

[54] **COMBINED UPPER AND LOWER FEED FOR SEWING MACHINES**

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[51] **Int. Cl.** D05b 27/06

[58] **Field of Search** 112/203, 212, 213, 235

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[57] **ABSTRACT**

This disclosure relates to a feed mechanism for sewing machines wherein the upper feed assembly includes a pressure foot and a separate upper fabric slide which operates in conjunction with a lower fabric slide. The pressure foot is constantly resiliently urged towards the needle plate and the mounting means for the upper fabric side includes a spring and means for compressing the spring and tightly applying the upper fabric slide against fabric during the feeding movement thereof with the force required to compress the spring reacting against the means resiliently retaining the pressure foot in place so as to reduce the pressure exerted by the pressure foot during the feeding of fabric relative thereto while at the same time permitting the restoring of the pressure on the pressure foot during the retracting movement of the fabric slides. The lower fabric slide may also have incorporated therein a spring resiliently urging the same towards the pressure foot with the combined reactive forces of the fabric slides springs being less than that applied on the pressure foot.

11 Claims, 3 Drawing Figures

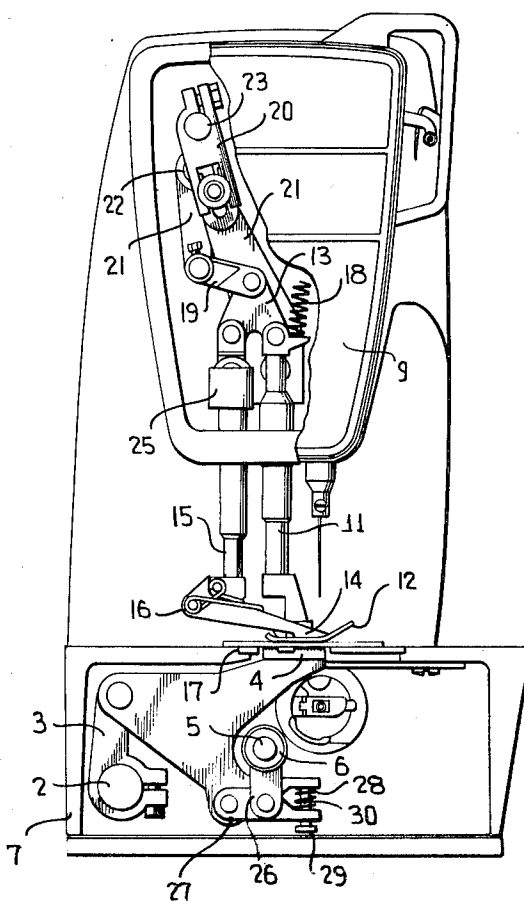


FIG. 1

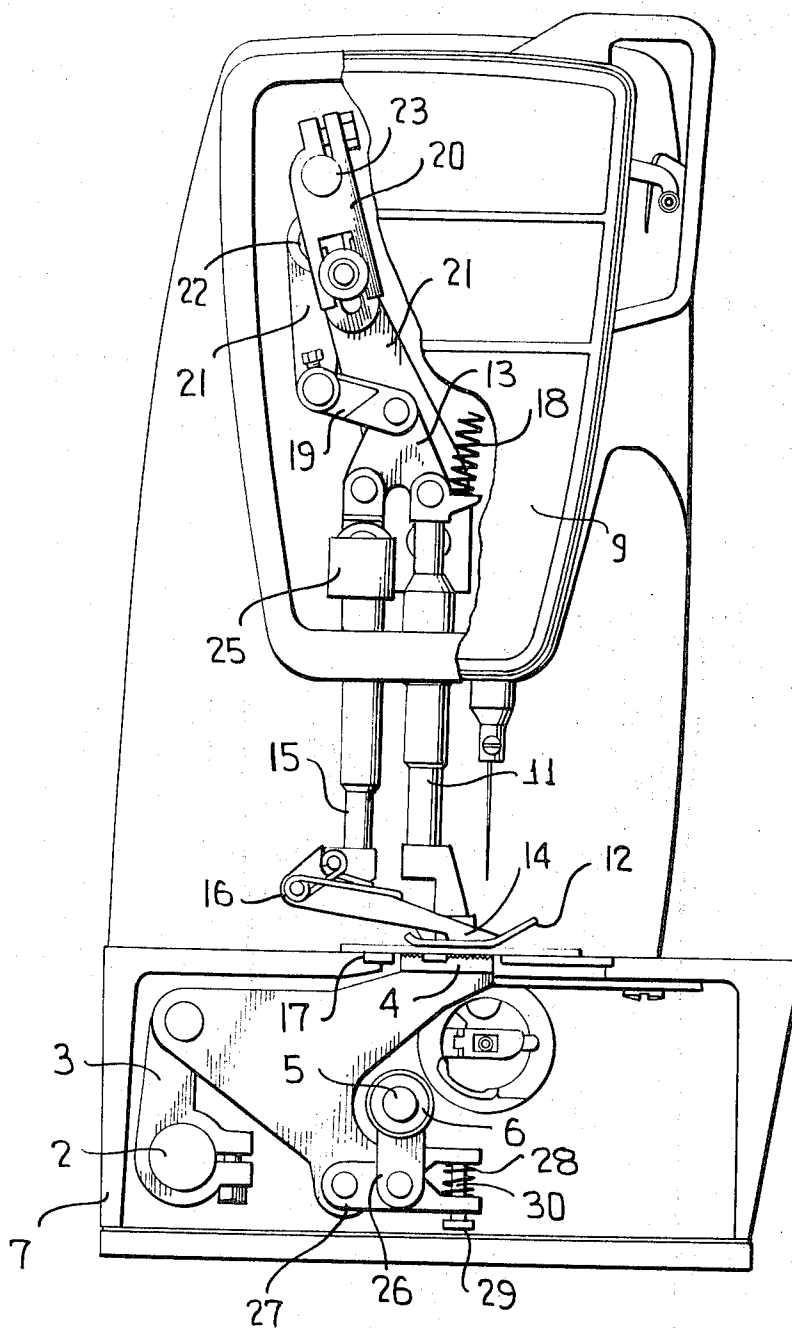


FIG. 2a

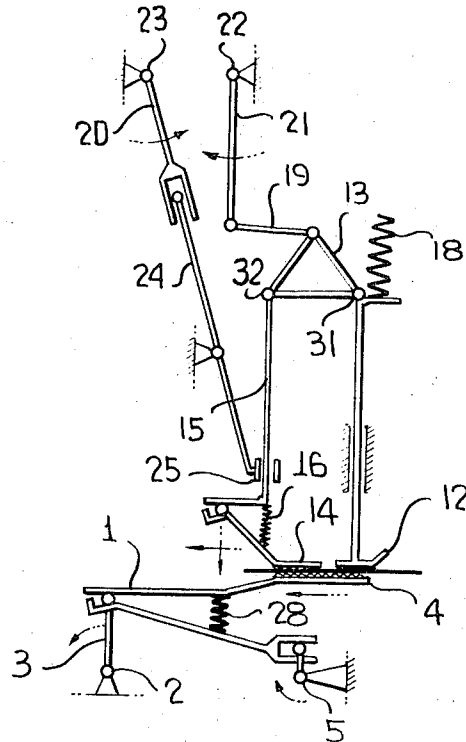
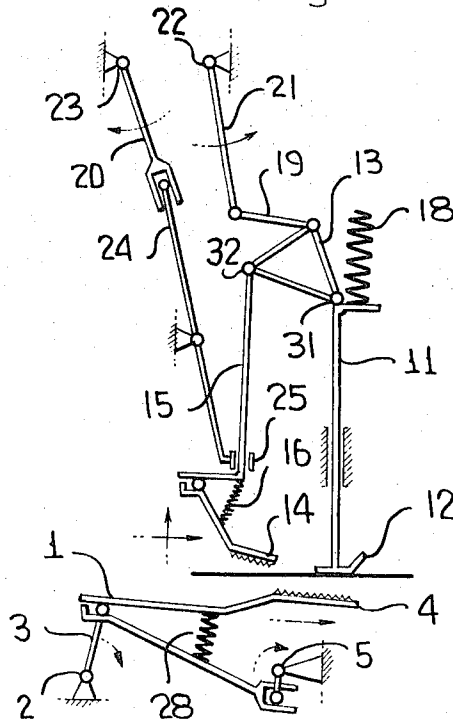


