

April 4, 1961

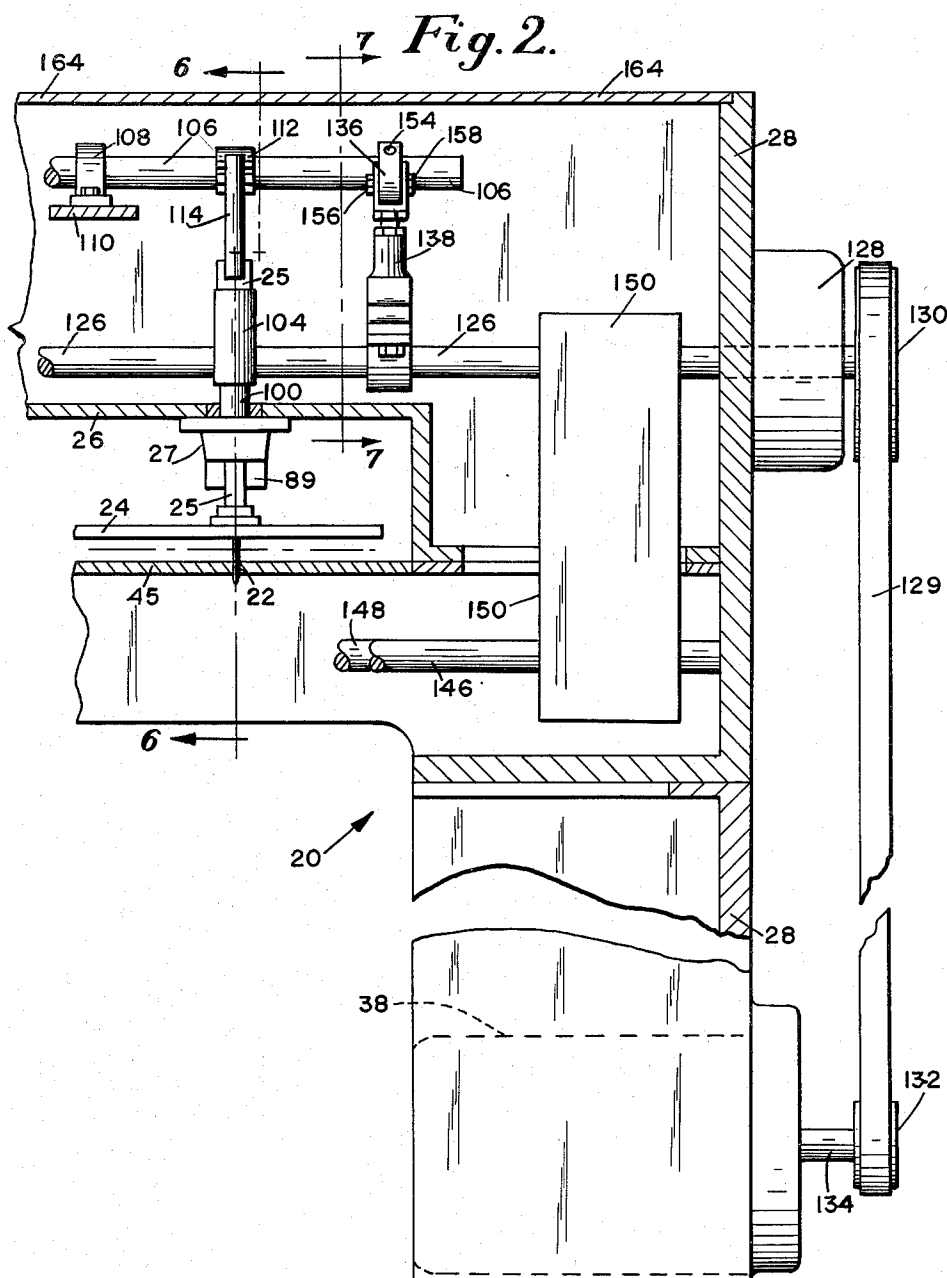
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2,977,905

TUFTING MACHINE

Filed March 4, 1958

5 Sheets-Sheet 2



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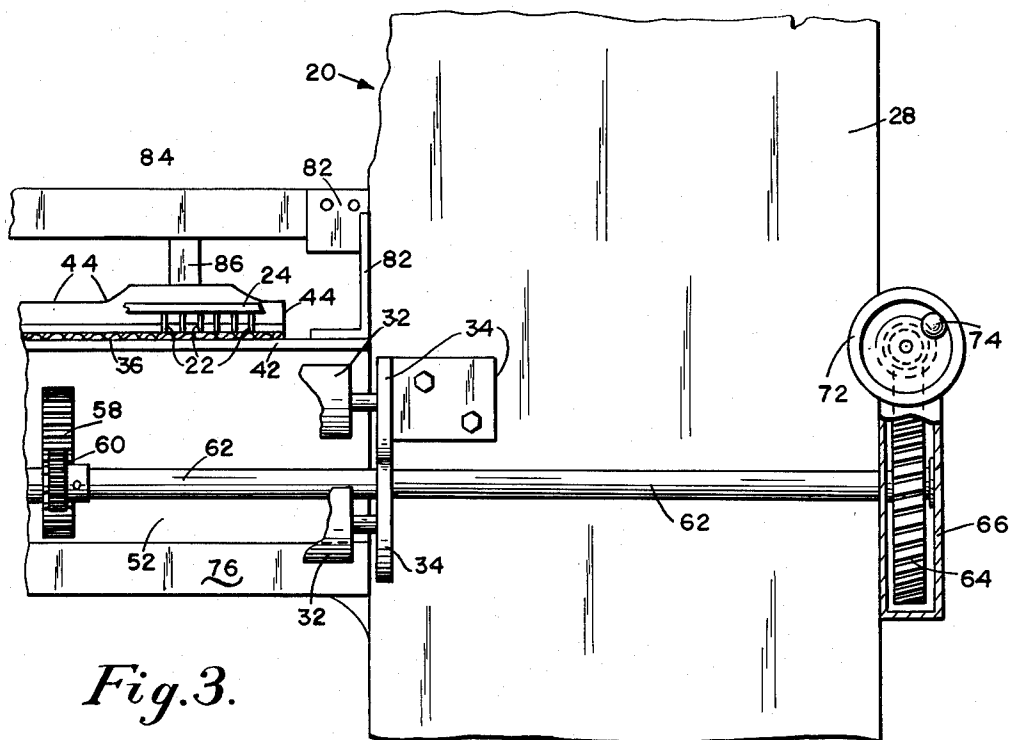


