

July 8, 1958

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METHOD OF MAKING PILE FABRICS WITH LOOPS
OF DIFFERENT HEIGHT AND APPARATUS
FOR PRACTICING THE METHOD

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2 Sheets-Sheet 1

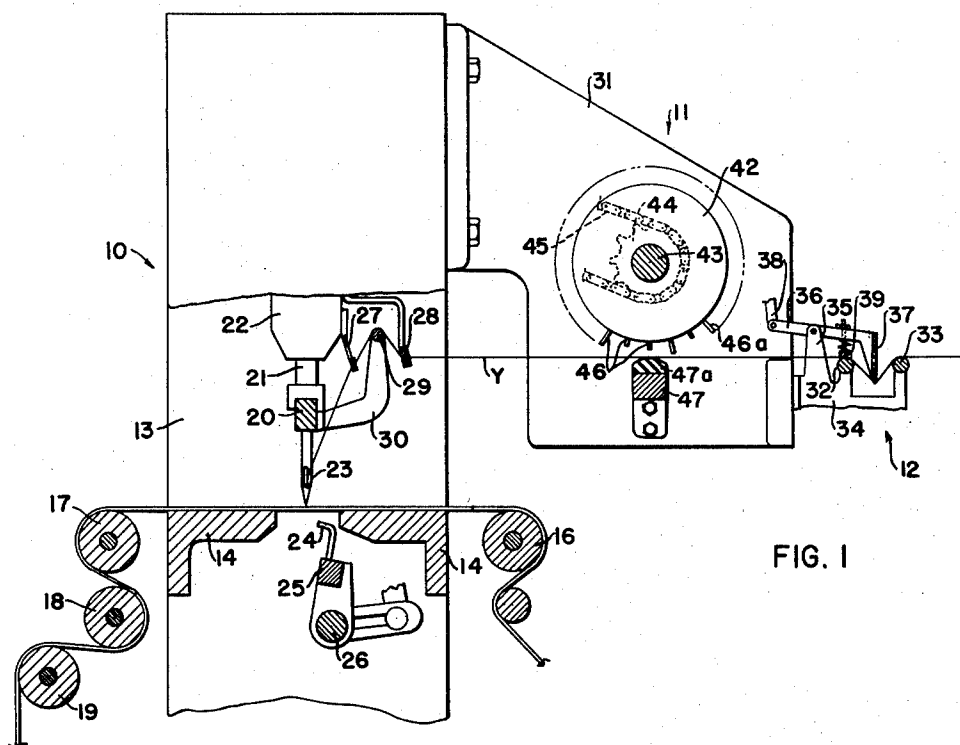


FIG. 1

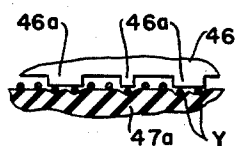


FIG. 2

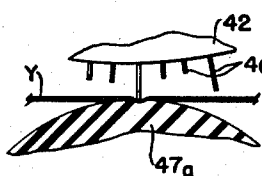


FIG. 3

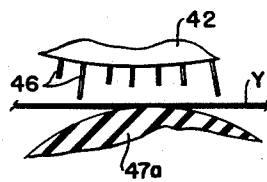


FIG. 4

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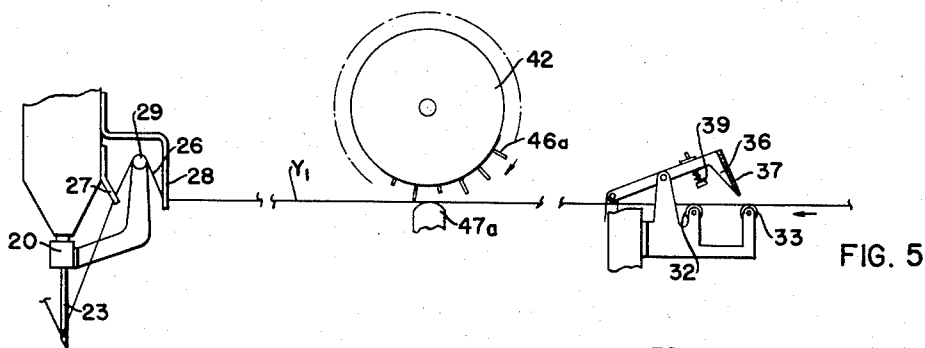