FIG. 2b



COMBINED UPPER AND LOWER FEED FOR SEWING MACHINES

The invention relates to a combined upper and lower conveyance device for sewing machines having a resiliently mounted pressure foot and driven upper and lower fabric slides.

BACKGROUND OF THE INVENTION

Sewing machines with combined upper and lower fabric conveyance devices have been used before in many types of sewing machines. As a rule, in these conveying devices a lower reciprocating fabric slide which also has up and down movement, is used. This fabric slide emerges from the needle plate during the feed and lifts both the upper fabric slide and the pressure foot. For this purpose and in order to exceed elevations in fabric, for example, transverse seams, the upper fabric slide and the pressure foot are resiliently mounted.

A considerable disadvantage of this combined upper and lower fabric conveying arrangement resides in the fact that the upper fabric slide and the pressure foot can only follow, because of inertia of the masses, the movements of the lower fabric slide emerging from the needle plate up to a certain speed of operation of the machine. Whenever this speed is exceeded, then satisfactory fabric feed can no longer be guaranteed. Varying lengths of stitches at varying sewing speeds are the consequence.

In order to avoid this drawback, it has been previously proposed to reduce the resiliently mounted masses laying above the needle plate. At the same time the pressure foot is separately equipped with springs, and the pressure foot assembly is adjusted to a certain level against the strong pressure of one spring forcing this assembly downward in the customary manner, the level corresponding to about the thickness of the fabric. The pressure foot itself is pressed against the needle plate under the action of a weaker spring. As a result and up to a certain thickness of the fabric only the pressure foot is lifted without the entire pressure foot assembly being set in motion.

In case of an arrangement with a separately resiliently mounted pressure foot, it has been found that, in case of higher speeds an oscillation in unison of the entire pressure foot assembly will be avoided, but the arrangement has to be readjusted repeatedly for new fabrics in order to achieve a faultless fabric feed. In addition, the reduced contact pressure of the separately resiliently mounted pressure foot has a disadvantageous effect in case of wedging of the fabric during the periods in which the lower fabric slide is lowered and no fabric feed takes place.

In the case of another combined upper and lower fabric conveyance device, the pressure foot is not lifted by the lower fabric slide. A special drive is provided for lifting of the pressure foot, which drive lifts the pressure foot alternately with the upper fabric slide. The lower fabric slide does not carry out any lifting movement on the pressure foot.

Even in case of this arrangement no satisfactory feed is insured, because the pressure foot moving up and down alternately with the upper fabric slide, is movable jointly with the upper fabric slide counter to an elastic force. As a result when the operation of the sewing machine exceeds a certain speed the entire system of the upper drive gets into an uncontrollable vibration

because of the mass inertia, and prevents a satisfactory even fabric feed.

SUMMARY OF THE INVENTION

The present invention is based on the objective of creating a combined upper and lower fabric conveyance device for sewing machines with a resiliently mounted pressure foot and driven upper and lower fabric slides, which guarantees a satisfactory fabric feed even at high sewing speeds and which adjusts automatically to any given thickness of fabric.

This objective is achieved essentially by limiting the movement of the lower fabric slide away from the needle plate to an extent avoiding a lifting movement of the pressure foot and urging the pressure foot constantly against the needle plate or the sewing material on it.

