HIGH SPEED BLINDSTITCH SEWING MACHINE

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References Cited
UNITED STATES PATENTS
2,109,014 2/1938 Mueller 112/212
2,833,234 5/1958 Parry 112/178
3,288,094 11/1966 Roth et al. 112/178

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ABSTRACT
Vibration and noise reducing features are provided in a blindstitch sewing machine and its supporting means, thereby enabling the machine to perform proper stitching at much higher speeds. Includes reduction in size and weight of connection from a rotary drive shaft to a node former for oscillating the latter. Use of toothed pulleys and belt connections from a main drive shaft to two rotary members on stationary or non-rotary shafts, which members serve to operate various devices within the machine to enable it to produce a continuous series of regular, non-skip stitches of seams involving both skip stitches and non-skip stitches, by appropriate adjustment of certain parts. Also involves the provision of special means for mounting the sewing machine on a supporting table and securing the machine thereto. Means are included in the machine structure for firmly retaining both ends of an eccentric shaft which serves to support and control the movement of a looper during stitch forming operations. This has also required changes in the form of the feed bar employed.

8 Claims, 9 Drawing Figures
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HIGH SPEED BLINDSTITCH SEWING MACHINE

This invention relates to improvements in blindstitch sewing machines which enable the latter to be operated at higher speeds than has been possible heretofore, without creating undesirable vibration and noise and without causing improper stitch formation.

Blindstitch sewing machines, heretofore constructed, have required the use of relatively heavy parts that are subjected to reciprocation or oscillation, or both, so that when the machine is attempted to be operated above 3,000 rpm objectionable vibrations are created.

The present invention has made possible the construction of a blindstitch machine having a number of desirable features which combine to enable the machine to be operated at 4,000 rpm, or even higher, without the development of objectionable vibrations.

An important feature of the invention, which contributes greatly toward the foregoing end, is the substantial reduction in size and weight of a reciprocating and oscillatory pitman for oscillating a needle former which makes possible the production of blindstitches. This feature of the invention has a number of primary aspects. One is the shortening of the pitman by providing an intermediate stationary shaft between the main drive shaft and the oscillatory shaft which carries the needle former, said intermediate shaft carrying a rotary member having an eccentric portion which operates the needle pitman. Another aspect is the provision of a non-metallic toothed belt which transfers the toothed pulleys on the main drive shaft and the intermediate shaft. A still further aspect is the special construction of the pitman which considerably lightens its weight. This involves the formation of the pitman of a number of different parts, including relatively thin steel side members that are spaced apart and have a few steel elements at spaced intervals serving to rigidify the structure, and bedding elements at the two ends of the pitman, all of the parts being welded together to form a rigid unit.

Another feature of the invention which contributes toward the desired end is the provision of a second toothed belt and pulley arrangement for driving a shaft which enables the production of skip stitches or non-skip stitches, as desired. One of the toothed pulleys may be two or three times the diameter of that on the main drive shaft, depending on whether it is desired to have alternate non-skip and skip stitches or two skip stitches following each non-skip stitch, when the machine is adjusted to produce skip stitches. The provision of the two belt connections above referred to, in the provision of an intermediate shaft in the connections from the main drive shaft for operating the needle former, bring about a great reduction in the mass of the parts being driven whenever the machine is in operation, and particularly the mass of parts that are reciprocated or oscillated.

A further important feature of the invention is the provision of a vibration absorbing or minimizing means in the mounting of the main frame of the machine on a supporting table. This involves the provision of special means for securing the machine to a table top, such means interposing a slightly yieldable material between the machine frame and the table top, and eliminating from said securing means any metallic means that is in contact at any point with either said frame or said table top. In the preferred embodiment this is achieved by providing hard rubber elements around certain metal bolts which hold the machine frame firmly secured to the table top, and also interposing rubber or the like between all parts of each bolt, as well as the attached nut, and the adjacent portions of the frame and table top.

Still another feature which makes possible the high speed operation of the machine is the provision of an eccentric supporting shaft for the looper mechanism which is retained at both of its ends by the frame of the machine. Heretofore, the eccentric supporting shaft has been retained at only one end, and this has resulted in malfunctioning even at conventional speeds after a period of time. To enable such support of both ends of the eccentric looper, the feed bar has been modified to avoid engagement with said shaft in the course of reciprocation and rocking of said bar.

