April 7, 1936. T. S. McDERMOTT 2,036,766

MACHINE FOR MAKING NEEDLE PUNCHED FABRIC

Filed July 28, 1932 2 Sheets-Sheet 1

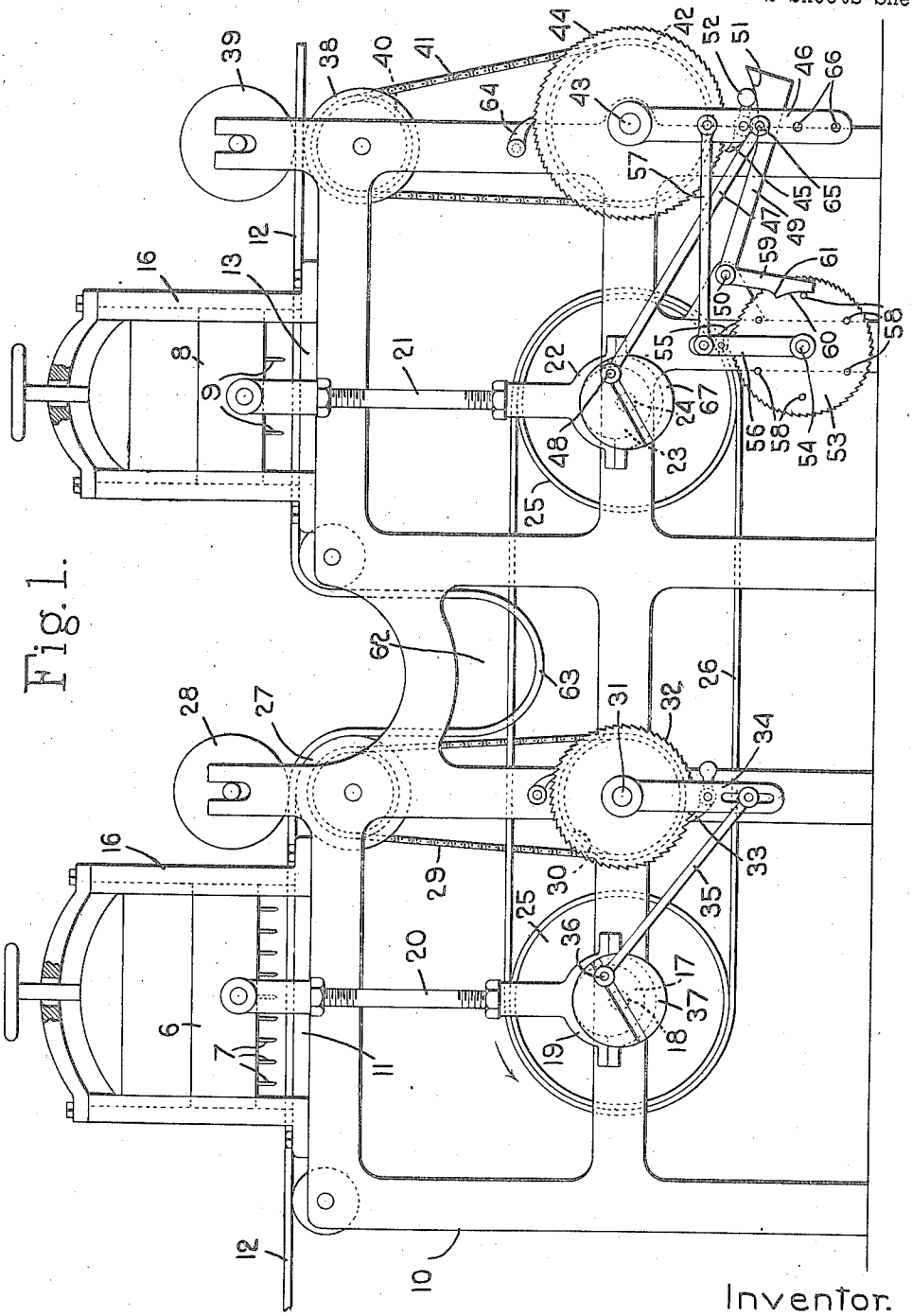

Fig. 1.

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Fig. 2.