Fig. 3.

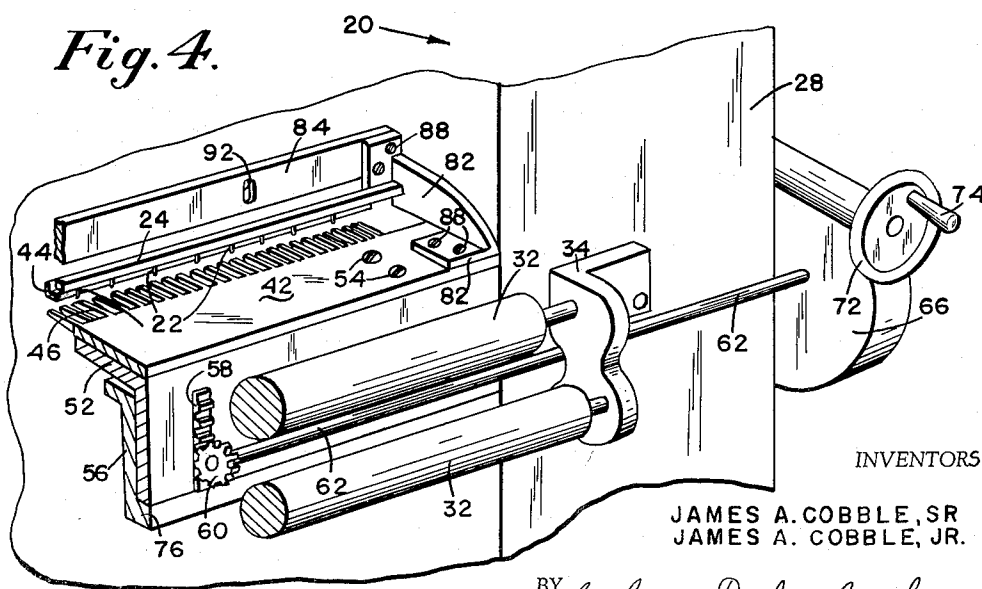


Fig. 4.

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Fig. 6.

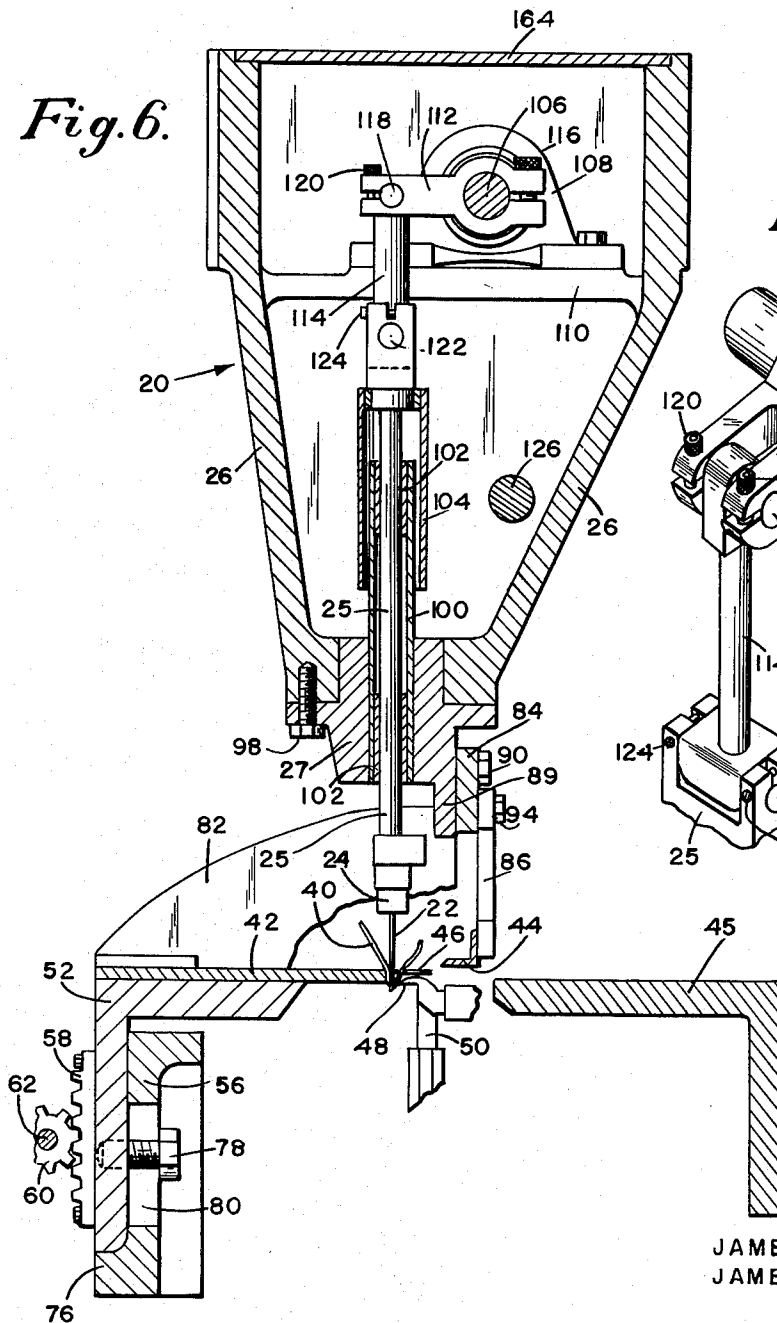
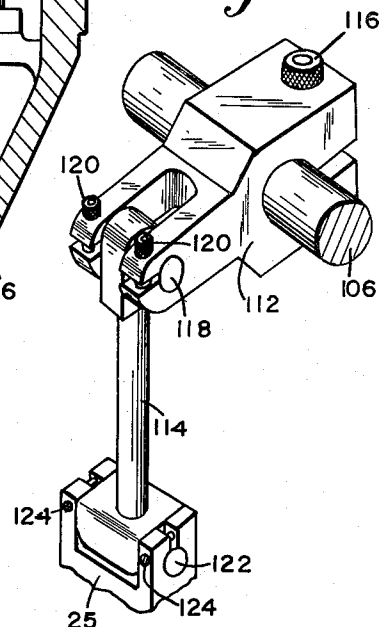


