United States Patent

Firestein et al.

[15] **3,661,103**

[45] **May 9, 1972**

[54] AUTOMATIC PLEATING MACHINE

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[22] Filed: **Nov. 2, 1970**

[21] Appl. No.: **86,025**

[52] **U.S. Cl.** **112/134**

[51] **Int. Cl.** **D05b 35/08**

[58] **Field of Search** 112/134, 135, 132, 133; 223/30

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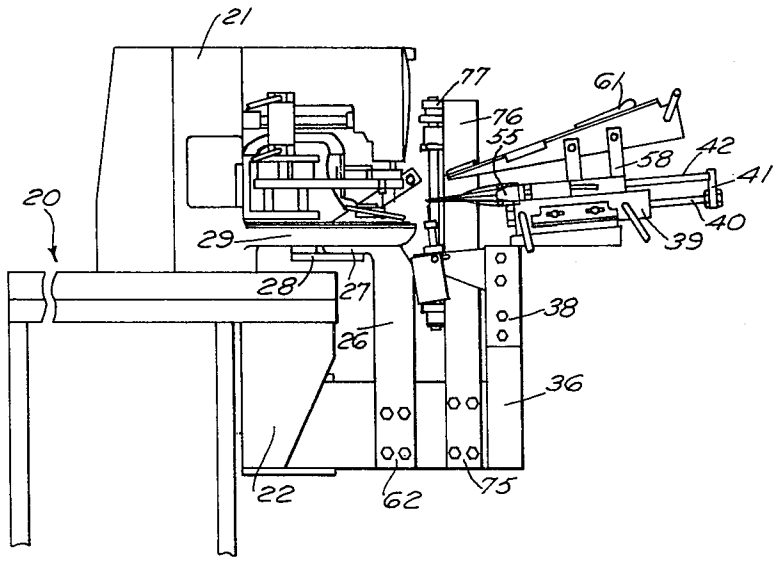
Primary Examiner—H. Hampton Hunter

Attorney—Max Schwartz

[57] **ABSTRACT**

This is an automatic pleating machine which is designed to automatically form a plurality of spaced pleats across the top of a piece of drapery or curtain material and to sew the pleats in place. A sewing machine is mounted on a stand and the automatic pleat forming device is mounted on an arm swung from beneath the stand in front of the sewing machine. A pair of jaws are pivoted to swing vertically into open position with a central tongue between them to form two separate sections. A C-shaped arm is designed to push the material into jaws on each side of the central tongue to form the pleat. A plurality of needles now swing upwardly through slots in the jaw to hold the pleat in position while the C-shaped device is removed. The jaws then close on the pleat and the entire jaw assembly moves forwardly to a point beneath the sewing machine needle. At this point the sewing machine clamp moves downwardly and clamps the pleat. The jaws are then withdrawn and opened up for the formation of another pleat. The second pleat is formed before the first pleat has been sewed by the machine. After the first pleat has been sewed the sewing machine clamp is raised and an arm comes downwardly to pull the material from beneath the needle of the sewing machine. The second pleat already completed in the jaws is then moved forwardly beneath the sewing machine clamp. This is repeated until the plurality of predetermined pleats in a predetermined spaced relation are formed on the material. The pleats are usually so arranged that the first and last pleats are approximately 3 inches from the edge of the material while the other pleats are approximately five inches apart. For this construction the apparatus is provided with an arm controlled by two cams. During the initial operation the first cam permits the arm to move downwardly to pull sufficient material to form the first pleat three inches from the edge. Thereafter during the operation of the device the second cam takes over and pulls more material for the formation of the pleat so that the pleats are now five inches apart. The various parts of the device the jaws and the pleat forming device are all operated by compressed air controlled by solenoid valves. The entire machine can then be programmed from a tape in the conventional manner.

