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Albrecht et al.

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[54] **RIBBON FEEDING DEVICE IN BUTTONHOLE SEWING MACHINES**

[75] Inventors: **Ernst Albrecht,** Hochspeyer; **Klaus Hubele,** Kaiserslautern, both of Germany

[73] Assignee: **Pfaff Industriemaschinen GmbH,** Kaiserslautern, (Pfalz), Germany

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[51] **Int. Cl.** **D05b 3/04**

[58] **Field of Search** 112/65, 66, 68, 70, 77, 112/130, 152, 121.27

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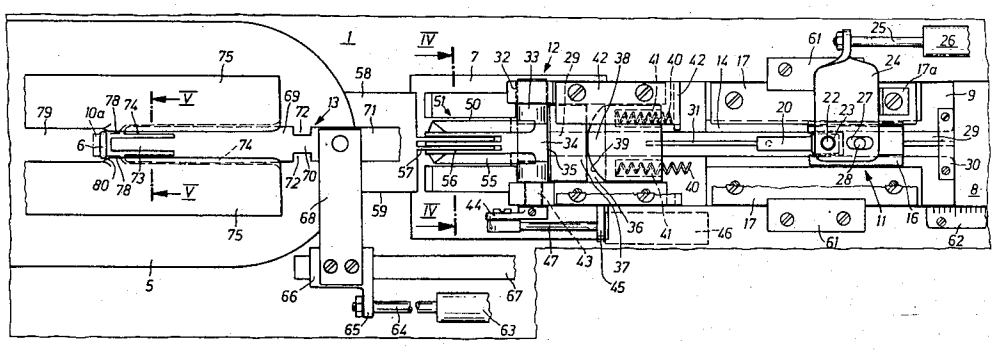
Primary Examiner—H. Hampton Hunter
Attorney, Agent, or Firm—McGlew and Tuttle

[57] **ABSTRACT**

The machine forms buttonholes reinforced by a ribbon stitched beneath the material fed over the feeding surface of a stitch plate to a sewing needle at a stitch formation location. The stitch plate is formed with a channel in the working zone of the material feeding frame and extending to the stitch formation location, and the upper edges of the channel have inwardly projecting ledges which, in the working zone of the material feeding frame, are flush with the feeding surface. The ribbon feeder is a relatively elongated strip of spring steel reciprocable, in guided relation, between a receiving zone, at which it engages a ribbon fed from a supply thereof and feeds a length of the ribbon into the channel and to the stitch formation location, the strip being reversely reciprocable to the receiving zone. The forward or leading end of the strip is trifurcated to form a middle finger pressing against the ribbon length and two outer fingers serving as guide surfaces projecting laterally over the ribbon and engageable beneath the ledges to press the middle finger against the ribbon. Intermediate its ends, the strip is bent upwardly and formed with a pair of laterally aligned outwardly opening notches engageable with the ledges. The rear end of the strip is curved upwardly and engageable by a ribbon supplying element, during supplying of the ribbon to the ribbon feeder, to lift the ribbon feeder for advance of the ribbon beneath the ribbon feeder. After a length of the ribbon has been advanced to the sewing needle and held in position by the ribbon feeder, a cutter severs the ribbon length from the remainder of the ribbon supply. An electromagnetic-pneumatic control arrangement is provided for operating the machine in repetitive buttonhole forming cycles.

