

July 30, 1957

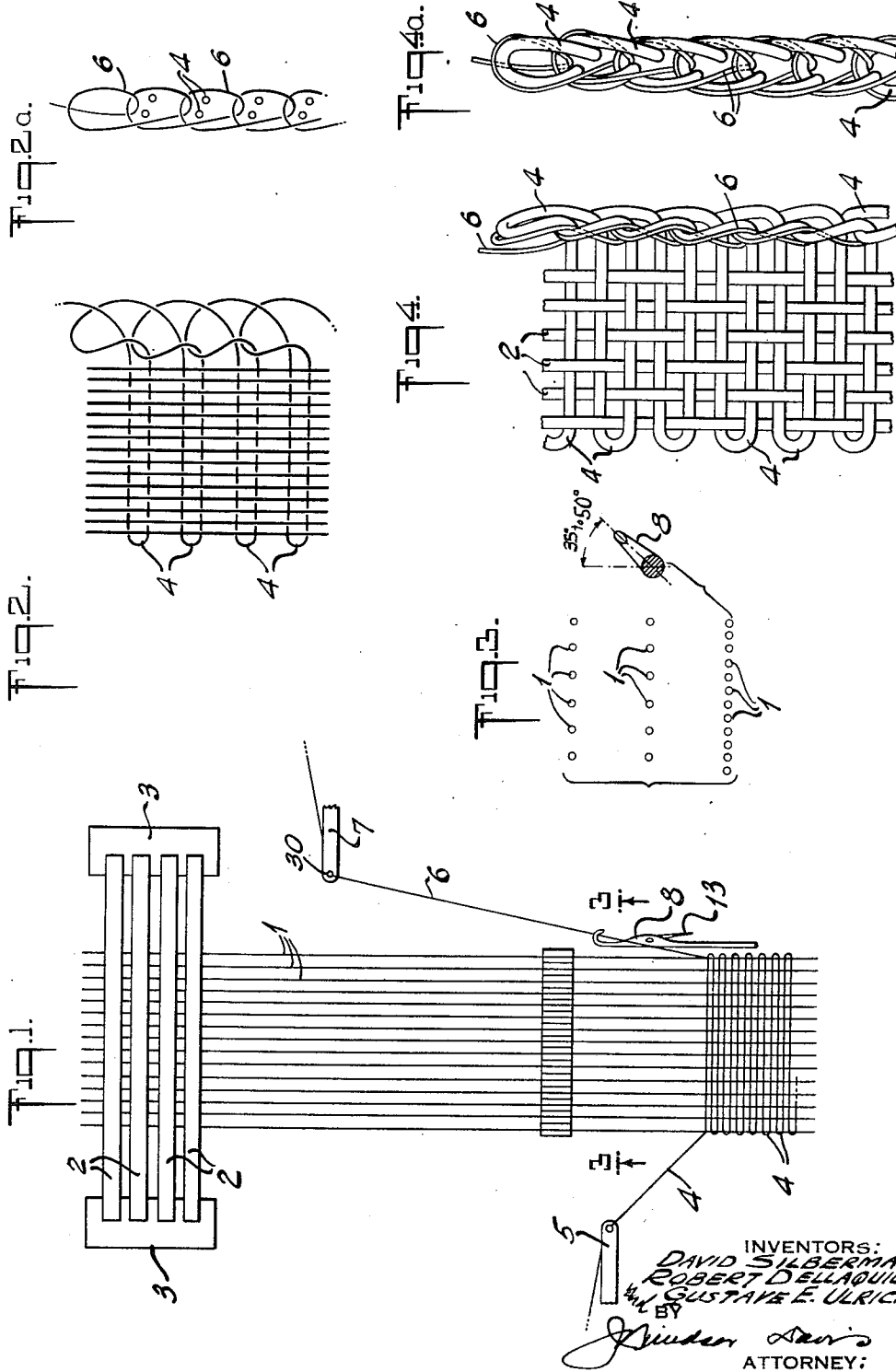
D. SILBERMAN ET AL

2,800,927

SHUTTLELESS LOOM FABRIC

Filed Dec. 15, 1952

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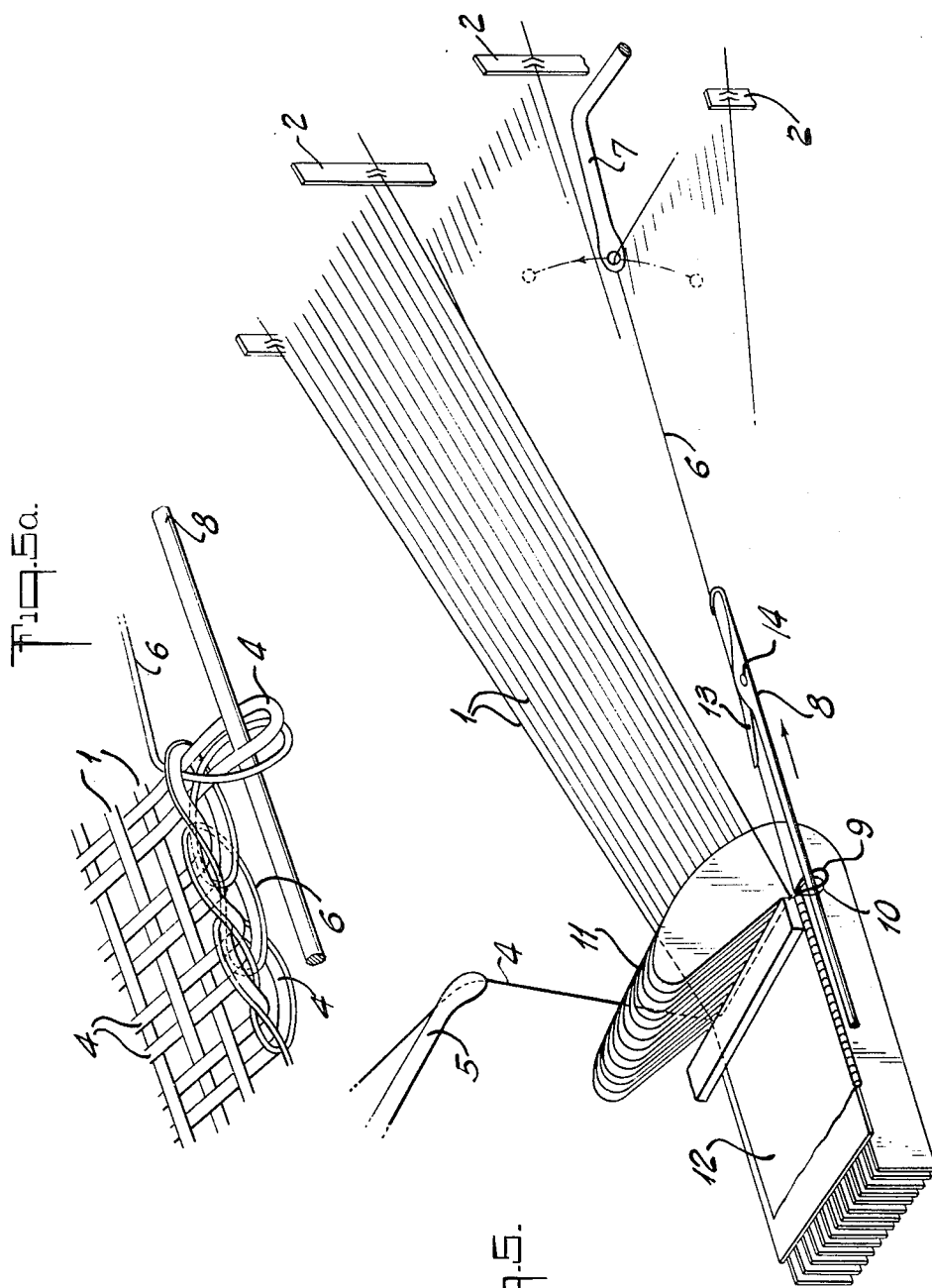
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8 Sheets-Sheet 2