By such a limitation of the movement of the lower fabric slide away from the needle plate, the pressure foot will stop at a level adjusted automatically to the fabric thickness and is not lifted by the lower fabric slide. The pressure foot system does not begin to vibrate, and even in case of high sewing speeds a satisfactory fabric feed will be achieved.

Preferably, the lower fabric feed, carrying out a lifting movement in a customary manner is urged under the action of a spring in the direction of the pressure foot, the force of this spring being less than the spring power, urging the pressure foot against the needle plate and the lower fabric slide. As a result of such a spring loading of the lower fabric slide, a secure engagement of the teeth of the lower fabric slide with the fabric will be guaranteed without lifting the pressure foot.

In another embodiment of the invention the lower fabric slide has a reciprocating movement without lifting movement and moves with the upper edge of its teeth in the plane of the upper edge of the needle plate. This embodiment with a non-vertical movement lower fabric slide is particularly advantageous in case of a connection of the upper fabric slide with the pressure foot by way of a ternary member, which is spring loaded against the needle plate and which has an upper fabric slide resiliently mounted with respect to its driving parts. In such a combination, the pressure foot upon engagement of the upper fabric slide is relieved of the spring force of the spring acting on the upper fabric slide and permits an easy lifting thereof by the fabric. Whenever the upper fabric slide lifts up, i.e., whenever fabric conveyance is interrupted and both fabric slides move back, the full power of the spring acting on the pressure foot again becomes effective and securely holds the fabric against any reverse drive by the returning lower fabric slide. In such a combination the sum of the spring forces acting on the upper and lower fabric slides is less than the spring force acting on the ternary member connecting the upper fabric slide and the pressure foot.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings:

In the drawings:

FIG. 1 is a side elevational view of a sewing machine with portions broken away and shows the essential parts of the drive for a combined upper and lower fabric conveyance device.

FIGS. 2a and 2b are schematic elevational views showing the combined upper and lower fabric conveyance device in different operating positions.

The combined upper and lower fabric conveyance device is shown in connection with a so-called flat bed sewing machine. In this machine a frame 1 of the lower fabric slide is articulately connected with a lever 3 attached on a rocking shaft 2. The lever 3 imparts a reciprocating movement to the frame 1 and thus to the lower fabric slide 4 carried thereby. The fabric slide 4 is given a lifting movement in the customary manner by a lift shaft 5 and by an eccentric 6 disposed thereon. The entire arrangement is disposed in the lower bed 7 of the sewing machine.

The pressure foot arrangement and the drive of the upper fabric slide are mounted in a customary manner in the head 9 of the machine. The pressure foot rod 11, which carries the pressure foot 12 at its lower end, is articulated to a ternary member 13. The upper fabric slide 14 is articulated to a rod 15, which also is in articulated connection with the ternary member 13. The upper fabric slide 14 is urged by the action of a spring 16 against a needle plate 17, from which the lower fabric slide 4 emerges upwardly. The pressure foot rod 11 is under the influence of a spring 18.

The ternary member 13 is connected by way of a connecting joint bar 19 with a lever 21 of a swinging shaft 22. This swinging shaft 22 imparts an up and down motion to the rod 15. The swinging shaft 23 is connected with the rod 15 by a swingle or forked lever 20 by way of a lever 24. A sliding guide 25 is placed between the lever 24 and the rod 15.

In the embodiments shown by way of example, the lift eccentric 6 for the lower fabric slide 4 is articulately connected with a lever 27 by way of a joint bar 26, which lever is articulated to the carrier 1 and is subject to the action of a spring 28. The movement of the lever 27 is limited by the head 29 of the spring bolt 30. The spring 28 urges the lower fabric slide 4 towards the upper fabric slide 14 and the pressure foot 12.

In the FIGS. 2a and 2b the arrangement is shown schematically in two different positions. At the same time and for the better understanding, insignificant changes in the structure have been made in relation to FIG. 1, which however are without influence on the basic function of the arrangement. FIG. 2a shows the arrangement during the fabric feed and FIG. 2b during the return of the fabric slides.

