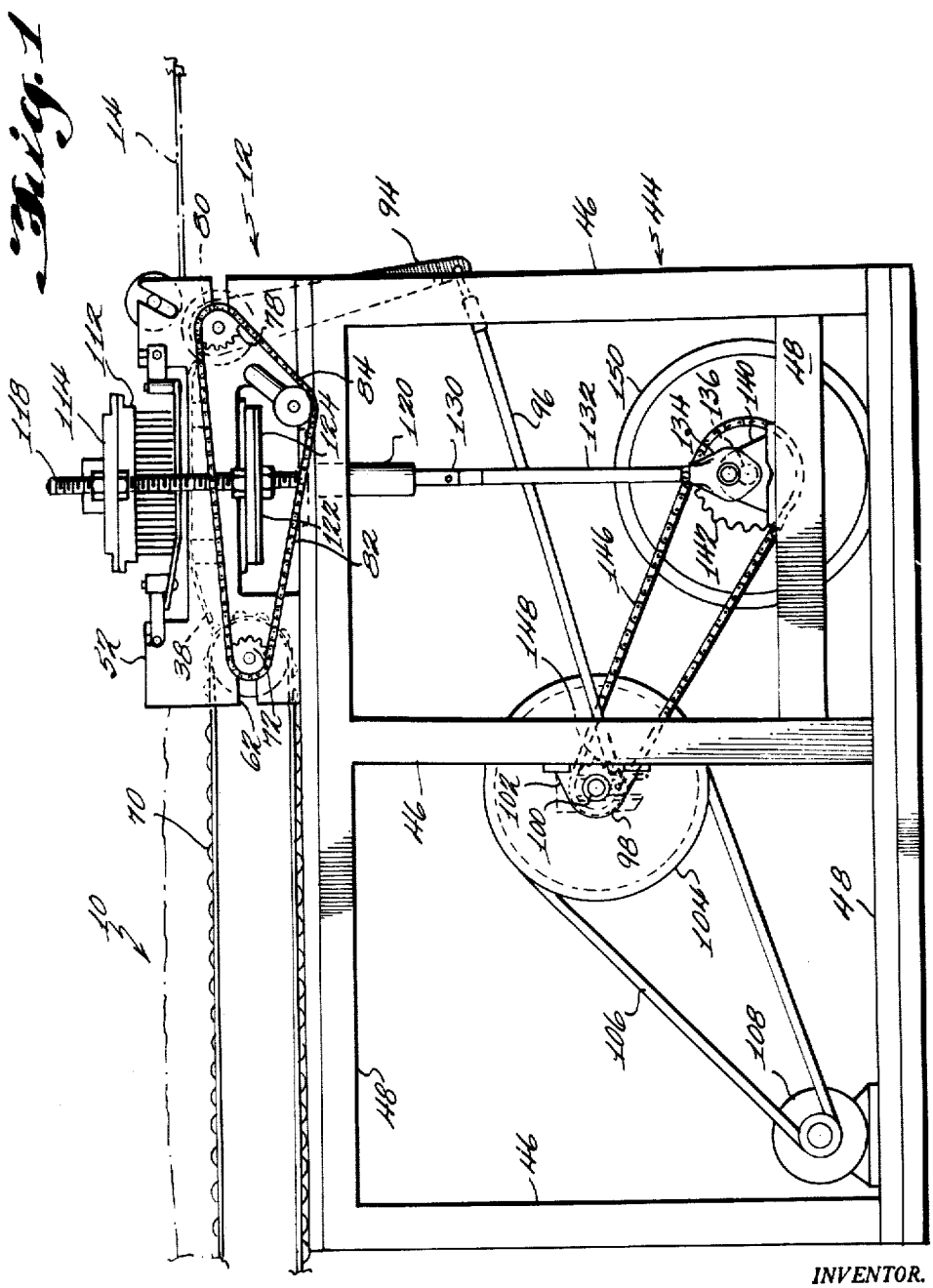
May 21, 1963 A. M. SMITH II 3,090,099

METHOD OF NEEDLE PUNCHING FABRICS SO AS TO INTERLACE THE FIBERS THEREOF

Filed May 13, 1960 3 Sheets-Sheet 1

Fig. 1



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Filed May 13, 1960 3 Sheets-Sheet 2

