This invention relates to zigzag sewing machines and more particularly to machines of this character adapted to produce stitches of the 404 type, as defined by the Federal specifications. Such stitches are formed by two threads, one carried by a needle which is reciprocated vertically and is also shifted transversely of the line of feed, to provide the zigzag effect, and the other carried by a four-motion looper.

A primary object of the invention has been to provide simple, but effective, needle thread loop retaining means mounted directly on the looper to assure proper formation of the desired thread triangle as the needle is reciprocated in either of its positions transversely of the line of feed. Heretofore it has been considered necessary or desirable to provide a special loop retainer in association with the looper, this retainer being given four-motion movements, independently of the looper, to impart an elliptical path of movement to the loop retaining thereof.

In accordance with the present invention the loop retaining function is achieved by a plurality of resilient elements mounted on the looper and arranged to partake of the movements of the latter. These elements, by a spring action, serve to retain the needle thread loop momentarily by friction at two different points along the length of the looper blade as the latter is being retracted. The arrangement is such that one of the resilient elements serves to hold the limb of the needle thread loop which is on the forward side of the looper sufficiently close to the shank of the looper to insure proper passage of the needle, on its next descent, through the thread triangle. It is of particular importance as the needle is being reciprocated along its righthand path, i.e. the path closer to the vertical standard, in the course of which the needle descends further from the point of the blade of the looper. After the needle thread loop is released by the resilient element described, upon the retraction of the looper, it is still retained by the second resilient element which frictionally grips the loop against the underside of the looper. The point at which the loop is held by this second resilient element is such as to insure continued downward motion of the needle in proper relation through the thread triangle. It will be appreciated that as the needle descends into cooperation with the looper it must clear the forward limb of the needle thread and subsequently clear the rearward limb of the needle thread. The two resilient elements serve to insure this proper coaction of the parts at all times.

The blade of the looper employed in accordance with the invention is preferably provided, intermediate its ends, with a lateral bend in a horizontal plane. Bending of the looper in this manner assists further in insuring the proper formation of the thread triangle for the desired descent of the needle through the triangle. If desired the two resilient thread retaining elements may be formed separately and mounted independently on the looper; however, they may be formed as a single unitary member.

Other objects, features, and advantages of the invention will appear from the detailed description of several illustrative embodiments of the same which will now be given in conjunction with the accompanying drawings, in which:

Fig. 1 is a view partly in elevation and partly in longitudinal vertical section through a sewing machine embodying the invention;

Fig. 2 is a detail view showing the improved looper construction in front elevation and in relation to the reciprocable needle;

Fig. 3 is a view similar to Fig. 2 but illustrates the parts in different relation assumed at a slightly earlier point in a cycle of operation;

Fig. 4 is a plan view of the looper when in the position shown in Fig. 2;

Fig. 5 is a plan view of the looper when in position shown in Fig. 3;

Fig. 6 is a plan view of the looper itself without the accessory devices;

Fig. 7 is an end view of the looper, with its accessory devices, as seen from the left in Fig. 2;

Fig. 8 is a view similar to Fig. 7 showing the looper with a needle guard attached thereto;

Fig. 9 is a front elevational view of the assembly shown in Fig. 8;

Fig. 10 is a front elevational view of a looper having a modified form of loop detaining means;

Fig. 11 is a plan view of the assembly shown in Fig. 9;

Fig. 12 is a plan view of the assembly shown in Fig. 10;

Fig. 13 is an enlarged perspective view of a unitary resilient, thread retaining member, embodied in Fig. 10, having two thread retaining portions; and

Fig. 14 is an end view of the assembly shown in Fig. 10 as viewed from the right of the latter.

The invention has been disclosed herein as applied to a machine of the character disclosed in the Hayes and Reimer application, Serial No. 485,882, filed February 3, 1955, now Patent No. 2,792,797, dated May 21, 1957. This machine is adapted to produce zigzag stitches of the type designated 404 in the Federal Specifications. By appropriate adjustment of the needle bar swinging mechanism it may produce a straight line seam of the 401 type.

