United States Patent

Hirayama

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[54] LOOPER DRIVE MECHANISM

[72] Inventor: **Tetsuro Hirayama**, Tokyo, Japan

[73] Assignee: **Tokyo Juki Kogyo Kabushiki Kaisha**, Tokyo, Japan

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[52] **U.S. Cl.**.....**112/199**

[51] **Int. Cl.**.....**D05b 1/06**

[58] **Field of Search**.....112/199, 197, 198, 200

[56] **References Cited**

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Primary Examiner—H. Hampton Hunter

Attorney—Wenderoth, Lind & Ponack

[57] **ABSTRACT**

A looper drive mechanism comprises a driving shaft or crank shaft, a connecting rod connected to the crank shaft, an arm coupled to the connecting rod, a looper shaft connected to the arm and supported by a support member mounted to the sewing machine, and a looper provided to the looper shaft.

3 Claims, 6 Drawing Figures

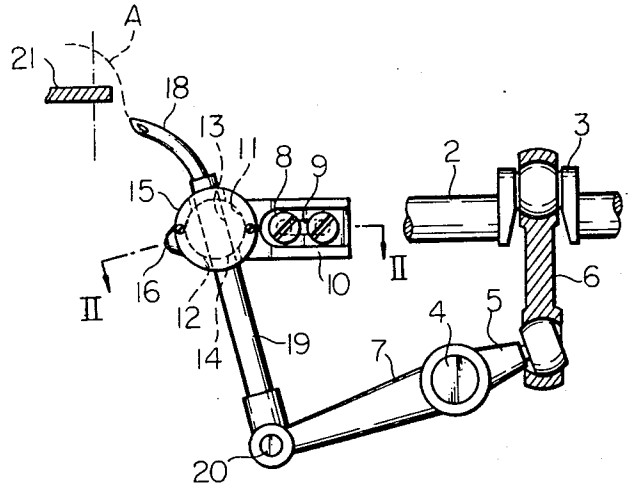


Fig. 1

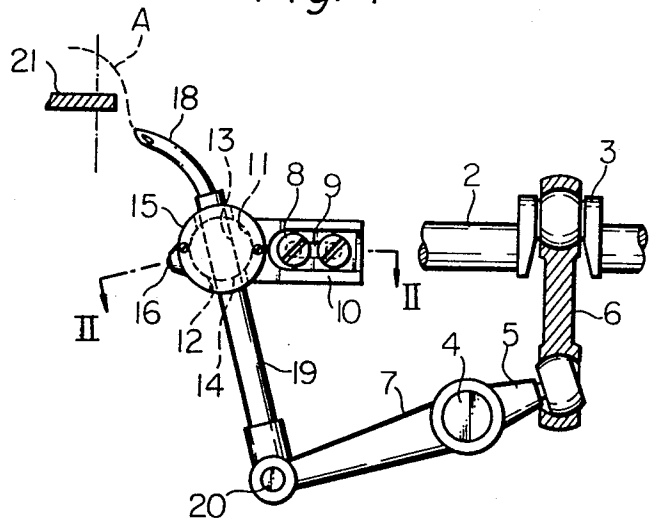


Fig. 2

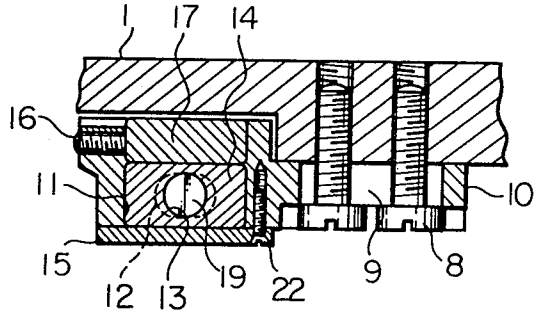
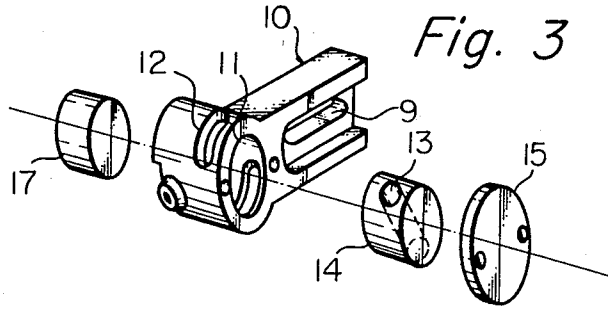


