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Marforio

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[54] **GUIDE AND SEWING DEVICE FOR FABRIC LAYERS ALONG A SHAPED EDGE**

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May 22, 1973 Italy 24367/73

[52] **U.S. Cl.** ..... **112/153;** 112/205; 112/219 A

[51] **Int. Cl.²** **D05B 35/10;** D05B 27/10

[58] **Field of Search** ..... 112/153, 136, 204, 205, 112/220, 219 A

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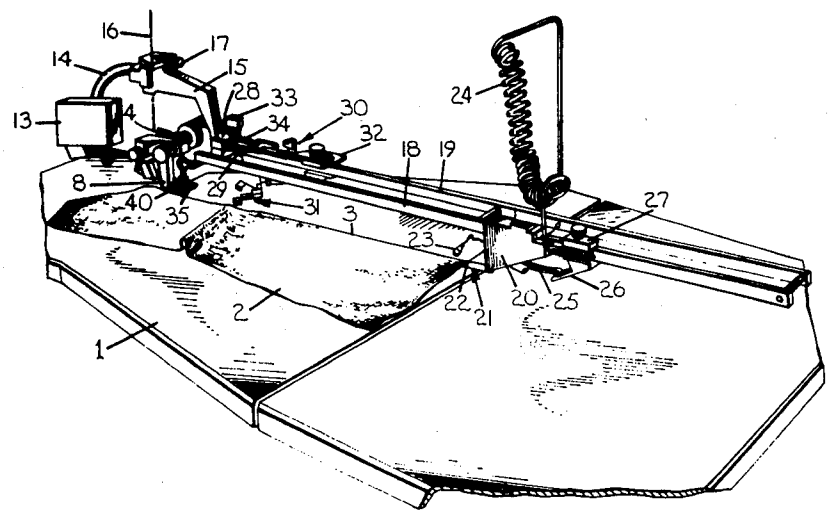
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Primary Examiner—H. Hampton Hunter

[57] **ABSTRACT**

An improved apparatus for guiding layers of fabric to be sewn along an edge of irregular configuration having clamping members for moving the work along a support plane to a sewing machine. The apparatus includes sensing elements for detecting irregularities in the edge to be sewn and devices operatively associated with the sensing elements for orienting the work as it is advanced to the sewing machine, reducing the speed of the sewing machine while sewing in the area of a variation in the fabric edge and returning the sewing machine to normal operating speed upon completion of the sewing in the area of the variation.

