Dec. 28, 1965 A. J. WILKES 3,225,723

AIR FEED TUFTING MACHINE

Filed July 6, 1962 3 Sheets-Sheet 1

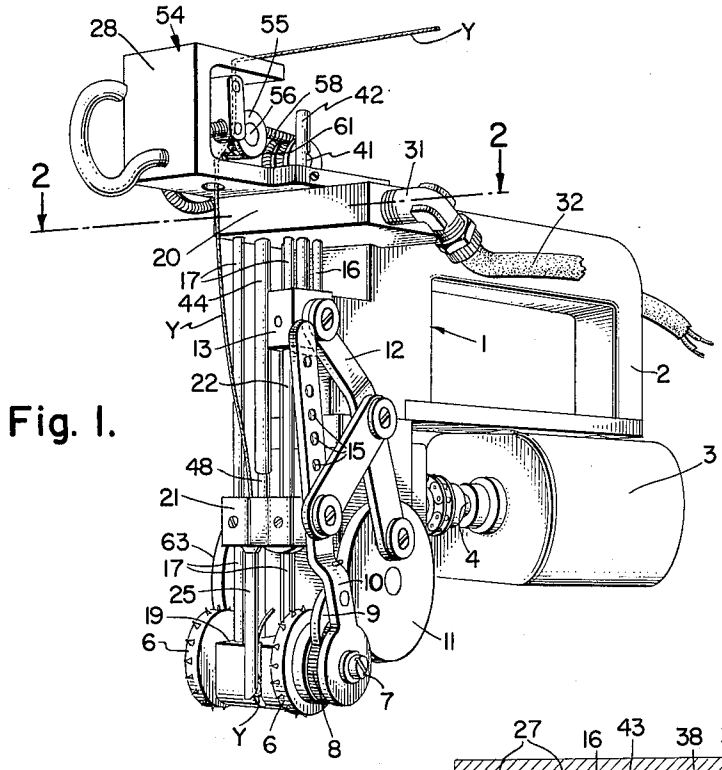


Fig. 1.

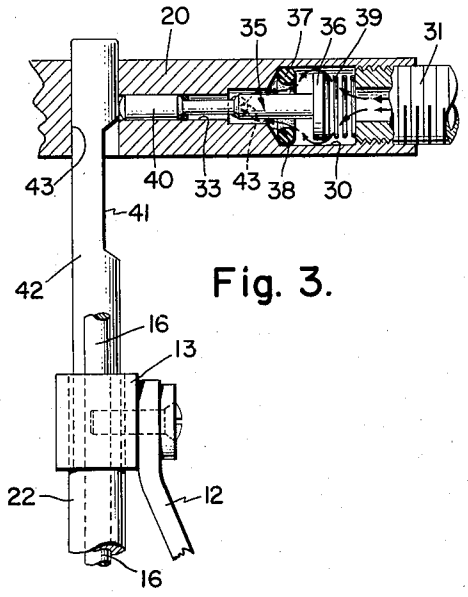


Fig. 3.

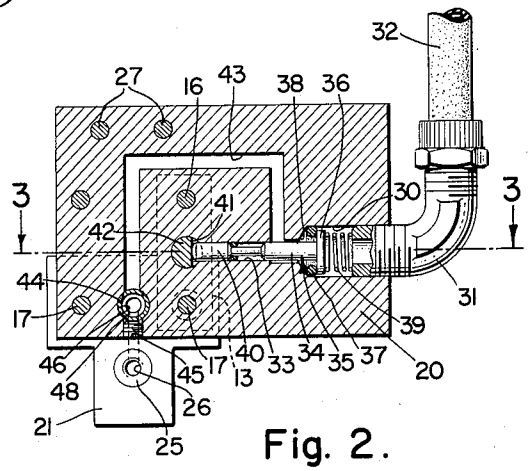


Fig. 2.

