United States Patent

[11] 3,595,186

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[21] Appl. No. **790,736**
[22] Filed **Jan. 13, 1969**
[45] Patented **July 27, 1971**
[32] Priority **Jan. 13, 1968**
[33] **Great Britain**
[31] **2014/68**

[54] NEEDLE ASSEMBLY FOR A TUFTING MACHINE

8 Claims, 15 Drawing Figs.

[52] U.S. Cl. 112/79
[51] Int. Cl. D05c 15/08
[50] Field of Search 112/79, 80, 79.6, 266, 410; 156/72, 435

[56] **References Cited**

UNITED STATES PATENTS

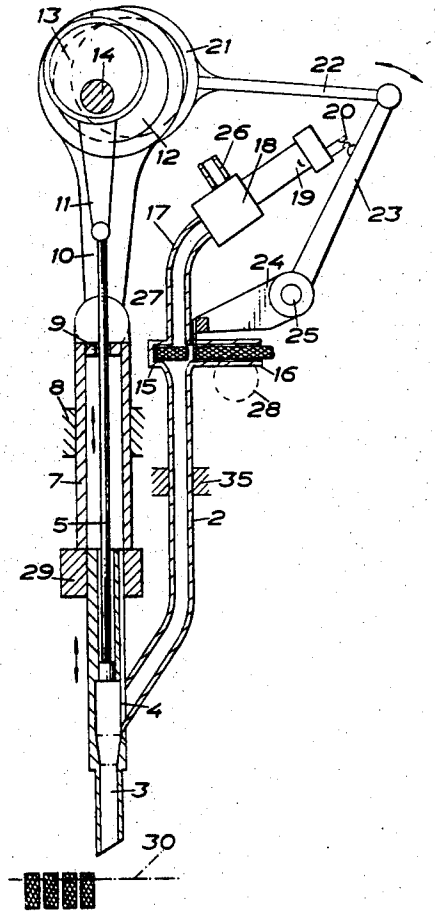
3,089,442	5/1963	Short	112/79
3,387,577	6/1968	Spanel et al.	112/79
3,389,667	6/1968	Mueller	112/80 X

FOREIGN PATENTS

6,603,650	9/1966	Netherlands	112/79
6,614,793	4/1967	Netherlands	112/79

Primary Examiner—James R. Boler
Attorney—Jacob L. Kollin

ABSTRACT: A needle assembly for a tufting machine, comprising a hollow reciprocating needle, a stationary feed tube for the needle having at least one bore the axis of the lower end of each bore making an acute angle with the axis of the needle, pressure air means for transferring a short length of tufting material from a feed entry through the feed tube into one end of the needle, and a ram actuated to press the tuft into the needle and accompany the needle and tuft during a stroke of the needle to penetrate a backing fabric, the tuft being left in the backing fabric on completion of the stroke.



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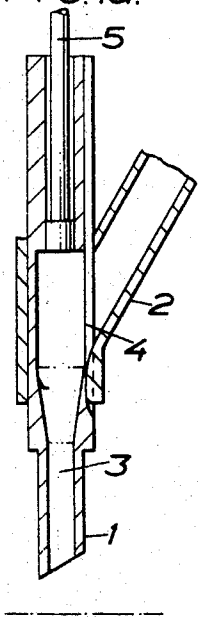
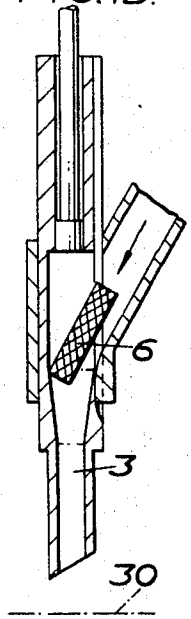
SHEET 1 OF 3

