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(54) **Zig-zag sewing machine.**

(57) The upper arm of a sewing machine according to the invention has its main shaft (16) carrying the crank disk extended perpendicularly to the zig-zag movement and positioned at the end of the arm. The problem in this positioning of the main shaft has been to develop a simple drive arrangement of the needle bar (15) so that the guiding means (12) of the zig-zag movement is not influenced by the needle bar propulsion. This invention has minimized the stressing of the zig-zag guiding means emanating from the needle bar propulsion. This allows the use of guiding means with a considerably less keeping force.

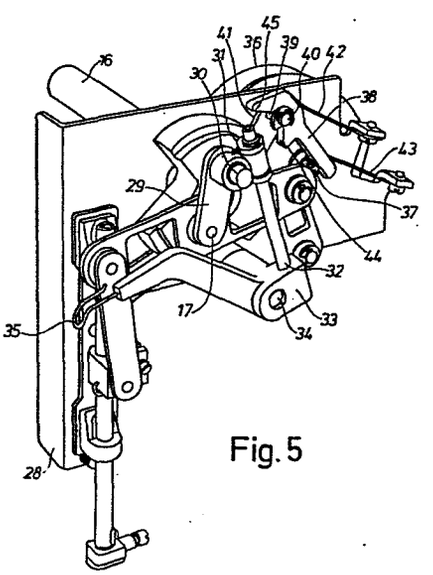

Fig. 5

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Zig-zag sewing machine

The present invention relates to domestic sewing machines, in particular to the zig-zag mechanism of such a machine.

In conventional zig-zag sewing machines the needle bar performs a vertical movement and a horizontal movement of which the latter is controlled by a guiding means which keeps the bar in an adjusted position during the downward movement of the needle which is effected by a crank and a connecting rod. When the material to be penetrated by the needle is hard or thick a torque on the needle bar created by the resistance in the needle movement can be so great that the needle is laterally moved from the adjusted position, whereby the needle is broken. Several solutions for eliminating this drawback have been suggested, for instance, an enforcement of the guiding means so that it can resist the torque, and further, a shortening of the lever arm of said torque and the use of universal joints etc. By a step motor arrangement for the zig-zag movement, which is more and more used in modern sewing machines, the guiding means has a rather limited force of keeping of the adjusted position and therefore it is important to make an arrangement having a very small torque on the needle bar when moving the needle.

The upper arm of the invention has a crank shaft perpendicular to the zig-zag movement of the needle. The problem forming the basis of the invention is how to achieve a simple propulsion on the needle bar when the crank shaft is positioned in this way including links and connecting means so that the guiding means of the zig-zag movement will not be disturbed by the driving force of the needle bar. The solution of the problem leads to a positioning of the connection between the connecting rod and the needle bar at a point which approximately coincides with the fulcrum of the zig-zag movement in the moment when the needle penetrates the cloth. The properties thus introduced into a sewing machine according to the invention are stated in the characterizing clause of Claim 1.

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An embodiment of the invention is described in the following with reference to the accompanying drawings which show in Fig. 1 a sketch of a needle bar mechanism with a top journalled needle bar, Fig. 2 a sketch of a mechanism with a center journalled needle bar, Fig. 3 a sketch of a mechanism with an oval-shaped movement path of the connecting rod, Fig. 4 the same mechanism as in Fig. 3 in another position and Fig. 5 a perspective view of such a mechanism.

The sewing machine according to the invention is provided with a hollow body having an upper arm, in the end of which there is a horizontal pin 10 and a needle bar frame 11 journalled thereon to be swingable in a direction perpendicular to the feeding direction of the machine. The adjustment of the frame, the zig-zag position, is effected by a guiding means 12 shown in a block in Figs. 1-4. A connecting rod 13 is connected at a point 14 to a needle bar 15 journalled in the frame. A crank shaft 16 is journalled in the body perpendicular to the zig-zag direction, its crank pin 17 is connected to the connecting rod, and a force is transferred from the crank shaft to the needle bar via the connecting rod when the needle hits the material. As this rod forms an angle v to the frame, which is journalled at its top (Fig. 1), there will be a lever arm L_1. This one and the force of the connecting rod form a torque at the pin 10 with a magnitude depending on the resistance to penetration of the material. This torque is stressing to the guiding means 12 which must be dimensioned to resist the torque which may be great.