Fig. 3



TETSURO HIRAYAMA,
INVENTOR

BY Wenderoth, Lind
and Ponack ATTORNEYS

Fig. 4

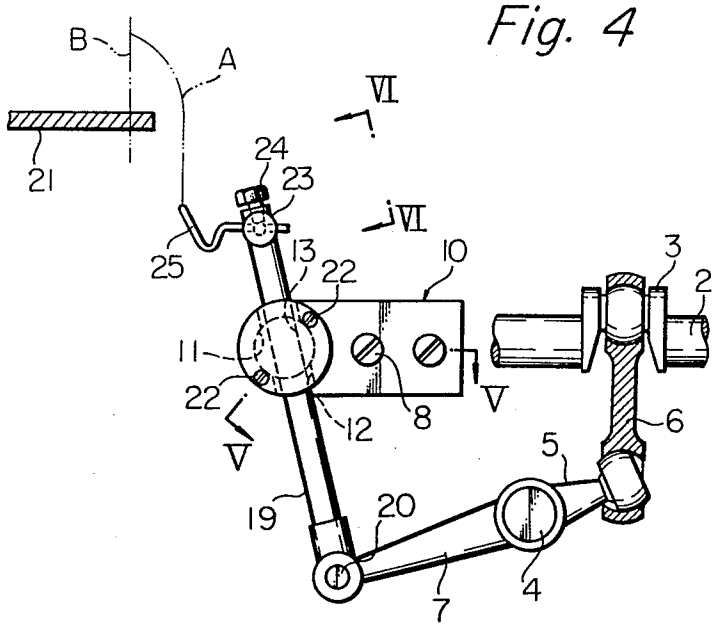


Fig. 5

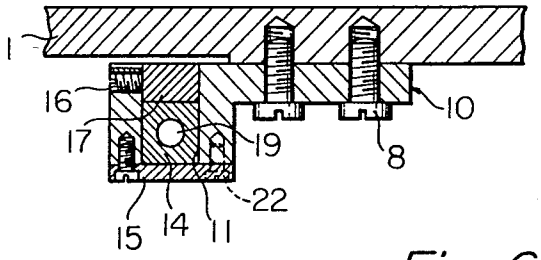
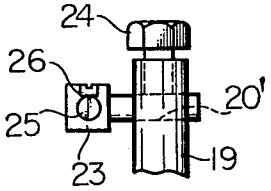


Fig. 6



TETSURO HIRAYAMA,
INVENTOR

BY Wenderoth, Lind & Ponack ATTORNEYS

LOOPER DRIVE MECHANISM

BACKGROUND OF THE INVENTION

This invention relates to a looper drive mechanism or assembly for the sewing machine, and more particularly, an upper looper drive mechanism for sewing the cloth with a hem-stitch by coaction of the overlock sewing machine needle with upper and lower loopers.

In a conventional looper drive mechanism or assembly, a looper shaft is slidably supported by a looper shaft support one end of which is pivotally mounted to the sewing machine frame. Such looper shaft support requires to have a relatively large diameter so that the support is caused to produce its axial movement when the looper shaft is moved. In order to prevent such movement of the support, a thrust ring is provided and rigidly secured to the support by a screw. Consequently, mass of the support reciprocally swingable in response to upward and downward movement of the looper shaft, becomes great. This requires more swing inertia of the support. Due to this inertia, lateral pressure of the looper shaft on the support will be increased when the support takes one direction reverse to the other direction to allow the looper shaft to slidably move within the support. As a result, moving resistance will be also increased to apply heavier load to driving parts of the looper shaft thereby constituting a factor in not only abrasion, vibration, and heat generation but also burning and increment of machine torque. For this reason, a stable stitch has not been obtained with high speed.

SUMMARY OF THE INVENTION

A looper drive mechanism or assembly according to the invention is arranged so that a looper shaft is supported by slidably mounting it within a bore through a drum element or member which is pivotally moved upon movement of the looper shaft, the drum member having a diameter sufficient to slidably hold the looper shaft.