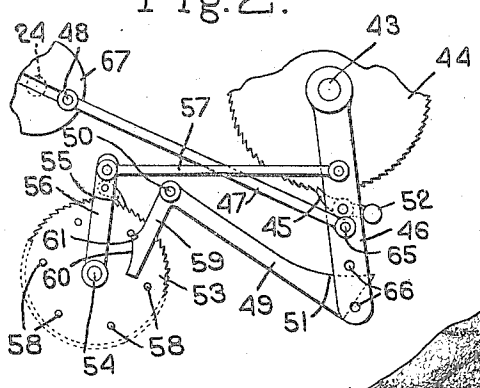


Fig. 3.

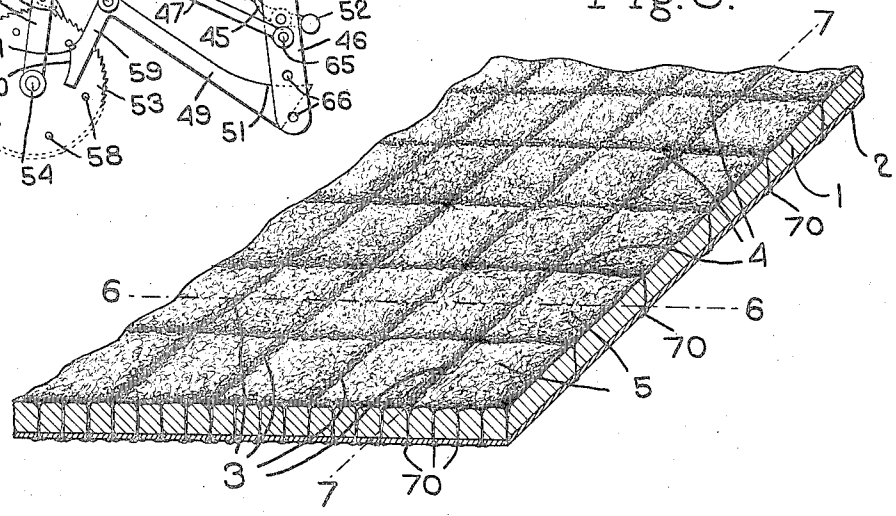


Fig. 4.

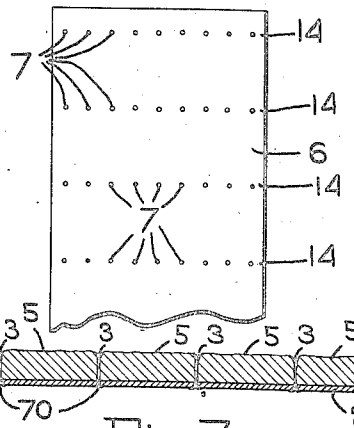


Fig. 6.

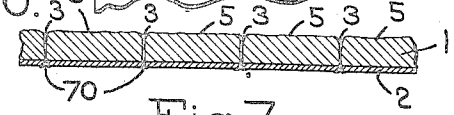


Fig. 7.

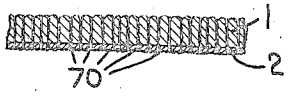
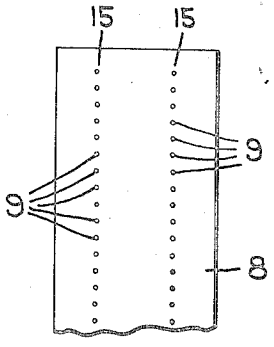


Fig. 5.



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Patented Apr. 7, 1936 2,036,766

UNITED STATES PATENT OFFICE

2,036,766

MACHINE FOR MAKING NEEDLE PUNCHED FABRIC

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Application July 28, 1932, Serial No. 625,343

11 Claims. (Cl. 28—4)

This invention relates to machines for making so-called "needle-punched" fabric, and one object of the invention is to provide an improved machine of this type which is constructed to needle or needle-punch the layer or layers of unspun fibre along prescribed lines only, which lines are preferably so arranged as to enclose unpunched areas of fibre. In one form of the invention the machine is constructed so that as a web of unspun fibre is delivered thereto, said web will be punched along separated lines extending longitudinally of the web and also along separated lines extending transversely of the web, the areas bounded by said crossing lines being unpunched. The result is that the final fabric has a sort of quilted effect. A fabric made in this way is more resilient transversely and has a better cushioning effect than if it were needle-punched over its entire surface. Such a fabric is capable of a wide variety of use whenever a needle-punched fabric is desired, but it is especially advantageous when used as a pad designed to give a cushion effect. Such a fabric is also excellently suited for insulating or acoustical purposes.

