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Rockerath

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[54] **SEWING MACHINE MATERIAL FEED MECHANISM**

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[52] **U.S. Cl.** **112/203,** 112/208

[51] **Int. Cl.** **D05b 27/00,** D05b 27/16

[58] **Field of Search** 112/2, 121.11, 121.12, 112/121.15, 121.26, 203, 208, 209, 214, 252, 260

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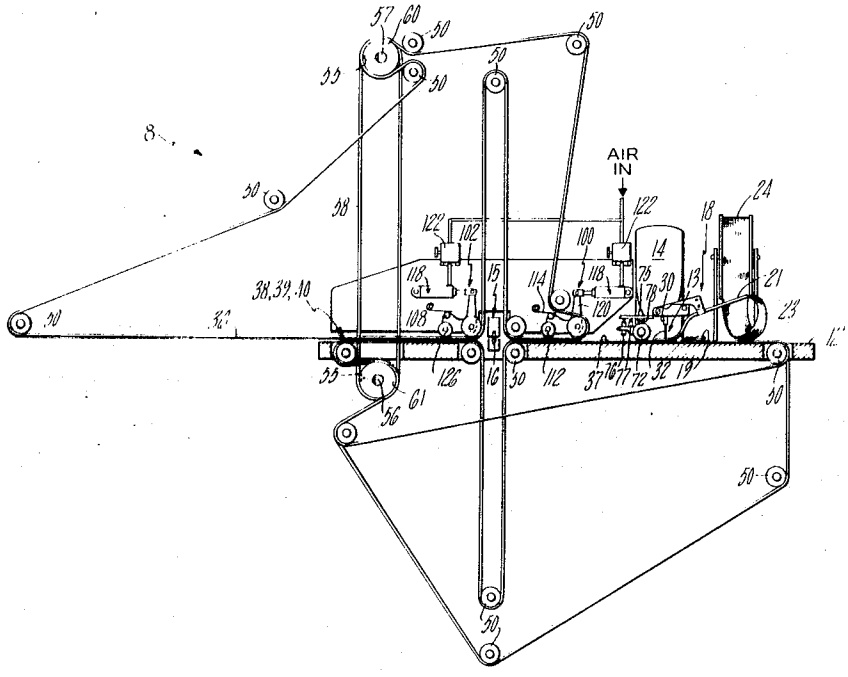
[57] **ABSTRACT**

A sewing machine installation for sewing a shirt front box hem having material handling apparatus for preassembling the shirt front and a material feed mechanism with pairs of cooperating upper and lower conveyor belts for feeding the shirt front. Certain conveyor belts are driven at different speeds to compensate for different effective feed rates of the material through the material handling apparatus and pneumatically operated pressure rolls are provided for urging the conveyor belts together for positively gripping the shirt front material. In one embodiment additional drive rolls are provided adjacent the sewing station for assisting in feeding the material through the sewing station and in a second embodiment the upper and lower conveyor belts convey the material through the sewing station and air arcuate conveyor belt support plate is provided at the sewing station for ensuring positive gripping of the material.