4 Claims, 5 Drawing Figures



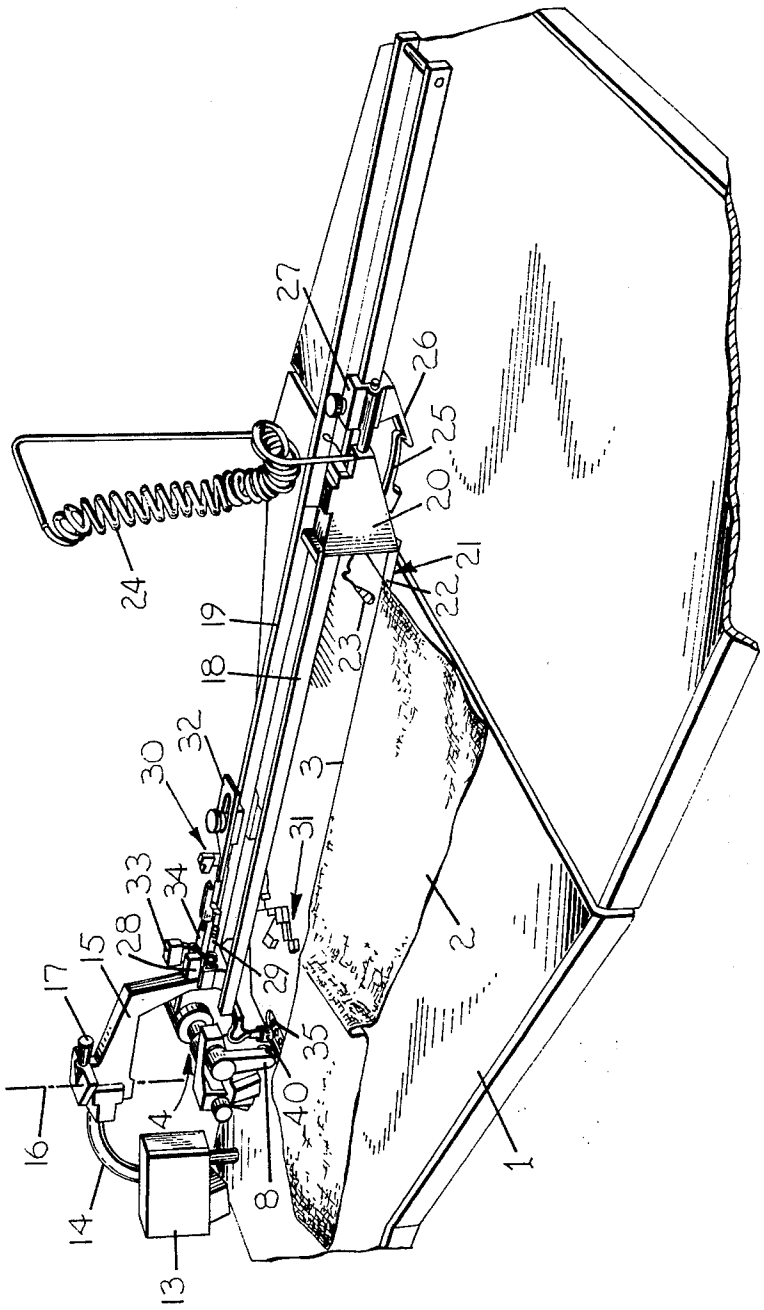

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FIG. 1

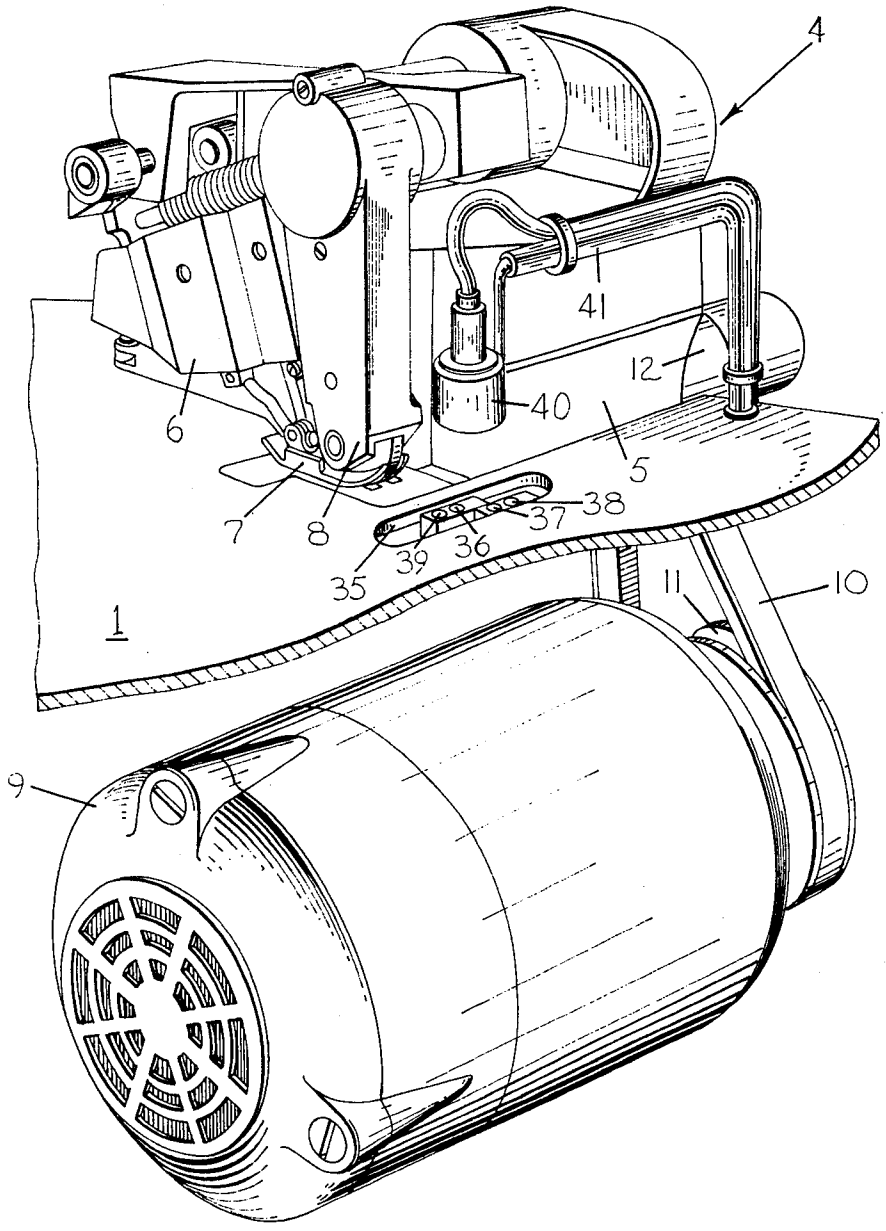


Fig. 2

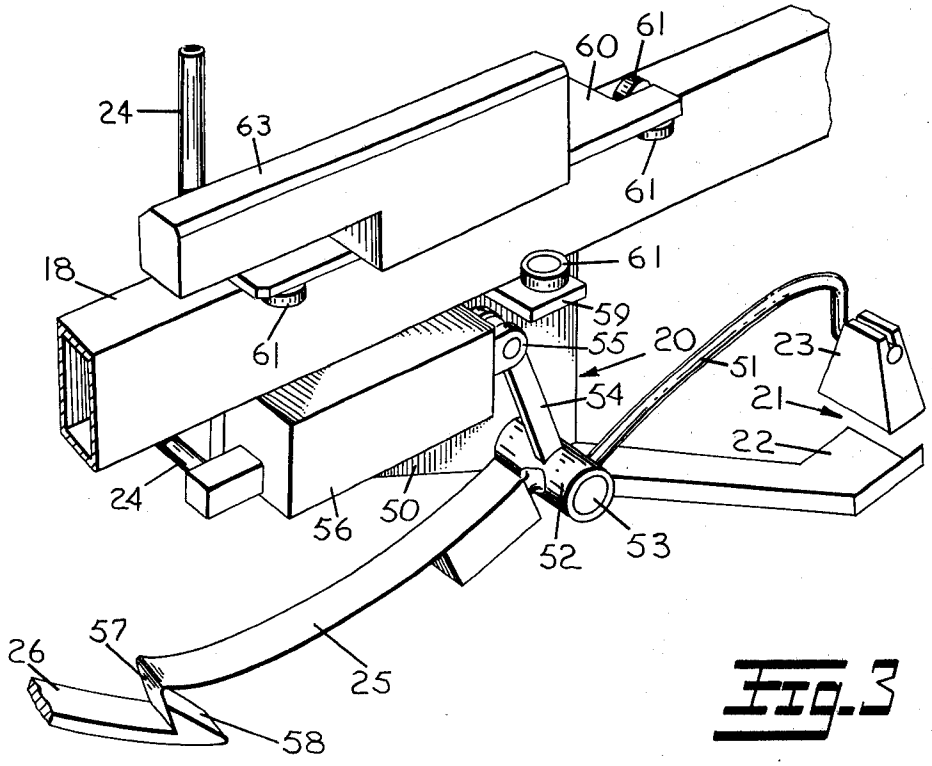

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Fig. 3

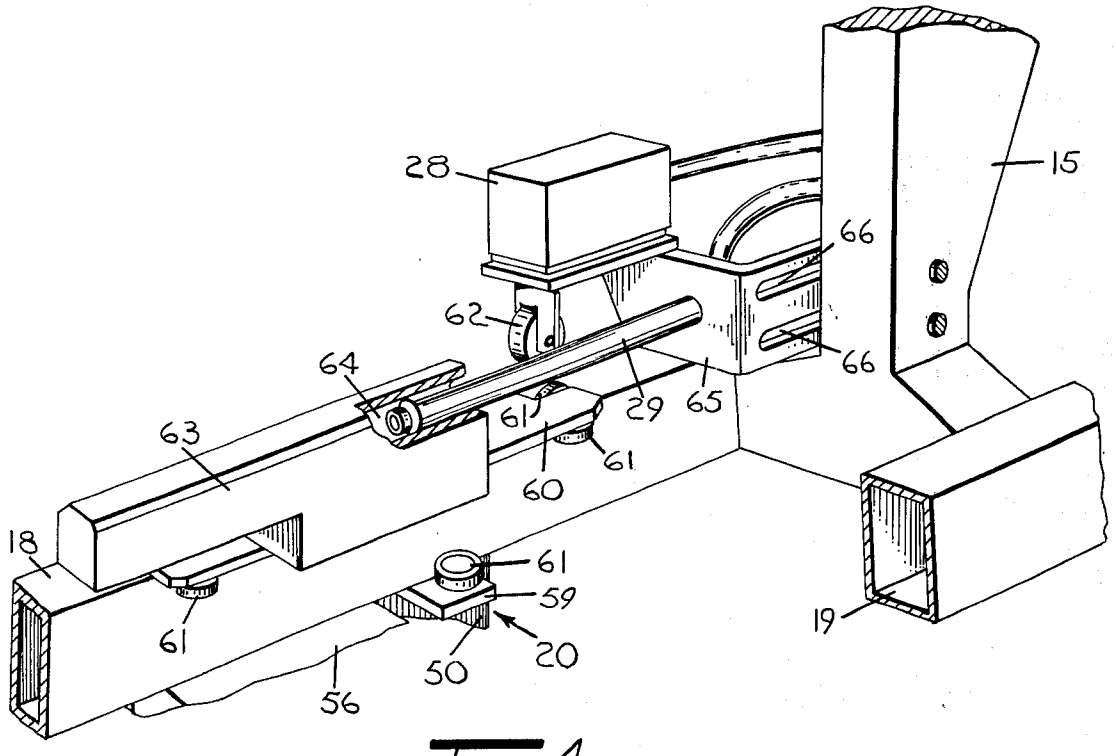

