

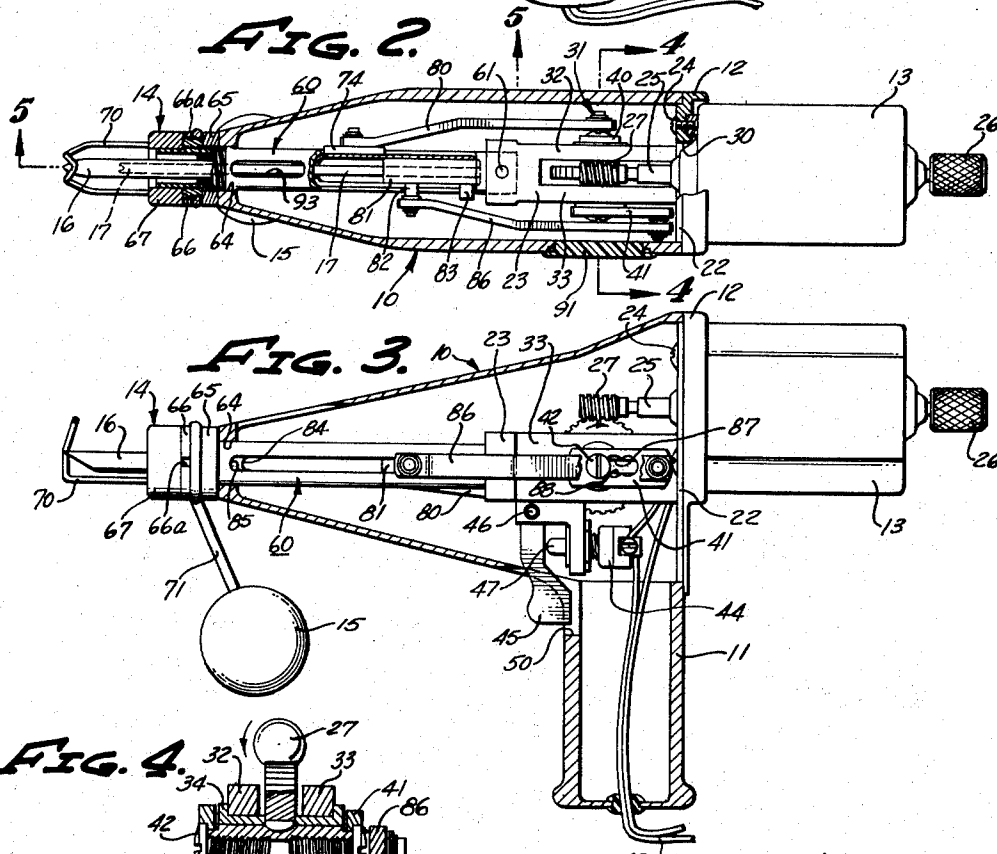
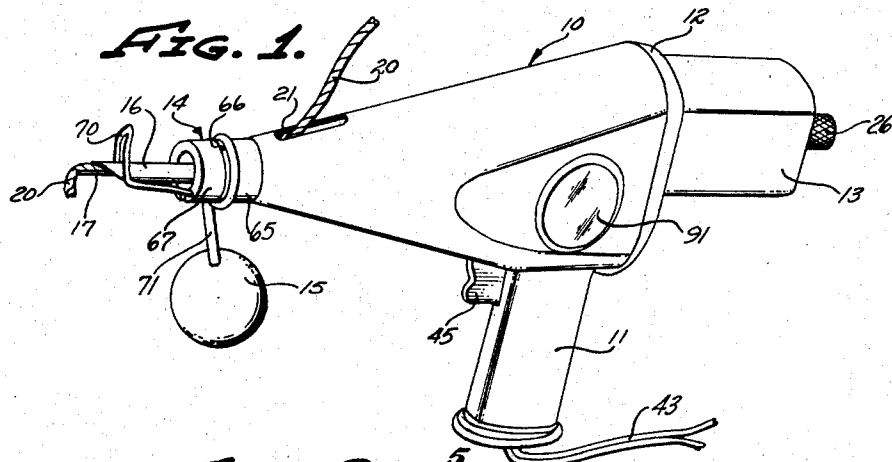
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R. L. STERNER
TUFTING MACHINE