Other features and advantages of the invention will appear from the following detailed description of a preferred embodiment of the same shown in the accompanying drawings, of which:

FIG. 1 is a view, partly in vertical section and partly in elevation, of a machine embodying the invention, the section being taken along a plane parallel with the axis of the main drive shaft of the machine;

FIG. 2 is a view, partly in vertical section and partly in elevation, the vertical section being taken in a plane perpendicular to the axis of the main drive shaft in the region of the vertical standard of the frame;

FIG. 3 is a view, partly in elevation and partly in vertical section through the forwardly extending arm of the frame of the machine and through a portion of the base and the work supporting member;

FIG. 4 is a view, partly in plan and partly in horizontal section through the frame of the machine, with certain parts broken away to illustrate other parts more clearly;

FIG. 5 is a top view of a pitman provided in the connections for the rocking of the node former;

FIG. 6 is a side view of the pitman shown in FIG. 5;

FIG. 7 is an end view of the pitman, as seen from the right in FIG. 6;

FIG. 8 is a detail view in section through a portion of the forwardly extending arm of the frame, and shows the feed bar and operating means therefor; and

FIG. 9 is an enlarged detail view, in section, through a portion of the base of the frame of the machine and the adjacent portion of the supporting table board.

The invention illustrated in the accompanying drawings is shown as embodied in a machine of the general character of that illustrated in the Roth et al. U.S. Patent No. 3,288,094, granted Nov. 29, 1966. That patent discloses the general mode of operation of a blindstitch machine adapted to selectively produce either alternate skip and non-skip stitches or all non-skip stitches. Numerous changes have been made in the construction of the machine illustrated in the Roth et al. patent to achieve the purposes of the present invention, namely to substantially reduce the vibrations imparted to the frame and other parts of the machine and the supporting table, when the machine is operated at high speeds. As indicated above, the combination of features embodied in the machine in accordance with the present invention has made it possible to operate the machine at a speed of 4,000 rpm, or higher, without the production of objectionable vibrations and noise.

Turning now to the drawings, the frame of the machine is provided with a base portion 10, a vertical standard 11 rising upwardly from the rear portion of the base, a horizontally extending overhanging arm 12 projecting from the upper end of the vertical standard and having at its free end a head portion 13 from which there extends forwardly and slightly downwardly an arm 14.

A main drive shaft 15 is journaled in the over-hanging arm 12 and extends longitudinally thereof into and through the vertical standard. At its right end, FIG. 1, the shaft 15 extends outwardly from the vertical standard and carries a combination handwheel and pulley 16 by which it may be turned manually or driven by a belt from a suitably located transmitter. Within the head 13 at the end of the overhanging arm 12, and extending forwardly from said head within the arm 14 are various operating connections for driving the stitch forming devices which include a curved needle 17 and a reciprocating and oscillatory looper 17a. The means for driving these stitch forming devices are of a well-known character and are similar to the means disclosed in the above-mentioned Roth et al. patent. As shown in FIG. 3, this mechanism includes a shaft 17b extending longitudinally of the arm 14 and having its left end connected for oscillation by crank means (not shown) secured to the shaft 17a. Also, the looper 17a is driven by suitable connections from the main drive shaft 15. This is done through a member 17c, which is secured to the main drive shaft and which carries an eccentrically disposed and inclined shaft element 17f. The connections from the latter, as shown in FIG. 3.
include a reciprocatory and oscillatory rod 17c. The latter has secured thereto a spherical bearing element 17d which is jour-
nelled for rotation and rocking movements within a spherical
bearing at the lower end of an arm 17g which is rockable
about a supporting shaft 18. The shaft 18, as best shown in
FIG. 4, has an enlarged portion 18a mounted for turning
within the arm 17g and the forwardly and downwardly extending
arm 14 of the frame of the machine. This enlarged portion of
the shaft has a slot 18b extending across the end thereof,
which is adapted to receive a screw driver for turning the shaft
through a suitable angle. When it has been adjusted to the
desired position it is retained against turning by a set-screw
18e (FIG. 1). The opposite end of the shaft 18 is of reduced
diameter and is journaled in a bushing 18d carried by the op-
posite wall of the downwardly extending arm of the frame.
This bushing is preferably retained in a fixed position by
another set-screw 18e. Intermediate the ends of the shaft 18,
the latter is provided with an eccentric portion 18f which is
the part of the shaft upon which the arm 17g is rockably
mounted. The arrangement is such that the position of the axis
of the eccentric portion 18f, and therefore the axis about
which the arm 17g is rockied, may be adjusted to pro-
terrible relation to the work, in accordance with the
thickness of the latter, to bring about the proper
formation. Arm 17g is held against any substantial
movement axially by a flange 18h adjacent to the end of eccentric
portion 18f and by the bushing 18d at the left end.
Secured to the main drive shaft 15 is a toothed pulley 19
which serves to drive a toothed belt 20 (FIGS. 1 and 2). This
belt in turn cooperates with a toothed pulley 21 mounted for
rotation on a fixed shaft 21a. As shown in FIG. 2, the diameter
of the toothed pulley 21 is twice that of pulley 19, so that the
pulley 21 will be given only one revolution for each two
revolutions of the shaft 15. As will be explained, this makes
possible the production of alternate skip stitches and non-skip
stitches when desired. In some instances, it may be desired to
have two skip stitches for each non-skip stitch. For that
purpose the pulley 21 should have three times the diameter of
pulley 19 so that one revolution of pulley 21 would require
three revolutions of the shaft 15.

