

[54] **ADJUSTABLE STROKE MECHANISM
FOR TUFTING MACHINES**

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[58] Field of Search.....112/79 R, 79 A, 80, 266, 410,
112/220, 221; 74/60

[56] **References Cited**

UNITED STATES PATENTS

2,781,011	2/1957	Ayres.....	112/221
155,943	10/1874	Hamilton	112/203 X
2,465,638	3/1949	Eckert.....	74/60
2,577,675	12/1951	Burkland	74/60

2,977,905	4/1961	Cobble, Sr. et al.	112/79 A
3,026,830	3/1962	Bryant et al.....	112/79 R
3,301,205	1/1967	Card	112/79 R
3,369,412	2/1968	McFarland et al.....	74/60

FOREIGN PATENTS OR APPLICATIONS

261,754	3/1911	Germany	74/60
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Primary Examiner—James R. Boler

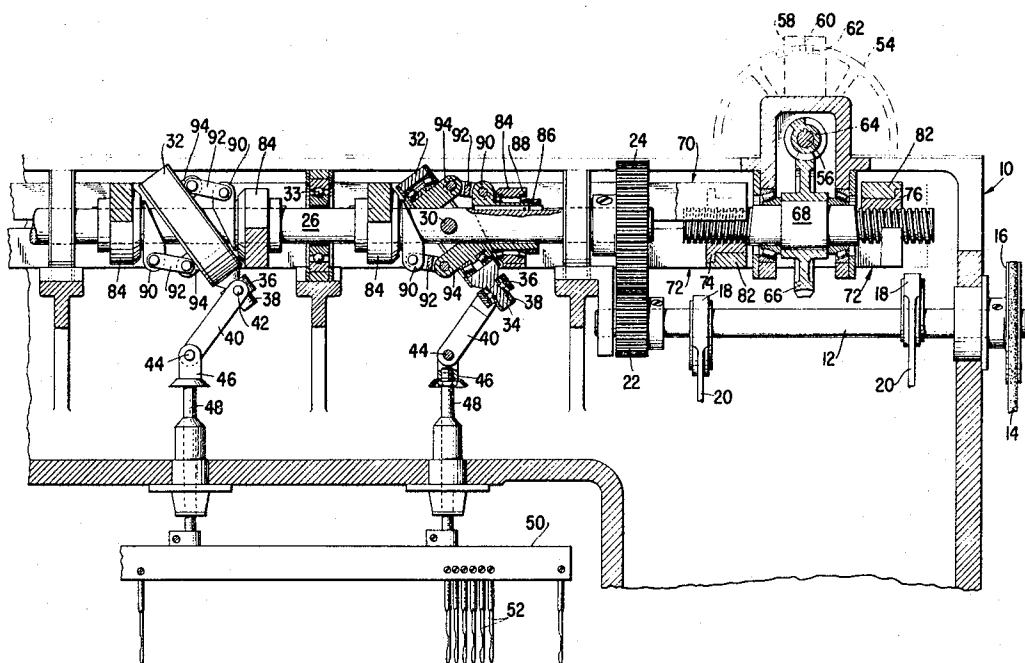
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[57]

ABSTRACT

This disclosure relates to tufting machines and, in particular, to an adjustable stroke mechanism for the needle mechanism of said machine which includes a nutating motion device for driving the needle mechanism and control means for varying the movement of the nutating motion device for changing the stroke of said needle mechanism.

