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STITCHING OF MATERIALS

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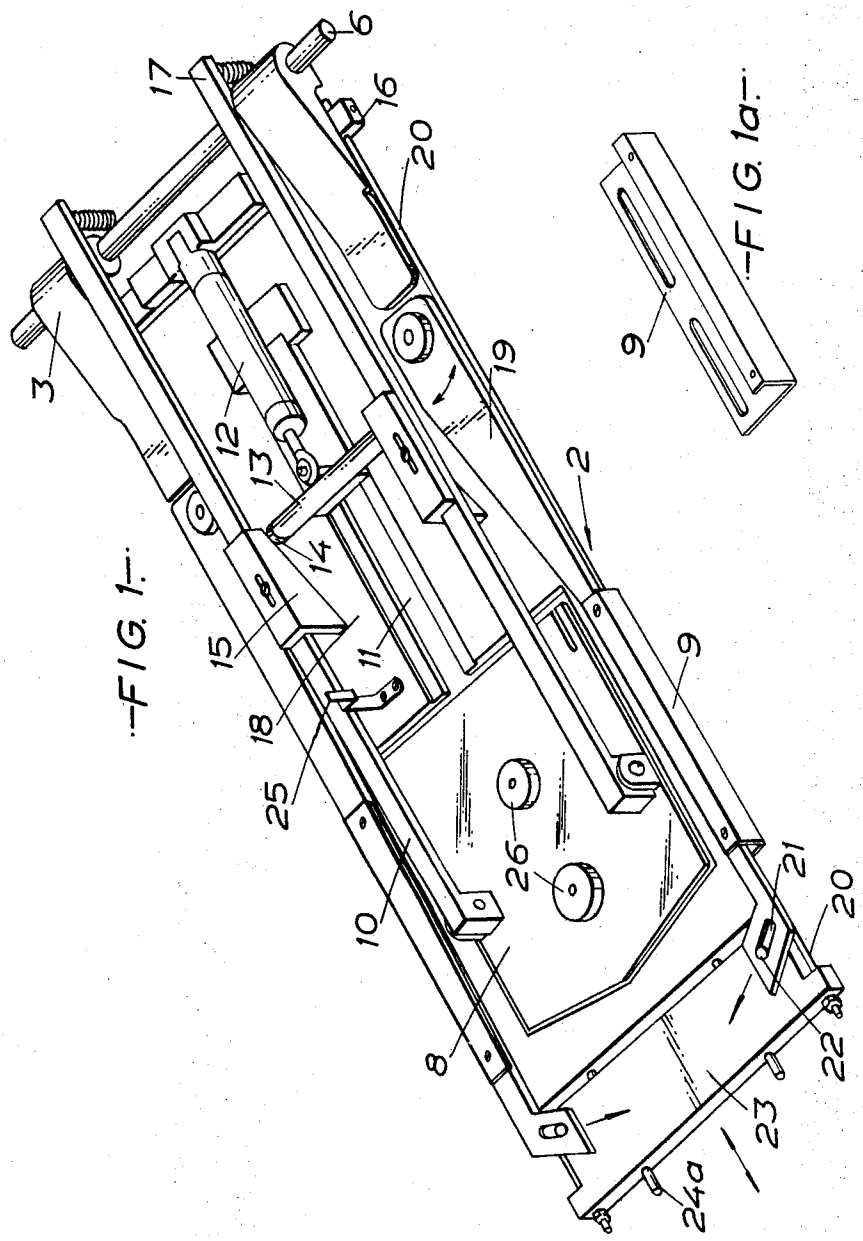


FIG. 1.




FIG. 1a.