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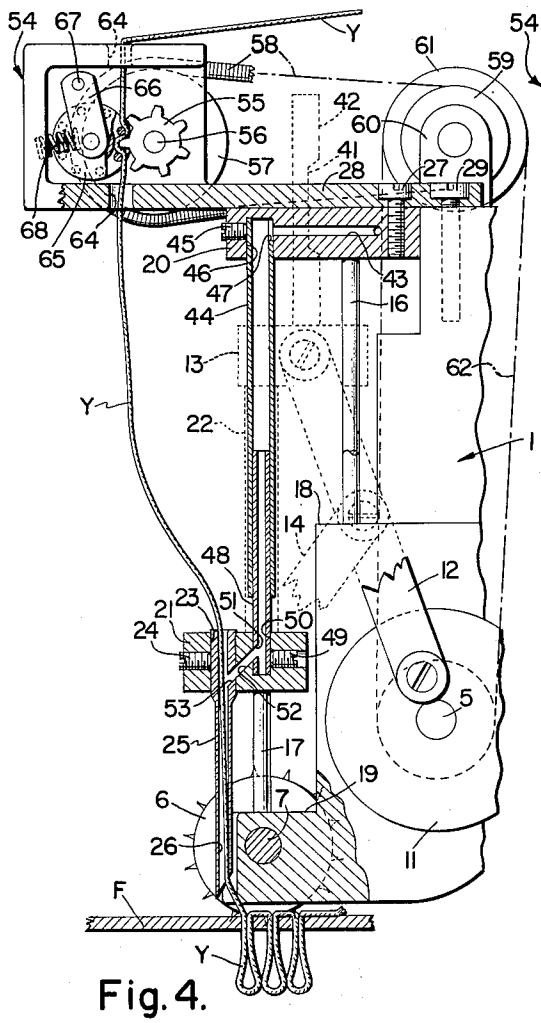


Fig. 4.

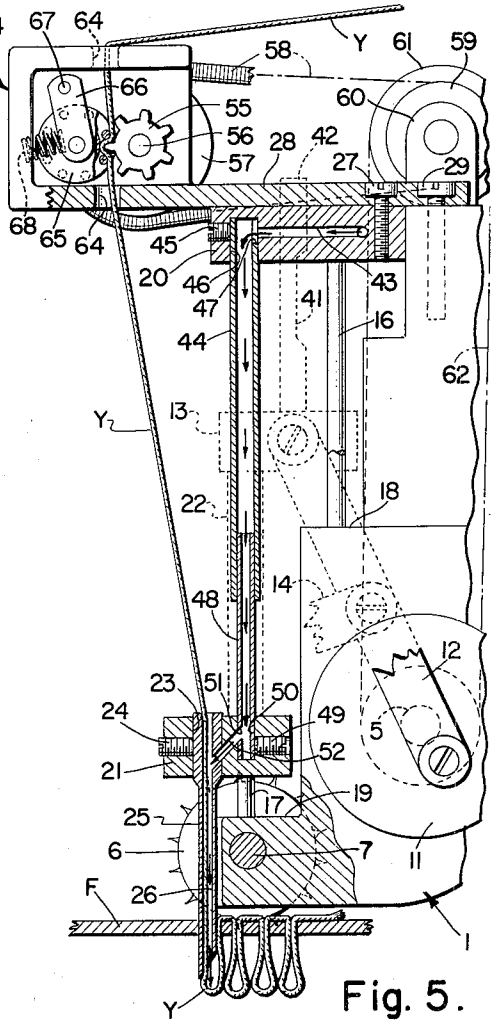


Fig. 5.

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Filed July 6, 1962 3 Sheets-Sheet 3