11 Claims, 6 Drawing Figures



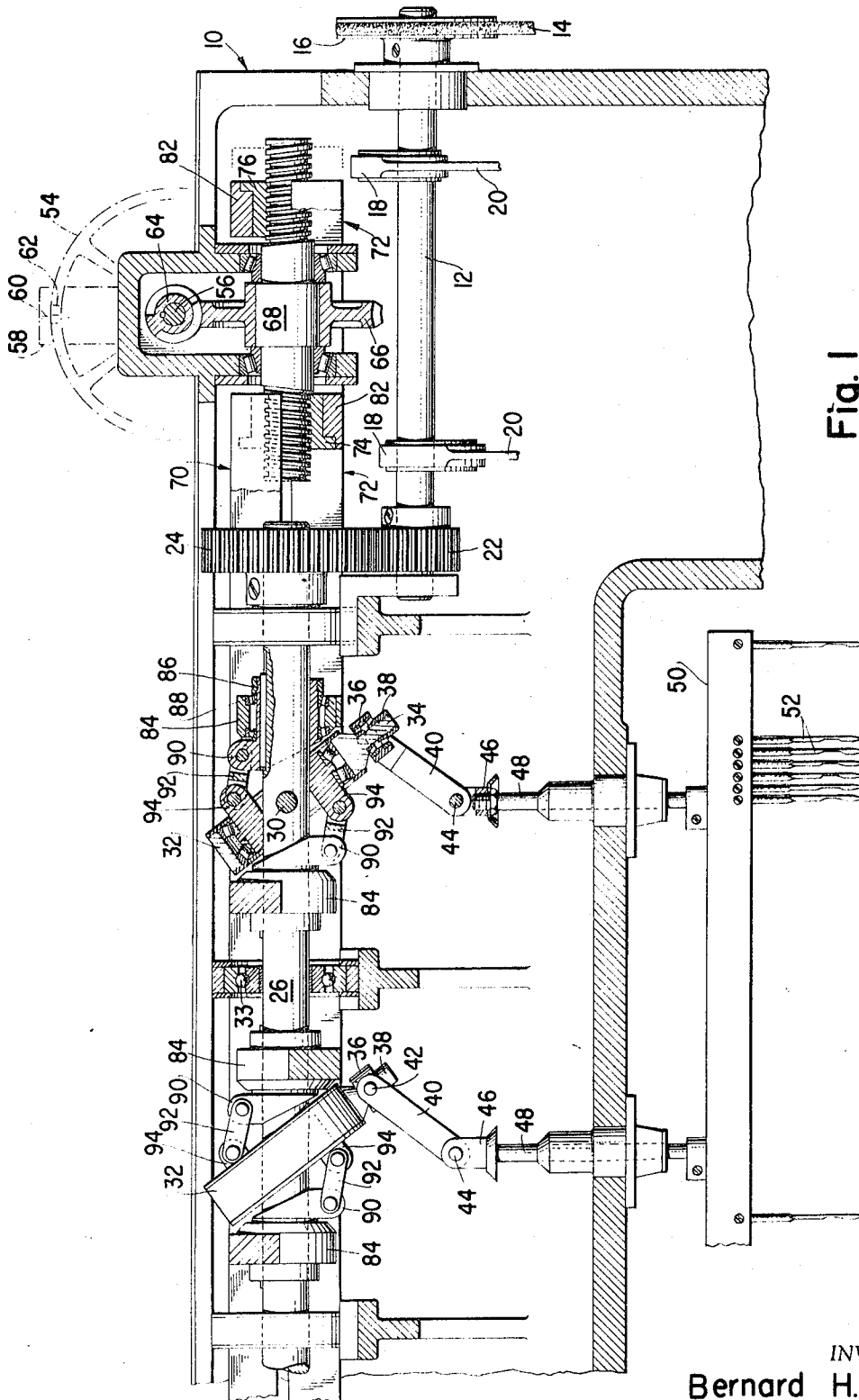


Fig. 1

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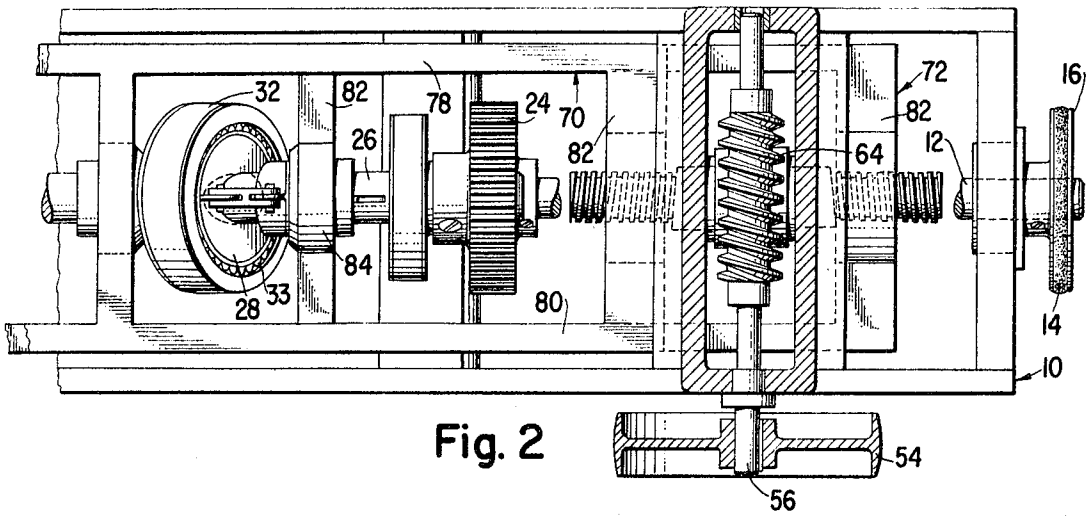