In Fig. 2 the mechanism is drawn as in Fig. 1 with the difference that the bearing pin 10 of the frame 11 in Fig. 1 is moved from the top to the center, i.e. to the same level as the point 14. In Fig. 2 this bearing pin is denoted 18. This means that the lever arm L_1 in Fig. 1 now is zero meaning that the needle bar frame does not obtain any torque from the force of penetration of the needle at this moment of the stitch forming procedure. When the needle has penetrated the material the lever arm increases somewhat in relation to another lever arm L_2 which is the distance between the pin 18 and the means 12, however, L_1 is still small so the horizontal component of the force of the connecting rod stressing the guiding means will be essentially less here than in the device shown in Fig. 1.

The mechanism in Figs. 3 and 4 involves still another improvement of the device. The propulsion of the connecting rod is here effected by means of a link system creating an oval movement 19. The system consists of a pin 20 disposed in the body and a link 21 journalled thereon and a crank arm 22 carrying a crank pin 17. An arm 23 connects the crank pin to two bearings 24, 25 of the link and the connecting rod, respectively. When the crank shaft 16 rotates the pin 17 describes a circular path 26, the bearing 24 makes an arc of a circle, and the bearing 25 makes the said oval path 19. As this path is narrowed in the horizontal direction

the angle u between the connecting rod and the needle bar frame is less than the angle v in Fig. 1. In Fig. 4 a position of the stitch forming procedure is shown where the ratio L_1, L_2 is most disadvantageous. L_1 is here very small which brings a slight influence of the force in the connecting rod on the guiding means 12. This means can therefore be dimensioned for a much less keeping force of the position than what is the case in the device according to Fig. 1. The pin 20 may be provided with an adjustable attachment so it may be raised or lowered in the body, thereby allowing an adjustment of the needle level in a simple way.

In Fig. 5 the mechanism is shown as a module in a plate frame 28 which either can constitute a part of the upper arm of the machine or be an independent part which is mounted in the arm. Most of the members in Fig. 4 appear in Fig. 5 which shows the principle of the design of the module. An arm 29 is provided on the crank pin 17 and has a pin 30 which carries a bearing of a sliding block 31 on a rod 32 which is fastened to a thread take-up lever 33 journalled on a shaft 34 in the module frame. The end of the arm has a thread guide 35 which in the usual way takes up the upper thread during a phase of the stitch forming procedure. The arm is driven by the crank shaft in a vertical, oscillating movement; when the crank pin moves in its circular path the sliding block 31 slides up and down on the rod 32 swinging the same to and fro and the arm is following in the oscillating movement.

The adjusting force for the zig-zag movement, as mentioned before, can be reduced in a device according to Fig. 4. In the module, Fig. 5, the zig-zag movement is effected by a step motor 36 and a gear and link system connected thereto. A pinion 37 is in mesh with a rack 38 which in one end has an angular recess 39. The rack carries a pin 40 which is entered in an extension 41 of the needle bar frame which thereby follows the movement of the rack. The pin is normally kept in the bottom of the angular recess thanks to the two sloping edges 44, 45 thereof and to a couple of compression springs 42, 43 which on the opposite side of the rack are fastened to the frame. However, it may happen that the pin slides up on one of the edges when the needle is subjected to a lateral force. The pin will return to the bottom of the recess when the force ceases. A similar guiding means is priorly described in the Swedish patent publication No. 423,912.

The mechanism now described is an example how to exercise the invention. The design of links, knee levers and fulcrums etc. can, of course, be changed without departing from the inventive idea as generally defined in the following claims.

Claims

1. A zig-zag mechanism in a sewing machine provided with a laterally swingable needle bar frame (11), a guiding means (12) for providing zig-zag movements, a connecting rod (13) connected to the needle bar (15) at a connecting point (14) performing a vertical reciprocating movement and a crank shaft (16) extended perpendicularly to the zig-zag movement, characterized in that a center position in said reciprocating movement of the connecting point approximately coincides with the fulcrum (18) of the needle bar frame.

2. A zig-zag mechanism according to Claim 1, characterized in that the said center position of the connecting point corresponds to a position of the needle tip when hitting the sewing material.

3. A zig-zag mechanism according to Claim 1, characterized in that the upper end of the connecting rod is journalled on a crank pin (17) projecting on the crank shaft.

4. A zig-zag mechanism according to Claim 1, characterized in that the upper end of the connecting rod is journalled to one end of an arm (23), the other end of which is journalled to a link (21), and is therebetween in driving connection with the crank shaft by means of a crank arm (22) and a crank pin (17).

5. A zig-zag mechanism according to Claim 4, characterized in that the upper end of the connecting rod describes an oval movement path (19) the longitudinal axis of which is extended in the longitudinal direction of the needle bar.

6. A zig-zag mechanism according to Claim 4, characterized in that the said link (21) has a bearing (20) in the body of the machine which bearing is adjustable in the vertical direction making the level of the needle adjustable in relation to the hook of the machine.

