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[54] **RIBBON FEEDING ATTACHMENT FOR SEWING MACHINES**

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[51] **Int. Cl.** **D05b 35/06**

[58] **Field of Search** 112/151, 121.26, 136, 150, 112/52

[56] **References Cited**

UNITED STATES PATENTS

2,266,538	12/1941	Evans	112/121.26
2,377,204	5/1945	Beyer	112/152

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[57] **ABSTRACT**

A device attached to a sewing machine for a tension-free feeding of ribbons to be sewn on a fabric, comprises a delivery roller driven at least at the maximum speed of the fabric advance, around which the ribbon drawn off a magazine roll is loosely wrapped in at least one loop before being fed under the pressure foot of the sewing machine. A comb-shaped ribbon retarder defines a meander ribbon feed path and it is mounted between the magazine roll and the delivery roller to hold the ribbon prestressed. At low speeds of the fabric, the draw-off force is small, the ribbon loop is kept loose and the delivery roller is permitted to slip on the ribbon, while at higher speeds of the fabric, the loop is tightened and the increased friction enables the delivery roller to drive the ribbon more effectively so that at any fabric speed, the draw-off and the friction forces are balanced and the ribbon is uniformly and easily fed. The necessary draw-off force to be applied may be reduced by increasing the member of ribbon loops on the delivery roller in which case, in order to prevent superposing of the loops, spacers are provided which are disposed on a rod extending parallel and close to the roller surface.

