July 4, 1967 A. C. BERGERON 3,329,110

SEQUENTIAL SEWING APPARATUS

Filed Jan. 19, 1965 5 Sheets-Sheet 1

FIG. 1

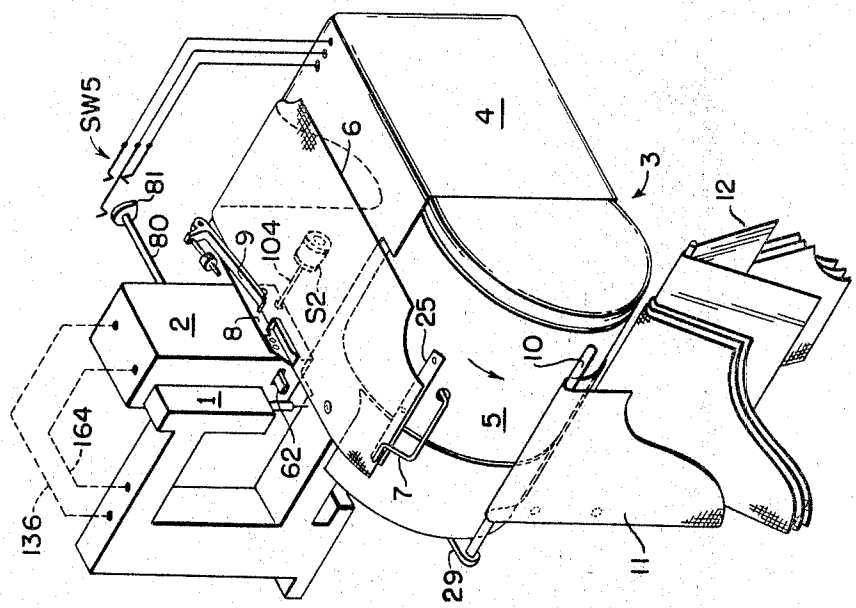
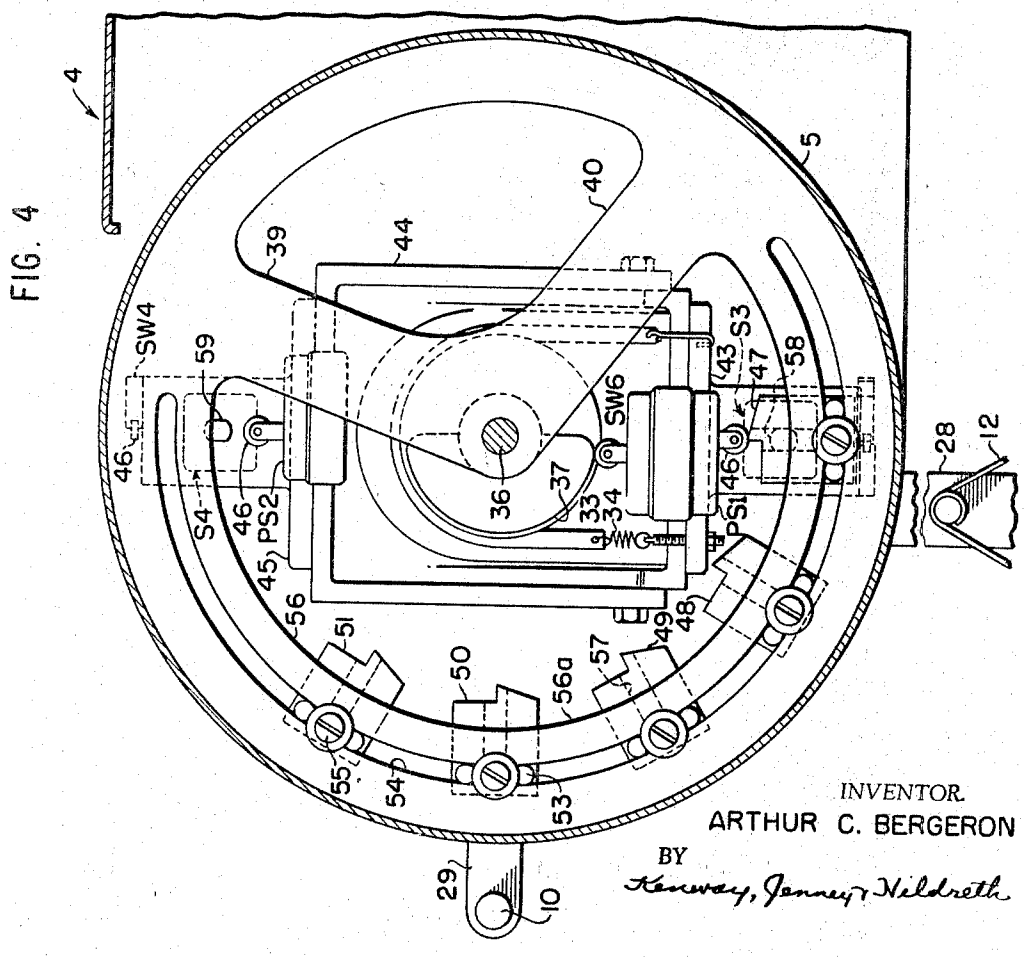