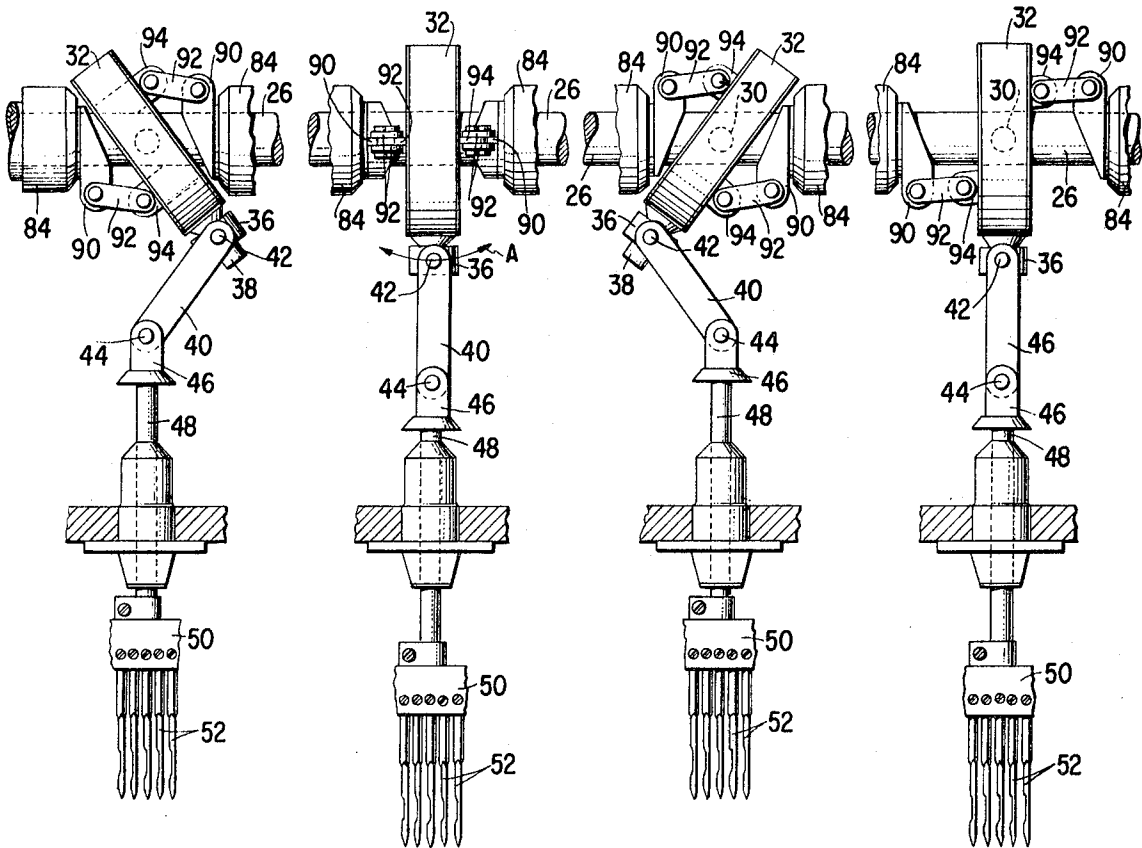
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ADJUSTABLE STROKE MECHANISM FOR TUFTING MACHINES