In order to give an understanding of the invention I have illustrated in the drawings one embodiment of the invention and have also shown one form of fabric which results from the use thereof.

Fig. 1 is a side view of an apparatus embodying the invention;

Fig. 2 is a fragmentary detail of the feeding device;

Fig. 3 is a sectional perspective view showing a needle-punched fabric such as produced by the machine;

Fig. 4 is a fragmentary view showing the arrangement of needles for punching the rows longitudinally of the fabric;

Fig. 5 is a fragmentary view showing the arrangement of needles for punching the rows transversely of the fabric;

Fig. 6 is a section on the line 6—6, Fig. 3;

Fig. 7 is a section on the line 7—7, Fig. 3.

Fig. 3 shows one type of fabric which results from the operation of a machine embodying my invention, such fabric comprising a body layer 1 of unspun fibre and a base layer 2 of burlap or similar fabric, said fabric being needle-punched along the separated lines 3 extending longitudinally of the fabric and along other separated lines 4 extending transversely of the fabric, thereby leaving areas 5 bounded by the crossing lines which have not been subjected to the needling operation. The space between the longitudinal lines 3 and also between the transverse lines 4 is considerably greater than the spacing between successive or adjacent needle jabs in each line. This is shown in Figs. 3 and 7, both of which, however, are more or less diagrammatic and are not intended to show the exact spacing of the needle pricks or needle jabs in any line. The places where the needle jabs have been made in the fabric are indicated at 10, and it will be observed that there are a plurality of such needle jabs in each line 4 between any two lines 3 and that there are also a plurality of needle jabs in each line 3 between adjacent lines 4. The fabric is naturally compressed somewhat along the lines where the needle jabs take place, but in the areas 5 which are circumscribed by these lines 3 and 4 of needle-punching the fibres of the unspun layer remain in their natural condition without being compressed. A fabric having this construction is more resilient transversely and has a greater cushioning effect than one which is needle-punched over its entire surface because of the fact that in the unpunched areas 5 the unspun fibre is in its natural condition. Such a fabric also has better heat-insulating properties than one which is needled over its entire surface owing to the fact that in the areas 5 the fibres are less firmly compacted together than in the case of a needle-punched fabric which is needled over its entire surface.

The fabric itself, however, is not claimed herein but is made the subject of a divisional application, Serial No. 40,909 filed Sept. 17, 1935.

The machine herein illustrated for making the needle-punched fabric in which the needle punching is performed along crossing lines comprises a vertical reciprocating needle board 6 carrying a plurality of needles 7 adapted to needle the fabric along the lines 3 and a second vertical reciprocating needle board 8 carrying needles 9 and adapted to needle the fabric along the lines 4. These needle boards are mounted in a suitable frame 10 which is provided with a bed portion 11 over which the web, indicated generally at 12, which is to be needled, is fed while the needles 7 are acting thereon, and which is also provided with another bed portion 13 over which said web is fed while the needles 9 are acting thereon. It will be understood that both needle boards extend transversely across the frame and the needles 7 in the needle board 6 are arranged in rows 14 which extend longitudinally of the web and which are spaced apart the proper distance to produce the desired needled lines 3.

Fig. 4 is a diagrammatic under side view of the needle board 6 illustrating the needles 7 arranged in rows 14 and it will be understood that as the web 12 is fed over the bed 11 the continued vertical reciprocation of the needle board 6 will serve to needle the fabric along the lines 3.

The needles 9 in the needle board 8 are arranged in one or more rows extending transversely of the web. In the illustrated embodiment of the invention there are two such rows indicated at 15 and these two rows have the same spacing as the needle-punched lines 4 which extend transversely of the web.

Any suitable means may be employed for giving the needle boards their vertical reciprocating movement. As shown each needle board is guided in ways formed in a suitable guiding frame 16 rising from the main frame 10.