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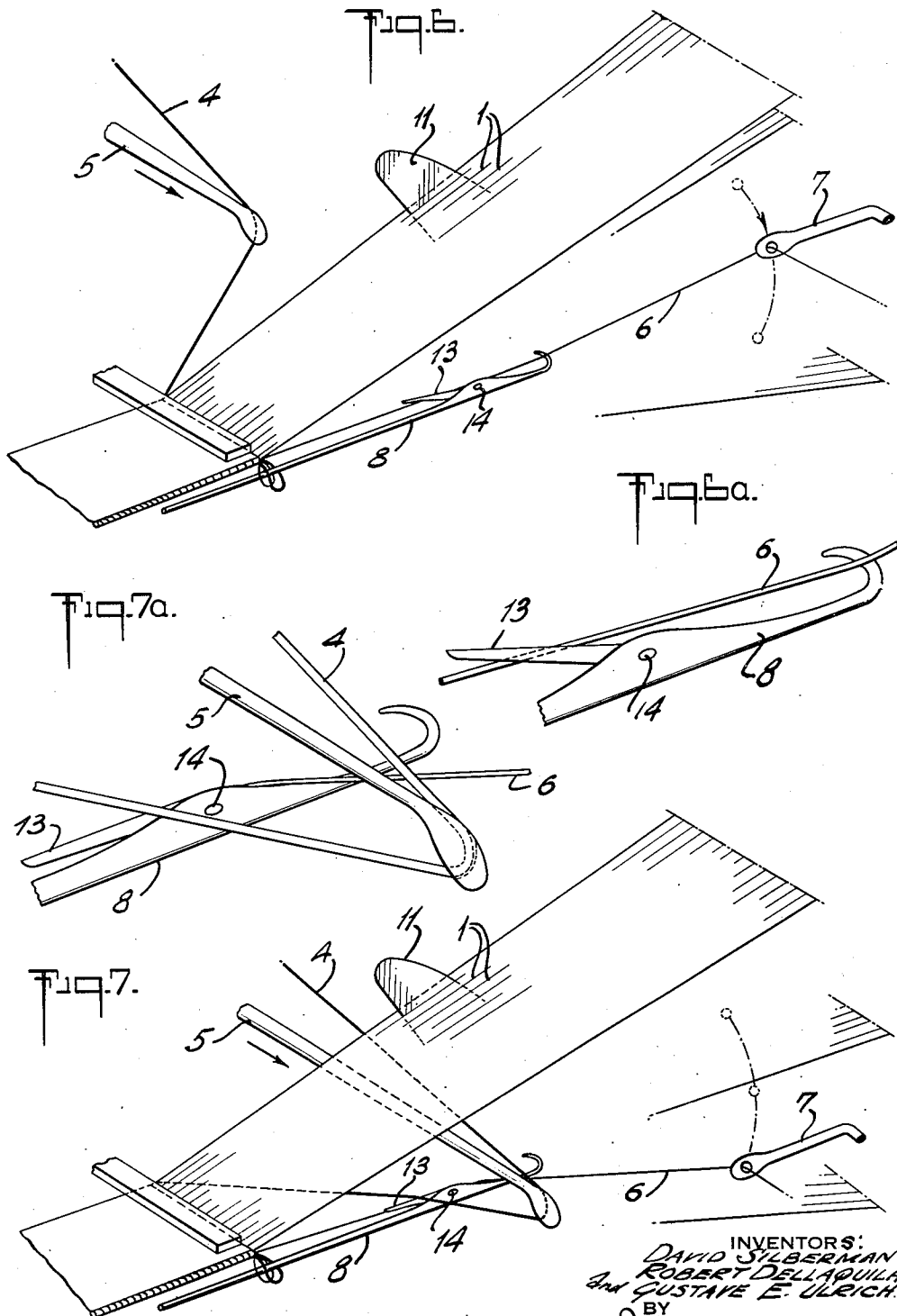
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SHUTTLELESS LOOM FABRIC

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8 Sheets-Sheet 3



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SHUTTLELESS LOOM FABRIC

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Fig. 8a.

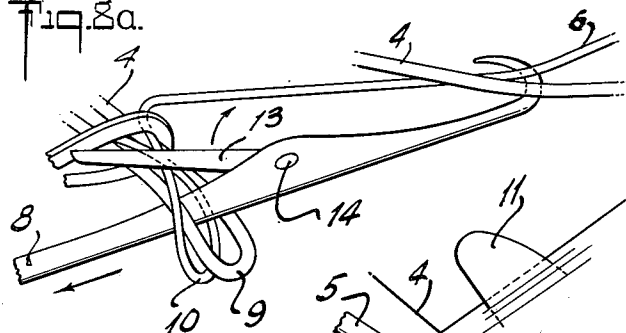


Fig. 8.

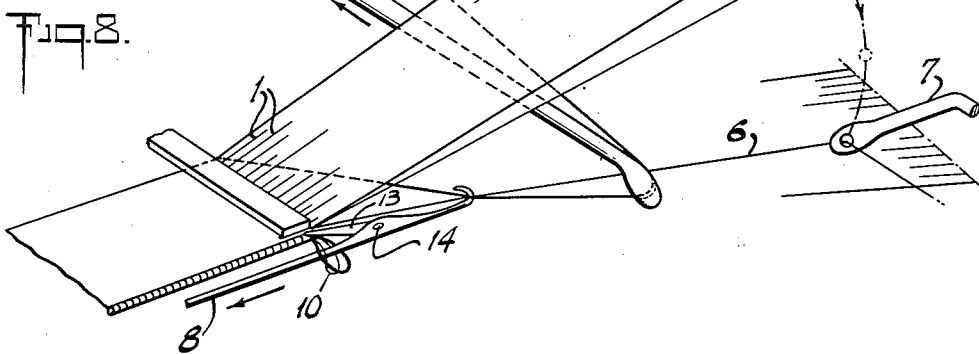


Fig. 8a.