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Fig. 4

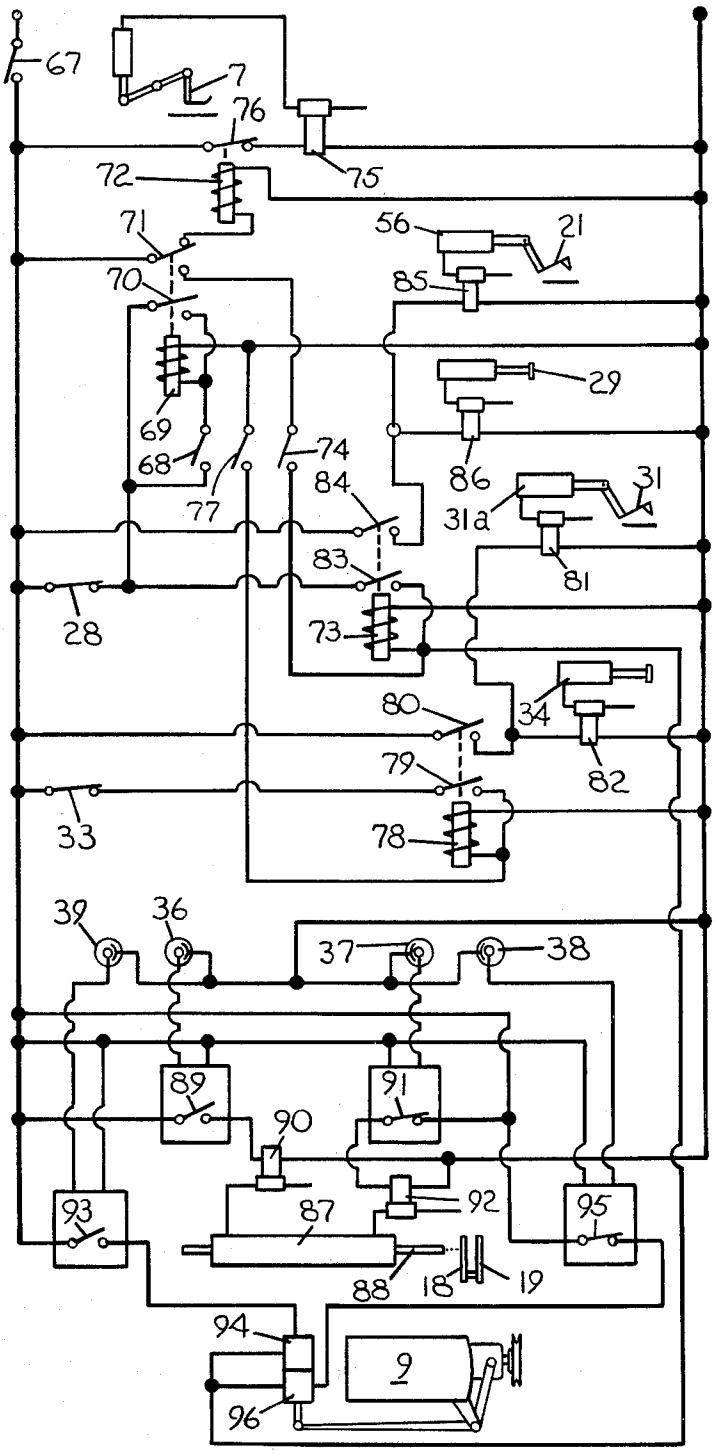

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Fig. 5

GUIDE AND SEWING DEVICE FOR FABRIC LAYERS ALONG A SHAPED EDGE

BACKGROUND OF THE INVENTION

The present invention is concerned with improvements in an apparatus for guiding and sewing layers of fabric along an edge of any type.

In particular, the improvements in question make it possible to stitch together two or more layers along perfectly overlapped edges characterized by a curving shape and by the frequently varying direction of the recesses.