FIG. 4



INVENTOR.
ARTHUR C. BERGERON
BY
Kenway, Jenney & Hildreth

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SEQUENTIAL SEWING APPARATUS

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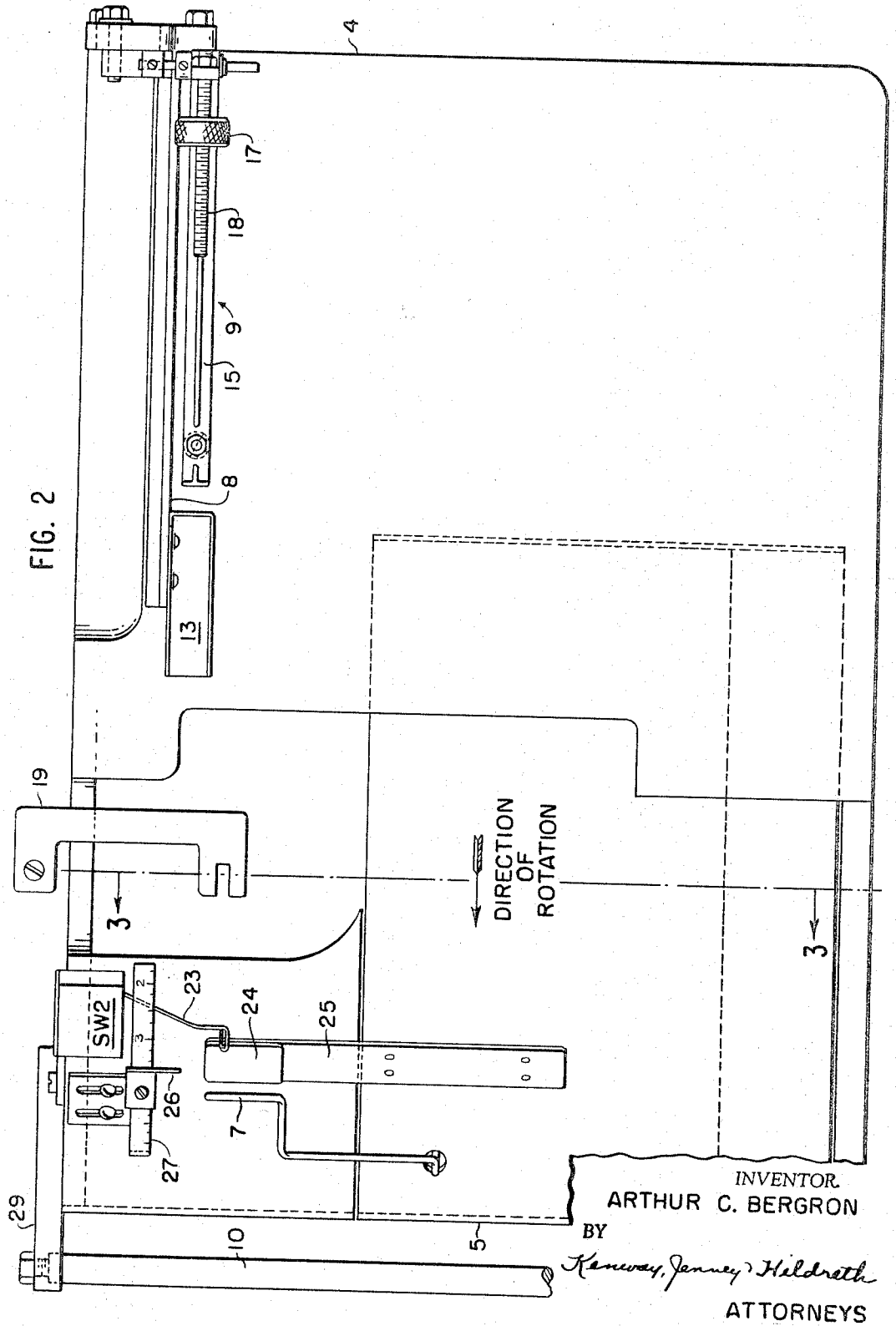