35 Claims, 18 Drawing Figures



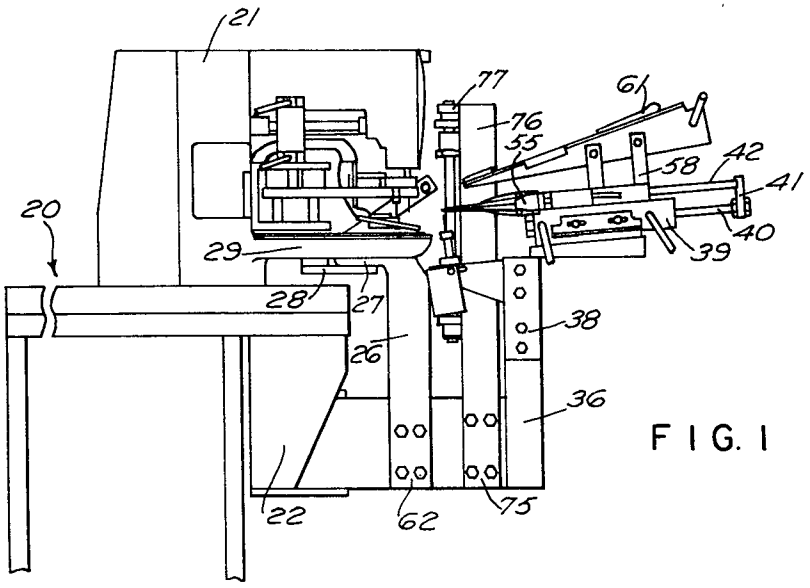


FIG. 1

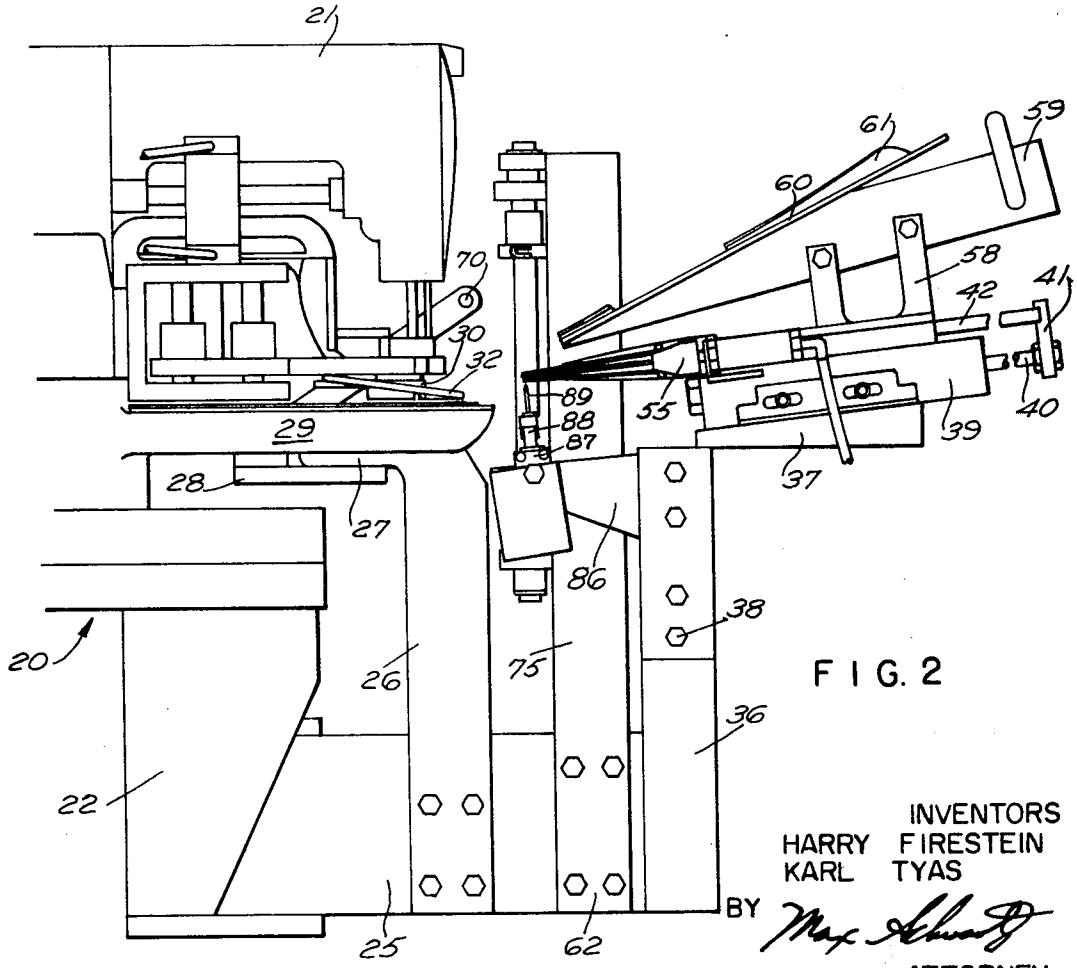


FIG. 2

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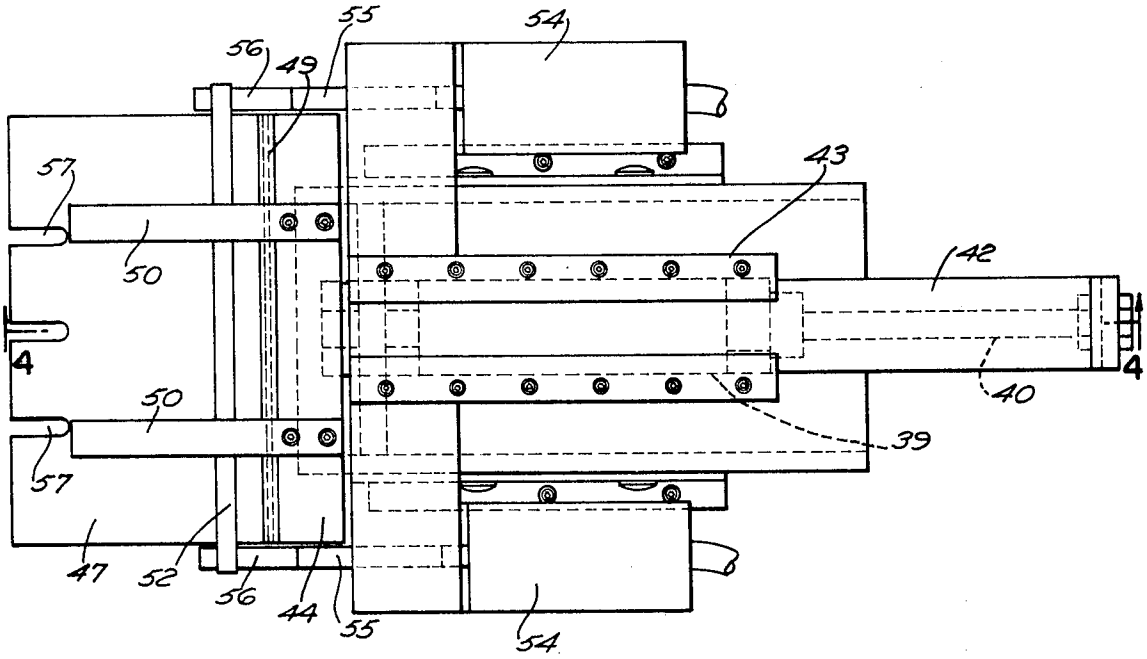


FIG. 3

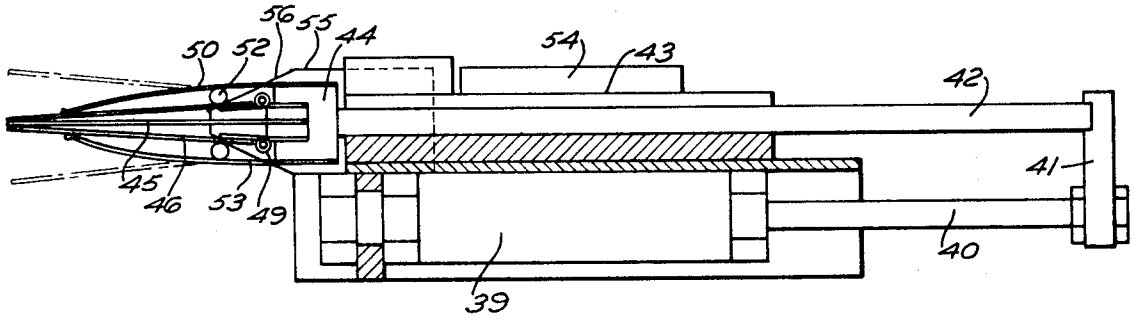


FIG. 4

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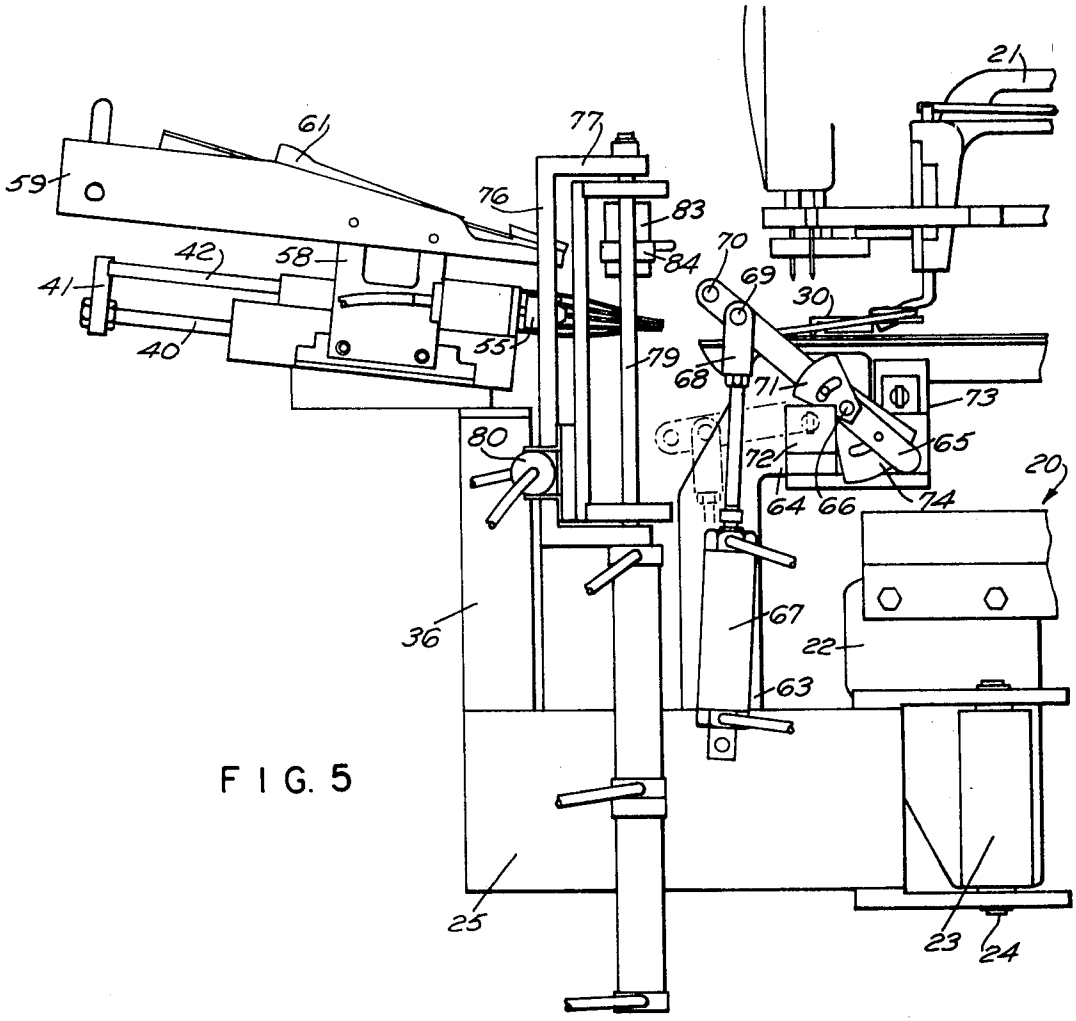