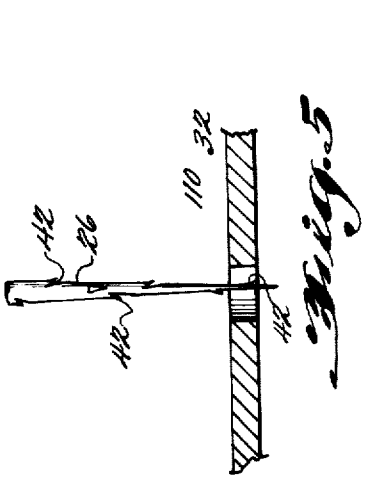

Fig. 5

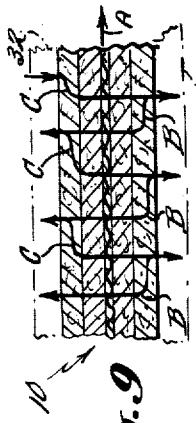

Fig. 9

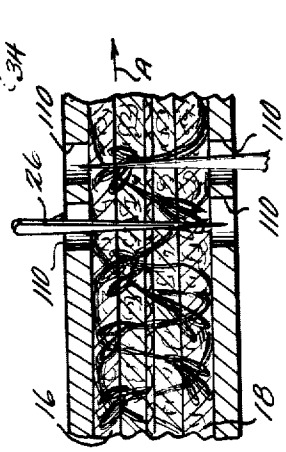

Fig. 8

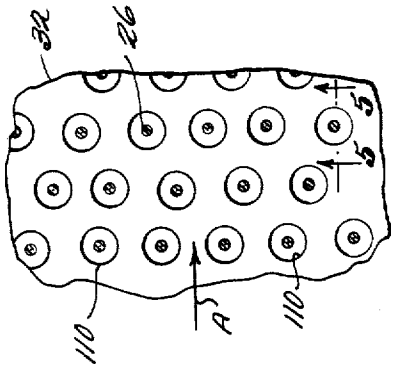

Fig. 4

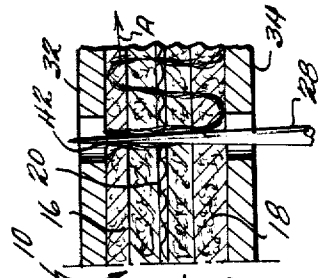

Fig. 7

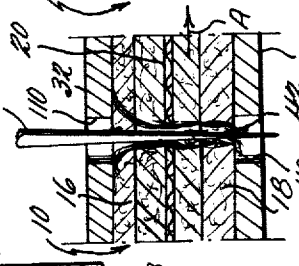

Fig. 6

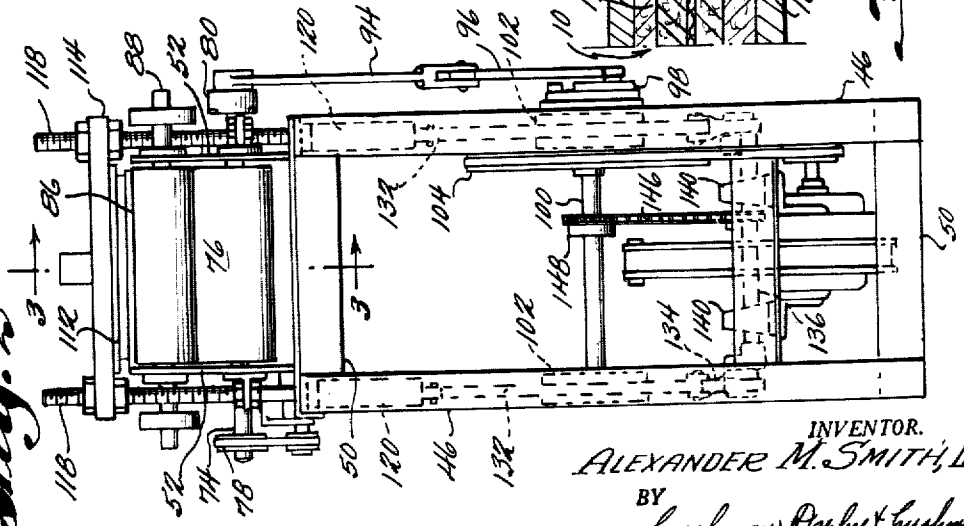

Fig. 2

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METHOD OF NEEDLE PUNCHING FABRICS SO AS TO INTERLACE THE FIBERS THEREOF