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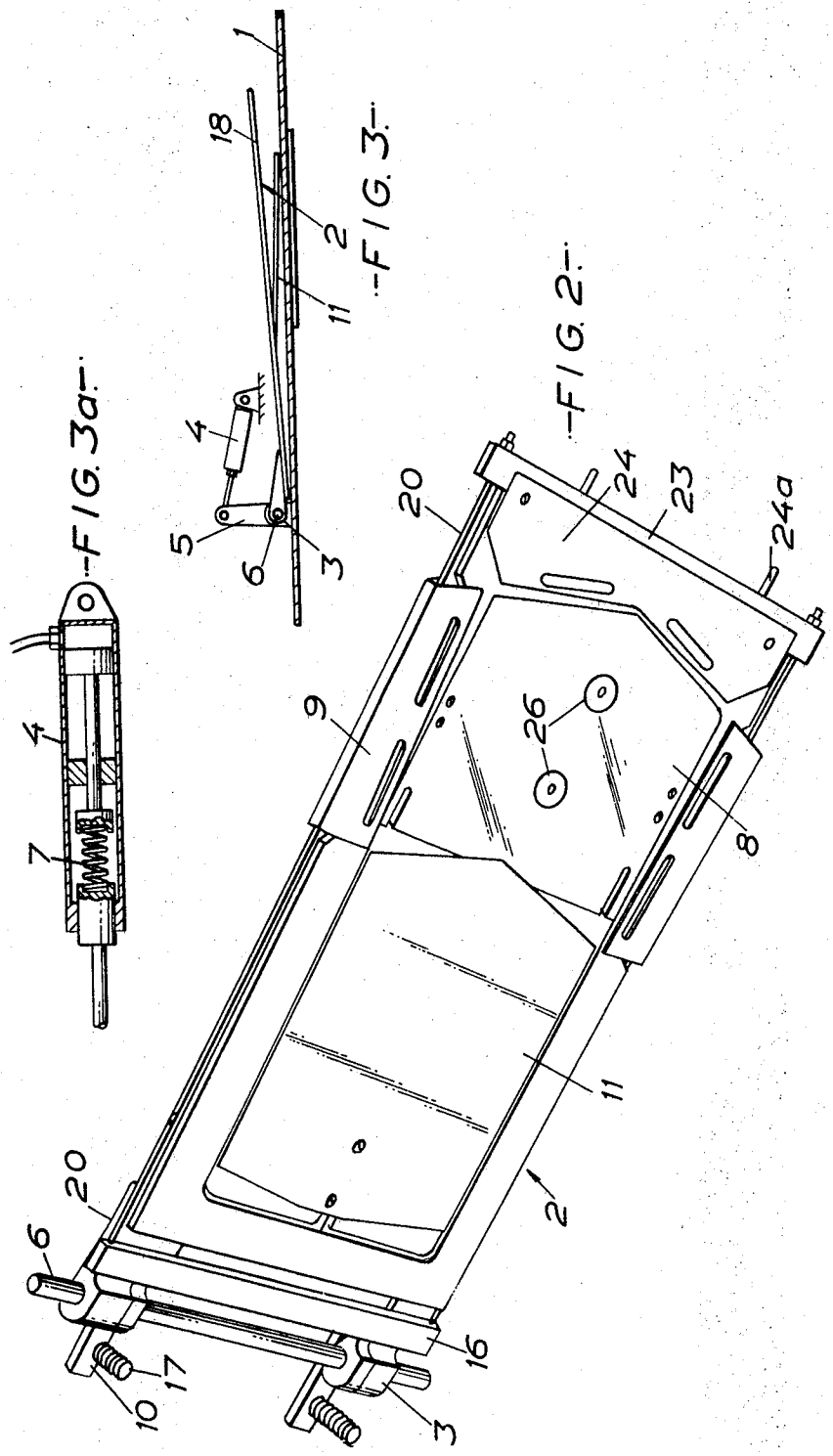


