Nov. 28, 1961 E. C. RUST, JR 3,010,178

NEEDLE LOOM

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Fig. 1

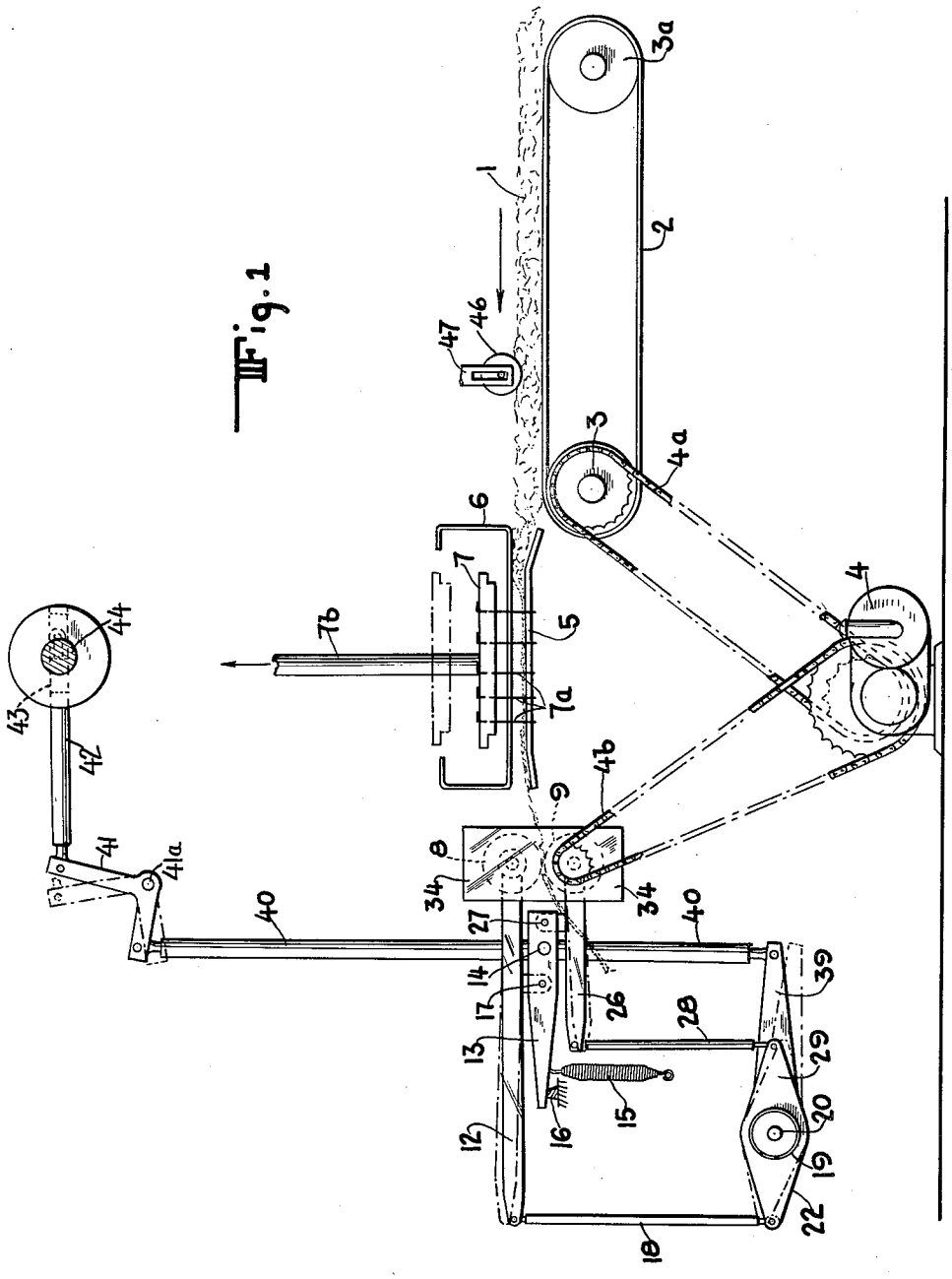

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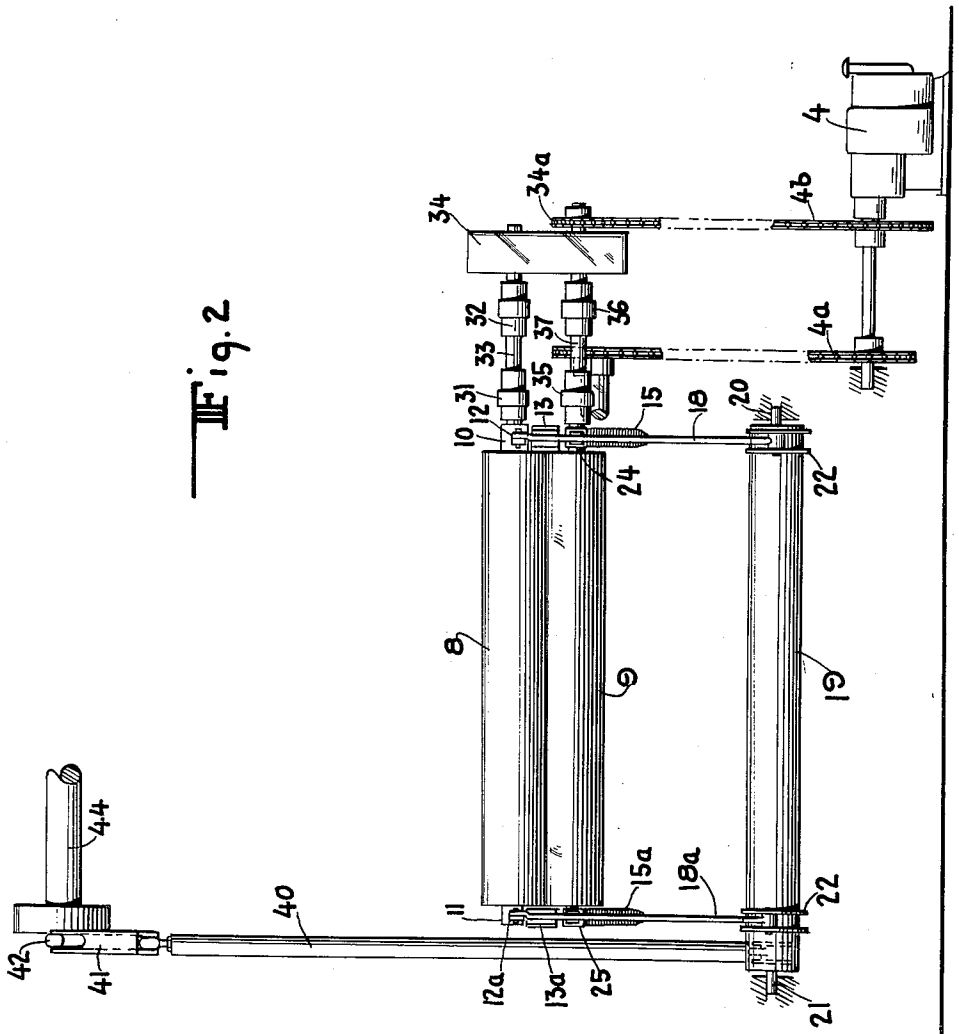
Fig. 2



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NEEDLE LOOM

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This invention relates to needle looms for punching felt and other non-woven fabrics. The invention has particular reference to a loom of this character having an improved feed mechanism for drawing the punched web from the bed plate, where the punching operation is performed, intermittently during the periods when the needles are withdrawn from the web.

Needle looms as commonly made comprise a bed plate on which the web to be punched is advanced progressively under a series of needles projecting downwardly from a needle board, and means for reciprocating the needle board to drive the needles through and withdraw them from the web on the bed plate. In such looms as made heretofore, the web to be punched is fed to and from the bed plate by a feed mechanism including an intermittently operating device for feeding the web to the bed plate and an intermittently operating device for drawing the punched web from the bed plate, these feeding devices being operated in synchronism with the means for reciprocating the needle board, so that the web is advanced along the bed plate a certain distance each time the needles are withdrawn from the web. Such feed mechanism in prior needle looms has left much to be desired, particularly because it is not adapted for high speed feeding operations and therefore limits the loom to a capacity considerably less than would otherwise be possible.

The principal object of the present invention is to provide a needle loom having improved feed mechanism whereby the web can be advanced rapidly along the bed plate during the periods of withdrawal of the needles from the web, thereby enabling the loom to be operated at high speed.