The needle board 6 is given its reciprocating movement through an eccentric 17 carried on a shaft 18 that is mounted in the frame, said eccentric having an eccentric strap 19 which is connected by a link 20 to the needle board 6. A similar construction is employed for reciprocating the needle board 8, said needle board having a link 21 pivotally connected thereto which is formed at its lower end with an eccentric strap 22 embracing an eccentric 23 on a shaft 24. Each shaft is shown as having a pulley or sprocket wheel 25 thereon and these pulleys or sprocket wheels are connected by a belt or sprocket chain 26 so that the two shafts will rotate in unison.

The power for driving the shafts may be applied to either shaft in any suitable way.

Means are provided for feeding the web 12 over the beds 11 and 13 and such feeding means is constructed to move the portion of the web acted on by the needles 9 forwardly with a step by step movement, each step of which is of a length equal to the distance between two adjacent needled lines 4, or what is the same thing, the distance between the two rows of needles 15. Such feeding means is also constructed so that between each feeding movement of the web over the bed 13 the needles 9 will make several penetrating thrusts through the web.

27, 28 indicate two feed rolls carried by the frame and between which the web passes, said rolls being shown as situated at the delivery end of the needle board 6. These rolls are intermittently actuated to feed the web forward, such intermittent feeding movement being derived from the rotation of the shaft 18. For this purpose the feed roll 27 is connected by a sprocket chain 29 with a sprocket wheel 30 pivotally mounted in the frame at 31 and which has rigid therewith a ratchet wheel 32. Co-operating with this ratchet wheel is a pawl 33 mounted on a pawl carrier 34 that is pivotally mounted coaxially with the ratchet wheel and said pawl carrier is connected by a link 35 to a crank pin 36 adjustably carried in a crank disk 37 that is fast on the shaft 18. At each rotation of the shaft 18, therefore, the feed wheel 27 will be stepped forward one step and with this arrangement the web will be fed continuously but intermittently over the bed 11.

The web is fed over the bed 13 by means of feed rolls 38, 39 which are also suitably journalled in the frame 10. The roll 38 has a sprocket wheel 40 rigid therewith which is geared by a sprocket chain 41 to another sprocket wheel 42 fast on a shaft 43 that is journalled in the frame.

Means are provided for giving the shaft 43 a forward step after the needle board 8 has made a predetermined number of reciprocations, each forward step of the shaft 43 being sufficient to feed the web forward a distance equal to that between the rows 15 of needles 9.

The shaft 43 has fast thereon a ratchet wheel 44 which co-operates with a pawl 45 mounted on a pawl carrier 46 which in turn is pivotally mounted on the shaft 43. This pawl carrier is connected by a link 47 to a crank pin 48 which is adjustably mounted in a slot formed in a crank disk 67 fast on the shaft 24. The pawl carrier 46, therefore, reciprocates in synchronism with the reciprocations of the needle board 8.

Means are provided for holding the pawl 45 out of engagement with the ratchet wheel 44 while the needle board 8 is making its predetermined number of reciprocations and then permitting the pawl to become operative for one rotation of the shaft 24 thereby to give the feed rolls 38 and 39 a rotative movement sufficient to step the web 12 forward a distance equal to the space between the two rows 15 of needles 9, said pawl being then thrown into inoperative position and held inoperative while the needle board 8 again makes its predetermined number of reciprocations.

The condition of the pawl 45, that is, whether it is in operative or inoperative position, is determined by a controlling member 49 in the form of an L-shaped lever pivoted at 50 to the frame 10. One end of this lever is provided with a pawl-engaging surface 51 which, when the pawl-controlling member 49 is in the position shown in Fig. 1, engages the tail end 52 of the pawl and holds the pawl out of engagement with the ratchet wheel. This is the position of the parts while the needle board 8 is making its predetermined number of reciprocations. When such predetermined number has been completed then the pawl-controlling member 49 is swung into the position shown in Fig. 2 which carries the surface 51 away from the tail of the pawl thereby allowing the pawl to swing into engagement with the ratchet wheel 44.

The tail 52 of the pawl is counterweighted so that when the controlling member 49 is swung into its inoperative position the counterweight throws the pawl into its operative ratchet-engaging position. The pawl is retained in this position during one revolution of the shaft 24, during which revolution the ratchet wheel 44 will be stepped forward the proper distance to give the correct amount of feeding movement to the web 12.