10 Claims, 6 Drawing Figures



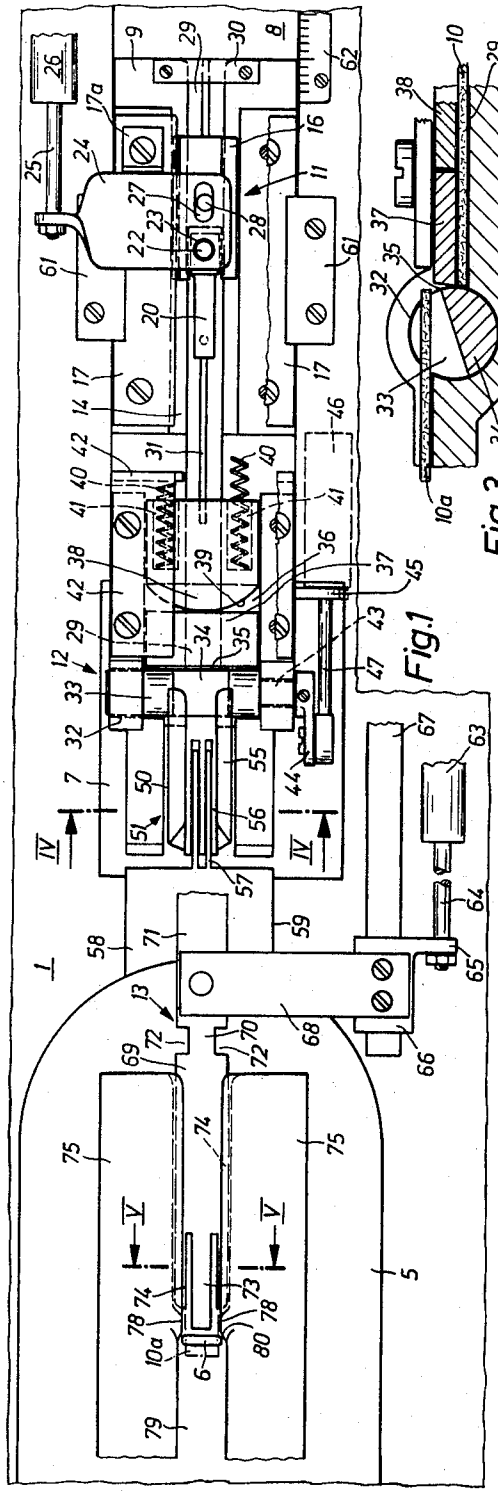


Fig.1

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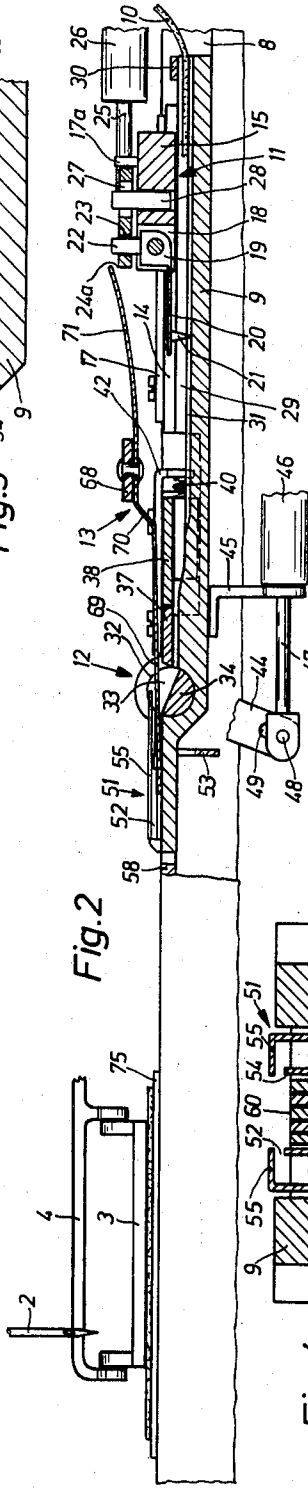


Fig.2

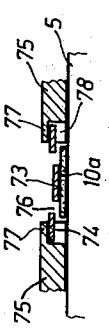
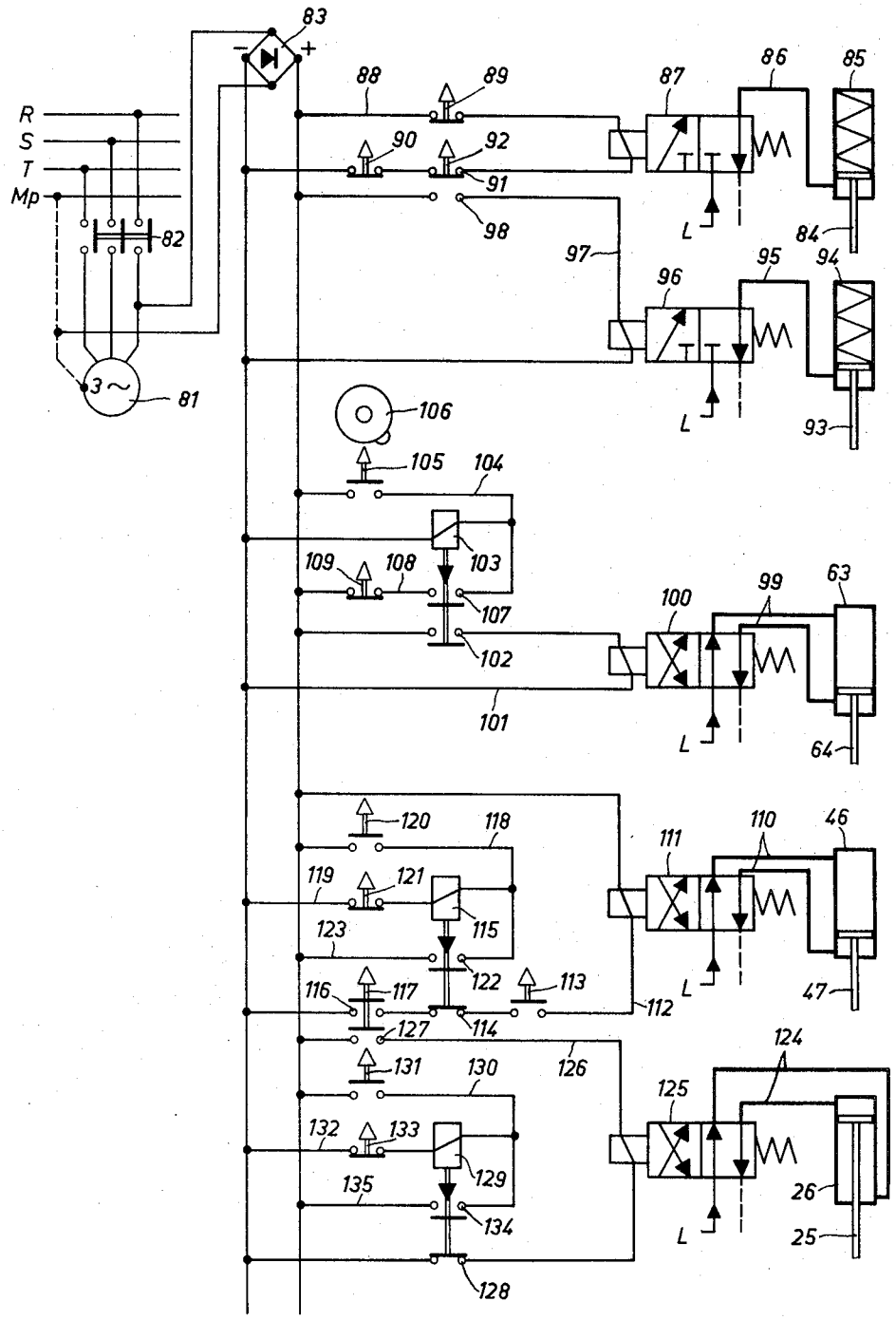