FIG. 5

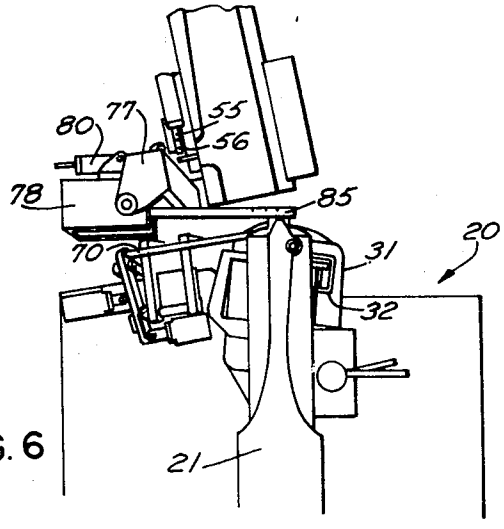


FIG. 6

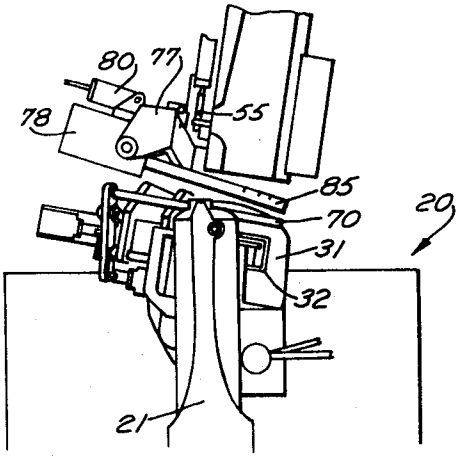


FIG. 7

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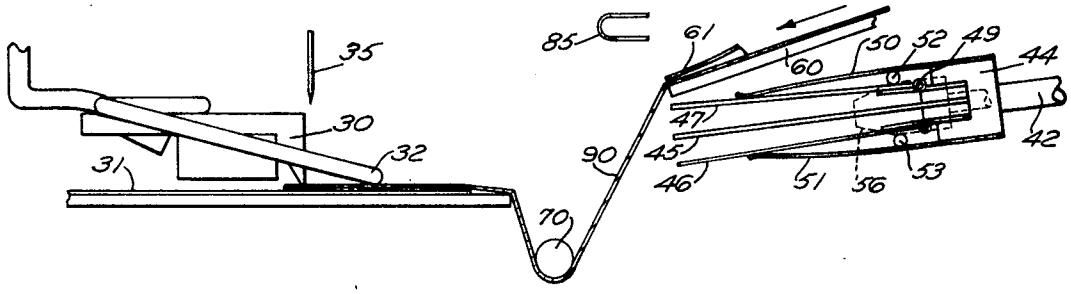


FIG. 8

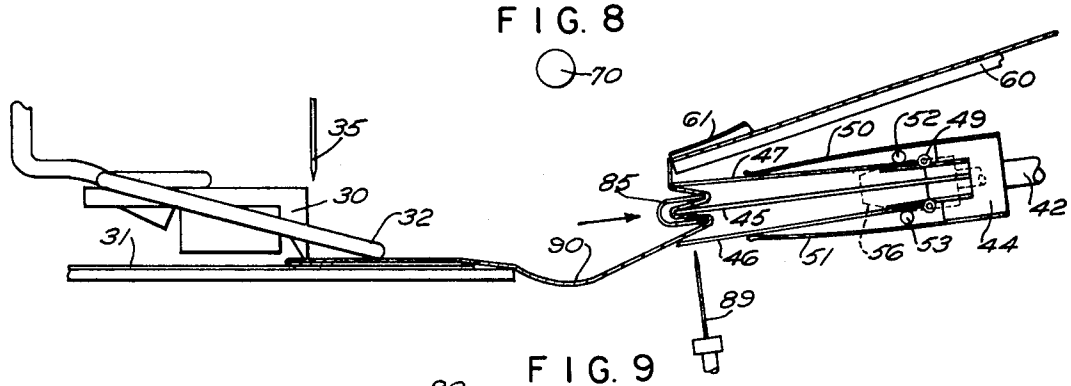


FIG. 9

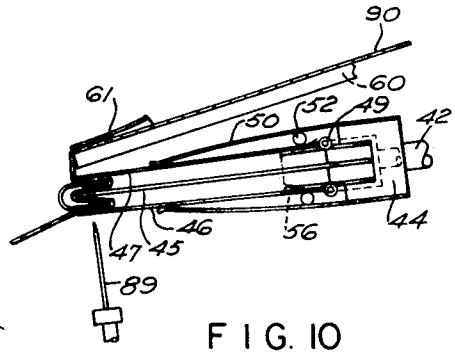


FIG. 10

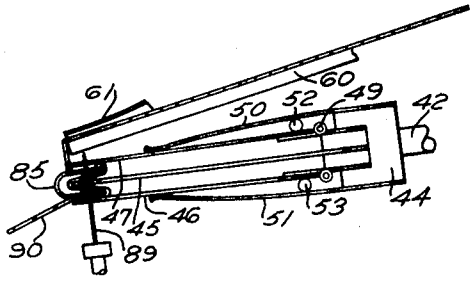


FIG. 11

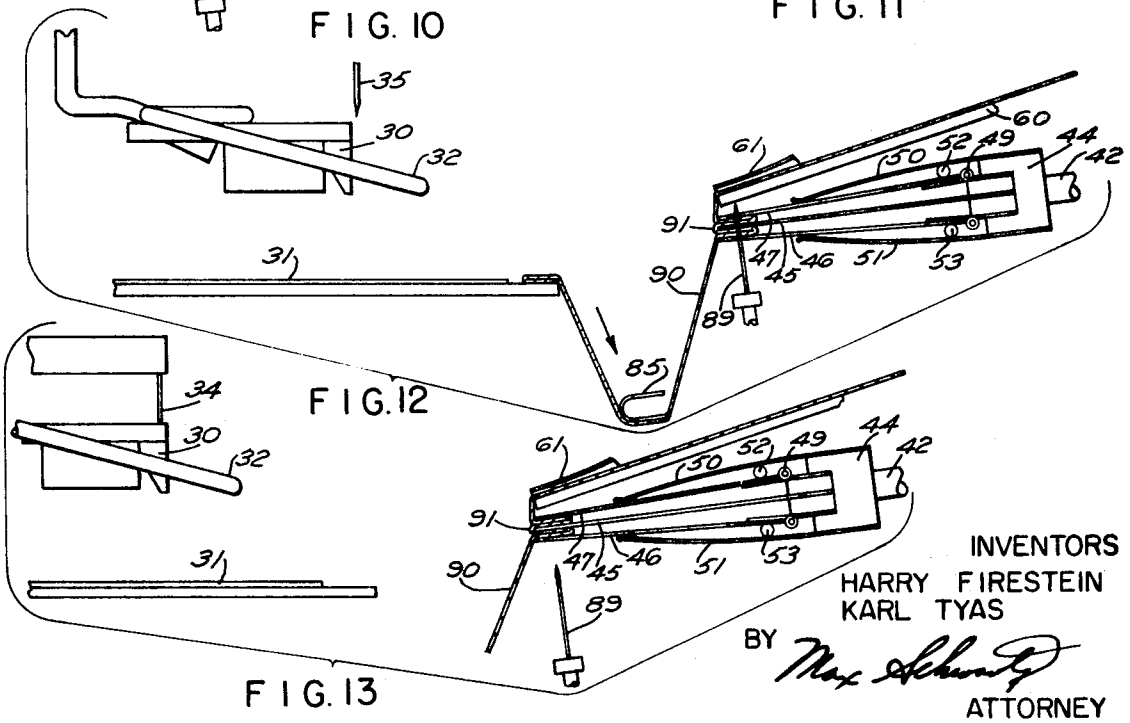


FIG. 12

FIG. 13

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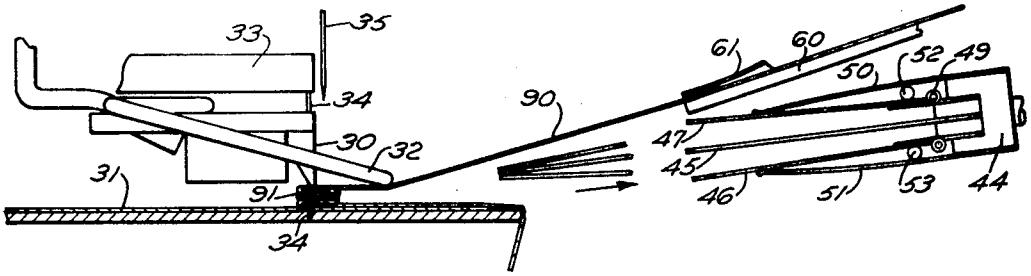