FIG. 5

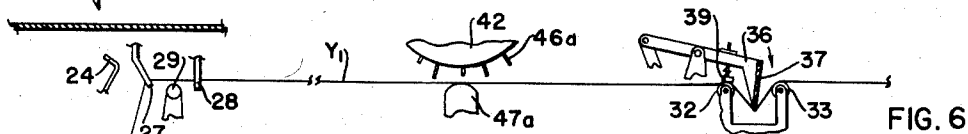


FIG. 6

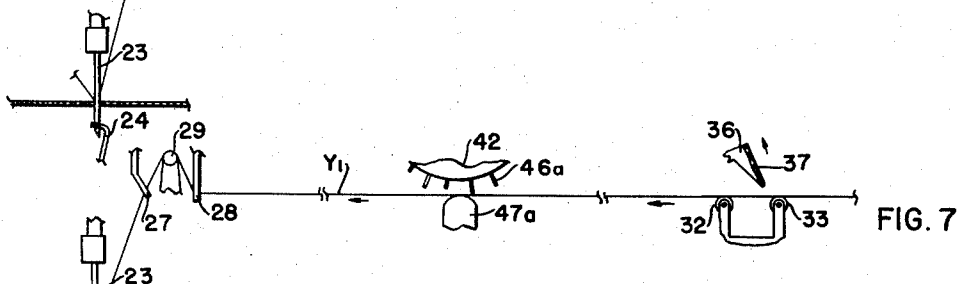


FIG. 7

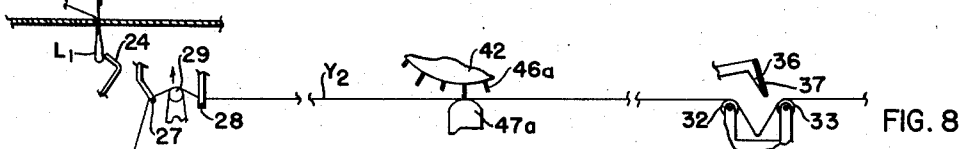


FIG. 8

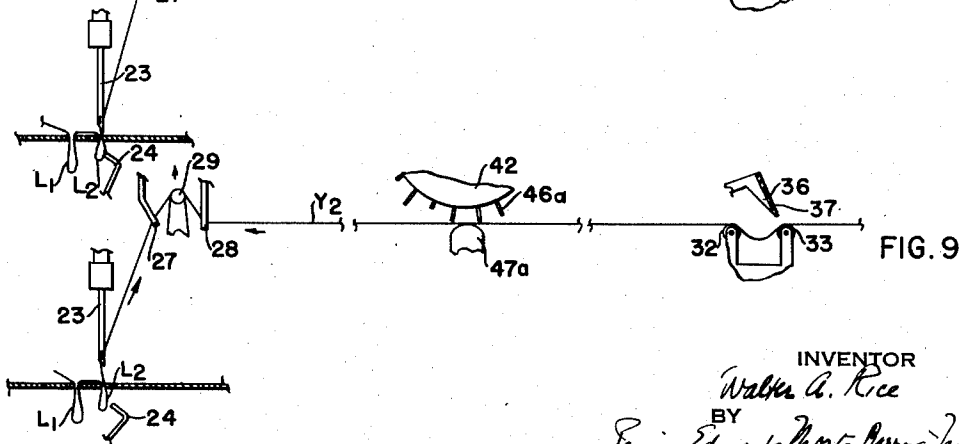


FIG. 9

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2,842,079

METHOD OF MAKING PILE FABRICS WITH LOOPS OF DIFFERENT HEIGHT AND APPA- RATUS FOR PRACTICING THE METHOD

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8 Claims. (Cl. 112—79)

This invention relates to the production of pile fabrics of the type commonly known as tufted fabrics made by passing loops of pile yarn through a backing sheet by means of needles. More particularly, the invention is concerned with a novel method for making such fabrics, in which the pile loops of the individual yarns vary in height in accordance with a pattern, and with an apparatus, by means of which the new method can be advantageously practiced.

Tufted pile fabrics can be produced rapidly and at low cost on sewing machines of the multiple needle type, but the machines commonly used heretofore for the purpose have not been provided with means for varying and controlling the height of the individual pile loops. As a result, it has not been possible to use ordinary machines in the production of sewn tufted fabrics with the variety of surface effects in the pile, which are obtainable in pile fabrics woven, for example, on looms equipped with a Jacquard mechanism.