9 Claims, 3 Drawing Figures

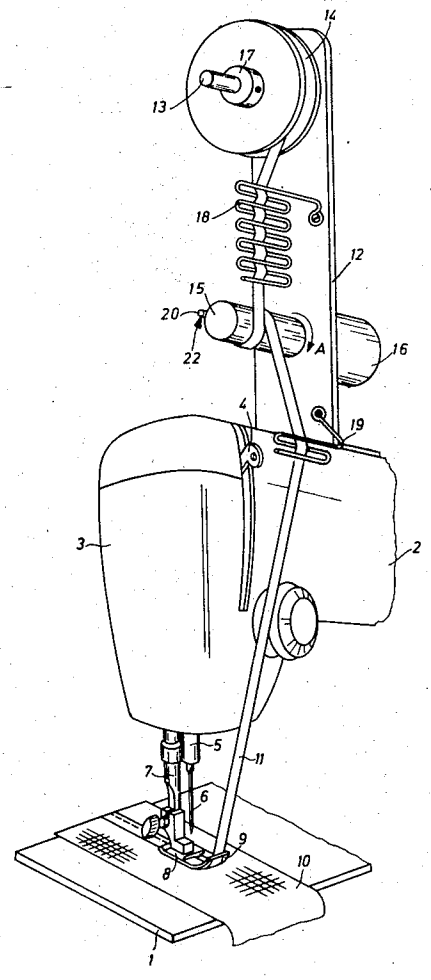


Fig. 1

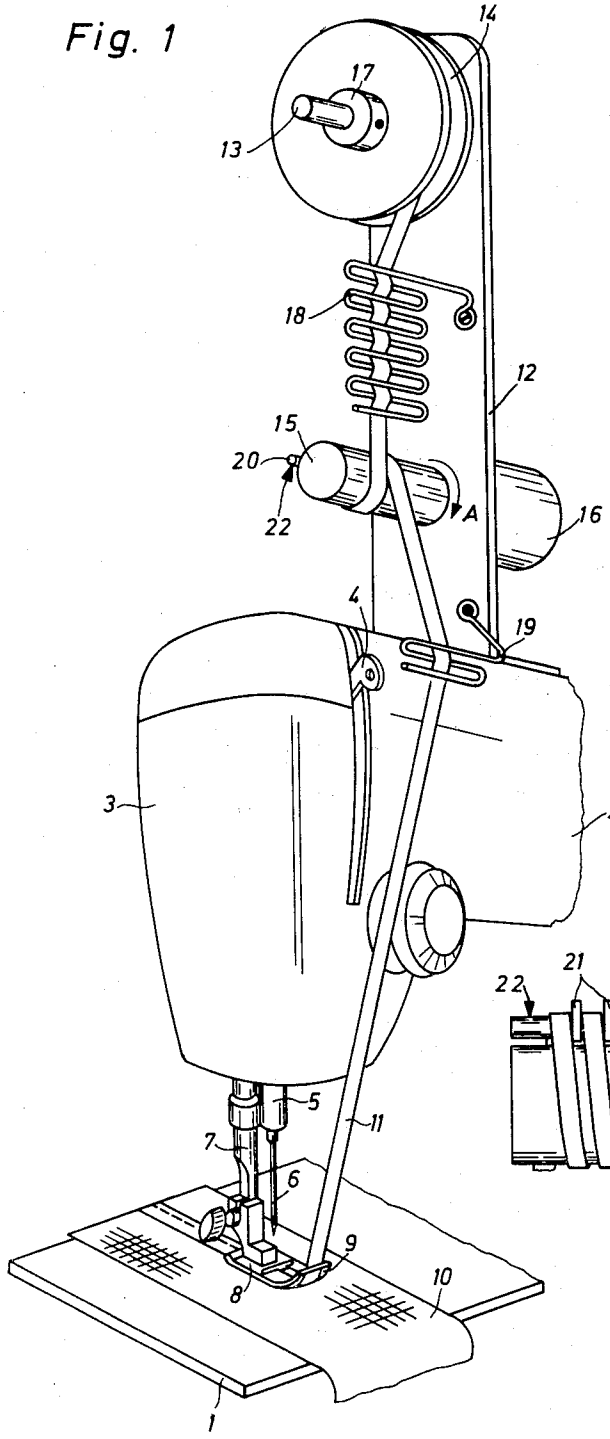


Fig. 3

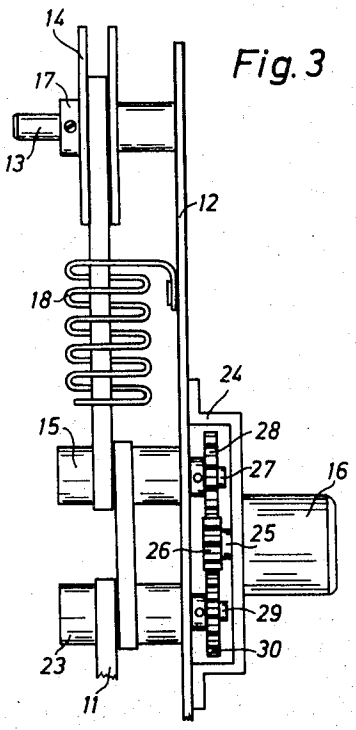
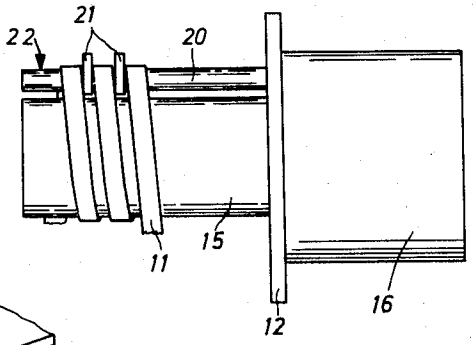


Fig. 2



RIBBON FEEDING ATTACHMENT FOR SEWING MACHINES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to sewing machines and, in particular, to a new and useful device for a uniform and tension-free feeding of ribbon-like strips to be sewn on a fabric into the sewing machine, comprising a delivery roller which is supported on the housing arm of the machine and driven at a peripheral speed at least equal to the maximum fabric speed and around which the ribbon supplied from a magazine roll is wrapped in at least one loop so that the ribbon, whose substantially constant prestress before the delivery roller is assured by a comb-shaped ribbon brake, can easily be drawn off and fed in under a small final tension.

2. Description of the Prior Art

In various sewing operations, ribbons, rubber laces, and trimmings to be sewn on a base fabric must be fed to the stitch forming location under a low tension, in order to obtain satisfactory results.

Known feeding devices of this kind substantially include a delivery roller, an idle back-up roller, a fixed guide rod and a feeler lever cooperating with a mercury switch. The ribbon supplied from a magazine roll passes between the delivery roller and the idle roller, through a guide eye of the feeler lever and finally through a guide eye of the horizontally extending guide rod and a loop is formed between the delivery roller and the guide eye of the guide rod.

Devices of this type operate on the principle of a two-position controller in which the feeler lever scans the sag of the ribbon loop and represents the controlled variable. As soon as the sag has attained a minimum value, the swinging up of the feeler lever starts the driving motor of the delivery roller by actuating a mercury switch. A further ribbon portion is then drawn off the magazine roll. Thereby, the sag of the ribbon loop becomes deeper until the feeler lever, which swings down under its own weight, stops the driving motor in its lower swinging position.