FIG. 14

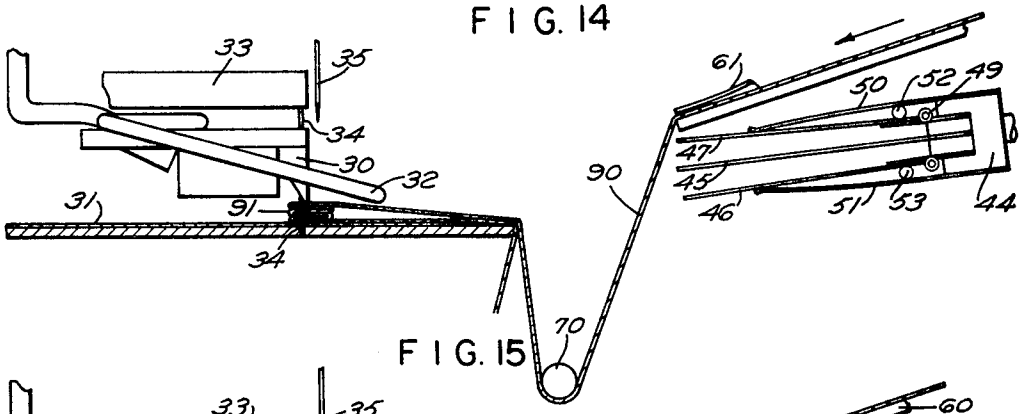


FIG. 15

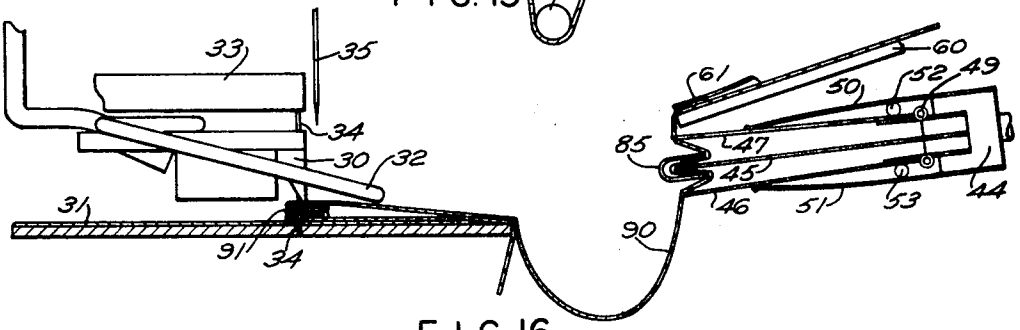


FIG. 16

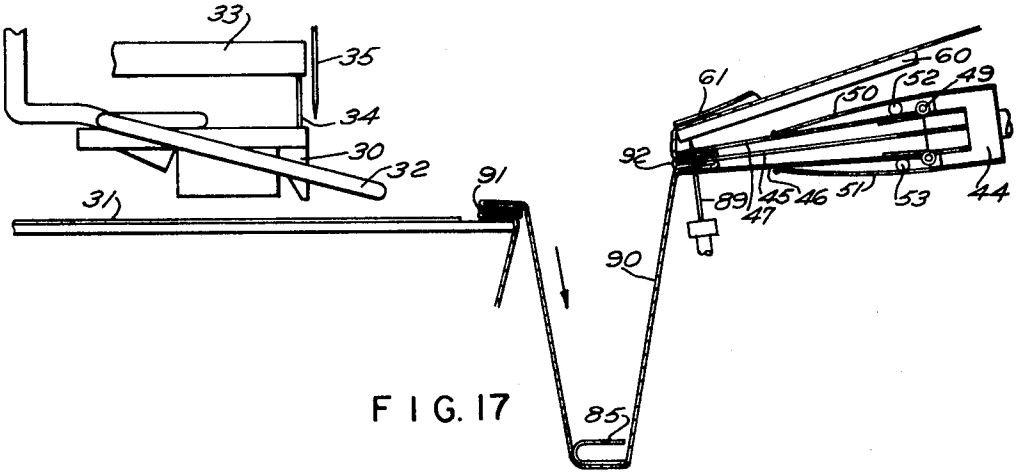


FIG. 17

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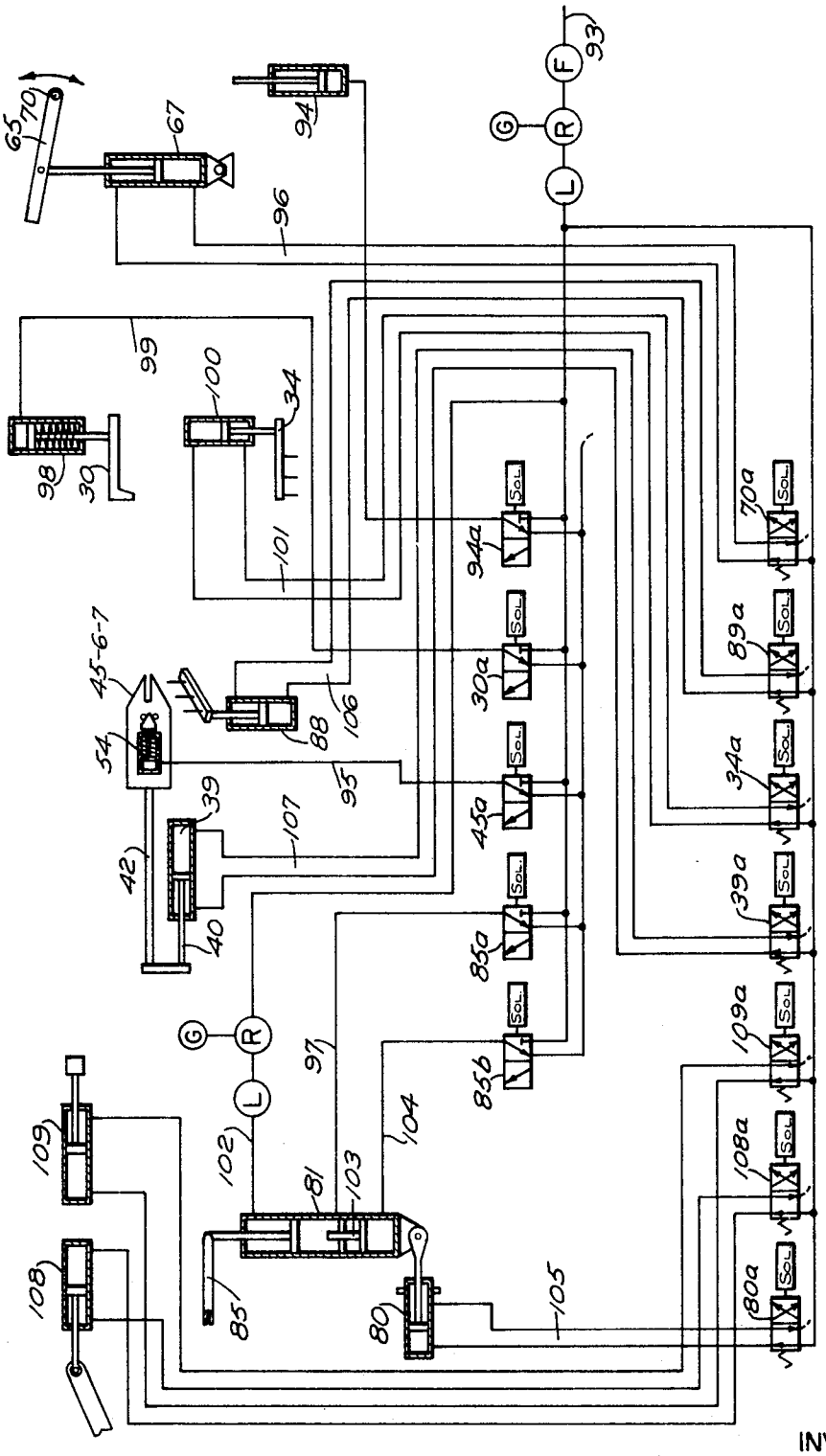


FIG. 18

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AUTOMATIC PLEATING MACHINE

Our present invention relates to the sewing art and more particularly to a novel automatic machine for forming and sewing pleats in spaced relation on a piece of material.

The principal object of the present invention is to provide a completely automatic device for forming a plurality of spaced pleats on a curtain or drapery and for sewing the pleats into position.

Another object of the present invention is to provide a device which will automatically form pleats at a predetermined spacing along the edge of a piece of material and will sew the pleats into position.

A further object of the present invention is to provide an automatic machine which operates in conjunction with a standard sewing machine to form a plurality of pleats and to feed them successively beneath the needle of the sewing machine for sewing into position.

Another object of the present invention is to provide an automatic machine which will rapidly form a succession of evenly formed pleats and will cause them to be sewed into position.