BACKGROUND OF THE INVENTION

It is known in the tufting machine art to provide machines which can tuft pile fabrics of different pile heights by varying or changing the length of the needle stroke of said machine. By changing the needle stroke the depth to which a loop of yarn is carried to the base fabric will be changed so that the length of the pile loop which is deposited to the base fabric may be said to depend upon the length of the needle stroke. In the prior art type mechanism commonly used in the art it is required that the machine be stopped down and access be had to the internal mechanism of the machine which initiates the needle movement and that this mechanism be manually changed for each position wherein adjustment is required. This type of adjustment is time consuming and requires a certain degree of skill by the operator initiating such a change. Mechanisms of this type are shown in U.S. Pat. No. 2,977,905 issued Apr. 4, 1961. Another disadvantage of the prior art method as illustrated by the above-identified U.S. patent, is that when the needle stroke is changed in accordance with the practice set forth therein, the bottom position of the needle stroke is changed so that the needles are no longer timed with the looper and knife mechanisms of the tufting apparatus. It, therefore, requires another adjustment of the looper and knife mechanisms to place the machine in time again with the new needle stroke. This also contributes to the extensive downtime of the machine during a change of stroke. It will be apparent hereinafter that the present invention provides an adjustable needle stroke which is infinitely adjustable between maximum and minimum positions and wherein the bottom position or lowest point of needle stroke is always the same so that there is no effect or change in the timing of the machine. The mechanism may be adjusted externally of the machine without requiring access to the interior so that there is substantially no downtime when changing the needle stroke according to the practice of the present invention.

GENERAL DESCRIPTION OF THE INVENTION

In accordance with the present invention the reciprocating needle mechanism is driven by a nutating motion device or wobble plate mechanism. Motion of the nutating motion device is initiated by a drive shaft of the machine to which a hub member of the nutating device is pivotally and drivingly connected therewith. The nutating motion device further includes an outer ring member in which the hub member rotates with said outer ring member being nonrotatable relative to the drive shaft. The outer ring member is caused to have a wobbling motion which is initiated by the hub member when said hub member is tilted at an angle relative to the axis of the drive shaft and is caused to rotate about the axis of the drive shaft. The wobbling motion of the inner hub members initiates the wobbling motion of the outer ring member which is, in turn, connected to a push rod mechanism through a linkage so that the wobbling motion of the outer ring member is converted to a reciprocating motion of the push rod member. The reciprocating motion of the push rod member is governed by the adjustment of the inner hub member according to its angular relationship relative to the axis of the drive shaft. A control mechanism is provided for changing the angular relationship of the inner hub member with the control mechanism having means for initiating changes of said angular position with said means being partially disposed on the exterior of the machine frame.

In one form on the invention, this control mechanism means takes the form of a handwheel with suitable gearing so that the adjustments may be made in response to changes in position of the handwheel externally of the machine and without requiring access to the interior mechanism of the machine. The mechanism described above is arranged such that the bottom position or lowest point of the needle stroke is always constant so that the only change in the needle stroke occurs at the top

or highest position of said needle stroke. Because of this arrangement, there is no requirement to vary the position of the looper mechanism of the tufting machine or the knife mechanism for changes in the needle stroke. Thus, a variation in the needle stroke has no effect in the timing of the machine. Further, since the change in the needle stroke is only dependent upon a variation in angle in the nutating motion device, there will be no change in the velocity of the operating parts of the mechanism so that it may be said that for all positions or degrees of needle stroke the machine may operate at a constant velocity. Also, since the drive for the needle mechanism is taken directly from the nutating motion device, there is no need for any oscillating intermediary mechanisms and the forces on the needle stroke mechanism for all positions of needle stroke will always be in one direction. Such intermediate oscillating mechanisms are normally required in the prior art type devices as illustrated in the aforementioned U.S. Pat. No. 2,977,905.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 shows a front sectional view of a portion of a tufting machine illustrating the invention with parts thereof removed for purposes of clarity of illustration;

FIG. 2 is a top view of a portion of the mechanism of FIG. 1;

FIGS. 3A, 3B and 3C are diagrammatic views illustrating the positions of the needle stroke mechanism substantially in its maximum and minimum stroke positions; and

FIG. 4 is a diagrammatic view illustrating the needle stroke mechanism when the control mechanism is in position of minimum stroke adjustment.