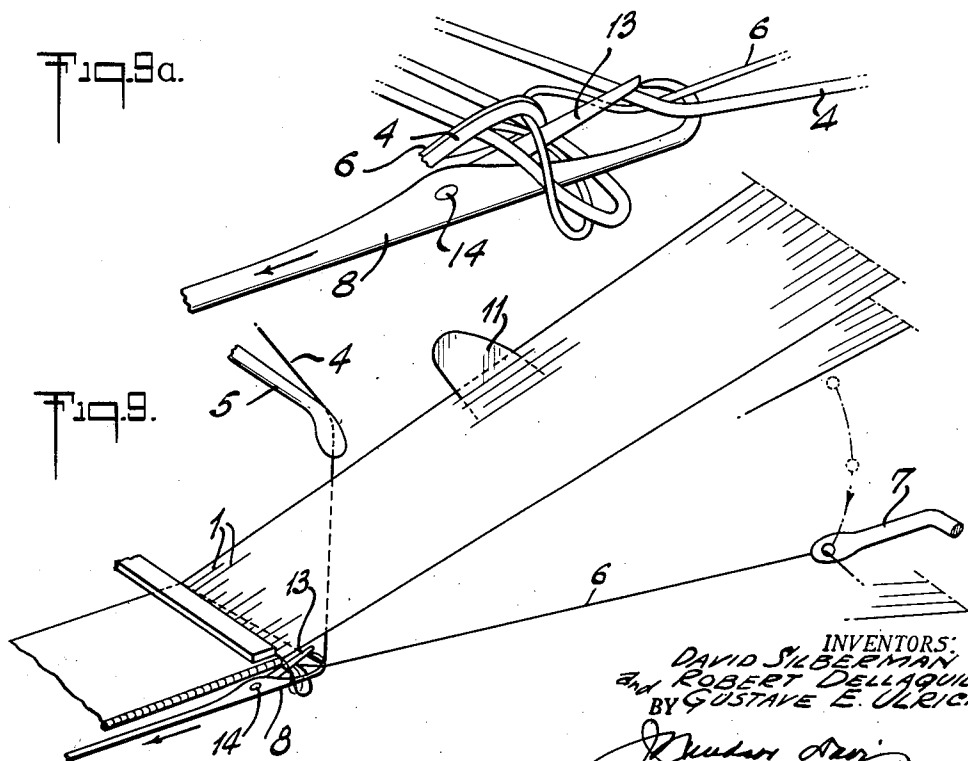


Fig. 8.

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SHUTTLELESS LOOM FABRIC

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Fig. 10.

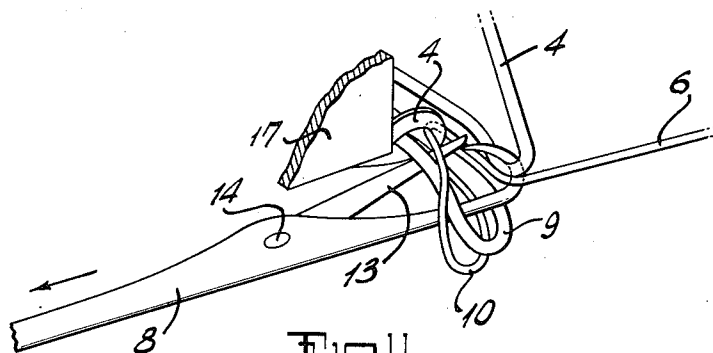


Fig. 11.

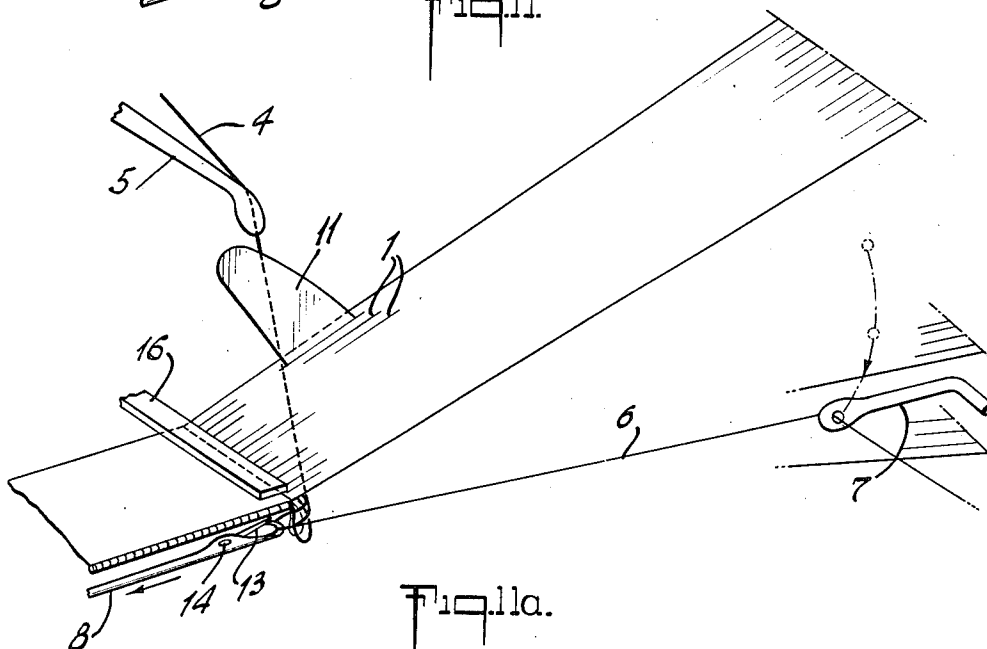
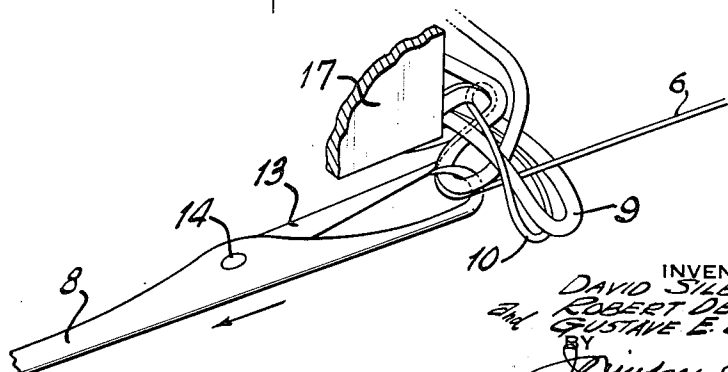


Fig. 11a.