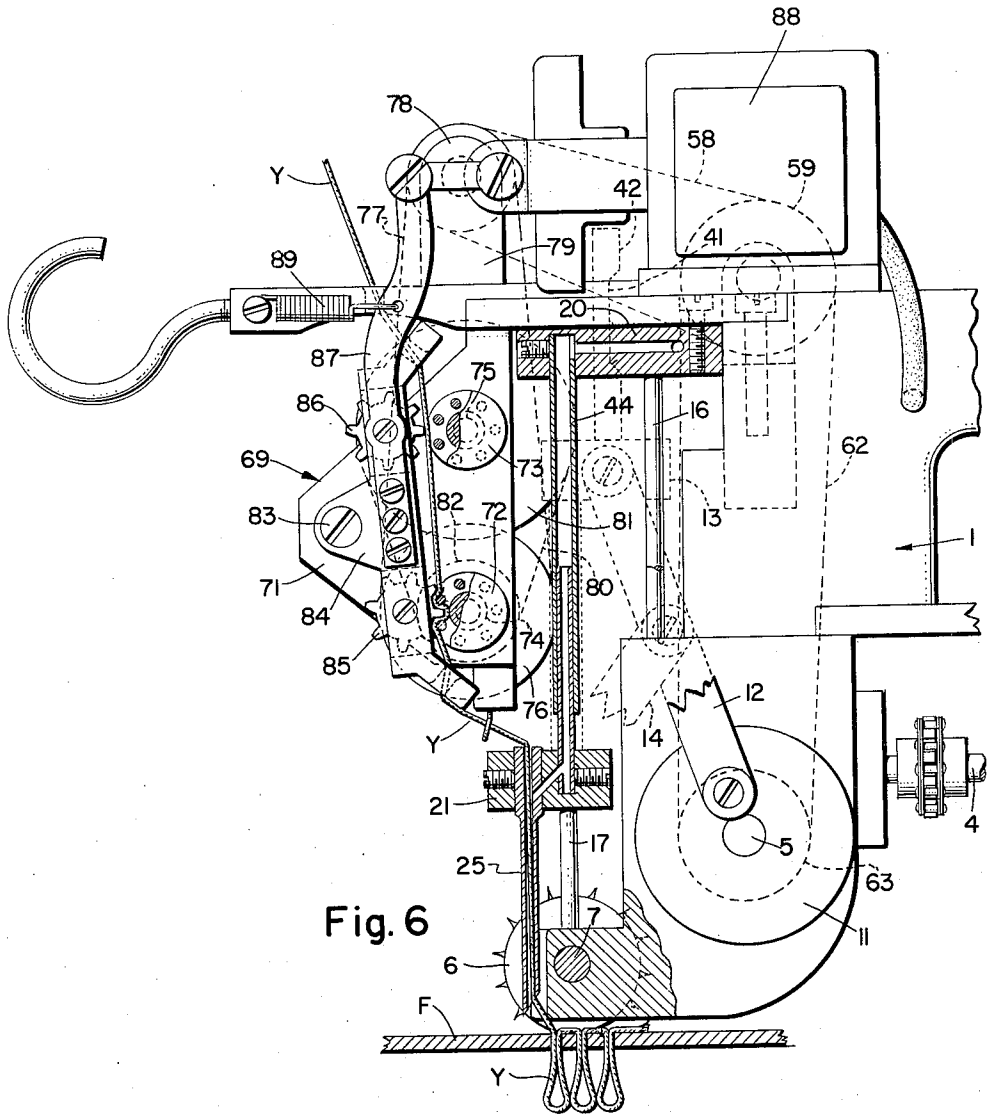


Fig. 6

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AIR FEED TUFTING MACHINE

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3 Claims. (Cl. 112—80)

The present invention relates to tufting machines and more particularly to a loop forming means for a tufting machine.

An object of this invention is to provide in a tufting machine an improved mechanism that will produce long pile.

A further object of this invention is to provide such a pile forming mechanism which is operable from one side only of the work.

A further object of this invention is to provide such a mechanism which is capable of forming pile of varying lengths.

A further object of this invention is to provide a pile forming mechanism that is particularly adapted for use in a portable tufting machine.

Further objects of this invention are to provide a pile forming mechanism for tufting machines which is economical, dependable, durable and efficient.

In accordance with this invention, there has been provided a tufting machine in which the pile forming mechanism comprises a hollow needle through which the yarn extends, a yarn feed mechanism which feeds a predetermined amount of yarn to the needle upon each stitch, and a source of air under pressure, which is directed through the hollow needle to force the yarn outwardly thereof to the extent permitted by the yarn feed mechanism, thereby forming the loop and maintaining the same as the needle is withdrawn from the fabric. In this manner, the loop that is formed can be made longer than the depth of penetration of the fabric by the needle thereby forming long loops without requiring a large needle stroke, the mechanism is operable from one side of the work only thus not requiring hooks and rendering the same applicable to a mending operation on goods such as carpet, the mechanism is capable of producing loops of varying length as determined by the amount of yarn fed by the yarn feeding mechanism and the mechanism is relatively light in weight and is therefore further adapted for use in a portable tufting machine designed for mending.

