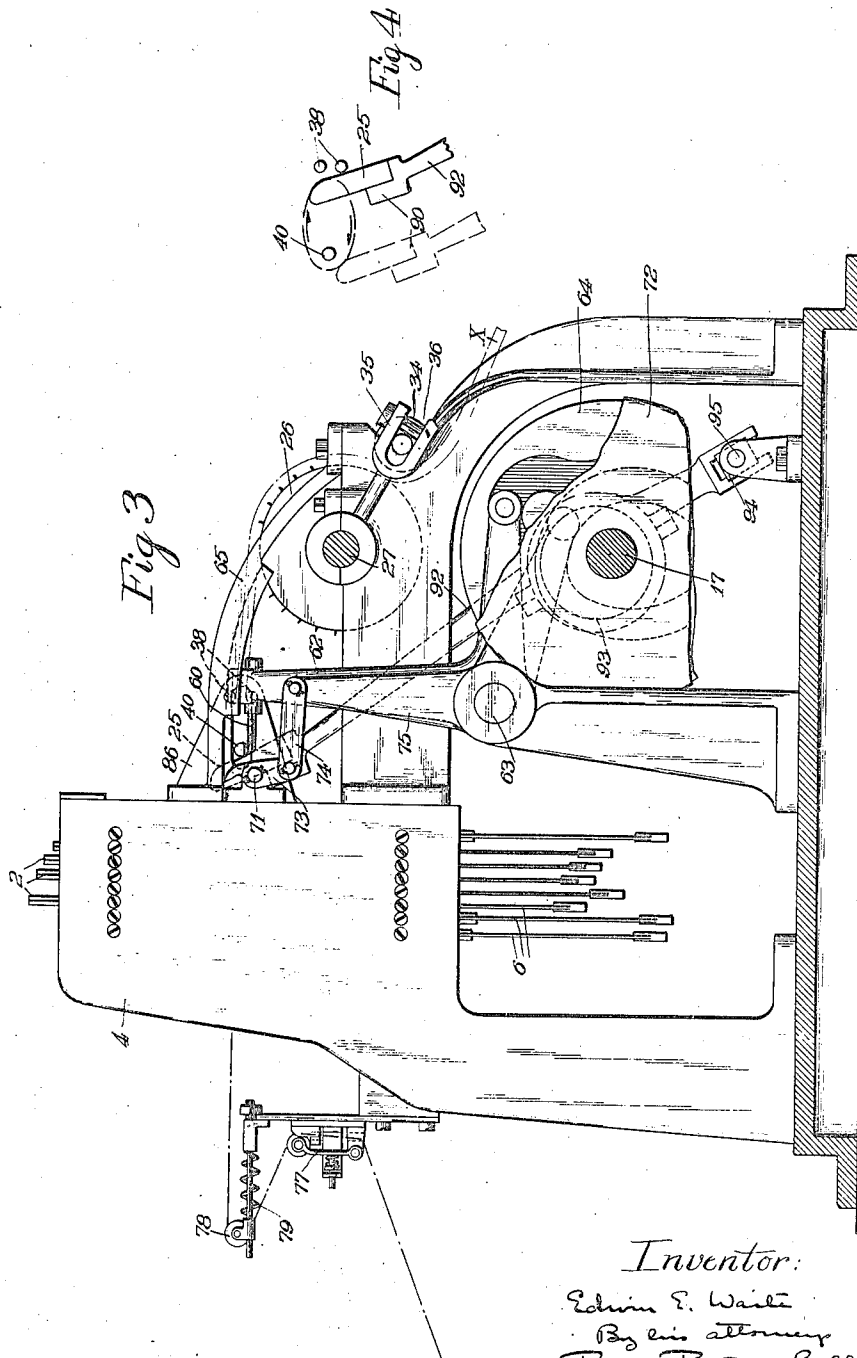


Inventor:
 Edwin E. Waite
 By his attorney
 Peter Peter & Baker

1,296,025.