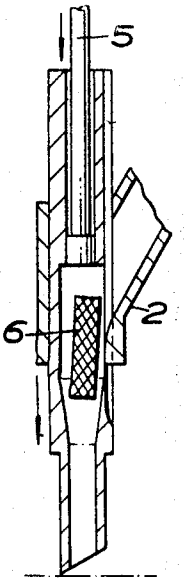
-FIG. 1a-



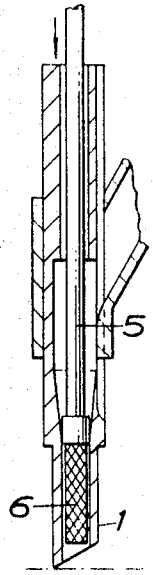
-FIG. 1b-



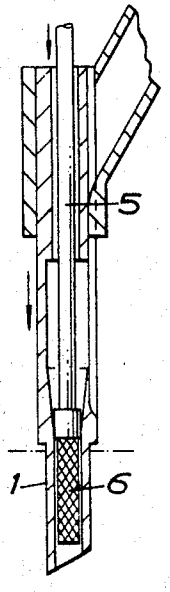
-FIG. 1c-

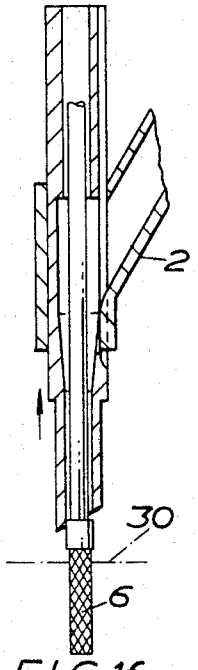


-FIG. 1d-

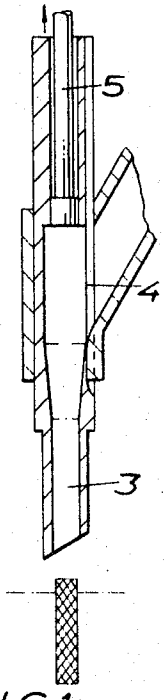


-FIG. 1e-





-FIG. 1f-



-FIG. 1g-

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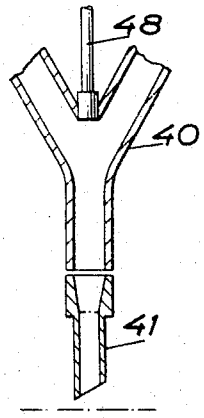
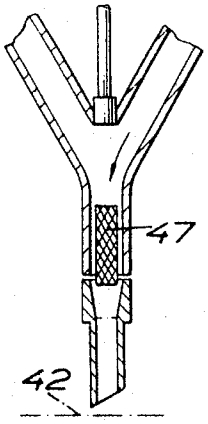
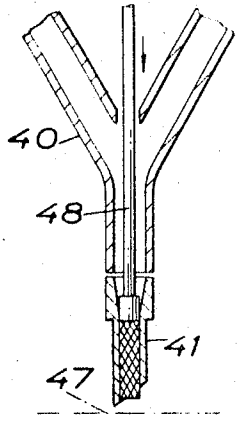
-FIG. 2a-