Fig.5

Fig.4

Fig.6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RIBBON FEEDING DEVICE IN BUTTONHOLE SEWING MACHINES

FIELD AND BACKGROUND OF THE INVENTION

This invention relates to ribbon feeding in buttonhole sewing machines for forming ribbon-reinforce buttonholes and in which a ribbon is fed to a stitch forming location by a ribbon feeder at timed intervals adapted to the working ribbon of the machine. More particularly, the present invention is directed to an improved ribbon feeding device for such a machine.

Known ribbon feeder for buttonhole sewing machines for manufacturing ribbon-reinforced buttonholes have the disadvantage that, after the ribbon has been fed below the main material or fabric feeding frame, the ribbon, or a cut ribbon length, lies loosely in a channel leading to the sewing needle. Thus, when the main material or fabric is introduced, or the material feeding frame is lowered, the ribbon length may be displaced from its predetermined position. In such a case, the ribbon is sewn irregularly to the buttonhole.

SUMMARY OF THE INVENTION

The objective of the invention is to provide an automatically operating ribbon feeder which securely retains a length of ribbon in place during and after the feeding of the main material or fabric and lowering of the main material feeding frame, the ribbon feeder being retracted only after the position of the ribbon length, beneath the main material, has been perfectly secured by a least a few stitches.

In accordance with the invention, this problem is solved by providing a ribbon feeding strip of flexible material, such as spring steel, which may be reciprocated within the range of the lowered material feeding frame, in the longitudinal direction of the ribbon. The leading or forward end of the strip comprises guide surfaces projecting laterally over the ribbon or ribbon length, and the strip can be introduced into a channel provided in the stitch plate of the sewing machine in the working zone of the material feeding frame. The upper edges of this channel are formed with inwardly projecting ledges which, in the working zone, are flush with the feeding surface over which the material feeding frame feeds the main material or fabric. The guide surfaces engage beneath these ledges and thus serve to press the leading end of the strip against the ribbon to hold the same firmly against the bottom of the channel.

Thereby, the ribbon feeding strip secures the position of the ribbon length in the stitch formation zone even after the material feeding frame has been lowered. An unintentional displacement of the ribbon length, during the introduction of the main material or lowering of the material feeding frame, is therefore effectively prevented.

According to a further feature of the invention, the ribbon feeding strip is formed with a tongue constituting the central part of the forward portion of the strip and resiliently applying against the ribbon length. This tongue is longer than the lateral guide surfaces of the strip and, because of its smaller width, can be introduced into a narrowed portion of the feed channel provided immediately before the stitch formation location and having a width corresponding to that of the ribbon.

Thus, during the feed operation, the ribbon feeding strip engages only the forward or leading portion of the ribbon length, displaces the latter into the stitch formation location and retains it there in a position perfectly aligned, relative to the stitch forming components of the sewing machine, until it is securely stitched to the main material.

As, during the formation of the buttonhole, the portion of the ribbon length one fixed is displaced along with the main material, the not yet fixed portion of the ribbon length which is then advance to the stitch formation location and which, due to the previous drawing off of the ribbon from a supply reel, is affected by a certain twist, becomes sufficiently straightened before the stitching operation, while passing a throat of the channel.

In a well-known manner, before coming into the operational zone of the ribbon feeding device, the ribbon is advanced, by a ribbon supply device, through a ribbon guide channel to the feeding strip. In this phase, the ribbon feeding strip is brought into an elevated position and the ribbon is introduced below the strip. Advantageously, in this position, the tongue of the feeding strip is located between lateral walls of a vertically movable guide member comprising inwardly open slits into which the lateral guide edges of the ribbon feeding strip are slidingly received. Thus, as the feeding strip is elevated during the supply of the ribbon thereto, the guide member is elevated at the same time and the lateral guidance of the ribbon is ensured.

An object of the invention is to provide an improved ribbon feeding device for buttonhole sewing machines for forming ribbon-reinforced buttonholes.

Another object of the invention is to provide such a ribbon feeding device which securely retains a ribbon length during introduction of the main material or fabric to a stitch formation location and during lowering of a main material feeding frame, and which ribbon feeding device is retracted only after the position of the ribbon length, below the main material, has been perfectly secured by at least a few stitches.

A further object of the invention is to provide such a ribbon feeding device comprising a relatively elongated strip of resilient material having a trifurcated leading end including a central tongue engageable with the ribbon and a pair of outer tongues forming guide surfaces projecting laterally over the ribbon and engageable beneath inwardly projecting ledges extending along the upper edges of a ribbon receiving channel formed in a stitch plate having a main material feeding surface, with the ledges, in the working zone of a material feeding frame, being flush with the feeding surface.