E. E. WAITE,
NEEDLE LOOM.
APPLICATION FILED OCT. 25, 1915.

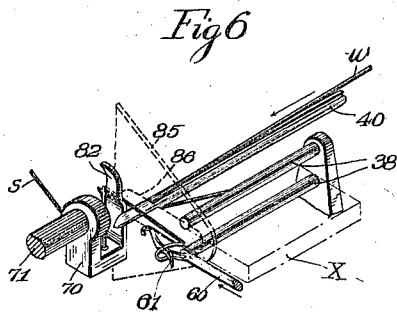
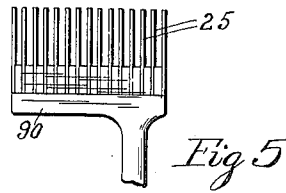
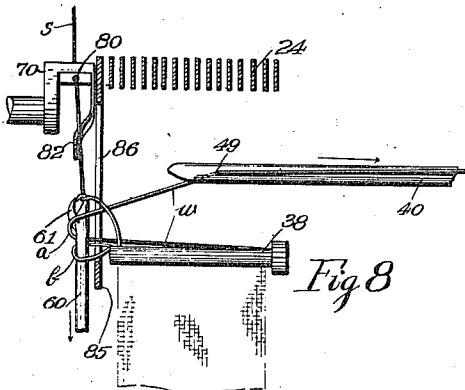
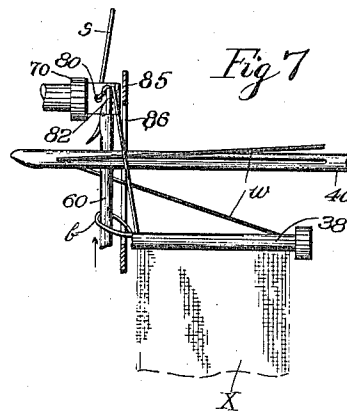
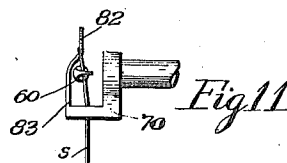
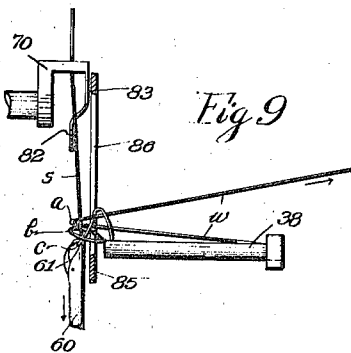
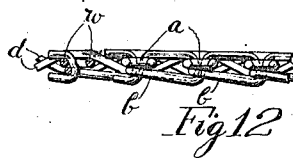
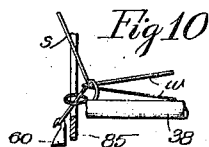
Patented Mar. 4, 1919.
4 SHEETS—SHEET 3.



Inventor:
Edwin E. Waite
By his attorney
Patterson & Bell

1,296,025.

4 SHEETS-SHEET 4.



Inventor:
Edwin E. White
By his attorney:
Ruth Ruth & Bell

UNITED STATES PATENT OFFICE.

EDWIN E. WAITE, OF FRAMINGHAM, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO STANDARD WOVEN FABRIC COMPANY, OF FRAMINGHAM, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

NEEDLE-LOOM.

1,296,025.

Specification of Letters Patent.

Patented Mar. 4, 1919.

Application filed October 25, 1915. Serial No. 57,744.

To all whom it may concern:

Be it known that I, EDWIN E. WAITE, a citizen of the United States, residing at Framingham, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Needle-Looms, of which the following description, in connection with the accompanying drawings, is a specification, like reference characters on the drawings indicating like parts in the several figures.

This invention relates to looms and is particularly concerned with looms designed to weave narrow fabrics and goods of the character known generally as "mechanical" fabrics, including brackelinings, straps, belting, etc.

Narrow woven fabrics of this character are now manufactured almost universally in looms of the general character employed to manufacture wider goods. The output of these machines, however, is limited by the speed at which the shuttle can be driven and so much time is lost in the starting and stopping of the shuttle, and in shutdowns due to breaking of the threads or necessitated by the replacing of the bobbin or cop in the shuttle that the rate of production is exceedingly low. It has been attempted heretofore to overcome this difficulty by inserting the weft with a reciprocating needle instead of with a shuttle, thus taking advantage of the fact that a needle can be operated at a very much higher speed than a shuttle, particularly on narrow goods when the stroke of the weft inserting device is relatively short. Machines of this character use substantially the common type of warp supporting and operating mechanism and because of their peculiar method of inserting the weft have sometimes been termed "needle looms." Such looms of course lay a double length of weft in each shed of the warp, thus forming a loop at the end of each of these double lengths, and in order to lock the series of loops so formed against raveling, a shuttle is employed to run a selvage thread through each loop as it is formed. These machines also have encountered the difficulty of requiring very frequent shutdowns to renew the bobbin in the shuttle handling the selvage thread and this, with other difficulties, has prevented machines of this type from going into commercial use to any substantial extent.