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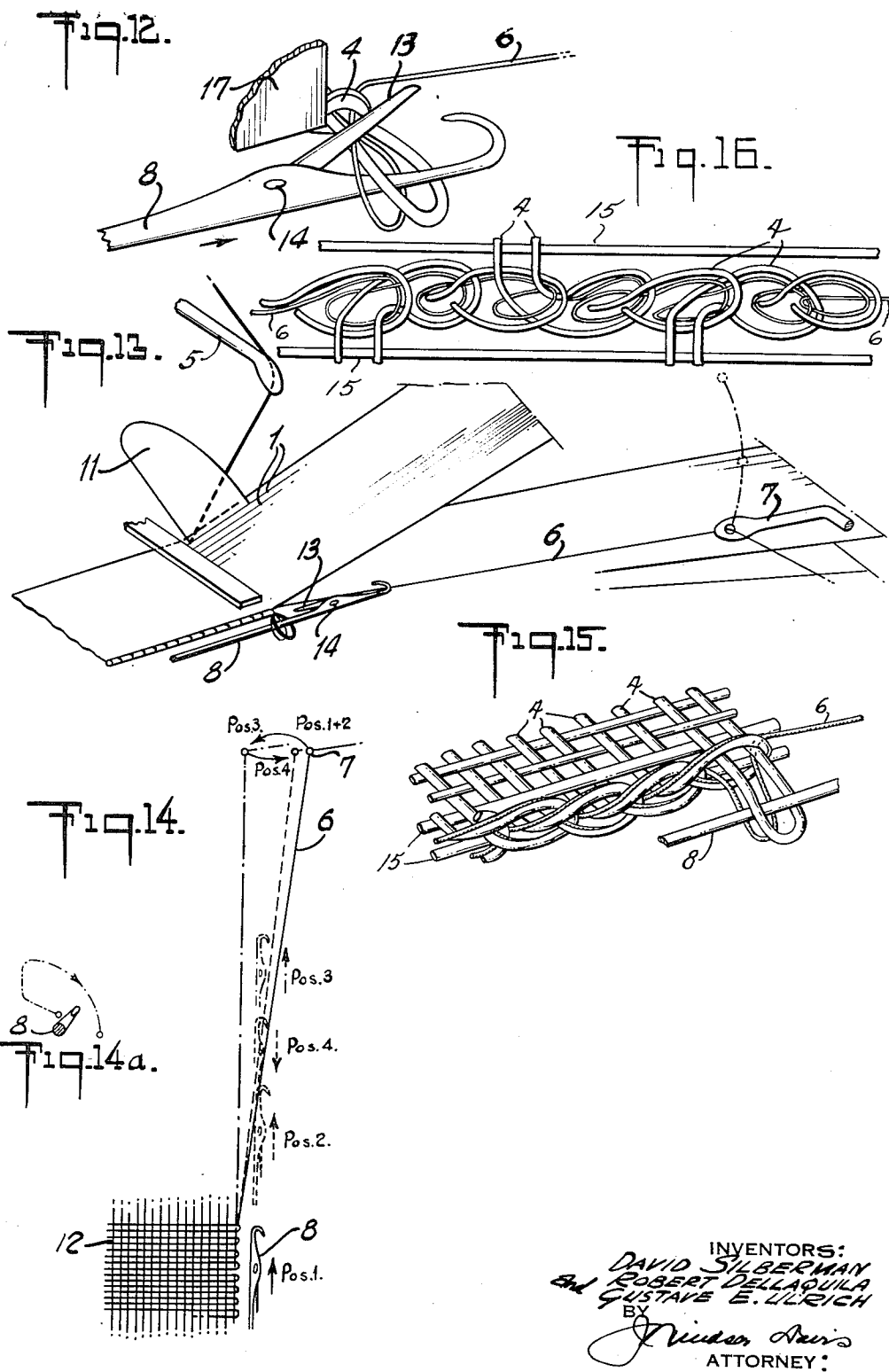
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8 Sheets-Sheet 6



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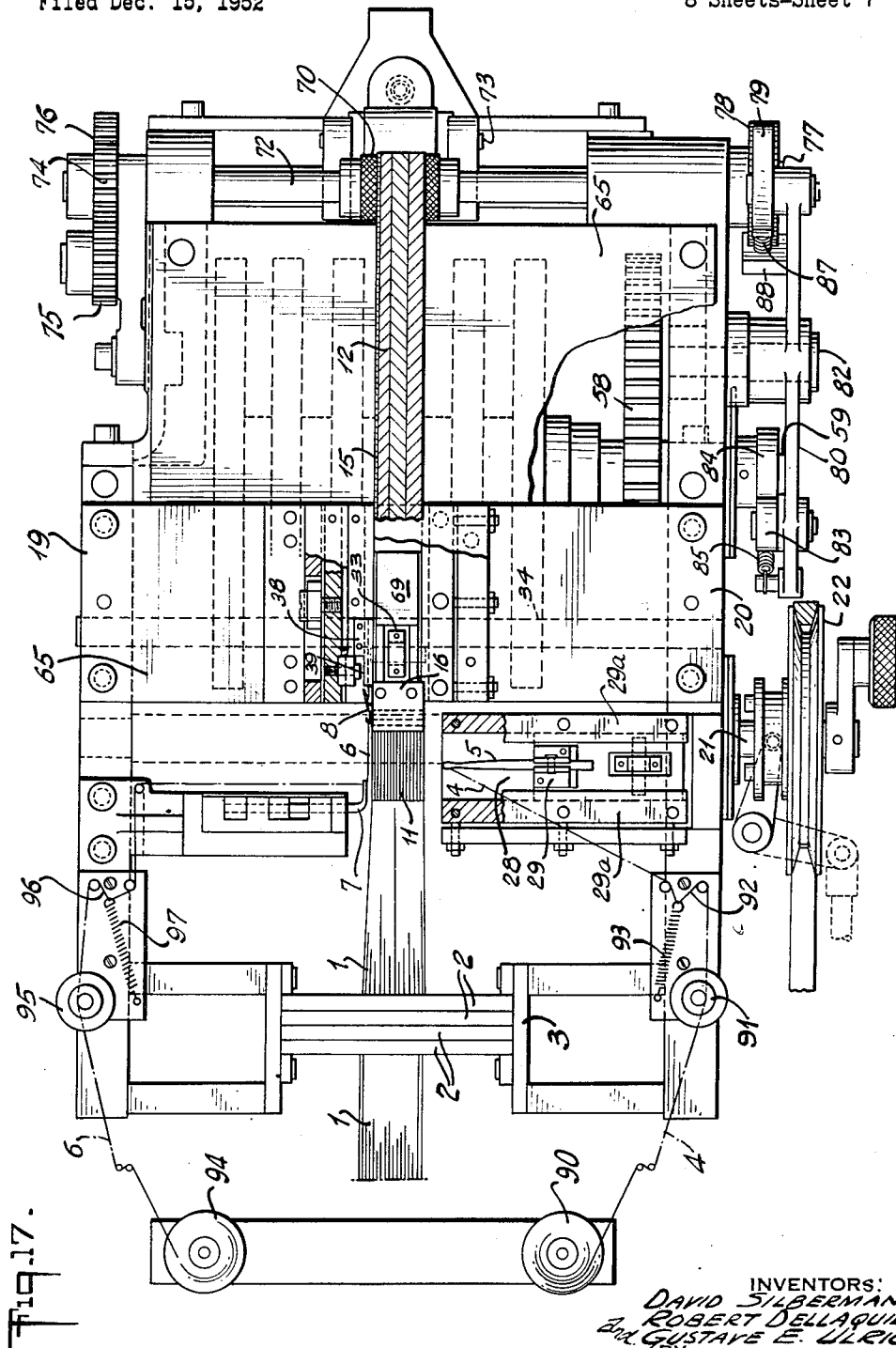


