This disclosure relates to tufting machines and in particular an adjustable crankshaft for varying the needle stroke in such machines which includes means for changing the position of the connecting rod relative to the crankshaft bearing blocks and the axis of the crankshaft whereby the crank throw will be changed and thus the needle stroke. An adjustable counterweight mechanism is also provided which may be adjusted in the same manner as the connecting rod but opposite thereto which results in a balanced crankshaft drive mechanism.

8 Claims, 6 Drawing Figures
ADJUSTABLE STROKE MECHANISM FOR TUFTING MACHINES

BACKGROUND OF THE INVENTION

Most tufting machines built today have a needle drive mechanism which includes a main drive shaft upon which is mounted a plurality of eccentric cam devices. These eccentrics drive the needle bar at a stroke which is dependent upon the amount of eccentricity relative to the main axis of the crankshaft. It will be apparent that as requirements for greater needle strokes are encountered, the eccentric cam devices must be made larger as the length of the needle stroke varies directly with the amount of eccentricity. There comes a point when the size of the eccentric cams is too great to be practical and such machines are thus limited in the length of the needle stroke which can be obtained. Further, when using large eccentrics there is a problem of machine stability and in achieving versatility in needle stroke adjustment. With the advent of popularity in shag type or long nap fabrics there has been a demand for a tufting machine which can provide a relatively long needle stroke, say up to three inches, while at the same time being readily adjustable so that lower nap fabrics can be produced on the same machine. It is the purpose of the present invention to provide such a machine.

GENERAL DESCRIPTION OF THE INVENTION

In the present invention, a tufting machine having a main drive shaft is constructed such that said main drive shaft is in the form of a crank shaft. The crank shaft is provided with a number of crank portions whose axes are offset from the axis of the main shaft itself. The connecting rods which drive the needle bar in its reciprocating motion are each connected to a crank portion so that the length of the stroke of the needle bar is controlled by the degree of offset of the axis of the crank portions. In order to vary the stroke of the needle bar the crank shaft is constructed such that the distance between the axis of the crank portions and the axis of the main shaft itself may be varied. In order to vary the distance between the aforementioned axes, the crank portions are readily moveable relative to the axis of the main shaft thus varying the distance of the throw of the crank portions. The crankshaft is balanced by providing adjustable counterweights which are provided adjacent each crank portion and which are preferably adjustable in the same manner as the crank portion itself but in a direction opposite to the direction of offset of the crank portion. The counterweights are selected to offset vibrational effects which may be present due to the offset rotation of the crank portion. The crankshaft of the invention thus provides for a smooth running drive mechanism in a tufting machine and which is capable of providing a relatively wide range of needle strokes.

Accordingly it is one object of the invention to provide a novel and improved tufting machine having a relatively wide range of selection of needle strokes.

It is another object of the invention to provide a novel and improved drive shaft mechanism for a tufting machine.

It is a further object of the invention to provide a novel and improved adjustable crankshaft for a tufting machine.

It is an additional object of the invention to provide a novel and improved adjustable crankshaft.

Other objects and advantages of the invention will be best understood from the following detailed description of the invention with the accompanying drawing.

DESCRIPTION OF DRAWING

FIG. 1 illustrates a cross-sectional view of a tufting machine embodying the present invention;

FIG. 2 illustrates an enlarged top plan view of a portion of one embodiment of the crankshaft of the invention taken in the direction of line 2 — 2 of FIG. 1;

FIG. 3 illustrates an enlarged front view of a portion of the crankshaft of FIG. 1 taken in the direction of line 3 — 3 of FIG. 1; and

FIG. 4 illustrates an exploded perspective view of a portion of the embodiment of FIG. 1; and

FIG. 5 is an enlarged top plan view of a portion of a second embodiment of the invention; and

FIG. 6 is an enlarged front view of a portion of the second embodiment of the invention.

DETAILED DESCRIPTION OF INVENTION

Referring to FIG. 1, a tufting machine 10 is illustrated as having a head portion 12 and a bedplate portion 14. Included in the head portion 10 is a needle mechanism which comprises a needle bar 16 which supports a plurality of needles 18 for penetrating a base fabric F with yarns Y. The needle bar 16 is connected to a push rod 20 which is driven in a reciprocating manner in a bushing 22 by a connecting rod 24 in a manner which will be more fully described hereinafter.