The present invention is directed to looms of the general type just described and has for its chief object the elimination of the difficulties heretofore experienced with machines of this character. The invention is particularly concerned with the mechanism for locking the loops of the weft along one selvage edge against raveling and aims to devise a mechanism of this character which can be operated at a high speed and which will not require the use of a shuttle. The invention also is directed to a novel construction of reed and operating and supporting mechanism therefor which enable the machine to be operated at a higher speed than could be obtained with the usual reed mechanism.

The various features of the invention will be readily understood from the following description, reference being made to the accompanying drawings, in which—

Figure 1 is a plan view of a machine embodying this invention;

Fig. 2 is a front elevation of the machine shown in Fig. 1, certain parts however being broken away;

Fig. 3 is a sectional view on the line 3—3, Fig. 1;

Fig. 4 is a fragmentary view of part of the reed illustrating its path of movement;

Fig. 5 is a front elevation of the reed;

Fig. 6 is a perspective view of part of the weft inserting and locking mechanism showing one step in the process of locking the loops of the weft against raveling;

Figs. 7 to 10, inclusive, are plan views partly in section showing additional steps in the process of locking the loops of the weft against raveling;

Fig. 11 is a front elevation of the selvage thread positioner and selvage needle in the positions in which they appear in Fig. 7; and

Fig. 12 is an edge view showing substantially the selvage of a single-ply fabric manufactured on the machine.

The machine shown for the purpose of explaining the invention resembles in its general organization that shown in my application Serial No. 38,269, filed July 6, 1915, for improvements in needle looms. The present machine employs a warp holding and operating mechanism and a weft inserting mechanism substantially like that shown in my earlier application. In the

present machine, however, the series of loops of the weft formed along one selvage edge by the weft inserting means are locked against raveling by an auxiliary or selvage thread independent of the warp and weft whereas the machine shown in my earlier application was designed to so manipulate the loops of the weft as to interlock them with each other and avoid the use of a separate selvage thread.

The illustrated machine comprises a warp holding and operating mechanism which includes a set of harnesses 2 mounted for vertical reciprocating movement in suitable guideways supported in the machine frame 4. Each of these harnesses has connected to its lower end a link 6 which is pivotally connected with the forward end of one of a series of levers 8 all fulcrumed on a horizontal lever shaft 9 and each carrying a counter-balance weight 10. Each of these levers carries a roll that is operated by one of a series of cams 12, all secured side by side on a horizontal shaft 14 which is supported in suitable bearings secured to the machine frame and which carries on its forward end a worm wheel 15 meshing with a worm 16 that is secured to a main shaft 17 supported horizontally in suitable bearings and lying at right angles to the shaft 14. This shaft 17 carries a loose pulley 18 which may be belted to any convenient source of power and which carries a clutch element designed to cooperate with a companion clutch element secured to one face of a hand wheel 20 that is keyed to but can slide longitudinally of the shaft 17. A bell crank lever 22, fulcrumed on the machine frame is designed to have one arm connected to a foot treadle or similar controlling element and has its other arm so connected with the hand wheel 20 that it can slide this wheel toward or from the pulley 18 and thus move the slidable clutch element into or out of clutching relationship to the driven element. The cams 12 operate through their respective levers 8 and links 6 to move the harnesses 2 up and down in their guideways and are of course timed to give to the harnesses the movements necessary to effect the desired movements of the warp threads and the binders.

The harnesses 2 are provided with suitable heddles (not shown) and a spool or cop supporting rack (not shown) is provided to hold the spools or cops from which the warp threads and binders are unwound, or the warp and binders may be unwound from beams. When the machine is "drawn in," that is, when the warp threads and binders are properly arranged on their supports and in the harnesses for the weaving operation, the warp and binding threads pass from the harnesses through a station-