Fig. 17.

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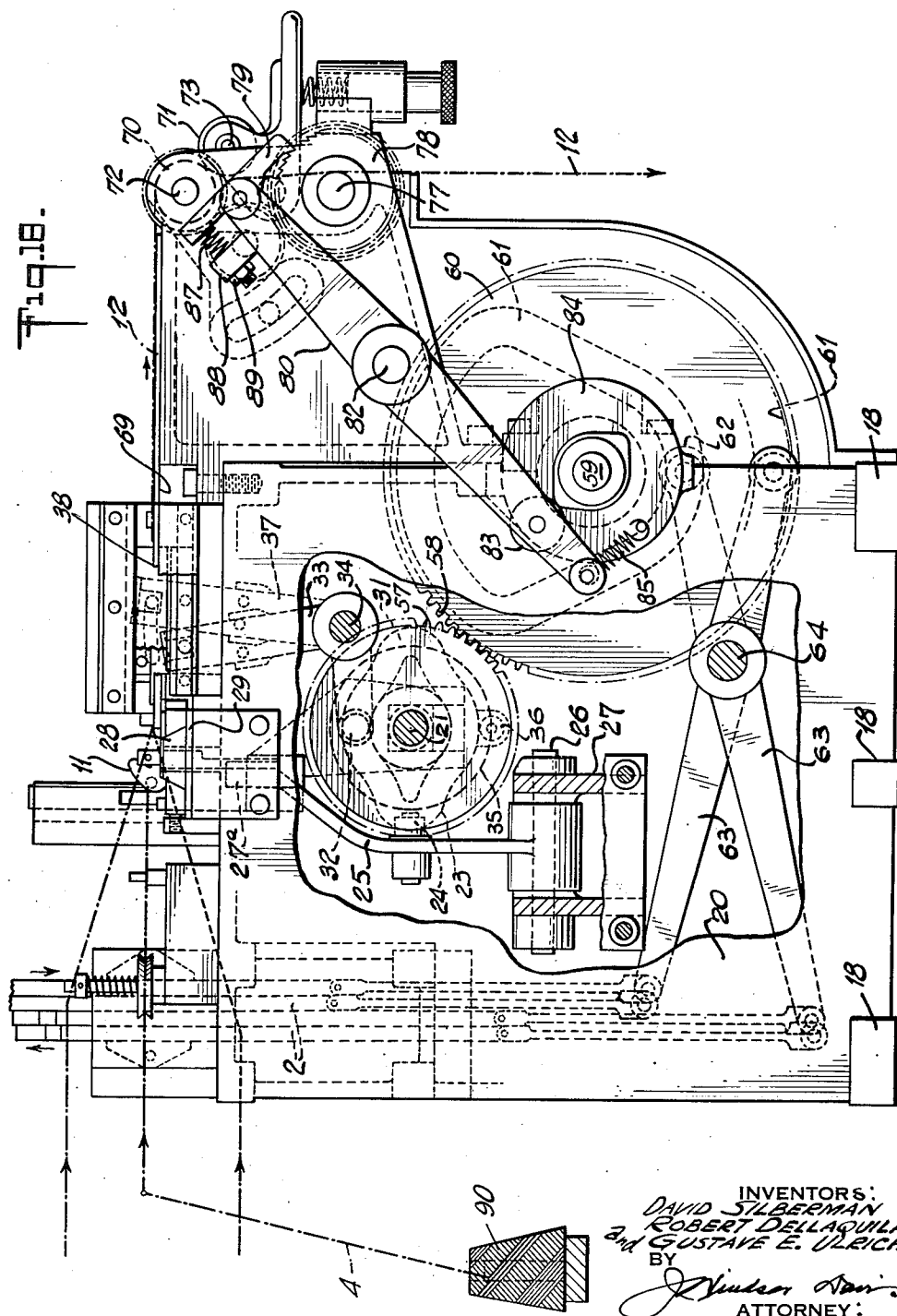
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2,800,927

SHUTTLELESS LOOM FABRIC

David Silberman, New York, and Robert Dellaquila, Long Island City, N. Y., and Gustave E. Ulrich, Union City, N. J., assignors, by mesne assignments, to Bonas Bros. Weavematic Looms (England) Ltd., Staffordshire, England, a company of England

Application December 15, 1952, Serial No. 325,994

3 Claims. (Cl. 139—383)

This invention relates to shuttleless looms of the type particularly adapted for weaving narrow fabric such as tape, braid, and the like. This application is a continuation in part of our co-pending application Serial Number 275,329, filed March 7, 1952, now Patent 2,758,614, dated August 14, 1956.

A principal object of the invention is to provide a shuttleless loom having a weft layer traversable through sheds of warp threads to lay the weft or filler threads (according to a pattern) having loops along the edges thereof and to engage the loops of one edge with each other and simultaneously with a locking thread so that a selvage edge is formed of an improved locked loop stitch. With respect to the original application of which this is a continuation in part, it is an object of this invention to teach an improvement in the manner of forming the locking stitch in order to obtain improved appearance of the selvage edge. With respect to said original application, it is a further object of this invention to provide means for laying in a double bead cord as a part of the warp. The double bead cords are useful as a means of accepting the attachment of slide fastener elements to narrow fabric which is commonly known as slide fastener tape.

Another object of the invention is to provide a lock stitch needle traversable through the selvage loops together with means for causing a locking thread from a separate spool to be fed to and looped around this needle in such manner that it knits the loops together and simultaneously forms a chain of the locking thread. The selvage loops are thus better locked, against unravelling, by a thread which can be supplied by a full sized spool which requires no attention over long periods of loom operation.