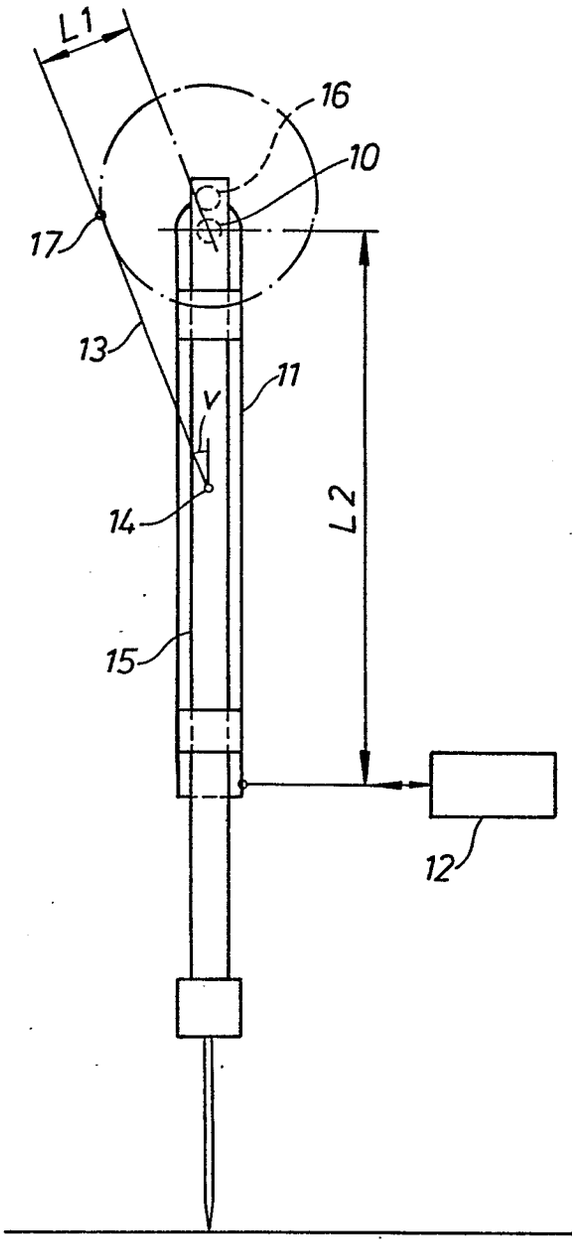

Fig. 1

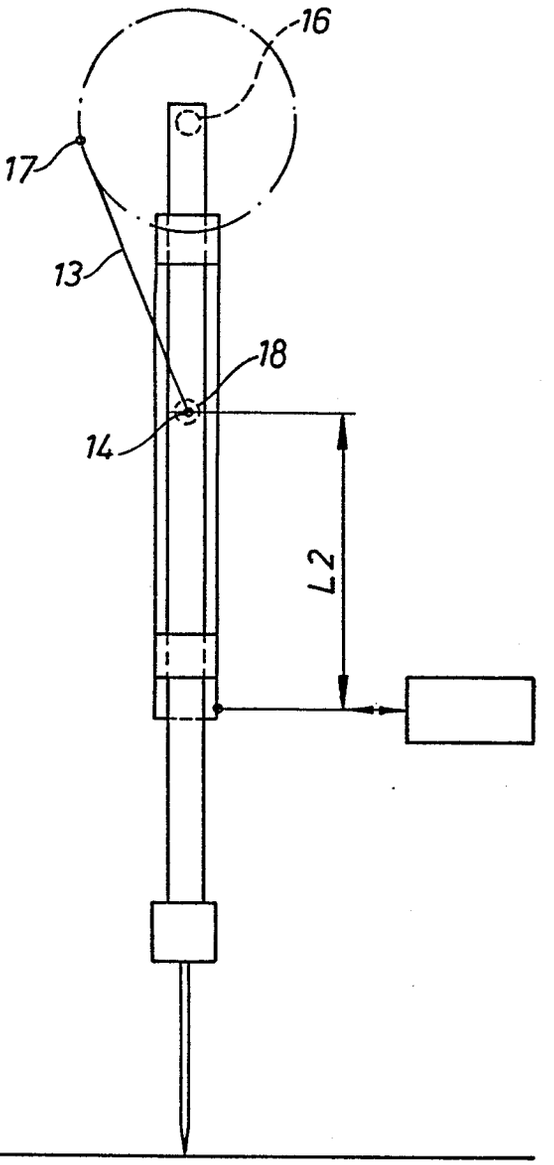

Fig. 2