A type of apparatus is known, to which the improvements in question refer, consisting of a support plane for the work, in one corner of which a sewing machine is installed, e.g. of the cut-and-seam type.

Suspended above the support plane of the work and in front of the sewing machine, a device is provided for guiding and clamping the layers of material which includes two parallel tracks rotatable about a vertical axis and disposed on a horizontal plane parallel to the plane of the work. A pair of clamping members are slidably carried on these tracks and are capable of holding back the layers of the material so that the actual edges to be sewn are perfectly matched.

The material is moved over the support plane of the work by means of lower feeding devices on the sewing machine and possibly also by means of upper feeding devices disposed forwardly or rearwardly of the sewing mechanism.

In front of the sewing machine and in the vicinity of its upper sewing machanism, two photoelectric cells are provided which are positioned at a distance from each other transversely to the direction in which the material to be sewn is advanced.

During the sewing phase, the profile of the edge of the material to be sewn must be constantly maintained between the two photoelectric cells in order to properly guide the material towards the sewing mechanism; consequently one of the photoelectric cells must always be dark and the other always lighted.

In the event that during the sewing phase the two photoelectric cells are both made dark or light according to whether the profile of the material has curves or recesses, one of the photoelectric cells controls a pneumatic mechanism which acts on the rotatable tracks, so as to vary their position accordingly.

Varying the direction or position of the tracks also varies the direction of the fabric clamping members which move along these tracks and additionally the direction of the edge of the material held by the fabric clamping members.

The edge of the material is therefore brought back between the two photoelectric cells more of less quickly according to the inertia of the pneumatic mechanism and of the rotatable tracks.

It is noted that the apparatus briefly described above cannot successfully make stitches along edges with a very irregular profile, i.e. having continuously and unexpectedly varying curves and recesses.

This is due to the fact that, in order to reduce the operating time, the present sewing machines sew at a high speed while the rotatable tracks, having a substantial inertia, are not able to instantaneously follow abrupt variations in the profile of the work.

More precisely, it is frequently observed that, whenever one of the photoelectric cells activates the pneumatic mechanism that causes the tracks to rotate, before the material moves, the profile of the material itself changes again and displays new curves or cavities corresponding to the photoelectric cells.

This means that, in accordance with the abrupt variations, the layers of the material are not sewn. In order to prevent the disadvantages described above and to permit the edge of the material to be constantly guided towards the sewing mechanism of the machine even when there is a sudden variation in the curves or recesses of the profile itself, the technical problem to be solved is to slow down the speed of the sewing machine during the sudden variation in the profile.

SUMMARY OF THE INVENTION

The technical problem described above is completely solved by the improvements that are the object of the present invention and that are applicable to an apparatus for guiding and sewing layers of fabric along an edge of any configuration. The apparatus includes a work-support plane for the layers of fabric to be sewn, a sewing machine with novel means for varying the operating speed, a device for guiding and clamping the work capable of guiding the edge of the material in the direction of the sewing mechanism of the machine. A first set of sensing elements is placed at a distance from each other transversely to the direction in which the material is advancing, in the vicinity of the sewing mechanism and is capable of sensing the changing curves or recesses in the profile of the material so that the orientation of the guiding and clamping devices can be varied accordingly. The improvements of the invention also include an additional set of sensing elements capable of sensing the abrupt variations in the profile of the material and of controlling the devices for varying the operating speed of the sewing machine so as to reduce the speed whenever there are abrupt variations in the profile of the material and which is capable of returning said speed back to the previous level when the curves and recesses of said profile are no longer changing.

These and other characteristics of the present invention will become clear upon reading the following detailed description of a preferred but not exclusive exemplified embodiment, illustrated purely by way of example on the attached drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the apparatus for guiding and sewing layers of fabric.

FIG. 2 is a perspective view showing the location of sensing means for detecting irregularities in the edge of the fabric to be sewn.

FIG. 3 is a perspective view showing elements of the apparatus in greater detail.

FIG. 4 is a perspective view showing the further detail of the apparatuses switching means; and

FIG. 5 is a diagramatical view of the control circuit for the apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In reference to FIG. **1**, **1** indicates a support plane for work **2**; this work **2** may consist of one or more layers whose edges must first be perfectly matched before they can be sewn together.

The borders of said layers may have a variable profile **3** of any desired configuration.

At one end of support plane **1** a traditional sewing machine **4** is fixed, for example of the cut-and-seam type for the forming of an overseam.

As can be better seen in FIG. **2**, the sewing machine **4** includes a head with a base **5** and a standard **6** at the end of which are the known upper sewing elements including the pressor foot **7**, and an upper feeding device **8** positioned forwardly of said upper sewing elements.