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2 Sheets-Sheet 1



INVENTOR.
RUSSELL L. STERNER

BY HIS ATTORNEYS.
HARRIS, KIECH, FOSTER & HARRIS

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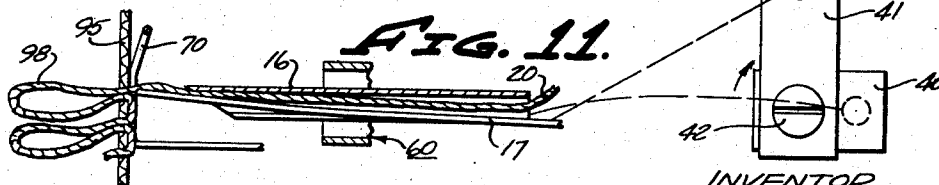
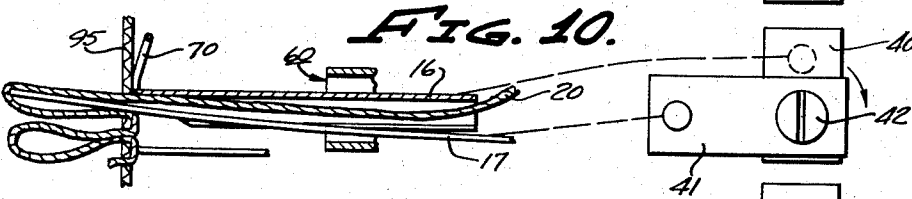
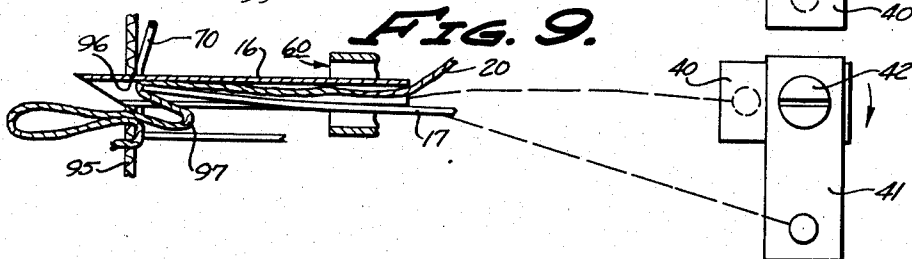
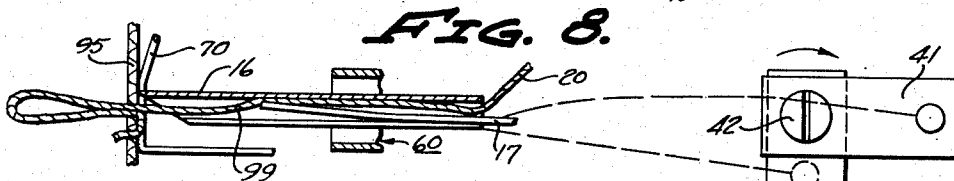
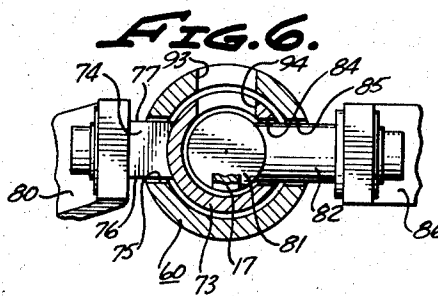
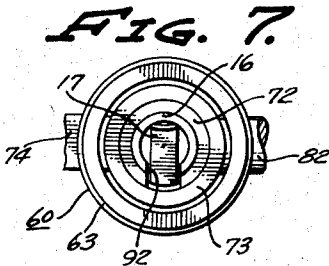
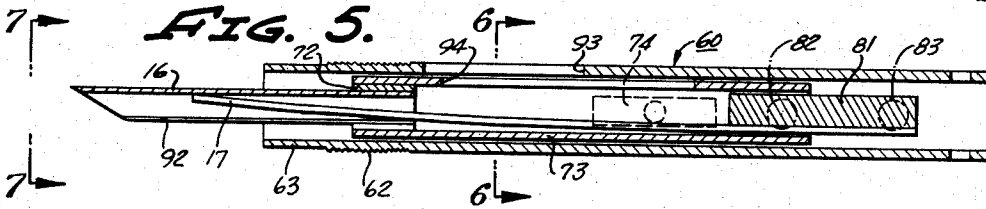
R. L. STERNER