Where bead cords, as above mentioned, form a part of the selvage edge the bead cords are a part of the warp threads so that the loops of the weft or filler threads extend therewith for engagement by the locking cord, as in the case of a simple selvage edge with the exception that they are laid, preferably, according to a different pattern. An object of this invention is to teach the preferred manner of forming this part of the pattern to accomplish the following results: first, to form a locking stitch which will be continuous with respect to the exterior of the bead cords and which will cover the juncture of those cords, and second, to impart to the beaded tape a shape which will be concave longitudinally so that when the slide fastener elements are applied by a chain machine, the slide fastener chain will be straight.

Another object of the invention is to provide an improved weft layer and operating mechanism therefor, the primary feature of which is in its timed linear operating path. A thread fed by this device can be readily controlled for constant tension, thus assuring accuracy of placement and uniformity of weave. The smooth movements of this mechanism are, also, a great aid in avoiding thread breakage. Maximum tension may, therefore, be applied to the thread available to this needle and the tensioned thread lends itself readily for connection to a

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switch capable of shutting off operation of the loom motors when it breaks.

A further object of the invention is to provide a simplified mechanism according to which the loom may be made small, compact, and economical to construct. As will hereinafter more fully appear, the weft layer, packing-comb or reed, locking needle and locking thread control means supplying the locking needle are all operated by a single camshaft. The above objects are thus made possible and further advantages accrue such as the opportunity to time the several cams with respect to each other with much greater facility.

As will be seen more fully hereinafter, this loom lends itself to threading from large spools and for operation for long periods of time without the attention of an operator. One operator can therefore supervise the operation of a large battery of these looms. The direct labor costs are thus greatly reduced. If some part should break, its assembly may be separately dismantled and taken to a machine shop for repair, thus reducing the indirect labor cost also.

Other objects and advantages will become more fully apparent as reference is had to the accompanying drawings wherein the invention is illustrated and in which:

Fig. 1 is a diagrammatic plan view of tape being made according to the invention;

Figs. 2 and 2a are diagrammatic plan views of the paths followed by weft thread and by the locking thread respectively in the manufacture of the body of the tape, but separately shown;

Fig. 3 is a transverse vertical section taken along the line 3—3 of Fig. 1 showing the relative position of the locking needle with respect to the warp threads from the headles;

Fig. 4 is a plan view of very loosely woven tape, in final form, made according to the invention, showing the actual construction of Figs. 2 and 2a;

Fig. 4a is an end view of Fig. 4;

Fig. 5 is a perspective view of the tape being formed, the relative positions of the parts being shown when the comb or reed is in full forward position after the laying of a double weft loop;

Fig. 5a is an enlarged perspective view of a portion of Fig. 5 showing the locking needle shank with a weft thread loop and locking thread therearound;

Fig. 6 is a view similar to Fig. 5 showing the needle in forward position just at the moment of first engaging the locking thread, the reed being now rearward;

Fig. 6a is an enlarged view of the needle in the position of Fig. 6;

Fig. 7 is a view similar to Fig. 6 showing the needle after it has fully engaged the locking thread and started forward;

Fig. 7a is an enlarged view of the needle and weft layer in the position of Fig. 7;

Fig. 8 is a view similar to Fig. 7 showing the needle as it engages the front run of a weft loop and while retaining engagement with the locking thread;

Fig. 8a is an enlarged view of the needle engaging the front run of a weft loop and while retaining engagement with the locking thread as in Fig. 8;

Fig. 9 is a view similar to Fig. 8 showing the needle as it closes preparatory to pulling the filler thread and the locking thread through loops on the shank of the needle;

Fig. 9a is an enlarged view of the needle as it closes preparatory to pulling the filler thread and the locking thread through loops in the shank of the needle similar to the position shown in Fig. 9;

Fig. 10 is an enlarged view of the needle as it is in the process of pulling the front run of the weft loop and the

locking thread through the loops of weft and locking thread formed by the preceding operation of the needle;

Fig. 11 is a view similar to Fig. 9 showing the needle after it has formed the lock stitch;

Fig. 11a is an enlarged view of the needle in the position of Fig. 11;

Fig. 12 is a view similar to Fig. 10 showing the needle going forward after slipping through the two new loops and prior to being opened thereby;

Fig. 13 is a view similar to Fig. 11 showing the needle moving rearwardly, the catch cord guide being down and the reed remaining in forward position;

Fig. 14 is a diagram to show the timing of the needle with respect to the catch cord guide;

Fig. 14a is also a diagram, looking along the length of the needle for purposes of explaining the timing of the needle and catch cord guide;

Fig. 15 is a perspective similar to Fig. 5a showing a double bead cord forming a part of the warp, with the catch cord applied;

Fig. 16 is a longitudinal schematic side view shown in Fig. 15;

Fig. 17 is a top plan view of the loom; and

Fig. 18 is a side elevation of the loom, with one main side plate broken away for purposes of illustration.

In explaining the invention the steps in the formation of a strip-like fabric such as tape or braid will be explained first. Thereafter the loom will be explained.

Fig. 1 shows a multiplicity of threads 1 threaded through a series of headles 2 which are guided by headle guides 3 in vertical pattern forming movements to form the warp of the fabric. A vertical section through the threads, as illustrated in Fig. 3, shows the threads 1 which come from one headle to form a shed which is parallel to the sheds from each other headle. A filler thread 4 is threaded through a guide 5, the guide moving back and forth between the sheds which come from the several headles 2 to lay the filler thread in successive loops to form the weft of the fabric. Another thread 6 is the catch cord or locking thread which is guided by a catch cord guide 7 into timed engagement with the lock stitch needle 8.

Fundamentally, the formation of the fabric is shown in Fig. 2 in which it will be seen that each loop of the weft threads 4 is carried into the path of the succeeding loop which passes therethrough. In Fig. 2a, the stitch or path of the locking thread or catch cord 6 is illustrated. It passes through its own loop then through its second successive loop, around the two branches 4 of a weft loop then through its intermediate loop.

Fig. 4 shows the results of simultaneously weaving the fabric and locking the weft loops by interthreading the locking cord therewith. In this view and in Fig. 4a, which is a side elevation of Fig. 4, it will be seen that each weft loop extends through a succeeding weft loop and that each catch cord passes through a weft loop and its own loop then encircles both branches of the second succeeding weft loop and its own second successive loop and its own intermediate loop, and so on.

As seen in Figs. 5 and 5a, after the feeder 5 has laid a double strand of the thread 4 through the warp threads 1 the needle 8 is moving rearwardly through the loop of the thread 4 and through a loop 10 of the catch cord 6. The comb or reed 11 is in the position of packing the filler strand into place against the fabric 12 already made. The catch cord guide 7 has started its upward movement.