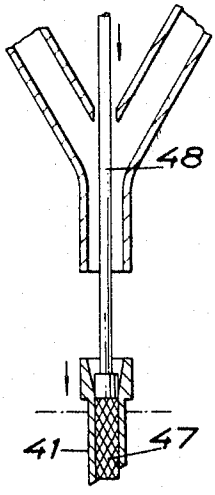
-FIG. 2b-



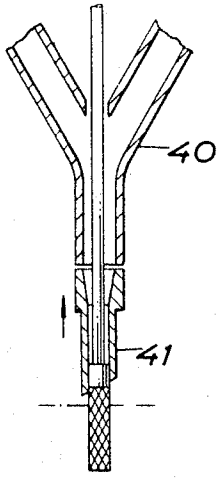
-FIG. 2c-



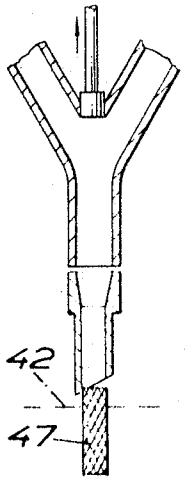
-FIG. 2d-



-FIG. 2e-



-FIG. 2f-



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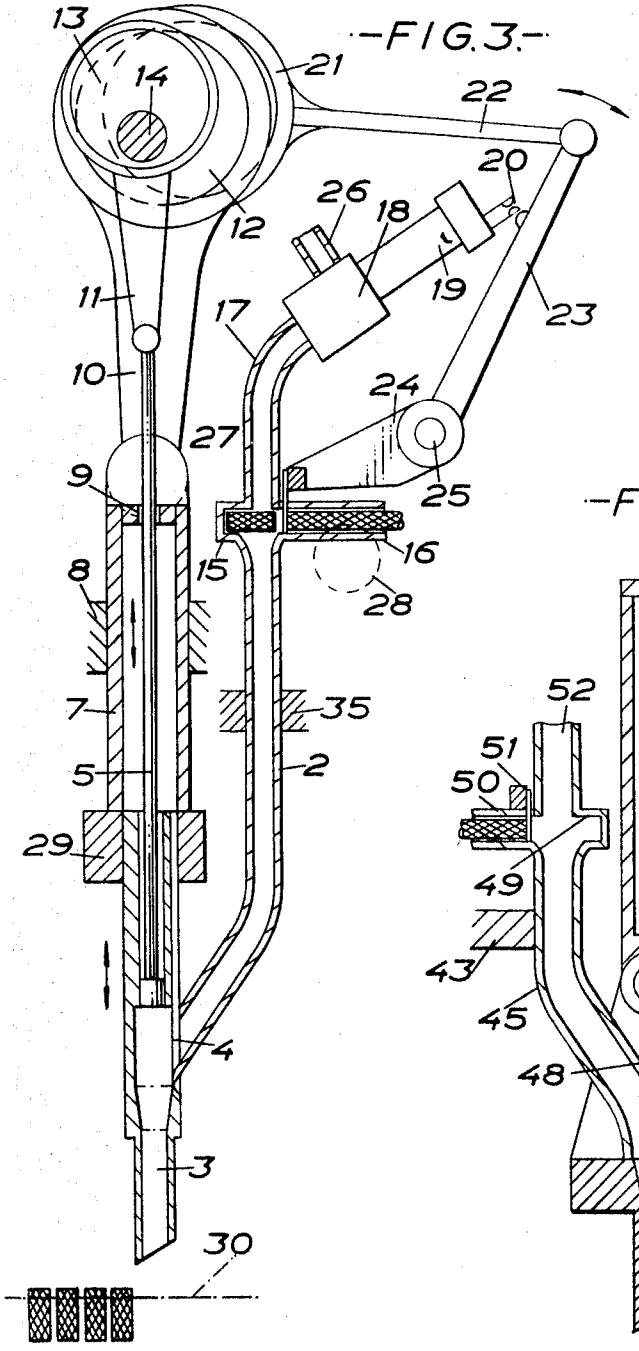
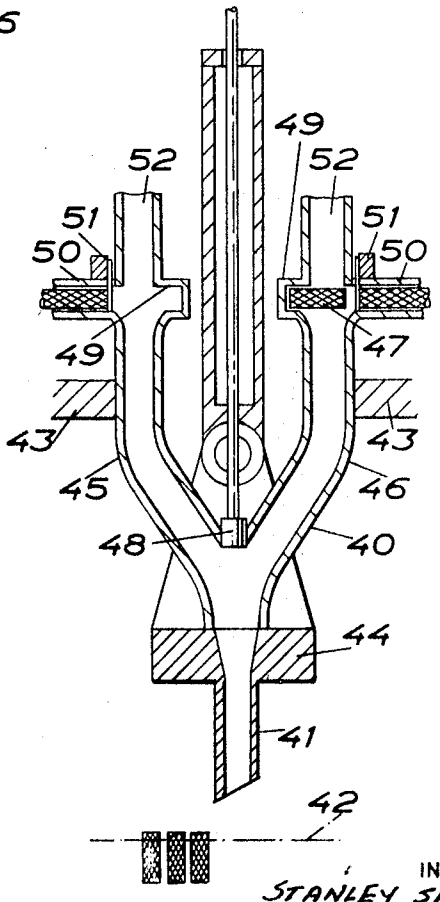
-FIG. 3-