A looper mechanism is supported in the bedplate portion and includes a plurality of loopers or hooks 26, one for each needle, operably supported on a hook shaft 28 which is driven in an oscillating motion in a well known manner. The hooks 26 serve to pick up loops of yarn from the needles 18 on their downstroke and hold the loops during the return stroke of the needles. A knife mechanism may be associated with each hook 26 for cutting the loops in order to make cut pile tufted fabrics and includes a plurality of knives 30 each operably supported on an oscillating knife shaft 32 which is suitably oscillated in timed relationship with the hooks to cut the loops. Feed rolls 34, 36, 38 and 40 are provided for feeding the base fabric F across a needle plate 42 so that as the fabric is advanced through the machine a plurality of rows of loops or cut loops will be formed in the base fabric. The mechanism thusfar described is conventional in tufting machines.

The main drive mechanism for the needle mechanism in tufting machines is generally provided in the head portion 12 and includes a main shaft 44, which is generally operably connected to a prime mover such as an electric motor (not shown). As briefly described above, mainshafts having eccentrics or cams have been used with connecting rods supported thereon so that as the main shaft rotates the connecting rods will impart a reciprocating motion to a push rod connected thereto. The length of the stroke of the push rod, to which the needle bar is connected, is dependent upon the amount of eccentricity of the cam. As the requirements for longer needle strokes become more desirable, say for example when tufting shag type or long nap fabrics, it becomes necessary to increase the size of the cams. However, as the mass of the cams becomes larger certain disadvantages appear such as requirements for in-
increasing the size of the head portion of the machine to accommodate the cams and unbalancing or undesirable vibrational characteristics. As a result it is not always practical to use a cam or eccentric drive when building a machine to be operated at high speed and for tufting shag fabrics.

In accordance with the present invention these disadvantages are overcome. In the embodiment of present invention shown in FIGS. 2-4, the main drive shaft 44 is generally in the form of a crank shaft comprising a plurality of stub shafts 46 journaled in bearing blocks 48 suitably fastened to a portion of the machine head 12 by bolts or the like as illustrated in FIG. 1. As best shown in FIG. 4, each stub shaft 46 has a reduced end portion 50 on each end thereof in which is formed a slot or groove 52 to form a pair of spaced tab or tongue portions 54 and 56. The tab portions 54 and 56 each have a plurality of holes 58 and 60, respectively, for receiving bolts 62 to which nuts 63 are fastened on the outside thereof in the usual manner. As will be seen in FIG. 4, the bolts 62 are preferably inserted from opposite sides, although the bolts could also be inserted from the same side.

With further reference to FIG. 4, in particular, it will be seen that each connecting rod 24 has a connecting rod bearing head portion 64 in which there is journaled a connecting rod bearing shaft or crank portion 66. Each such shaft 66 has a reduced portion comprising a tongue or tab 68 on each end thereof in which there is drilled a hole 70 for receiving the bolts 62. Each tab 68 is made to fit into a slot 62 in a stub shaft 46 and the holes therein will mate with holes 58 and 60 of the adjacent stub shafts 46 so that the bolts 62 will pass through both elements 46 and 66 to fasten them together. It will be apparent from FIGS. 2, 3 and 4 that the selection of the mating holes 58, 60 and 70 will determine the distance between the axis of the stub shaft 46 and the connecting rod bearing shaft 66 or the eccentricity of the shaft 66 relative to the shaft 46. With the shaft 66 being connected to the bearing block 64 and the connecting rod 24, the stroke of the connecting rod 24 and push rod 20 will thus be determined by the relative location of the shaft 66 and 66.

As the distance between the axes of the shafts 46 and 66 is increased through adjustment, as described above, there may be a tendency for an increase in vibration in the machine. In order to counteract the increase in vibration a counterweight is provided between each connecting rod position and is constructed for attachment and adjustment relative to the stub shaft 46 in the same manner as shaft 66. Thus, for example, in FIGS. 2 and 3 it will be seen that between each connecting rod 24 and shaft 66 there is a counterweight 72 which as illustrated in FIG. 2 is disposed for adjustment or positioning relative to the axis of the shafts 46 an equal amount but in an opposite direction to the adjustment or positioning of the shaft 66 in order to counterbalance the shaft 66. The ends of the counterweights 72 are formed with a tab constructions 73 which is substantially the same as the similar construction on the shafts 66. For every change in position of a shaft 66 there will be an equal and opposite change in position of the counterweight 72 whereby the entire shaft will always be in balance and relatively free of vibration. This will permit operation at relatively long strokes and at high speeds which has heretofore not been readily possible.

Referring now to FIGS. 5 and 6, wherein like numerals refer to like elements, each connecting rod 24 and shaft 66 construction is essentially the same as in the first embodiment. In the embodiment of FIGS. 5 and 6 the counterweight construction comprises a pair of counterweights 74 and 76 which are attached to the same tab element construction 54, 56 and slot 52 as the particular shaft 66 with which the counterweights are associated. In other words the counterweights are now disposed at a connecting rod position on the shaft instead of between adjacent connecting rod positions. As illustrated the counterweights 74 and 76 are connected to the tab elements by bolts 62 and nuts 63 and are adjustable relative to the connecting rod position to counterbalance the offset of the connecting rod from the center of the shaft axis. This construction permits a change in eccentricity and thus needle stroke to be made relatively rapidly at a single position for each connecting rod and counterweight.