ary reed 24 mounted just in front of the harnesses, then through a movable reed 25 to a cloth roll or beam 26. This member is mounted on a shaft 27 which is supported horizontally in suitable bearings and carries a worm wheel 28 that meshes with a worm 29 mounted loosely on a vertical shaft 30. Normally the shaft 27 is driven from the shaft 30 by means of a ratchet wheel 31 fast on the shaft 30 engaging a pawl 32 pivoted on the top of a hand wheel 33 that rotates with the worm 29. This driving mechanism enables an operator to rotate the cloth beam 26 backwardly to slack off the web of fabric whenever desired for any reason simply by turning the hand wheel 33 in a direction opposite to the direction in which it is normally driven by the connections just described. The shaft 30 carries a worm wheel that meshes with the worm 16 on the main shaft 17 and serves to drive the shaft 30. The periphery of the cloth beam 26 is provided with a series of pins to enable it to grip the fabric as it is woven. A guide roll 34 is mounted slightly below and in front of the cloth beam 26 in position to press the web of fabric X (see Fig. 3) against the cloth beam 26. In order to permit the easy removal of this roll 34 it is mounted on a short shaft 35 that rotates freely in two slots 36 (see Figs. 2 and 3) positioned at opposite sides of the roll, this shaft normally being held in the slots by a pair of pins 37 which can readily be removed, thus allowing the roll and its shaft to be slipped out of the slots.

Just back of the cloth beam 26 a pair of horizontal guide rods 38 are mounted, between which the web of fabric X passes on its way to the cloth beam.

The warp supporting and operating mechanism above described is arranged to shed the warp, the shed lying between the harnesses and the guide rods 38. A needle 40 is mounted in suitable horizontal guides to reciprocate back and forth through the shed and this needle is utilized to insert the weft. The operating mechanism for this needle comprises an eccentric fast on the main shaft 17 and driving an eccentric strap 42 which is connected to one arm of a bell crank lever 44, the opposite arm of said lever being connected by a short link 46 to the needle 40. The needle 40 is provided near its forward end with an eye 49 through which the weft thread *w* is guided. This thread is led from a supply spool or cone, not shown, through a tension device 50 to a takeup roll 52 rotatably mounted on the rear end of the needle 40, and then through a stationary thread guide 54 to the eye 49 of the needle. Any suitable form of thread tension device may be used, that shown consisting of two rolls which are pressed yield-

ingly together by a spring and between which the thread is guided as it is fed forward.

The mechanism so far described is, with the exception of the reeds 24 and 25 and some minor changes in the driving mechanism for the cloth beam, substantially identical with that shown and described in my earlier application for improvements in needle looms.

As above indicated, the weft inserting needle 40 is operative to lay a double length of weft in each shed, leaving a loop in the end of each of said lengths at the side of the shed opposite to that from which the needle enters and a novel stitch forming mechanism is employed to lock the loops so formed against raveling. This mechanism comprises a selvage needle 60 cooperating with a thread positioner 70 to manipulate a selvage thread *s*, independent of the warp and weft, in such a manner as to form a series of chain stitches through the loops of the weft. The needle 60 has a hook at its forward end and a latch 61 is pivoted in the shank of the needle just back of the hook so that it can swing into a forward position where it closes the opening in the hook, or into a rearward position parallel to the shank of the needle where it leaves the hook open. This needle is mounted in a suitable holder formed in the upper end of a bell crank lever 62 which rocks on a shaft 63 and carries at its end opposite the needle 60 a roll running in the cam path of a cam 64 fast on the main shaft 17. This cam operates through the lever 62 to give the needle 60 a reciprocating movement back and forth in substantially a horizontal plane and just under the forward end of the path of movement of the needle 40. The upper end of the lever 62 runs in a vertical slot formed in a bracket 65 supported in the machine frame, which serves to support the lever arm against lateral movement out of its proper path.

The thread positioner 70 comprises a U-shaped member mounted on the end of a shaft 71 which is supported in suitable bearings and is rocked by connections with a cam 72 fast on the shaft 17, these connections comprising an arm 73 fast on the shaft 71 and a link 74 that connects this arm with the upper end of a bell crank lever 75 fulcrumed on the shaft 63 and carrying a roll running in a cam path formed in the cam 72. The selvage thread *s* is guided from a supply roll or cone through a thread tensioning device 77 similar to the device 50 over a takeup roll 78 operated by the spring 79 to the eye 80 of the part 70 (see Fig. 8). This thread next passes over a shoulder forming a part of the surface of a curved notch cut in the

end 82 of one arm 83 of the U-shaped thread positioner 70 and then goes to the hook of the selvage needle 60. The end 82 of the arm 83 is bent in slightly, as best shown in Figs. 6 to 9, into the space between the arms of the U-shaped member 70 so that this end 82 and the shoulder above mentioned lie almost in line with the thread guiding eye 80 that is formed through the horizontal member or bridge piece of the U-shaped part 70. The arm 83 is made very thin and is so positioned with reference to the path of travel of the needle 60 that this needle can move into the space between this arm and the plane of the eye 80, as shown in Figs. 7 and 11.