A further object of the present invention is to provide an apparatus which is fairly simple in construction and easy and economical to manufacture and assemble.

With the above and other objects and advantageous features in view our invention consists of a novel arrangement of parts more fully disclosed in the detailed description following in conjunction with the accompanying drawings and more particularly defined in the appended claims.

In the drawings,

FIG. 1 is a side elevation of an apparatus embodying our present invention.

FIG. 2 is an enlarged view similar to FIG. 1 with the material which is being fed shown on the device.

FIG. 3 is a top plan view of the pleat forming jaws.

FIg. 4 is a section taken on line 4—4 on FIG. 3.

FIG. 5 is a side elevation from the side opposite FIG. 2.

FIG. 6 is a top plan view showing the apparatus swung to the left.

FIg. 7 is a top plan view showing the apparatus as it is swung towards the right.

FIGS. 8 to 17 inclusive are fragmentary side elevational views of the sewing machine needle and clamp and the jaws illustrating the sequence of operation of the machine.

FIG. 18 is a diagrammatic view of the compressed air and solenoid valve hookup for operating the sequence hereinabove referred to.

In the manufacture of certain types of curtains and draperies it is customary to provide the upper edge of the material with a stiffening material such as buckram. The stiff material is run through a device which scores it to form preliminary fold lines. The pleats are usually positioned an equal distance apart along the edge of the material but each pleat at each end is usually a shorter distance from the edge of the material. For example in a conventional construction the first pleat is three inches from the edge and each succeeding pleat is five inches from the preceding pleat. When the last pleat is formed it should be three inches from the other edge. An operator by hand forms a pleat along the score lines places it beneath the needle of a sewing machine and proceeds to operate the sewing machine to sew the pleat in place. Now the operator forms the next pleat by hand and so on. In U.S. Pat. No. 3,331,345, issued July 18, 1967, and entitled PLEATING ATTACHMENT FOR A SEWING MACHINE, a device has been illustrated which considerably shortened the time necessary for forming the pleats by eliminating the pre-scoring and by forming the pleats automatically. This device enables the operator to pick a finished pleat from the machine and place it beneath the needle of the sewing machine.

However, the device shown therein has the disadvantage that the operator must individually pick up each pleat and skillfully place it beneath the needle of the sewing machine and proceed to sew the pleat into position. The machine of the present invention has gone one step further. The device of the present invention now forms the pleat and places it beneath the needle of the sewing machine and sews it into position. Thus the operator need only feed the material into the machine and the machine does the rest automatically. The device of the present invention can be preset to form the first pleat a predetermined distance from the edge and then to form the successive pleats a pre-determined distance from each other. The entire operation is completely automatic requiring practically no skill on the part of the operator in forming the pleats.

Referring more in detail to the drawings illustrating our invention FIGS. 1 to 7 inclusive illustrate the construction and assembly of the machine of the present invention. We supply a table or support 20 on which the sewing machine 21 is mounted. Extending downwardly from beneath the front side edge on both ends of the table top 20 is a supporting plate 22. An elongated beam or support 23 extends horizontally between the plates 22. Pivotally mounted on the support 23 at 24 is a horizontal arm 25 in the form of a wide beam vertically positioned to form an extremely strong support. A guide member 26 extends vertically from the beam 25 and is provided with a horizontal flat upper end 27 which extends into a slot formed by a plate 28 mounted beneath the sewing machine plate 29 in spaced relation. The portion 27 slides into the space and forms an additional support and guide for the supporting beam 25 as it swings in a horizontal position.

The sewing machine itself is of a conventional type designed to move a piece of material first in one direction and then in the other to form a double row of stitching. Since the plate beneath the needle would normally swing in an arc these sewing machines are equipped with a cam operated construction which forms the stitch in a straight line. However, for the purposes of the present invention the sewing machine is also provided with a clamping member 30 which is designed to hold the material on the sewing plate 31. An additional spring wire clamping member 32 extends just ahead of the clamping member 30 to hold the material in front of the sewing needle and prevent the material from bunching up and wrinkling during the sewing operation. In addition we provide a holding member 33 having a plurality of spaced needles 34 designed to extend vertically through the clamping member 30 to hold the pleat as shown in FIGS. 14,15 and 16. The needles 34 are positioned just behind the sewing needle 35 as seen in FIG. 14.

The pleat forming and feeding portion of the device is mounted on the support 25 as shown in FIGS. 1 to 7 inclusive. A rectangular block 36 is vertically mounted at the end of the supporting arm 25. The block 36 is mounted in a plane parallel to the front of the sewing machine table 20. We now provide a wedge shaped support 37 extending at right angles from the top of the block 36. The top portion of the block 36 is hollow and the wedge shaped member 37 is provided with welded holding strips, not shown, which extend into the block 36 and are held therein by the bolts 38. Mounted on top of the wedge member 37 is an enlarged cylinder 39 from which the piston rod 40 extends axially rearwardly, see FIG. 4. At the outer end of the rod 40 is a vertical connecting member 41 designed to operate an elongated plate 42. The member 42 extends through a guide block 43 mounted above the cylinder 39. Mounted at the front end of the member 42 are the pleat forming jaws illustrated in FIGS. 3 and 4.

Mounted on the front end of the member 42 is a transverse rectangular elongated holder 44. Extending from the center of the front edge of the holder 44 is a central rectangular plate or tongue member 45. Now mounted in spaced parallel relation to the central tongue member 45 is a plate 46 forming a lower jaw and a plate 47 forming an upper jaw. The front ends of the jaws 46 and 47 are tapered towards each other at 48 and meet at the outer end of the central member 45. The jaws 46 and 47 are pivotally mounted at 49 in front of the supporting block 44. Now on the upper surface of the supporting block 44 are a pair of spaced leaf springs 50 and mounted below the supporting member 44 are a pair of spaced leaf springs 51. The leaf

springs 50 and 51 are bowed inwardly towards the jaws 46 and 47 and their outer free ends contact the jaws just short of the end portions 48, see FIG. 4.

With the above construction the jaws 46 and 47 are resiliently retained in the closed position shown in FIG. 4 by the leaf springs 50 and 51. Extending across the top of the upper spring 50 is a rod 52 whose ends extend beyond the side edges of the jaw as shown in FIG. 3. A similar rod 53 extends across the bottom jaw 46. The rods 52 and 53 are in spaced vertical position. A cylinder 54 is now mounted on each side of the block 43. Each cylinder 54 is provided with a forwardly extending piston 55 carrying a wedge 56 at its outer end designed to extend between the extending ends of the rods 52 and 53, see FIG. 2. On operation of the cylinders 54 the wedges 56 will move forwardly between the rods 52 and 53 and spread them apart into the dotted line position shown in FIG. 4. This will spread the jaws 46 and 47 into the dotted line position against the action of the springs 50 and 51. The cylinder 39 and its piston 40 serve to move the jaws axially toward and away from the sewing machine plate 31. The front bevelled portions 48 of the jaws 46 and 47 and the central dividing tongue 45 are provided with a plurality of spaced slots 57, see FIG. 3, for a purpose hereinafter to be described.

Finally, the jaw assembly is provided with a C-shaped vertical support 58 extending from one side edge of the block 43. Mounted on the upper end of the support 58 is an elongated sheet 59 having a portion 60 bent at right angles to form a flat feed surface. The portion 60 is mounted at a forwardly tapered angle so that its front end terminates just above the ends of the jaws, see FIG. 2. The back side edge of the flat portion 60 is bent upwardly and inwardly to form a slotted section 61 which forms a feed guide. The entire jaw assembly hereinabove described being mounted on the supports 36 and 25 will swing on the pivot 24, see FIG. 5, so that in one position, FIG. 6, it will be swung to the left away from the front of the sewing machine and in a second position, FIg. 7, it will be swung to the right directly in alignment with the sewing machine plate 31.

Now referring to FIG. 5, the horizontal support 25 is provided with a narrower vertical support 62 firmly bolted to it. The support 62 is provided with a vertical section 63 and its upper end is bent at right angles to form a horizontal supporting section 64. A lever arm 65 is pivoted at 66 to the horizontal portion 64. An air cylinder 67 is mounted on the vertical portion of the support at 63 and is provided with a piston 68 pivotally attached to the lever 65 adjacent its outer end at 69. With this construction it is evident that reciprocation of the piston 68 will cause pivotal movement of the lever 65 around its pivot pin 66. A slack sizing rod 70 extends at right angles from the end of the lever 65 above and across the front of the sewing machine, see FIG. 7. It should be noted that with the lever positioned as shown in FIG. 5, the rod 70 will be above the jaws.