3 Claims, 6 Drawing Figures



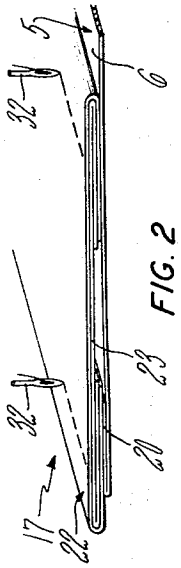


FIG. 2

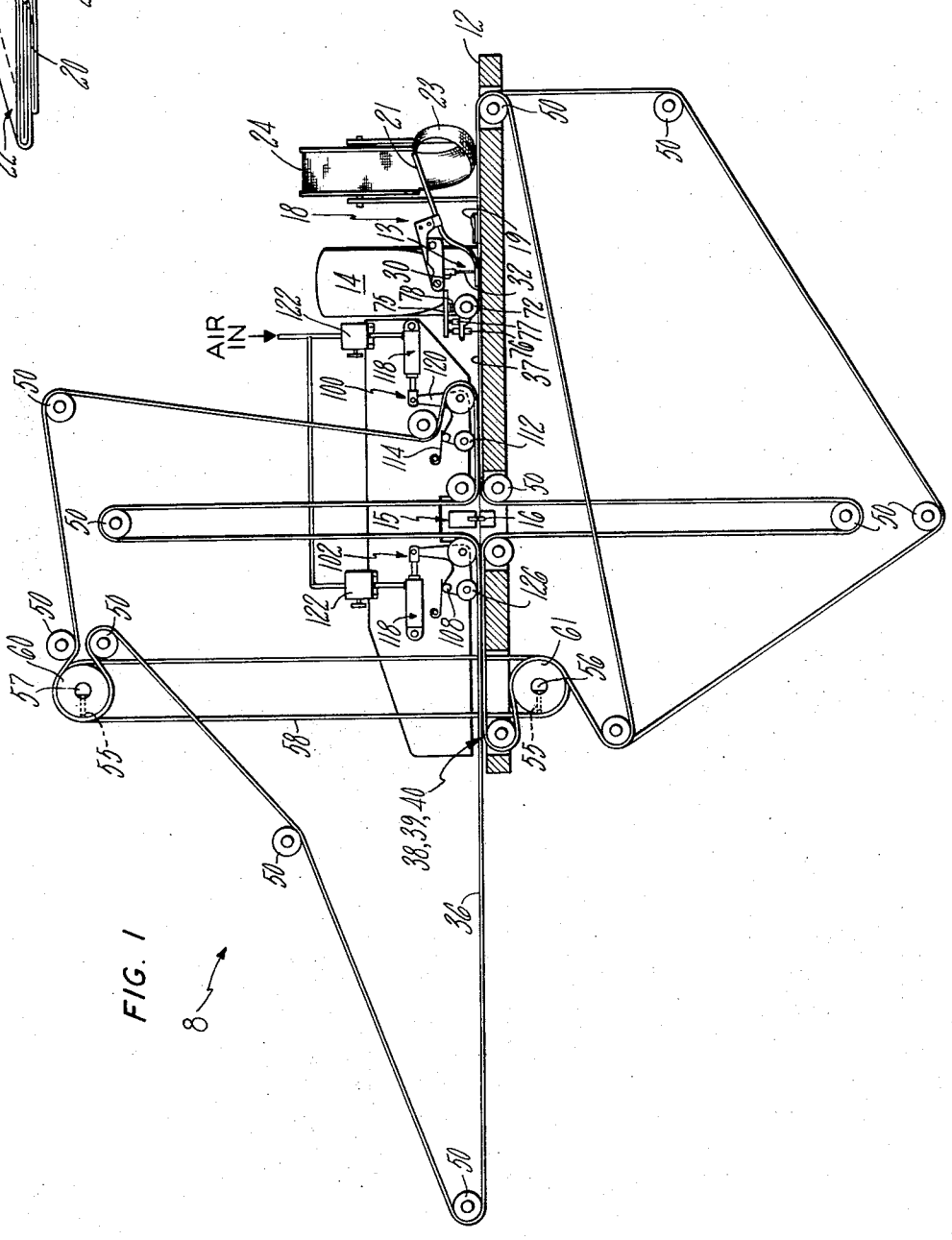


FIG. 1