In the position according to FIG. 2b, the swinging shaft 22 rocks the lever 21 counter clockwise. As a result, the ternary member 13 swings around the pivotal point 31 and lifts the upper fabric slide 14 off of the fabric (not shown). The pivotal point 31 is supported by the pressure foot rod 11 and the pressure foot 12, which in this position is under full load and holds the fabric securely on the needle plate. Swinging shaft 23 moves the lever 20 clockwise and imparts a movement counter to the feed of the fabric to the upper fabric slide 14 via the centrally pivoted lever 24. At this time lift shaft 5 has pulled the lower fabric slide 4 downward and the rocking or feed shaft 2 moves the fabric slide 4 counter to the feed direction.

Whenever the shaft 22 moves in the opposite direction, i.e., clockwise corresponding to FIG. 2a, the upper fabric slide 14 is placed on the fabric. The pivotal point 31, however, does not lift up after placement of the upper fabric slide 14, but the spring 16 permits

a further lowering of the hinge point 32. The force of the spring 16 decreases the force of the spring 18 which presses the pressure foot 12 against the fabric. As a result, the friction between pressure foot 12 and fabric is considerably reduced during the feeding of the fabric.

Simultaneously with the pressure engagement of the upper fabric slide 14 with the fabric, the lower fabric slide 4 is lifted. But it only lifts to a point at which the pressure foot 12, being under pressure from the spring 18, resists such movement. In order to avoid any further lifting of the pressure foot 12, the lower fabric slide 4 has been resiliently mounted in relation to its lifting drive by the spring 28. The force of the spring 28 is weaker than the force of the spring 18, reduced by the force of the spring 16. The lower fabric slide 4 therefore, emerges from the needle plate only far enough so that its teeth are buried in the fabric that is to be moved forward without however lifting the pressure foot 12.

Optimum conditions are created with the arrangement according to the present invention. Whenever the two fabric slides 4 and 14 move counter to the feed direction and the feed is interrupted, the pressure foot 12 jams the fabric against the needle plate 17 under the greatest available power of the spring 18. As a result, momentum feeding of the fabric and thus variable lengths of stitches at variable sewing speeds will be safely avoided. Whenever the fabric slides 4 and 14 grip the fabric, the greatest possible contact pressure is imparted to them by the springs 16 and 28. The pressure foot 12, however, is relieved by this pressure. As a result, the fabric is gripped securely and is pulled underneath the relieved pressure foot 12. This also contributes to the achievement of a uniform length of the stitches at variable sewing speeds. Furthermore, the fact that the pressure foot 12 does not carry out a movement, but is merely alternately loaded and relieved, also contributes to the uniform stitch length. This characteristic of the pressure foot 12 is of decisive importance for the achievement of high sewing speeds at optimum feed conditions.

Depending on the type of the fabric that is to be fed in, one can achieve an almost equal method of operation whenever no lifting movement is imparted to the lower fabric slide 4 and it is adjusted such that it emerges with its teeth from the needle plate to such a point that it engages with the fabric but does not lift the pressure foot 12. The fabric slide 4 slides along the fabric during its movement counter to the direction of feed without however carrying along the fabric, since the fabric is held securely on the needle plate under the greatest clamping power directed to the pressure foot 12 during this period.

Naturally it is also possible to limit the lifting movement of an unsprung fabric slide, which has a lifting movement in addition to the feed movement in the customary manner in such a way, that it will not lift the pressure foot.

We claim:

1. A fabric feeding device for a sewing machine comprising a needle plate, a pressure foot, first means mounting said pressure foot for cooperation with said needle plate including a pressure foot spring constantly urging said pressure foot towards said needle plate, a lower fabric slide disposed in cooperating relation with said pressure foot, second means mounting said lower

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fabric slide for reciprocating movement generally parallel to said needle plate, third means connected to said pressure foot for reducing the effective pressure of said pressure foot spring on said pressure foot during the fabric feeding movement of said lower fabric slide and said lower fabric slide projects through said needle plate only to the extent that fabric being sewn is effectively gripped thereby, and means limiting such projection to one wherein lifting movement of said pressure foot is avoided.

