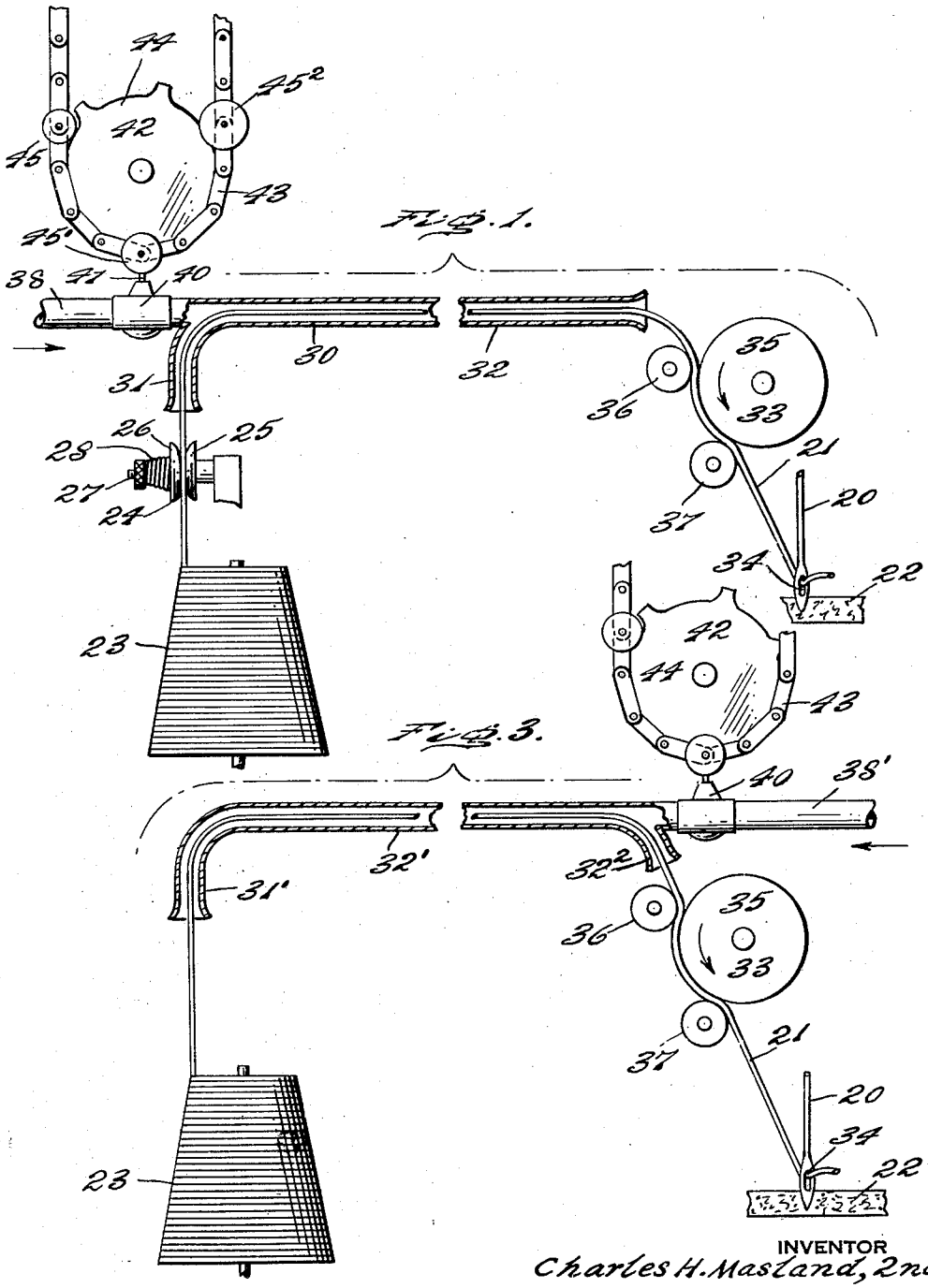
Dec. 30, 1958 C. H. MASLAND 2ND 2,866,424