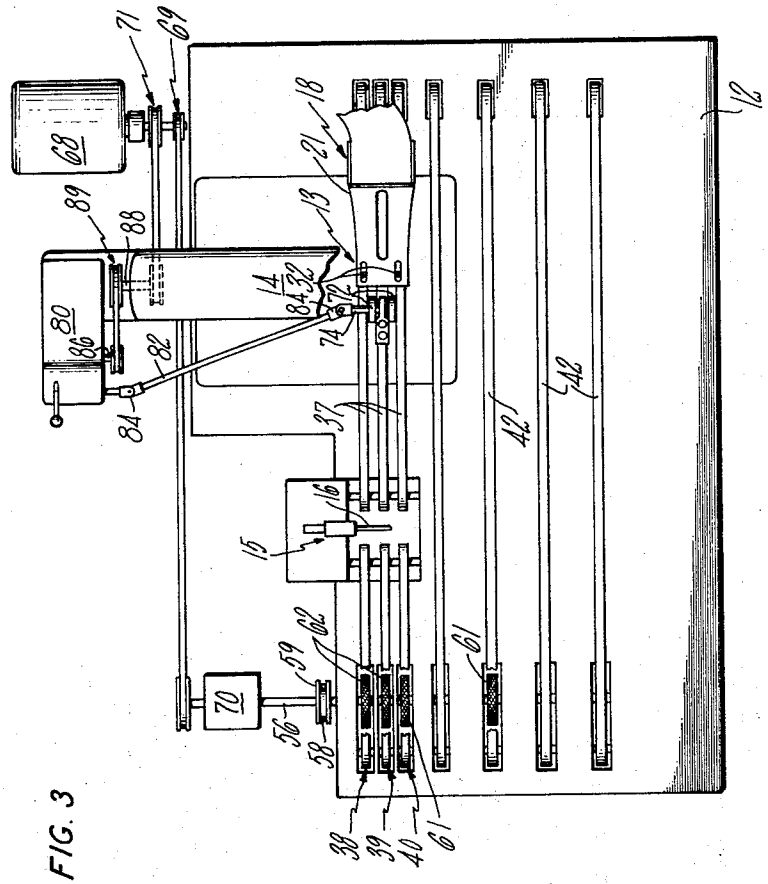

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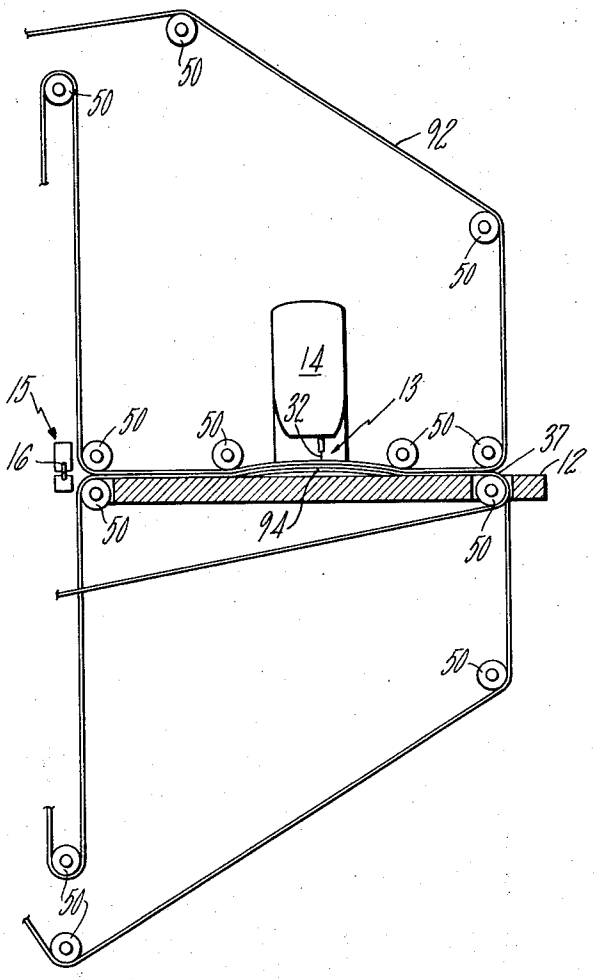
FIG. 3