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TUFTING MACHINE

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2 Sheets-Sheet 2



INVENTOR.

RUSSELL L. STERNER

BY HIS ATTORNEYS.

HARRIS, KIECH, FOSTER & HARRIS

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TUFTING MACHINE

Russell L. Sterner, Downey, Calif., assignor to
Clarence Klug, Los Angeles, Calif.

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2 Claims. (Cl. 112—80)

This invention relates to the making of pile or tufted fabrics and more particularly to machines for inserting tufts of yarn or thread through a backing, such as burlap, to produce a tufted fabric suitable for use as a rug and the like.

Tufted fabrics are sometimes made by pushing a length of yarn through a backing with a needle, the yarn being threaded through an eye near the point of the needle, and then withdrawing the needle from the backing, thereby forming the length of yarn into a loop. In order to form more uniform loops and to reduce the amount of needle penetration, and hence the time necessary to form a loop, a hook may be provided on the loop side of the backing to hold the length of yarn in place while the needle is being withdrawn, thereby forming a loop of a height equal to the needle penetration. However, such a hook cannot be used with a portable or hand-held machine.

In the hand-held tufting machine of the invention, a looping rod or pusher is used to hold the yarn and aid in forming a loop. The looping rod is inserted through the same opening in the backing as the needle and yarn and it remains in the opening with the yarn looped over its end until the needle is withdrawn, thereby forming a loop with a height equal to the looping rod penetration.

A disadvantage of earlier tufting machines is that the yarn or tufting material is forced through the backing and has to make its own opening therein and, therefore, the yarn is dragged against the backing causing friction and damage to the material. Another disadvantage lies in the fact that the length of the loop is related to the needle penetration and, hence, especially in a deep pile fabric, considerable time is required for needle travel.

It is an object of the invention to provide a tufting machine which is fast in operation and which provides tufts which are evenly spaced and uniform in height, and one in which the tuft is formed in the following steps: inserting a needle through the backing only far enough to make an opening therein; inserting a loop of yarn through the opening to the desired pile height by means of a pusher; withdrawing the needle, thereby permitting the backing material to close tightly around the yarn and pusher; and withdrawing the pusher.

Another object of the invention is to provide such a tufting machine that is power operated and one that may be held in the hands and guided over the backing.

A further object of the invention is to provide a portable tufting machine which steps itself along the backing to properly space the tufts, requiring only support and guidance from the operator.

Still another object of the invention is to provide a tufting machine having a frame carrying a drive motor and a housing, the latter enclosing and partially supporting the reciprocating elements.

Another object of the invention is to provide a tufting machine having a hand grip and a finger-operated trigger to start and stop the machine.

An important object of the invention is to provide a

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tufting machine having a hollow needle through which the yarn is inserted in a backing by a pusher sliding within the hollow needle.

Another object of the invention is to provide a tufting machine in which the needle and the pusher are reciprocated in timed relationship. Still another object is to provide such a machine in which the needle and pusher are continuously reciprocated and one in which they are driven by rods connected to a pair of arms on a crankshaft.

In the process of developing the invention it has been determined that the relative timing of the needle and pusher movements is important in the formation of firm and uniform tufts. If the needle is withdrawn thereby allowing the opening in the backing to close before the loop is substantially complete, many of the potential advantages of this type of machine are lost. In a machine in which the needle and pusher are continuously reciprocated it has been determined that optimum results are obtained when the needle action leads the pusher action by approximately ninety degrees of crankshaft rotation. Accordingly, it is an object of the invention to provide a tufting machine in which the needle motion leads the pusher motion by approximately ninety degrees.