Fig. 8.



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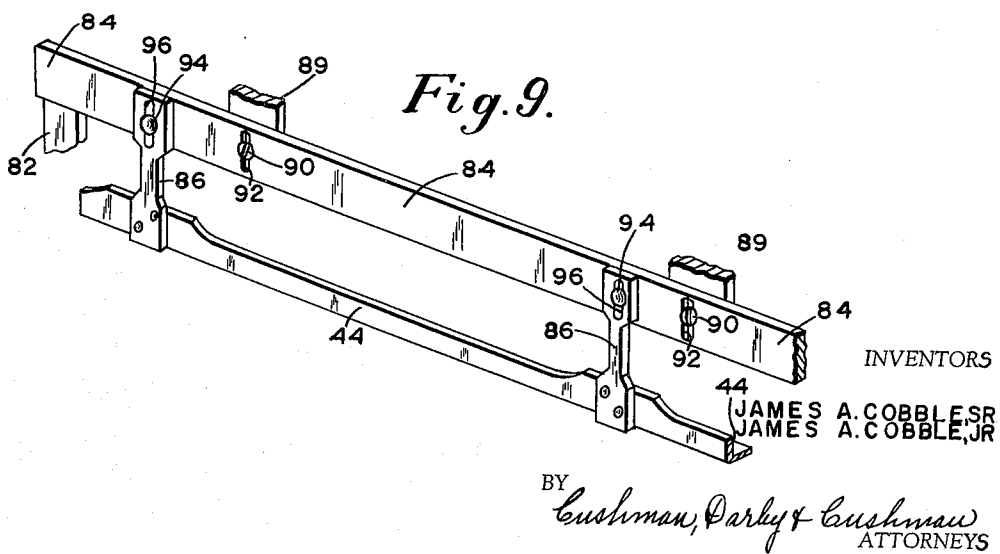
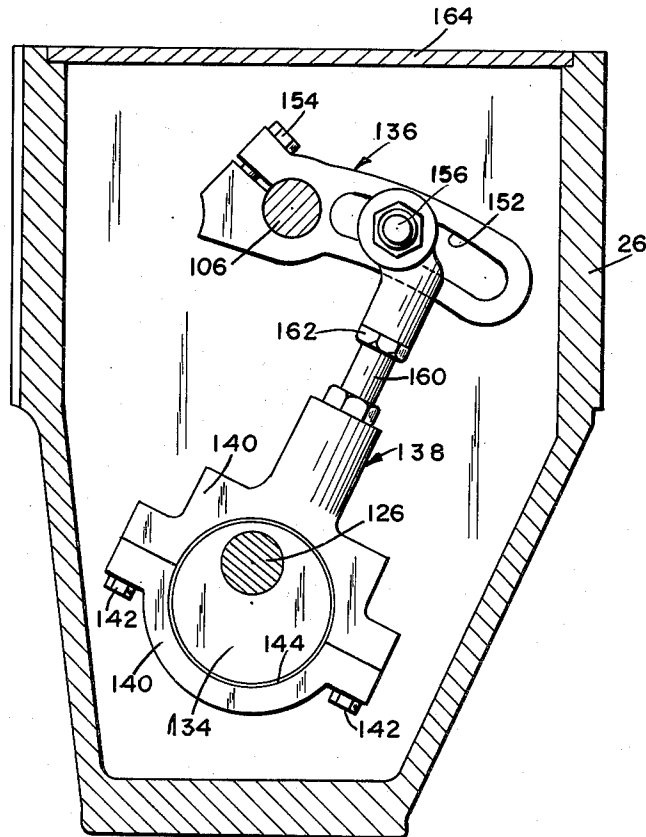
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Fig. 7.



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2,977,905

TUFTING MACHINE

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13 Claims. (Cl. 112-79)

This invention relates to machines for forming tufted articles; that is, articles such as rugs, carpets and the like defined by a backing having face pile thereon. Such machines are commonly called "tufting machines" and are operable to form on the backing a face pile composed of cut pile tufts and/or uncut pile loops which may be arranged in some suitable pattern to produce a decorative effect. As is understood, tufting machines operate on previously formed backings, and in this sense are distinguishable from weaving machines or looms wherein pile is provided in a fabric backing simultaneously with the weaving operation forming the backing.