FIG. 2

INVENTOR.
ARTHUR C. BERGRON
BY
Kenway, Jenney & Hildreth
ATTORNEYS

July 4, 1967 A. C. BERGERON 3,329,110

SEQUENTIAL SEWING APPARATUS

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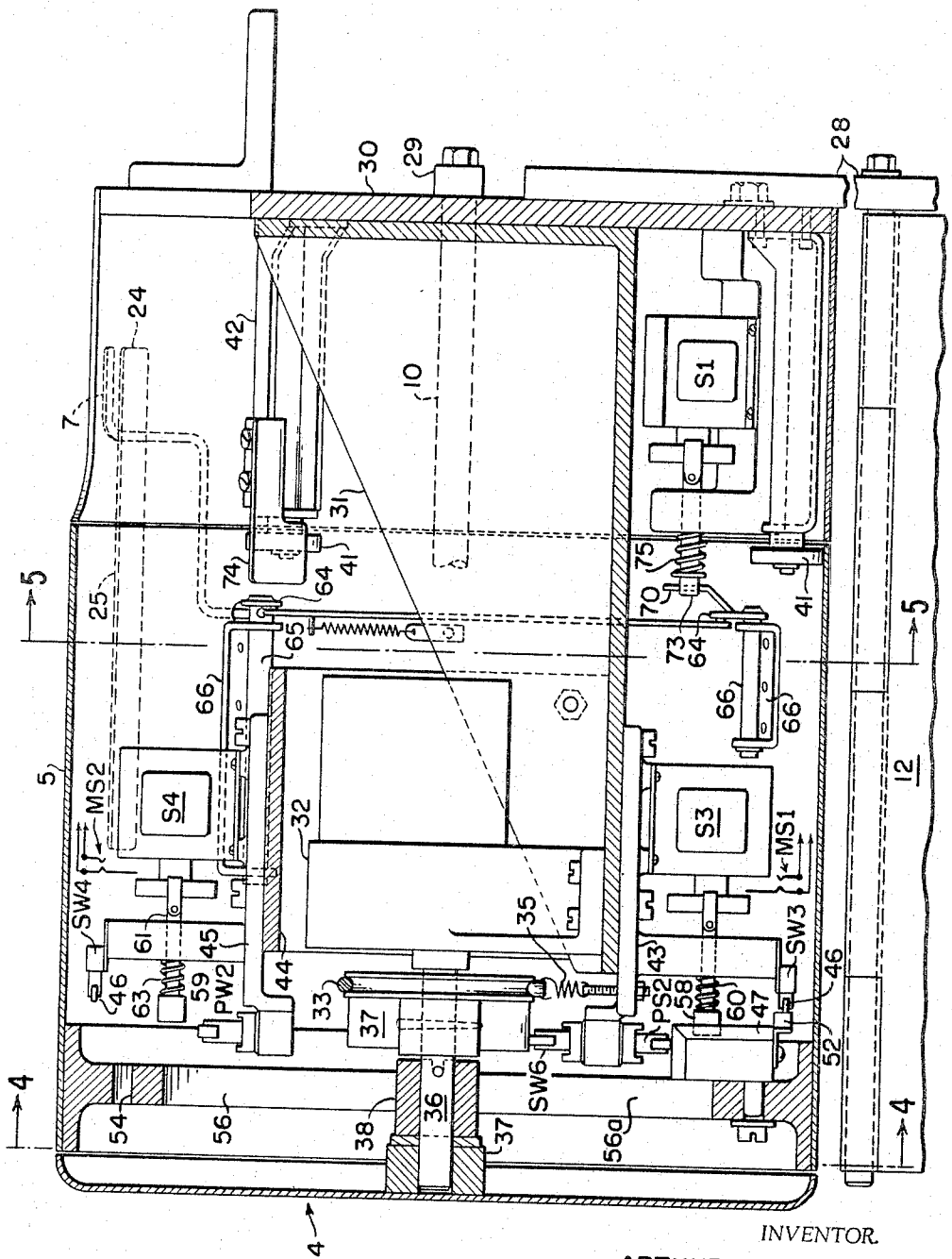