FIG. 4



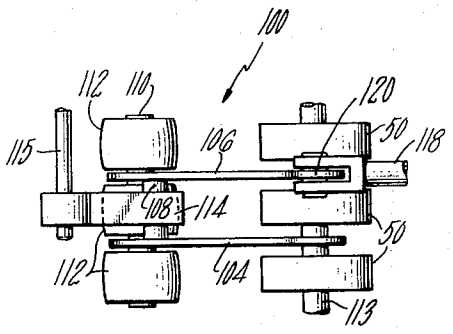


FIG. 5

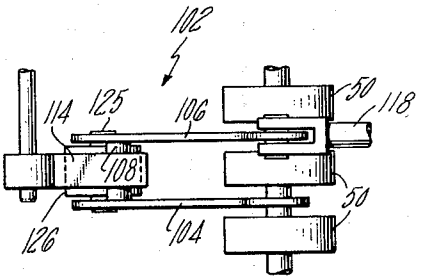


FIG. 6

SEWING MACHINE MATERIAL FEED MECHANISM

BRIEF SUMMARY OF THE INVENTION

The present invention relates generally to sewing machine material feed mechanisms and more particularly to a new and improved material feed mechanism providing greater feed control and elimination of imperfections resulting from improper material feed.

It is a primary aim of the present invention to provide a new and improved sewing machine feed mechanism having notable utility with material folding or other material handling apparatus which preassemble the material to be sewn.

It is another aim of the present invention to provide a new and improved sewing machine belt conveyor system for positively conveying the material through the sewing station of the sewing machinery and also, if desired, through a cutting station of the sewing machine.

It is a further aim of the present invention to provide a new and improved sewing machine belt conveyor system for use in a sewing machine installation designed for sewing shirt front box hems.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

A better understanding of the invention will be obtained from the following detailed description and the accompanying drawings of illustrative applications of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a generally diagramatic elevation view, partly broken away, of a sewing machine installation for sewing shirt front box hems and employing an embodiment of a material feed mechanism incorporating the present invention;

FIG. 2 is a partial perspective view, partly broken away and partly in section, showing a shirt front box hem of the type stitched with the sewing machine installation of FIG. 1;

FIG. 3 is generally diagramatic plan view of the sewing machine installation;

FIG. 4 is a generally diagramatic elevation view, partly broken away of a sewing machine installation employing another embodiment of a material feed mechanism incorporating the present invention;

FIG. 5 is an enlarged plan view of a pressure roll subassembly of the sewing machine installation; and

FIG. 6 is an enlarged plan view of another pressure roll subassembly of the sewing machine installation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings in detail wherein like numerals represent like parts throughout the several figures, a sewing machine installation **8** incorporating an embodiment of a material feed mechanism of the present invention is shown comprising a material support table **12** for supporting material as it is being fed, from right to left as viewed in FIG. **1**, for being stitched at a stitching station **13** by a sewing machine head **14** and for being sheared at a shearing station **15** by a cutter **16**. The sewing machine installation **8** shown is employed for stitching a box front hem or pleat **17** (shown

in FIG. 2) of a man's shirt front **5** and employs conventional material handling apparatus **18** for prefolding and preassembling the components of the shirt front **5**. More particularly the material handling apparatus **18** comprises a lower folding device **19** for prefolding an inner edge **20** of a precut shirt front blank **6** upwardly and inwardly and an upper folding device **21** for prefolding the lateral edges of an elongated pre-cut band **22** of shirt material downwardly and inwardly around a liner or stiffener **23** and guiding the assembled band **22** and liner **23** onto the prefolded shirt blank **6** to be stitched together at the stitching station **13**. In a conventional manner the liner **23** is fed into the upper folding device **21** from a roll **24**, and the pre-cut band **22** and shirt front blank **6** are manually fed into the upper and lower folding devices **19, 21** respectively.