-FIG. 4-



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NEEDLE ASSEMBLY FOR A TUFTING MACHINE

Our invention relates to tufting machines, and has for its object the provision of a tufting needle assembly capable of inserting tufts of pile fabric into a backing material in succession, the tufts being of different colors if required. In a tufting machine, a row of such needles is provided, extending across the width of the backing material. The invention also concerns a method of use of the assembly.

In some known tufting machines, continuous yarn is supplied to each needle, which is reciprocated into and out of a base material, the needle carrying the yarn and placing it in position in the backing material in loops or tufts. Our invention is concerned with a form of needle assembly which is particularly adapted to inserting separate tufts in succession into the backing material, the tufts being of different colors if required.

According to the present invention a needle assembly for a tufting machine comprises a hollow reciprocating needle, a stationary feed tube for the needle having at least one bore the axis of the lower end of each bore making an acute angle with the axis of the needle, pressure air means for transferring a short length of tufting material from a feed entry through the feed tube into one end of the needle, and a ram actuated to press the tuft into the needle and accompany the needle and tuft during a stroke of the needle to penetrate a backing fabric, the tuft being left in the backing fabric on completion of the stroke.

Reference should now be made to the accompanying drawings, in which:

FIG. 1 *a* to *g* shows the various stages of operation of a first form of needle mechanism:

FIG. 2 *a* to *f* shows the stages of operation of a second form of needle mechanism:

FIG. 3 shows details of construction of the first form of needle and its means of operation:

FIG. 4 shows details of construction of the second form of needle.

In the first form of our invention, FIGS. 1 and 3, a tufting needle assembly consists of a hollow needle 1 open at its point, slidably mounted adjacent to the open end of a feed tube 2, the needle interior tapering towards the pointed end to a bore 3 of a narrower cross section than that of the feed tube, with an aperture 4 in its sidewall of the same cross section as the feed tube, so that the needle's hollow interior communicates with the feed tube when the needle is in the position shown in FIG. 1 *a* and *b*. A ram 5 is mounted in the upper bore of the needle so as to be slidable from a position above the aperture 4 in the sidewall to a position in which it protrudes from the open point of the needle, FIG. 1 *b*. Means are provided for moving the needle relative to the feed tube, and the ram relative to the needle.

The feed tube is supplied with tufts of pile fabric 6, which are cut and inserted in the tube in the desired color sequence.

The operation of this invention as shown in FIG. 1 *a* to *g* is as follows.

For each insertion of a tuft, the needle is initially above the backing material, the aperture in its sidewall communicating with the feed tube, the ram being above the aperture FIG. 1 *a*. A tuft of pile fabric is passed along the side tube 2 by air pressure, and enters the interior of the needle, FIG. 1 *b*. The needle and ram together slightly move downwards relative to the feed tube, FIG. 1 *c*, the lower edge of which pushes the tuft into an upright position. The needle then remains stationary while the ram descends and pushes the tuft into the tapered portion of the needle, near the point, FIG. 1 *d*. The needle and ram descend together so that the needle pierces the backing material 30, FIG. 1 *e*. When the tuft within the needle is at the required position, the needle is raised clear of the backing material while the ram remains immobile, the tuft being thus ejected from the needle and remaining in the backing material in the required position, FIG. 1 *f*. The needle and ram then return to the starting position, FIG. 1 *g*, and the process is repeated, a tuft of yarn being fed down the feed tube for each operation. After the tufts are inserted, the backing material is sprayed with adhesive on its rear (upper) side to hold the tufts firmly in place.