Conventional tufting machines usually include a gang of thread or yarn carrying needles, a gang of thread engageable members, such as loopers and/or cutters, below the needles and operatively associated therewith, and a bed plate and needle plate disposed intermediate the needles and loopers or cutters. The needles usually are reciprocated in a vertical stroke to pass yarn through a backing moving through the machine and supported by the bed plate and needle plate. The loopers and/or cutters engage the yarn after it has passed through the backing and form the appropriate cut pile tufts or uncut pile loops. Thus each of the needles and its associated looper and/or cutter can form a line of stitching in the backing to provide the face pile.

In some conventional tufting machines, when it is desired to change the depth of the pile being produced, the vertical position of the needle plate has to be adjusted, as by removing it from the bed plate and shimming it up or down to the right position. At the same time, however, it is necessary for the stroke of the needles to be increased for increased pile depth or decreased for decreased pile depth. Heretofore, such change in the stroke of the needles would alter the stroke at both ends, that is, if the stroke were increased, the needles would go down to a lower position than before and to a higher position than before. This obviously changed the relationship of the needles to the loopers and/or cutters when the needles were at the bottom of their stroke, thereby necessitating some further adjustment, usually effected by appropriately changing the vertical position of the needles in the needle carrier, in order that the bottom of the needle stroke would be maintained in proper relation to the loopers and/or cutters.

Understandably, this procedure makes the operation of adjustment of the machines for changes in pile depth arduous, time consuming and demanding. Our invention, accordingly, has for a principal objective the provision in tufting machines of novel structures, arrangements and combinations particularly designed to simplify and facilitate adjustment of the machine to obtain desired changes in the depth of face pile on the tufted article produced.

Additional and more specific objects of our invention include: the provision of a novel unitary needle plate and needle stripper arrangement conveniently adjustable vertically; and the provision of a novel arrangement for

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adjusting the stroke of the needles whereby only the top of the stroke is changed while the bottom of the stroke is always in the same position thereby leaving undisturbed the relation between the needles at the bottom of their stroke and the loopers and/or cutters.

Another disadvantage of conventional tufting machines is the danger of having lubricant leak from the driving means for the needles onto the backing and yarn. As is customary, the driving means for the needles is positioned above the needles and backing and unless extreme care is taken lubricant may leak down the driving needle bars connected to the needles and onto the backing. This invention, thus, has for a further object the provision of a novel structural arrangement, in the driving means for reciprocating the needles, particularly adapted to eliminate the danger of lubricant leaking onto the backing.

Further objects and advantages of the invention will be in part obvious and in part pointed out hereinafter.

The novel features of the invention may be best made clear from the following description and accompanying drawings in which:

Figure 1 is a perspective view of an exemplary construction of tufting machine to which the present invention is applicable;

Figure 2 is an enlarged, fragmentary and partially cut away view of the right hand end of the machine of Figure 1, and with certain structure omitted for convenience of illustration;

Figure 3 is an enlarged, fragmentary view of a portion of the right hand end of the machine of Figure 1, also with some parts omitted for convenience of illustration;

Figure 4 is an enlarged and fragmentary perspective view of certain parts at the right hand end of the machine of Figure 1;

Figure 5 is a sectional view taken generally along line 5-5 of Figure 1;

Figure 6 is an enlarged, vertical sectional view taken generally along line 6-6 of Figure 2;

Figure 7 is an enlarged, vertical sectional view taken generally along line 7-7 of Figure 2;

Figure 8 is a fragmentary and enlarged perspective view of a part of an illustrative construction for the driving connection for the needles of the machines; and

Figure 9 is a fragmentary and enlarged perspective view of the rear of the needle stripper showing an exemplary manner of attaching it to the needle bar housing.

Referring now to the drawings, an exemplary type of tufting machine is shown in Figure 1 and identified by numeral 20. As is understood and as will be again referred to in more detail hereinafter, these machines commonly include a gang of vertically reciprocable individual needles carrying thread or yarn, and a gang of individual looper and/or cutter mechanisms generally vertically aligned with the needles and disposed therebelow. Further, a needle plate and needle stripper are usually provided intermediate the needles and loopers, and form a passageway therebetween through which the workpiece is fed. The needles conventionally are carried by a needle carrier extending transversely of the direction of feed for the workpiece, and a driving bar or bars is or are connected to the needle carrier to impart the desired stitching stroke thereto. While our invention is particularly applicable to this type of tufting machine, it should be evident from the following description of the illustrative embodiments thereof that the invention is also applicable to other types of tufting machines, for example, tufting machines wherein a single needle and a single looper and/or cutter mechanism are utilized.

As indicated heretofore, our invention is primarily

concerned with the provision of improved structures for simplifying and facilitating adjustment of the machine to obtain the desired depth of face pile in the finished article, and also to eliminate lubricant leakage on the workpiece.

In achieving these purposes, it is contemplated by this invention that the needle plate and needle stripper be constructed as a unitary structure and further, that novel means be provided for permitting convenient manual adjustment of the vertical position thereof. It is also contemplated that a novel device be included in the driving means for the needles so that the reciprocating stroke of the needles may be adjusted, as desired, yet without varying one of the two limit positions in the stroke; that is, the needle stroke is adjustable, but all the adjustment occurs at one end of the stroke while the position of the other end of the stroke remains constant. Thus, the invention comprehends these two novel aspects both in combination and individually. And, additionally, it is contemplated that the needle driving means include novel structure for preventing leaks of lubricant.