The machine is provided with a work supporting member 22
which may be of conventional construction, such as that
shown in the above-mentioned Roth et al. patent. It is mounted
for rocking movement about a shaft 23, suitably journaled in
the structure extending portions 19a of the base of the frame
of the machine. As best shown in FIG. 4, the shaft 23 is held in
a stationary position by set-screws 23a. At its left end the shaft
has a tapered portion 23b arranged to cooperate with a bush-
ing 22a carried by the rockable work support 22, and at its op-
posite end the shaft has a conical opening which cooperates
with the conical end of a screw stud 22b carried by the rocka-
ble work support. This screw stud is adapted to be adjusted
into proper position for the desired rockable movement of the
work support, and it may be retracted to enable assembly and
disassembly of the work support in relation to the frame of the
machine. A set-screw 22c serves to insure retention of the
screw stud 22b in its adjusted position.

A rockable shaft 24c is carried by the work support member
22, this shaft serving to carry a node former 25, (FIG. 3)
which may suitably be of the dual type disclosed in the Roth
et al. patent. This enables the selection of one or the other of
the two node forming portions to deal with work having either a
hard finish or a soft finish. As will be understood, the selection
of one or the other of the node forming portions to be used
is determined by proper manipulation of an actuating element
24a which is secured by screws (not shown) to the shaft 24. Upon
loosening a screw 24c in a link 24b, indexing element 24a,
shaft 24 and node former 25 can be manually turned 180° in
order to present the other node forming portion. Screw 24c is
then again tightened. Shaft 24, as shown in FIGS. 2 and 4,
thereafter carries the link 24b thereto and therewith movements
are imparted to the shaft 24 and node former 25. For this
purpose, a pitman 26, to be described in detail
hereinafter, has one end connected to said link 24b while its
opposite end 26d surrounds an eccentric 27a mounted for
rotation about a fixed shaft 28. Connected with the eccentric
27a is a toothed pulley 27 (FIGS. 1 and 4) which is connected
by a toothed belt 29 with a toothed pulley 30 secured to the
drive shaft 15. This arrangement is such that for each revolu-
tion of the eccentric pulley 27, the corresponding eccentric
27a will be given one revolution about the shaft 28.