A row of such needles is provided, extending across the width of the backing fabric, to insert a row of tufts simultaneously. The needles may be supplied with different colors of pile fabric to form a pattern.

FIG. 3 shows the mechanism of a needle as described above. The needle 1 is connected to a common needle bar 29 and thence to a sleeve 7 which reciprocates in a slide bearing 8. The ram 5 slides in a hole 9 in the top of the sleeve 7, and both the sleeve and ram are provided with connecting rods 10, 11, which are connected to and operated by eccentrics or cam mechanisms 12, 13, on a drive shaft 14. The feed tube 2 is stationary and is fixed to the framework of the machine at 35. The tube has a blind enlargement 15 at its upper end, with a yarn entry 16 opposite the enlargement. The upper side of the enlargement is connected to an airblast tube 17 terminating in a valve 18 controlled by a solenoid 19. The valve has a supply of pressurized air 26. The solenoid is energized from a suitable current source through contacts 20, these being opened and closed by an eccentric 21 and a lever linkage 22, 23, the latter being pivoted at 25.

The lever 23 carries an extension 24, to end of which a knife blade 27 is attached, this blade sliding in a slot in the yarn entry 16. When a tuft is required, the yarn is fed forward by means 28 not forming part of the present invention, the knife having been lifted out of the way, so that the end of the yarn lies in the enlargement 15. A tuft is then cut off by the knife, the contacts 20 close momentarily to energize the solenoid, open the air valve and blow the tuft down the tube 2 into the needle 1. Thereafter the cycle of operations is as described with reference to FIG. 1, *a*—*g*.

In another embodiment of our invention, shown in FIGS. 2 *a* to *f*, and 4, a tufting needle assembly consists of a Y-shaped tube 40 located above and close to a hollow needle 41, the needle having a tapered hole terminating in a bore of narrower cross section than the bores of the Y-tube, the lower end of the needle being sharpened so as to pierce the base material 42. The Y-shaped tube has a ram capable of being inserted through a hole at the juncture of the Y-axis. A plurality of Y-shaped guide tubes are fixed to a common stationary bar 43, and all the needles are fixed to a common needle bar 44 which is reciprocated so as to cause the needles to rise above the backing material and pierce through it alternately.

The two arms of the Y, 45, 46 are connected to means for supplying colored tufts of pile fabric to the Y and thence to the needle (see later), the tufts being cut off and inserted in the arms of the Y. The ram and needle are independently reciprocable, and the device operates as follows.

Assuming the needle is at the top of its stroke, FIG. 2 *a*, then its upper end is in contact with the lower end of the Y-shaped tube. A tuft 47 of pile fabric is blown into a single arm of the Y-tube under control of a pattern device, the other arm of the Y-shaped tube being sealed by its knife. The tuft of yarn descends until it reaches the tapered portion of the needle and is there halted by the taper, FIG. 1 *b*. The ram 48 now descends and pushes the tuft first along the taper of the Y-tube and then into the needle, until the lower end of the tuft is substantially level with the cutting end of the needle FIG. 2 *c*. The needle and ram now descend at the same rate so that the needle pierces the backing material, FIG. 1 *d*, whereupon the needle rises, leaving the ram immobile, FIG. 1 *e*. This ejects the tuft of pile fabric into the backing material 42, with a short length of the tuft still projecting from the side of the backing material from which the needle entered. Thereafter the ram rises to its original position, FIG. 2 *f*.

The process is repeated, a tuft of yarn being fed to the needle from one or other of the arms of the Y-shaped tube before each stroke of the needle. After the tufts are inserted in the backing material, its upper surface is sprayed with an adhesive

so as to locate the short ends of the tufts firmly in the backing material. This upper surface forms the back of the finished carpet.

