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(54) **Title**: DRIVING DEVICE FOR LATERAL NEEDLE BAR MOVEMENT

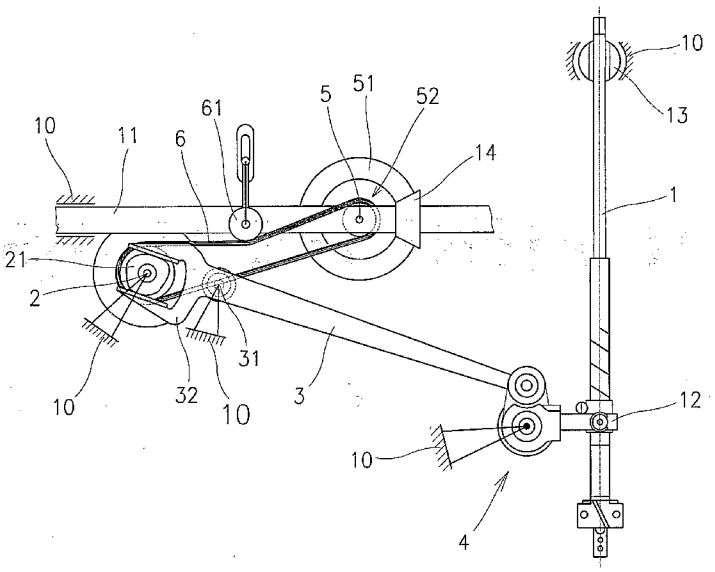

Fig. 1

(57) **Abstract**: The invention relates to the device for driving of lateral needle bar movement (1), especially of sewing machines for button holes, comprising the driving shaft (2) of lateral movement mechanism provided with the driving cam (21) of lateral movement and coupled with the driving shaft (11) of vertical movement of the needle bar (1). The device comprises the counter shaft (5) connected by means of a tooth gear assembly to the driving shaft (11) of vertical movement of the needle bar (1), while the counter shaft (5) is parallel with the driving shaft (2) of lateral movement mechanism and it is connected with the driving shaft (2) of lateral movement mechanism by means of the toothed belt (6).

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Driving device for lateral needle bar movement

Technical field

A device for driving of lateral needle bar movement, especially of sewing machines for button holes, comprising a shaft for driving the lateral movement mechanism provided with driving cam of lateral movement and coupled with driving shaft of vertical movement of needle bar.

Background art

The sewing machines used for stitching the button holes comprise a mechanism for lateral needle bar movement which enables to secure the fabric in vicinity of a button hole by means of zig-zag stitch before cutting through or after cutting through the button hole.

The device performs the transfer of needle bar above the sewn material at a moment when the needle bar with needle is lifted above the fabric.

Upon sewing the lateral movement is achieved by alternating shifting of the needle bar itself, while sometimes to this movement also the alternating side movement of the table with the sewn material is being added. The required size of lateral movement is adjustable within structural scope of possibilities of mechanism coupled with needle bar and/or with the table.

The drive of mechanism of needle bar lateral movement is realised by means of a lateral movement shaft driven by a special motor, or preferably it is derived from the main driving crank-shaft, by means of which the vertical reversible movement of needle bar is caused. At embodiment with common motor the axis of lateral movement shaft is arranged perpendicularly to the crank-shaft. The lateral movement shaft quite often comprises means to balance the inertial forces induced at reverse movement of lateral movement mechanism. For the reason of mechanism's rigidity it is advantageous to mount both ends of the lateral movement shaft into the frame of sewing machine. This nevertheless requires that the shafts of lateral movement mechanism and of the

drive of vertical movement of needle bar are skew, at the same time the minimum mutual distance of their axis must enable a sufficient dimensioning of the shafts.

One of the known embodiments solves the coupling of the main driving shaft and to it in a skew manner perpendicular counter-shaft which drives the lateral movement mechanism by means of gear assembly formed of cylindric worm wheels. Such gear assemblies first of all feature high surface pressures and high relative sliding speeds in the place of teeth engagement. The result is a great wear and from it resulting inaccuracy of adjusted values for lateral movement and inaccurate synchronising of vertical and lateral movement motion of the needle bar.