In needle looms made according to the invention, the punched web is drawn from the bedplate by mechanism comprising snatch roll means including a continuously driven snatch roll adapted for gripping engagement with one side of the punched web, and actuating means operable in synchronism with the needle board reciprocating means for actuating the snatch roll means to effect alternate gripping and release of the web by the continuously driven roll. Preferably, the snatch roll means comprise opposed, continuously driven snatch rolls engageable with the opposite sides, respectively, of the punched web, the actuating means being operable to move these rolls bodily toward and away from each other to alternately grip and release the web. Also, the actuating means preferably include a reciprocating member operable in synchronism with the needle board reciprocating means, and a yieldable element through which the reciprocating member is operatively connected to the snatch rolls and which is adapted to yield to prevent the reciprocating member from forcing the snatch rolls together against the web with an excessive force.

The new needle loom in its preferred construction comprises a continuously operating feeding device for feeding the web to the bed plate and which allows the web material to accumulate in front of the bed plate during the periods when the needles are engaged with the web.

For a better understanding of the invention, reference may be had to the accompanying drawings, in which:

FIG. 1 is a side elevational view of a preferred form of the new needle loom, and

FIG. 2 is an end elevational view of the loom illustrated in FIG. 1, showing particularly the intermittently operating feed mechanism for drawing the punched web from the bed plate.

Referring to the drawings, the reference numeral 1 designates the web of material to be punched, such as felt. This web is advanced to the punching station by a feed apron in the form of an endless conveyor belt 2 mounted on rolls 3—3*a*, which are journaled in suitable bearings. The apron roll 3 is positively driven by an electric motor 4 through a driving belt or chain 4*a*. From the feed apron 2, the web 1 passes onto a bed plate 5 where the needle-punching operation is performed. Thus, the parts 2—4 constitute a device for continuously feeding the web 1 toward the bed plate 5.

Spaced above the bed plate 5 is a stripper plate 6, which, like the bed plate, is stationary, the web 1 passing from the feed apron 2 into the space between the plates 5—6. Above the stripper plate 6 is a needle board 7 carrying a series of the usual barbed needles 7*a* which project downwardly through holes in the stripper plate 6. The needle board 7 is adapted to be reciprocated vertically by means of a crankshaft 44 to which the board is connected in any suitable manner, as by a connection indicated generally at 7*b*. As the board 7 moves up and down, the needles 7*a* are first driven downwardly through the web 1 on bed plate 5, the needles passing into aligned holes in the bed plate, and are then raised to withdraw their barbed ends from the web, the stripper plate 6 holding the web against upward movement with the needles. Since the parts 5—7, as well as the means for reciprocating the needle board, are conventional and well known in the art, they are shown only schematically.

The punched web 1 is intermittently drawn from the bed plate 5 by feed mechanism comprising a pair of continuously driven snatch rolls 8 and 9. The upper snatch roll 8 is rotatably mounted at its ends by journal bearings 10 and 11, respectively, which receive shafts projecting axially from the roll. The bearings 10 and 11 are supported on the ends of levers 12 and 12*a*, respectively. Movable supporting elements 13 and 13*a* are located below the levers 12 and 12*a*, respectively, each of these supporting elements being in the form of a lever or arm mounted on a fixed pivot 14 secured to the loom frame (not shown). The supporting element 13 is urged downwardly around its pivot 14 (counter-clockwise as shown in FIG. 1) by a biasing element in the form of a coiled spring 15. The upper end of the spring 15 is connected to the supporting element 13, and the lower end of this spring is fixed in any suitable manner (not shown), the spring normally holding the outer end of element 13 down against a fixed stop 16. The lever 12 is pivotally supported at 17 on the element 13, the pivot 17 being located on the element 13 between the spring 15 and the fixed pivot 14. It will be understood that the other lever 12*a* carrying the journal bearing 11 is similarly supported on the corresponding supporting element or arm 13*a*, which is pivotally mounted on the loom frame in the same manner as the element 13 and is held down by spring 15*a* against a stop similar to stop 16.

At their ends remote from the journal bearings 10 and 11, the levers 12 and 12*a* are connected by rods 18 and 18 A, respectively, to a rock shaft or torque tube 19. The latter is pivotally mounted at its ends in journal bearings 20 and 21 attached to the machine frame. More particularly, the rods 18 and 18*a* at their upper ends are pivotally connected to the levers 12 and 12*a*, respectively, and the lower ends of these rods are connected to arms 22 and 22*a* respectively, on the rock shaft 19, these arms being located at the opposite end portions of the rock shaft.