The sewing machine head **14** incorporates a needle bar **30** with a pair of laterally spaced needles **32** for stitching both edges of the box front hem **17**. Thus, to form a shirt front **5** a band **22** and an edge of a pre-cut shirt front blank **6** are initially manually fed through the respective folding devices **19,21** to the stitching station. The machine is then energized to automatically feed the preassembled shirt front blank **6**, band **22** and liner **23** together through (a) the stitching station **13** to stitch a box front hem **17** along the entire lateral edge of the shirt front and then the (b) shearing station **15** to properly shear the leading and trailing edges of the box front hem. A section of a box front hem **17** is shown in FIG. **2** to illustrate how the pre-cut shirt front blank **6**, liner **23** and pre-cut band **22** are folded and stitched together.

The sewing machine feed mechanism provides for feeding the shirt front through the stitching station **13** and through the shearing station **15**. The cutter **16** is preferably of the type described in my copending U. S. patent application Ser. No. 153,664 filed June 16, 1971 and entitled "Retractable Sewing Machine Cutting Mechanism" and as explained in detail in that application provides for accurately severing the leading and trailing edges of the shirt hem.

The material feed mechanism comprises upper and lower conveyers having three laterally spaced pairs **38–40** of cooperating belts **36, 37** respectively engageable along a plane slightly above the table and cooperable for advancing the material along the table. The lower conveyor also comprises three additional conveyor belts **42** which may be identical to the lower belts **37** and which provide for conveying the body of the front blank **6** along the table, it being seen that the pairs **38–40** of conveyor belts **36, 37** are located to engage the center hem of material to ensure that the center hem is positively conveyed along the table. The inner and outer lower conveyor belts **37** of the lower conveyor are positioned immediately laterally inwardly and laterally outwardly respectively of the two laterally spaced sewing machine needles **32** and the intermediate conveyor belt **37** of the lower conveyor is located centrally between the needles **32** and such that the three lower conveyor belts **37** do not interfere with the operation of the sewing machine head **14**.

The conveyor belts **36, 37, 42** are supported on a number of suitable rollers **50** rotatably mounted on parallel support shafts for guiding the endless conveyor belts around a circuitous path. The circuitous path is provided in part to provide belt separation at the cutting station **15** to permit the cutter **16** to function prop-

erly without interfering with the operation of the upper and lower conveyors.

The upper and lower conveyor belts are driven together by parallel drive shafts **56, 57** which are interconnected by a timing belt **58** and pulleys **59** to be driven at the same angular velocity. Individual knurled drive wheels **60, 61, 62** detachably mounted on the shafts **56, 57** respectively by suitable set screws **55** are provided for driving the conveyor belts **36, 37, 42.** As seen in FIG. **1,** the conveyor belt guide rollers **50** are positioned so that the conveyor belts engage a substantial peripheral portion of the knurled drive wheels. Also the conveyor belts are elastic and are mounted in a slightly stretched condition to firmly engage the knurled drive wheels **60, 61, 62** so that the belts are driven without slippage. The lower belt drive shaft **56** is connected to a treadle operated motor **68** by a belt and pulley system **69** and a suitable transmission **70.** The sewing machine **14** is also connected to the treadle operated motor **68** by a suitable belt and pulley system **71** and such that the sewing machine head **14** and the belt drive system are simultaneously driven at coordinated speeds.

The upper conveyor also comprises a pair of laterally spaced feed rolls **72** mounted immediately adjacent to and, as shown, after the stitching station **13.** Also the pair of feed rolls **72** are preferably mounted between the three laterally spaced lower conveyor belts **37.** The feed rolls **72** are fixed onto a laterally extending drive shaft **74,** and the shaft **74** is rotatably mounted on a shaft **74,** and the shaft **74** is rotatably mounted on a support **75** for limited vertical displacement on a pair of guide rods **76, 77** and biased downwardly by a compression spring **78** for biasing the rolls **72** into engagement with the workpiece material. The feed rolls **72** are connected to be driven along with the conveyor belts **36, 37** and sewing machine head **14** by a transmission **80** having an output shaft parallel to the roll shaft **74** and connected thereto by a drive shaft **82** and suitable universal joints **84.** The input shaft **86** of the transmission **80** is driven by a sewing machine head drive shaft **88** via a belt and pulley system **89.** The transmission **80** is of the type which is infinitely adjustably within a given drive ratio range and such that the peripheral speed of the feed rolls **72** can be accurately adjusted with the transmission **80** in accordance with the linear speed of the conveyor belts **36, 37.**