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STITCHING OF MATERIALS

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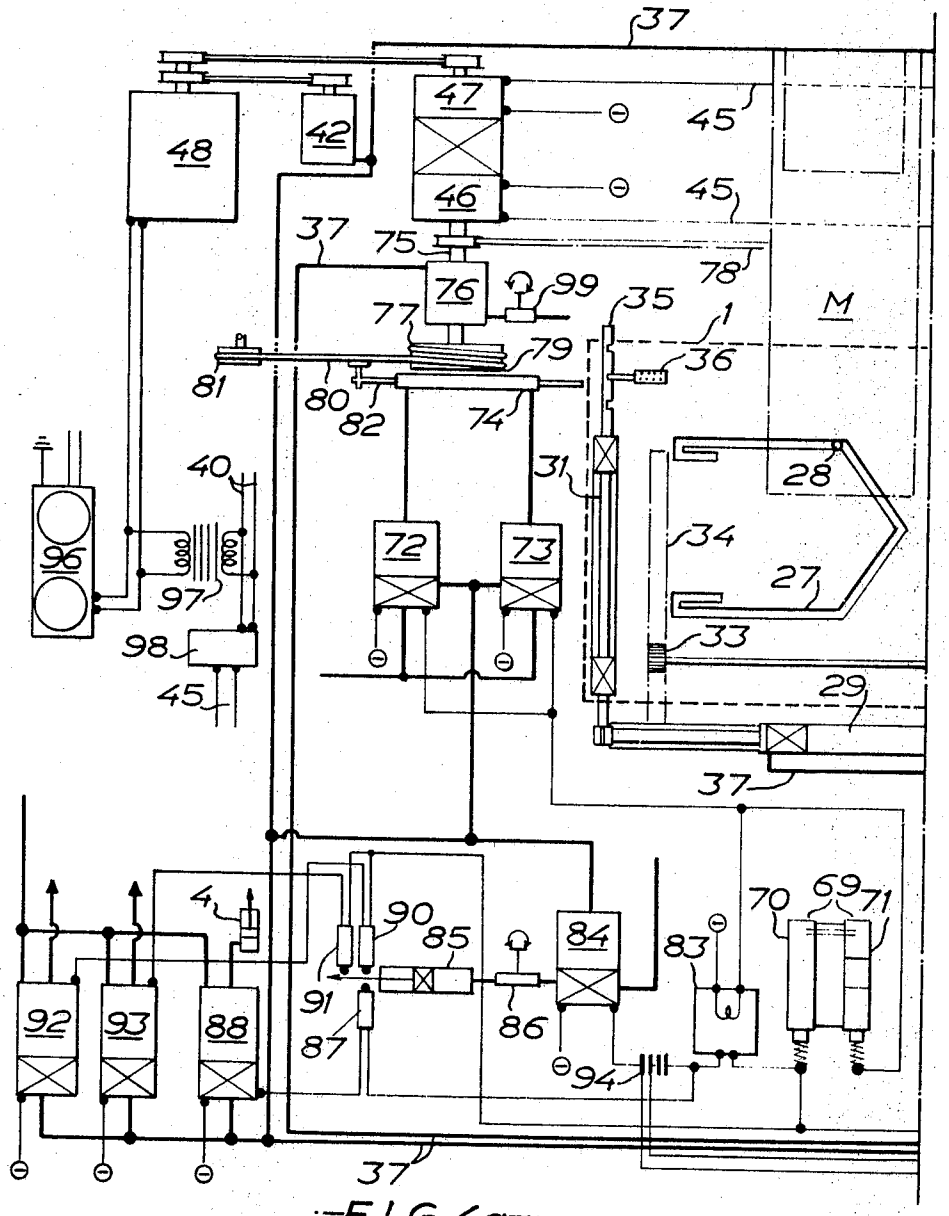