General organization

Referring again to the exemplary tufting machine 20 illustrated in the drawings, the gang of needles 22 is shown carried by a transverse needle carrier 24 located below a housing 26 extending between the vertical frame or chassis sections 28. The needle carrier 24 preferably is driven by vertical needle bars 25 attached thereto and extending into housing 26 through collars 27 carried by the housing (see Figures 2 and 6). Any suitable number of needle bars 25 may be used. As will be more fully explained hereinbelow, the means for reciprocating the needle bars 25 to drive the needles 22 are arranged in housing 26. The machine includes any suitable source of power, such as the prime mover indicated by numeral 38 at the bottom of the right hand frame section 28 (see Figure 2). As the needles 22 move up and down, they pass the yarn or thread 40 (Figure 6) carried thereby through the backing 36 (Figure 3). The yarn will be fed to the needles in any known manner by any appropriate means (not shown).

Suitable means, designated 30, are provided at the infeed side of the machine for directing the workpiece into position below the needles. This means may include upper and lower transverse feed rollers 32 (see Figures 3 and 4) journaled in brackets 34 connected to the frame sections 28, as shown. One or both of these rollers may be appropriately driven and the workpiece or backing 36 may pass, for example, under the lower roller, between the rollers, and over the top roller into the machine.

The backing will be fed through the machine at the proper rate from left to right as viewed in Figure 6, passing over needle plate 42 under the needle stripper 44 and over rear bed plate 45 to an appropriate take-off device (not shown). The inner or rearward end of the needle plate 42, as shown, includes a comb-type structure 46 (see Figure 4) through which the various needles pass after they have pierced the backing, as is understood.

Any suitable thread engaging members will be positioned underneath the needle plate 42 to coact with the needles for the purpose of forming the desired cut pile tufts or uncut pile loops or both in a manner well understood in the art. As indicated in Figure 6, both a looper 48 and a cutter 50 are associated with each needle 22. If cut pile tufts are desired, the cutter 50 will be used. If uncut pile loops are desired, only the loopers 48 will be used. And if decorative and varied patterns composed of both cut pile tufts and uncut pile loops are desired, both the loopers and cutters associated with each needle will be arranged for individual and independent operation in a predetermined sequence. The structure and operation of loopers and cutters are well known

and the invention contemplates that any suitable variety thereof may be utilized.

During operation of this machine, as will be understood, the needles and looper-cutter mechanisms form spaced longitudinal lines of stitching in the backing 36, extending therethrough and forming face pile on one side of the backing. Among other things, the needle plate 42 and stripper 44 prevent undesirable movements of the backing 36 as the needles pass therethrough. To enable the depth of the face pile to be altered, the needle plate 42 and needle stripper 44 are designed of novel construction and novel means are provided for vertical adjustment thereof relative to the looper 48 and cutter 50.

Structure and mounting of needle plate and stripper

The needle plate 42, as best seen in Figures 4 and 6, preferably extends between frame sections 28 and is mounted on the horizontal leg of an angle member 52 by any suitable means, such as the fasteners 54 shown in Figure 4. A front bed plate 56 is arranged below angle member 52, also extending between the frame sections 28. The plate 56 may be secured to the sections 28 in any desired manner. As indicated, the vertical legs of member 52 and plate 56 are mounted in slidable engagement. That is, the member 52 can be moved vertically relative to bed plate 56.

The novel means providing for convenient adjustment of the position of the needle plate 42 and angle member 52 relative to the bed plate 56, in the illustrative embodiment thereof, includes a rack 58 arranged on the vertical leg of member 52 with a pinion gear 60 in engagement therewith, as shown in Figures 3, 4 and 6. Further, a shaft 62 for rotating the pinion gear extends therefrom, through bracket 34 to a worm wheel 64 (Figures 3, 5). This worm wheel may be disposed in a housing 66 suitably mounted on the adjacent frame section 28, and in which shaft 62 is journaled. A driving worm 68 is mounted in the upper part of housing 66 in engagement with the worm wheel 64, as shown in Figure 5, and the horizontal worm shaft 70 is journaled in the housing 66 and extends therethrough for connection to a manually operable means 72 shown in the form of a wheel or dial having handle 74 thereon.

As will be evident, rotation of the wheel 72 by handle 74 will be effective to cause appropriate vertical movement of the member 52 and needle plate 42 through the medium of the worm wheel 64, shaft 62, pinion 60 and rack 58.

The bottom of the front bed plate 56 may be provided with an outwardly extending shoulder 76 to limit downward movement of member 52 (see Figure 6). And, if desired, suitable means may be provided to detachably fasten the member 52 to bed plate 56. Such means, for example, may include a bolt 78 extending through a vertical slot 80 in bed plate 56 and into member 52. Thus, after the needle plate 42 has been adjusted to the proper height relative to the stationary looper 48 and cutter 50, the bolt 78 may be tightened so that the weight or pressure on the worm 68 and gears 60, 64 will be relieved. Any appropriate number of bolts 78 and slots 80 may be used, and the slots 80 may be formed in member 52 with the bolts 78 reversed and being tightened in bed plate 56, if desired.

The needle stripper 44 preferably is of angular cross section, as shown in Figure 6, and is substantially coextensive with needle plate 42. Means are provided for connecting the stripper 44 to the plate 42 to make them, in effect, a unitary structure. In the illustrative embodiment, this means includes brackets 82 connected to the needle plate 42 at each end thereof, and extending rearwardly in the machine for connection to a transverse bar 84 located above the stripper 44 (see Figures 3, 4, 6 and 9). Vertical connecting pieces 86 suspend the stripper 44 from the bar 84, as best shown in Figure 9. Brackets 82

may be connected to plate 42 and bar 84 by any convenient means, as by fasteners 88, while the bar 84, as best seen in Figures 6 and 9, may be detachably connected to a lip 89 depending from the rear of the needle bar collars 27 by a bolt 90 and slot 92 connection whereby the position of bar 84 relative to the collars 27 can be varied. Similarly, a bolt 94 and slot 96 arrangement may be used for connecting the vertical pieces 86 to the bar 84.