Filed May 13, 1960 3 Sheets-Sheet 3

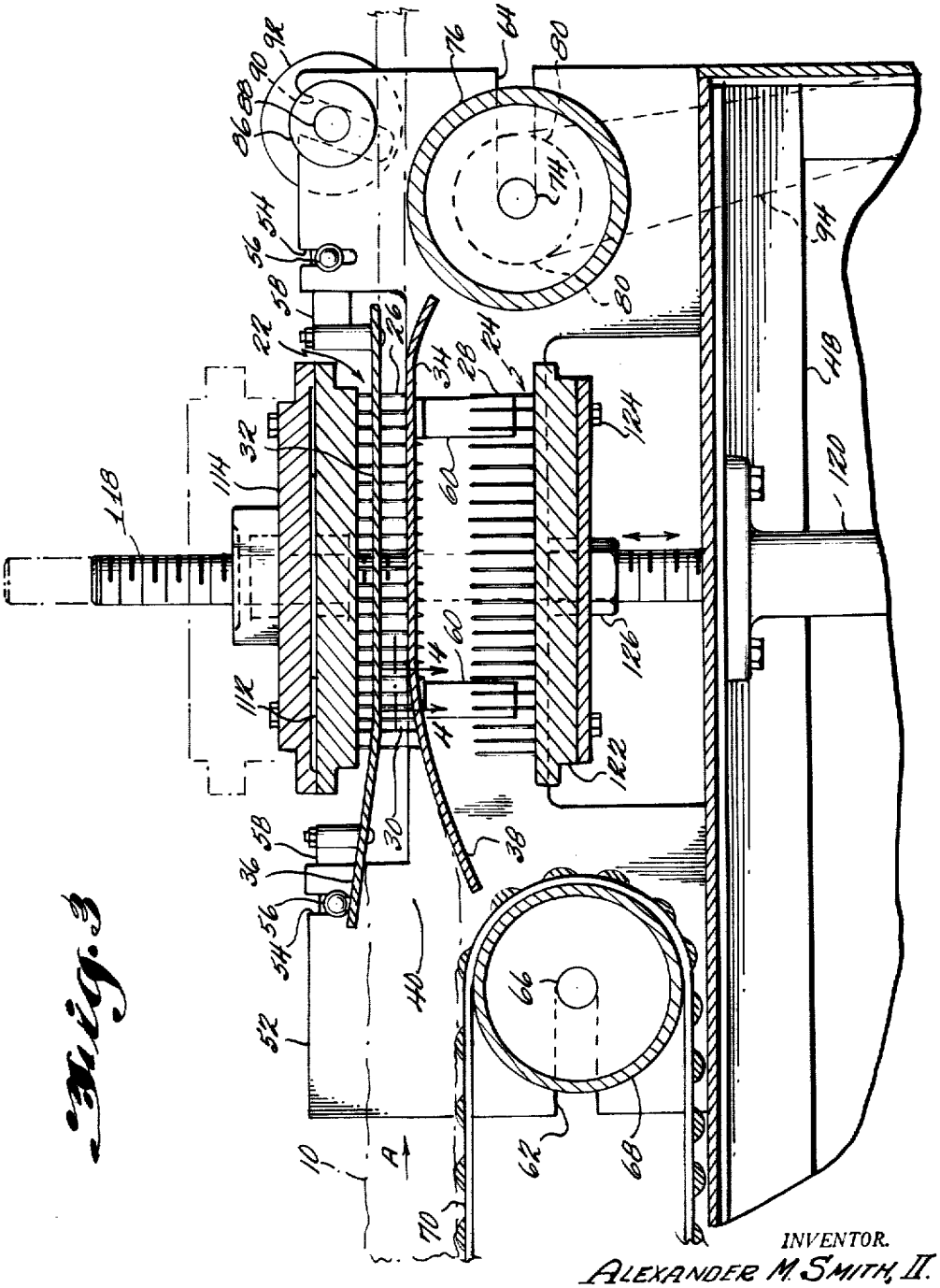

Fig. 3

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United States Patent Office 3,090,099 Patented May 21, 1963

3,090,099

METHOD OF NEEDLE PUNCHING FABRICS SO AS TO INTERLACE THE FIBERS THEREOF

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Filed May 13, 1960, Ser. No. 29,115
18 Claims. (Cl. 28—72.2)

The present invention relates to an improved method for making a new and improved needled or non-woven fabric material and an improved apparatus for accomplishing the method. More particularly, the invention contemplates an improved method of interlacing and/or interlooping fibers in a loosely matted material and an improved needle punch machine for carrying out the interlacing and/or interlooping of fibers according to the improved method to produce the new and improved needled or non-woven fabric structure.

Non-woven unbonded fabric structures deriving coherence and strength from inner fiber entanglement and accompanying frictional forces are commonly known as felt, and such material has been heretofore made by mechanical working of wool or wool-like materials and some cases by a process known as needle punching wherein loosely matted fibers are rearranged and entangled by barbed or hooked needles passing therethrough. The advent of synthetic fibers in recent years has resulted in increased use of needle punching in the manufacture of non-woven, felt-like products. The present invention is intended for use in producing non-woven fabrics from either natural fibers or synthetic fibers or a blend of natural and synthetic fibers, the produced non-woven fabrics being especially desirable for use in blankets or outerwear fabrics and the like. Also, the present invention may be used in producing a non-woven fabric from two or more webs of loosely matted fibers having a scrim of woven, non-woven, or bonded fabric being interposed between the webs or batts of loosely matted fibers.

Conventional methods and machines now in use for felting have not proved entirely satisfactory in tightly interlacing and/or interlooping fibers as the punching needles have not been arranged to coordinate with each other in such a manner as to provide an interlacing and/or interlooping of fibers from both surfaces of the web or webs being treated. Further, conventional machines have required passing the material to be treated through the machines more than one time in order to obtain adequate entanglement of fibers. In some cases, the machines have been rather heavy and cumbersome and slow moving in order to obtain necessary entanglement of loosely matted fibers fed thereto and the resulting product has been lacking in strength and density. Further, the products heretofore made by needle punching are subject to elongation because of the lack of proper interlacing and/or interlooping. Because of the lack of coherence, uniform napping properties of both surfaces of the resulting product could not be obtained and such products lost much of their strength upon a subsequent napping operation such as when blankets or the like were made from the product.

Throughout the specification wherever the term "interlacing" is used, it is to define a binding together of fibers from one outside surface of a web to the other outside surface of the web. Interlacing of fibers is somewhat similar to sewing machine action although it does not depend on a continuous threaded action. On the other hand, the term "interlooping" as used throughout the specification is intended to mean a binding of fibers through loops of other fibers below the surface of the web. Interlooping is akin to knitting as it provides entanglement of fibers by loop engagement; however, it is confined to the subsurface interior of the web as distinguished from interlacing wherein fibers from one surface are carried to the opposite surface and intermingled with fibers from that surface in the course of being returned toward the original surface.