For transfer of the drive from the main driving shaft to the cross lateral movement shaft the solution according to the JP 2007029433 utilises the conical hypoid gear assembly. This indeed features a high rigidity of the tooth in the place of engagement and a calm running, nevertheless this is again a worm gear assembly with a great slippage at engagement. This requires lubrication with special lubricants, without which it loses its positive properties. Simultaneously in the structure of the sewing machine it is practically impossible to ensure the desired lubrication in an acceptable manner. The disadvantage of such an arrangement is also the price of the gear assembly and the costs for its possible adjustment.

The goal of the technical solution is to eliminate shortcomings of the background art, especially to reduce its production and operational costs, at the same time to preserve the advantageous compact arrangement of two skew running shafts for vertical movement of the needle and with it coupled movement in direction of the lateral movement.

Principle of the invention

The goal of technical solution has been achieved by a device for driving the lateral needle bar movement, whose principle consists in that, it comprises the counter shaft connected by means of a tooth gear assembly to the driving

shaft of needle bar vertical movement, while the counter shaft is parallel with the driving shaft of lateral movement mechanism and it is with the driving shaft of lateral movement mechanism connected by means of a toothed belt.

At the same time it is advantageous, when the counter shaft and the driving shaft of needle bar vertical movement are mutually positioned in a skew manner. This enables to use a common bevel gear.

The counter shaft connected with the driving shaft of needle bar vertical movement by means of bevel gear assembly in combination with gearing of toothed belt enables an easy skew arrangement of the driving shaft of needle bar vertical movement and of the driving shaft of lateral movement mechanism.

At the same time it is especially preferred, if this bevel gear is a bevel gear with straight teeth, which is price affordable and features satisfactory functional properties.

To achieve more quiet running and a higher accuracy of bevel gear it is advantageous to use the gear assembly with inclined or cyclopaloidal teeth.

To reduce the demand as for operation it is advantageous, if to the toothed belt there is assigned a means for its stretching. Optimally tightened toothed belt exerts a positive impact on accuracy of dependence at turning of input and output shaft of gearing and on service life of the belt.

Description of the drawing

An exemplary embodiment of the device according to the technical solution is schematically represented in the drawing where the Fig. 1 shows a longitudinal view to the device and the Fig. 2 a ground plan of the device.

Examples of embodiment

The drive of the needle bar **1** in vertical direction is in a known manner initiated by the driving crankshaft **11** driven by the not represented electro-motor. The crank of the shaft and its coupling to the needle bar is not

represented. The driving shaft is rotatable mounted in the frame **10** of sewing machine.

The lateral movement motion of the needle bar **1** is initiated by a known lateral movement mechanism, which comprises the shaft **2** for drive of the lateral movement mechanism arranged in a skew manner with respect to the driving shaft **11** of vertical movement of the needle bar **1**. The shaft **2** for drive of the lateral movement mechanism is rotatable mounted in the frame **10** of sewing machine. In a ground plan view the shafts **2** and **11** are mutually perpendicular. To one end of the shaft **2** for drive of the lateral movement mechanism there is attached the known driving cam **21** of lateral movement. With the shaft **2** for drive of lateral movement mechanism there is further in a fixed manner also connected the toothed pulley **22**, and in exemplary embodiment also the wheel **23** of manual steering.

The lateral movement mechanism further comprises a two-armed transmission lever **3** mounted by means of a pivot pin **31** in the frame **10** of sewing machine. The pivot pin **31** in vertical plane with respect to the frame **10** of the sewing machine is in a known manner controllably displaceable , for example by means of the not represented gate. By means of this arrangement the size of lateral movement is defined, at the same time the size of lateral movement may be adjusted. The transmission lever **3** on one of its ends is provided with removable fork **32**, which with its inner surface of its forking is in contact with perimeter of the driving cam **21**. The second end of the transmission lever **3** is in a joint manner connected with the in detail not represented known leverage **4** serving to initiate motion of the lower guiding bearing **12** of the needle bar **1**. On outer surface of the lower guiding bearing **12** of the needle bar **1** a not represented known device for turning of needle is arranged. The upper end of the needle bar **1** in a known manner is mounted in the frame **10** of the machine by means of the spherical bearing **13**.