Because the counterweights and connecting rods are located at the same position along the length of the shaft, the portions of the shaft between connecting rod positions can be of relatively simple construction. Thus, as seen in FIGS. 5 and 6, the shaft portions 78 which extend between adjacent connecting rod positions are of substantially uniform diameter along their length and through the bearing blocks 48. Their end portions 80 and 82 and groove 84 are constructed the same as that described in the first embodiment with relation to shaft 46, namely end portions 54 and 56, but there are only half as many such constructions since the adjustable counterweights have been removed from positions between adjacent connecting rod positions. As a result the construction of the second embodiment is relatively simple in construction and enables relatively simple and rapid adjustment.

From the above description and illustration in the drawings, it will be apparent that a relatively wide range of stroke adjustment is available in tufting machines incorporating the structure of the present invention. For example, a needle stroke ranging from one inch to three inches has been readily attainable with this mechanism and the machine has been operable at relatively high speeds even with the maximum needle stroke. It will further be seen that the shaft construction of the invention does not require a relatively large area in the machine head as would be the case if a standard type tufting machine eccentric mechanism were used to accomplish the same needle stroke range. Further, it is a relatively simple matter to change the needle stroke without requiring a lot of machine down time as was previously the case. All that is required is removing the head cover and loosening and moving the machine screws for each shaft 46 and 66, repositioning the same and the counterweights and re-tightening the machine screws. The degree of needle stroke will of course be governed by the relative position of the shafts 46 and 66 with the maximum needle stroke occurring at the greatest distance between the axes of the shafts 46 and 66.

While applicant has set forth his invention in its preferred form it will be apparent to those skilled in the art, that various modifications and changes may be made without departing from the spirit and scope thereof as set forth in the appended claims.
What is claimed is:

1. In a tufting machine having an adjustable stroke needle mechanism and means for initiating reciprocating motion of said needle mechanism including a connecting rod means operably connected to said needle mechanism, a drive shaft operably connected to a source of power for initiating rotary motion of said drive shaft, said drive shaft including a first shaft member for receiving thereon a connecting rod means, a plurality of second shaft members each being journaled in a bearing block in coaxial relationship, said first shaft member having its end portions disposed between facing end portions of adjacent second shaft members and having its axis offset relative to the axis of said second shaft members, interconnectable means fixed on the end portions of said first shaft member and on said facing end portions of said second shaft members, and means for adjustably securing the interconnectable means of said first shaft member to adjacent interconnectable means of said second shaft member facing end portions for adjusting the position of said first shaft member relative to its associated second shaft member such that the offset of the axis of said first shaft member can be radially changed relative to the axis of said second shaft members whereby for each change in the position of said first shaft member relative to said second shaft members there will be a change in stroke of the needle mechanism.

2. In a tufting machine as recited in claim 1 further comprising means for counterbalancing said drive shaft including counterweight means, and means for adjusting the position of said counterweight means to counterbalance the relative offset position of said first shaft member and its connecting rod means.

3. In a tufting machine as recited in claim 1 wherein said interconnectable means lie in planes parallel to a plane containing the axes of said first and second shaft members, and said securing means lie in planes perpendicular to the planes of said interconnectable means.

4. In a tufting machine as recited in claim 3 wherein the interconnectable means on one of said first and second shaft members comprises a pair of spaced tongues, and the interconnectable means on the other of said first and second shaft members comprises a tab receivable in the space between said tongues, said securing means comprises a plurality of spaced tongues through said tongues, and at least one hole in said tab, and bolt means extending through a selected hole in each pair of tongues and through the hole in the corresponding tab.

5. In a tufting machine as recited in claim 4 further comprising means for counterbalancing said drive shaft including counterweight means and means for adjustably connecting said counterweight means to one of said tab and tongue pair.

6. In a tufting machine as recited in claim 2 wherein said counterweight means are adjustably connected to said second shaft members.

7. In a tufting machine as recited in claim 4 wherein said spaced tongues are formed on the second shaft members, and said tab is formed on the first shaft member.

8. In a tufting machine as recited in claim 7 including means for counterbalancing said drive shaft, said counterbalancing means comprising counterweight means, a tab having a hole formed on said counterweight means receivable in the space between the tongues, and bolt means extending through the hole in the tab and through a hole in the pair of tongues spaced from said selected hole.