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 DRAWINGS

In the Drawings:

FIG. 1 is a top plan view of a part of the bed of a buttonhole sewing machine having a ribbon feeding device embodying the invention, the ribbon feeding device being shown in its feeding position;

FIG. 2 is an elevational view, partly in section, of the same part as illustrated in FIG. 1, the ribbon feeding device being shown in its retracted position;

FIG. 3 is an enlarged sectional view of a ribbon cutting mechanism;

FIG. 4 is an enlarged transverse sectional view taken along the line IV—IV of FIG. 1;

FIG. 5 is an enlarged transverse sectional view taken along the line V—V of FIG. 1; and

FIG. 6 is a simplified connection diagram showing a combination of electric and pneumatic control elements for controlling the operation of the ribbon supplying and ribbon feeding devices.

GENERAL DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to FIGS. 1 and 2, a buttonhole sewing machine for forming ribbon-reinforced buttonholes, comprises a bed 1, a sewing needle 2, a main material or fabric feeding frame 3, a support 4 for the latter, and a needle plate 5 in which a needle hole 6 is provided.

Bedplate 1 of the machine is formed with an opening 7 and a recess 8 accommodating a supporting plate 9 of a ribbon supplying or drawing device serving to draw off a ribbon 10 from a ribbon reel, which has not been shown, for feeding of a ribbon length below sewing needle 2 by the ribbon feeding device, and to cut off a ribbon length 10*a*. To this end, there is provided a ribbon drawing mechanism 11 for supplying ribbon 10 to a cutting mechanism 12 to a ribbon feeder 13 which feeds ribbon lengths, such as the lengths 10*a* separated from the remainder of the ribbon by a cutting mechanism 12, one by one into the stitch formation location defined by the sewing needle 2 and the stitching hole 6.

A longitudinally extending guide track 14 is formed in supporting plate 9 and receives a slide 15 constituting the main component part of ribbon drawing mechanism 11. Slide 15 is guided in the track 14 by two laterally projecting ledges 16. Guide ledges 16 are displaceably engaged and held by cover strips 17 which are secured to supporting plate 9. The end portion of slide 15 facing needle 2 is formed with a fork 18 in which an angular rocking lever 19 is swingably mounted. Rocking lever 19 comprises a resilient arm 20 provided with a downwardly projecting point 21 and with a pin 22 projecting upwardly into a bore 23 of an arm 24. Bore 23 has rounded walls so as to be bellmouthed on both ends. Arm 24 is connected to a piston rod 25 of a pneumatically operated double-acting cylinder 26 which is suitably fixed to bed 1, and is further formed with a slot 27 through which a pin 28, fixed in slide 15 projects. The stroke of piston rod 25 is limited by a stop angle 17*a* secured to cover plate 17, against which arm 24 abuts.

The ribbon 10, drawn off the ribbon reel, is introduced into a ribbon channel 29 extending below slide 15. A cover strip 30 serves as a guide element. A longitudinal groove 31 is provided in ribbon channel 29, permitting point 21 of arm 20 to penetrate the ribbon.

Ribbon channel 29 terminates at a transverse bore 32 provided in supporting plate 9 and serving as a bearing for a cylindrical member 33. In its middle portion facing ribbon channel 29, cylindrical member 33 is partly milled off so that a flat is produced forming a cutting face 34. One edge of this face 34 coinciding with the generating line of the cylindrical member serves as a cutting edge 35. Edge 35 cooperates with a flat counterblade 37 which is displaceably mounted in a guide recess 36 of supporting plate 9. Counterblade 37 at the same time forms the upper limitation of ribbon channel 29 and is pressed against the circular periphery of cylindrical member 33 adjacent cutting face 34 by means of a pressure piece 38 whose front edge 39, engaging counterblade 37, is rounded. The pressure is produced by springs 40 which are received in blind holes 41 provided in pressure piece 38 and which engage backing angles 42 secured to supporting plate 9.

Cylindrical member 33 is provided with an extension pin 43 to which a lever 44, projecting downwardly through opening 7 of the bedplate 1 of the sewing machine, is firmly clamped. A pneumatically operated double-acting cylinder 46 is secured to a supporting angle 45 mounted on the bottom surface of supporting plate 9. The piston rod 47 of cylinder 46 carries a pin 48 engaging an elongated slot 49 in lever 44.

Adjacent transverse bore 32 in which cylindrical member 33 is received, supporting plate 9 is provided with two slots 50 (FIG. 4) in which a guide member 51 is inserted. Guide member 51 is assembled of two pieces, each piece comprising, as shown in FIG. 4, a rectangular tube section formed by a sheet-metal strip. The bent longitudinal edges of the sheet-metal strips are not joined to each other so that slots 52, having a function which will be explained later, are formed. The two pieces of guide member 51, inserted into slots 50 and symmetrically designed, are connected to each other by a C-frame 53 projecting downwardly. The lateral inside walls 54 of guide member 51 serve as a lateral guide for ribbon 10 while the latter is advanced over cutting face 34. The top walls 55 of guide member 51 are extended in the rearward direction, as seen in FIGS. 1 and 2, beyond the ends of the lateral walls 54 and their free ends rest against the circular periphery of cylindrical member 33.

The end portion of supporting plate 9 facing needle plate 5 is formed with prongs 56. Corresponding prongs 57 are provided on an intermediate plate 58 which is located between needle plate 5 and supporting plate 9, prongs 57 being received between prongs 56. Intermediate plate 58 is accommodated in a recess 59 milled out in bedplate 1, and serves as a plane sliding surface for advancing ribbon sections 10*a* from the surface 60 of prongs 56, 57 to the surface of the needle plate 5.