Because of its design as a two-position controller with a movable feeling member and a switch for controlled starting and stopping of the driving motor, the known device is relatively expensive. That is why the problem arose to provide a mechanism for feeding ribbons into a sewing machine permitting, during the sewing operation, the holding of the ribbon under a low tension and which includes a delivery roller which is driven independently of any ribbon measuring or feeling device.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided an improved device for feeding ribbons in a sewing machine in which the ribbon is loosely passed around a delivery roller which, at least during each sewing operation, is continuously driven.

In a preferred embodiment of the invention, the ribbon is passed, at least once, around the whole circumference of the delivery roller, in the sense of rotation of the roller. As long as the ribbon portion extending between the delivery roller and the stich forming location is not subjected to a tensile force, the ribbon loop remains applied loosely to the circumferential surface of the delivery roller. Thereby, owing to the continuous rotary motion of the roller and at least during each sewing operation, a frictional force acting in the direction of the ribbon feeding is produced between the roller and the ribbon. This force, however, is not sufficient for drawing off a new portion of ribbon from the magazine roll. But as soon as the ribbon is subjected to a tension resulting from the advance of the fabric during the sewing operation, the ribbon loop is tightened about the delivery roller and, in comparison with the previous loose wrapping, the friction between the delivery roller and the ribbon is considerably increased. This friction depends on the tensile force applied at the exit of the device, that is at the ribbon portion extending between the delivery roller and the sewing machine, as well as on the roughness or grip of the peripheral surface of the delivery roller. A very small tensile force is already sufficient to draw a further ribbon length off the magazine roll.

Provided there is a regular forward motion of the ribbon, the result is that during each sewing operation, a state of equilibrium sets in between the withdrawal force applied at the end of the ribbon and the slip occurring between the ribbon and the delivery roller. Consequently, at the stitch forming location, the ribbon moves forward at a uniform speed and under a constantly small tensile stress.

The feeding of the ribbon, in conformity with the needed length and with the fabric advance, is thus controlled quite automatically by the slip variation between the ribbon and the delivery roller. Also, the delivery roller can be driven continuously at a constant peripheral speed, independently of the actually needed ribbon length.

The inventive device may remain switched on also during the time between two sewing operations, when the sewing machine is stopped and no ribbon is fed. That is, in such a period of time, the ribbon loop on the delivery roller is sufficiently loosened so that the friction is too small to cause a forwarding of the ribbon. It is proved by the present invention that a ribbon can be fed into a sewing machine under a very small tensile stress even with the aid of a device whose construction, as compared to a two-position controller, is most simple. Two substantial advantages are combined in the inventive device, namely very low manufacturing costs and a high reliability as well as insensitivity to troubles in service, due to the small number of component parts which, in addition, are very simple and almost nonwearing.

In accordance with the rope friction law, provided the draw-off tension at the ribbon supply side of the device remains constant, the withdrawing force to be applied at the delivery side can be reduced further by increasing the angle of wrap.

If, to this end, the ribbon is passed around the delivery roller more than once, a guide fixture is provided, in accordance with the invention, which is mounted close to the surface of the delivery roller and carries a plurality of guide pieces arranged side by side at adjustable distances. The ribbon is then passed around the delivery roller so that the neighboring ribbon loops are separated from each other by a guide piece. Thus, the loops are guided laterally and can neither superpose nor hinder one another.

Accordingly, it is an object of the invention to provide a device for continuous feeding of a ribbon or ribbon-like strip into a sewing machine, comprising a de-

livery roller driven at a circumferential speed at least equal to the maximum advance speed ribbon in the machine and around which the ribbon supplied from a magazine roll can be loosely wrapped in at least one loop following the sense of rotation of the roller.

Another object of the invention is to provide a guide fixture associated with and located close to the peripheral surface of the delivery roller and preventing a superposition, or hindering of the individual loops of the ribbon.

Another object of the invention is to provide the guide fixture in the form of a rod mounted parallel to the delivery roller for feeding ribbon to a sewing machine and carrying guide pieces adjustably spaced thereon, the loops of the ribbon being passed around both the delivery roller and the rod and separated from one another by the guide pieces.

Another object of the invention is to provide a continuous drive of the delivery roller for ribbon of a sewing machine at least during the time of each sewing operation.

Another object of the invention is to provide an appropriate, preferably coated, surface of the delivery roller so as to obtain a desired smoothness or grip of the same.