Referring to Fig. 1, the machine comprises a hollow frame having a work supporting base portion 10, a vertical standard 11, and an overhanging arm 12 terminating in a needle head 13. A rotary drive shaft 14 is suitably journaled in the base and extends through the wall at the right end of the base and carries outwardly of the frame a combined handwheel and pulley 15 through which the machine may be driven. The stitch forming devices include a reciprocable needle bar 16 carrying a needle 17 at its lower end. Needle bar 16 is mounted for vertical reciprocation in bearing portions 18 and 19 of a downwardly extending arm 20 of an L-shaped lever which is pivoted at 21 adjacent the top of the needle head. This pivot as shown, is disposed just to the left of the path of travel of the needle bar. As explained in said Hayes, et al. application this embodiment the use of a full length needle bar and also brings about a more favorable coaction between the needle and the looper to be hereinafter described. Rigidly secured to the arm 20 is a horizontally extending arm 22 forming part of the L-shaped lever. Arm 22 extends longitudinally of the overhanging arm 12 to a point within the vertical standard adjacent the top of the latter.

For imparting vertical reciprocations to the needle bar
there is provided a crank 23 on the shaft 14 having a crank element preferably of the type disclosed in the application of John Atwood, Serial No. 310,295, filed September 18, 1952, now Patent No. 2,729,179, dated January 3, 1956, with which cooperates a strap carried by the lower ends of a pair of connecting rods 24 the upper ends of which carry a strap cooperating with a ball pin 25. The latter projects outwardly from the end of a neck 26 rockably mounted by means of a shaft 27 extending transversely of the overhanging arm. At its left end the lever 26 is connected by a link 28 with a block 29 clamped upon the needle bar 16. As explained in said Hayes, et al. application, means are provided for rocking the L-shaped lever 20, 22 to swing the needle bar into alternate positions in a plane perpendicular to the line of feed. The arrangement is such that the needle bar is shifted in one direction during one revolution of the shaft 14 and in the opposite direction upon the next revolution of the shaft 14. For this purpose the arm 22 of the L-shaped lever is provided with a ball pin 30 at its free end which cooperates with a strap at the upper end of an extensible connecting rod 31, the lower end of which carries a strap cooperating with a ball pin 32 projecting laterally from a rock member 33. This rock member forms a part of a unit designated 34 which is secured to the frame within the vertical standard and includes a cam (not shown) for rocking the member 33. Gear 35 in the unit 34 is connected with the cam mentioned and meshes with a pinion 36 connected to the shaft 14. This arrangement is such that the cam is given one revolution for each two revolutions of the shaft 14.

Cooperating with the needle bar as it descends beneath the work supporting surface of the base is a looper 37. This is secured to the upper end of an arm 38 oscillatable about a pivot stud 39 extending forwardly from a sleeve member 40 secured to a rock shaft 41. Oscillatory movements are imparted to the arm 38 about the stud 39 through a pin 42 engaging the arm 38 and having at its outer end a strap cooperating with a ball pin carried by an arm 43. The latter is secured to a shaft 44 extending transversely of the base of the frame and is provided with a radially projecting arm or bolt 45 within the vertical plane which contains the axis of the shaft 14. At the outer end of this arm or bolt there is provided a ball pin 46 which is received by a strap at the lower end of a pitman 47 that has a strap at its upper end cooperating with a spherical crank element in the shaft 14. Through the connections described loop-seizing and shedding movements are imparted to the looper 37. Needle avoid movements are imparted to the looper by rocking the shaft 41 in appropriately timed relation to the reciprocation of the needle and the oscillation of the looper. For this purpose an eccentric 49 secured to the shaft 14 cooperates with a strap 50 on a pitman, the lower end of which is pivotally connected with an arm 51 secured to and extending rearwardly from the shaft 41. Suitable means of the character disclosed in said Hayes, et al. application is provided for advancing the work. Such means includes a four motion feed dog 52 (Fig. 1) which may be driven by connections from the shaft 14 of the general character disclosed in the patent to Wohlfart, No. 1,817,727, granted August 4, 1931.