Referring to FIG. **4,** where feasible (depending upon the material handling apparatus employed), a modified conveyor system may be used in which three upper conveyor belts **92** are mounted to cooperate with the three lower conveyor belts **37** for conveying the material through the stitching station **13** as well as the shearing station **15.** With such a modified conveyor system a slightly arcuate or arches convex throat plate **94** is provided at the stitching station **13** for maintaining substantially constant belt clamping pressure on the intermediate material workpiece for ensuring essentially positive conveyance of the workpiece material through the stitching station **13.** The throat plate **94** is preferably mounted so that the pair of laterally spaced stitching needles **32** are located essentially at the top of the throat plate **94** and so that the belts provide for positively conveying the material both to and from the stitching station **13.** The workpiece material is preferably continuously conveyed by the conveyor system during stitching and the needles are therefore distorted slightly by the moving material during the short interval the needles penetrate the material for each stitch. Thus, firm engagement of the material is found to be very desirable to prevent any material slippage and resulting inferior stitching. The convex throat plate **94** ensures continuous material movement and good stitching results.

Pressure roll or puller subassemblies **100, 102** are provided before and after the cutting station **15** to ensure that the cooperating belts **36** (or belts **92** in the embodiment of FIG. **4**) and **37** firmly clamp the material and positively convey the material through the cutting station **15.** The leading pressure roll subassembly **100** is shown in FIG. **5** to comprise a frame having a pair of laterally spaced support plates **104, 106** an upper cross bar **108** secured to the plates **104, 106** and a lower roller support shaft **110.** Three laterally spaced generally barrel shaped rolls **112** are rotatably supported on the shaft **110** for engagement with the three laterally spaced belts **36** of the upper conveyor system. The support plates **104, 106** are pivotally mounted on an adjacent belt roller support shaft **113** and a leaf spring **114** is mounted on a support shaft **115** for engagement with the upper cross bar **108** for urging the rolls **112** into engagement with the belts **36** with an initial predetermined minimum bias. A pneumatic cylinder **118** is connected to an arm **120** of the support plate **106** to increase the roll pressure and to thereby increase the belt clamping force on the material where found desirable in certain applications and with certain materials. The pneumatic cylinder **118** is connected via a suitable manually adjustable pressure regulator **122** for manually setting the bias on the conveyor belts provided by the pneumatic cylinder **118.**

The trailing pressure roller subassembly **102** is similarly constructed with a pair of supports **104, 106** a cross bar **108** and a roller support shaft **125.** However, only a single cylindrical roll **126** is mounted on the support shaft **125** for engagement with the center belt **36.** A leaf spring **114** engages the cross bar **108** to urge the roll **126** into engagement with the center belt **36** and a pneumatic cylinder **118** is provided for establishing an additional bias on the center belt **36.** The pneumatic cylinder **118** is connected via a separate manually adjustable pressure regulator **122** for adjusting the roll pressure in accordance with the sewing machine application, material used, etc.