It will be appreciated that by reason of this arrangement, vertical adjustment of the positioning of needle plate 42 will be automatically accompanied by a corresponding movement of stripper 44. Bolts 78 and 90 will, of course, be loosened for each adjustment of the needle plate and stripper, and tightened thereafter. After the needle plate has been adjusted to a new height, the stroke of the needles 22 requires similar adjustment.

Needle bar drive and mounting means

The illustrative embodiment of the adjustable needle bar drive and mounting means is best seen in Figures 2, 6, 7 and 8. As there shown, each of the collars 27 is mounted in the lower end of the housing 26 and may be secured thereto as by bolts 98. A vertical sleeve 100 is stationarily mounted in the collar 27 (see Figure 6) and extends upwardly within housing 26. Each needle bar 25 is slidably mounted within its respective sleeve 100, with stationary bushing means 102 being carried by the sleeves for engagement with the bars 25, as shown. These bushing means 102 preferably are of the self-lubricating variety, and hence do not require liquid lubrication.

Carried by the upper end of each of the needle bars 25 is a tubular shield 104 depending therefrom and surrounding the upper end of the sleeve 100, as shown. The lower ends of the needle bars are suitably drivingly connected to the needle carrier 24, and as the needle bars are reciprocated, the shield 104 will always be in a position covering the open upper end of the sleeve 100, thereby protecting against any flow of lubricant into the sleeve 100 and down the sleeve onto the backing 36. Such lubricant might come from the various lubricated moving parts in the housing 26 to be described more fully hereinafter.

A main shaft 106 is rotatably mounted in the housing 26 above the needle bars 25, as by pillow block bearings 108 carried by cross pieces 110 joined to housing 26, as shown in Figures 2 and 6. Any suitable number and spacing of these bearings 108 and cross pieces 110 may be utilized. This shaft 106 is connected to the bars 25 to impart rectilinear, reciprocating motion thereto, as by a drive lever 112 and connecting link 114 for each needle bar 25. The lever 112 extends radially outwardly from shaft 106 directly above the respective needle bar 25, being drivingly connected to shaft 106, as by the adjusting set screw 116 tightly clamping the split end of the lever around the shaft in the manner indicated. At the free, bifurcated end of lever 112, a wrist pin 118 is mounted, extending through the upper end of link 114, as shown in Figure 8. Set screws 120 may be used to hold the split free ends of lever 112 around the wrist pin, and the wrist pin will be journalled in link 114. A similar wrist pin or equivalent connection may also be provided at the lower end of link 114 connecting it to the needle bar. For example, such a wrist pin 122 is shown extending through the upper part of the needle bar 25 and through the lower part of the link 114. Clamping set screws 124 may also be provided to clamp the split, bifurcated upper end of bar 25 around the pin 122, the pin 122 being journalled in link 114.

Thus, it should be evident that rotation of shaft 106 in opposite directions will effect a reciprocating motion of needle bars 25, and thereby also the needles 22. The means for so rotating the shaft 106 includes a driving cam shaft 126 arranged, for example, in the housing 26 below and parallel to shaft 106, as best seen in Figures 2, 6 and

7. Any appropriate means for rotating shaft 126 may be provided. For example, as shown in Figure 2, one end of the shaft 126 may extend through the side wall of the right hand frame section 28 and through a bearing support 128 for attachment to a pulley or sheave 130 drivingly connected by the belt 129 to the pulley 132 on shaft 134 of motor 38. A guard member 133 may be provided for this pulley and belt arrangement, as indicated in Figure 1. Although not shown, it will be understood that the other end of shaft 126 will be supported, for example, by being journalled in the opposite or left hand frame section 28. Additionally, intermediate bearing supports (not shown) for shaft 126 may be provided within housing 26, as desired.

Adjacent one or both ends, preferably both ends of the shaft 106, a circular cam 134 is eccentrically affixed to shaft 126 (see Figure 7) to be rotated thereby. And above this cam 134, a drive lever 136 is attached to shaft 106. The end of this lever that engages the shaft may be split with a set screw 154 or the like effecting the driving connection with the shaft, as indicated. The lever 136 is operatively connected to the cam 134 by a connecting rod 138. The lower end of the connecting rod 138 is journalled to the cam 134, as by the split sections 140 engaged around the cam and secured thereto by bolts 142 in the manner shown in Figures 2 and 7. A bearing sleeve 144 may be interposed between the cam 134 and split sections 140, as shown.

As shaft 126 rotates, the action of the eccentrically mounted cam 134 will cause the rod 138 to be moved up and down as the cam rotates between bottom dead center position (shown in Figure 7) and top dead center position, 180° therefrom. This up and down movement of the rod 138 will produce an oscillation of lever 136, which in turn will effect periodic rotation of shaft 106 in opposite directions to reciprocate the needles 22, as discussed heretofore. The action of the loopers 48 and cutters 50, as understood, will be coordinated with the reciprocation of the needles. This may be accomplished by appropriate operative connection of the loopers and cutters to the respective shafts 146, 148 mounted in the machine below shaft 126 as shown in Figure 2, and which in turn may be connected to shaft 126 to be driven thereby by any convenient power transmitting means, such as that indicated schematically at 150.

As previously indicated, adjustment of the vertical position of needle plate 42 to alter the depth of the face pile obtained on the backing will require corresponding adjustment of the stroke of needles 22, to assure that the needles will have the proper clearance above the backing in their upward stroke. If in their adjusted stroke the needles go down to a different bottom position, the required relationship between the needles and the loopers 48 and cutters 50 will be changed, thus necessitating some further adjustment to reestablish this required relationship. In our invention, novel means are provided for engaging the upper end of connecting rod 138 to lever 136 whereby the stroke of the needles can be changed without changing the bottom position of the stroke. This is accomplished by providing for a detachable engagement of the rod 138 to lever 136 whereby the point of engagement therebetween may be varied along a circularly arcuate path having a radius of curvature drawn from the geometric center of circular cam 134 when the cam is at bottom dead center (its Figure 7 position). Stated somewhat differently, the rod 138 is detachably engageable to the lever 136 along a circularly arcuate path whose center of curvature coincides with the center of curvature of circular cam 134 when the cam is at bottom dead center and the needles 22 therefore at the bottom or lower end of their stroke.