Since it is necessary to allow for two separate spacing measurements of pleats, the first pleat being closer to the edge than the distance between the pleats, the sizing rod 70 must be given two separate downward motions. This is accomplished by the pair of cams and microswitches illustrated in FIG. 5. An adjustable cam 71 is mounted on the lever 65 at the pivot pin 66 on one side of the lever and its leading edge is designed to contact the microswitch 72 on its downward stroke. This cam and microswitch are adjusted for the first measurement of the first pleat. Thereafter, the microswitch 72 is cut off and a second microswitch 73 is activated. The second microswitch is behind and above the lever 65. A second adjustable cam 74 is mounted on the other side of the lever 65 and is designed to contact the microswitch 73 after a more sweeping pivotal action of the lever 65. Thus by using two microswitches, the first microswitch causes the lever 65 to go down a predetermined amount before contacting the microswitch and causing the cylinder 63 to reverse the motion of the piston 68. Thereafter the second microswitch takes over and this one permits a more pronounced pivot of the lever 65 to cause the rod 70 to move further downwardly. The purpose of this action will be more clearly hereinafter described.

Also mounted on the horizontal support 25 is a vertical supporting member 75. Adjacent its upper end the member 75 supports a C-shaped member having an elongated vertical portion 76 and short laterally extending portions 77 at each end of the portions 76. A C-shaped member 78 is pivotally mounted between the members 77 on a pivot bar 79. A cylinder 80 is horizontally attached to the pivoted member 78 with its piston end tied to the fixed support 76. Thus, as can be seen in FIGS. 5 and 6, movement of the piston inwardly and outwardly will cause pivotal motion of the member 78 around the pivot bar. A three position dual control cylinder 81 is mounted in alignment beneath the pivot point of the member 77 and the piston thereof extends upwardly around the bar 78 at 82 carrying a block 83 and collar 84 at its upper end, see FIG. 2. Extending laterally from the collar and blocks 83 and 84 is an arm 85 of general C-shape. The open side of the arm 85 faces the jaws, the closed end facing towards the sewing machine.

With the above construction, pivotal movement of the member 78 caused by the cylinder 80 and its attachment to the fixed member 77, will cause pivotal movement of the arm 85 towards and away from the jaws. Simultaneously, operation of the cylinder 81 and its associated piston will cause vertical movement of the arm 85 in a manner hereinafter to be described.

In addition to the foregoing structure, the supporting block 36, see FIGS. 1 and 2, is provided with a laterally extending supporting plate 86 extending in the direction of the sewing machine and beneath the jaws. Supported on the plate 86 is an angularly adjustable cylinder 87 having an upwardly extending piston 88 on which a plurality of spaced vertical needles 89 are mounted. Now referring to FIG. 3, the spacing of the needles 89 correspond to a spacing of the slots 57 in the jaws 46 and 47. Thus if the jaws are moved forwardly, right to left in FIG. 2, they will extend above the needles 89. Upward movement of the piston 88 will push the needles 89 through the slots 57.

The various parts of the machine hereinabove described are all operated by air cylinders controlled from a main line by solenoid valves. Operation of the solenoid valves are controlled in their proper timing and sequence from any conventional device such as a taped system. The particular hookup for operating the device is illustrated in FIG. 18. However, it is best to first examine the sequence of operation as set forth in FIGS. 8 to 17 inclusive.

With the parts assembled as hereinabove described and the air pressure turned on, the jaws are in open position and withdrawn and the sewing clamp 30 and the associated needles 34 are in raised position at the sewing machine. Now assuming that it is desired to put a plurality of pleats adjacent the edge of a piece of material with the pleats approximately five inches apart but the first and last pleat only three inches from the adjacent edges. The operator places the material 90 on the plate 60 with the edge beneath the guide 61. The operator now forms a fold at the forward edge of the material to provide a front seam and pulls the material forwardly along the guide 60 until its forward edge is beneath the sewing machine needle 35. The operator now presses a button and starts the sequence of operation. The sewing machine clamp 30 descends to grip the material as shown in FIG. 8, the spring wire member 32 also moving downwardly on top of the material to prevent wrinkling under the sewing machine needle 35. The sizing rod 70 also moves downwardly, see FIG. 8, and since the left end of the material 90 is clamped beneath the sewing machine clamp 30, a portion of material is pulled from the holding guide plate 60 downwardly as shown in this figure. This operation is caused by the movement of the piston 68 pulling the lever 65 downwardly on its pivot 66. The smaller cam 71 will hit the microswitch 72 to limit the downward movement of the lever 65 and the associated sizer arm 70 to the point where it pulls just enough material to form

the first pleat 3 inches from the edge now clamped beneath the sewing machine.

The cylinder **67** now reverses the movement of the piston **68** and the bar **70** moves upwardly out of the way as shown in FIG. **9**. Simultaneously the cylinder **81** now operates to move the portion **84** carrying the pleat forming stripper **85** downwardly until it is opposite the open jaws of the device. At this point the cylinder **80** operates to swing the holder **78** in a counterclockwise direction viewing FIG. **6** to move the member **85** inwardly against the jaws carrying the material over and under the central tongue **45** as shown in FIG. **9** and forming a pleat. The wedges **56** on each side of the jaws are now withdrawn allowing the springs **50** and **51** to clamp the jaws on the pleat as shown in FIG. **10**. Now the cylinder **87** causes its piston **88** to move upwardly, and the needles **89** enter the slots **57** in the front portion of the jaws and pass through the pleat formed in the jaws as shown in FIG. **11**.

The parts are now positioned with the front edge of the material folded under and clamped in the sewing machine a small segment of material loose between the sewing machine and the jaws and a formed pleat in the jaws and held therein by the clamping action of the jaws and the needles **89**. The sewing cycle now begins. The sewing machine starts to sew the lead edge of the material, the plate **31** moving from right to left and back again, FIGS. **6** and **7**, with a cam action to produce a straight stitch. Since the material is being carried back and forth beneath the sewing needle and shortly spaced from the needle a new pleat is firmly held within the jaws, it is necessary that the entire jaw unit be swung with the sewing machine to follow the action under the needle. To this end the unit swings on its pivot **24** in an arc as illustrated in FIGS. **6** and **7**.

Now viewing FIG. **12**, the sewing machine clamp **30** and its associated member **32** moves upwardly freeing the edge of the material **90**. The cylinder **80** now operates to turn the member **78** and move the pleater **85** out from the jaws and the cylinder **81** moves the pleater upwardly out of the way. With the parts positioned as shown in FIG. **12**, the pleater **85** now moves downwardly into the slack of material **90** and strips the end of the material from beneath the sewing machine until it drops downwardly hanging from between the jaws. The stripper **85** now moves back upwardly and out of the way. Now viewing FIG. **13**, the needles **89** pull downwardly out of the jaws and the pleat **91** which is clamped between the ends of the jaws and held therein by the action of the springs **50** and **51**. The edge of the material, now finished, hangs downwardly.

The jaws now move forwardly and move the pleat **91** beneath the sewing machine clamp. The clamp **30** moves downwardly and grips the pleat **91** and the needles **34** also move downwardly and pierce the pleat **91** to retain it in locked position. As shown in FIG. **14**, the jaws now pull towards the right and the clamp **30** and needles **34** serve to strip the pleat **91** from between the jaws. The jaws move back to their original position and are immediately opened up as shown in FIg. **14**. In this position, instead of the forward edge, a completed pleat **91** is now positioned beneath the sewing machine needle **35**. It is locked in place not only by the clamp **30** but by the needles **34** passing through them. The jaws meanwhile are back in the original position shown in FIG. **8**.

Now the cylinder **67** is again activated pulling the piston **68** downwardly, see FIg. **5**, and causing the lever **65** to pivot downwardly. The sizing rod **70** now pulls the material downwardly as shown in FIG. **15**. However, since the pleat **91** is firmly grasped beneath the sewing machine clamp **30** and the needles **34**, the material must be pulled from the feed plate **60**. As mentioned hereinabove, the spacing between the pleats is usually greater, approximately five inches, than the distance from the edge of the material to the first plate. So now the microswitch **72** is de-activated and the microswitch **73** has been activated. This permits the lever **65** to swing downwardly until the cam **74** contacts the microswitch **73**. A comparison of FIGS. **8** and **15** clearly indicates that now the sizer rod **70** moves further downwardly pulling more material from the feeding plate **60** than in the previous operation.