The work is urged into cooperation with the feed dog by means of a presser foot 53 mounted upon a vertical movable presser bar 54. The latter is urged downwardly by means of a spring 55.

Turning now to Figs. 2 to 8 inclusive, the construction of the looper 37 and associated elements will be described in further detail. The looper has a main body portion provided with a downwardly extending shank 56 having a flat side 57, this shank being arranged to cooperate, with a corresponding opening in the upper end of the looper carrying arm 38. Extending laterally from the upper end of the shank 56 is a horizontal support portion 58 of the looper from the lower end of which extends upwardly and rearwardly an arm 59 from which projects laterally the thread carrying and needle loop seizing blade 60 of the looper. The latter is preferably curved in a substantially horizontal plane or is provided with a bend at about its mid-point, as indicated at 61 in Fig. 6. This member extends the looper to direct its outer end away from the vertical plane through the longitudinal axis of the support portion 58 assists in creating the desired thread triangle, as will be explained hereinafter. A thread passage 62 provided through the arm 59 adjacent its upper end enables the latter to cooperate with a slot 66 in the forward face of the blade 60 of the looper for appropriate threading of the latter.

Adjacent the free end of the blade 60 there is a thread passage 66 from the slot 65 extending to the top surface of the blade from which the looper thread L extends to the work.

For the purpose of retaining the needle thread loop on the blade 60 of the looper in proper position to insure formation of the desired thread triangle for the passage of the needle upon its descent along either of its paths of travel, there is mounted on the looper suitable loop retaining means. This comprises a member, preferably formed of spring steel, by which a portion 67 secured by a screw 68 to the support portion 58 of the looper, this portion having a screw threaded opening 69 therein to receive the screw. To provide for suitable adjustment of the thread loop retainer the base portion 67 is provided with an elongated arcuate slot 70 cooperating with a pin 71 extending upwardly from the support portion 58. It will be apparent that the retainer may be adjusted about the axis of the screw 68 and then secured in its adjusted position by tightening the screw. Integral with the base 67 is an upwardly and rearwardly extending arm 72 carrying at its upper end a rounded nose-like portion 73 which is urged resiliently against the forward face of the blade 60 of the looper.

As best shown in Fig. 2, the point of engagement is about midway between the ends of the blade and in the upper region thereof.

Another thread-loop detainer is also mounted on the main body of the looper. This has a base plate 74 provided with a vertically elongated slot 75 (Fig. 7) through which it is adjustably mounted by means of a screw 76 on the arm 59 of the looper. A branch 77 of plate 74 extends upwardly and outwardly away from the plate to provide a spring arm 78 arranged to engage under the surface of the blade 60 of the looper. The outer end of the spring arm 78 is turned downwardly, as shown at 79, to insure passage of the needle thread loop between the under surface of the blade 60 and the top of the spring arm 78 as the looper is given its loop-seizing movement.

The operation of the two loop retaining elements 73 and 78 is best shown in Figs. 2 to 5. In considering the showing of the elements in these views it must be understood that the needle 17 which is carrying another loop of needle thread downwardly along the right-hand path of movement of the needle was, during the formation of the preceding needle thread loop indicated by the limbs N and N' in the drawings, moved by the left hand path of movement. As the needle descends below the throat plate the looper is being retracted toward the right, as indicated by the arrows, but the previous needle thread loop is being held well inwardly from the free end of the loop by the action of the retainer 73. This retainer acts upon the spring 78 to hold the needle thread loop. After the point of the needle has descended below the limb N', the continued movement of the looper toward the right will bring about the release of the thread from the frictional retainer 73 so that the loop will assume the position indicated in Fig. 2. It will be noted that the loop is still retained by the spring arm 78; so that, as the needle continues to descend, it will pass in front of the limb N of the previ
ous needle thread loop. This, by the combined action of the two loop retainers 73 and 78 the proper positioning of the blade: the desired thread tri is brought about. As hereinabove indicated, this is of particular importance when the needle is descending along its righthand path of travel in the course of forming zigzag stitches.