CONTROL OF PILE HEIGHT IN NEEDLING

Filed Sept. 29, 1953 2 Sheets-Sheet 1



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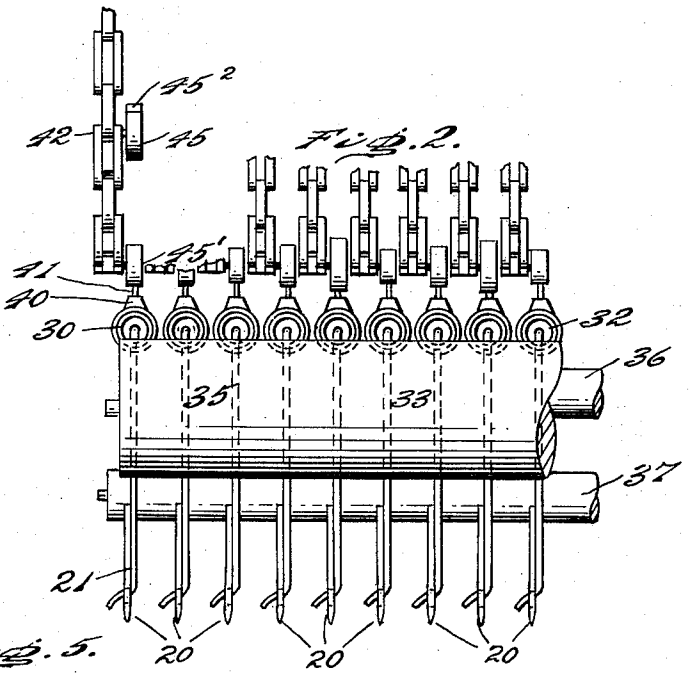


Fig. 2.

Fig. 5.

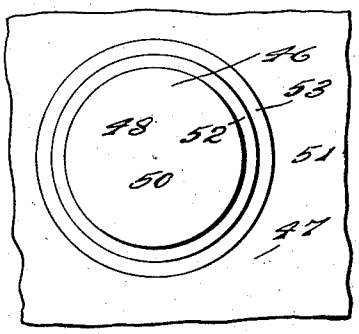
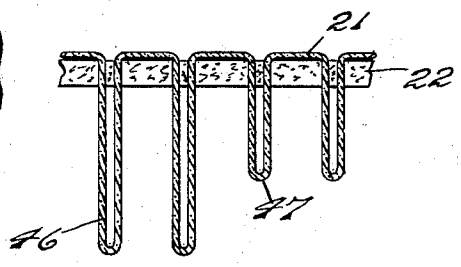


Fig. 4.



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CONTROL OF PILE HEIGHT IN NEEDLING

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8 Claims. (Cl. 112—79)

The present invention relates to the control of the height of pile on individual pile yarn ends of needle fabrics.

A purpose of the invention is to utilize the longitudinal force of a stream of gas applied around a pile yarn end to vary the feed of the pile yarn end to one of a gang of needles.

A further purpose is to apply the stream of gas in the direction of yarn feed or alternatively opposed to the direction of yarn feed.

A further purpose is to apply frictional drag to yarn fed to individual needles of a gang at a point behind the needles in the direction of feed and to reduce the effect of the frictional drag on the individual yarn ends by applying streams of gas selectively to particular yarn ends in the direction of feed.

A further purpose is to control the lengths of individual stitches.

A further purpose is to gradate the heights of stitches at the edge of a high pile area.

A further purpose is to regulate the force applied to the yarn by the gas streams to control pile height.

Further purposes appear in the specification and in the claims.

In the drawings I have chosen to illustrate a few only of the numerous embodiments in which my invention may appear, selecting the forms shown from the standpoints of convenience in illustration, satisfactory operation and clear demonstration of the principles involved.

Figure 1 is a diagrammatic central longitudinal section showing the yarn feed and control to one reciprocating needle of the gang.

Figure 2 is a fragmentary front elevation showing the feed of Figure 1 applied to a series of pile yarn ends and needles, the needles being represented in transverse section taken at the eyes of the needles.

Figure 3 is a view similar to Figure 1 showing a variation.

Figure 4 is an enlarged fragmentary longitudinal section through the pile fabric produced.

Figure 5 is a top plan view of one form of fabric according to the invention.

Describing in illustration but not in limitation and referring to the drawings:

Pile fabrics have been manufactured extensively by needling, stitching or punching through a backing, suitably a fabric such as burlap, osnaberg or felt, and forming pile projections by the action of the needles in forcing pile yarn through the backing. This type of pile manufacture is referred to herein as needling. In the process a gang of needles in a row receives individual pile yarn ends, one of which is threaded through the eye near the point of each needle. The needles reciprocate forward and backward, and, as well known in the art, the pile projections formed when the needles are thrust through the backing are often held by hooks which engage the yarn on the side of the backing remote from the needle bar.