The driving shaft **11** of vertical movement of the needle bar **1** by means of the tooth bevel gear is connected with the counter shaft **5** mounted rotatable in the frame **10** of the sewing machine. In the exemplary embodiment the bevel gear has a straight teeth, in other exemplary embodiments has a inclined teeth,

possibly cyclopaloidal. The shafts **11** and **5** are mutually positioned in a skew manner and are perpendicular. On the driving shaft **11** of vertical movement of the needle bar **1** in a fixed manner is mounted the pinion **14**, which is in engagement with the tooth wheel **51** mounted in a fixed manner on the counter shaft **5**. On the counter shaft there is further in a fixed manner mounted the tooth pulley **52**.

On the shaft **2** of drive of lateral movement mechanism the tooth pulley **22** is attached, which is with toothed belt **6** connected with tooth pulley **52** of the counter shaft **5**. The tension pulley **61** abuts on the outer surface of the toothed belt **6**.

At sewing the driving shaft **11** of vertical movement of the needle bar **1** is rotating, which imparts the needle bar **1** the reversible vertical movement. Rotation of the driving shaft **11** by means of the bevel tooth gear formed of the pinion **14** and the toothed wheel **51** and the gear with toothed belt **6** is brought to the shaft **2** of the drive of lateral movement mechanism. A total gear ratio of the bevel gear and to it adjoining gear of toothed belt has the value of 2, this means the shaft **2** of drive of the lateral movement mechanism is rotating in a half speed with respect to the shaft **11** of vertical movement of the needle bar **1**. The driving cam **2** at rotation is acting upon the inner side surfaces of the sensing fork **32** of the transmission lever **3**. The transmission lever swings around the pivot pin **31** which moves in a controlled manner in the gate, at the same time its second end moves by means of the leverage **4** the lower guiding bearing **12** of the needle bar **1**. This movement is performed in a plane being perpendicular to running of the sewn material, this is in the plane being parallel with plane of the Fig. 1 so that the desired lateral movement is achieved.

Initial tension of the toothed belt **6**, which during running of the machine is reduced due to its stretching as a result of material fatigue, may be periodically adjusted by means of stretching means containing the contact tension pulley **61**.

The device according to the technical solution may replace the hypoidal gearing, possibly other tooth gearing with acceptable slippage of engaging teeth enabling coupling of two skew and in the ground plan mutually perpendicular

shafts, which is from the point of view of lubrication, acquisition costs as well as maintenance very demanding. Moreover, arrangement with gearing with toothed belt increases variability of the structural arrangement of the space in the box of sewing machine. Gearing by means of the toothed belt at the same time does not require any lubrication and it features a minimum operational noise.

List of referential markings

1	needle bar
10	frame of sewing machine
11	driving shaft (of vertical movement of needle bar)
12	lower guiding bearing (of needle bar)
13	spherical bearing (of upper end of needle bar)
14	pinion (of bevel gear)
2	shaft of drive of lateral movement mechanism
21	cam
22	tooth pulley (of driving shaft of lateral movement mechanism)
23	wheel of manual steering
3	transmission lever
31	pivot pin (of gearing lever)
32	sensing fork (of gearing lever)
4	leverage (of vertical drive of lower guiding bearing of needle bar)
5	counter shaft
51	tooth wheel (of bevel gear)
52	tooth pulley (of counter shaft)
6	toothed belt
61	tension pulley

CLAIMS

1. The device for driving of lateral needle bar movement (1), especially of sewing machines for button holes, comprising the driving shaft (2) of lateral movement mechanism provided with the driving cam (21) of lateral movement and coupled with the driving shaft (11) of vertical movement of needle bar (1), **characterised in that** it comprises the counter shaft (5) connected by means of a tooth gear assembly to the driving shaft (11) of vertical movement of the needle bar (1), while the counter shaft (5) is parallel with the driving shaft (2) of lateral movement mechanism and it is connected with the driving shaft (2) of lateral movement mechanism by means of the toothed belt (6).