FIG. 3

INVENTOR.
ARTHUR C. BERGRON
BY
Kenway, Jenney & Hildreth
ATTORNEYS

July 4, 1967 A. C. BERGERON 3,329,110

SEQUENTIAL SEWING APPARATUS

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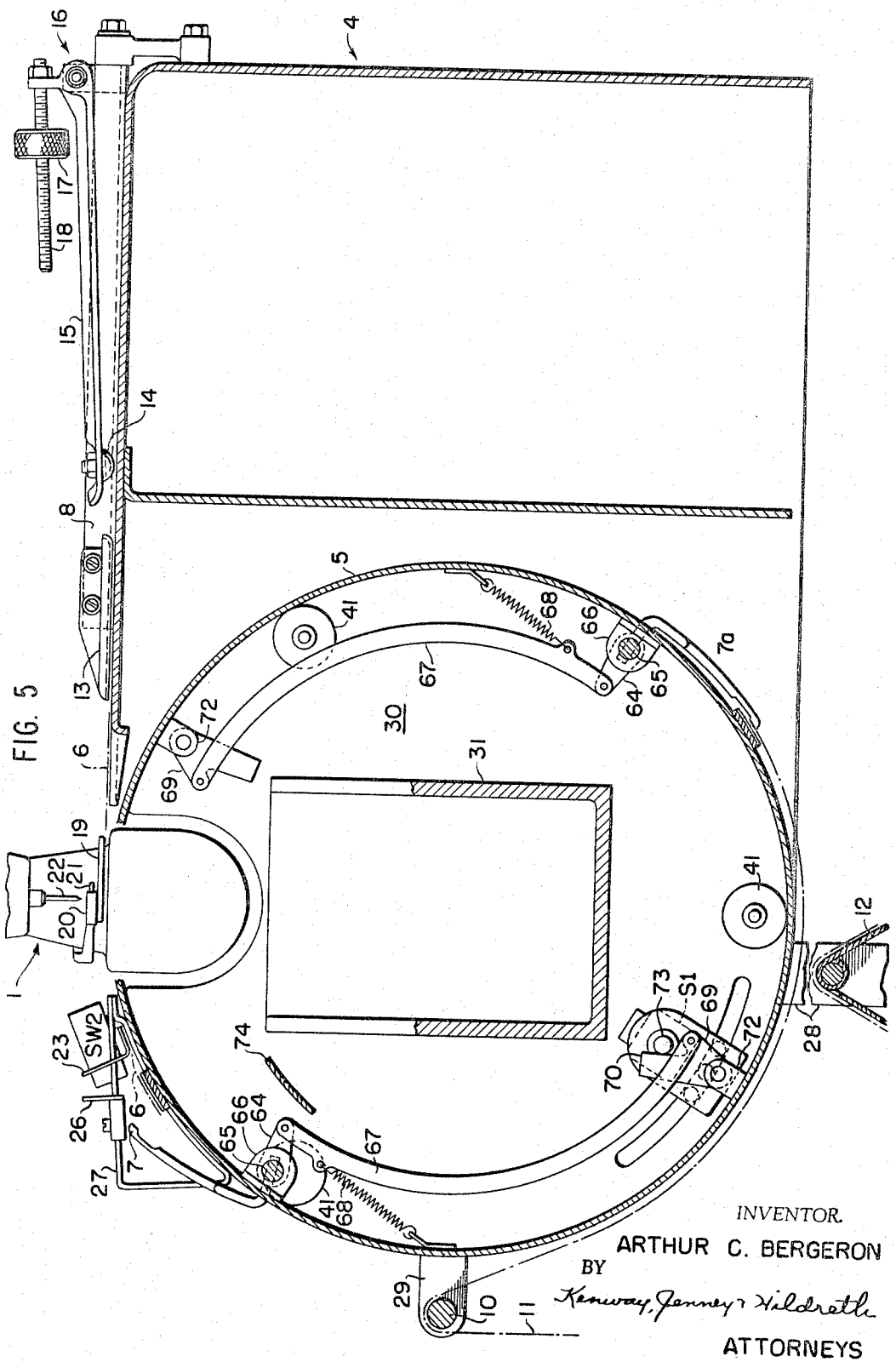