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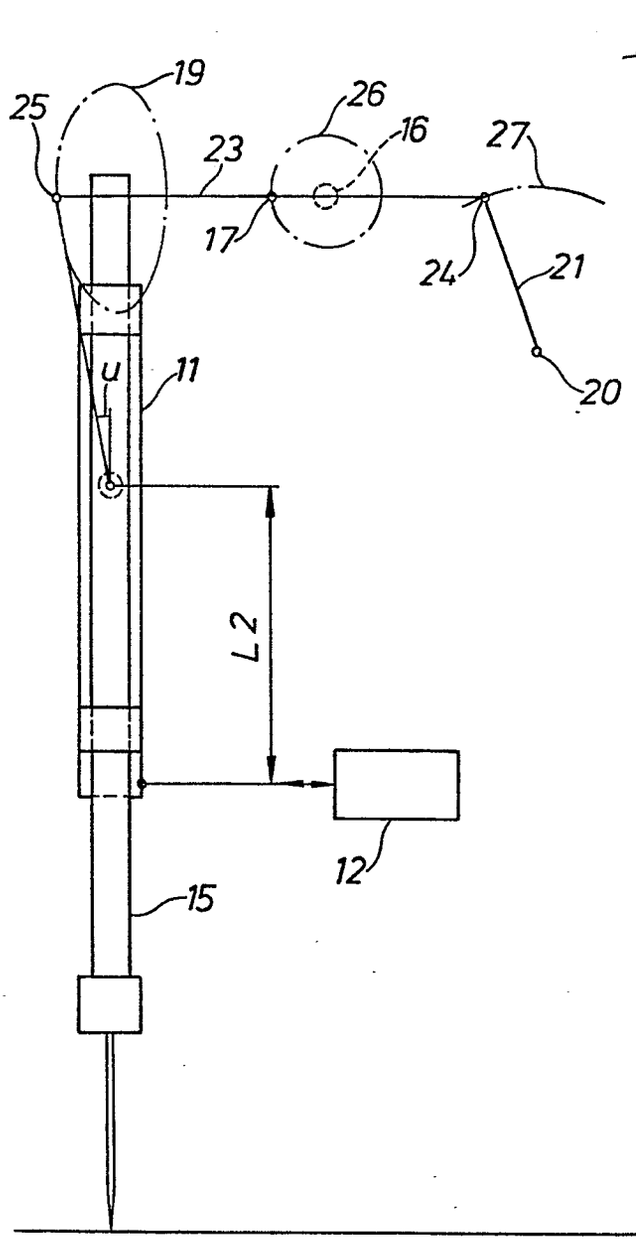