Accordingly, an object of the present invention is to provide a new and improved needled or non-woven fabric structure from an improved method of needling or punching a web or batt of a loosely matted fiber which will result in fabricating fibers by tightly interlacing and/or interlooping, giving the resulting fabric structure more strength, coherence, density, uniform napping properties, and less elongation in use.

Ancillary to the preceding object, it is a further object of the present invention to provide an improved type of needle punching apparatus for interlacing and/or interlooping the loosely matted fibers in a web or batt to produce an improved needled or non-woven material.

Still another object of the present invention is to provide an improved method of needling loosely matted fibers to tightly interlace and interloop the same so that there is less loss of strength when the resulting product is napped.

A further object of the present invention is to provide an improved apparatus which will tightly interlace loosely matted fibers in a web upon one pass of the web through the apparatus, the resulting product having extremely high separation strength.

Another object of the present invention is to provide an improved apparatus for needling a loosely matted material, the apparatus being capable of compressing the material as well as tightly interlacing and/or interlooping the fibers in the material.

Still a further object of the present invention is to provide a method and apparatus which will provide an extremely high number of punches or penetrations of the material in a square inch upon passage of the material through the machine once.

A further object of the present invention is to provide a method and apparatus wherein the interlacing and/or interlooping of fibers may be controlled by coordinating the advancement of the web through the machine with alternate penetration of needle patterns from each side of the web to be punched.

A still further object of the present invention is to provide an improved method and apparatus for needling material to produce a needled or non-woven fabric having uniform and substantially identical characteristics on both surfaces or faces. This is an important consideration when the product is subjected to subsequent finishing operations, particularly napping.

These and other objects and advantages of the present invention will appear more fully in the following specification, claims and drawings in which:

FIGURE 1 is a side elevational view of an improved apparatus for accomplishing the improved novel method of producing a non-woven fabric material;

FIGURE 2 is an end elevational view looking from the right of FIGURE 1;

FIGURE 3 is an enlarged vertical sectional view partly in elevation and taken on the line 3—3 of FIGURE 2;

FIGURE 4 is an enlarged fragmentary view of a web guide plate taken on the line 4—4 of FIGURE 3 and illustrating the pattern of needles for accomplishing the high number of penetrations per square inch of material treated;

FIGURE 5 is an enlarged fragmentary view taken on the line 5—5 of FIGURE 4 and showing a typical barbed needle;

FIGURES 6 and 7 illustrate progressive steps of inter-

lacing fibers as the web of material passes through the apparatus of the present invention;

FIGURE 8 is a view illustrating interlacing combined with interlooping within the interior of the web, the view showing for purpose of illustration only, needles penetrating from opposite sides of the web at the same time; and

FIGURE 9 is a schematic view of the needle path through the material resulting from cordination between needle movement and advancement of the material according to the method of the present invention.

Referring now to the drawings wherein like character and reference numerals represent like or similar parts, and in particular to FIGURE 1, it will be noted that a web or batt of loosely matted fibers generally designated at **10** is moving from the left to the right of the figure through the needle punch machine generally designated at **12**. Passing from the machine **12** at the right hand side of the figure is a needled or non-woven fabric material shown in broken lines and designated by the numeral **14**. It will be understood that the web or batt of fibrous material may be continuously fed from a conventional carding machine (not shown) where the fibers are combed and loosely formed into the web or it may be supplied from rolls of such material after the material has been taken from a carding machine and formed in a roll. If desirable and depending upon the type of end product to be made, the web shown as **10** in FIGURE 1 may be formed from two or more layers of loosely matted fibers **16** and **18** separated by a scrim which is usually loosely woven fabric **20**, as best shown in FIGURES 6 to 8 inclusively.

In order to accomplish the novel method of the present invention resulting in the interlacing and/or interlooping of the fibers in the web **10**, the web is advanced in intermittent step-by-step motion between opposed patterns of needles generally designated at **22** and **24** (FIGURE 3). The needle patterns **22** and **24** are arranged to travel in a path perpendicular to the direction of travel of the web to the surfaces of the web and the motion of the needle patterns is coordinated with the step-by-step motion of the web as will be explained in more detail. Needle patterns **22** and **24** are made up of an array of downwardly extending needles **26** and an array of upwardly extending needles **28**. The paths of travel of the needle patterns **22** and **24** are substantially mirror-image paths of each other and are, thus, substantially identical but reversed of each other. One way of providing mirror-image paths for the patterns of needles is by arranging the needles **26** of needle pattern **22** to travel point-on-point with the needles **28** of the needle pattern **24**. The needle patterns **22** and **24** are arranged to alternately penetrate the web **10** while the web is traveling through a confined throat **30** defined by a pair of spaced apart web guide plates **32** and **34**. The guide plates **32** and **34** are provided with curved inlet portions **36** and **38** respectively, which define a gradually decreasing infeed portion **40** for the throat **30**. The infeed portion **40** of the throat tapers down to a thickness to which the web is compressed by the needling, this thickness being substantially the thickness of the finished non-woven product produced by the needle punching machine **12**. The needles **26** and **28** are each provided with a plurality of barbs **42** on their surface for engaging the fibers as they penetrate the web.