The invention also comprises novel details of construction and novel combinations and arrangement of parts, which will more fully appear in the course of the following description. However, the drawings merely show and the description merely describes a preferred embodiment of the present invention as applied to a portable tufting machine, which is given by way of illustration or example only.

In the drawings:

Fig. 1 is a perspective view of an embodiment of the invention showing a piece of yarn threaded through the machine;

Fig. 2 is a top view of the embodiment of Fig. 1 shown partially in section;

Fig. 3 is a side view of the embodiment of Fig. 1 shown partially in section;

Fig. 4 is an enlarged partial sectional view taken along the line 4—4 of Fig. 2 showing the crankshaft and associated parts;

Fig. 5 is an enlarged sectional view taken along the line 5—5 of Fig. 2 showing the barrel, needle and pusher;

Fig. 6 is an enlarged sectional view taken along the line 6—6 of Fig. 5;

Fig. 7 is an enlarged end view taken along the line 7—7 of Fig. 5; and

Figs. 8 through 11 are diagrammatic views showing the formation of a tuft and the relative positions of the needle and the pusher for four positions of the crankshaft.

Referring now to the drawings, an assembled tufting machine embodying the various features of the invention is shown in Fig. 1. The machine includes a housing 10 having a handle 11, a frame 12, a drive means 13, a front end assembly 14, a handgrip 15, and a loop-forming means including a needle 16 and a pusher 17 projecting through the front end assembly 14. A portion of a piece of tufting material 20, such as yarn or thread, is fed through a slot 21 in the housing 10 and through the needle 16 and is looped over the end of the pusher 17.

The construction of the tufting machine may be seen more clearly in Figs. 2 and 3. Therein the frame 12 is illustrated as a one piece metal casting including a vertical plate member 22 and a boss 23 extending perpendicularly from the plate. The drive means 13, which may be an electric motor, is attached to the back of the plate 22 by screws 24. The drive means 13 has a rotating shaft

25 extending from each end thereof. A knurled knob 26 is mounted on one end of the shaft 25 and this allows the machine to be operated manually to set the moving parts in proper position for threading and beginning a tuft. A worm 27 is mounted on the other end of the shaft which projects through an opening 30 in the plate 22.

A crankshaft 31 is mounted in the boss 23 of the frame 12. A portion of the boss 23 is slotted forming two legs 32, 33. The crankshaft construction is shown in detail in Fig. 4 wherein two bushings 34, 35 are mounted respectively in the two legs 32, 33, the bores of the bushings being aligned. A shaft 36 is rotatably positioned in the bushings 34, 35 and a worm wheel 37 is keyed to the shaft 36 and is located in the slot between the legs 32, 33 to mesh with the worm 27. Crank arms 40, 41 are attached respectively to each end of the shaft 36 by screws 42. The crank arms 40, 41 are keyed to the shaft 36 so that they rotate in unison with it when the shaft is driven by the drive means 13 through the worm 27 and the worm wheel 37.

The drive means 13 is shown as an electric motor and power is supplied to it through a conductor cord 43 and a push-type switch 44, the latter being mounted on a portion of the frame 12. A lever 45 is pivotally attached to the frame 12 by a pin 46 and is positioned to bear against a plunger 47 of the switch 44. The lever 45 extends through an opening 50 in the housing 10 adjacent the junction of the handle 11 with the main portion of the housing and the lever's lower end is trigger-shaped so as to be easily operated with the index finger of a person holding the machine.

A barrel 60 has one end mounted in the boss 23 of the frame 12, being held in position by any suitable means such as a pin 61. The opposite end of the barrel 60 is rigidified by the rigid housing 10 and provides a threaded portion 62 and a portion 63 of lesser outside diameter at the tip (Fig. 5). The housing 10 has an opening 64 at its smaller end which is a tight fit over the barrel 60. In assembling the tufting machine, the housing 10 is slid over the barrel 60 and frame 12 with the larger end of the housing resting against the plate 22. A spacer 65 is placed over the barrel 60 against the smaller end of the housing and a locking ring 66 having tool-receiving notches 66a is screwed onto the threaded portion 62 of the barrel 60, thereby clamping the frame, barrel and housing into a rigid unit.