-FIG. 4a-

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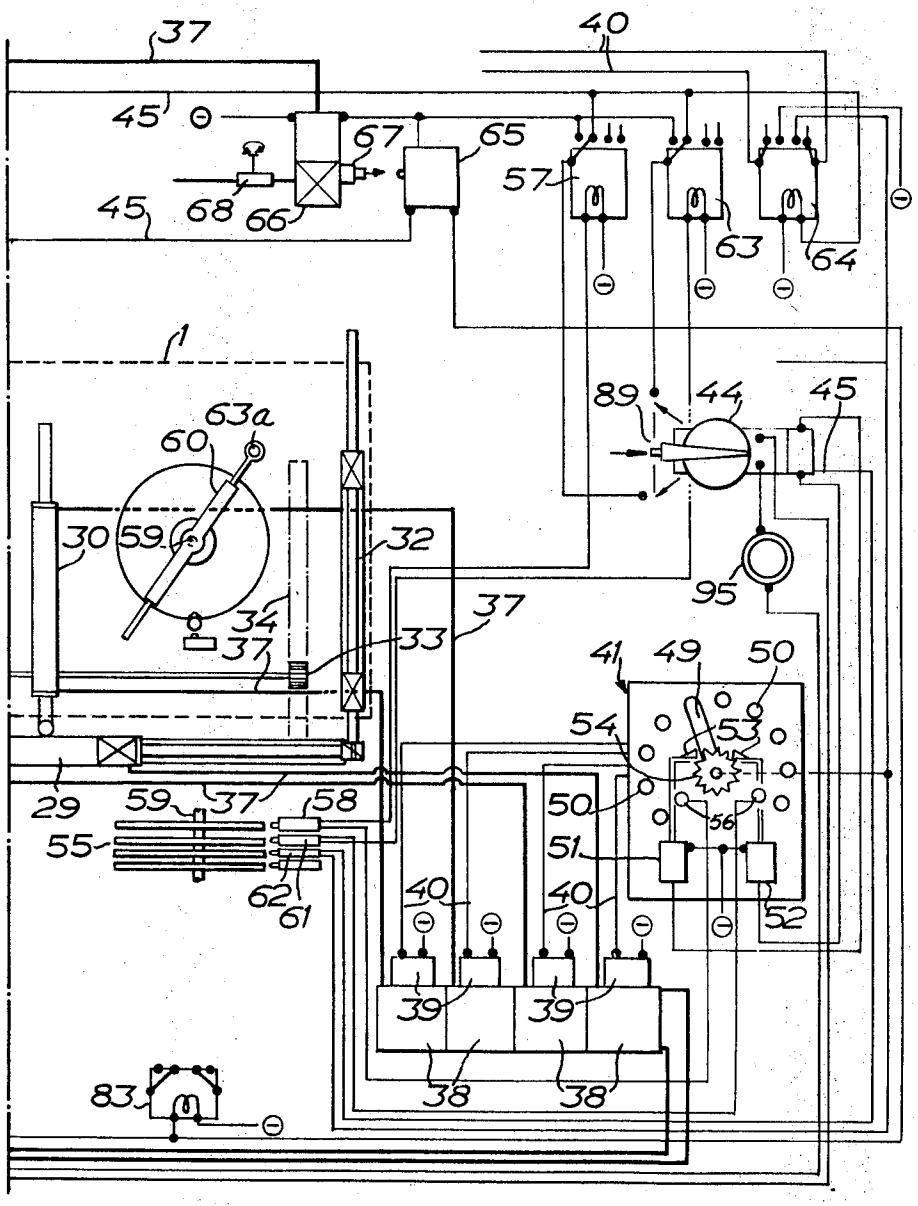
STITCHING OF MATERIALS

Filed July 25, 1968 4 Sheets-Sheet 4




-FIG. 4b-

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United States Patent Office 3,517,630
Patented June 30, 1970



3,517,630

# STITCHING OF MATERIALS

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Filed July 25, 1968, Ser. No. 747,691
Claims priority, application Great Britain, July 26, 1967, 34,276/67; Mar. 22, 1968, 13,890/68
Int. Cl. D05b 21/00
U.S. Cl. 112—121.12 9 Claims

## ABSTRACT OF THE DISCLOSURE

Apparatus for profile stitching a cut-out piece of material to a layer of material, including a sewing machine, a movable workplate carrying a hinged template beneath the machine needle, said template being adapted to hold a cut-out piece of material, fold its edges inwardly and then press said piece down onto the layer of material on the workplate, said workplate having a guide track with a stationary follower therein, and fluid pressure operated rams for giving movement to the workplate and loaded template in their own plane according to the guide track, said sewing machine stitching round the folded cut-out piece during said movement to secure the piece and layer together.

This invention relates to methods of, and means for, facilitating the stitching of materials together by a sewing machine in a predetermined manner.

In the manufacture of some articles, particularly articles of clothing, certain operations involve the stitching together of at least two layers of material in a particular manner, and this requires skilled operatives. For example, when patch pockets have to be stitched to a garment the operation entails shaping of the pocket by folding in the pocket edge and then the stitching operation to provide a good appearance and correct positioning of the pocket.

According to the present invention there is provided a method of controlling the shaping and then the stitching of a layer of material to another layer on a sewing machine, consisting in locating at least two layers of material in superposed and retained relationship on a movable workplate having a slotted guide track profiled to suit the line of stitching to be produced by the machine needle, causing the workplate to have movements in its own plane by a follower entered into the guide track and applying two pressurised fluid forces to the workplate at right angles to one another in a controlled order, and causing the plate movements to be fractionally intermittent so that there is no movement whilst the machine needle is in the material.

The invention includes a profile stitching apparatus for use in shaping and then stitching the shaped piece of material onto a layer of material on a sewing machine, including a workplate supporting a pivoted template for holding the materials related, a rectangular motion guide mounting for the workplate and a profiled guide track slot in the plate which defines the stitching line, a track follower engaged with the guide track to control the plate in varied movements in its own plane according to the track, a fluid pressure operating system for moving the workplate on its mounting, and electrical control means for operating valve means in said system for changes in the direction of the applied force.