To retain supporting plate 9 in place, clamping plates 61 are provided, which are secured to bedplate 1 by screws and hole supporting plate 9 firmly in recess 8. For adjusting the length of the ribbon section 10*a* to be cut off, a rule 62 is provided which is screwed to bedplate 1. By adjusting the lateral edge of supporting plate 9 relative to rule 62, the length of ribbon sections 10*a* can be adjusted.

A pneumatically operated double-acting cylinder 63, fixed to bedplate 1 is connected, through a piston rod 64, to an arm 65 of a sliding piece 66 mounted for displacement on a guide bar 67 extending parallel to the longitudinal axis of the machine and suitably secured to bedplate 1. A flat supporting arm 68, made of spring-steel sheet metal, is screwed to sliding piece 66 and carries ribbon feeding strip 13. Ribbon feeding strip 13 is also made of spring-steel and comprises a forward portion 69, extending almost parallel to the surface of

the bed **1**, and an upwardly offset rear portion **71** connected to forward portion **69** by an upwardly sloping middle portion **70**. In its part adjacent supporting arm **68**, rear portion **71** of the feeding strip **13** also extends parallel to the surface of bed **1** but the free end of portion **71** is slightly bent upwardly.

Lateral recesses or notches are formed on the opposite edges **72** of sloping middle portion **70** to permit portion **70** to pass through the space between top walls **55** of guide member **51**. The front end of forward portion **69** of ribbon feeding strip **13**, facing in the direction of needle hole **6**, is formed with two longitudinal slots trifurcating this end portion into a central tongue **73**, which is narrower than the width of ribbon section **10***a*, and two lateral guide tongues or edges **74** extending along the length of portion **69**. Tongue **73** is bent downwardly slightly at its free end to assure a firm engagement with ribbon section **10***a*.

Two symmetrically designed headplates **75** are firmly secured to needle plate **5** and form a feeding surface against which feeding frame **3** of the machine presses the main material during the sewing operation and over which this material is fed. Between headplates **75**, a feed channel **76** (FIG. **5**) is formed, into which forward portion **69** of ribbon feeding strip **13** can be introduced. Along upper edges of feed channel **79**, headplates **75** are formed with ledges **77** projecting into channel **79**. The upper surfaces of ledges **77** are flush with surfaces of headplates **75**, and the lower surfaces of ledges **77** serve as guides and backing surfaces engaged by lateral guide edges **74** of feeding strip **13** during the feeding operation.

Immediately before needle hole **6**, which is designed as a slot, feed channel **76** is narrowed and forms a throat **78** having a width corresponding to the width of ribbon section **10***a*. Beyond throat **78** in the feed direction, channel **79** is enlarged again and its width corresponds to the length of needle hole **6**. The respective surface **80** of the walls forming the throat **78** and facing needle hole **6** are rounded.

As shown in the connection diagram of FIG. **6**, the drive motor **81** of the sewing machine is supplied with three-phase current (lines R, S, T) through a main switch **82** while the control devices for the air cylinders are supplied with direct current through a rectifier **83**.

In a well-known manner, material shifting frame **3** of the sewing machine is pressed down on the main material or against headplates **75** by means of a compression spring.

For elevating shifting frame **3**, support **4** carrying frame **3** is displaced by the piston rod **84** of a pneumatically operated single-acting elevating cylinder **85** which is secured to the sewing machine in a non-represented manner and connected, through a flexible tubing **86**, to an electromagnetically actuable 3/2-way-valve **87**, i.e., a valve having three ports and two distinct positions. Valve **87** is connected, through a circuit **88**, switches **89**, **90**, and rest contacts **91** of a change-over switch **92**, to rectifier **83**. Switch **90** is actuated by the switching mechanism of the sewing machine so that, at the beginning of the sewing operation, the switch is opened and, at the end of the sewing operation, the switch is closed again.

The switch-on or clutch-in operation of the sewing machine is effected by the piston rod **93** of a pneumatically operated single-acting switch-on cylinder **94** which is connected, through a flexible tubing **95**, to an electromagnetically controlled 3/2-way-valve **96**, i.e., a valve having three ports and two distinct positions. The valve **96** is connected to rectifier **83** through a circuit **97** and the operating contacts **98** of change-over switch **92**.

Cylinder **63**, controlling the ribbon feeding strip **13**, is connected, through a flexible tubing **99**, to an electromagnetically actuable 4.2-way-valve **100**, i.e., a valve having four ports and two distinct positions, which is connected to rectifier **83** through a circuit **101** and the front or make contacts **102** of a relay **103**. Relay **103** is connected to rectifier **83** through a further circuit **104** in which a switch **105** is provided. Switch **105** is briefly actuated, at the beginning of the buttonhole sewing operation, after the formation of some stiches, by means of a cam **106** which is connected to the control disc of the sewing machine.

Relay **103** is also provided with front or make contacts **107** which are connected in a self-holding circuit **108** including also a limit switch **109** which is actuated by a non-represented stop in the upper end position of piston rod **84** of elevating cylinder **85**.

Cylinder **46** is connected, through a flexible tubing **110**, to an electromagnetically controlled 4/2-way-valve **111**, i.e., a valve having four ports and two distinct positions, which is connected, through a circuit **112**, a limit switch **113**, and the rest or back contacts **114** of a relay **115**, as well as through the operating contacts **116** of a limit switch **117**, to rectifier **83**. Relay **115** is connected to rectifier **83** through lines **118** and **119**, a limit switch **120** being connected in line **118** and a limit switch **121** being connected in line **119**. In addition, relay **115** is provided with front or make contacts **122** through which it is connected, by means of lines **123** and **119**, to rectifier **83**.