A further object of the invention is to provide a device for a continuous and tension-free feeding of a ribbon-like strip into a sewing machine which is simple in design, rugged in construction and economical to manufacture.

For an understanding of the principles of the invention, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a partial perspective view of a sewing machine equipped with an attachment for a continuous feeding of a ribbon, in accordance with the invention; and

FIG. 2 is an enlarged top plan view of a delivery roller provided with a guide fixture according to the invention and

FIG. 3 is a side elevational view partly in section of another embodiment of the invention.

GENERAL DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, in particular, the invention embodied therein, as shown in FIG. 1, comprises a device for feeding a ribbon attached to a sewing machine of which only a part of the base plate 1 and the forepart of the housing arm 2 with the head 3 are represented.

The head 3 supports a thread guide or take-up lever 4, a needle bar 5 holding the needle 6 and a pressure foot bar 7. A pressure foot 8 is secured to the bar 7 and provided with a guide aperture 9 through which a ribbon 11 to be sewn on a fabric 10 can be passed.

In the embodiment shown in FIG. 3 parts which are identical with those shown in FIG. 1 are designated with the same numeral. In this construction however an additional delivery roller 23 is rotatably mounted on support 12 in line with and immediately the roller 15. The ribbon 11 is guided around the delivery roller 23 in one complete loop before it is passed to the pressure foot 8. The drive motor 16 is then connected to rotate each of the rollers 15 and 23 and in one suggested arrangement this drive connection may be from a drive shaft 25 and drive gear 26 to driven gears 28 and 30 on respective roller shafts 27 and 29 of the rollers 15 and 23. The motor 16 is advantageously mounted on a gear housing 24 which contains the gear 26, 28 and 30.

The inventive device includes an angle support 12, a bar axle 13 rotatably mounted on the upper end portion of the support and adapted to bear a magazine roll 14 for the ribbon 11, and a delivery roller 15 rotatably mounted on the support 12 so as to extend below the magazine roll 14. The roller 15 is connected to and driven by a motor 16 disposed on the opposite side of the support 12.

To fix the magazine roll 14 laterally, setting rings 17 are mounted on the bar axis 13, at each side of the roll. A comb-shaped ribbon brake 18 or continuous flat coil member defines a meander ribbon path around alternate fingers and it is located between the magazine roll 14 and the delivery roller 15 and secured to the support 12. A similar ribbon guide 19 is fixed to the lower end portion of support 12 and protrudes outwardly away from the housing arm 2 of the machine, and keeps the ribbon out of the range of action of the thread guide or take-up lever 4. Close to the delivery roller 15 and parallel thereto, another bar 20 is mounted on the support 12. Several disk-shaped guide pieces 21 are disposed on the bar 20, and can be displaced along the same. The bar 20 and the guide pieces 21 form together a guide fixture 22.

The device operates as follows:

After a magazine roll 14 is slipped onto bar 13, the ribbon 11 is passed through successive fingers of the ribbon brake 18, around the delivery roller 15 following the sense of rotation of the same, through the ribbon guide 19 and the guide aperture 9 of the pressure foot 8, and is clamped under the foot.

Before starting the sewing operation, the driving motor 16 is switched on and thereby the delivery roller 15 is put into regular rotation, The circumferential speed of the delivery roller 15 is at least equal to the maximum feeding speed of ribbon 11, usually corresponding to the maximum sewing speed.

As long as no tensile force is exerted on the ribbon portion extending between the delivery roller 15 and the stitch forming location, the ribbon loop reposes loosely on the delivery roller 15 and the roller 15 exerts a slight friction force on the ribbon, in the feeding direction. However, this friction force is not sufficient to overcome the braking force of the ribbon brake 18 and to draw ribbon 11 from the magazine roll 14.

At the start of the sewing operation, the advanced fabric 10 entrains the ribbon 11 introduced under the pressure foot 8 and the tensile force thereby produced is transferred to the ribbon portion between the foot and the delivery roller 15 and causes a tightening of the ribbon loop on the delivery roller. Consequently, the friction force between the delivery roller 15 and the ribbon 11 increases as a function of the tensile force exerted on the ribbon portion extending below the delivery roller 15, the roughness or grip of the circumferential surface of the delivery roller 15 and the angle of wrap of the ribbon 11 on the delivery roller 15. The relation of these influence factors follows the known law of rope friction:

$$P1 = P2 \cdot e^{\mu\alpha}$$

where:

P1 is the tensile force at the entrance of the device (above the delivery roller)

P2 is the tensile force at the exit of the device (below the delivery roller)

e is the base of natural logarithms = 2.718

μ is the friction coefficient between the ribbon **11** and the delivery roller **15**

α is the angle of wrap in radian measure.