Returning to the pulley 21 mounted on shaft 21a there is,
therefore, with that pulley a member having a concentric
disc-like portion 21b and a partially eccentric disc-like portion
21c. These may be formed integrally or may be separate discs
connected together. They are spaced slightly from the pulley
21 by means of a reduced diameter cylinder 21d. A plurality
of screws 21e serve to retain the pulley 21 and the discs or cylin-
ders 21b, 21c and 21d in assembled relation. Accordingly,
whenever the machine is in operation the entire assembly
referred to will be rotated about the axis of the shaft 21a.
To retain the assembly against movements in an axial direction
along the shaft, the latter has secured thereto a pair of collars
21f. These provide just the amount of clearance required to
respect the ends of the assembled unit to permit the latter to
be driven without excessive friction.

Means controlled by either the eccentric or the concentric
disc-like portions of the unit described above serve to deter-
mine whether a skip stitch or a non-skip stitch will be produced
during the cycle of operation. For this purpose, there is provided a stationary shaft 31 in the base of the
frame of the machine. Rockably mounted on this shaft is a
lever 32 which is held in proper position axially of the shaft by
means of collars 31a. The upper end of the lever 32, at the
right side thereof as shown in FIG. 2, has a hardened flat sur-
face 32a. This may be integral with the lever 32 or provided
by a separate plate or the like applied to the latter. It is very
wear resistant.

Cooperating with the lever 32 is a swingable member 33
which is pivotally connected with a pin 33a carried by a
member 33b. The latter has a screw threaded extension which
cooperates with an internally screw threaded sleeve 34b hav-
ing a reduced diameter extension 34a. To the latter there is
secured a knob 34. This may be formed of any suitable materi-
AL, and carries within its head portion a sleeve 34c. The knob
and this sleeve are secured to the extension 34a by a set-screw
34d. Turning of the knob through a suitable angle, which may
involve several revolutions if desired, will serve to shift the
axis of the pin 33a laterally and toward the right or
upwardly and toward the left (FIG. 2), depending upon the
direction of rotation of the knob. The purpose of this, as is
well understood in the art, is to adjust the machine to deal with
work pieces of different thicknesses. This is accomplished by
rocking the work supporting member 22 about the axis of the
shaft 23. Briefly, such adjustment is achieved by the coopera-
tion of a disc 33d rotatably mounted on the member 33 and
adapted to cooperate with either the concentric or the eccen-
tric disc-like portions 21b and 21c, respectively, of the unit
above described. Regardless of which of these disc-like portions
is engaged by the disc 33d, the rocking of the member 33 in
a clockwise direction by the turning of the knob 34 will cause
the lower portion of the member 33, which engages the
upper end of the lever 32, to rock the latter in a counter-
clockwise direction. Such movement of lever 32 will cause an
outwardly curved portion 32b thereon, which engages the
end of a rod 35 (FIGS. 1, 2 and 4), to move said rod toward
the left (FIG. 2), thereby rocking the work support member in
a clockwise direction. An eccentric 35a is disposed between a portion 10b of the frame of the machine
and a collar 35a secured to the rod, to hold the end of the rod
in engagement with the projection 32b of lever 32. In turn, this
serves to determine the position of the work support member
22. For this purpose, the latter carries an adjustable screw
36, the inner end of which engages the adjacent end of the rod 35,
as shown in FIG. 2. The screw 36 is adjustable to exercise
some control over the normal position of the work support.
member 22, and a nut 36a serves to retain the screw 36 in its adjusted position. A spring 37 (FIGS. 1 and 3) has one end connected to a rod 37a which is in turn pivotally connected with the eccentric disc-like portion 31c of the unit above described. The opposite end of spring 37 is connected with a block 37c which is adjustable to vary the tension applied to the spring. This is accomplished by providing the block 37c with a screw threaded stem which cooperates with internal threads on a member 37d having a hexagonally shaped head 37e so that it may be readily turned in one direction or the other by a wrench.

Manually operable means are provided for determining whether the machine is to produce skip stitches along with periodic non-skip stitches. This control is effected by a knob 38 secured to a stem 38a (FIG. 2) of a forked member 38b having its ends straddling the disc 33d. The knob 38 may be shifted horizontally to shift the disc 33d into alignment with the eccentric disc-like portion 31c of the unit above described, to produce skip stitches. However, for only non-skip stitches to be produced, the knob 38 is shifted to carry the disc 33d into cooperation with the concentric disc-like portion 21b. Stem 38c passes through a suitable slot in a plate 39 secured to the frame of the machine, and this plate may be provided with indications as to the type of stitches for which the machine has been set.