Referring now to FIGURES 6 to 9 inclusive, it will be assumed that the web **10** is moving through the throat **30** between the guide plates **32** and **34** in the direction of the arrow A in step-by-step motion. The step-by-step motion of the web **10** is coordinated with the movement of the needles **26** and **28** so that either set of the needles initially penetrate the surface of the web when the web is making its step motion. This causes the fibers adjacent the surfaces of the web to be caught by the needle points and moved in a substantially horizontal direction for a short distance. Then the web stops and the needles

of the particular pattern **22** or **24** which is penetrating, continue the perpendicular movement through the web, the barbs **42** of needles carrying with them some of the fibers near the surface of the web which have been oriented horizontally as well as other unoriented fibers picked up near the surface during the course of needle movement through the web. When the needles of a particular pattern **22** or **24** such as the needles **26** as shown in FIGURE 6 have passed completely through the web with their lowermost barb **42** positioned adjacent a surface of the web or extending out of the web no greater than one-half inch, the needles **26** are then withdrawn from the web and while the web is still stationary.

When the needles **26** have been withdrawn from the web and just as penetration by the opposed array of needles **28** begins, the web makes another increment of movement in the direction of the arrow A. Since the needles **28** enter the web at the point where the respective aligned needles **26** projected through thte web, some of the loop fibers previously brought through by the needles **26** are picked up near the surface of penetration by the needles **28** and are carried along horizontally with other surface fibers. The web **10** then stops but penetration of the needles **28** continues through the web until the barbs closest to the needle points are adjacent to or extend no greater than one-half of an inch past the other surface of the web. Then the needles **28** are withdrawn while the web is stationary and once they are withdrawn the above-described operation is repeated. It will be understood that the needle patterns **22** and **24** reciprocate into and out of the web, the arrangement being such that there is alternate penetration of the web from opposite sides by the needle patterns **22** and **24** with two increments of advancement in each cycle.

Referring now to FIGURE 9, which schematically shows the path of the needles **26** and **28** through the web, the lettter B represents the path of the reciprocating needles **28** through the web when the web is moved in step-by-step increments, the movement of the web being indicated just after the needles **28** begin their penetration. As shown in the lower portion of FIGURE 9, the path B is somewhat horizontal as the needles **28** start into the web but once the web is stopped and the needles **28** continue their travel through the web, the path is vertical. Likewise, the needles **26** penetrating the top side of the web **10** have a path through the same as represented by the letter C. Their path is similar to the path of the needles **28** in that adjacent the upper surface and when the needles **26** first enter the web, the fibers adjacent the surface are dragged in a substantially horizontal direction as the web is moving perpendicular to the vertical movement of the needles. Once the web is stopped and with the needles **26** continuing their downward movement, some of the fibers moved horizontally are then moved vertically as well as other fibers which are picked up as the needles descend through the web. FIGURE 9 which represents a pair of point-on-point needles **26** and **28** clearly illustrates that the point of penetration on surface of the web of one needle is at the point which the oppositely disposed aligned needle extended out of the web on the previous penetration stroke. This arrangement results in some of the surface and subsurface fibers of the web being oriented toward the opposite surface and then entangled with some of these surface fibers and oriented parallel to this surface and back toward the first-mentioned surface of the web.

Referring now to FIGURE 4, the pattern **22** of needles **26** is shown, it being understood that the pattern **24** of the needles **28** is an identical mirror image of pattern **22** as the needles of one pattern are in alignment point-on-point with the needles of the other pattern. The needles **26** are arranged in a plurality of rows extending transverse of the direction of travel of the web **10**. The rows are staggered so that more needles may be punching the web transversely of the same in each widthwise inch. In

other words, because the size of the needles will not permit the needles to be placed in close enough spaced relationship widthwise of the web, rows of needles are provided with the rows being staggered so as to provide a high number of needles punching the web for every widthwise inch of the web.

It has been found that to obtain a needled or non-woven fabric having the desired strength characteristics and density, the web **10** must be punched at least 1,000 times/sq. inch of area as it passes through the throat **30**. Preferably, it is desirable to punch the fabric more than 1,000 times/sq. inch to obtain a better interlacing effect. Further, in accomplishing a high number of punches/sq. inch, it is preferable to approximately balance the number of widthwise punches per inch of the web with the number of punches each needle makes per linear inch of the web. For example, if the rows of needles of the upper needle pattern **22** are so staggered that for one widthwise inch of the web, there are 40 punches and the web is advanced one-twentieth of an inch between each successive penetration of the patterns **22** and **24**, movement of the web entirely through the pattern will result in 800 punches/sq. inch by the top pattern **22**. Likewise, the lower pattern **24** will have 800 punches/sq. inch for one pass of the web through the machines, thus, resulting in a total 1,600 punches/sq. inch. By arranging the needles in staggered rows spaced linearly with respect to the web **10** and extending widthwise of the same, it will be understood that complete interlacing of fibers is accomplished by the time the web has passed completely through the throat **30**. This may be seen by referring to FIGURES 6 and 7. In FIGURE 6, it is assumed that the needle **26** is one of the first needles to penetrate the web as the web is moving from left to right. In FIGURE 7 assuming that the needle **28** is oppositely disposed to and on point with the needle **26** in FIGURE 6, it will be noted that the web has moved a small increment of distance as determined above and that other fibers will have been picked up and oriented in the manner described. As the web **10** continues to pass through the throat **30** and as it approaches the other end of the throat, interlacing by point-on-point needles **26** and **28** is repeated in much the same manner as a sewing machine operation in that the fibers are interlaced back and forth between the surfaces of the web. While FIGURES 6 and 7 show only one pair of aligned point-on-point needles **26** and **28**, it must be realized that such an operation as described above is being accomplished by each pair of point-on-point needles **26** and **28** with no pair penetrating the same holes as another pair.