A slotted collar 67 having an inside diameter slightly smaller than the outside diameter of the tip portion 63 of the barrel 60 is pressed over the tip end 63. A U-shaped loop of wire 70 is mounted in the collar 67 and extends forward from the front end assembly 14. The wire 70 serves to space the tufting machine a suitable distance from the backing material in which the tufts are being produced. The handgrip 15 is mounted on one end of a small rod 71, the other end of which is formed into a circle. The end of the locking ring 66 has a shoulder of reduced diameter which fits within the circular end of the rod 71, so that the spacer 65 in combination with the locking ring 66 provides a circumferential groove in which the circular end of the rod 71 may be placed. Thus a support is provided for the front end of the tufting machine, whereby the machine is rotatable about the axis of the needle 16. This arrangement permits an operator to follow intricate patterns with ease.

The needle 16 is mounted in a bushing 72 which in turn is mounted in a needle carrier 73. The needle carrier is positioned within the barrel 60 and is made to have a sliding fit with it. A block 74 is attached to one side of the needle carrier 73 and extends through a longitudinal slot 75 in the barrel 60. The sides 76, 77 of the block 74 are parallel with each other and with the walls of the slot 75 and the block is a sliding fit in the slot. The block 74 is connected to the crank arm 40 by a connecting rod 80 so that the needle carrier has a reciprocating

ing motion within the barrel when the crankshaft rotates.

The pusher 17 is mounted in a pusher carrier 81. The pusher carrier is positioned within the needle carrier 73 and is made to have a sliding fit with it. Bosses 82, 83 are attached to one side of the pusher carrier 81 and extend through a longitudinal slot 84 in the needle carrier 73 and a similar slot 85 in the barrel 60. The bosses 82, 83 are sliding fits in the slots 84, 85, and the boss 82 is connected to the crank arm 41 by a connecting rod 86 so that the pusher carrier has a reciprocating motion within the needle carrier when the crankshaft rotates. Hence, when the crankshaft rotates the needle and the pusher are both reciprocated and this relative motion is controlled by the angular relationship of the crank arms 40 and 41. For the reason given above, it is preferred to have the crank arms fixed approximately 90° apart with the motion of the needle preceding the motion of the pusher. The operation of the needle and pusher in forming a tuft will be described in detail below.

The length of the loop or tuft that the machine will make may be set by adjusting the travel of the pusher. In the embodiment of the invention illustrated the pusher travel is adjusted by changing the working length of the crank arm 41. Referring to Fig. 3, a portion of the connecting rod 86 is broken away to show the length adjusting mechanism. The shaft 36 has a square end and the crank arm 41 has a slot 87 which receives the square end and enables the crank arm to slide along the shaft. A plurality of counterbores 88 are provided along the slot 87 to receive the head of the screw 42. The crank arm may be locked to the shaft by positioning any one of the counterbores over the shaft and tightening the screw, thereby providing an adjustment for the working length of the crank arm. Access to this adjustment mechanism is available through an opening in the housing and a removable plate 91 is provided to cover the opening.

The needle 16 is hollow so that the pusher 17 and the yarn 20 may be inserted through an opening made by the needle. The needle has a longitudinal slot 92 extending to its point end. The pusher 17 is made of a resilient material, such as spring steel, and is mounted on the pusher carrier 81 so that its tip end bears against the inner wall of the needle opposite the slot 92.

Slots 93 and 94 corresponding to the slot 21 in the housing 10 are provided in the barrel 60 and the needle carrier 73 respectively so that the yarn 20 may be fed into the center of the needle 16. From the description of the tuft-forming operation given below, it will be seen that the slot 94 need not enter the backing material, and it is preferred that the slot 94 does not extend beyond the end of the barrel when the needle is extended the maximum amount. This preferred construction reduces the possibilities of snagging of the tufting material.