The invention will now be more particularly described with reference to the accompanying diagrammatic drawings in which:

FIG. 1 is a perspective view of a pocket stitching template, with associated detail which forms part of the apparatus;

FIG. 1*a* illustrates a side folding blade used in the invention;

FIG. 2 is a perspective view of the template from below;

FIG. 3 is a side elevation of the template with associated enlarged detail;

FIG. 3*a* illustrates, partially in cross-section, a piston-cylinder unit used in the invention; and

FIGS. 4*a* and 4*b* constitute a diagrammatic layout of the electric control circuit and hydraulic operating systems for the template.



Basically the invention comprises a carrier workplate **1** for a template or jig **2** of the type described in our copending British patent application No. 41,628/66 filed Sept. 19, 1966. The workplate provides hinge means **3** to allow the template to have rising and falling movements and a pressurised fluid operated piston-cylinder unit **4** connected to a lever **5** on the hinge pin **6** can cause such movements. There is a resilient loading arrangement **7** between the piston and lever. This loading allows a limited reverse movement of the hinge pin and template opposite to the fluid pressure without having to resist the latter. The pocket retaining or pressure plate **8** in this apparatus is preferably transparent, mainly for material pattern viewing purposes and the side folding blades **9** can also have slots for the same purpose. This allows stripes or checks on a pocket and garment part to be registered. Also the pressure plate **8** is dependent from a pair of carrier arms **10** through ball joints to have a slight degree of self-adjusting movement when depressed. Again the underneath pocket shaping or former plate **11** is operated by a top piston-cylinder unit **12** through a front cross bar **13** having end rollers **14** which run under downwardly inclined cam tracks **15**, carried by the aforesaid carrier arms **10**, during the forward movement of the former plate **11**. The arms are secured on the hinge pin **6** for the template top frame rear cross bar **16** and have spring loaded tail ends **17**. The top carrier frame **18** carries the pivoted side frame members **19** which carry the side folder blades **9** and have inclined end cam slots **21** in which follower rollers **22** engage from an end cross bar **23** carrying the end folder blade **24**. This cross bar has guide pins **24***a* slidable in the end of the top frame which thus carries the bar **23** and folder blade **24**.

A shirt or other garment front part is first located on the workplate **1** and a pocket is then passed under the pressure plate **8** with the pocket edges resting on the carrier frame **18**. The pressure plate is normally held raised by a manually released spring catch **25** which is then operated for the plate **8** to fall and depress the pocket on to the garment front part. The former plate **11** is then pushed by its piston-cylinder unit **12** between the pocket and garment. Continued operation of the unit causes the side folding blades **9** to move in to fold the pocket side edges under the former **11** and further movement of the side frame members **19** pulls the end folding blade **24** in under the ends of the side blades and plate **11** to complete the pocket edge folding action. Magnets **26** carried by the pressure plate **8** pull the former plate **11** up to trap the pocket between the two plates. The former **11** and folding blades **9** and **24** are then withdrawn for stitching to be carried out around the pocket edges with back-tacking stitches at the ends of the stitching run.

The carrier workplate **1** has a rectangular recess in its upper face to accommodate the template in its lowered position and the base of this recess has a cam track slot **27** formed therein, into which a follower **28** projects from the throat plate of a sewing machine M on the table

top of which the workplate is mounted. Said cam track is profiled to suit the shape of pocket to be stitched to the forepart of a garment. Said follower has an axial needle passage hole and may be a roller.

The aforesaid carrier workplate **1** is given required movements by means of ram units **29**, **30** located at right angles to one another. One ram unit **29** will give longitudinal movement to the carrier workplate, to which it is secured, and the other ram unit **30** in a fixed position will give a transverse motion. The guide means **31**, **32** for the transverse movement form part of a frame, to which the pistons of the units **29**, **30** are attached, and may be of the linear bush type and connected pinions **33** and rack means **34** in parallel relationship are provided to ensure a true movement of this frame. A tail extension **35** of one transverse ram operated guide unit is notched to be engaged by a spring loaded catch **36** to prevent any tendency to side drift of the workplate. The ram units **29**, **30** are incorporated in a fluid pressure operating system **37** having valve means **38** which are electrically controlled through solenoids **39** and this electrical circuit **40** includes a number of relays and a timing i.e. selector device **41**. The fluid can be pressurised by a pump **42** from a reservoir if hydraulic, or from the atmosphere if pneumatic and if desired the fluid operation may be hydraulic/pneumatic.