To accomplish effective interlacing by the above described method, it has been found that each needle pattern **22** and **24** must have an array of needles which will provide a range of needle punches per widthwise inch of the web **10** of about 25 to about 50. Thus, in effect, there will be 25 to 50 paths of punches as the web is advancing through the needle patterns **22** and **24**. With the above range of widthwise punches, it has been found that each needle of each pair of point-on-point needles should penetrate the web **10** in a range of 6 to 30 penetrations per linear inch of web. This is accomplished by moving the web in step-by-step increments of one-sixth to one-thirtieth of an inch for each successive penetration of a needle pattern.

Barb penetration, which is the distance of penetration through the web of the barb closest to the point of the needle, has been accomplished in a range from the surface of the web opposite the surface of penetration to a point where the aforesaid barb extends one-half of an inch from the surface. A range of barb penetration for maximum interlacing has been found to be three-sixteenths of an inch or greater whereas it has been found that maximum interlooping plus some interlacing is obtained in a range from the surface of the web to one-eighth of an inch below the surface.

Interlacing gives the resulting non-woven fabric good tensile and separation. Also, interlacing provides good compactness and density to the produced fabric. However, non-woven fabric made entirely by interlacing of the fibers is not entirely satisfactory when the fabric must be submitted to a subsequent napping operation on its surfaces. Such an operation breaks down or destroys the interlacing structure and reduces the strength of the fabric. Where napping is required, it has been found desirable to have some interlooping of the subsurface fibers of the web so that the strength of the fabric is not adversely reduced by napping. The proportion of interlooping has been found to increase with a larger number of penetrations per lineal inch of web in the range mentioned above as well as at the lower end of the barb penetration range i.e. where the barb nearest the needle point extends just to the surface or slightly through the surface. Where there is maximum barb penetration and approximately 10 punches per lineal inch of web, the fibers are interlaced with little or no interlooping. On the other hand, where there is minimum barb penetration and for example 30 punches per lineal inch of web, the fibers are interlaced and interlooped.

FIGURE 8 of the drawings illustrates schematically the web **10** having fibers which are both interlaced and interlooped. Such entanglement of fibers results in a non-woven fabric having a strength and compactness associated with woven fabrics. The fabric can be napped so that it obtains a surface softness which makes it highly desirable for use in blankets and outerwear.

Referring back to FIGURES 1, 2 and 3, the improved needle punching apparatus **12** for accomplishing the above-described method is best illustrated. The needle punching apparatus **12** includes a frame structure **44** made from suitable vertical standards **46**, side frame members **48** and cross members **50**. Mounted on the upper side frame members **48** on each side of the frame structure **44** are a pair of spaced parallel vertical plates **52** which are adapted to support therebetween the guide plates **32** and **34** respectively. In more detail, the plates **52** are provided with slots **54** extending vertically downwardly from their upper edge, the slots **54** being adapted to receive studs **56** of bracket members **58** which are fixedly secured to the upper surface of the upper plate **32**. The lower plate **34** is supported by L-shaped brackets **60** welded to the side plates **52** and to the bottom of the guide plate **34**. As is now evident, the upper plate **32** may be adjusted relative the lower plate **34** by supporting the studs **56** at a desired height in the slots **54**.

Side plates **52** are provided with the horizontally extending slots **62** and **64**. Slots **62** of side plates **52** are adapted to receive ends of a shaft **66** which supports one pulley **68** of an endless conveyor structure **70**. The portion of the shaft **66** which extends outwardly of the plate **52** shown in FIGURE 1 is provided with a drive sprocket **72**.

Slots **64** in plates **52** are adapted to receive the ends of a shaft **74** which supports an outfeed roller **76**. Carried outwardly of the plates **52** on the end of the shaft **74** is a drive sprocket **78** (FIGURE 1). The other end of the shaft **74** is coupled to a one-way clutch and brake assembly **80** (FIGURE 2). A drive chain **82** extending around the sprockets **72** and **78** and an idler sprocket **84** cause the pulley **62** to be rotated in step-by-step increments when the shaft **74** is rotated in step-by-step increments by the one-way clutch and brake assembly **80**.

Cooperating with the outfeed roller **76** is a weighted roller **86** carried on the shaft **88** supported in diametrically opposed slots **90** provided in plates **52**. The shaft **88** is provided on its outer ends with weights **92** so that the roller **86** will bear against the upper surface of the

non-woven fabric **14** as it is discharged from the machine.