Cylinder **26** is connected, through a flexible tubing **124**, to a further electromagnetically controlled 4/2-way-valve **125**, i.e., a valve having four ports and two distinct positions, which is connected, through a circuit **126** and the operating contacts **127** of limit switch **117**, as well as the back or rest contacts **128** of a relay **129**, to rectifier **83**.

Relay **129** is connected to rectifier **83** through a line **130** including a limit switch **131** and through a line **132** including a limit switch **133**, and has front or make contacts **134** connected to rectifier **83** through lines **135** and **132**.

Valves **87**, **96**, **100**, **111** and **125** are connected, through respective lines L, to a non-respresented compressed-air source.

In a non-represented manner, while piston rod **64** is in its extreme out-position, arm **65** connected to piston rod **64** actuates limit switches **121** and **133** and, in the extreme inposition of piston rod **64**, the limit switch **117**, whose operating contacts **127** are then closed immediately while the operating contacts **116** are closed with delay.

In the extreme out-position of piston rod **47**, pin **48** actuates limit switch **120** in a manner not shown.

Finally, in the extreme out-position of piston rod **25** of cylinder **26**, arm **24** connected thereto actuates limit switch **131** and, in the extreme in-position of the piston rod, actuates limit switch **113**.

The device operates as follows:

Ribbon **10** supplied, from a non-respresented ribbon reel, is guided below cover strip **30** into ribbon channel

29. At this time, as shown in FIG. 1, ribbon drawing mechanism 11 is in its righthand limit position, cutting face 34 is in rest position and ribbon feeding strip 13 is in its lefthand end position. In this position, feeding strip 13 retains a ribbon section 10*a* in the sewing position. The indications "righthand" and "lefthand" in the following always relate to the views shown in FIG. 1 and FIG. 2.

After switching on main switch 82, motor 81 is started. Valve 87 is switched over through circuit 88, the rest contacts 91 of the change-over switch 92, and closed switches 89 and 90, so that air is supplied into elevating cylinder 85 through flexible tubing 86 and material shifting frame 3 is elevated from needle plate 5 by piston rod 84 of cylinder 85. The machine is now ready for sewing.

After introducing the main material, the operator swings a non-represented treadle into a first operating position in which switch 89 is opened. Thereby, valve 87 switches over so that elevating cylinder 85 is vented and material shifting frame 3 is lowered onto the material under the action of a compression spring.

At a further actuation of the treadle, switch 92 is switched over from its rest contacts 91 to its operating contacts 98 so that valve 96 is connected in the circuit 97. Thereby, air is supplied into the clutch control cylinder 94 through flexible tubing 95 and piston rod 93 puts the buttonhole sewing machine in operation in a well-known manner. The machine begins with the sewing of a buttonhole. In this operation, the ribbon section 10*a* positioned with one of its ends below sewing needle 2 is sewn from below to the main material as a reinforcement of the buttonhole. The not yet cut off end portion of the continuous ribbon 10 is abutting against cutting edge 35 of cutting face 34.

As the sewing machine is started, switch 90 is opened so that the treadle can be swung back into its rest position. At this time, valve 96 is switched over and cylinder 94 is vented.

After some of the first buttonhole stitches have been formed, cam 106 fixed to the control disc of the machine briefly actuates switch 105. Circuit 104 of relay 103 is closed, relay 103 attracts and closes the front or make contacts 102 and 107. Self-holding circuit 108, keeping relay 103 excited, is thereby closed. Also, circuit 101 to valve 100 is closed and cylinder 63 is supplied with compressed air through flexible tubing 99 so that piston rod 64 is retracted into cylinder 63.

As piston rod 64 starts moving, limit switches 121 and 133 are released. Through arm 65, piston rod 64 displaces sliding piece 66 on guide bar 67. Through supporting arm 68, sliding piece 66 draws ribbon feeding strip 13 into its righthand end position, shown in FIG. 2. Thereby, forward portion 69 of ribbon feeding strip 13 is pulled out of channel 76. Due to sloped middle portion 70, rear portion 71 of feeding strip 13 moves above top walls 55 and forward portion 69 moves in slots 52 below top walls 55 of the guide member 51.

In this end or retracted position of ribbon feeding strip 13, arm 65 actuates limit switch 117 in which contacts 127 close immediately while contacts 116 close with delay after the limit switch has been released. Through operating contacts 127, circuit 126 is connected to valve 125 whereby, through flexible tubing 124, cylinder 26 is supplied with compressed air so that piston rod 25 is moved into its lefthand end position. Limit switch 113 is released by arm 24 immediately after the displacement has started.

As arm 24 is displaced, it first swings arm 20 downwardly about pin 22 so that point 21 penetrates ribbon 10 positioned in ribbon channel 29. During further displacement of arm 24, pin 28 abuts against the end of slot 27, is entrained and displaces slide 15 into its lefthand end position. At the same time, point 21 displaces ribbon 10 in the direction of the stitch formation location and the ribbon end hiterto resting on cutting mechanism 12 is displaced beyond cutting face 34 and between lateral walls 54 of guide member 51, below tongue 73 of ribbon feeding strip 13.