In the illustrative embodiment of this feature of the invention, the lever 136 is formed with an arcuate slot 152 therein (see Figure 7), having its center of curvature coinciding with the geometric center of cam 134 when

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the latter is in its bottom dead center position. The upper end of rod 138 is connected to the lever by a bolt or pin 156 extending through slot 152. The upper end of rod 138 may be bifurcated, engaging lever 136 on opposite sides, with the bolt 156 extending therethrough and detachably held in position as by nut 158. Thus, in order to change the stroke of needles 22, the nut 158 will be loosened and the position of the upper end of rod 138 will be appropriately varied along the slot 152, toward or away from shaft 106, and the nut 158 will then be tightened to hold the rod in this new position. As will be evident, movement of the upper end of rod 138 toward or away from shaft 106 will change the amplitude of oscillation of lever 136 as rod 138 continues to move up and down through the same amplitude determined by the size of cam 134. It should further be evident that the amplitude of lever 136 will be decreased as the upper end of rod 138 is moved away from shaft 106, and increased as the upper end of rod 138 is moved closer to the shaft. This change in amplitude of lever 136 changes the amplitude of rotation of shaft 106 in both directions, which in turn changes the stroke of the needles 22 as a result of their connection to the shaft 106 described above.

It will be observed that whether the amplitude of the needle stroke is increased or decreased, the position of the bottom of its stroke will remain constant. That is to say, since the slot 152 is circularly arcuate about the geometric center of cam 134 when the latter is at bottom dead center, the position of lever 136 will always be the same when the cam 134 is at bottom dead center irrespective of the position of the upper end of rod 138 and bolt 156 relative to the shaft 106. Therefore, whether the bolt 156 is at the outer or inner end of the slot 152, or in any other position relative thereto, lever 136 will always be in the position illustrated in Figure 7 when the cam 134 is at bottom dead center, this position corresponding to the bottom of the stroke of the needles 22 as previously stated. Hence, any adjustment of rod 138, toward or away from shaft 106, will alter the position of the top of the needle stroke only (i.e. the top of the oscillatory movement of lever 136), leaving the bottom of the stroke unchanged and thereby preserving the required relation between the loopers 48 and cutters 50 on the one hand, and the bottom of the needle stroke on the other hand.

Thus, it will be appreciated from the foregoing that the invention enables the machine to be conveniently adjusted to produce tufted articles having face pile of the desired depth. As already explained, all that is necessary is to operate the wheel or dial 72 which moves the needle plate 42 and stripper 44 vertically, and then appropriately adjust the position of the upper end of rod 138 on lever 136 to vary the stroke of the needles 22. No further adjustment of the vertical position of the needles 22 in their carrier 24 will be necessary. It will be understood that the yarn feed will be changed for each adjustment of the machine to obtain a different depth of face pile. Any suitable means may be used for this purpose.

The top of the housing 26 may be closed by a cover 164 with means being provided affording access into the housing 26 for adjustment of the position of connecting rod 138.

Although not necessary, the needles 22 may be mounted in appropriate holes in their carrier 24 for individual vertical adjustment, as by use of set screws (not shown) screwed into the carrier and engaging the needles. And the length of rod 138 may be adjustable, if desired, such as by providing an adjusting stud 160 threadedly connected at its ends to the upper and lower sections of the rod 138, with lock nuts 162 locking the stud in desired position.

The present invention will thus be seen to completely and effectively accomplish the objects enumerated hereinabove. It will be realized, however, that various changes and substitutions may be made to the specific

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embodiments disclosed herein for the purpose of illustrating the principles of this invention, without departing from these principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

We claim:

1. In a tufting machine having a needle bar, a thread-carrying needle fixed to said bar, and a thread engageable member vertically spaced therefrom, means for supporting a workpiece and disposed intermediate said needle and said member, means for reciprocating said needle in a stroke extending between a first point adjacent said member and a second point vertically spaced therefrom, said needle passing thru said workpiece to form face piles therein, means for vertically adjusting said supporting means to vary the depth of face piles formed in the workpiece and means for adjusting the stroke of said needle without changing the position of said first point thereof and without changing the position of said needle relative to said needle bar, said means for adjusting the stroke of said needle comprising only one adjustable connection.

2. In a tufting machine having a needle bar, a needle fixed to said bar, a thread engageable member spaced in general vertical alignment therewith, and means for supporting a workpiece intermediate said needle and said member, the improvement which comprises: means for reciprocating said needle in a stroke extending between a first point adjacent said member and a second point vertically spaced therefrom, and means for adjusting the stroke of said needle without changing the position of the first point thereof and without changing the position of said needle relative to said needle bar, said means for adjusting the stroke of said needle comprising only one adjustable connection.

3. In a tufting machine having a needle bar, a gang of vertical needles fixed to said bar, and a gang of thread engageable members arranged in generally vertical alignment therewith, means for reciprocating said needles in an adjustable vertical stroke extending between a first limiting point adjacent said members and a second limiting point vertically spaced therefrom, said means including: a horizontal main shaft operatively connected to said needles to impart vertical movement thereto, a driving cam shaft parallel to said main shaft, a circular cam eccentrically mounted on said cam shaft, a connecting rod journaled at one end to said cam, an arcuate lever engaged to said main shaft and extending along a circular path having a radius of curvature drawn from the center of said cam when said needles are substantially in their lowermost position; means detachably connecting said connecting rod to said lever outwardly of said main shaft; and means for varying the point of detachable connection of said connecting rod along said lever whereby the uppermost point of the stroke of said needles is varied without varying the lowermost point.