Fig. 3

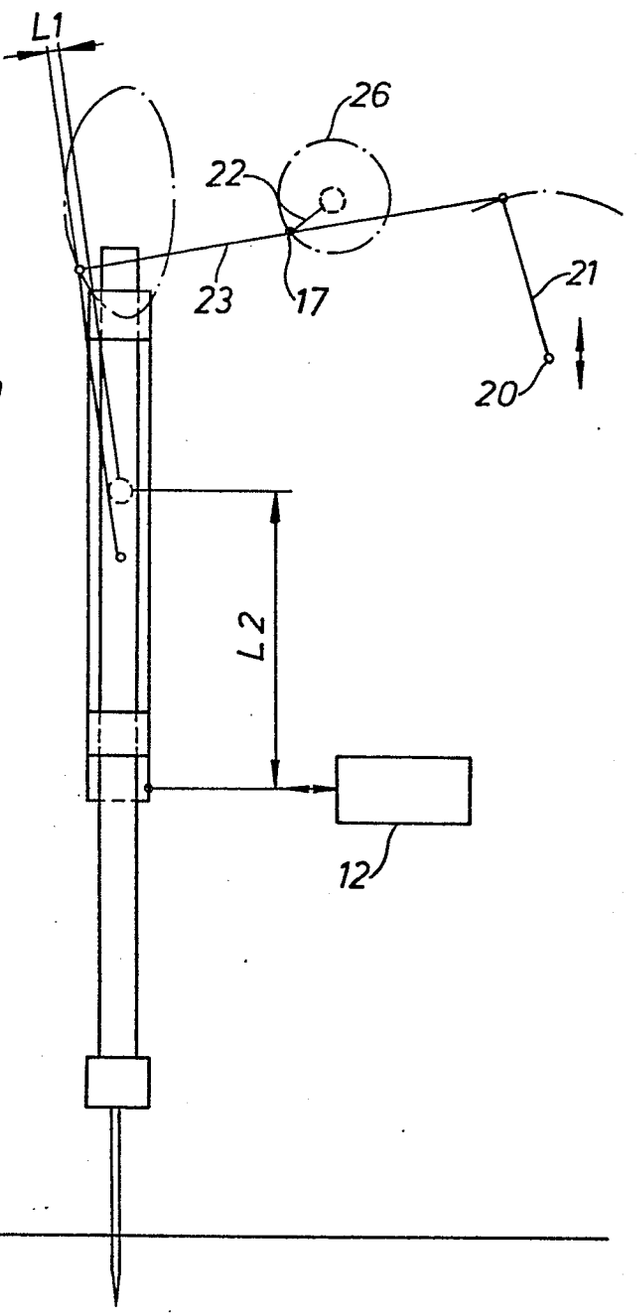

Fig. 4

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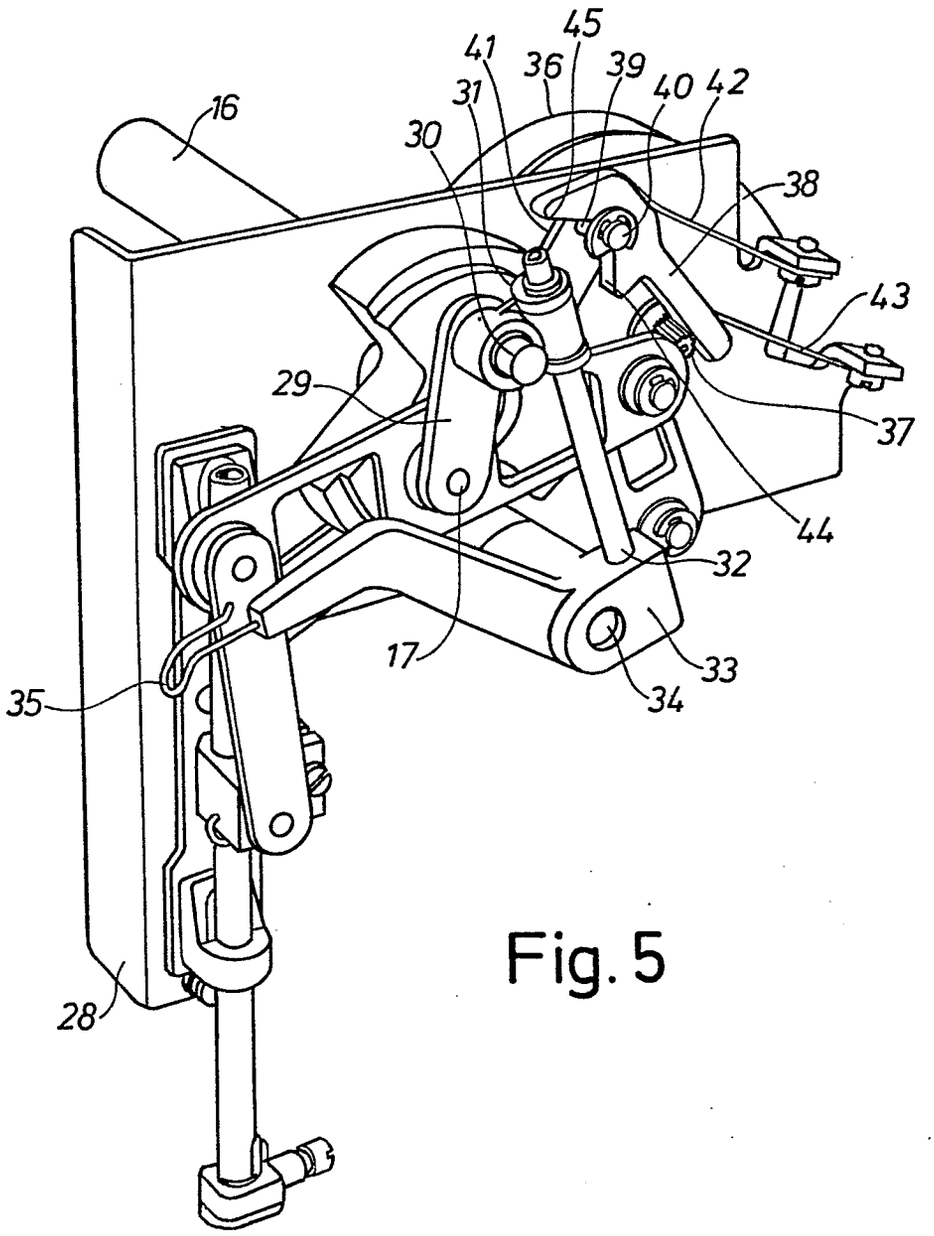

Fig. 5