The method of the present invention makes it possible to make tufted fabrics, in which the height of each loop of each yarn inserted through the backing sheet is under the control of a pattern, and the loop is either high or low as determined by the pattern. In the practice of the method on the machine of the invention, the lengths of the yarns inserted through the backing sheet in each cycle of operation are drawn from final stored supplies of the yarns. Preliminary stored supplies of the yarns are formed between the final stored supplies and the main sources of supply of the yarns by drawing the yarns from such main sources of supply and, during each cycle, yarns selected in accordance with a pattern are held between the final and preliminary stored supplies. While certain yarns are thus held, loops of all the yarns are inserted through the backing and the final stored supplies are then re-established by drawing the yarns, which are not held, from the preliminary stored supplies thereof, while the yarns, which are held, are drawn at least in part from the inserted loops thereof. The withdrawal of the yarns from the loops reduces the height of the loops and, if desired, may withdraw the loops entirely from the backing fabric. Ordinarily, however, the held yarns are released prior to the completion of the final stored supplies with the result that the inserted loops of such yarns are not wholly withdrawn from the backing sheet.

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

Fig. 1 is a view in side elevation with parts omitted and other parts broken away or shown in section of one form of the apparatus of the invention;

Fig. 2 is a partial transverse sectional view of the apparatus showing a pattern wire in effective position;

Figs. 3 and 4 are fragmentary views in side elevation and with a part shown in section illustrating the action of the pattern control device;

Figs. 5-7, incl., are diagrammatic side elevational views of the apparatus showing different stages in its operation

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during the formation of a loop of a yarn not held by the pattern control device; and

Figs. 8 and 9 are views similar to Figs. 5-7, incl., but showing the formation of a loop of a yarn held by the pattern control device.

The form of the new apparatus as shown in Fig. 1 includes a sewing machine 10 having a device for final storage of the pile yarns immediately before their insertion in the backing sheet, a pattern control device 11, and a preliminary yarn storage device 12.

The sewing machine is generally of conventional construction and comprises a frame structure 13 provided with a table 14, over which a backing sheet 15 is advanced stepwise from a supply by means of rollers 16, 17, 18, and 19, some or all of which are driven. A needle bar 20 is mounted above the table on the lower ends of push rods 21 movable in vertical guides 22 and the bar carries a plurality of needles 23. The push rods are reciprocated in their guides by the usual drive shaft and eccentrics (not shown) to raise and lower the needle bar and cause the needles to penetrate the backing fabric during the periods of rest thereof.

Beneath the table are a plurality of loopers 24, one for each needle, which are illustrated as mounted on a bar 25 carried by arms on a shaft 26. The shaft is rocked in timed relation to the action of the needle bar, so that, when the needles pass loops of yarn Y through the backing sheet, the loopers are swung to cause their hooks to enter the loops and hold them momentarily as the needles are retracted and rise out of the fabric.

The sewing machine is provided with a final yarn storage device comprising spaced guides 27, 28 mounted on the push rod guides 22 and having eyes for the individual yarns Y passing to the needles. A storage or deflecting bar 29 mounted on brackets 30 attached to the needle bar extends beneath and across the sheet of yarns and may engage the yarns between the eyes of guides 27, 28. The deflecting bar is so positioned relative to the needle bar that, when the needles are in their lowermost positions, the bar 29 lies slightly spaced from the portions of the yarns lying in a straight line between the eyes of guides 27 and 28 or barely makes contact with those portions of the yarns. When the needle bar rises to retract the needles from the backing sheet, the deflecting bar engages the yarns between guides 27 and 28 and deflects them upwardly. The extra length of yarn, which is drawn into the space between the eyes of guides 27, 28 when a yarn extending in a straight line between the eyes is deflected upward by bar 29, is a final stored supply of the yarn and this supply is sufficient to extend along the backing sheet from one loop to the next and to form a loop of maximum height.

The yarns Y to be fed to the respective needles are drawn from packages in a creel by the preliminary storage device 12, which may be mounted on brackets 31 attached to the frame 13 of the sewing machine. The device 12 comprises a pair of spaced guide rolls 32, 33 carried by arms 34 attached to brackets 31 and having vertical extensions 35, on which are pivoted levers 36. The yarns traveling from the creel to the final storage device pass over the rollers and levers 36 carry a deflecting plate 37 operable to deflect the yarns downward between the rollers. The levers are rocked to actuate the plate by suitable means, including links 38 attached to the levers and reciprocated by the drive mechanism of the sewing machine. The levers carry a spring-pressed clamping bar 39 extending across the yarns and operable, as the plate begins to depress the yarns between the rollers, to clamp the yarns against roller 32. As the plate moves down between the rollers and increases the length of the portions of the yarns extending from one roller to the other, the addi-

tional quantities of yarn required are drawn from the packages and the clamping bar prevents any tension being applied to the yarns between roller 32 and the eyes of guide 28.