Positioned close beside the part 83 and beside the path of movement of the needle 60 is a vertical stationary plate 85 supported by the reed 24 and provided with a long narrow aperture 86 through which the end of the needle 40 passes on its forward stroke. The aperture 86 extends substantially from a point back of the path of movement of the needle 40 to a point about opposite the ends of the two guide rods 38. When the machine is in operation the warp holding and operating mechanism forms a shed between the harnesses and the guide rods 38, as above stated, and the vertical bars of the stationary reed 24 hold the adjacent sets of superposed warp threads properly separated from each other. The plates 25 of the movable reed lie normally just in front of the corresponding plates of the reed 24 and are spaced apart by the same distances that separate the plates of the reed 24. The weft inserting needle 40 is advanced through the shed and through the aperture 86, as indicated in Figs. 6 and 7, until it reaches substantially the position in which it is shown in Fig. 7 at the forward limit of its stroke. In this position the eye 49 of the needle is advanced considerably past the opening 86 in the plate 85 and consequently the needle at this time holds the part of the weft thread *w* in the shed in a V-shape, the apex of the V lying at the left of the plate 85 as the parts are seen in Fig. 7. This movement of the needle 40 locates a loop of the weft in position for the selvage needle 60 to move through it and the operating mechanism for the latter needle advances it, as shown in Fig. 6, at the same time that the needle 40 is being advanced. The selvage needle thus is caused to slide just under the needle 40 behind the eye 49 and through the loop of weft now positioned by the needle 40 until it arrives in substantially the position in which it is shown in Fig. 7. At this time the needle 40 starts on its return stroke moving back toward the position in which it is shown in Fig. 8. The thread positioner 70 is at this time in an

upright position as shown in Figs. 6 and 7 so that it holds the selvage thread *s* in the position indicated in these figures and in Fig. 11, thus permitting the selvage needle 60 to move under the shouldered end 82 and into a position between the arm 83 of the thread positioner and the part of the thread *s* that is stretched between the eye 80 and the shoulder 82. The needle 60 advances to a point slightly beyond that in which it is shown in Fig. 7 and as it moves ahead the point of the hook pushes the thread *s* slightly aside but on its return movement this hook engages the thread *s* as shown in Figs. 7 and 11, and pulls the thread backwardly, as indicated in Fig. 8. While this movement of the selvage needle is taking place the weft needle 40 is returning or moving backwardly to its initial position at the side of the shed opposite to the plate 85. The weft *w* is looped about the shank of the selvage needle 60 at this time, as indicated in Fig. 8 at *a*. As the selvage needle 60 retires from the position in which it is shown in Fig. 7 to that in which it appears in Fig. 8 and then to that shown in Fig. 9, it forms a loop *c* in the selvage thread *s* and carries this loop through the loop *a* of weft that encircles its shank and also through a loop *b* of the selvage thread which has been formed at the previous cycle of operations and which at this time also encircles the shank of the selvage needle. The latch 61, of course, closes as soon as it comes in contact with the first loop on its shank and enables the loops *a* and *b* to slide freely over the hooked end of the needle. When this needle arrives in the position in which it is shown in Fig. 9 it has pulled the loop *c* of the selvage thread *s* entirely through the loops *a* and *b*. By this time the weft inserting needle 40 has returned to nearly the rearward limit of its stroke. During this return movement the weft *w* renders freely through the eye 49 of the needle until the takeup roll 52 on the rear end of the needle has tightened all the slack in the weft. The further rearward movement of this needle of course causes the roll 52 to tighten this slack weft thread lying between the tension device 52 and the fell of cloth and consequently it pulls up this entire length of weft and therefore shortens the double length which it has last laid in the shed, pulling it up from about the condition in which it is shown in Fig. 9 to substantially that shown in Fig. 10. Of course when this tension on the slack weft exceeds a certain amount, it operates to pull additional weft from the supply roll or cop through the tension device 50 and thus feeds off substantially the length required for the next pick. This tightening of the weft is a very desirable operation and serves to pull in toward the selvage end of the fabric both the loops *a* and *b* that pre-

viously have encircled the shank of the selvage needle 60. While the selvage needle is moving backwardly, as indicated in Figs. 8, 9 and 10, the thread positioner 70 swings down into a horizontal position, as shown in Figs. 8 and 9, thus releasing the selvage thread and facilitating the formation of the loop by the selvage needle. The harnesses now change and the reed 25 beats up the last double length of weft laid in by the needle 40.