Efforts have been made to produce pile projections of varying height, but the apparatus previously produced has been subject to certain difficulties. The mechanism employed has often been complicated, it has in some cases been impossible to control the height of individual pile yarn ends and of individual stitches, and in many instances it has not been possible to obtain a wide variety of heights of pile or to obtain any particular height of pile with accuracy.

In accordance with the present invention, the mechanism required is very simple, individual pile yarn ends are controlled as to height in accordance with pattern demand, individual stitches are controlled in height, a wide variety of heights of pile is possible and indivdual pile heights can be regulated accurately. Furthermore, in accordance with the invention, it is readily possible to change the pile height requirement in a minimum of time.

Considering now the forms of Figures 1 and 2, a gang of needles 20, of which one needle only is shown, are reciprocated up and down in unison by the needle bar (not shown) as well known, to force pile yarn ends 21 individual to each needle through a backing 22. The pile yarn ends 21 come from a source of yarn, suitably a creel 23 (only part is shown) and are carried through a yarn drag mechanism 24 individual to each pile yarn end, and consisting of a stationary dished friction element 25, and an opposed movable dished friction element 26 having a hole at the center through which a bolt 27 passes, and urged together by a spiral compression spring 28 held by the bolt.

The yarn end then passes through a feeding tube 30 having an upwardly extending and forwardly curving branch 31 and a forwardly extending branch 32, to a yarn feed 33 and then to the eye 34 of the appropriate needle 20. The yarn feed 33 preferably consists of a feed roll 35 rotating in the direction of the arrow, and positively fed intermittently or constantly as desired, and guide rolls 36 and 37 which hold the yarn on a portion of the periphery of the feed roll 35. It will be evident that the yarn is capable of slipping over the periphery of the feed roll 35.

Each of the tubes 30 has a rearwardly extending branch 38 connected to a source of air or other gas, and a valve 40 interposed near the forward end of the branch 38 in line with the forwardly extending branch 32. The valve 40 is manipulated by a plunger 41 against a suitable internal spring (not shown) so that when the plunger 41 is depressed the valve opens and the extent of opening is regulated by the extent of depression.

The valve 40 is controlled by any suitable pattern control mechanism to determine whether and to what extent it is to open. It is immaterial whether the pattern control mechanism is a jacquard, a dobby chain or any other well known type which selects the particular pile yarn ends to which air is to be applied and the extent of force to be exerted by the air, and varies the setting preferably for each stitch of each pile yarn end. In the form shown in Figures 1 and 2 a dobby chain mechanism 42 is used consisting of a dobby chain 43 moving intermittently as well known over sprockets 44 (only one is shown) and having at positions of rest rollers 45, 45' and 45^2 which by their presence or size determine the opening of the valve 40.

In operation it will be evident that each pile yarn end is fed to the appropriate needle or other pile loop forming device by the feed 33 pulling against the frictional drag mechanism 24. If, on the other hand, at the particular pile yarn end and the particular stitch the valve 40 is open, the effective frictional drag from the frictional drag mechanism 24 is reduced as far as that pile yarn end is concerned by the tendency of the stream of gas

to advance the pile yarn end, so that less slipping over the feed 33 occurs. By controlling the pattern selection mechanism, therefore, the tendency of the yarn to pull out pile yarn from the previous loop during advance of the needle, or to pull back pile yarn and thus shorten the pile as the needle retracts is regulated, so that when the valve 40 is opened and the effective drag or pull-back is reduced, high pile projections 46 are formed, but when the valve 40 is not opened and the drag by the mechanism 34 is high, low pile projections 47 are produced. Thus pile projections of different height in the same transverse rows of pile projections result. By opening the valve 40 to different extents by rollers 45, 45′ or 45^2, several different pile heights can be obtained.

In the form of Figures 1 and 2 the stream of air or other gas is blown in the direction of feed and acts against the frictional retardation applied behind the air blast in the direction of feed.