It has been found that where material is fed through some form of material handling apparatus such as the folding devices **19, 21** and/or different materials as employed, a portion or portions of the workpiece material may be distorted slightly due to the differential drag on the workpiece material by the material handling apparatus and/or be conveyed at a different effective rate by the conveyor system such that, for example, an imperfectly stitched hem with material puckering or other imperfections may result. In accordance with the present invention, such imperfections are prevented by driving the upper and lower conveyors or portions thereof with slight speed differentials such that the portion or portions of the material being distorted due to greater drag or which are conveyed at a lower effective rate by the material handling apparatus are driven by at a slightly faster speed to compensate for such drag and/or lower effective rate of conveyance. In the installation shown in FIG. **1,** it has been found that the inner edge of the shirt front blank **6** is distorted slightly rela-

tively to the preassembled band **22** and stiffner **23** due to the drag from the lower folding device **19** on the inner edge of the shirt front blank **6** and the greater effective rate of conveyance of the preassembled band **22** and stiffener **23** by the conveyor system resulting from the greater stiffness of the stiffener **23.** It has been found that such distortion can be properly compensated for by driving the two innermost conveyor belts **37** of the lower conveyor at a speed slightly greater than the upper conveyor. The differential conveyor drive is provided by using driving wheels **62** for the two innermost lower conveyor belts **37** having a slightly larger diameter than the remaining driving wheels **60, 61** for the remaining conveyor belts. For example, the knurled drive wheels **62** mounted on the lower conveyor drive shaft **56** may have a diameter of 2.266 in. and the remaining knurled drive wheels **60, 61** on the upper and lower conveyor drive shafts may have a diameter of 2.254 in. such that a differential belt speed of approximately 5.3 percent is provided. Where pressure rolls **72** are provided as shown in FIG. **1** the adjustable transmission **80** would be set to drive the pressure rolls **72** such that their peripheral speed is also approximately 5.3 percent less than the linear speed of the two innermost lower conveyor belts **37.**

A different sewing machine application may require a different differential speed and/or require other elements of the conveyor system to be increased in speed or decreased in speed depending upon the type of material handling apparatus employed, the form of the stitched hem, etc., and the weights and types of material used. Although adjustment of the differential speed for each application will normally be required to obtain optimum results, it is believed that the required differential speed will normally be 5.5 percent or less and not likely ever in excess of 10 percent. Also to be effective it is believed that the required speed differential will normally exceed 2 percent.

As will be apparent to persons skilled in the art, various modifications, adaptations and variations of the foregoing specific disclosure can be made without departing from the teachings of the present invention.

I claim:

1. In a sewing machine having a sewing machine head for stitching material at a stitching station and material feeding apparatus for feeding the material through the stitching station and comprising upper and lower cooperating belt conveyors having at least one pair of cooperating conveyor belts extending through the stitching station and engageable with opposite sides of the material for feeding the material through the stitching station and drive means for driving the upper and lower belt conveyors together for feeding the material through the stitching station, the improvement wherein the sewing machine further comprises a convex support extending through the stitching station below the cooperating conveyor belts for guiding the cooperating conveyor belts through an arcuate path at the stitching station for maintaining the conveyor belts in effective gripping engagement with the material.

2. In a sewing machine having a sewing machine head for stitching material at a stitching station, a cutting mechanism for cutting the material at a cutting station after the stitching station and material feeding apparatus for feeding the material from the stitching station and through the cutting station and comprising upper and lower cooperating belt conveyors having at least one pair of cooperating conveyor belts engageable with opposite sides of the material both before and after the cutting station for feeding the material through the cutting station and drive means for driving the upper and lower belt conveyors together for feeding the material, the improvement wherein the material feeding apparatus comprises pressure roll means engageable with the conveyor belt of one of the belt conveyors for biasing the conveyor belt toward the other conveyor belt for firmly gripping the material, the pressure roll means comprising a reciprocable frame, a pressure roll rotatably mounted on the frame for engagement with the belt of said one belt conveyor, and biasing means for biasing the frame in one direction for urging the belt conveyors together for gripping the material.

3. In a sewing machine according to claim **2** wherein the biasing means comprises a pneumatic cylinder connected for urging the frame in said one direction and pneumatic pressure regulator means connected to the pneumatic cylinder and adjustable for controlling the pneumatic pressure in the cylinder for controlling the bias on the frame in said one direction.

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