Referring to Fig. 8, the mechanism is seen at the beginning of a tuft forming operation. The needle 16 is moving out from the barrel 60, the needle point is just making contact with a backing material 95 and the U-shaped wire 70 is resting against the backing. The pusher 17 is at its most inboard position and is lightly clamping the tufting material 20 between the pusher point and the needle wall. As the crankshaft 31 rotates, both the needle and the pusher move outward from the machine. The needle enters the backing by spreading the woven members of the fabric and forms an opening 96 therein as seen in Fig. 9. The pusher, traveling toward the backing, creates a loop 97 of the tufting material lying between the backing and the pusher point. The slot 92 allows the loop 97 to form outside the needle, thereby permitting the use of smaller needles.

The crankshaft continues to rotate and the pusher, carrying a loop of tufting material, enters the opening 96 formed by the needle. The needle begins its with-

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drawal from the backing, but the opening exists until the pusher has nearly reached its maximum penetration. In Fig. 10 the pusher is at its maximum extension and the needle has just left the backing allowing it to close around the pusher and the loop of tufting material. As the pusher is withdrawn, the newly formed tuft 98 is held in place by the backing (Fig. 11).

The height of the finished loop 98 above the backing material 95 is substantially equal to the distance of penetration of the pusher 17 through the backing material. This loop height is changed by adjusting the length of the crank arm 41. It is preferred that the front surface of the wire 70 which contacts the backing material be located with respect to the crankshaft 31 so that the tip of the pusher 17 moves approximately an equal distance in both directions from the backing material, as shown in Figs. 8 and 10. When the machine is so constructed a portion 99 of the tufting material between the backing and the tip of the pusher when the pusher is fully retracted (Fig. 8) becomes one half of the loop 98. If the portion 99 were greater in length than one half of a loop, the tufting material would not be drawn tight against the backing between loops. If the portion 99 were less than one half of a loop, some of the tufting material would be pulled over the tip of the pusher before the pusher was fully extended, in order to form a full-size loop. This would produce undesirable stress and abrasion of the tufting material.

It is not necessary for the operator to advance the tufting machine after a tuft has been formed. Because of the unique features of the invention, the machine advances itself the proper distance and the operator need only support the machine and guide it over the desired pattern. The point of the needle is formed on the periphery rather than in the center of the needle. As the needle enters the backing, the opening expands substantially uniformly in all directions and since the needle does not increase in size uniformly in all directions from the point, the longitudinal axis of the needle moves parallel to the plane of the backing in the direction of the point of the needle. When the needle has fully entered the backing, the axis of the needle has moved to the spot where the point entered the backing, thereby advancing

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the machine a distance substantially equal to the radius of the needle.

Although an exemplary embodiment of the invention has been disclosed and discussed, it will be understood that other applications of the invention are possible and that the embodiment disclosed may be subjected to various changes, modifications, and substitutions without necessarily departing from the spirit of the invention.

I claim as my invention:

1. In a tufting machine, the combination of: a frame including plate means having a front side and a back side; drive means mounted on said back side of said plate means; a crankshaft operatively coupled to said drive means and having two crank arms; a barrel supported at one end in said frame; needle means slidably positioned within said barrel; pusher means slidably positioned within said needle means; rod means connecting said crank arms to said needle means and said pusher means, respectively, so that said needle means and said pusher means are reciprocated in timed relationship; a housing enclosing said crank arms and said rod means, said housing being mounted on said front side of said plate means and including an opening for telescopingly receiving the other end of said barrel with said other end projecting from said housing when said housing is mounted on said plate means; and a clamp nut for engaging said projecting end of said barrel and fixing said housing, barrel and plate means rigidly together.

2. A tufting machine as defined in claim 1 in which said clamp nut has an annular shoulder which when said nut is engaged with said projecting end of said barrel defines an annular groove, and including a hand grip having a loop at one end thereof positioned in said annular groove for rotation relative to said housing.

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