DETAILED DESCRIPTION OF INVENTION

Tufting machines in general, include a needle or a plurality of needles which are disposed in a machine frame for reciprocating motion. A base fabric is fed across a support means of the tufting machine beneath the needles and the needles penetrate the base fabric with loops of yarn to deposit tufts on the opposite side of the base fabric and a looper is provided for each needle for holding tufts or loops of yarn while the needle returns to its initial position whereupon the fabric is advanced and the cycle repeated. For purposes of clarity of illustration, the support means, the base fabric and the looper mechanism have not been shown in the drawings. It should be understood, however, that such mechanism is normally provided and additionally a knife mechanism can also be provided for cooperation with the looper mechanism to form cut pile, if desired.

Referring to the drawings, in FIG. 1 there is shown a portion of a machine frame 10 in which there is rotatably supported a drive shaft 12 which is driven by a suitable motor means (not shown) through a belt 14 and pulley 16. The drive shaft 12 may carry eccentric mechanisms 18 thereon which are rotatably connected with the drive shaft 12 for imparting reciprocating motion to connecting rods 20, a portion of which is shown which, in turn, may drive the looper and knife mechanisms in a known manner. A gear 22 is supported at the opposite end of drive shaft 12 for rotation therewith and meshes with a gear 24 supported for rotation on a main shaft 26. The main shaft 26 extends substantially across the entire tufting width of the machine and only a portion thereof is shown in FIG. 1.

Normally, in tufting machines used today, a plurality of eccentric mechanisms similar to that shown at 18, are carried by the main shaft 26 for imparting reciprocal motion to the needle mechanism. However, as stated briefly above, in order to vary the needle stroke, a relatively complicated adjustment mechanism must be provided when using eccentric mechanisms and the adjustment thereof is somewhat time consuming. In order to adjust such mechanisms, access must be had to the interior of the machine frame 10 and each eccentric mechanism, of which there are normally several, must be individually adjusted to change the needle stroke. In ac-

cordance with the present invention, a nutating motion mechanism is substituted for the generally used eccentric mechanism for imparting reciprocating motion to the needle mechanism and, as will be apparent hereinafter, a control means is provided for changing the needle stroke in a relatively simple manner.

Referring to FIGS. 1 and 2, a hub member 28 is provided for each nutating motion mechanism with the hub member being carried on the main shaft 26 for rotation therewith by a pivot pin 30. The hub member 28 is disposed for relative pivotal motion about the axis of pivot pin 30 which is perpendicular to the centerline of the main shaft 26. Thus, the hub member 28 will rotate with the main shaft 26 but may be pivoted about the pivot pin axis relative to said main shaft 26. An outer member, or ring member 32, is disposed in concentric relationship with the hub member 28 and a bearing 33 supported between the members 28 and 32 so that the hub member 28 may rotate within the outer ring member 32. When the inner hub member 28 is tilted at an angle relative to the centerline of the main shaft 26 as shown in FIG. 1, it will rotate about the centerline of the main shaft 26, but, since the outer ring member 32 is not rotatable, it will be caused to swing back and forth along an arc such as shown at A. Nutating motion mechanisms similar to the type thus far described are known in and of themselves such as illustrated in U.S. Pat. No. 1,118,799 issued Nov. 24, 1914.