This is made possible because, during this displacement, stop edge 24*a* of arm 24 comes into contact with bent-up rear portion 71 of ribbon feeding strip 13 and, in the course of the further motion, due to the resilience of supporting arm 68, elevates the entire feeding strip 13 to such an extent that a sufficient clearance is produced between surface 60, of the prongs 56, 57, and tongue 73 for receiving the ribbon. Along with forward portion 69 of feeding strip 13, guide member 51 is also elevated by guide edges 74 received in slots 52. The advancing ribbon is then guided in a satisfactory manner by elevated lateral walls 54 of guide member 51.

In the lefthand end position of ribbon drawing mechanism 11, arm 24 actuates limit switch 131. Thereby, circuit is closed through lines 130 and 132, and relay 129 attracts and holds itself through front or make contacts 134 and lines 132 and 135. Rest or back contacts 128 are opened and valve 125 switches over so that piston rod 25 is retracted into cylinder 26. Thereupon, arm 24 releases limit switch 131.

When arm 24 is displaced to the righthand side, it first swings angular rocking lever 19 so that lever arm 20 moves upwardly and point 21 releases ribbon 10. During further motion through pin 28, arm 24 pushes slide 15 back into its initial position.

During the back motion of arm 24, its stop edge 24*a* is withdrawn from rear portion 71 of ribbon feeding strip 13 so that strip 13 is lowered and tongue 73 applies against the front portion of ribbon 10.

In the end position of slide 15, arm 24 actuates limit switch 113. Thereby, circuit 112 to valve 111 is closed. Cylinder 46 is supplied with compressed air through flexible tubing 110 so that piston rod 47 is displaced to the righthand side. Through lever 44, piston rod 47 imparts an angular motion to cutting face 34 so that, as shown in FIG. 3, cutting edge 35 and counterblade 37 acting as shears, ribbon 10 is cut through and a ribbon section 10*a*, having a predetermined length, is separated.

If a different length of ribbon 10*a* is desired, for example for another length of the buttonhole, clamping plates 61 are loosened and supporting plate 9 is displaced by the desired distance relative to rule 62. Due to the now shortened or lengthened stroke of slide 15 and to the changed position of stop angle 17*a* relative to the cylinder 26, the ribbon length advanced beyond cutting face 34 is also changed. The length difference appearing between supporting plate 9 and intermediate plate 58 is bridged by the finger-like interengagement of prongs 56, 57.

In the righthand end position of piston rod 47, pin 48 actuates limit switch 120. Relay 115 is excited through lines 118 and 119, closes its front contacts 122 and opens its rest contacts 114. Relay 115 holds through

lines 119 and 123. The circuit 112 to valve 111 is opened, the valve switches over, and cylinder 46 is supplied with compressed air at its opposite end. Piston rod 47 is again pushed out of cylinder 46, limit switch 120 is opened and cutting face 34 is turned back into its rest position. Thereby, the operation of drawing off and bringing a new ribbon length 10a into its ready position is terminated.

As soon as the sewing of the buttonhole is finished, the machine switches off in a well-known manner. Switch 90 and, consequently, circuit 88 to the valve 87 are thereby closed. By supplying compressed air into elevating cylinder 85, material feeding frame 3 is elevated. In its elevated position, it actuates limit switch 109.

Circuit 108 is thereby opened and relay 103 drops out, whereby front contacts 102 are opened and circuit 101 is interruped. Valve 100 switches over and piston rod 64 of cylinder 63 is displaced in the lefthand direction. Limit switch 117 is thereby released.

Piston rod 64 displaces ribbon feeding strip 13 together with tongue 73 and ribbon section 10*a* from surface 60 of prongs 56, 57 over intermediate plate 58 into feed channel 76 between headplates 75. Lateral guide edges 74 of forward portion 69 of feeding strip 13 slide on the bottom surfaces of ledges 77 and ensure thus that tongue 73 is securely held down. During further advance, tongue 73 pushes the head portion of ribbon section 10*a* over needle hole 6 and retains it there firmly until in the next buttonhole sewing operation, the ribbon section is sufficiently fixed from below to the main material by the first stitches.

In the lefthand end position of ribbon feeding strip 13, arm 65 actuates limit switches 121 and 133. Thereby, relays 115 and 129 are without current and rest contacts 114 and 128 are closed while front contacts 122 and 134 are opened.

When the main material and the ribbon section 10*a* are displaced by material feeding frame 3 during the formation of the first row of buttonhole stitches, ribbon section 10*a* is pulled through throat 78 toward needle hole 6. Due to the guidance of ribbon section 10*a* provided by the lateral walls of throat 78, the ribbon section is fed to needle hole 6 in a perfectly aligned position and the twist, inherent in section 10*a* due to the previous winding on the reel, is suppressed. During the sewing of the first row of buttonhole stitches, ribbon section 10*a* is positioned in channel 79. As material feeding frame 3 moves back during the formation of the second row of buttonhole stitches, the sewn-on ribbon section 10*a* pushed along rounded lateral walls 80 of throat 78 up to the level of the main surface of headplates 75.