FIG. 5

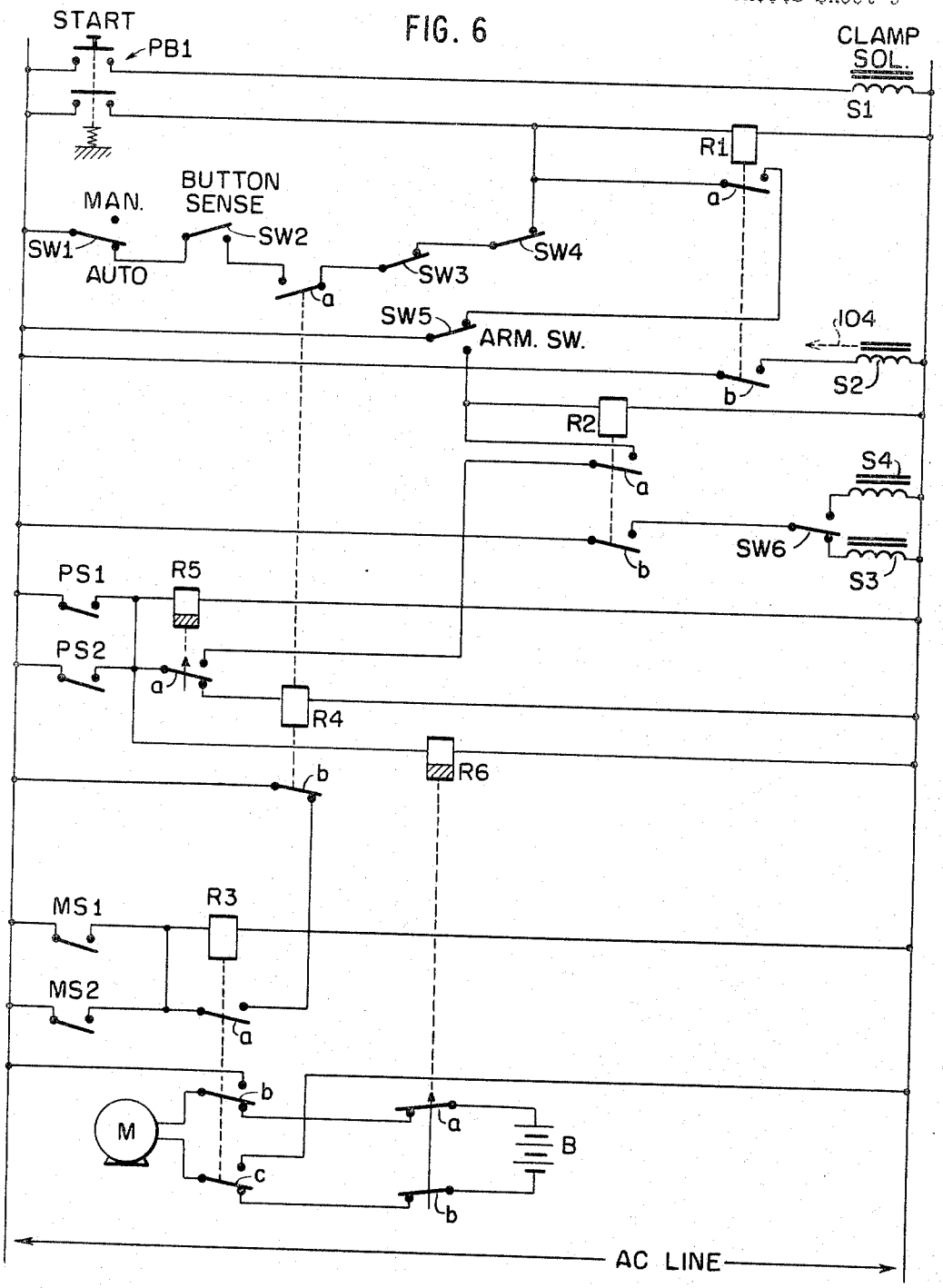
INVENTOR.
ARTHUR C. BERGERON
BY
Kenway, Jenney & Hildreth
ATTORNEYS

July 4, 1967 A. C. BERGERON 3,329,110

SEQUENTIAL SEWING APPARATUS

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FIG. 6



INVENTOR.
ARTHUR C. BERGERON
BY
Kenway, Jenney & Heldreth
ATTORNEYS

United States Patent Office 3,329,110 Patented July 4, 1967

3,329,110

SEQUENTIAL SEWING APPARATUS

Arthur C. Bergeron, Seekonk, Mass., assignor to A. J. Mitchell Co., Fall River, Mass., a corporation of Massachusetts

Filed Jan. 19, 1965, Ser. No. 426,615
16 Claims. (Cl. 112—2)

ABSTRACT OF THE DISCLOSURE

An article positioning device which includes a releasable fabric clamp attached to an intermittently rotated driven drum, which clamp pulls the leading edge of the fabric over a work station. The drum is driven about its axis through a series of intermediate work stations with the fabric on the top surface of the drum. The article positioning means is responsive to a signal from a sewing means and a button feeding means whereby after a button is sewn on the fabric the article positioning means moves the fabric on the top surface of the drum in a uniform manner a predetermined distance and then stops and actuates the sewing means to commence the cycle again.

My invention relates to garment manufacture, and more particularly to novel apparatus for performing repetitive operations such as button sewing at a sequence of spaced locations on an article such as a shirt.

Operations such as button sewing, buttonhole making, bar-tacking, the attachment of snap fasteners, and the like, must frequently be performed at a series of accurately spaced locations on articles of fabric, leather, plastic or the like. Numerous machines have been devised for carrying out the individual operations automatically, however, prior to my invention, so far as I am aware, the step of moving the material from one position to the next, after such an operation has been performed, has been most successfully performed by an operator who would manually reposition the material after each sewing operation. This operation is relatively time-consuming, as the material must be carefully relocated each time a new operation is to be performed, and the possibilities for error are multiplied by the number of operations to be performed on each article. Attempts to devise machines for the purpose have not been entirely successful, as they have not succeeded in dealing with the problem of cumulative position error, and have provided no satisfactory solution to the problem of handling the material created by the fact that the article must in some instances be slightly moved during the operation. The objects of my invention are to facilitate the rapid performance of a sequence of operations at a series of accurately spaced locations on an article and to improve the productivity of machine operators by reducing the number of operations that must be carried out by hand.

In its broader aspects, my invention is applicable to any of such common sequential operations as sewing on buttons, making buttonholes, bar-tacking, attaching snap fasteners, and the like, A specific and preferred embodiment of my invention is especially adapted for use in sewing a series of buttons on an article such as a shirt. This preferred embodiment comprises a sewing machine having an automatic button feeding attachment in combination with a material positioning device on which an article on which buttons are to be sewn can be placed.