2. A fabric feeding device for a sewing machine comprising a needle plate, a pressure foot, first means mounting said pressure foot for cooperation with said needle plate including a pressure foot spring constantly urging said pressure foot towards said needle plate, a lower fabric slide disposed in cooperating relation with said pressure foot, second means mounting said lower fabric slide for reciprocating movement generally parallel to said needle plate, third means connected to said pressure foot for reducing the effective pressure of said pressure foot spring on said pressure foot during the fabric feeding movement of said lower fabric slide said second means includes a lower fabric slide spring resiliently urging said lower fabric slide towards said pressure foot, and the effective force of said lower fabric slide spring is less than that of said pressure foot spring.

3. A fabric feeding device for a sewing machine comprising a needle plate, a pressure foot, first means mounting said pressure foot for cooperation with said needle plate including a pressure foot spring constantly urging said pressure foot towards said needle plate, a lower fabric slide disposed in cooperating relation with said pressure foot, second means mounting said lower fabric slide for reciprocating movement generally parallel to said needle plate, third means connected to said pressure foot for reducing the effective pressure of said pressure foot spring on said pressure foot during the fabric feeding movement of said lower fabric slide, said second means mount said lower fabric slide for reciprocating movement only, and said lower fabric slide has fabric engaging teeth with upper edges lying substantially in the plane of the upper surface of said needle plate.

4. A fabric feeding device for a sewing machine comprising a needle plate, a pressure foot, first means mounting said pressure foot for cooperation with said needle plate including a pressure foot spring constantly urging said pressure foot towards said needle plate, a lower fabric slide disposed in cooperating relation with said pressure foot, second means mounting said lower fabric slide for reciprocating movement generally parallel to said needle plate, third means connected to said

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pressure foot for reducing the effective pressure of said pressure foot spring on said pressure foot during the fabric feeding movement of said lower fabric slide, an upper fabric slide, and fourth means mounting said upper fabric slide for cooperation with said lower fabric slide and for reciprocating movement in unison therewith.

5. The device of claim 4 wherein said fourth means includes an upper fabric slide spring urging said upper fabric slide towards said needle plate, and said third means includes means for actuating said fourth means to move said upper fabric slide towards said needle plate compressing said upper fabric slide spring and transferring the force thereof to oppose the force of said pressure foot spring and thus relieve the effective pressure of said pressure foot spring.

6. The device of claim 4 wherein said first and fourth means include first and second support rods for said pressure foot and said upper fabric slide respectively, and said third means includes a ternary member separately pivotally connected to said first and second support ends, and actuating means connected to said ternary member to effect pivoting thereof in timed relation to the reciprocation of said upper and lower fabric slides.

7. The device of claim 6 wherein the connection between said ternary member and said first support rod defines a pivot for said ternary member.

8. The device of claim 6 wherein said fourth means includes an upper fabric slide spring extending between said upper fabric slide and said second support rod and said ternary member being operable when pivoted to depress said second support rod against the force of said upper fabric slide spring and transfer the reaction therefrom to said pressure foot spring to reduce the force exerted thereby on said pressure foot.

9. The device of claim 8 wherein the connection between said ternary member and said first support rod defines a pivot for said ternary member.

10. The device of claim 8 wherein said second means includes a lower fabric slide spring resiliently urging said lower fabric slide towards said pressure foot, and the combined effective force on said pressure foot of said upper and lower fabric slide springs is less than that of said pressure foot spring.

11. The device of claim 4 wherein said second mounting means include spring means for biasing said lower fabric slide in a direction towards that upper fabric slide, and said fourth mounting means includes spring means for biasing said upper fabric slide in a direction towards said lower fabric slide.

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