While a specific embodiment of the invention has 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. In a bottonhole sewing machine for forming ribbon-reinforced buttonholes, including a bedplate, a sewing needle, a stitch plate on the bedplate and formed with a needle hole to receive the needle and defining a stitch formation location, a material feeding frame for feeding material to the sewing needle, ribbon supply and ribbon cutting means for supplying ribbon lengths to a ribbon feeder a receiving zone for feeding of the ribbon to the stitch formation location beneath the material feeding frame for stitching to the material, and drive and control means for operating the machine in repetitive buttonhole forming cycles: an improved ribbon feeding device comprising, in combination, means forming a channel in said stitch plate in the working zone of said material feeding frame and extending to said stitch formation location, and providing a feeding surface over which the material is fed to said stitch formation location by said frame; the upper edges of said channel having, over at least a part of their length, inwardly projecting ledges, which ledges, in said working zone, are flush with said feeding surface; said ribbon feeder comprising a relatively elongated strip of resilient material reciprocable, in guided relation, forwardly from said receiving zone into said channel, and reversely to said receiving zone, and said strip including means engageable with the ribbon at said receiving zone to feed a length of the same into said channel and to said stitch formation location; said strip having guide surfaces projecting laterally over the ribbon and engageable beneath said ledges; and means for reciprocating said ribbon feeder.

2. In a buttonhole sewing machine, an improved ribbon feeding device, as claimed in claim 1, in which the engaging means includes the end of said strip facing toward said stitch formation location being trifurcated to form a central tongue resiliently engaging a ribbon and a pair of tongues, one on each side of said central tongue, constituting said guide surfaces; said central tongue being bent downwardly relative to said pair of tongues.

3. In a buttonhole sewing machine, an improved ribbon feeding device, as claimed in claim 2, in which said channel is formed with a restricted throat in advance of said stitch forming location; said central tongue extending beyond said pair of tongues, considered in the direction of said stitch formation location, and having a width such as to pass through said throat; the width of said throat being of the order of the width of the ribbon.

4. In a buttonhole sewing machine, an improved ribbon feeding device, as claimed in claim 1, in which said strip comprises a substantially flat forward portion engageable with the base of said channel, a substantially flat rear portion spaced above and substantially parallel to said forward portion and having an upwardly curved free end, and an upwardly sloping intermediate portion interconnecting said forward and rear portions; said forward portion including said guide surfaces; said intermediate portion being formed with a pair of aligned notches in its side edges engageable over said ledges.

5. In a buttonhole sewing machine, an improved ribbon feeding device, as claimed in claim 4, including connecting means connecting said reciprocating means to said strip of resilient material and providing for vertical displacement of said strip when said strip is in said receiving zone; means on said bedplate forming a second channel extending rearwardly from said receiving zone and open at its rear end to receive a ribbon drawn from a supply; said ribbon supply means including a slide reciprocable lengthwise of said second channel and carrying means engaging a ribbon to advance the ribbon along said second channel toward said receiving zone; second means for reciprocating said slide; said slide having a forward end engaged between the upwardly curved rear portion of said strip to lift said strip

as said slide moves toward said receiving zone for introduction of the ribbon beneath the forward portion of said strip.

6. In a buttonhole sewing machine, an improved ribbon feeding device, as claimed in claim **5,** in which the engaging means includes the leading end of said forward portion of said strip being trifurcated to provide a central tongue bent downwardly to resiliently engage a ribbon and a pair of tongues, one on each side of said central tongue and constituting said guide surfaces; said means providing said second channel being formed with a pair of parallel elongated slots at said receiving zone; a guide element including two interconnected guide members, one disposed in each of said slots; means interconnecting said guide members for conjoint vertical displacement in their respective slots; each guide member being formed as a substantially rectangular tube including a substantially vertical inner wall, and said inner wall defining a guiding path for the ribbon at said receiving zone; the top walls of said guide members being spaced from the upper edges of the respective inner walls to define spaces each receiving one of said pair of tongues with the rear portion of said strip riding over the upper surfaces of said top walls and said notches embracing the inner edges of said top walls; whereby, when said ribbon feeding strip is raised during supply of a ribbon thereto, said guide member is also raised to maintain continuous guiding of the ribbon.

7. In a buttonhole sewing machine, an improved ribbon feeding device, as claimed in claim **6,** including cutting means extending transversely of said second channel adjacent the rear end of said guide member; said means providing said second channel constituting a plate mounting said ribbon supply means and seated in an elongated groove in the upper surface of said bedplate; clamping means arranged to maintain said mounting plate in adjusted position on said bedplate; a stop on said bedplate limiting retracting movement of said slide; and a scale cooperable with the rear transverse edge of said mounting plate; whereby said clamping means may be loosened and said mounting plate may be adjusted along said scale to adjust the length of ribbon to be cut by said cutting means.

8. In a buttonhole sewing machine, an improved ribbon feeding device, as claimed in claim **7,** including a compensating member mounted on said bedplate between said mounting plate and said stitch plate and forming a transverse surface for the ribbon; said compensating member having at least a pair of prongs extending rearwardly therefrom; the portion of said mounting member between the slots receiving said guide member being formed as a plurality of prongs interfitting with the prongs on said compensating member to provide a continuous surface between said mounting member and said compensating member to compensate for adjustment of said mounting member.

9. In a buttonhole sewing machine, an improved ribbon feeding device, as claimed in claim **7,** in which said cutting means comprises a cylindrical member rotatable about an axis extending transversely of said second channel; said cylindrical member having an intermediate portion, whose axial length corresponds substantially to the width of said channel, in the form of a segment one of whose edges constitutes a ribbon cutting edge; a cutting plate cooperable with said cutting edge upon rotation of said cylindrical member; and means connected to said cylindrical member and operable to oscillate the same to cut a length of ribbon from the remaining ribbon.

10. In a buttonhole sewing machine, an improved ribbon feeding device, as claimed in claim **9,** including means mounting said cutting plate for movement toward and away from said cylindrical member; and means biasing said cutting plate into engagement with said cylindrical member.

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