The pattern control device 11 comprises a drum 42 on a shaft 43 mounted in bearings in brackets 31 and advanced stepwise in timed relation to the operation of the needle bar by drive means including a sprocket wheel 44 and chain 45. The drum carries a set of pattern elements, which are shown as wires 46 projecting radially from the drum and lying parallel to shaft 43. Each wire has pattern sections 46a, one for each of the yarns, and the height of the wire at each section is either high or low depending upon the requirements of the pattern. A stationary clamping member 47 is mounted below drum 42 parallel to shaft 43 and the member has a yielding face plate 47a engaged by the high pattern sections on the wires, as the wires come to rest in effective position directly above member 47. Yarns engaging the high pattern sections on a wire are, accordingly, clamped by the wire against member 47 and held against movement, when the wire is in effective position, while yarns opposite low pattern sections on the wire are not so clamped and held and can be moved endwise.

The operation of the apparatus will be apparent from an examination of Figs. 5-9, incl., in which Figs. 5, 6, and 7 show different stages in the cycle during the formation of a loop L_1 of a yarn Y_1 not held by the pattern control device, while Figs. 8 and 9 show similar stages during the formation of a loop L_2 of yarn Y_2 , which is held by the device.

At the stage shown in Fig. 5, the needle bar is at its highest point and about to descend, a final stored supply of the yarn has been formed by the deflecting bar 29, the preliminary stored supply of yarn Y_1 has not been formed, and no pattern element 46 is in effective position. When the needle descends, the bar 29 releases the final stored supply of yarn Y_1 and the needle penetrates the fabric and carries a loop of the yarn with it. The looper 24 enters the loop before the needle starts upward and holds the loop momentarily during the ascent of the needle. During the descent of the needle, the levers 35 cause the deflecting plate to engage and depress the yarn between the rollers 32, 33 but, before the plate engages the yarn, the spring-pressed clamping bar 39 clamps the yarn against roller 32, so that the downward movement of plate 37 draws a length of the yarn from the package. During the descent of the needle bar, drum 42 advances to bring the next pattern element in the sequence into effective position above the clamping member 47. The section of the pattern element so moving toward effective position, which lies above yarn Y_1 , is a low section, so that the yarn is not clamped against member 47 and held.

In Fig. 6, the looper 24 is shown as having entered the loop of yarn, the needle is about to rise, the deflecting plate 37 has formed the preliminary stored supply of the yarn, and drum 42 has moved a pattern element to effective position. As the needle leaves the fabric and the deflecting bar 29 forms the next final stored supply between guides 27, 28, this supply is provided by pulling the yarn between the effective pattern element and clamping member 47 and thus withdrawing the yarn from the preliminary stored supply. The reason for this action is as follows. Since the length of yarn between the deflecting bar 29 and the preliminary stored supply is not clamped by a pattern element and member 47, the formation of the final stored supply by the raising of bar 47 does not impose sufficient tension on the yarn between guide 27 and the inserted loop L_1 to withdraw yarn from the loop and the loop L_1 , accordingly, remains at full length. Just before the needle and deflecting bar 29 reach their topmost positions, the drum 43 starts to advance and, when the needle and bar reach such positions, a cycle of operations is complete.

In Figs. 8 and 9, there is illustrated the insertion of a

loop of yarn Y_2 , which is clamped and held by a high section on the pattern element in effective position at the time the final stored supply of the yarn is formed after the insertion of the loop. In the cycle of operations, of which two stages are illustrated in Figs. 8 and 9, the descent of the needle has inserted a loop of the yarn through the backing and the loop so inserted is initially of the same length as loop L_1 , since the needle penetrates the same distance through the fabric on each descent. This loop has been momentarily held by the looper, but, as the needle rises and the deflecting bar 29 begins to form the succeeding final stored supply of the yarn, the deflection of the yarn between the eyes of guides 27, 28 causes tension to be placed on the yarn. Since the yarn is being clamped against member 47 by a high pattern section of the pattern element in effective position and thus held against endwise movement, the rise of the deflecting bar 29 causes yarn to be pulled from the loop just inserted and the height of the loop L_2 begins to diminish. In order to prevent complete withdrawal of loop L_2 , the pattern drum 42 starts its next step before bar 29 has reached its uppermost position and completed the final yarn storage. This movement of the drum displaces the previously effective pattern element from clamping position, so that the yarn Y_2 is no longer clamped and the additional length of yarn required to complete the final stored supply is withdrawn from the preliminary stored supply between rollers 32, 33.