The outer ring member 32 is provided with a projecting portion 34 thereon which projecting portion 34 carries a small annular member 36 or ring member 36 which may be held onto the projecting portion 34 as by a nut 38. A connecting link member 40 is pivotally connected to the annular member 36 as by a wrist pin or pivot pin 42 and at its other end has a pivot pin 44 for pivotal motion about a cap member 46 which is secured to the push rod 48. The push rod 48 is disposed for reciprocating motion in the machine frame 10, as illustrated, and carries at its bottom portion a needle bar 50 in which there are supported a plurality of needles 52. The link member 40 preferably is in the form of a yoke and may be connected to two sides of the projecting portion 34.

During rotation of the main shaft 26 and with it the inner hub member 28, when said hub member 28 is disposed at an angle such as that illustrated in FIG. 1, the outer ring member 32 is caused to swing through a path such as that shown by arc A in a back-and-forth or wobble motion. As the outer ring member swings back and forth through the arc A, it will cause the link member 40 to swing back and forth about its pivot pins 42 and 44 which will thus cause the push rod 48 to be raised and lowered to an extent dependent upon the length of the arc A. Therefore, the motion of the nutating motion mechanism will initiate a reciprocating motion to the needles 52 as is similar to the case when an eccentric mechanism is used. See, for example, the illustrations of FIG. 3 which will be described more completely hereinafter. As mentioned briefly above, it is desirable from time to time to change the stroke of the reciprocating needles 52. This is due to the fact that in the tufting fabric industry, in particular the tufted carpet industry, it is desirable to tuft fabrics having different pile heights, or nap lengths, to bring about different styling effects and different quality carpets. It is the purpose of the present invention to provide a tufting machine wherein the needle stroke can be changed in a minimum amount of time so that the fabric manufacturer may vary the pile height of the carpet without any substantial downtime of the machine.

In accordance with the present invention, a control mechanism is provided for changing the length of the needle stroke and may comprise a handwheel 54 supported for rotation with a shaft 56 in machine frame 10. As illustrated in FIGS. 1 and 2, the handwheel 54 is provided externally of the machine and in a position of easy access to the operator. The handwheel 54 may cooperate with an index plate 58 suitably supported on the machine which may carry an index mark 60 for cooperation with calibrations 62 on the handwheel 54. Thus, as will be apparent hereinafter, the operator may merely

adjust the handwheel by matching the desired indicia on the handwheel 54 and on the index plate 58 so as to obtain the desired needle stroke. The shaft 56 carries a worm gear 64 thereon which meshes with another gear 66 supported at right angles thereto on a shaft 68 so that by turning the handwheel 54 the shaft 68 will be rotated about its axis. The shaft 68 is threaded at each end thereof but with the threads at each end being opposite to each other or, in other words, one end has a left-hand thread and the other end has a right-hand thread.

Suitably supported substantially across the entire width of the machine, is a pair of ladderlike members 70 and 72 (see FIG. 2). As further illustrated in FIGS. 1 and 2, the ladderlike member 70 is supported above the centerline of the shaft 26 and the ladderlike member 72 is supported below the centerline of the main shaft 26. The members 70 and 72 each carry at their ends adjacent to the shaft 68 a threaded insert member 74 and 76, respectively. The threaded insert members 74 and 76 are disposed on the associated ends of the shaft 68 as illustrated in FIGS. 1 and 2, so that as the shaft rotates the threaded portions thereof will cause members 70 and 72 to move in opposite directions on said shaft 68 due to the opposite threading thereof. Each ladderlike member 70 and 72 includes a pair of elongated frame members 78 and 80 which are joined by spaced cross members 82, there being one such cross member 82 for each member 70 and 72 at each nutating motion mechanism station and also at each end thereof. The cross members 82 at each nutating motion mechanism station have supported thereon an outer member 84 which is disposed therein for motion with the ladderlike members 70 and 72. An inner annular member 86 is supported for rotation within the annular member 84 by a suitable bearing 88 as illustrated and the inner annular member 86 is further splined or otherwise supported on the shaft 26 for rotation therewith. Thus, the inner annular member 86 may rotate within the outer member 84 and may be moved in a direction parallel to the centerline of main shaft 26 during adjustment of the handwheel 54 and movement of the ladderlike members 70 and 72 and carry with it the outer member 84.