The electrical circuit **40** includes a control switch **44** which controls A.C. and D.C. circuits **40** and **45**. The A.C. circuit **40** may be 110 volts and controls the hydraulic flow control valves **38** and the selector switch mechanism **41**. The D.C. circuit **45** may be 90 volts and energises an electric brake **46** and clutch **47** for the machine driving motor **48**.

The selector device **41** for further controlling the electrical circuit **40** consists basically of a sweep arm contactor **49** capable of rotation over any required number of contacts **50** equally disposed. Actuation of the sweep arm is controlled by two solenoids **51**, **52** opposed to each other and each motivating a pivoted pawl **53**. The pawls are capable of engaging on a star wheel **54** type gear. Upon energising the solenoid **51** the appropriate pawl is drawn into engagement with the star wheel indexing the gear wheel one tooth. This in turn has moved the sweep arm **49** from one contact **50** to the adjacent contact **50** and the sequence is perpetuated by signal pulses caused by the discs **55** to the solenoid in question. Upon reversal of the cycle by operation of control switch **44** the said solenoid **51** is disconnected from the circuit and the second solenoid **52** takes over the same function but on the opposite side of the star wheel thus rotating the sweep arm **49** in the opposite direction, thereby giving full electrical reverse control to the hydraulic cylinders **29**, **30**. Switch **44** when placed in the reverse control position also acts to reverse the circuits to valves **39** to reverse the fluid flow to the cylinders **29**, **30**. This ensures that regardless of the position of the sweep arm **49**, direction of the machine is always relative to the outline being stitched and reverse or forward directions are obtained simply by the main control switch **44** selecting either the first solenoid **51** or the second solenoid **52**.

The aforesaid back-tacking in the stitching run commences when the sweep arm **49** of the selector mechanism in either of its end positions of the cycle. In each of these settings an auxiliary contact **56** is made which is independent of the main sweep arm circuits. The contacts energise a relay **57** which is in circuit with the electrical clutch unit **47**. To achieve position of the electrical brake to the clutch the circuit is fed through a micro-switch **58** which is in turn controlled by one disc of a series of discs **55** mounted on the shaft **59** of a rotary slider control gear unit **60** to operate the micro-switches **58**, **61** and **62**. This control gear unit is itself actuated by the movement of the top carrier workplate **1** to which it is anchored at **63***a*. When this micro-switch is actuated the relay **57** is energised thereby breaking the circuit to the clutch **47** and achieving a changeover of the power supply to the brake unit **46** which is in conjunction with the clutch **47**. Thus, the back-tack lengths and starting position can be controlled simply by the setting of this disc which operates switch **58**. This disc and sweep arm system is duplicated at the other end of the cycle for relay **63** and the switch **61** to be operated for back-tacking. When the clutch circuit is broken by the relay **57** or **63** this is interlocked electrically by relay **64** to break the circuit controlling the hydraulic valves **38** thereby closing the hydraulic system **37** completely. Thus two selector discs **55** control micro-switches **58**, **61**, one for each way of the stitching runs.

The invention also includes means for ensuring the machine needle is stopped automatically in a required position, e.g., raised. The needle position sequence follows from the back-tack circuit and is interlocked when the relay controlling the back-tack position is energised thus creating the back-tack finish position. The power changeover from these relays **57**, **63** is fed into a micro-switch **65** and at the same time opens a solenoid **66** in the hydraulic system **37** controlling a hydraulic piston-cylinder unit **67**. This allows the hydraulic cylinder to exhaust itself at a predetermined rate controlled by an adjustable throttle valve **68**. The piston-cylinder unit in its normal position has been actuating the micro-switch **65** in question. The switch in its normal position controls the circuit to the electrical brake in conjunction with the clutch unit. This opening of the switch **65** brakes the machine to a standstill. As the cylinder **67** exhausts itself it allows the micro-switch **65** to take up its alternative position which, in turn, breaks the circuit to the electrical brake and energises a brush gear unit **69**. This consists of a full commutator ring **70** which we shall call the "master" supply ring and a connected commutator ring **71** which has an insulated brake sector on its periphery. The circuit is fed to the commutator ring **71**, with the insulated sector, by the master supply ring **70** and when the brushes are in contact a circuit is formed controlling solenoids **72**, **73** which actuates a hydraulic piston-cylinder unit **74** the piston movement of which continues until the insulated sector comes into contact with the brush thereby breaking the circuit to the solenoids.