In accordance with the preferred embodiment of my invention, the material positioning device comprises a rotatable drum carrying two clamps at diametrically opposed locations, each clamp being used during a different part of the machine cycle to clamp the leading edge of a shirt panel and move the panel to a series of sewing positions

on the work table of the sewing machine as the drum is rotated to successive locations determined by adjustable cams mounted on the drum. The material positioning device is adapted for use with machines for performing other operations, such as those described above, with little or no modification, by providing the necessary mechanism for interconnection with the machine to permit automatic cyclic operation, in a manner to be illustrated by description of the preferred embodiment. Apparatus is provided for yieldably tensioning the shirt panel as it is moved by the clamp, and for guiding the panel in a straight line to the sewing machine. The combination of the single clamp for the leading edge of a shirt panel with the guiding and tensioning means for the trailing part is an important feature of my invention. By this arrangement, the tension of the material is automatically kept uniform. Control means are provided for initiating a first sewing cycle after the panel has been placed in position, to sew a first button on the material. Control apparatus is provided for automatically rotating the drum from one position to the next at the conclusion of a cycle of operation of the button feeding attachment, and for initiating another cycle of the button feeding attachment when the drum is latched into each succeeding position. Means are provided for relieving the tension on the shirt panel during the drum latching operation, so that a button may be moved during the sewing cycle. This tension relief is useful not only in button sewing, where the button is moved after a first pair of holes has been sewn to the article so that a second pair can be sewn, but also in other operations requiring slight movement of the article during the operation. At the conclusion of the sewing operation, the trailing edge of the first shirt panel is thrown by an operator over a drape rod provided on the machine, while the panel is still clamped on the drum at the leading edge, and a second shirt panel is positioned on the machine and held by the second clamp. The second panel is then sewn in the same manner as the first, and during the sewing of the second panel, the first panel is automatically released onto a storage rack. The only operations required of the operator are initially positioning each shirt panel on the material positioning device, draping the sewn panel over the drape rod, and collecting the finished products when a sufficient quantity has been accumulated. The provision of means for automatically disposing of the finished article is another important feature of my invention, as with prior machines it was necessary to remove the finished article before another could be inserted. Since this operation is unnecessary with the apparatus of my invention, an operator can easily take care of more than one machine. Means are provided for stopping the machine if it fails to complete the sewing of a button at a location, and means are also provided for stepping the apparatus manually for one operation at a time, as when it is desired to make repairs should a button be missing or improperly sewn.

The apparatus of my invention will best be understood in the light of the following detailed description, together with accompanying drawings, of a preferred embodiment thereof.

In the drawings,

FIG. 1 is a schematic perspective sketch of sequential sewing apparatus in accordance with my invention;

FIG. 2 is a plan view of the article positioning apparatus of FIG. 1 with parts broken away and indicating the location of the sewing machine material hold-down plate;

FIG. 3 is a cross sectional view of the apparatus of FIG. 2 taken substantially along the lines 3—3 in FIG. 2;

FIG. 4 is a fragmentary cross sectional view taken substantially along the lines 4—4 in FIG. 3 with parts omitted for clarity;

FIG. 5 is a cross sectional view taken substantially along the lines 5—5 in FIG. 3, with parts omitted for clarity; and

FIG. 6 is a schematic wiring diagram of control apparatus forming a part of the sequential sewing apparatus of FIGS. 1 through 5.

Referring first to FIG. 1, the automatic sewing apparatus of my invention essentially comprises a conventional sewing machine **1**, an automatic button feeding attachment **2**, and the material positioning apparatus of my invention generally designated by **3**, all mounted together on a suitable support. The sewing machine **1** is arranged to be operated by the button feeding attachment **2** in the manner shown and described in detail in U.S. Letters Patent No. 2,921,544, issued on Jan. 19, 1960, to Grant N. Willis and Frank A. Clary, Jr., for Button Feeding Attachment for Sewing Machines. Referring to that patent, a button feeding attachment for a sewing machine is disclosed that is operative to actuate the sewing machine to sew a button on a piece of material, and, at the conclusion of the sewing operation, to break the thread and replace the button in the button holder on the sewing machine by another button. Briefly, and referring again to FIG. 1, beginning with a button in position on the sewing machine **1**, operation is commenced by movement of a lever **104** shown in detail in the patent and indicated schematically by the dotted line **104** in FIG. 1. In response to movement of the lever **104**, the button feeding attachment actuates a rod **136** interconnecting the sewing machine and the button feeding attachment as schematically indicated in FIG. 1, whereupon the sewing machine proceeds to sew the button on the desired article. When the sewing operation is finished, the sewing machine actuates an interconnecting rod shown schematically at **164** in FIG. 1 to cause the button feeding attachment **2** to place another button in position on the sewing machine, involving the movement of a transfer arm **62**, and when the arm **62** is returned to its original position, the operation is complete. As indicated schematically in FIG. 1, in addition to the apparatus just described, means are required for momentarily changing the state of a two-position switch SW5 as the arm **62** returns to its original position, for purposes to appear. Any suitable conventional expedient may be adopted for this purpose, but as schematically illustrated I have shown the switch as being actuated by an auxiliary cam **81** mounted on the cam shaft **80** of the button feeding attachment. A protuberance on the cam **81** engages the armature of the switch SW5 and changes the state of the switch briefly just before the arm **62** returns to its initial position. Preferably, the cam **81** is adjustably mounted on the shaft **80**, as by means of a set screw, so that the timing of the actuation of the switch SW5 can be adjusted.