The sewing machine also has an electric motor **9** of a known type provided with an electromagnetic friction-brake clutch unit on whose driven shaft a sheave **11** is assembled and, which is operatively connected by a belt **10** to the usual hand wheel **12** of the sewing machine.

The friction-brake clutch unit of motor **9** is of the type which permits obtaining two or more rates of revolution for the number of revolutions of the driven shaft and consequently of the sewing machine handwheel, while the number of revolutions of the electric motor remains the same.

In the friction-brake clutch unit, the number of revolutions of the driven shaft is varied by the relay control which is excited and deenergized with a preestablished frequency by the electromagnets.

According to one possible example of a variant, electric motor **9** can be any triphase asynchronous motor with a friction-brake clutch system of the mechanical type in which provision is made for the known rheostatic systems to regulate the speed of the motor itself. As is shown in FIG. **1**, to the left of the sewing machine there is a box **13** which contains the electric controls for starting the electric motor of the sewing machine and for controlling other elements which will be more fully described hereinafter.

Assembled to the frame that supports plane **1** and upwardly directed curved arm **14** is provided which extends over the head of the sewing machine.

Hinged to curved arm **14** is a second arm **15** which can rotate, with respect to curved arm **14**, around a verticl axis **16**; and said second arm **15** includes a handle **17** for effecting manual rotation thereof. Attached to the second arm **15**, which is disposed forwardly of the sewing machine, are two tracks **18** and **19** located parallel to each other and to support plane **1**.

On track **18** a carriage **20** is movable and includes a clamping device **21** consisting of a fixed clamp **22** that communicates with plate **1** and which is carried on a vertical supporting plate **50** (FIG. **3**). This clamping device further includes a pivotable clamp **23** carried on an arm **51** of a bell crank type lever which is pivotably supported as at **53** to the vertical support plate **50**. The other arm of this bell crank level is identified by numeral **54** and is pivotably connected to a piston **55** of a pneumatic cylinder **56** (FIG. **3**) which is also fixed by any suitable means to the vertical supporting plate **50**. The pneumatic cylinder **56** receives its source of air through a line or flexible tube **24** having a plurality of spiral windings that enable it to follow the carriage **20** during its movement.

In a diametrically opposed location relative to arm **51** of the bell crank level **52** a hook **25** is provided having a detent **57** (FIG. **3**) on the free end thereof adopted for engagement with a detent **58** of conforming configuration connected to an end stop or limit switch **27** that is selectively located on the track **18** (FIG. **1**).

As shown in FIG. **3**, the vertical supporting plate **50** includes plate members **59** and **60** fixed thereto which carry roller elements **61** on their free ends which are disposed so as to engage different surfaces of the track **18**. These roller elements serve to provide unrestricted movement of the carriage and to prevent any possible tilting thereof on track **18**.

Referring to FIGS. **3** and **4**, plate member **60** is adapted to engage and depress an actuator **62** of a microswitch **28** located adjacent the end of the track **18** disposed in close proximity with the sewing machine and serves to actuate in sequence both the pneumatic cylinder **56** and a pneumatic propelling unit **29**.

Above the carriage **20** an L-shape block member **63** is provided which includes an internal and horizontally extending cavity **64** into which the pneumatic propelling unit **29** (FIG. **4**) is caused to enter when the carrige **20** reaches the limit of its travel. At this time a jet of air under pressure is released by the pneumatic propelling unit **29** within the cavity **64** and is effective in reversing the direction of movement of the carriage so as to return it to the position in readiness for repeating the cycle. During the initial reverse movement of the carriage **20** the detent **57** is caused to engage detent **58** on a hinge member **26**. Both the microswitch **28** and the pneumatic propelling unit **29** are supported on a bracket **65** (FIG. **4**) having slots **66** which by suitable means (not shown) is assembled to the second arm **15**. Slots **66** provide a means whereby the position of the microswitch **28** can be adjusted to the most desirable operating location. Another carriage **30** is mounted and movable on track **19**. This carriage **30** being of a known type and similar to carriage **20** includes a pair of clamps **31** similar in control and operation to clamp **21**, and have the function of gripping the material at an intermediate position along its length, particularly in the case where the edges of the layers to be sewn have different profiles. A limit-switch **32** is provided on track **19** and its position may be selectively located on said track; also said limit-switch **32** is provided with means for engaging carriage **30**.

At the beginning of track **19**, near the sewing machine, a microswitch **33** and a known pneumatic propelling unit **34** are installed which are capable of driving carriage **30** to the end of track **19** into the position at the end of the course.