One cycle of operations of the weft inserting means and the stitch forming mechanism has now been completed and both the weft inserting needle 40 and the selvage needle 60 next advance toward the positions in which they are shown in Fig. 6 to perform their next cycle of operations. As the needle 60 moves forward the loop *c* of the selvage thread, which has just been pulled through the loops *a* and *b*, is still held by the needle and while the needle advances, this loop *c* slips back along the shank of the needle opening the latch 61, as shown in Fig. 6. This loop *c* now takes the place of the loop *b* shown in Fig. 7 so far as the next cycle of operations is concerned. As soon as the needle 60 starts forward, the thread positioner 70 begins to swing from the horizontal position in which it appears in Fig. 9 into its vertical position in which it is shown in Fig. 6, thus positioning the selvage thread *s* for the next engagement therewith of the hook of the needle 60. Inasmuch as one end of the selvage thread *s* is now bound into the selvage of the fabric by the loops of the weft, this thread will be stretched between the selvage of the fabric *X* and the shouldered end 82 of the thread positioner 70. During the movement of the thread positioner from its horizontal to its vertical position it feeds through the tension device 77 substantially the length of thread required for the next stitch forming operation. A spring pressed takeup roll 78 maintains the entire length of selvage thread between the device 77 and the selvage of the cloth under tension. It will be readily understood that the chief function of the member 70 is to position the selvage thread for the proper engagement therewith of the hooked end of the selvage needle 60, thus cooperating with this needle to form a loop in the selvage thread which is pulled through the loop of weft as the weft is laid in by the needle 40.

As the machine continues its operation the stitch forming mechanism, including the selvage needle 60, will pull a loop of selvage thread similar to the loop *c*, Fig. 9, through each loop *a* of weft as it is positioned by the needle 40 and through the previous loop *b* of selvage thread, thus manipulating the selvage thread to form therewith a series of chain stitches along one sel-

vage edge of the fabric, these stitches extending, respectively, through the loops of weft and thus locking them against raveling. Fig. 12 shows in a general way the appearance of the selvage edge of a single-ply piece of goods made on this machine. It will be noted from this figure that each loop *b* of selvage thread is pulled through the previous loop *b* and also through a loop *a* of weft which is formed at one end of the double length laid in at each reciprocation of the needle 40. The weft is locked at the opposite selvage edge of the fabric by the crossings or intersections of the warp in the same manner that it is locked in an ordinary piece of goods.

As soon as the weft inserting needle 40 has laid in a double length of weft in the shed and has moved out of the path of the movable reed 25 on its return stroke, this reed is swung forward by its operating mechanism to beat up the pick of the weft just inserted. It is obvious that, if the usual type of reed were employed it would be necessary for this reed to make its operative or beating stroke and then to complete its return stroke, or in other words, to move back to a position behind the path of movement of the needle 40 before this needle could advance again to make the next pick. In order to permit the more rapid operation of these parts a novel construction of reed and a novel supporting and operating mechanism for it has been devised by which the reed is moved on its return stroke in a path that avoids the path of movement of the needle 40. Consequently the needle 40 is enabled to advance as soon as the reed has swung forward out of the path of the needle. The reed shown comprises a supporting head 90 carrying a series of plates indicated at 25 which extend vertically into the shed and are separated from each other by such distances that the plates can project between the sets of superposed warp threads in the shed, the space between these places being open at the upper end of the reed so that the reed can move vertically in the shed as well as longitudinally of it. The head 90 is formed on the upper end of a long lever arm 92 that carries between its ends an eccentric strap running on an eccentric 93 fast on the main shaft 17. This lever arm is bifurcated at its lower end to form a guideway in which a block 94 is received, this block being rotatably mounted on a short shaft 95 supported in suitable bearings. It is obvious that this mechanism will cause any given point on the reed 25 to move in an elliptical path as best indicated in Fig. 4 and in a direction indicated by the arrows in said figure. The path of movement of the reed is so located with reference to the path of the needle 40 that on its forward or beating stroke, the reed crosses the path of the nee-

dle, thus sweeping ahead of it the last double length of weft laid in by the needle 40, and then returns to a position behind the needle 40 again along a path that drops below the needle and consequently avoids any interference with the needle.