Mounted on the drive member of the one-way clutch **80** is a crank arm **94**. A connecting arm **96** (FIGURE 1) connects the crank **94** with a disk or wheel **98** keyed to a shaft **100** rotatably supported in the bearing pillows **102**. Shaft **100** carries a drive wheel **104** which is rotated by a belt **106** coupled to a source of power such as an electric motor **108**. As will now be understood, continuous rotation of the shaft **100** by the motor **108** will cause the crank **94** to oscillate back and forth. Since the crank **94** is connected to the drive member of the one-way clutch and brake assembly **80**, clockwise movement of the crank will cause rotation of the outfeed roller **76** as well as the infeed conveyor **70**. During counterclockwise movement of the crank **94**, the roller **76** and the conveyor **70** will be stationary and consequently, there will be no feed of the web **10** through and out of the machine.

As previously stated, the upper needle pattern **22** includes a plurality of downwardly extending needles **26** whereas the lower needle pattern **24** includes a plurality of upwardly extending needles **28**. The needles **26** and **28** are arranged to pass through aligned holes **110** provided in the upper and lower web guide plates **32** and **34** respectively. The needles **26** are secured in a needle board or holder **112** fixedly secured to a reciprocating plate **114** by bolts, clamps or other suitable means. The reciprocating plate **114** is adjustably mounted on a pair of reciprocating rods **118** carried in vertical sleeves or slide bearings **120** supported on the upper side frame members **48**. The lower set of needles **28** are suitably supported in a needle board or holder **122** fixedly supported on a reciprocating plate **124**. Plate **124** is adjustably supported on the reciprocating rods **118** in spaced relationship beneath the upper needle board **112** and plate **114**. As shown in FIGURE 3, the rods **118** are threaded and by adjustment of nuts **126**, the lower plate **124** and upper plate **114** can be adjusted vertically with respect to each other so that the distance between the points of the needles **26** and **28** respectively can be varied.

Each lower end of the reciprocating rods **118** is pivotally connected as indicated at **130** to connecting rods **132**. The other end of each of the connecting rods **132** is connected to cranks **134** mounted on the ends of a shaft **136** rotatably supported in the bearing pillow blocks **140**. A sprocket **142** carried on the shaft **136** is driven by a chain **146** also trained around a sprocket **148** carried on the drive shaft **100**. As is now apparent by an inspection of FIGURES 1 and 2, rotation of the drive shaft **100** by the motor **108** will cause rotation of the cranks **134** so that the connecting arms **132** reciprocate the rods **118** to simultaneously move both needle patterns **22** and **24** in a path normal to the path of travel of the web **10** through the machine. The reciprocation of the needle patterns **22** and **24** is so timed with the intermittent feed of the web **10** that the needles of each of the patterns will penetrate the web when the web is moving. However, as soon as the needles of the particular pattern **22** or **24** enter the surface of the web, the advancement of the webs stops as the needles continue their movement through the web and the web remains stationary until the needles of the particular pattern are withdrawn. After the needles of one of the patterns are withdrawn from the surface of the web and as the needles of the pattern are beginning to penetrate the opposite surface, the web will begin its advancement. When the web **10** again stops, needle penetration continues through the web.

Referring now to FIGURE 3, it will be noted that the first few rows of needles **26** and **28** of upper and lower needle patterns **22** and **24** respectively pass through the curved inlet portions **36** and **38** of the guide plates **32** and **34**. Some of these needles do not pass completely through the web as heretofore described but merely enter the web and compress the web in the tapering infeed portion **40** of throat **30**. In other words, the needles in this forward portion are not entirely effective to cause interlacing and/or interlooping of the loosely matted fibers but they do compress the web to proper thickness and density for passage through the confined throat **30**.

The contour of plates **32** and **34** is such that they conform to the web as it is compressed, i.e., they allow no up and down flapping motion of the web driving the needling process.

A flywheel **150** mounted on the shaft **136** provides sufficient inertia to the drive mechanism of the apparatus once the apparatus is started so that it reduces the power necessary to drive the same. Any suitable braking means may be used to compensate for inertia of the flywheel and assist in stopping the apparatus after the motor **108** is shut off.

Throughout the specification, the novel fabric structure or material produced by the novel method and apparatus has been referred to as a "needled or non-woven" fabric structure. It will be understood that the term "needled" or the term "non-woven" includes any fabric structure made primarily from a web or a batt of loosely matted fibers with or without a scrim.

While the objects and advantages of the method and apparatus of the present invention have been fully and effectively accomplished, it will be understood that the improved method and/or apparatus is subject to some changes and modifications without departing from the principles and scope of the invention involved. Therefore, the terminology used in the specification is for the purpose of description and not limitation, the scope of the invention being defined in the claims.

I claim:

1. A method of producing a needled fabric by needling a web of loosely matted fibers comprising the steps of: advancing the web in step-by-step motion through a confined throat, initially penetrating the web from one side thereof by causing a first pattern of needles to travel in a path substantially perpendicular to the surface of the web while the web is moving and further continuing penetration of the web by the first pattern of needles while the web is stationary to a point at least adjacent its other side, withdrawing the first pattern of needles while the web is stationary, and initially penetrating the web from the other side thereof by causing a second pattern of needles to travel in a path substantially perpendicular to the surface of the web while the web is moving and further continuing the penetration of the web by the second pattern of needles while the web is stationary to a point at least adjacent the opposite side.