The position of the controlling member 49, that is, whether it shall have its operative position shown in Fig. 1 or its inoperative position shown in Fig. 2, is controlled by a pin wheel 53 which is mounted on a shaft 54 carried by the frame. This pin wheel is in the nature of a ratchet wheel with which co-operates a pawl 55 carried by a pawl carrier 56 pivotally mounted on the shaft 54. This pawl carrier is connected by a link 57 with the pawl carrier 46 and hence the ratchet wheel 53 will be stepped forward in timed relation with the rotation of the shaft 24.

The ratchet wheel 53 is provided with a plurality of pins or projections 58 which are adapted to engage the arm 59 of the lever 49. This arm is provided with a curved pin-engaging surface 60 with which the pins engage and so long as any pin is engaging this surface 58 the pawl-controlling member will be held in its operative position shown in Fig. 1 thereby holding the pawl 45 out of engagement with the ratchet wheel 44. When any pin 58 drops off from the surface 60

then the pawl-engaging member will by gravity swing into its inoperative position shown in Fig. 2 thereby releasing the pawl **45** and allowing it to come into engagement with the ratchet wheel **44**.

The parts are so designed that the pawl-controlling member **49** will remain in its inoperative position while the ratchet wheel **44** is being stepped forward one step only. During the next backward movement of the pawl carrier **46** after the ratchet wheel **44** has been stepped forward one step a pin **58** will engage the cam surface **61** of the lever arm **59** and will thereby swing the pawl-controlling member **49** back into its operative position shown in Fig. 1, in which position it will remain during several forward steps of the ratchet wheel **53** and until the pin has passed off from the curved surface **60**. During the time that the pawl-controlling member **49** is in its operative position the needle board **8** will make several reciprocations.

The frame **10** is shown as having a well portion **62** into which the web **12** is lowered as indicated at **63** between the two bed sections **11** and **13**. This gives sufficient slack in the web to provide for the long forward steps over the bed portion **13** without subjecting the web to undue tension.

64 is a stop pawl co-operating with a ratchet wheel **44** to prevent backward movement thereof.

I have herein shown an adjustable connection between the link **47** and the pawl carrier **46** which will furnish means for varying the amplitude of swinging movement of the pawl carrier **46** and consequently the length of the forward step given to the ratchet wheel **44**.

The link **47** is connected to the pawl carrier **46** through a bolt or pin **65** and said pawl carrier is provided with a plurality of apertures **66** into any one of which the bolt **65** may be entered.

The amplitude of the oscillating movement of the pawl carrier may also be adjusted by adjusting the crank pin **48** in the slot of the crank disk **67**.

The machine which is described above thus operates to needle the body layer **1** along predetermined lines which are arranged so as to enclose areas of the body layer which are not subjected to the needling action and while in order to illustrate the principle of the invention I have shown a machine in which the predetermined or prescribed lines are separated lines running both longitudinally and transversely of the fabric, yet from a broad viewpoint the invention is not limited to the making of a fabric in which the lines are in the form of crossing lines extending longitudinally and transversely of the fabric but may be embodied in a needled fabric in which the lines along which the fabric is needled have other forms and shapes provided only that said lines circumscribe areas of the body layer which are not subjected to the needling action.

While I have described the invention as applied to the making of a needle-punched fabric comprising a base layer of woven fabric and a body layer of unspun fibre, yet the invention is equally applicable to the making of any punched fabric having a body of unspun fibre whether or not it includes other layers such as the base layer.

I claim:

1. A machine for needling a web of unspun fibre, said machine comprising two needle boards, one having a plurality of separated rows of needles extending in the direction of the length of the web and the other having a row of needles extending transversely to the length of said web, means to reciprocate said needle boards to cause the needles carried thereby to prick through the web, and means operative after a predetermined number of reciprocations of the needle board having the transverse row of needles to feed the web forward beneath said needle board.

2. A device for needling a web of unspun fibres, said device comprising a needle board having a plurality of separated rows of needles extending in the direction of the length of the web, a second needle board having a row of needles extending transversely of said length, means to reciprocate said needle boards to cause the needles carried thereby to punch through the web, web-feeding means comprising means to feed a portion of the web being acted on by the needles of the first-named needle board intermittently with short forward steps and the portion of the web being acted on by the needles of the second needle board at less frequent intervals but with longer forward steps.