Both tracks **18** and **19**, which are rigidly joined together, can rotate around vertical axis **16** and said rotation, in addition to being obtained manually with handle **17**, is accomplished automatically via known pneumatic means which are not illustrated here.

As is illustrated more clearly in FIG. **2**, and disposed forwardly of the upper feed device **8** of the sewing machine, in support plane **1**, there is a aperture **35** for housing a first and second pair of photoelectric cells **36–37** and **38–39**, respectively that are positioned transversely to the direction in which the material is advancing and over which a lamp **40** supported by an arm **41** is positioned.

The two central photoelectric cells **36** and **37** have the known function of detecting the variations in the profile **3** of the material and of consequently controlling the known pneumatic means which cause the tracks to rotate around the axis **16** in order to guide the edge of the material in the direction of the sewing device.

The two external photoelectric cells **38** and **39**, being at a greater distance from each other, have the function of detecting the abrupt variations in profile **3** and control the means provided for reducing the speed of the drive shaft of the friction-brake unit of motor **9** or of the motor itself whenever said variations are sensed and of subsequently returning the speed back to the rated operating speed whenever said variations cease.

The way in which the apparatus operates will now be described. An operator after closing a main switch **67** (FIG. **5**) carried on the box **13** aligns the edges of the layers of fabric before inserting them under the pressure foot **7** and then by means of a manual control **68** in said box **13** lowers said pressure foot into engagement with the fabric to be sewn. Actuation of the hand control **68** energizes a relay **69** which closes its own holding contact **70.** Energizing relay **69** also actuates another contact **71** from the feed circuit of a relay **72** toward a feed circuit of a relay **73** having a control **74** preferably of the treadle type. The actuation of the holding contact **71** causes the deenergizing of relay **72** which is normally energized to actuate a solenoid controlled valve **75** that is operatively associated with the pneumatic circuit to control the raising of the presser foot **7** at the end of the sewing cycle. Consequently the deenergizing of relay **72** causes the opening of its contact **76** and the lowering of the pressure foot **7** to a position of engagement with the fabric to be sewn. At this point the operator effects activation of the clamps **31** by activation of a hand control **77** that controls the energizing of a relay **78** and which is effective in closing its own holding contact **79** as well as actuation of the microswitch or limit switch **33** in series therewith. Another contact **80** is provided for actuating a solenoid controlled valve **81** which controls the feeding of a pneumatic cylinder **31a** that is operatively connected to the clamps **31.** The closing of the contact **80** energizes a solenoid controlled valve **82,** forming a part of the pneumatic circuit, which is effective in actuating the pneumatic propelling unit **34** upon actuation of microswitch **33.**

The operator after positioning the fabric for holding by the clamp **21** and actuating control **74** cause actuation of said clamp **21** and the starting of the electric motor **9.** The actuation of control **74** controls the energizing of relay **73** which closes its own contact **83** that is in series with the microswitch **28.** Additionally, a contact **84** is provided for actuating a solenoid controlled valve **85** which controls the feeding of the pneumatic cylinder **56** that is operatively connected to the clamp **21.** With the closing of the contact **84** energization of a solenoid controlled valve is also affected, this value being in the pneumatic unit **29** is prepared for operation when the clamp **21** initiates actuation of the microswitch **28.** More precisely the opening of the microswitches or limit switches **28** and **33** causes the deenergizing of the solenoid controlled valves **86** and **81** and the release of a predetermined quantity of air by the pneumatic propelling units **29** and **34** so as to effect the return of the carriages **20** and **30** to their starting positions. The electric motor **9** functions normally until actuation of the microswitch **28** which is controlled by the carriage **20.** When a variation occurs in the profile of the fabric being sewn and the variation is slight, light to the photoelectric cell **37** becomes interrupted and the photoelectric cell **36** remains energized to effect operation of a pneumatic device **87** which includes a pneumatic cylinder having a piston **88** operatively connected to both tracks **18** and **19.** These tracks **18** and **19** are rotatable about a vertical axis **16** in one direction or the other as dictated by the variation in the profile **3** of the fabric being sewn.