The main electrical clutch output shaft **75** is connected to a rotary valve **76** in the hydraulic system and, in turn, an extension from this valve is utilised to mount a free-wheel type bearing unit **77**. This bearing unit is similar to a ball race in appearance but has the property of being able to transmit power in one direction only thus creating a free-wheel action on the reverse direction of rotation. The free-wheel bearing is mounted so that the normal running direction of the sewing machine through belt **78** achieves the free-wheel action and does not transmit power to the outer housing ring of the free-wheel unit. On this housing is mounted a pulley **79** having a spiral groove formation around which a Bowden or other cable **80** is mounted, the ends being trapped by clamping screws in the pulley. This cable runs around a slave pulley **81** some distance from the free-wheel unit and tensions accordingly. The piston rod **82** of the previously mentioned hydraulic cylinder **74** is connected to the cable and thus when the cylinder piston is actuated it moves the cable which, in turn, drives the pulley **79** on the free-wheel unit **77** and thus the sewing machine through belt **78** in the correct direction of rotation. It is essential that the stroke of the hydraulic cylinder **74** is equal to or exceeds the circumference of the cable pulley fitted to the free-wheel unit so that the positioning of the needle is always possible regardless of the stopping position of the insulated sector of brush gear **69**. The brush gear previously mentioned is mounted on the top shaft of the sewing machine and is timed so that the insulated section on the commutator ring **71** is relative to the desired position of the needle, thus when the machine has been rotated to the

predetermined needle position the insulated sector on the commutator comes into contact with the electrical brush gear and breaks the circuit controlling the system to the hydraulic cylinder **74** thereby finishing the fluid feed to the hydraulic cylinder when the needle is in the desired position.

The control of the aforesaid template or jig may be as follows. Here again the sequence of this cycle is interlocked to the needle position control and cannot be actuated until the insulated sector on the commutator ring **71** is in its closed position, i.e. the needle control cylinder piston rod **82** is stopped. Power is then fed through a series of interlocking relays **83** and also to the control circuit of a solenoid controlled hydraulic valve **84** which, when activated, opens and allows a hydraulic piston-cylinder unit **85** to be operated through a throttle valve **86** which can be adjusted to allow the operation of the piston cylinder unit **85** to progress at a predetermined rate. This hydraulic unit actuates the selector gear. At the same time as the piston-cylinder unit **85** is operated a micro-switch circuit **87** is opened which, in turn, actuates a second solenoid controlled hydraulic valve **88** thereby motivating the hydraulic piston-cylinder unit **4** which lifts the template so that at the end of the needle up position cycle the template automatically lifts to its raised position.

At this stage the pocket patch is loaded and folding operations commence on the operation of an electrical switch **89** which is mounted in the control switch knob **44**. This switch **89** operates a relay system which, in turn, allows the solenoid of valve **84** first mentioned to commence its action. As the piston rod of this cylinder **85** moves out at its predetermined rate a series of micro-switches **87** and **90, 91** are actuated in a predetermined pattern thus opening solenoid controlled valve **92** for allowing first of all the piston of the unit **12** controlling the profiled former plate **11** to move forward. When this has reached the end of its stroke the folders **9** and then the end folder **24** will have moved in and the template is then lowered to drop the folded pocket onto the shirt front. From this operation a solenoid controlled valve **93** is actuated which retracts the profiled former plate **11** to its rearward position, this reverse movement causing the folders to withdraw. The garment parts are then in a position for sewing to commence.

This cycle can be used with plain materials but if striped or patterned materials are to be used and matching of these patterns is essential (i.e., matching of a pattern in the patch material in relation to the pattern in the garment forepart) a secondary circuit is brought in by means of a switch **94** which in turn operates a further interlocked relay system which interrupts the folding cycle thus allowing the profiled former plate to remain in the forward position with the template down on the garment part. This allows the patterns to be matched. When this has been achieved a control button **95** adjacent to the main control knob **44** is operated and allows the solenoid controlled piston-cylinder actuator **12** to withdraw the profiled former to its rearward position.

A further piston-cylinder unit in the hydraulic system may automatically cause cutting means to cut the sewing thread at the end of a stitching run.