The machine is provided with more-or-less conventional work feeding mechanism, but it has been found necessary to modify this to a certain extent in order to enable the eccentric shaft 18 to extend completely across the forwardly and downwardly extending arm 14 of the frame, so as to be supported at both of its ends by the frame. Thus, referring to FIG. 8, the drive shaft 15 has mounted thereon an adjustable eccentric 40 having two components which may be adjusted in relation to each other to vary the extent of eccentricity, and thus vary the feed stroke to be imparted to the work. A feed bar 41 has been adapted to cooperate with the eccentric to bring about the selected feed stroke to be imparted to the feed dog 41b. In a manner similar to that disclosed in the patent to Mueller U.S. Pat. No. 2,109,014, granted Feb. 22, 1938, the feed bar is connected with a link 42 in the region between the eccentric 40 and the feed dog 41b. This brings about rocking and longitudinal movements of the feed dog carrying member upon rotation of the eccentric 40. In this connection, it will be noted from FIG. 8 that the feed bar 41 has been given a special form to avoid interference with the eccentric shaft 18. In prior constructions, the looper supporting shaft, such as the eccentric shaft 18 of the present invention, has been supported by only the wall of the forwardly and downwardly extending arm of the frame, and has permitted the same to move in a plane outwardly of the free end of such support element.

All of the foregoing features of the sewing machine constructed in accordance with the present invention serve to contribute toward greatly reducing the vibration and noise developed in the course of operation of the machine at the desired high speed of 4,000 rpm, or higher, and further reduce or absorb the vibrations that may be imparted to the machine frame, and to prevent its transmission to the supporting table on which the machine is mounted, the present invention involves a novel type of attachment means for securing the sewing machine frame to a table top. This is illustrated in FIG. 9. It will be understood that this figure simply discloses one of the novel attachment units, and that a plurality of these will be employed in securing the frame of the machine to a table top.

Referring to FIG. 9, a portion of the base 10 of the frame of the machine is shown, this having a horizontally extending portion 10a or the like that is provided with an opening through which the attaching device may be passed. Similarly, the table board 45 of a suitable supporting structure for the machine is provided with an opening into which the securing means may be snugly fitted. Another flange 10c (FIG. 4) extending horizontally from the forward edge of the base 10 of the machine frame is provided with openings 10d adapted to receive similar securing means.

The securing means comprises a metal bolt 46 having a screw threaded portion at its lower end adapted to receive a nut 47. Surrounding a major portion of the length of the bolt is a vibration isolating member formed of synthetic rubber or the like. This member has a tubular portion 48a having an opening therethrough which is also adapted to snugly receive the shank of the bolt. The outer surface of tubular portion 48a is adapted to snugly fit within the opening passing through the table board 45. It terminates slightly above the lower end of the opening through the table board. Integral with the tubular portion 48a is a collar portion 48b extending radially outwardly from the tubular portion and adapted to rest on the upper surface of the table board 45. This collar, of course, has an opening therethrough which is also adapted to snugly receive the shank of the bolt 46. Above the collar is a further smaller diameter tubular portion 48c which is adapted to snugly fit into the opening provided through the horizontally extending portion of the base 10 of the frame of the machine. This portion of the frame rests upon the upper surface of the collar 48b, and the tubular extension 48c terminates slightly below the top surface of the horizontally extending portion 10e of the machine frame. Resting upon the top of the flange 10e is a separate collar 49 formed of a vibration absorbing material such as rubber, this collar surrounding and snugly receiving the upper portion of the shank of the bolt. Between the collar 49 and the head of the bolt 46 there is provided a metal washer 50. Similarly, at the lower end of the bolt a vibration absorbing collar 51 is snugly applied to the shank of the bolt and arranged to cooperate with the bottom surface of the table board 45. Below this collar is a metal washer 52 which cooperates with the nut 47.