The tufts are inserted across the width of the backing fabric by a number of needles simultaneously, row after row, and a colored pattern may be repeated along and/or across the width of the fabric as required.

FIG. 4 shows some details of the construction of the Y-shaped needle mechanism. The other details are substantially similar to those shown in FIG. 1. The needle bar 44 carries a plurality of needles 41, and the bar is reciprocated, with its needles, by a connecting rod and cam mechanism similar to that shown at 10, 12, FIG. 1. The ram 48 is similarly reciprocated. Each branch of the Y-tube terminates in an enlargement 49, with a side entry 50 for yarn, there being a knife 51 in each entry, operated in the manner shown in FIG. 1, at 21, 22, 23, 24. An airblast is supplied as described above in connection with FIG. 1 at an appropriate moment in each cycle to one or another of the tubes 52, the tube supplied being this time determined by which entry 50 feeds the yarn. This yarn feed is effected by a pattern mechanism forming no part of the present invention. During the blow, the tube 45 not in use is sealed by its knife 51 and its pressure air valve (not shown), both of which are in a closed position, so that air blow-back up an inoperative part of the Y-tube does not take place.

The insertion of the tufts may be controlled by a pattern, which will also determine in the case of FIG. 4, which branch of the Y-tube is to carry a yarn; the air valve opened will of course correspond to the branch of the Y-tube loaded with a yarn tuft. This is effected by electrical contacts energized in known manner by the pattern control mechanism. The branches may be fed with yarns of different colors.

It should be noted that in both the single entry and Y-shaped needles, the lower ends of the supply tube bore axes make an acute angle with the axis of the bore of the needle. It should also be noted that the amount of each tuft projecting through the back (upper surface) of the backing fabric is always constant and independent of the overall length of tuft. This means that a pattern can be made of long and short tufts as determined by the pattern mechanism to produce a sculptured effect, though the amount of each tuft used to secure it

in the backing fabric is always the same. This is effected without any readjustment of the mechanism.

We claim:

1. In a tufting machine a needle assembly comprising a hollow needle, means for reciprocating said hollow needle a stationary feed tube for said needle having at least one bore the axis of the lower end of said bore making an acute angle with the axis of said needle, pressure air means for transferring a short length of tufting material from a feed entry through said feed tube into one end of said needle and a ram and actuating means to press said tuft into said needle and accompany said needle and tuft during a stroke of said needle to penetrate a backing fabric, said tuft being left in said backing fabric on completion of said stroke.

2. A needle assembly as recited in claim 1, wherein said feed tube has a single bore, said needle extending up to and beyond said feed tube and sliding over the end thereof.

3. A needle assembly as recited in claim 2 wherein said ram slides in an upper part of said needle, and comprising drive devices for said needle and ram.

4. A needle assembly as recited in claim 2, comprising a valve supplying pressurized air into said feed tube at its end remote from said needle a yarn entry and a yarn cutter near said valve, and means for actuating said cutter and said valve so as to cut off a tuft length of yarn from said yarn entry and blow it along said feed tube into said needle.

5. A needle assembly as recited in claim 4 comprising a drive mechanism actuating said cutter, a solenoid which actuates said air valve, and a contact actuated by said drive mechanism to energize said solenoid.

6. A needle assembly as recited in claim 1 wherein said feed tube is of a Y-shape, a pressurized air valve, a yarn entry and a cutter for each of the branches of said tube the stem of said Y-tube resting against the upper end of said needle when the latter is at a position remote from said backing fabric.

7. A needle assembly as recited in claim 6 wherein the ram slides in an aperture defined by said feed tube midway between the branches of said Y-tube.

8. A tufting machine with a plurality of needle assemblies as claimed in claim 7, and comprising a common needle bar carrying said needles, a common mechanism operating said rams, and a common drive for said cutters.