2. The method defined in claim 1 wherein the first and second pattern of needles are caused to travel in a path with their needles aligned point on point.

3. The method defined in claim 1 wherein penetration of said first pattern of needles is effective to at least the surface opposite the surface of penetration of the same and wherein the penetration of the second pattern of needles is also effective to at least the surface opposite the surface of penetration.

4. A method of producing a needled material from a web of loosely matted fibers comprising the steps of: advancing the web in step-by-step motion between oppositely disposed patterns of needles, alternately penetrating the web by the oppositely disposed patterns of needles traveling in substantially mirror-image paths of one another in sequence with the step-by-step advancing of the web so that successive alternate penetrations engage fibers previously oriented by the oppositely-disposed pattern of needles of the immediately previous penetration to cause a chain entanglement of fibers into cohering relationship with each other from both sides of the material and so that the web is penetrated at least one thousand times/sq. inch upon one pass through the opposed patterns of needles.

5. The method defined in claim 4 including causing the substantially mirror-image paths of the opposed needle patterns to be such that needles of the respective patterns travel point-on-point throughout their entire movement.

6. The method defined in claim 4 including advancing the web approximately one-fortieth of an inch for successive penetrations of the oppositely disposed patterns of needles.

7. The method defined in claim 4 including advancing the web a sufficient distance for each penetrations of the patterns of needles whereby the number of penetrations of web per inch of width is equal to the number of penetrations of the web per inch of length.

8. The method defined in claim 4 including penetrating the web by each of the patterns of needles in a plurality of longitudinally spaced rows extending transversely of the web passing therebetween and transversely staggering the penetrating rows with respect to all other rows in the same pattern of needles.

9. The method defined in claim 4 including moving the patterns of needles perpendicular to the web and penetrating the surface of the web when the web is moving and continuing the penetration through the web while it is stationary.

10. The method defined in claim 8 including penetrating through the web to a distance no greater than one-half of an inch out of the surface of the web opposite the surface of penetration.

11. A method of producing a needled fabric from a web of loosely matted fibers comprising the steps of: advancing the web in intermittent step-by-step motion through a confined throat having a thickness substantially equal to the desired thickness of the produced fabric; needling the web from opposite sides of the same while in the confined throat to orient fibers into a cohering relationship with each other, said needling being accomplished by initially penetrating one surface of the web while the web is advancing to orient at least some of the fibers adjacent the one surface of penetration substantially parallel to direction of web travel, continuing the penetration through the web when the web is stationary to orient some of the previously oriented surface fibers as well as unoriented fibers in the body of the web substantially transverse to direction of web travel, then initially penetrating the other surface of the web while the web is advancing to orient at least some of the fibers adjacent the other surface of penetration substantially parallel to direction of web travel as well as reorient some of the previously transversely oriented fibers, and continuing this latter penetration through the web while the web is stationary to orient some of the previously oriented surface fibers adjacent the other surface of penetration as well as unoriented fibers in the body of the web substantially transverse to direction of web travel, and repeating the needling sequence as the web is advanced.

12. A method of producing a needled fabric by needling a web of loosely matter fibers with barbed needles comprising the steps of: penetrating the web alternately from opposite sides by needle patterns having needles moving in paths of travel which are mirror images of one another and each needle pattern capable of punching the web in a range of about 25 to about 50 individual punches for each widthwise inch of web, advancing the web in step-by-step increments in a relationship to the penetration by the needle patterns wherein each needle of a needle pattern punches the web in a range of about 6 to about 30 punches per linear inch of web.

13. The method of claim 11 including controlling the penetration of the needles through the web where the barb closest to the tip of each of the needles of each needle pattern passes through the web at least to the surface opposite the surface of penetration but no greater than one-half inch out of the surface opposite the surface of penetration.

14. The method defined in claim 11 wherein penetration of the web begins while the web is moving and continues while the web is stationary.

15. The method of claim 11 including causing the needles of one pattern to travel in the mirror image paths with the needles of the other pattern so that the needles are aligned point on point.

16. A method of producing a needled fabric from a web of loosely matted fibers comprising the steps of: advancing the web in intermittent step-by-step increments through a confined throat, needling the web from opposite sides of the same while in the confined throat to orient the fibers into a chain of entanglement of fibers in cohering relationship with each other, accomplishing said needling by penetrating one surface of the web with a first needle pattern to orient some of the fibers therein, then penetrating the other surface of the web with a second needle pattern traveling in a substantially mirror image path of the path of the first needle pattern with the increment of advancement of the web being such that some of the previously oriented fibers in the web are reoriented and some other fibers are oriented and entangled therewith, and repeating the needling sequence and increment of advancement of the web to accomplish the chain of entanglement of fibers in cohering relationship with each other.

17. The method defined in claim 15 including causing the substantially mirror image paths of the needle patterns to be such that needles of the respective patterns travel point on point substantially perpendicular to the surface of the web.

18. The method of claim 15 wherein penetration of the web is begun by each of the needle patterns while the web is moving and is completed while the web is stationary.

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