In Fig. 5 the needle 8 is illustrated as progressing on its rearward stroke in open position. In Fig. 6 this needle has reached its rearmost position. The catch cord guide 7 has a vertically arcuate movement and is illustrated as having reached its uppermost position and returned halfway down thus moving the catch from in rear of the needle to a position crossing the needle. The comb 11 is now in rearward position. When the guide 7 reaches the bottom of its movement as illustrated in Fig. 7, it has carried the catch cord over the open end of the needle 8,

the needle 8 by this time having begun its return movement forward. The filler thread feeder 5 has now carried a new pass through the weft threads. As the needle 8 moves forwardly it retains engagement with the catch cord 6 and also engages the forward strand of the thread 4, as shown in Fig. 8. As this happens, it will be noted particularly in Fig. 8a that the closing element 13 of the needle 8 is sliding on the loops 9 and 10 around the needle so that as the needle 8 continues its forward movement to the position shown in Figs. 9 and 9a the closing element 13 rotates on its pivot 14 thus closing the end of the needle 8.

Continued forward movement of the needle 8 thus causes it to carry the catch cord 6 and the lower strand of the new pass of the filler thread 4 into and then completely through the loops 9 and 10, as shown in Figs. 10, 11 and 11a. In Fig. 11 it is seen that the feeder 5 has begun its withdrawal through the warp threads. It then completes its withdrawal after the loops 9 and 10 are slipped off the needle thus putting tension on the strand leading to the loop 9 which will thereby pull it and the loop 10 closely against the selvage edge of the fabric. A tensioning device (not shown) also tensions the cord 6. The new strands are pulled beneath a guide or hold-down bar 16 and against a stripper plate 17.

The needle 8 dwells momentarily at the end of its forward stroke so that the cord 4 may be tensioned thus pulling the old loops 9 and 10 against the selvage edge and so that the comb 11 may pack the new strands before the needle can move them out of place.

When the needle 8 now goes rearwardly on a new stroke that portion of the threads 4 and 6 which are caught in the closed end of the needle stay substantially in the position illustrated in Figs. 11 and 11a, the needle 8 in moving rearwardly thus passes through them, causing the closure elements 13 to open and we have two new loops, the same as loops 9 and 10 around the needle as illustrated in Figs. 12 and 13.

As a further explanation of the operation of the needle 8 and the locking thread or catch cord 6, reference is made to Figs. 14 and 14a. In Fig. 14 the timing of the needle is as follows: when the needle 8 is in forward position, indicated as position 1, the guide 7 is in lowermost position, the catch cord extending from the selvage edge of the fabric 12 to the guide 7. The guide remains in lowermost position until the needle moves about half way rearwardly to its position 2. As the needle moves to its rearmost position 3 the guide completes its upward arcuate travel and begins its return so that by the time the needle has moved one-fourth the way forward to position 4, the guide is well on its downward stroke, thus carrying the locking thread 6 from a position in rear of the needle to a position across the needle, so that it will be engaged by the needle.

The timing of the needle 8 with respect to its guide 7 need not be exactly as above described, and in fact has been varied substantially from that just described, due to other considerations, as for instance, in the investigation of the best and most economical manner of making certain other loom parts. The desiderata is that the locking thread 6 must be moved across the needle in such manner that the hook of the needle will positively engage it, so that the hook will be able to engage the forward weft thread as illustrated in Fig. 8.

The foregoing description is directed essentially to the manufacture of narrow fabrics. One type of narrow fabric used in quantity is slide fastener tape. It is conventional for a slide fastener manufacturer to purchase tape and to stitch bead cording on one edge thereof. The fastener elements are applied to the cord in a chain machine. Numerous attempts have been made, some successful, to weave the bead cord as a part of the tape. So far as applicant is aware, no one has heretofore marketed such a tape having the advantages of that shown in Figs. 15 and 16.

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In Fig. 15 the narrow fabric is essentially the same as has been previously described with the exception that two bead cords 15 constitute the outer two warp threads and each is fed through its own headle (not shown). These cords 15 are so guided by the loom that one will be directly atop the other, a plane containing their axes being normal to the plate of the rest of the tape. They alternate with each other but each is woven one under, three over each weft loop as shown in the perspective view in Fig. 15. In applicants' method of weaving the warp threads form a new shed between successive loops as distinct from successive loop legs. The needle 8 receives each loop in the same manner as previously described, that is, it acts to pass each loop through each succeeding loop, and the locking thread or catch cord 6 is also applied in exactly the same way. When the threads are all pulled taut the edge of the tape will then appear as illustrated in Fig. 16 in which it will be seen that the locked loops of the weft threads 4 and the locking cord 6 form a continuous pattern which covers the exposed juncture of the two bead cords 15. That is to say the fabric is formed by a weft thread laid in successive loops in a shed formed by warp threads, the warp threads at the selvage edge of the fabric being bead cords and overlying each other in a direction normal to the plane of the fabric. The weft threads in forming the successive loops pass between the bead cords and then over one bead cord, and then alternately between the bead cords and under the other thereof. The weft loops each extend through a succeeding weft loop and a locking thread is interthreaded with the interthreaded weft loops. That is the locking thread is interthreaded alternately through each of the loops and around both branches of a succeeding loop.

In forming the beaded tape it is recommended that the reed 11 be of such width that it will not beat the weft thread adjacent the last warp thread next to the bead cords.

The loom will now be described briefly. It is fully illustrated in the parent case previously identified.

The base of the loom is composed, essentially, of several cross members 18 from which the side plates 19 and 20 arise. Journalled in the side plates is a cam shaft 21 which projects outwardly through the side plate 20 to receive a driving pulley 22 adapted to be driven by a motor (not shown). This shaft carries a cam 23 the function of which is to actuate the filler thread feeder. This cam has a track to receive a roller 24 rotatably mounted on a feeder actuating arm 25. The arm 25 is pivotally mounted at its lower end on a rockshaft 26 mounted in a bracket 27, the bracket being secured to the mainside plate 20. As seen in Fig. 17, rotation of the cam 23 causes the arm 25 to oscillate on the shaft in a vertical arc parallel to the plane of the paper.

The arm 25 is forked at its upper end 27a to form a sliding yoke connection with a slide 28 mounted on a sliding base member 29 which carries the filler thread guide 5 and which has a linear path normal to the direction of movements of the warp threads. The path of the movement of the sliding member 29 is defined by the guides 29a.

Thus, as the cam 23 rotates this arm 25 is oscillated in a vertical arc which causes reciprocation of the filler thread guide 5 in a path parallel to the plane of the paper of Figure 17. It is to be noted that the guide 5 is elongated and projects well ahead of the base member 29 so that it may travel back and forth through the sheds of the warp, as indicated in Figs. 6, 8, 9 and 11, the outer end of this guide having an eye 30 (see Fig. 1) through which the filler thread is threaded.