It will be evident from the description of the construction and mode of operation of the apparatus that the height of each loop of each yarn inserted through the backing sheet may be controlled and can thus be determined in advance by selection of a set of pattern elements of the desired form. The elements in a set are mounted to form an endless series, so that the pattern in the pile repeats regularly, and, if desired, the elements may be mounted on an endless support other than a drum as, for example, a set of chains. The height of the loops of less than maximum height is controlled by the timing of the advance of the group of pattern elements and, if such loops are to be relatively small, the yarns will be held by the pattern elements until storage of the final supply of the yarn by the deflecting bar 29 has almost been completed. If such loops are to be almost as high as the loops of maximum height, the pattern elements will release the yarns shortly after the storage of the final supply of yarn begins.

I claim:

1. A method of making a pile fabric with pile elements of different heights, in which the pile elements are formed from yarns, which comprises advancing a backing sheet stepwise, providing final stored supplies of the respective yarns, drawing lengths of a plurality of pile yarns from the final stored supplies of the yarns and passing the yarns through the sheet during the successive periods of rest of the sheet to form loops of the respective yarns, the loops of the yarns lying in rows extending transverse to the direction of movement of the sheet and the loops of each single yarn lying in a row lengthwise of the sheet and being connected by that yarn, providing preliminary stored supplies of the respective yarns between the final stored supplies and the main sources of supply of the yarns by drawing the yarns from the main sources of supply, momentarily holding yarns selected in accordance with a pattern between the final and preliminary stored supplies of the yarns, the selected yarns being held for a predetermined length of time after each loop-forming operation, and replenishing the final stored supplies of the yarns after each loop-forming operation by drawing the held yarns at least in part from the last inserted loops thereof, dependent upon the length of time said yarns are held, and by drawing the yarns not held from the preliminary stored supplies thereof.

2. A method of making a pile fabric with pile elements of different heights, in which the pile elements are formed

from yarns, which comprises advancing a backing sheet stepwise, providing final stored supplies of the respective yarns, drawing lengths of a plurality of pile yarns from the final stored supplies of the yarns and passing the yarns through the sheet during the successive periods of rest of the sheet to form loops of the respective yarns, the loops of the yarns lying in rows extending transverse to the direction of movement of the sheet and the loops of each single yarn lying in a row lengthwise of the sheet and being connected by that yarn, providing preliminary stored supplies of the respective yarns between the final stored supplies and the main sources of supply of the yarns by drawing the yarns from the main sources of supply, momentarily holding yarns selected in accordance with a pattern between the final and preliminary stored supplies of the yarns, the selected yarns being held for a predetermined length of time after each loop-forming operation, varying the height of the loops of each group simultaneously passed through the backing sheet by withdrawing at least part of the yarn from the loops formed of the held yarns, dependent upon the length of time said yarns are held, and forming final stored supplies thereof, and drawing from the preliminary stored supplies thereof the yarns not held to form final stored supplies of such yarns.

3. In apparatus for making a pile fabric having means for advancing a backing fabric stepwise over a support, needles operating to pass loops of yarn through the backing fabric and loopers for holding the loops during retraction of the needles; means for supplying yarns to the needles comprising means for drawing the yarns from main sources of supply and forming preliminary stored supplies of the yarns, means operating with the needles for forming final stored supplies of the yarns as the needles are retracted, and means for momentarily holding yarns selected in accordance with a pattern between the preliminary and final stored supplies of the yarns, the means for forming final stored supplies of the yarns drawing from the preliminary stored supplies the yarns not held by the holding means and drawing from the last inserted loops the yarns held by the holding means.

4. The apparatus of claim 3, in which the means for forming the final stored supplies of the yarns comprises spaced guides for the yarns on the way to the needles and means for deflecting the yarns from their normal rectilinear paths between the guides.

5. The apparatus of claim 4, in which the needles are mounted on a reciprocating bar and the yarns are deflected between the guides by an element secured to the needle bar to move therewith.

6. The apparatus of claim 3, in which the means for forming the preliminary stored supplies comprises spaced supports for the yarns, means for holding the yarns adjacent one support, and means for deflecting the yarns from their normal path between the supports to draw the yarns from their main sources of supply.

7. The apparatus of claim 3, in which the means for holding the yarns selected in accordance with a pattern comprises a support, over which the yarns pass from the preliminary to the final stored supplies, pattern elements mounted in an endless series above and extending lengthwise of the support and transverse to the yarns, and means for advancing the elements to bring them successively into effective position relative to the support, the elements having pattern sections for the individual yarns with certain of the sections determined by the pattern operating to clamp their yarns against the support and hold the yarns against advancing movement.

8. The apparatus of claim 7, in which the pattern elements are wires varying in height in the different pattern sections, the high sections cooperating with the support to hold the associated yarns against advancing movement.

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