Similarly, the next operation shown in FIg. **16** is similar to that shown in FIG. **9**. The sizing rod **70** has been raised out of the way and the pleat forming device **85** has moved downwardly and inwardly pushing the material between the jaws. The jaws now close on the pleat and the needles **89** move upwardly into the jaws as illustrated in FIGS. **10** and **11**. We now have a new pleat formed in the jaws and held therein by the clamping action of the jaws and the needles **89** and the previously formed pleat positioned in the sewing machine beneath the clamp **30** and with the needles **34** therethrough. Now the needles **34** are withdrawn from the pleats in the sewing machine and the sewing cycle begins again.

The sewing machine sews the pleat **91** swinging it backwardly and forwardly with the assembly following it as shown in FIGS. **6** and **7**. At the completion of the second sewing cycle the clamp **31** lifts and the pleat forming stripper bar **85** now moves downwardly as shown in FIG. **17** and pulls the finished pleat **91** from the machine, the new pleat **92** being held in the jaws by the action of the jaws and the needles **89**. This returns the material and the mechanism to the condition shown in FIG. **12**. The only difference being that there is a completed pleat adjacent the edge of the material now hanging downwardly from the jaws.

The cycle now begins again with the needles **89** being withdrawn as shown in FIG. **13** and the second pleat **92** being fed under the machine as shown in FIG. **14**. From this point on the sizing rod **70** will move its maximum distance controlled by the cam **74** and microswitch **73**. Now when the last pleat has been sewed on the material the machine will be swung to the left position shown in FIG. **6** clearing the front of the sewing machine. The operator now manually folds the edge of the material and places it beneath the sewing machine needle. The operator now presses the button or foot pedal and the machine goes through a sewing cycle. At the end of this sewing cycle the machine will then swing to the right as shown in FIG. **7** ready for the first operation again.

It is thus obvious that the operator must fold the leading edge of the material and place it on the machine to start the operation and must then fold the back edge of the material and place it under the needle for the final sewing operation. In between these manual handlings the machine will automatically form and sew the pleats in proper spaced position along the cloth. Depending on the length of the cloth, the device can be programmed for any number of desired pleats. Also, by changing the position of the cams **66** and **74** on the sizing lever, the amount of material pulled downwardly by the rod **70** can be varied to vary the distance not only between the pleats but the distance from the edge of the material to the first pleat.

It should also be noted that to prevent any chance of a mishap in a pleat pulling out from the jaws or from beneath the machine, the needles **34** which lock it beneath the sewing machine and the needles **89** which lock it in the jaws are always in position in the pleat when either the sizing rod **70** is pulling downwardly on the material or the pleat forming stripper **85** is moving downwardly on the material FIGS. **15** and **16** illustrate this The parts are all air operated and solenoid valves are used to perform the necessary operations. These solenoid valves can be programmed by any conventional electronic device, not shown. The applicants prefer to use a tape type programming device so that program changes can be made by merely changing the tape in the programming device.

Where there is no back pressure on the operation, the cylinder can be operated by a single line of compressed air and use a spring loaded return when the air is cut off. Where work must be performed in both directions, the cylinder is provided with two lines so that compressed air can be used to move in both directions. The power hookup for the above operations is illustrated in FIg. **18**. This figure illustrates the compressed air line hookup to each of the operating cylinders and their control solenoid valves. The main air line **93** is preferably a shop air line of between 80 and 100 PSI, the line being equipped with the conventional filters, pressure regulators, etc. When the air is put on the system, the entire system becomes pres-

surized so that when the starting button **94** is pressed the corresponding solenoid controlled valve **94a** opens the exhaust line and prepares the system for operation.

At the start the jaws **45**, **46** and **47** are in open position because the solenoid controlled valve **45***a* has transmitted pressure through line **95** to the cylinders **54**. At this point the sizer rod **70** at the end of the lever **65** has been raised by the cylinder **67** which is operated in both directions by the lines **96** controlled by valve **78**. Also, the pleater arm **85** is in raised position due to the pressure on the cylinder **81** through line **97** and valve **85***a*. At the first operation the sewing machine clamp **30** is moved downwardly by the cylinder **98** through pressure line **99** controlled through valve **30***a*. At this time the needles **34** do not come down. However, as hereinabove described, during the later operation of the cycle the needles **34** will now come down to pierce the pleat placed beneath the clamp. The needles **34** are operated from a cylinder **100** and pair of power lines **101** and the valve control **34***a*. After the sizer **70** has been moved up and down by the cylinder **67** to produce the slot in the cloth illustrated in FIGS. **8** and **15**, the pleater **85** is moved downwardly in the cylinder **81** by opening the pressure on line **97** and allowing the line pressure in line **102** to push the piston downwardly until it contacts the inner piston **103** which is held in its raised position by pressure through the line **104** from valve **85***b*. The pleater must now be turned inwardly to form the pleat. This is accomplished by cylinder **80** pressurized through lines **105** from valve **80a**.

The jaws **45**, **46** and **47** are now closed by relieving the pressure from the cylinder **54** which allows a spring return of the wedge. The needles **89** are now pushed upwardly by the pressure in the cylinder **88** through lines **106** from valve **89***a*. Axial movement of the jaws is controlled by the cylinder **39** piston **40** and the rod **42**. Pressure to the cylinder **39** is controlled through lines **107** to valve **39***a*. Radial movement of the system is controlled by two cylinders **108** and **109**, cylinder **108** controlled by valve **108***a* and **109** controlled by valve **109***a*. Cylinder **108** is for tacking the first edge and cylinder **109** is for the operating run of the pleats.

Now returning to the operating cycle, after the sewing machine has completed its work, the valve **80a** operates to turn the pleater out of the jaws and pressure is applied to raise the pleater **85** out of the way. The sewing machine clamp **30** is lifted by removing the pressure from line **99** and allowing the spring to return it into raised position. The pleater **85** is now allowed to move to the bottom of the cylinder **81** by removing the air pressure from lines **97** and **104**. This strips the work from under the sewing machine. The pleater is now moved to the top again by the cylinder **81** by again pressurizing lines **97** and **104**. The needles **89** are now withdrawn from the next set of pleats by the cylinder **88** and the jaws **45–6–7** are moved forwardly by the cylinder **39** to the sewing machine clamp. The clamp **30** and needles **34** are now moved downwardly on the line pressure and the jaws **45–6–7** are withdrawn. The jaws are now opened by movement of the cylinder **54**.

The cycle is now repeated for forming the new pleat with the clamp **30** and needles **34** remaining in their downward position to hold the previously formed pleat in the machine. After the formation of the new pleat, the needles **34** are raised by the cylinder **100** and the sewing operation begins. Thus, all parts of the machine are designed to operate under a compressed air line controlled by a series of solenoid controlled valves. The sequence and timing of the operation is simple to control since all that it requires is a proper sequential timing of the firing of the solenoid valves. This can be accomplished in many conventional ways.

We has thus provided a novel apparatus for the manufacture of pleated drapery and curtain material with a minimum of manual handling. Apart from the initial folding of the front edge of the cloth and placing it under the clamp of the sewing machine and the final folding of the rear edge and placing it beneath the needle for a sewing cycle, the operator does not touch the material while the pleats are formed and sewn in proper spaced relation. The operation is rapid since the distances from the various parts are comparatively short and the machine will pass through its cycle at fairly constant speed. The size and spacing of the pleats have been adjusted and predetermined in the machine before it is started. While there are of necessity many parts to the device, the assembly is fairly simple and not particularly complex. The operation is sure and there are no misses because of the use of the needles **34** and **89** which positively lock the pleats in position against accidental removal during the time when the cloth is being pulled. The result is that the machine can be operated by unskilled and virtually untrained operators. Other advantages of the present invention will be readily apparent to a person skilled in the art.

We claim:

1. A device for automatically forming and sewing a plurality of spaced pleats of a piece of textile material comprising a table, a sewing machine mounted on said table at right angles to the front edge, a support pivotally mounted on said table below said sewing machine and extending horizontally from said table, a guide plate mounted on said support for guiding a piece of textile material toward said sewing machine, means on said support below said guide plate for forming a pleat in the textile material, means for axially moving said pleat forming means to said sewing machine to position the pleat beneath the sewing needle, means on said sewing machine for clamping onto the pleat and for stripping the pleat from said forming means on withdrawal of said forming means from said sewing machine, means on said support for pulling a slack of material from said guide plate while said material is held by said clamping means, said pleat forming means forming a second pleat from the slack, and means on said sewing machine for moving said clamping means and pleat beneath the sewing needle during the sewing operation of said sewing machine.