In Figs. 8, 9, and 11 there is shown the same type of looper, having two separate needle loop retaining means and also having applied to the looper a suitable needle guard 89 positioned appropriately in front of the blade of the looper. This needle guard has integrally connected therewith a flat base portion 81 superimposed upon the base portion 67 of the first described loop retaining element. The needle guard is secured to the looper by means of the same screw 86 by which the thread loop retainer is attached. As best shown in Fig. 11, the outer end of the needle guard is curved outwardly away from the loop-seizing blade of the looper to provide the desired needle guard function.

Figs. 10, 12, 13 and 15 show a modified form of loop retainer which incorporates in a single member the two loop retaining elements. This member, illustrated in perspective in Fig. 13, has a base plate 82 provided with an opening 83 for the reception of a screw 84 by means of which the combined loop retainer may be secured to the arm 59 of the looper. It will be understood that the latter has a screw threaded opening to receive the screw threaded shank of screw 84. Preferably the opening 83 is of somewhat larger diameter than the shank of the screw to enable slight adjustment of the combined loop retainer. A curved spring arm portion 85 of the retainer extends laterally from the base plate beneath the blade 60 of the looper and engages the under face of the blade at approximately the same point as the arm 78 of the second retainer described in relation to Fig. 2. The point on the arm 85 which so engages the under face of the looper is indicated at 86 in Fig. 13. Beyond this the arm is curved downwardly as indicated at 87 to provide clearance for the needle thread loop to pass between the retainer and the under surface of the blade 60 of the looper. An upwardly projecting part 88 of the arm 85 is curved wings 89, as best shown in Fig. 12, is adapted to engage the front face of the loop-seizing blade 60 of the looper. Its point of contact with such front face coincides substantially with that of the nose 73 of the retainer shown in Fig. 4. Due to the springiness of the arm 85 and the upward extension 88 a suitable frictional gripping of the indicated surfaces of the loop-seizing blade to retain the needle thread loop in the same manner as the element 73 and 78 of Fig. 2, at the points described, in the course of a cycle of operation of the machine.

It should be understood that the blade 60 of the looper, in the modified construction shown in Figs. 10, 12, 13, and 14, may be curved or bent in a substantially horizontal plane in the same manner as the blades of the earlier forms described. Also a needle guard, similar to the guard 80, may be mounted on the support portion 58 of the looper body.

While several illustrative embodiments of the invention have been described in some detail, it will be understood that various changes may be made in the construction and arrangement of the various elements and parts thereof within the scope of the appended claims. The provision of means for frictionally retaining a needle loop at two spaced points along the looper blade makes unnecessary the provision of a separate four-motion loop retainer even in the formation of relatively wide gauge zigzag stitches.

What is claimed is:

1. In a sewing machine a looper assembly comprising a looper having a main body portion and a loop seizing blade projecting laterally from said body portion, and resilient means carried by said body portion in fixed relation thereto having parts thereof yieldingly urged into engagement with said blade and arranged to grip and frictionally retain a needle thread loop on said blade at two spaced points intermediate the ends of said blade.

2. In a sewing machine a looper assembly comprising a looper having a main body portion and a loop seizing blade projecting laterally from said body portion, and resilient means carried by said body portion in fixed relation thereto having parts thereof yieldingly urged into engagement with said blade and arranged to grip and frictionally retain a needle thread loop on said blade at two spaced points intermediate the ends of said blade, said means having a part arranged to urge a portion of said thread loop against a side face of said blade and another part arranged to urge a portion of said thread loop against the under surface of said blade.

3. In a sewing machine a looper assembly comprising a looper having a main body portion and a loop seizing blade projecting laterally from said body portion, and a single resilient member carried by said body portion in fixed relation thereto having parts thereof yieldingly urged into engagement with said blade and arranged to grip and frictionally retain a needle thread loop on said blade at two spaced points intermediate the ends of said blade, said means having a part arranged to urge a portion of said thread loop against a side face of said blade and another part arranged to urge a portion of said thread loop against the under surface of said blade.