The second cam 31 on the shaft 21 has the function of actuating the reed or comb 11. This cam has a track to engage a roller 32 carried on the outer end of a bell crank lever 33, this lever being rockably mounted on a supporting shaft 34 which is supported by the side plates 19 and 20. The outer end of the lever 33 carries the reed or comb 11 so that rotation of the cam 31 causes oscilla-

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tion of the lever 33 in a vertical arc and movement of the reed 11 parallel to the eye of the reader as viewed in Fig. 18.

A third cam on the shaft 21 has the function of actuating the catch cord needle 8. It has a cam track engaged by a roller which is carried by the outer end of a bell crank 37 rockably mounted on the supporting shaft 34. The outer end of the bell crank is yoked to bracket 38 to which a needle holding block 39 is bolted. Rotation of the camshaft 21 causes oscillation of the lever 37 and movement of the needle 8 parallel to the plane of the paper as viewed in Fig. 18.

A fourth cam on the shaft 21 has the function of actuating the catch cord guide 7. The guide 7 is given a motion through a vertical arc as hereinbefore stated. The details of the mechanism are shown in detail in the parent application.

The camshaft 21 has a driving gear 57 keyed thereon in engagement with a gear 58 keyed on a shaft 59 journalled in the plates 19 and 20. This shaft 59 has the pattern cams 60 keyed thereon, the function of which is to actuate the headle frames 2 in timed relation. Each of these cams has a cam track 61 (Fig. 18) for receiving roller 62 each of which is rotatably mounted on the end of a long lever 63 pivotally mounted intermediate its ends on a supporting shaft 64 supported by the side plates 19 and 20. The other end of each lever 63 is pivotally attached to the bottom of a headle 2, as best shown in Fig. 18. Fig. 18 shows only two cam levers 63 connected to headles 2 but it will be understood that all, or as many as are necessary for a given pattern of weaving, or connected to other headles 2. It will thus be seen that rotation of the cams 60 by the gears 57 and 58 causes oscillation of the levers 63 through vertical arcs thus vertically reciprocating the headles 2.

Above the level of the cam support is a guide plate 69 on which the fabric, as it is finished, is pulled forwardly of the loom by engagement between two rollers 70 and 71. The two fabric drawing or feeding rollers 70 and 71 are carried by shafts 72 and 73, respectively. The shaft 72 has a gear 74 thereon which engages an idler gear which in turn engages a driving gear keyed to a shaft 77 journalled in the side plates 19 and 20. These gears are all located adjacent the plate 19. On the other end of the shaft 77 a ratchet wheel 78 is keyed. A pawl 79 pivotally mounted on a rocking lever 80 is spring pressed into engagement with the ratchet wheel 78 and driven thereby as the lever 80 rocks on its pivotal mounting 82 in consequence of an oscillating movement imparted to its lower end by engagement of a roller 83 carried thereby with a cam 84. The cam 84 is mounted on the end of the pattern cam shaft 59 which, as stated, is driven by the gears 57 and 58. A spring 85 anchored at one end to the lever 80 and at its other end to the bearing housing of the shaft 59 urges the roller 83 in constant pressure contact with the cam 84.

Thus as the cam 84 is rotated by the shaft 59 it rocks the lever 80 thus causing a partial rotation of the ratchet wheel 78 by each such actuation. The roller 70, which is preferably knurled, is thus given similar actuations. The tape 12 which lies over this roller is pressed against the roller 71, which is preferably rubber covered, by the action of spring 87 supported on a stationary bracket 88 the compression of which may be varied by manual rotation of an adjustment screw 89. The tape 12, as best seen in Fig. 18, thus is allowed to fall vertically downwardly after passing through these rollers.

The warp threads 1 originate from spools or packages (not shown) where they are first threaded through the headles 2 then led between the hold down bar 16 and the guide plate 69 thence between the rollers 70 and 71. The intermittent partial rotation of the gears 74 and 76 thus determine the rate at which the warp threads pass through the loom and the timing of the headle movements with respect to each other and with respect to the move-

ments of the filler feeder determine the pattern of weaving.

The filler thread 4 originates from a spool or package 90 at the rear of the loom where it is led over a roller 91 thence through a tension device 92 controlled by a spring 93. If the thread breaks the spring 93 loses its stress and its reduction in size may then be used to actuate a switch to stop the operation of the loom. Since microswitches and such devices are well known in the art, none is here illustrated. The thread 4 is led from the tension device through the eye 30 of the filler thread guide 5 and thence back and forth continuously between the warp threads 1 in order to form the filler or weft of the tape or fabric 12. Each pass of the guide 5 between the warp threads forms a loop at the selvage edge of the tape.

The catch cord 6 originates from a spool or package 94 from where it is led over a guide roller 95 thence through a tensioning device 96 of the same type as the tensioning device 92, having a spring 97 which may similarly be used to control a switch to stop operation of the loom if this thread breaks. The thread 6 is then threaded through the eye of the catch cord guide 7 thence past the needle 8, thence to the selvage edge for continuous incorporation as a part thereof. When the needle begins its forward travel its end engages the catch cord 6 and one of the two strands of the last formed loop of the filler thread to form the loop-lock stitch previously described.

Various modifications may be made without departing from the spirit of our invention and we, therefore, desire to be extended protection as defined by the scope of the appended claims.

What we claim is:

1. A woven fabric having a weft thread laid in successive loops in a shed formed by warp threads, the warp threads at the selvage edge of said fabric being bead cords and overlying each other in a direction normal to the plane of the fabric, said weft thread in forming said successive

loops passing between said bead cords then over one bead cord, then alternately between said bead cords and under the other thereof, said weft loops each extending through a succeeding weft loop and a locking thread interthreaded with the interthreaded weft loops.

2. A woven fabric having a weft thread laid in successive loops in a shed formed by warp threads, the warp threads at the selvage edge of said fabric being bead cords and overlying each other in a direction normal to the plane of the fabric, said weft thread in forming said successive loops passing between said bead cords then over one bead cord, then alternately between said bead cords and under the other thereof, said weft loops each extending through a succeeding weft loop and a locking thread interthreaded alternately through each of said loops and around both branches of a succeeding loop.

3. A woven fabric having a weft thread laid in successive loops in a shed formed by warp threads, two of the warp threads at the selvage edge of said fabric being bead cords and overlying each other in a direction normal to the plane of the fabric, said weft thread in forming said successive loops passing between said bead cords then over one bead cord, then alternately between said bead cords and under the other thereof, said weft loops each extending through a succeeding weft loop and a locking thread interthreaded alternately through each of said loops thence around both branches of the second succeeding loop thence through the intermediate loop and so on.

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