The advantages of the looper drive mechanism according to the invention over the prior art are that not only is the mass of the bearing remarkably decreased but also inertia of the bearing is reduced to thus allow the sewing machine to be driven at high speeds whereby efficiency of sewing is increased and troubles such as abrasion, vibration, heat generation, burning, and increment of machine torque are caused.

It is, therefore, a primary object of the invention to provide a new and useful looper drive mechanism which is capable of driving the sewing machine at high speed.

Another object of the invention is to provide a looper drive mechanism by which defects as mentioned hereinbefore are eliminated to prolong life time of the sewing machine.

The invention will be more readily understood from the following description and by reference to the accompanying drawings, in which preferred embodiments of the invention are shown, and wherein:

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a plan view showing a looper drive mechanism according to the present invention,

FIG. 2 is a sectional view taken along the line II—II of FIG. 1,

FIG. 3 is an exploded perspective view of the looper shaft support,

FIG. 4 is a plan view similar to FIG. 1, but showing another embodiment of the invention,

FIG. 5 is a sectional view taken along the line V—V of FIG. 4, and

FIG. 6 is a fragmentary view of the looper shaft viewed from the line VI—VI of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, FIGS. 1 – 3, there is shown a drive shaft 2 which is disposed in a frame 1 of the sewing machine and rotatably driven by a motor (not shown). The drive shaft 2 is provided with a crank 3 thereon and thus serves a crank shaft. A connecting rod 6 includes one end connected to a crank pin of the crank shaft and the other end connected to an arm 5 at one end thereof by the ball joint. The arm 5 is fixedly mounted to a pivot 4 pivotally mounted to the frame 1. The pivot 4 fixedly carries a swing arm 7 at one end thereof.

A support 10 is secured to the frame 1 by a plurality of screws 8 passing through a slot 9 formed in the support. The support 10 includes a cylindrical opening 11 of which the center axis extends in a direction perpendicular to the axis of the crank shaft 2. A pair of slots 12 are bored through a periphery wall defined by the opening 11 and the center axis passing through the slots 12 is perpendicular to the axis of the opening 11. A drum member 14 having the outer diameter somewhat smaller than the inner diameter of the opening 11 is snugly received in the opening and adapted to rotate with respect to the opening 11. The drum member 14 is provided with a bore 13 passing therethrough. The opening 11 is closed at its one end by a cover or lid 15 through screws 22. A thrust block 17 is received from the other end of the opening 11 and held therein by setscrews 16. This prevents the axial movement of the drum member 14 with respect to the opening 11.

A looper shaft 19 which mounts at one end thereof a looper 18 is provided to pass through the slots 12 in the support 10 and the bore 13 in the drum member 14. The looper shaft further extends from the support and is pivotally connected at the other end by a pin 20 to the swing arm 7 at the other end thereof.

The rotational angle of the pivot 4 produced when the crank shaft 2 is rotated, the length of the arm 7, and the distance between the drum member 14 and the pivot 4 are determined so that the looper 18 is raised, independently of location of the support with respect to the frame 1, along a path by which the tip end of the looper is not brought into contact with a needle plate or feed plate 21 and a cloth and then faces thereon to act with a needle (not shown) thereby sewing the cloth with a hem-stitch. It should be noted that although a lower looper is provided, of course, to coact with the looper 18 when a hem-stitch is made, it is not shown since such coaction of the lower loop with the looper is of no importance to the invention by which the looper shaft is properly supported to be well adapted for high speed drive of the sewing machine.

The operation of a looper drive mechanism or assembly will be readily understood from the following description.

Where the looper 18 assumes the lowermost position at the termination of the path of movement path of the looper, the crank 3 of the crank shaft 2 is held in the raised position. Rotation of the crank shaft allows the connecting rod 6 connected to the crank pin to effect its reciprocal movement. More specifically, the lower movement of the connecting rod clockwise rotates the arm 5 about the pivot 4. As a result, the looper shaft 19 connected by the pin 20 to the swing arm 7 is upwardly urged. Since the looper shaft 19 is at its lower end pivotally mounted to the swing arm 7 and is at its upper end supported by the drum member 14, it is counterclockwise rotated about the drum member when it is upwardly urged. At the same time, the drum member 14 is also rotated with rotation of the looper shaft.