The lower snatch roll 9 is rotatably mounted at its ends in journal bearings 24 and 25 which are carried by respective levers located below the supporting elements 13 and 13*a*, respectively. One of the latter levers, shown at 26 in FIG. 1, carries the journal bearings 24 and is pivotally connected at 27 to the corresponding supporting element 13, the pivot 27 being located on supporting element 13 at the opposite side of fixed pivot 14 from the pivot 17. At its end remote from the corresponding snatch roll 9, the lever 26 is connected by a rod 28 to an arm 29 on rock shaft 19. It will be understood that the journal bearing 25 for the opposite end of roll 9 is carried on a lever similar to the lever 26 and similarly pivoted on the corresponding supporting element 13*a*, the latter lever being connected to rock shaft 19 through a connection similar to the connection 28—29.

From the foregoing, it will be apparent that when the rock shaft 19 is rocked clockwise, as viewed in FIG. 1, snatch roll 8 is moved downwardly and snatch roll 9 is moved upwardly, whereby these rolls are moved into gripping engagement with the punched web 1 passing between the rolls. More particularly, as the rolls 8 and 9 approach each other, they contact both sides of the web and compress it; and once they have been urged against the web with sufficient "nip" pressure to develop the necessary traction for pulling the web from bed plate 5, any further clockwise rotation of shaft 19 causes the supporting elements 13—13*a* to swing upwardly against the action of their corresponding springs 15 and 15*a*, thereby extending these springs. When the rock shaft 19 rotates in the opposite direction (counter-clockwise as shown in FIG. 1), the supporting elements or arms 13—13*a* are first returned against their stops by the respective springs 15 and 15*a*, whereupon further counter-clockwise rotation of shaft 19 causes the snatch rolls 8 and 9 to move apart and thereby release the web 1. Accordingly, the above-described arrangement prevents unnecessarily high loads in the linkages between the rock shaft 19 and the snatch rolls 8—9. It also prevents excessive compression of the web 1 between the snatch rolls so as to avoid possible damage to the web. In addition, this arrangement avoids a destructive build-up of stresses in the mechanism in the event that a heavier or thicker web is passed between the snatch rolls.

The upper snatch roll 8 is connected at one end through universal joints 31—32 and a shaft 33 to a gear box 34. Similarly, the lower snatch roll 9 is connected through universal joints 35—36 and a shaft 37 to the gear box 34. The latter contains gearing (not shown) connected to the couplings or joints 32 and 36 and which is driven from motor 4 through a chain 4*b* and a sprocket wheel 34*a*. By means of motor 4, operating through the gearing in box 34, the snatch rolls 8 and 9 are driven continuously at the same peripheral speed but in opposite directions, so that they are operable to draw the punched web from bed plate 5 when these rolls are moved toward each other into gripping engagement with the web, as previously described. Of course, this drawing action on the web ceases when the rolls 8—9 are moved away from each other so as to release the web.

The rock shaft 19 has an arm 39 pivotally connected to the lower end of a rod 40. At its upper end, the rod 40 is connected to one arm of a bell-crank 41 mounted on a fixed pivot 41*a*. The other arm of bell-crank 41 is connected through a link 42 to a crank 43 on the crankshaft 44, this crankshaft also serving as a means for reciprocating the needle board 7 in addition to rocking the rock shaft 19, as previously described. Thus, crankshaft 44, operating through the rock shaft 19 and the linkage previously described, constitutes a means for actuating the snatch rolls 8—9 in synchronism with the needle board, whereby the punched web is drawn intermittently from bed plate 5 during the periods when the needles 7*a* are withdrawn from the web.

In operation, the snatch rolls 8—9 are driven by motor 4 at a surface speed substantially greater than the surface speed of the feed apron 2, since the rolls 8—9 are in feeding contact with the web during only part of the cycle. As an example, the surface speed of the continuously driven rolls 8—9 may be about two and one-quarter times the surface speed of the feed apron 2. This ratio is not critical, however, because as soon as the rolls 8—9 have taken up all of the slack which has accumulated during the punching period, due to continuous feeding by the apron 2, the rolls 8—9 will slip on the web and thereby compensate for any excess of the roll movement above what is required to effect the desired advance of the web along the bed plate 5. By adjustment of the tension in biasing springs 15—15*a*, it is possible to control the magnitude of the force with which the snatch rolls 8—9 grip the web, thereby avoiding excessive build-up of tension in the web and destructive scrubbing of the surface fibers of the web.