As illustrated in FIG. 1, the material positioning apparatus of my invention comprises a suitable housing **4**, in which is rotatably mounted a drum **5**. The leading edge of a shirt front panel **6** is arranged to be fixed with respect to the drum by means of a clamp generally indicated at **7**. As indicated in FIG. 1, the clamp **7** carries the shirt front over an arcuate guide surface forming part of the housing **4**. The shirt front **6** is yieldably guided by an edge guide **8** and a combined tensioning and guiding means **9**. As will appear, the tensioning and guiding means **9** yieldably urges the shirt front down against a support surface forming part of the housing **4** and maintains uniform tension in the fabric. When the apparatus is in the position shown and ready for the first sewing operation, means are provided for actuating the arm **104** to cause the first button to be sewn by initiating a cycle of the button feeding attachment to operate the sewing machine **1**. At the end of this sewing operation, a new button is placed in the button clamp of the sewing machine (see FIG. 5) by the button feeding attachment **2**, and at the end of the cycle of operation of the button feeding attachment the switch SW5 is momentarily actuated, signalling the control apparatus within the housing **3** to rotate the drum **5** to a second position defined by an adjustable cam stop. When the drum is in position, the arm **104** is again actuated to cause a sewing operation. This action continues for as many sequential sewing operations as may be desired, within a 180 degree rotation of the drum **5**. At this point, the shirt panel is away from the sewing station and the operator may throw the tail over a drape rod **10** so that it has the general outward appearance suggested at **11**. A second shirt panel is then placed on the machine in the manner shown at **6**, and a second 180 degree rotation takes place, during which the first shirt front is automatically released and dropped over a drape rack **12**, from which it may be removed by an operator when a sufficient number has accumulated. Thus, buttons may be sewn on two shirt fronts during a single revolution of the drum. Alternatively, the apparatus may be arranged to complete only a single cycle of operations per revolution of the drum, as where longer articles are to be handled.

Having described the general arrangement and operation of the apparatus of my invention in connection with FIG. 1, reference is now made to FIGS. 2 through 5 for a more detailed description of a preferred embodiment thereof. Referring first to FIGS. 2 and 5, the edge guide **8** is mounted on the frame **4** by suitable conventional means, and at its forward end is mounted a forward guide **13**. The shirt front is led up under the forward guide **13** and alongside the edge guide **8**, being urged to the edge guide by the combined tensioning and guiding means **9**, comprising a temple **14** of conventional construction having an edge inclined forwardly towards the edge guide **8** and being mounted on an arm **15** pivoted to the frame at **16** and urged downwardly against the fabric of the shirt front by an adjustable weight **17** threaded on a stud **18**. The material passes under the material hold-down plate **19** of the sewing machine **1**. Above the material hold-down plate **19**, a button holder **20** of the sewing machine holds a button **21** in place for sewing by the needle **22**.

Beyond the button sewing station, at a distance equal to one button separation space on the shirt front to be sewn, is the arm **23** of a button-sensing switch SW2. This switch is adapted to be closed by a button sewn on the shirt front after the first button is sewn and will interrupt the continued operation of the apparatus in a manner to be described if no button is sensed. As shown, in the reference state of the apparatus corresponding to the beginning of a cycle, next beyond the arm **23** is a clamp **7** and a clamp pad **24**, the latter being mounted on a clamp base **25** formed of metal or the like and fixed to the drum **5**. As indicated, the clamp arm **7** extends within the drum **5**, for actuation in a manner to appear.

Above the clamp base is a guide **26** adjustably mounted on a scale **27** and arranged for use by an operator in positioning the shirt front at the beginning of the cycle so that it will be accurately located with respect to the clamp base **24** before the clamp **7** is actuated to bring it into contact and hold the shirt front. As indicated in FIG. 5, the scale **27** is formed with a bracket extension for mounting on the frame **4** of the machine. As suggested in FIG. 5, the drape rack **12** is mounted to the frame **4** by suitable means such as brackets **28**. The drape rod **10** is mounted on the frame by means of a suitable bracket **29**.

Referring next to FIG. 3, the frame **4** of the apparatus comprises a back plate **30** on which is mounted a motor mounting bracket **31**. A drive motor **32** of conventional alternating current induction construction is shown mounted on the bracket **31**. A conventional brake band **33** passes around a pulley **34** on the output shaft **38** of the motor **32**, and is held in braking engagement with the pulley by means of a spring **35**. This arrangement assists in stopping the motor when the current is removed.