According to this relation, the tensile force produced at the exit of the device is so amplified that a very small force applied in addition is sufficient to overcome the braking effect of the ribbon brake **18** and the friction between the magazine roll **14** and the bar axis **13** and to draw-off a new portion of ribbon **11** from the magazine roll **14.** At the same time, the ribbon brake **18** produces a braking force with the effect that the ribbon **11** is supplied to the delivery roller **15** with a constant prestress and is forwarded from the delivery roller **15** continuously and without jerks.

In consequence, provided that in the stitch forming zone the ribbon is advanced at a regular speed, a state of equilibrium sets in between the applied tensile force and the slip occurring between ribbon **11** and delivery roller **15.** Thus, ribbon **11** is fed into the machine at a regular speed and under a constant, small tensile stress. As soon as the sewing operation is terminated, no further tensile force is exerted on ribbon **11.** Therefore, the ribbon loop on the delivery roller **15** is loosened and while the delivery roller **15** continues to rotate, no ribbon **11** is drawn off the magazine roll **14.**

As it follows from the above formula, a further reduction of the tensile force to be applied at the exit of the device can be obtained, while keeping the tension of the ribbon portion above the delivery roller constant, for example by increasing the angle of wrap of the ribbon. For this purpose, as shown in FIG. **2,** ribbon **11** is passed around the delivery roller **15** several times, each loop being passed also around the bar **20.** The guide pieces **21** disposed between the adjacent loops prevent a superposition and mutual hindering of the same.

Further possibilites of reducing the tensile force to be applied are, for example, to provide a coating of the delivery roller **15** in order to increase the grip and thereby the friction coefficient, or to use, in addition to the first delivery roller **15,** a second synchronously driven delivery roller, to increase the angle of wrap.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. An attachment for feeding ribbon-like strips to be treated under a small tensile stress to the stitch forming location below a foot of a sewing machine, comprising a ribbon supply reel, a delivery roller adjacent said ribbon supply reel, a separate drive motor connected to said delivery roller for rotating said delivery roller at a permanently constant circumferential speed corresponding at least to the maximum possible advance speed of the strip in the machine, means for guiding the ribbon from the ribbon supply reel loosely around said delivery roller in at least one complete and loose loop of at least 360° and following the sense of rotation of the delivery roller and to the sewing machine foot, said delivery roller being driven continuously at least during each sewing operation.

2. An attachment according to claim **1,** including a guide fixture located close to the circumferential surface of the delivery roller defining a meander path through which the ribbon is directed.

3. An attachment according to claim **2,** wherein said guide fixture comprises a guide rod extending along and close to the circumferential surface of the delivery roller, on which spaced apart guide fingers are disposed around which the ribbon is guided.

4. An attachment according to claim **2,** wherein the circumferential surface of said delivery roller is provided with a surface friction coating, so as to increase the friction coefficient between the strip and the delivery roller.

5. An attachment according to claim **1,** wherein in order to increase the angle of wrap, two delivery rollers are provided.

6. An attachment according to claim **1,** including a comb-like guide disposed between said ribbon supply reel and said delivery roller having spaced parallel fingers over which the ribbon is alternately looped over and under so as to follow a meander path thereover, and a guide member disposed between said delivery roller and the foot of the sewing machine.

7. A method of feeding ribbon to the foot of a sewing machine for sewing to a material comprising directing at least one complete loop of 360° of the ribbon from a supply reel over a rotatable delivery roller on its way to the foot and rotating the roller continuously at a constant circumferential speed corresponding at least to the maximum possible advance speed of the ribbon in the foot during sewing while retarding the ribbon between the supply reel and the delivery roller.

8. A method, according to claim **7,** wherein the ribbon is retarded by directing it through a meander path before the delivery roller.

9. An attachment according to claim **1,** including a fixed bar guide located alongside and substantially parallel to said delivery roller, said at least one loop of said ribbon comprising a plurality of loops engaged around said delivery roller and said guide bar, and a plurality of spacer pieces overlying said bar located between adjacent loops of said ribbon and maintaining the spacing between the loops during operation.

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