As shown in FIG. 1, a roll 46 is mounted for vertical movement above the feed apron 2 in position to rest on the web 1 being fed to the bed plate. The roll 46 extends across the entire width of the web 1 and is guided in its vertical movement by means including a fixed bracket 47. Thus, the roll 46 is supported by the web and can move up and down to accommodate different thicknesses of the web. While the needles 7*a* are engaged with the web (at which times the web is released by the snatch rolls 8—9), the continuous feeding action of apron 2 causes the web to "telescope" or buckle accordion-fashion in the path between the weight roll 46 and the bed plate 5. Therefore, the distance between the weight roll 46 and the bed plate 5 should be sufficient to accommodate the momentary "excesses" of web length which thus accumulate during the needle punching portion of the cycle. The weight roll 46 acts to prevent the snatch rolls 8—9 from drawing the web in varying amounts depending on the tension, elasticity, coefficient of friction with the apron 2, the distance to the previous machine, etc. In other words, the weight roll 46, in conjunction with the continuous feed apron 2 meters the amount of web length made available to the loom during each stroke.

I claim:

1. In a needle loom for punching a fibrous web and including a bed plate on which the web is advanced progressively, a needle board having a plurality of needles projecting therefrom toward the bed plate, and means for reciprocating the needle board to drive the needles through and withdraw them from the web on the plate, thereby punching the web, a web-feeding mechanism comprising a device for continuously feeding the web toward the bed plate, snatch roll means including a continuously driven snatch roll adapted for gripping engagement with one side of the punched web to draw it from the bed plate, and actuating means operable in synchronism with said reciprocating means for actuating the snatch roll means to effect alternate gripping and release of the web by said continuously driven roll, whereby the punched web is drawn intermittently from the bed plate during the periods of withdrawal of the needles from the web, the peripheral speed of said continuously driven snatch roll being substantially greater than the feeding speed of said continuously feeding device.

2. A needle loom according to claim 1, in which said snatch roll means also include a second roll opposite the first-mentioned roll, said rolls being engageable with opposite sides, respectively, of the punched web to draw it from the bed plate.

3. A needle loom according to claim 1, in which said snatch roll means also include a second roll opposite the first-mentioned roll, said rolls being engageable with opposite sides, respectively, of the punched web to draw it from the bed plate, and means for continuously driving said rolls in opposite directions.

4. A needle loom according to claim 1, in which said actuating means include a reciprocating member, and an operative connection between said member and the con-

tinuously driven snatch roll for moving said roll into and out of gripping engagement with the web.

5. A needle loom according to claim 1, in which said actuating means include a reciprocating member, and an operative connection between said member and the continuously driven snatch roll for moving said roll into and out of gripping engagement with the web, said connection including a yieldable element through which the reciprocating member urges the roll into said gripping engagement.

6. A needle loom according to claim 1, in which said continuously feeding device includes an endless belt engageable with the web, and means for driving the belt.

7. A needle loom according to claim 1, comprising also means coacting with said continuously feeding device and spaced from the bed plate for imposing a resistance to drawing of the web from the bed plate by said snatch roll means.

8. In a needle loom for punching a fibrous web and including a bed plate on which the web is advanced progressively, a needle board having a plurality of needles projecting therefrom toward the bed plate, and means for reciprocating the needle board to drive the needles through and withdraw them from the web on the plate, thereby punching the web, a web-feeding mechanism comprising snatch roll means including a continuously driven snatch roll adapted for gripping engagement with one side of the punched web to draw it from the bed plate, and actuating means operable in synchronism with said reciprocating means for actuating the snatch roll means to effect alternate gripping and release of the web by said continuously driven roll, whereby the web is drawn intermittently from the bed plate during the periods of withdrawal of the needles from the web.

9. In a needle loom for punching a fibrous web and including a bed plate on which the web is advanced progressively, a needle board having a plurality of needles projecting therefrom toward the bed plate, and means for reciprocating the needle board to drive the needles through and withdraw them from the web on the plate, thereby punching the web, a web-feeding mechanism comprising a pair of opposed snatch rolls engageable with opposite sides, respectively, of the punched web, means for continuously driving said rolls, and actuating means operable in synchronism with said reciprocating means for moving the rolls bodily toward and away from each other to alternately grip and release the web, whereby the punched web is drawn intermittently from the bed plate during the periods of withdrawal of the needles from the web.

10. A needle loom according to claim 9, in which said actuating means include a reciprocating member, and a yieldable element through which the reciprocating member is operatively connected to the snatch rolls.

11. A needle loom according to claim 9, in which said actuating means include a reciprocating member, a movable supporting element, levers pivotally mounted on said element and through which the reciprocating member urges the snatch rolls against the web to grip it, said element being movable from a normal operating position to prevent excessive gripping pressure on the web by movement of said reciprocating member, and a biasing element urging said supporting element toward its normal operating position.

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