2. A device as in claim **1**, wherein means are mounted on said support for releasably locking the pleat in said pleat forming means.

3. A device as in claim **1**, wherein means are mounted on said sewing machine for releasably locking the pleat beneath said sewing machine clamping means.

4. A device as in claim **1**, wherein means are mounted on said table for pivoting said support during the sewing operation to align with the movement of said clamping means.

5. A device as in claim **1**, wherein said slack pulling means is adjustable to pull less slack on the first pleat and more slack on the succeeding pleats in the same sequence.

6. A device as in claim **1**, wherein said pleat forming means includes an elongated strip mounted for axial sliding movement toward and away from said sewing machine, a supporting block mounted on the front end of said strip, a flat rectangular plate extends from said block in alignment with said strip, said plate forming a central tongue, a flat rectangular jaw member pivotally mounted on spaced relation on each side of said tongue, said pivot mountings being at the rear edge of each jaw adjacent said block, a pair of spaced bowed leaf springs mounted on the upper and lower sides of said block and extending forwardly in contact with said jaws to resiliently bias said jaws toward each other and toward the said central tongue into closed position, and means for spreading said jaws into open position against the pressure of said leaf springs.

7. A device as in claim **6**, wherein said spreading means comprises a rod mounted transversely across each of said jaws, the ends of said rods extending beyond the edges of said jaws, a wedge mounted on each side of said jaws and adapted to enter between said extended portions of said rods to spread said jaws, and means for actuating said wedges.

8. A device as in claim **1**, wherein said pleat forming means includes a C-shaped member mounted on said support, a vertical shaft mounted in said member, a block slidable in said shaft, means for moving said block on said shaft, means for pivotally turning said member and block, and a C-shaped arm extending horizontally from said block, said arm pushing the slack material into said pleat forming means on turning movement of said block.

9. A device as in claim 1, wherein said slack pulling means comprises a lever pivotally mounted on said support, a slack forming rod extending horizontally from one end of said lever, means for reciprocating said lever, a microswitch for reversing said reciprocating means, and an adjustable cam on said lever for tripping said microswitch.

10. A device as in claim 9, wherein said lever is provided with a second cam, a second microswitch on said support, said second cam adapted to trip said second microswitch to provide for different reciprocating movements of said lever and slack rod.

11. A device as in claim 1, including control means for the elements of said device comprising individually operated air cylinders and pistons under air pressure, a solenoid controlled valve, a second microswitch on said support, said second cam.

12. A device as in claim 2, wherein said releasable locking means comprises a supporting block, a plurality of needles extending upwardly from said block, and means for vertically reciprocating said block into said pleat forming means to pass said needles through the pleat to releasably lock the pleat in said pleat forming means.

13. A device as in claim 3, wherein said releasable locking means comprises a block mounted on said sewing machine, a plurality of needles depending from said block, and means for vertically reciprocating said block to pass said needles through said clamp and into the pleat to releasably lock the pleat under said clamp means.

14. A device as in claim 2, wherein means are mounted on said sewing machine for releasably locking the pleat beneath said sewing machine clamping means.

15. A device as in claim 14, wherein means are mounted on said table for pivoting said support during the sewing operation to align with the movement of said clamping means.

16. A device as in claim 14, wherein said slack pulling means is adjustable to pull less slack on the first pleat and more slack on the succeeding pleats in the same sequence.

17. A device as in claim 15, wherein said slack pulling means is adjustable to pull less slack on the first pleat and more slack on the succeeding pleats in the same sequence.

18. A device as in claim 6, wherein the front edges of said jaws and tongue are provided with slots, and means are mounted on said support for releasably locking the pleat in said pleat forming means through said slots.

19. A device as in claim 7, wherein the front edges of said jaws and tongue are provided with slots, and means are mounted on said support for releasably locking the pleat in said pleat forming means through said slots.

20. A device as in claim 19, wherein means are mounted on said sewing machine for releasably locking the pleat beneath said sewing machine clamping means.

21. A device as in claim 6, wherein said pleat forming means also includes a C-shaped member mounted on said support, a vertical shaft mounted in said member, a block slidable in said shaft, means for moving said block on said shaft, means for pivotally turning said member and block, and a C-shaped arm extending horizontally from said block, said arm pushing the slack material into said pleat forming means on turning movement of said block.

22. A device as in claim 7, wherein said pleat forming means also includes a C-shaped member mounted on said support, a vertical shaft mounted in said member, a block slidable on said shaft, means for moving said block on said shaft, means for pivotally turning said member and block, and a C-shaped arm extending horizontally from said block, said arm pushing the slack material into said pleat forming means on turning movement of said block.

23. A device as in claim 18, wherein said pleat forming means also includes a C-shaped member mounted on said support, a vertical shaft mounted in said member, a block slidable on said shaft, means for moving said block on said shaft, means for pivotally turning said member and block, and a C-shaped arm extending horizontally from said block, said arm pushing the slack material into said pleat forming means on turning movement of said block.

24. A device as in claim 19, wherein said pleat forming means also includes a C-shaped member mounted on said support, a vertical shaft mounted in said member, a block slidable on said shaft, means for moving said block on said shaft, means for pivotally turning said member and block, and a C-shaped arm extending horizontally from said block, said arm pushing the slack material into said pleat forming means on turning movement of said block.

25. A device as in claim 6, wherein said slack pulling means comprises a lever pivotally mounted on said support, a slack forming rod extending horizontally from one end of said lever, means for reciprocating said lever, a microswitch for reversing said reciprocating means, and an adjustable cam on said lever for tripping said microswitch.

26. A device as in claim 7, wherein said slack pulling means comprises a lever pivotally mounted on said support, a slack forming rod extending horizontally from one end of said lever, means for reciprocating said lever, a microswitch for reversing said reciprocating means, and an adjustable cam on said lever for tripping said microswitch.

27. A device as in claim 21, wherein said slack pulling means comprises a lever pivotally mounted on said support, a slack forming rod extending horizontally from one end of said lever, means for reciprocating said lever, a microswitch for reversing said reciprocating means, and an adjustable cam on said lever for tripping said microswitch.

28. A device as in claim 22, wherein said slack pulling means comprises a lever pivotally mounted on said support, a slack forming rod extending horizontally from one end of said lever, means for reciprocating said lever, a microswitch for reversing said reciprocating means, and an adjustable cam on said lever for tripping said microswitch.

29. A device as in claim 24, wherein said slack pulling means comprises a lever pivotally mounted on said support, a slack forming rod extending horizontally from one end of said lever, means for reciprocating said lever, a microswitch for reversing said reciprocating means, and an adjustable cam on said lever for tripping said microswitch.

30. A device as in claim 29, wherein said lever is provided with a second cam, a second microswitch on said support, said second cam adapted to trip said second microswitch to provide for different reciprocating movements of said lever and slack rod.

31. A device as in claim 29, wherein said releasable locking means comprises a supporting block, a plurality of needles extending upwardly from said block, and means for vertically reciprocating said block into said pleat forming means to pass said needles through the pleat to releasably lock the pleat in said pleat forming means.

32. A device as in claim 20, wherein said releasable locking means comprises a block mounted on said sewing machine, a plurality of needles depending from said block, and means for vertically reciprocating said block to pass said needles through said clamp and into the pleat to releasably lock the pleat under said clamp means.

33. A device as in claim 32, wherein said pleat forming means includes a C-shaped member mounted on said support, a vertical shaft mounted in said member, a block slidable on said shaft, means for moving said block on said shaft, means for pivotally turning said member and block, and a C-shaped arm extending horizontally from said block, said arm pushing the slack material into said pleat forming means on turning movement of said block.

34. A device as in claim 33, wherein said slack pulling means comprises a lever pivotally mounted on said support, a slack forming rod extending horizontally from one end of said lever, means for reciprocating said lever, a microswitch for reversing said reciprocating means, and an adjustable cam on said lever for tripping said microswitch.

35. A device as in claim 34, wherein said lever is provided with a second cam, a second microswitch on said support, said second cam adapted to trip said second microswitch to provide for different reciprocating movements of said lever and slack rod.

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