It is obvious that many changes may be made in the details of construction without departing from the essential characteristics of the invention and accordingly I do not wish to be limited to the precise details of construction shown. Obviously some features of the invention, particularly the reed mechanism, could be used to advantage with looms of other kinds, such for instance as the needle loom shown in my earlier application, or needle looms in which a shuttle is employed. Some of the advantages of the present invention also could be obtained by using a stitch forming mechanism that includes a shuttle, particularly in manufacturing fabrics of a nature permitting the use of a very small or fine bobbin thread so that the renewals of the bobbin would be comparatively infrequent.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:—

1. In a needle loom, the combination with warp holding and operating mechanism constructed and arranged to shed the warp, of a weft inserting needle mounted for reciprocating movement through the shed of the warp and operative to lay a double length of weft in each shed leaving a loop in the end of each of said lengths at the side of the shed opposite to that at which the needle enters the shed, a latch needle mounted at the side of the shed at which said loop is positioned, operating mechanism for said latch needle constructed and arranged to move it back and forth from a point adjacent to the apex of the shed through each loop of weft as it is positioned by said weft needle, and means for positioning a selvage thread for the engagement therewith of said latch needle comprising a part operated to engage the thread and move it into position to be grasped by said latch needle and then to be moved out of engagement with said thread, said thread positioning means being arranged to cooperate with said latch needle to manipulate said selvage thread to form therewith a series of chain stitches through the loops at the ends of said double lengths of weft.

2. In a needle loom, the combination with warp holding and operating mechanism constructed and arranged to shed the warp, of weft inserting means comprising a reciprocating needle operative to lay a double length of weft in each shed leaving a loop in the end of said length at the side of the shed opposite to that from which the needle enters the shed, a latch needle mounted at

the side of the shed at which said loop is made for movement transversely to the direction of motion of said weft inserting needle, operating mechanism for said latch needle, arranged to move it through each loop of the weft as it is positioned by said weft needle, and a rocking thread positioner coöperating with said latch needle to manipulate a separate selvage thread and form therewith a series of stitches through the series of loops at the ends of said double lengths of weft.

3. In a needle loom, the combination with warp holding and operating mechanism constructed and arranged to shed the warp, of weft inserting means comprising a needle constructed to carry a weft thread and mounted to reciprocate through the shed, operating mechanism for said needle operative to cause the needle to lay a double length of weft in each shed leaving a loop in the end of each of said lengths at the side of the shed opposite to that at which the needle enters the shed, a plate positioned at right angles to the direction of movement of said needle at the side of the shed at which said loops are formed and provided with an aperture through which said needle moves, and a stitch forming mechanism positioned at the side of said plate opposite to the shed and operative to manipulate a selvage thread to form therewith a series of chain stitches through the loops at the ends of said double lengths of weft, said stitch forming mechanism including a latch needle and means for reciprocating it through each loop of the weft as said loop is positioned by said weft inserting needle.

4. In a needle loom, the combination with

warp holding and operating mechanism constructed and arranged to shed the warp, of weft inserting means comprising a needle constructed to carry a weft thread and mounted to reciprocate through the shed, operating mechanism for said needle operative to cause the needle to lay a double length of weft in each shed leaving a loop in the end of each of said lengths at the side of the shed opposite to that at which the needle enters the shed, a plate positioned at right angles to the direction of movement of said needle at the side of the shed at which said loops are formed and provided with an aperture through which said needle moves, a hook-shaped selvage needle mounted close to said plate at the side thereof opposite to said shed, supporting and operating means for said selvage needle arranged to move it through each loop of the weft as it is positioned by said weft inserting needle, said selvage needle being constructed to manipulate a selvage thread and having a latch mounted to open or close the opening in its hook, a rocking thread positioner mounted in front of said selvage needle, and operating mechanism for said positioner constructed and arranged to cause it to so position said selvage thread as to enable said selvage needle to grasp said thread upon its forward stroke and form a loop therein, said positioner being operative to release said thread while said selvage needle draws said loop through a loop in the weft and through another loop previously formed in said selvage thread.

In testimony whereof I have signed my name to this specification.

EDWIN E. WAITE.