As further illustrated in FIG. 1, the inner annular member carries a projecting portion 90 to which there is pivotally connected a link 92 which is, in turn, pivotally connected to a projecting portion 94 on the hub member 28. As stated above, each member 70 and 72 has an inner annular member and related mechanism disposed at each nutating motion station. Therefore, since during adjustment of the handwheel 54, the ladderlike members 70 and 72 move in opposite directions, as explained above, the adjustment mechanisms or annular members 86 and 84 at each nutating motion station will move in opposite directions. It will, therefore, be apparent that, as the adjustment mechanisms move in opposite directions, the hub member 28 and outer ring member 32, will be tilted by the pushing or pulling of the link members 92 which connect the nutating motion mechanism to the opposite moving adjustment mechanisms.

Referring to FIG. 3, there is shown one complete cycle for one adjustment of the needle drive mechanism. In FIG. 3A, the outer ring member 32 is substantially at one extreme end of its arc for the particular adjustment of the adjustment mechanisms. It will be apparent from FIG. 3A that the needles 52 are at the top of their stroke when the outer ring member 32 is in the position illustrated. In FIG. 3B it will be seen that half-way through the stroke or motion of outer ring member 32, the link member 40 is in line with the pushrod 48 and the needles 52 will be at the bottom of their stroke during this position. In FIGS. 3C the outer ring member 32 has moved through its full arc and is at the other end of its motion and the needles 52 will again be at their uppermost position of their stroke. By adjustment of the handwheel 54, the adjustment mechanisms 84 illustrated in FIG. 3A will be moved in opposite directions. In order to reduce the needle stroke, the control wheel 54 would be turned to move the adjustment mechanisms in opposite directions or away from each other whereupon the angle of tilt of the outer ring member 32 rela-

tive to the centerline of the main shaft 26 would become less thus reducing the length of the arc A and consequently lowering the uppermost limit of the needle stroke. It will be apparent that for any adjustable position of the outer ring member or change in angle relative to the main shaft 26, the bottom of the needle stroke will always be a constant since, for any such position, the mechanism will always align itself in a position such as shown in FIG. 3B wherein the link 40 will be in line with the push rod 48 coincident with the bottom of arc A. Thus, the bottom of the needle stroke is never changed and, therefore, there is no need for a retiming of the other tufting mechanisms such as the loopers and knives which is a requirement in adjustable stroke mechanisms of the prior art machines.

As shown in FIG. 4, an adjustment may be made where there is no tilt of the outer ring member relative to the centerline of the main shaft 26. Or, stated in another manner, the outer ring member may be considered as perpendicular to the centerline of the main shaft 26. In reference to tilt as used herein, it is meant a tilt from the position illustrated in FIG. 4 relative to the main shaft centerline. When the adjustment is made to a position such as that shown in FIG. 4, there will be no wobble or swinging through an arc of the nutating motion mechanism so that there will be no reciprocating motion of the needles 52. The mechanism may be adjusted to the position in FIG. 4 while the machine is in operation so that any other adjustments which are required, such as raising and lowering the bedplate of the machine, can be accomplished while the machine is running. Further, any changes in needle stroke through the mechanism of the invention may be accomplished while the machine is in operation, if desired.

As stated above, the present invention provides a relatively simple mechanism for changing the needle stroke in a tufting machine. The mechanism of the invention permits changes in the needle stroke of the machine without any substantial downtime or without requiring any changing in the timing of the related tufting components of the machine since the bottom of the needle stroke will always be the same. Also, an infinite amount of adjustments can be made between the minimum and maximum adjustment positions of the mechanism of the invention and, since the forces always operate in the same direction for any adjusted position, there is no need for any oscillating shaft mechanisms such as commonly required in other adjustable needle stroke mechanisms known in the art. It will also be apparent that other means may be substituted for the handwheel mechanism illustrated for making adjustments and that such other means are considered within the scope of the invention as set forth herein. During changes in the needle stroke according to the invention, it may be necessary to raise or lower the bedplate or support means for the fabric. When this is necessary, a mechanism for accomplishing this purpose such as shown in the aforementioned U.S. Pat. No. 2,977,905 may be employed.