4. In a sewing machine a looper assembly comprising a looper having a main body portion and a loop seizing blade projecting laterally from said body portion, and resilient means carried by said body portion arranged to engage and frictionally retain a thread loop on said blade at two spaced points intermediate the ends of said blade, said means having a part arranged to urge a portion of said thread loop against a side face of said blade adjacent the top thereof and another part arranged to urge a portion of said thread loop against the under surface of said blade.

5. In a sewing machine a looper assembly comprising a looper having a main body portion and a loop seizing blade projecting laterally from said body portion, said blade being bent laterally in a substantially horizontal plane, and resilient means carried by said body portion in fixed relation thereto having parts thereof yieldingly urged into engagement with said blade and arranged to grip and frictionally retain a needle thread loop on said blade at two spaced points intermediate the ends of said blade.

6. In a sewing machine a looper assembly comprising a looper having a main body portion and a loop seizing blade projecting laterally from said body portion, resilient means carried by said body portion in fixed relation thereto having parts thereof yieldingly urged into engagement with said blade and arranged to grip and frictionally retain a needle thread loop on said blade at two spaced points intermediate the ends of said blade, and means for adjusting said resilient means to said body portion.

7. In a zigzag sewing machine having work feeding devices arranged to feed work pieces in a predetermined direction, a reciprocable needle bar carrying a thread bearing needle, a carrier for said needle bar arranged to shift the same back and forth transversely of the direction of feed, and a motion, thread carrying looper cooperating with said needle to form a zigzag line of stitches, said looper comprising a body portion and a loop seizing blade projecting laterally from said body portion, the combination of resilient means carried by said body portion of said looper in fixed relation thereto and having spaced needle thread loop engaging parts urged yieldingly against said blade at points spaced along the length thereof to retain the loop momentarily at said points.

8. In a zigzag sewing machine having work feeding devices arranged to feed work pieces in a predetermined direction, a reciprocable needle bar carrying a thread bearing needle, a carrier for said needle bar arranged to
shift the same back and forth transversely of the direction of feed, thread carrying looper cooperating with said needles to form a zigzag line of stitches, said looper comprising a body portion and a loop seizing blade projecting laterally from said body portion, the combination of resilient means mounted on said body portion of said looper in fixed relation thereto and having spaced needle thread loop engaging parts urged yieldingly against said blade at points spaced along the length thereof to retain the loop momentarily at said points, said points at which said parts of said resilient means engage said blade being so disposed as to retain the loop in a position to form a triangle with the looper thread and said blade through which the needle may descend.

9. In a zigzag sewing machine having work feeding devices arranged to feed work pieces in a predetermined direction, a reciprocable needle bar carrying a thread bearing needle, a carrier for said needle bar arranged to shift the same back and forth transversely of the direction of feed, and a four motion, thread carrying looper cooperating with said needle to form a zigzag line of stitches, said looper comprising a body portion and a loop seizing blade projecting laterally from said body portion, the combination of resilient means mounted on said body portion of said looper in fixed relation thereto and having spaced needle thread loop engaging parts urged yieldingly against said blade at points spaced along the length thereof to retain the loop momentarily at said points, and means for adjustably securing said resilient means to said body portion of the looper.

10. In a zigzag sewing machine having work feeding devices arranged to feed work pieces in a predetermined direction, a reciprocable needle bar carrying a thread bearing needle, a carrier for said needle bar arranged to shift the same back and forth transversely of the direction of feed, a four motion, thread carrying looper cooperating with said needle to form a zigzag line of stitches, said looper comprising a body portion and a loop seizing blade projecting laterally from said body portion in a direction transverse to the direction of feed, and means for oscillating said looper in said transverse direction to seize and shed needle thread loops, said blade having a bend therein to provide a free ended portion directed in part in the direction of feed, the combination of resilient means mounted on said body portion of said looper in fixed relation thereto and having a part thereof urged yieldingly against said blade at a point inwardly of said free ended portion thereof and another part urged yieldingly against said blade at a point along said free ended portion thereof.

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