The application of the stream of gas may be opposite to the direction of feed as shown in Figure 3 where the air tube has an upwardly extending element 31′ which gradually bends into the horizontally extending tube 32′ and terminates in a branch 32^2 directed down toward the feed 33. The gas inlet pipe 38′ is at the end of the tube 32^2 adjoining the feed, and has a valve 40 near the point at which branch 32^2 diverts. Again the dobby mechanism acts as before to accomplish pattern selection.

In this form the high pile on the particular pile yarn end is formed when the valve 40 is closed or only partly open, and the low pile is formed when the valve 40 is open or further open so that the drag and pull-back tendency during the advance and retraction of the needle is increased.

It is possible by the invention to obtain gradations of pile height where high and low pile join. Thus in Figure 5 a rosette 48 is formed of high pile projections 46 in the main area 50, and is surrounded by low pile projections 47 in the ground area 51. Intermediate between these areas are gradations, consisting of an area 52 with pile slightly lower than the high pile and an area 53 slightly higher than the low pile. Any number of gradations may be used.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the process and structure shown, and I, therefore, claim all such insofar as they fall within the reasonable spirit and scope of my claims.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. The method of feeding pile yarn ends to pile forming machines having multiple loop formers, which comprises feeding a plurality of pile yarn ends each through its own tube to an associated pile loop former to form pile projections, introducing a separate stream of gas into each tube around the pile yarn at a point located before the yarn arrives at the loop former and regulating the gas stream in one tube with respect to the gas stream in adjacent tubes by pattern control, thereby to provide for varying the lengths of yarn fed to the loop formers during the pile forming operation.

2. The method of feeding pile yarn in needling to make pile of different heights, which comprises feeding a plurality of pile yarn ends each through its own tube to an associated needle of a needling machine having a plurality of needles, introducing a different stream of gas into each tube around the pile yarn and in the direction of feed of the yarn at a position before the yarn arrives at the needles, and regulating the gas stream in one tube with respect to the gas stream in other tubes per stitch, thereby to provide for varying the lengths of yarn fed to the needles during the needling operation.

3. The method of feeding pile yarn to an associated needle of a needling machine having a plurality of needles, which comprises feeding a plurality of pile yarn ends each through a separate tube to the associated needle, introducing a separate stream of gas into each tube around the pile yarn and extending in the direction opposed to the direction of feed of the yarn at a position before the yarn arrives at the needles, and regulating the g s stream in one tube with respect to the gas stream in adjacent tubes on each stitch, thereby to provide for varying the lengths of yarn fed to the needles on each stitch.

4. The method of feeding pile yarn to an associated needle of a needling machine having a plurality of needles, which comprises feeding a plurality of pile yarn ends each through a different tube to the associated needle, retarding the pile yarn ends by frictional drag applied along each end behind each needle and behind each tube in the direction of yarn feed, discharging a separate stream of gas into each tube around the pile yarn end in the direction of feed from points between the points of frictional drag and the needles, and selectively varying the gas stream in one tube with respect to the gas stream in adjoining tubes according to a pattern control on each stitch, thereby to provide for varying the length of yarn fed to the needles on each stitch.

5. In a feed for yarn to a pile forming machine, a plurality of elongated feed tubes, means for feeding an individual yarn end each through a different feed tube and from the feed tubes to the pile forming machine, said means including means for introducing a separate stream of gas into each feed tube and means responsive to pattern control for varying the gas feed to one tube with respect to the gas feed to adjacent tubes per cycle of the pile forming machine.

6. A yarn feed to a pile forming machine having a gang of needles, comprising in combination, a plurality of elongated feed tubes, means for feeding an individual yarn end each to a different feed tube and from the feed tube to one of the needles of the pile forming machine, said means including means for feeding a stream of gas to each tube in the direction of feed of the yarn and means responsive to pattern control for varying the stream to one tube with respect to the stream to adjacent tubes.

7. A pile forming machine having a gang of reciprocable needles, means for feeding yarn ends individually to the different needles including elongated tubes adapted to surround the individual yarn ends, and means responsive to a pattern for introducing variable streams of gas into the tubes in a direction opposed to the direction of feed on each reciprocation of the needles.

8. A pile forming machine having a gang of reciprocable needles, a yarn feed for feeding individual yarn ends to the needles including elongated tubes adapted to surround the individual yarn ends, means for applying frictional drag to each yarn end at a point back of the needles and back of the tubes in the direction of yarn feed, and means responsive to a pattern for introducing vari ble jets of gas into the tubes on each reciprocation of the needles.

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