Having in mind the above and other objects that will be evident from an understanding of this disclosure, the invention comprsies the devices, combinations and arrangements of parts as illustrated in the presently preferred embodiment of the invention which is hereinafter set forth in such detail as to enable those skilled in the art readily to understand the function, operation, construction and advantages of it when read in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of a portable tufting machine embodying the present invention.

FIG. 2 is a sectional view taken substantially on the line 2—2 of FIG. 1.

FIG. 3 is a fragmentary sectional view taken substantially on the line 3—3 of FIG. 2.

FIG. 4 is a fragmentary sectional view longitudinally of the machine of FIG. 1.

FIG. 5 is a fragmentary sectional view siimlar to FIG. 4 but illustrating the parts in a different operative position.

FIG. 6 is a fragmentary sectional view similar to FIG. 4, but illustrating a machine having a controlled yarn feeding mechanism in place of the plain yarn feeding mechanism.

With reference to the drawings, the illustrated machine, which is a portable tufting machine, comprises a frame 1 including a handle portion 2 beneath which is mounted an electric motor 3 by which the machine is driven. The motor 3 has a drive shaft 4 that is adapted to drive through a worm and gear (not shown) a shaft 5 journaled transversely of the frame 1.

The machine is adapted to be advanced relatively to the fabric in which the pile is to be formed by a feed mechanism including a pair of spiked feed wheels 6 secured on a shaft 7 journaled transversely of the frame 1 at the lower end thereof. Intermittent one-way rotation is imparted to the shaft 7 and thus to the feed wheels 6 by a ratchet 8 coupled to the shaft 7 and cooperating with a pawl 9 pivotally mounted on a crank arm 10 that is in turn pivotally mounted in shaft 7. Oscillation is imparted to the crank arm 10 by a crank disc 11 on the shaft 5 to which is pivotally connected one end of a link 12, which at its other end is pivotally connected to a needle driving block 13 and which at an intermediate point is connected by a link 14 to the crank arm 10. The crank arm 10 is provided with a series of apertures 15 to receive the pivotal connection of the link 14, thereby providing for adjustment of the feed.

The needle driving block 13 is guided for rectilinear motion by a guide pin 16 and one of a pair of guide pins 17 which extend respectively between ledges 18 and 19 in the frame and a block 20 mounted on the frame. A needle carrier 21 is also mounted on the guide pins 17 and is connected for unitary motion to the needle driving block 13 by a tubular connecting element 22 that slides as one of the pins 17. The needle carrier 21 has a through bore 23 in which is secured by a set screw 24 the shank portion of a depending hollow needle 25 having a pointed work penetrating or free end and having a bore 26 axially therethrough and defining an opening whereby yarn may be introduced into the hollow center of said needle and out the free end thereof.

The block 20 is secured as by screws 27 to the yarn feed housing 28 that is in turn secured by screws 29 to the top of the frame 1. The block 20 has a bore 30 which is connected by a fitting 31 threaded into the block 20 to a conduit 32 that may be connected to any convenient source of air under pressure. The bore 27 communicates axially with a bore 33 of reduced diameter and which receives the stem 34 of a valve 35 having a head 36 that is adapted to cooperate through an O-ring 37 with a seat 38 formed at the shoulder between the bores 30 and 33. The valve 35 is biased closed by a compression spring 39 acting between the head 36 and the fitting 31 and is adapted to be opened by a valve-actuating plunger 40 disposed in the bore 33 and cooprating with a cam surface 41 on a rod 42 carried by the needle driving block 13 and extending slidably through a bore 43 in the block 20 that is intersected by the bore 33. The block 20 is also provided with a bore 43 communicating with the bore 33 and with a tube 44 secured by a set screw 45 in a bore 46 in the block 20 and having a cutout 47 in the side wall thereof to provide a passage from the bore 43 to the interior of the tube 44. The tube 44 telescopically receives a tube 48 that is carried by the needle carrier 21, thereby providing means for conducting the air from the block 20 to the needle carrier 21 while accommodating the relative motion between the same. The tube 48 is secured by a set screw 49 in a bore 50 in the needle carrier and has an opening 51 in the side wall thereof that is connected to the needle-receiving bore 23 by a bore 52 in the needle carrier 21 which bore 52 is inclined relatively to the axis of needle toward the work penetrating end thereof. The shank of the needle 25 has an opening 53 communicating with the bore 52. The opening 53 is also inclined so

that the air is directed into the bore 26 in the needle and toward the work penetrating end thereof.