2. The device according to the claim 1, **characterised in that, the** counter shaft (5) and the driving shaft (11) of vertical movement of the needle bar (1) are mutually positioned in skew manner.

3. The device according to the claim 2, **characterised in that, the** tooth gear assembly, by means of which the counter shaft (5) is connected to the driving shaft (11) of vertical movement of the needle bar (1), is the bevel gear with straight teeth.

4. The device according to the claim 2, **characterised in that, the** tooth gear assembly, by means of which the counter shaft (5) is connected to the driving shaft (11) of vertical movement of the needle bar (1) is the bevel gear with inclined teeth.

5. The device according to the claim 2, **characterised in that, the** tooth gear assembly, by means of which the counter shaft (5) is connected to the driving shaft (11) of vertical movement of the needle bar (1) is the bevel gear with cyclopaloidal teeth.

6. The device according to any of the previous claims, **characterised in that to the** toothed belt (6) there is assigned the means for its stretching.

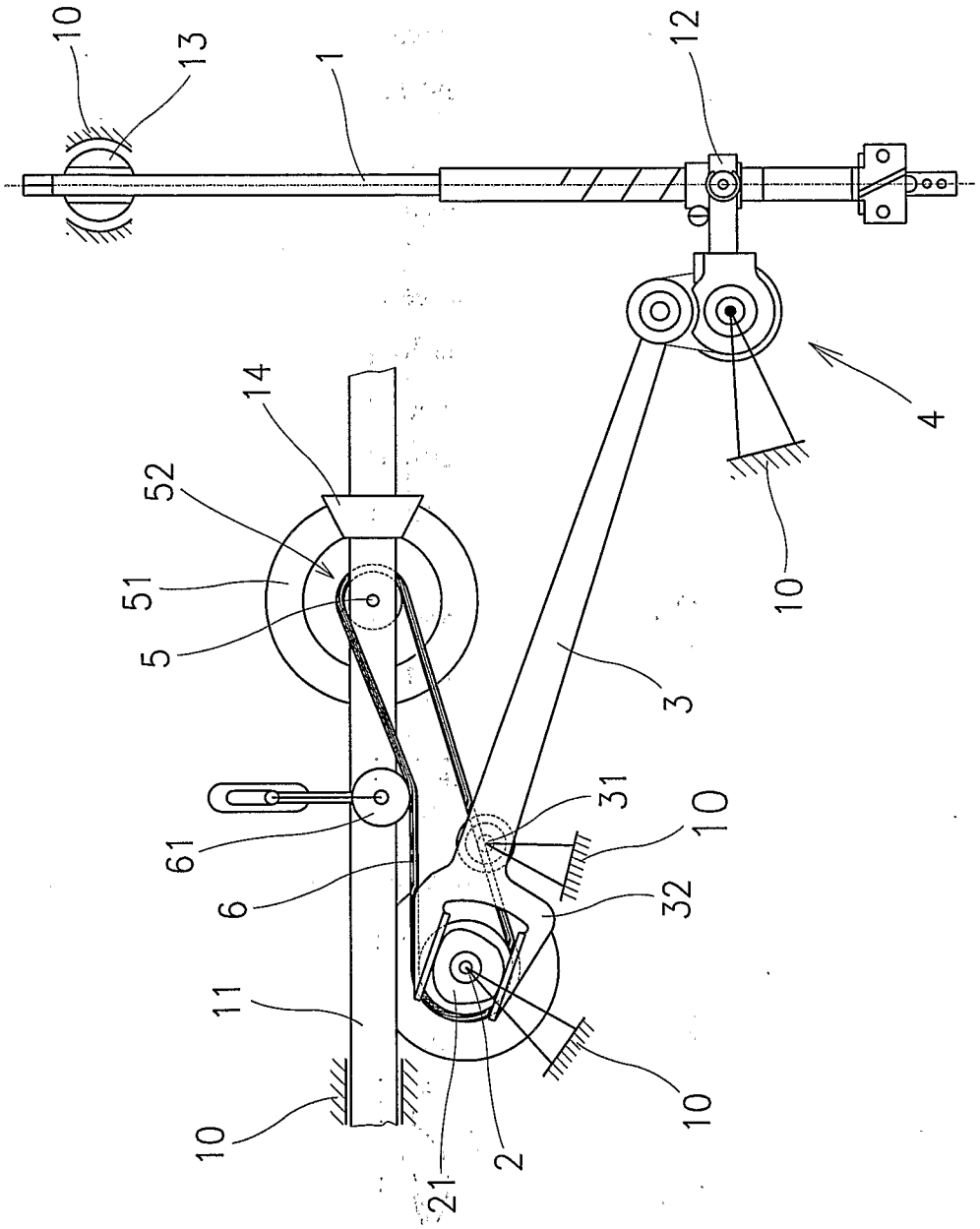

Fig. 1

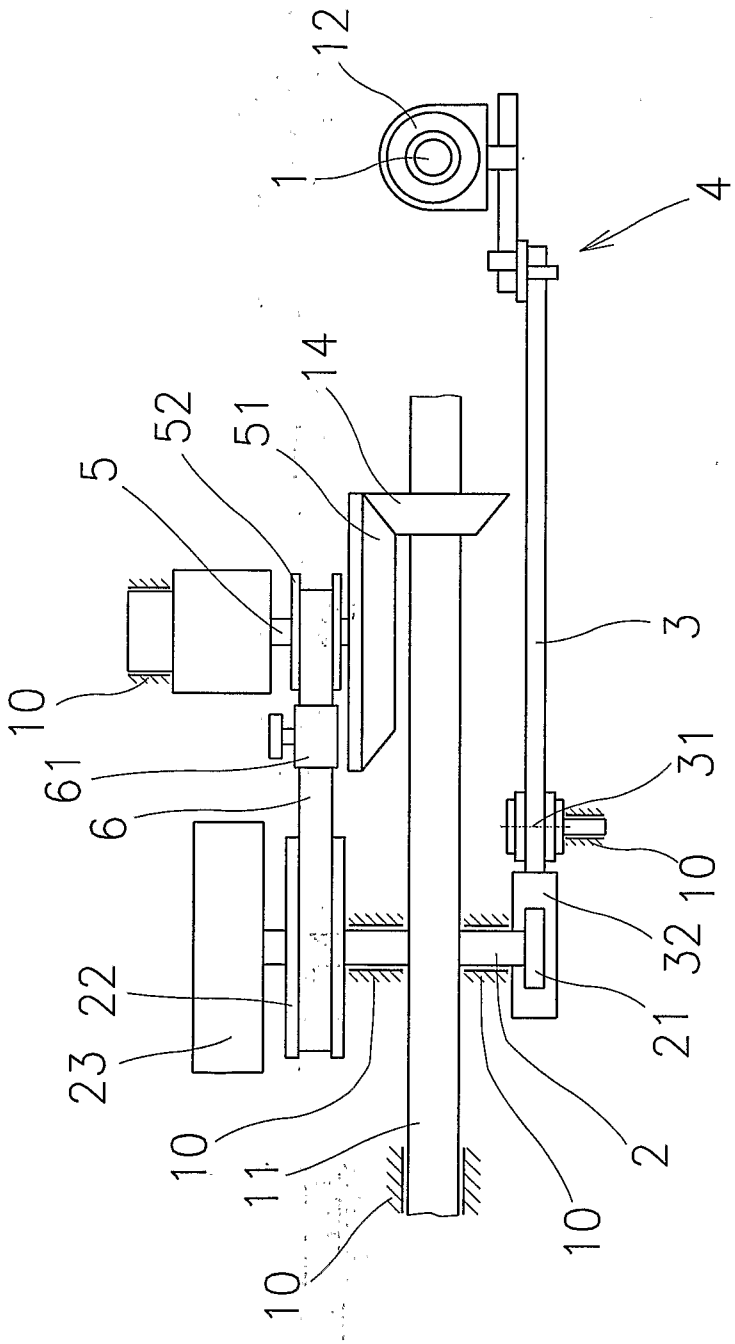

Fig. 2