3. A machine of the class described comprising means for feeding forwardly a web of unspun fibres to be needled, means for needling said web along separated lines extending in the direction of the feeding movement, a vertically-reciprocating needle board having two separated rows of needles extending transversely to the direction of feeding movement, said web-feeding means feeding the web beneath said needle board with a step by step movement, each step of which is of a length equal to the distance between said rows of needles, whereby the web is needled along separated lines extending both in the direction of the feeding movement and transversely thereof, and means to reciprocate said needle board a plurality of times between each feeding movement of the web.

4. A machine for needling fabric comprising means to feed forward a web of unspun fibre, means operative as the web is fed forward to needle said web along relatively widely separated lines extending in the direction of the feeding movement while leaving the portions of the web between said lines unneedled, and other means acting on the web after it has been thus needled to needle said web further with closely contiguous needle jabs along relatively widely separated lines extending transversely to the line of feed while leaving the portion of the web between said transverse lines unneedled.

5. A machine for needling fabric comprising means to feed forward a web of unspun fibre, two needling devices acting successively on any portion of the web as it is fed forward, one needling device having needles arranged to needle the web along relatively widely separated lines extending in the direction of feed with closely contiguous needle jabs while leaving the portion of the fabric between said lines unneedled, and the other needling device having needles arranged to needle the fabric along relatively widely separated transverse lines with closely contiguous needle jabs while leaving the portion between said lines unneedled.

6. A machine for needling fabric comprising means to feed forward a web of unspun fibre, two needling devices, one having needles arranged to needle the web along relatively widely separated lines extending in the direction of feed and the other needling device having needles arranged to needle the fabric along relatively widely separated lines extending transversely to the direction of

feed, said web-feeding means being constructed to feed the web to the first-named needling device with a relatively short step-by-step motion, and to feed the web to the last-named needling device with a relatively long step-by-step motion.

7. A machine for needling fabric comprising means to feed forward a web of unspun fibre, two needling devices, one having needles arranged to needle the web along relatively widely separated lines extending in the direction of feed and the other needling device having needles arranged to needle the fabric along relatively widely separated lines extending transversely to the direction of feed, said web-feeding means being constructed to feed the web to the first-named needling device with a relatively short step-by-step motion and to feed the web to the last-named needling device with a relatively long step-by-step motion, each step of which has a length equal to the spacing between the transverse lines.

8. A machine for needling fabric comprising means for feeding forwardly a web of unspun fibres, means operative as the web is fed forward to needle said web along relatively widely spaced lines extending in the direction of the feeding movement, and a vertically-reciprocating needle board having needles arranged to needle said web along lines extending transversely to the direction of feeding movement, said web-feeding means operating to feed the web beneath said needle board with a step-by-step movement, each step of which is of a length equal to the distance between the transverse lines.

9. A machine for needling fabric comprising means for feeding forwardly a web of unspun fibres, means operative as the web is fed forward to needle said web along spaced lines extending in the direction of the feeding movement while leaving the portion of the fabric between said lines unneedled, a vertically-reciprocating needle board having a row of needles extending transversely to the direction of feeding movement, and means for reciprocating said needle board, said web-feeding means operating to feed the web beneath said needle board with a step-by-step movement, each step of which is of a length equal to the distance between the desired spacing of the transverse lines in the fabric.

10. A machine for needling fabric comprising means for feeding forwardly a web of unspun fibres, means operative as the web is fed forward to needle said web along spaced lines extending in the direction of the feeding movement while leaving the portion of the fabric between said lines unneedled, a vertically-reciprocating needle board having a row of needles extending transversely to the direction of feeding movement, and means for reciprocating said needle board, said web-feeding means being operative to give a forward movement to the portion of the web being acted upon by the needles in the needle board after a predetermined number of reciprocations of said needle board.

11. A device of the class described comprising a bed for supporting a web of unspun fibres to be needled, web-feeding means for feeding the web forward with a step-by-step movement, a needle board having a plurality of rows of needles extending transversely to the direction of feed of said web and means to reciprocate the needle board a plurality of times between each forward feeding movement of the web, whereby each row of needles is caused to penetrate the web a plurality of times along the same line.

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