The yarn feed housing 28 carries the yarn feed mechanism 54 which comprises a yarn feed wheel 55 in the form of a gear integral with a shaft 56 journaled in and extending through the side wall of the housing 28 and having a pulley 57 secured on the end thereof. The pulley 57 is connected by a belt 58 with a pulley 59 of a double pulley that is journaled in a bracket 60 secured to the frame 1 and having a pulley 61 connected by a belt 62 with a pulley 63 (FIG. 1) on the shaft 5. The yarn Y is directed tangential to the feed wheel 55 by a pair of yarn guides 64 comprising apertures in the housing 28 and is held against the feed wheel 55 by an idler wheel 65 journaled in a bracket 66 that is pivotally mounted in the housing 28 on a pivot shaft 67 and biased toward the feed wheel 55 by a compression spring 68.

The operation of the device is as follows. The yarn Y, from the feed mechanism 54 is threaded downwardly through the bore 26 of the needle 25. The machine is placed against the fabric F, and the operation thereof is initiated by energizing the motor 3. As the shaft 5 is rotated by the motor 3, the pulley 63 and crank disc 11 are rotated. The pulley 63, through the belt 62, pulleys 61 and 59, belt 58, pulley 57 and shaft 56, rotates the feed wheel 55 to introduce a predetermined amount of yarn into the system. The amount of yarn so introduced will determine the length of the pile loops, and can be varied by substituting pulleys of different diameter for the pulley 57, thereby varying the drive ratio. Rotation of the crank disc 11 actuates the link 12 which, through the link 14, crank arm 10, pawl 9 and ratchet 8, actuates the feed wheels 6 to advance the machine step-wise relative to the fabric F. At the same time, the link 12 reciprocates the needle driving block 13 which through the rod 42 controls the valve 35 and which, through the connecting element 22, reciprocates the needle carrier 21 and thus the needle 25. The mechanics of the system are such that the feed wheels 6 are actuated when the needle 25 is at the top of its stroke.

As the needle 25 descends, it penetrates the fabric F and forces a loop of the yarn Y therethrough. At this time, the rod 42 has descended so that the rise on the cams surface 41 thereof has forced the valve-actuating plunger 40 inwardly to unseat the valve 35 and thereby permitting air to flow through the bore 43, telescoping tubes 44 and 48 and bore 52 to the bore 26 of the needle. A stream of air is thus directed outwardly of the work penetrating end of the needle 25, which air acts upon the yarn Y to force it outwardly of the needle, thereby extending or expanding the loop. The amount of yarn that is forced through the needle by the air stream depends upon the amount of yarn fed by the yarn feeding mechanism 54, which thus determines the length of the loop. The air stream is maintained as the needle 26 is withdrawn from the fabric F to keep the yarn from following the needle out of the fabric. As the needle 26 rises, the cam surface 41 of the rod 42 releases the valve-actuating plunger 40 to permit the spring 39 to reseat the valve 35, thus stopping the flow of air to the needle.