In this manner, the tip end of the looper 18 moves up along a path indicated by the dotted line and faces on the needle plate or feed plate 21. That is, the looper 18 assumes the uppermost position at the termination of the path of movement of the looper when the connecting rod 6 is moved from the upper position to the lower position, namely, the crank shaft rotates through half revolution.

On the other hand, movement of the connecting rod 6 from the lower position to the upper position rotates the arm 5 and the swing arm 7 counterclockwise about the pivot 4. This allows the looper shaft 19 to slidably and downwardly move within the bore 13 in the drum 14 to thus clockwise rotate the drum about its axis. Therefore, the tip end of the looper 18 moves down along a path indicated by the dotted line and

returns to its original position shown in FIG. 1. It will be understood that if one reciprocal movement of the looper **18** is assumed as one stroke, such stroke is made by one rotation of the crank shaft.

FIGS. 4 to 6 show another embodiment of the invention, wherein similar numerals are used to illustrate like parts shown in FIGS. 1 to 3.

Since each member in the second embodiment is identical with that in the preceding embodiment except the looper, it is deemed sufficient to describe only the looper.

The looper shaft **19** is provided at its upper end with a lateral opening **20'** (FIG. 6) parallel to the axis of the opening **11**. A looper hold bar **23** is received in the opening **20'** and is rigidly secured by a screw **24** threaded into the looper shaft **19** at its upper end. The looper hold bar **23** is provided at its one end with a looper mount. A looper **25** is fixed mounted to the looper mount of the bar **23** by means of a screw **26**.

The operation of this mechanism will be understood from the description hereinafter.

Movement each of the crank shaft, connecting rod, arm, swing arm, looper shaft is identical with that described when reference is made to the preceding embodiment.

Rotation of the crank shaft moves the crank from the upper most position to the lowermost position to allow the looper shaft **19** to counterclockwise rotate about the drum **14** and then to move up. At this moment, the tip end of the looper **25**, as indicated by the dotted line A of FIG. **4**, faces on the needle plate **21** and engages the loop of the needle reciprocated along with the path indicated by the dotted line B in response to movement of the drive shaft **2** thereby forming a stitch.

If engagement of the needle loop is not made due to improper alignment of path A of the looper **25** and path B of the needle, thereby forming no stitch, such may be prevented since the hold bar **23** may be adjustably moved in the lateral opening **20'** in parallel with the axis of the opening **11** by unfastening the screw **24**, or the position of the looper **25** may be adjusted so as to engage the needle loop by rotating the hold bar **23** about its axis to turn the looper, the position of the looper **25** mounted to the looper mount may be adjusted by unfastening the screw **26**.

Thus it is possible to adjust the member in the manner set forth above, if necessary to ensure engagement of the needle loop, thereby forming a stable stitch by use of the high speed drive sewing machine.

Also, as will be apparent from FIG. **2**, support member **10** may be adjustably moved with respect to frame **1** by means of slot **9** and screws **8**. Thus, as will be recognized in FIG. **1**, by so adjusting the position of support member **10**, the angle and position of looper shaft **19** may be adjusted.

While only the preferred embodiments of the invention have been described, it should be understood that various changes or modifications may be made within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. A looper drive mechanism comprising a crank shaft as a driving shaft, a connecting rod one end of which is connected to a crank pin of said crank shaft, an arm coupled to the other end of said connecting rod, a pivot fixedly connecting said arm to the machine frame, the other end of said arm comprising a swing arm portion, a looper shaft, a looper mounted to said looper shaft at its top end, means pivotally mounting the lower end of said looper shaft to said swing arm, a support member adjustably fixed to said frame for supporting said looper shaft, said support member having a cylindrical opening and a pair of opposed slots in the peripheral wall defining said opening, and a drum member bodily and rotatably received in said opening, said drum member including a bore through which said looper shaft slidably passes and by which said looper shaft is supported to be slidable with respect to the axis of the bore, said bore communicating with said opposed slots, whereby said looper shaft extends through the bore of the drum member and the slots of the supporting member.

2. A looper drive mechanism in accordance with claim **1**, including an adjustable looper hold bar on the upper end of said looper shaft, wherein said looper is mounted on said looper hold bar, whereby position and angle of said looper may be adjusted as desired.

3. A looper drive mechanism in accordance with claim **1**, said support member having therein a slot means for adjusting the position of said support on the frame and thereby adjusting the angle and position of said looper shaft.

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