During normal sewing light to the photoelectric cell **36** is interrupted and if a variation in the profile **3** exposes said photoelectric cell **36** to its source of light it becomes energized to effect the closing of a contact **89.** The closing of contact **89** actuates a solenoid controlled valve **90** that is normally closed, and causes compressed air to enter and operate the pneumatic cylinder **87.** The pneumatic cylinder being operated in this manner effects shifting or movement of the tracks **18** and **19** toward the right, which movement continues until the fabric being shifted by said tracks interrupts the light directed to the photoelectric cell **36.** When light to the photoelectric cell **36** is interrupted, it is deenergized causing the opening of contact **89** and the deenergizing of the solenoid controlled valve **90.** The deenergizing of the solenoid controlled valve **90** stops further movement of the tracks **18** and **19** by a shut off of air to the pneumatic cylinder **87** and said tracks remain stationary until a subsequent variation in the profile **3** occurs. If a variation in the profile **3** causes an interruption of light to the photoelectric cell **73,** which is normally energized, then a contact **91** is opened causing the deenergizing of a solenoid controlled valve **92.** The deenergizing of this solenoid controlled valve **92** causes compressed air to enter the pneumatic cylinder on the opposite side from which piston **88** extends, and is effective in moving the tracks **18** and **19** in the opposite direction or to the left until light to the photoelectric cell **37** is no longer interrupted.

When variations in the profile **3** require movement of tracks **18** and **19** for shifting the work and directing it toward the sewing mechanism for sewing along the variation in said profile, it is necessary that the rate of advance of the work be lessened as well as the speed of the motor **9** so that the piston **88** of the pneumatic cylinder **87** will stop said tracks in a position corresponding to the variation in said profile. If one of these variations causes the energizing of photoelectric cell **39** disposed to the left of photoelectric cell **36** there is a closing of a contact **93** and the energizing of an electric control **94** which decreases the speed of the electric motor **9** through the energizing and deenergizing with pre-established frequency the electromagnetic components of said motor's clutch. It should be understood that changes in the speed of the electric motor can be obtained by other suitable means such for example as a pneumatic system.

If the variation in the profile **3** causes interruption of light to the photoelectric cell **38** disposed to the right of photoelectric cell **37,** a normally closed contact **95** is opened to effect a reduction in rotating speed of the electric motor **9** through interruption of current to another electric control **96** whose function is similar to that of the electric control **94.** The difference between the two electric controls **94** and **96** is that while one is

normally deenergized during motor operation, the other is normally energized. When profile 3 of the material has been returned to the space between photoelectric cell 36 and photoelectric cell 37, tracks 18 and 19 will stop rotating around axis 16 and electric motor 9, and consequently the sewing machine will once again start operating at the normal speed. Carriages 30 and 20 will continue to move along the tracks pulled along by the work until reaching — first carriage 30 and then carriage 20 — the course limit, within a short distance of the sewing machine. In this position carriage 30 engages the microswitch 33 which causes the opening of clamp 31 and the invention of the pneumatic propelling unit 34; this pushes carriage 30 back against limit switch 32 which stops it and holds it back; still in this position, carriage 20 engages the microswitch 28, thus causing the opening of clamp 21 and the intervention of the pneumatic propelling unit 29; this pushes carriage 20 back against limit switch 27 which stops it by means of hook 25 and clasp 26. The sewing machine stops after the clamp 21 has been open for a certain period of time and the apparatus is then ready to start sewing on a new piece of material.

I claim:

1. An apparatus for guiding and sewing layers of fabric along an edge of irregular configuration comprising:

a. a support plane;

b. a sewing machine fixed to one end of said support plane having a drive motor of the electromagnetic friction brake-clutch type;

c. a support arm extending from said support plane having rotatable guide means carried thereby in a plane parallel with and spaced from said support plane;

d. means movable along said rotatable guide means for clamping the fabric and advancing the same toward said sewing machine along said support plane;

e. sensing means carried by said support plane for detecting variations in the edge of the layer of fabric to be sewn which includes:

1. means operatively connected to said sensing means for rotating said rotatable guide means and clamping means carried thereby so as to orient the position of the fabric as it is advanced to said sewing machine;

2. means for reducing the speed of said sewing machine when the fabric is shifted to accommodate an acute variation in the edge of the fabric; and

3. means for returning said sewing machine to its initial operating speed upon completion of the sewing in the area of the acute variation in the fabric edge.

2. The apparatus for guiding and sewing layers of fabric according to claim 1 wherein said sensing means includes first and second pairs of photoelectric cells located adjacent to said sewing machine and disposed in a plane extending transversely to the direction of advance of the fabric to be sewn.

3. The apparatus for guiding and sewing layers of fabric according to claim 2 wherein said means for rotating said rotatable guide means and clamping means includes a pneumatic cylinder having a solenoid controlled valve in circuit with said first and second pairs of photoelectric cells.

4. The apparatus for guiding and sewing layers of fabric according to claim 2 wherein said means for reducing the speed of said sewing machine includes an electrical control in circuit with said second pair of photoelectric cells for effecting energizing and deenergizing with pre-established frequency the electromagnetic components of the clutch portion of said drive motor.

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