The machine illustrated in FIG. 6 is the same as the machine of FIGS. 1–5 in all respects except that a controlled yarn feeding mechanism 69 has been substituted for the plain yarn feeding mechanism 35. The controlled yarn feeding mechanism 69 comprises a housing 70 secured to the frame 1 in the same manner as the housing 28. The housing 70 includes a depending flange 71 in which are journaled a pair of yarn feed wheels 72 and 73 having shafts 74 and 75. The yarn feed wheel 72 is driven by a pulley 76 on the shaft 74, about which pulley 76 is entrained a belt 77 that is also entrained about a double pulley 78 that is journaled in a bracket 79 mounted on the housing 70. The pulley 78 is in turn driven, in the same manner as the pulley 57, by

the belt 58 that is entrained about the pulley 59 and which is driven by the belt 62 from the pulley 63 on the shaft 5. The feed wheel 73 is driven from the feed wheel 72 by a belt 80 entrained about a pulley 81 on the shaft 75 and a second pulley 82 on the shaft 74. Pivotally mounted intermediate its ends on the housing 70 by a pivot screw 83 is a rocker 84 in the opposite ends of which are journaled idler wheels 85 and 86 adapted to cooperate selectively with the feed wheels 72 and 73 to hold the yarn in feeding engagement therewith. The rocker 84 has an arm 87 that is pivotally connected to the armature of a solenoid 88 and is biased by a spring 89 in the return direction. Thus, when the solenoid 88 is energized, the rocker 84 is pivoted to move the idler wheel 86 into feeding cooperation with the feed wheel 73. When the solenoid 88 is de-energized, the spring 89 acts to pivot the rocker 84 to move the idler wheel 86 out of feeding cooperation with the feed wheel 73 and to move the idler wheel 85 into feeding cooperation with the feed wheel 72. In view of the ratios between the diameters of the pulleys 81 and 82, the feed wheel 73 is driven at a slower rate than the feed wheel 72, and thus, less yarn will be fed when the feed wheel 73 is operative than when the feed wheel 72 is operative. With less yarn made available, the resulting loops formed in the fabric F will be shorter than when a larger length of yarn is made available.

Numerous alterations of the structure herein disclosed will suggest themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to a preferred embodiment of my invention which is for purposes of illustration only and not to be construed as a limitation of the invention. All such modifications which do not depart from the spirit of the invention are intended to be included within the scope of the appended claims.

Having thus set forth the nature of the invention, what I claim herein is:

1. In a tufting machine for forming yarn pile in a fabric having a frame, drive means on said frame, a needle carrier mounted on said frame for reciprocation, means connecting said needle carrier and said drive means for imparting to said needle carrier reciprocation comprising a work pentrating stroke and a return stroke, a hollow needle having a shank secured within said needle carrier and reciprocable therewith, said needle having a work penetrating end and a yarn inlet opening in the shank thereof and a yarn outlet opening in the work penetrating end thereof for introducing a yarn into the hollow of said needle and out the work penetrating end thereof, a source of air under pressure, conduit means for directing a flow of air from said source to said needle carrier, said conduit means including telescoping tubular elements comprising a first element secured to said frame and a second element secured to said needle carrier, said needle having an air inlet opening in the shank thereof and said needle carrier having a bore communicating with said conduit means and with said air inlet opening, said bore and the air inlet opening in said needle being inclined relatively to the axis of said yarn inlet opening for directing the flow of air into the hollow of said needle and toward the work penetrating end thereof on the upstroke of the needle to force outwardly of the work penetrating end of said needle a length of yarn for forming a loop that is adapted to be of a length greater than the depth of penetration of the needle at the end of the work penetrating stroke thereof.

2. A tufting machine in accordance with claim 1 having valve means for controlling the flow of air, and valve actuating means operable with said needle carrier for providing a flow of air when the needle carrier is adjacent to the bottom of its stroke and for stopping the flow of air when the needle carrier is adjacent to the top of its stroke.

3. In a tufting machine in accordance with claim 2 in

which said valve actuating means comprises a rod movable with said needle carrier and having a cam surface, and a plunger operatively connected to said valve and engaging said cam surface.

References Cited by the Examiner

UNITED STATES PATENTS

984,195	2/1911	Cooper	57—34
1,581,093	4/1926	Howie.	
1,809,241	6/1931	Jennings	112—79
1,919,674	7/1933	Wenczel	112—78
2,422,126	6/1947	Parker	112—80
2,599,226	6/1952	Briem	112—218
2,866,424	12/1958	Masland	112—79.6
3,039,170	6/1962	Marshall	112—79 X
3,089,442	5/1963	Short	112—79

FOREIGN PATENTS

618,165	2/1949	Great Britain.

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