The invention also has application in stitch placement mechanisms such as the so-called sliding needle plate mechanism illustrated by U.S. Pat. No. 3,301,205 issued on Jan. 31, 1967 or the so-called gliding needle bar mechanism illustrated by U.S. Pat. No. 3,026,830 issued Mar. 27, 1962. Each of these known mechanisms utilizes a rotary, fixed surface cam for converting rotary shaft motion into reciprocating motion of a needle plate and needle bar, respectively. From the above description of the invention and its advantages, it will be seen the apparatus of the invention could be utilized to provide a novel, adjustable, and more reliable operating sliding needle plate or sliding needle bar mechanism. Such mechanisms are intended to be within the scope of the present invention.

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

1. An adjustable stroke mechanism a needle mechanism in combination with including needle means, a rotatable shaft for imparting motion to said needle means, nutating motion means operably connected to said shaft and to said needle

means for converting rotary motion of said shaft into reciprocating motion for said needle means, and control means operably connected to said nutating motion means for controlling the operable relationship between said nutating motion means and said shaft such that for changes in said operable relationship initiated by said control means the stroke of said reciprocating needle means will be changed.

2. An adjustable stroke mechanism as recited in claim 1 wherein said nutating motion means includes a first member supported on said rotatable shaft for rotation therewith, a second member surrounding said first member with said second member being nonrotatable relative to said first member and said first and second members being tiltable relative to the axis of rotation of said rotatable shaft.

3. An adjustable stroke mechanism as recited in claim 3 wherein said control means is connected to said nutating motion means for initiating tilting movement of said nutating motion means such that during at least some positions of tilt of said nutating motion means reciprocating movement of said needle means will be initiated.

4. An adjustable stroke mechanism as recited in claim 3 wherein the length of the reciprocating stroke of said needle means is controlled by the tilting of said nutating motion means by said control means.

5. An adjustable stroke mechanism as recited in claim 4 wherein during all positions of adjustment of tilt of said nutating motion means the bottom of the stroke of said reciprocating needle means is always constant.

6. An adjustable stroke mechanism as recited in claim 3 wherein said control means is connected to said first member and said second member is operably connected to said needle means.

7. An adjustable stroke mechanism as recited in claim 4 wherein at least during some positions of tilt of said nutating motion means a motion will be induced for said first and second members.

8. An adjustable stroke mechanism as recited in claim 5 further comprising a link means pivotally connected to said second member and a push rod of said needle means for converting the motion of said nutating motion means into reciprocating motion of said needle means.

9. An adjustable stroke mechanism as recited in claim 6 wherein said control means includes an adjustment means, said adjustment means having oppositely moveable members connected to opposite sides of said first member such that movement of said adjustment means will initiate tilting of said first member.

10. In a tufting machine, needle means for penetrating a base material, reciprocating means being free of eccentric means for reciprocating said needle means in endwise movement, said reciprocating means including a rotatable drive shaft, a first annular member supported on said shaft for rotation therewith, a second annular member surrounding said first annular member and supported thereon in relative non-rotatable relationship therewith, said second annular member being connected to said needle means for imparting reciprocating motion to said needle means, and control means for initiating tilting movement of said first and second annular members relative to the axis of said rotatable drive shaft with the length of the stroke of said reciprocating needle means being determined in accordance with the degree of tilt of said first and second annular members.

11. A stroke adjustment mechanism for a tufting machine including a rotatable drive shaft means, a first member connected to said drive shaft for rotation therewith and for pivotal motion relative to said drive shaft, a second member disposed for pivotal motion with said first member and in nonrotatable relationship therewith, means connected to said first member for pivoting said first and second members relative to said drive shaft such that during rotation of said drive shaft and said first member said second member is caused to have a wobblelike motion, said tufting machine including a reciprocable mechanism and said reciprocable mechanism of

said tufting machine being operably connected to said second member for converting the wobblelike motion of said second member into reciprocating motion of said reciprocable mechanism.

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