In the securement of the sewing machine to the table top by a plurality of the bolt structures described above, the nut 47 of each such structure will be tightened against the steel washer 52 to a certain extent but not so firmly as to prevent the turning of the rubber collars 49 and 51 by hand. A conventional felt 53 may be provided on the top of the table board 45 and beneath the frame of the sewing machine. It has been found that the employment of attachment means of the character shown and described will serve to reduce to a minimum any tendency of vibrations that may be imparted to the frame of the sewing machine in the course of its high speed operation to be transmitted to the table top and its supporting structure.

While a preferred embodiment of the invention has been shown and described in considerable detail, it will be understood that various changes may be made in certain of the parts and in the overall combination, within the scope of the appended claims.

What is claimed is:

1. A blindstitch sewing machine adapted for high speed operation which comprises a frame having a base, a vertically extending standard, a laterally extending arm at the upper end of said standard, and a forwardly extending arm adjacent the end of said laterally extending arm, said base having an upwardly extending portion in a region beneath the end of said forwardly extending arm, a work support pivotally mounted on said portion to be rockable thereabout, a main drive shaft journalned in said laterally extending arm, an oscillatable node former carrying shaft journaled in said rockable work support, and connections from said main drive shaft to said node former carrying shaft which includes an intermediate shaft mounted in the base of said frame beneath said drive shaft, a toothed pulley secured to said drive shaft, a toothed pulley mounted on said intermediate shaft, a toothed belt interconnecting said pulleys for rotation in unison, an eccentric connected with said pulley on said intermediate shaft, and a pitman having one end surrounding said eccentric in the other end arranged to impart rocking movements to said node former carrying shaft.

2. In a blindstitch sewing machine as set forth in claim 1, a second toothed pulley secured to said drive shaft, a further drive shaft mounted in said vertical standard in a region between said drive shaft and said intermediate shaft, a toothed pulley mounted on said further shaft, said pulley having a diameter...
which is a plurality of times that of the second toothed pulley secured to said drive shaft, a toothed belt interconnecting said two last-mentioned pulleys, means having a disc-like concentric portion and a disc-like eccentric portion connected with said toothed pulley mounted on said further shaft, a pin mounted within said standard and a member pivotally mounted about said pin so as to be swingable thereabout within said standard, a disc carried by said swingable member and arranged for cooperation with one or the other of said disc-like portions of said means, manually operable means for selectively shifting said disc into cooperation with the desired disc-like portion, and means cooperating with said swingable member for rocking said work support when said disc cooperates with a part of said eccentric disc-like portion.

3. In a blindstitch sewing machine as set forth in claim 1, said pitman comprising two spaced parallel side members formed of relatively thin flexible steel, rigidifying means disposed between and connected with said side members at spaced points, and means rigidly connected with the ends of said side members, the means at one end being adapted to cooperate with said eccentric, and the means at the other end of said side members being connected with means adapted to impart rocking movements to said node former.

4. In a blindstitch sewing machine as set forth in claim 3, all of said means disposed between and connected with the ends of said side members being welded to the latter.

5. In a blindstitch sewing machine as set forth in claim 1, stitch forming means including an oscillatable needle and a reciprocatory and oscillatable looper, an oscillatable member connected with said looper for supporting the same, a shaft having an eccentric portion on which said oscillatable member is rotatably mounted, means carried by the frame of the machine for supporting and firmly retaining both ends of said shaft, said shaft being rotatably mounted in said means, for adjusting the position of said eccentric portion and means for retaining the shaft in a set position in said supporting and retaining means.

6. In a blindstitch sewing machine stitch forming means including an oscillatable needle and a reciprocatory and oscillatable looper, an oscillatable member connected with said looper for supporting the same, a shaft having an eccentric portion on which said oscillatable member is rotatably mounted, means carried by the frame of the machine for supporting and firmly retaining both ends of said shaft, said shaft being rotatably mounted in said means, for adjusting the position of said eccentric portion and means for retaining the shaft in a set position in said supporting and retaining means.

7. In a blindstitch sewing machine as set forth in claim 6, said shaft having a recess in one end adapted to receive a tool for turning the shaft, and said means for retaining the shaft in a set position includes means for holding said shaft against rotation.

8. In a blindstitch sewing machine as set forth in claim 7, a bushing carried by the frame of the machine into which the opposite end of said shaft extends.