The electric drive motor **48** is controlled by the usual "START," "STOP" switch **96** and a transformer **97** and rectifier **98** are connected into this circuit for the D.C. circuit **45**.

These stitching operations require to be such that in effect the template is fractionally stationary whilst the sewing needle is in the material. To achieve this the rotary valve **76** is incorporated in the exhaust side of the fluid pressure operating system **37** so that, in effect, there are pulses in the fluid which creates the required momentary stoppages of the template, which in appearance appear to be vibrations in the apparatus. It will be understood this exhaust control valve **76** is timed to suit the stitching position and speed of the needle. Furthermore, an adjustable flow valve **99** can be included in this exhaust side of the system for varying the length of the stitch for the sewing operation.

What we claim is:

**1.** Apparatus for joining together two layers of material by stitching, comprising a sewing machine, a workplate on which a first layer of material can be laid, a template for holding and positioning the second layer of material in relation to the first layer, hinge means for mounting said template for movement relative to said workplate, guide means supporting and guiding said workplate for sliding movement along two mutually perpendicular paths, a profiled guide track in said workplate which defines the stitching line, a fixed track follower engaged with said guide track, a fluid pressure operating system for moving said workplate on said guide means, control valves in said fluid pressure operating system, an electrical control means for said control valves, an operating device pivotally anchored to the workplate, a set of rotary disc means operable by said operating device, electrical switch means operable by said disc means, a selector device controlled by operation of said electrical switches, a series of electrical contacts in relation to which said selector device is movable, said electrical contacts forming part of said electrical control means and being contacted by said selector device to ensure a sequence of movements of template and workplate.

**2.** Apparatus in accordance with claim **1**, further comprising a frame by way of which said workplate is supported on said guide means, and wherein said fluid pressure operating system comprises a first piston-cylinder unit having its piston attached to said frame and its cylinder attached to said workplate, and a second piston-cylinder unit disposed transversely to said first piston-cylinder unit and having its piston attached to said frame and its cylinder attached to stationary structure of the apparatus.

**3.** Apparatus in accordance with claim **1** wherein said selector device comprises a sweep arm movable from one to another of said electrical contacts, a toothed wheel secured to rotate with said sweep arm, first and second pawls engageable with said toothed wheel and operable to drive said toothed wheel respectively in a clockwise or an anticlockwise direction, a first solenoid for operating said first pawl, and a second solenoid for operating said second pawl, said first and second solenoids being controlled by operation of said electrical switches.

**4.** Apparatus in accordance with claim **2** wherein said selector device comprises a sweep arm movable to engage each of said electrical contacts, means controlled by operation of said selector switches to operate said sweep arm to move clockwise or anti-clockwise, and wherein said control valves control said first and second piston-cylinder units to move said workplate in response to said sweep arm.

**5.** Apparatus in accordance with claim **4** wherein said electrical contacts form a series having two ends and include a further contact at each end of said series, each of said further contacts when contacted by said sweep arm being effective to cause an opposite movement of the workplate for a back tacking stitching operation at each end of the normal stitching run.

**6.** Apparatus in accordance with claim **1** wherein said fluid pressure operating system includes a piston-cylinder unit connected to move said template about said hinge means to raise and lower said template relative to said workplate.

**7.** Apparatus in accordance with claim **6** and including a hinge pin forming said hinge means, a lever secured to rotate said hinge pin, and spring loading means connecting said lever to said piston-cylinder unit to allow limited manual movement of said lever in opposition to fluid pressure in said piston-cylinder unit.

8. Apparatus in accordance with claim 1 wherein said electrical control means includes alternating and direct current circuits, a driving motor for said sewing machine, an electrically operated clutch and brake in the drive to said sewing machine, a hydraulic pump driven by said motor, a brush unit in said direct current circuit, said unit having a commutator ring with an insulated sector, solenoid operated valves controlled by said brush unit, and a piston-cylinder unit controlled by said valves and adapted to cause movement of said sewing machine to move the machine needle to a preselected position.

9. Apparatus in accordance with claim 8 and further comprising a drive shaft, a free-wheel unit controlled by said piston-cylinder unit to give rotary motion to said drive shaft, a rotary valve operated by said driving motor, a hydraulic system into which said rotary valve is connected, said hydraulic system operating said workplate and said rotary valve being so ported as to create pulses in the hydraulic system and thus momentary pauses in the template movement whilst the needle is in the material layers.




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