4. A tufting machine having a frame, a horizontal main shaft rotatably carried by said frame, a gang of needles, means drivingly connecting said needles to said main shaft for imparting vertical movement to said needles, a gang of thread engageable members arranged beneath said needles, means for supporting a workpiece intermediate said members and said needles, means for periodically rotating said main shaft in opposite directions to reciprocate said needles in a stroke extending between a first point adjacent said members and a second point vertically spaced therefrom, and means for adjusting the stroke of the needles without changing the position of the first point thereof, said periodically rotating and adjusting means including a cam shaft spaced from and parallel to said main shaft, a lever extending from said main shaft and a connecting rod engaged at one end to said cam shaft, and an adjustable connection between the other end of said rod and said lever, said means for adjusting the

stroke of the needles comprising said adjustable connection.

5. The structure defined in claim 4 wherein said periodically rotating and adjusting means further includes a circular cam eccentrically affixed to said cam shaft, said connecting rod being journaled to said cam at one end thereof and detachably engaged to said lever at the other end thereof, said lever extending along a circular path having a radius of curvature drawn from the center of said cam when said needles are substantially at said first point, and means for changing the point of engagement of said rod to said lever along a circularly arcuate path having a radius of curvature extending from the center of said circular cam when said needles are substantially at said first point.

6. In a tufting machine having a vertically reciprocating needle and a thread engageable member spaced in general vertical alignment therewith, means for supporting a workpiece, said means including: a bed plate; a unitary needle plate and needle stripper, said needle plate being mounted on said bed plate on one side of said needle and intermediate said needle and said member, said needle stripper being disposed on the opposite side of said needle, and said needle plate and said needle stripper forming a workpiece passageway therebetween.

7. The structure defined in claim 6 further comprising means operatively engaged to said needle plate and providing for vertical adjustment of said needle plate and said needle stripper as a unit, and relative to said bed plate.

8. In a tufting machine having a gang of vertically reciprocating needles and a gang of thread engageable members arranged in generally vertical alignment therewith, the improvement which comprises: a needle plate and a needle stripper arranged on opposite sides of said needles intermediate said needles and said members and forming a workpiece passageway therebetween; means connecting said stripper to said plate to form a unitary structure; and means providing for vertical adjustment of said plate and said stripper as a unit.

9. In a tufting machine having a frame, a needle mounted in said frame for vertical reciprocation, a thread engageable member mounted in said frame in generally vertical alignment with said needle, the improvement which comprises: a unitary needle plate and needle stripper disposed intermediate said needle and said member, said frame including means for supporting said needle plate and needle stripper in operative position wherein said needle plate and said needle stripper are on opposite sides of said needle, said needle plate and needle stripper forming a workpiece passageway therebetween, and means operatively connected to said needle plate and engaged to said frame providing for vertical adjustment of said needle plate and said needle stripper as a unit.

10. The structure defined in claim 9 wherein a vertical member depends from said needle plate and wherein said means providing for vertical adjustment includes: a vertical rack mounted on said vertical member; a pinion engaging said rack; and manually operable means carried by said frame for rotating said pinion.

11. In a tufting machine having a needle bar, a thread-carrying needle fixed to said bar, and a thread engageable member arranged in generally vertical alignment therewith, a needle plate and a needle stripper arranged intermediate said needle and said member, said needle plate and stripper forming a workpiece passageway therebetween; means for vertically reciprocating said needle relative to said member in a stroke extending between a first

limiting point adjacent said member and a second limiting point vertically spaced therefrom, said needle passing through said workpiece to form face piles therein; means providing for vertical adjustment of said plate and said stripper as a unit to vary the depth of face piles formed in the workpiece by said needle; and means for adjusting the stroke of said needle so that said second point varies while said first point remains unchanged and without changing the position of said needle relative to said bar.

12. In a tufting machine having a needle bar, a gang of thread-carrying needles fixed to said bar, and a gang of thread engageable members arranged in generally vertical alignment therewith; means for supporting a workpiece disposed intermediate said needles and said members; means for vertically adjusting said supporting means to vary the depth of face piles formed in the workpiece; means for vertically reciprocating said needles relative to said members and in an adjustable stroke, extending between a first limiting point adjacent said members and a second limiting point vertically spaced therefrom, said needles passing through said workpiece to form face piles therein, the length of said face piles being changed upon adjustment of said supporting means and the stroke of said needles, said reciprocating means for said needles including a horizontal main shaft operatively connected to said needles to impart vertical movement thereto, a driving cam shaft parallel to said main shaft, a circular cam eccentrically mounted on said cam shaft, a connecting rod journaled at one end to said cam, an arcuate lever engaged to said main shaft and extending along a circular path having a radius of curvature drawn from the center of said cam when said needles are substantially in said first limiting point position, means detachably connecting said connecting rod to said lever outwardly of said main shaft, and means for varying the point of detachable connection of said connecting rod along said lever whereby the second limiting point of the stroke of said needles is varied without varying the first limiting point and without changing the position of said needle relative to said needle bar.

13. The structure defined in claim 12 in which said workpiece supporting means comprises a needle plate and a needle stripper arranged in opposite sides of said needles forming a workpiece passageway therebetween, and wherein said means providing for vertical adjustment of said workpiece supporting means comprises a vertical rack drivingly connected to said plate and a pinion engaging said rack whereby said plate and said stripper are adjusted as a unit.

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