Adjustably secured to the output shaft **36** of the motor **32**, as by a set screw or the like, is a 180 degree cam **37** (see also FIG. 4) which actuates a single pole, double throw orientation switch SW6 of conventional construction to a first position during one-half revolution of the drum **5**, and to a second position during the second half. The shaft **36** is journalled as indicated at **37** in the frame **4**, and intermediate the bearing and the cam **37** is mounted the hub **38** of the drum **5**, the hub being connected to the drum by means of spokes **39** and **40**. The drum is supported and guided at the end opposite the hub by means of rollers such as **41** journalled on brackets such as **42** mounted on the end plate **30**.

Fixed to the mounting bracket **31** by means of intermediate plates and brackets **43**, **44** and **45**, as indicated in FIGS. 3 and 4, are a lower position switch PS1 and an upper position switch PS2. These switches are provided with an actuating roller **46** to at times be closed by a suitably formed face on one of five locating cams **47**, **48**, **49**, **50** and **51**. While five cams are shown, it should be understood that this number is not critical, and merely corresponds to the number of operations to be performed in the particular embodiment illustrated. Mounted on suitable extensions of the same brackets and connected to the mountnig bracket **31** are a lower stop switch SW3 and an upper stop switch SW4, each being provided with a suitable actuating roller **46** for actuation at times by an extension **52** formed on the first cam **47** and not provided on the other cams. The switches are constructed such that with the cams **47** in the position shown in FIG. 4, the switch SW3 will be open, and in the position 180 degrees away from the position shown, the switch SW4 will be open, both switches being closed at other times.

Referring now to FIG. 4, the cams **47** through **51** are adjustably mounted on the drum **5** by means of pins such as **53** passing through an arcuate slot **54** formed in an annular flange **56** attached to the drum **5**. The cams **47** through **51** may be secured in any desired relative spaced positions along the slot **54** by means of bolts such as **55** threaded into the cams, the cams being located by means of a scale, not shown, but engraved, painted or otherwise inscribed on the face **56***a* of the flange **56** (FIG. 3). As indicated schematically in FIGS. 3 and 4, the cams such as **47** are provided with a slot at their rear faces, indicated at **57** on the cam **49** in FIG. 4, forming a keeper to at times receive one of two locating latches **58** and **59** mounted on the output shafts **60** and **61**, respectively, of two solenoids S3 and S4, respectively. As indicated in FIG. 3, the latches **58** and **59** are urged outwardly by springs **62** and **63**, respectively, and may be retracted by actuation of the associated solenoid.

The solenoids S3 and S4 are each mounted to the mounting bracket **31** by means of the intermediate brackets shown, and are arranged when energized to actuate a pair of microswitches, a microswitch MS1 being actuated by the solenoid S3 and a microswitch MS2 being actuated by the solenoid S4, actuation taking place near the end of the stroke of the solenoid.

Referring now to FIGS. 3 and 5, the clamp **7** and a corresponding clamp **7***a* displaced 180 degrees from the clamp **7** extend within the drum **5** and are connected to levers **64** pivotally mounted on pins **65** journalled to brackets **66** connected to the frame **5**. Pivotally mounted to each lever **64** is an arcuate arm **67**. Each lever **67** is connected by means of a spring **68** to the drum **5**, urging its associated lever **64** in a clockwise direction. The opposite end of each lever **67** is pivotally connected to one end of a lever **69**, formed with an integral projection **70** and journalled by means of pins such as **71** in brackets such as **72** connected to the frame **5**. The projections **70** are adapted to be engaged either by the actuating arm **73** of a clamp release solenoid S1 mounted on the back plate **30**, or by a camming bar **74** shown in FIG. 5 and also mounted on the back plate **30**. The camming bar **74** may be connected to the back plate **30** by forming it integral

with one of the roller support brackets **42**. With the latch **70** retracted by either of these means, as indicated in FIG. 5 for the projection **70** associated with the clamp **7**, the clamp will be raised out of engagement with the clamp base. If the clamp is in the position shown for the clamp **7**, it will be in position for a new article to be inserted under the clamp. If the clamp is in the second 180 degrees of rotation, the clamp will be opened at about 315 degrees counterclockwise from the sewing station by engagement with the camming bar **74** with the associated projection **70**, to release a finished article. Thus, each clamp will be actuated alternately by the solenoid S1 and the camming bar **74**. Comparing FIGS. 3 and 5, it will be apparent that actuation of the solenoid S1 to retract its output shaft **73** against the action of a spring **75** will be permit the projection **70** to sweep past the face of the arm **73** and lower the clamp, thereafter precluding the solenoid S1 from actuating the projection **70** until somewhat less than 360 degrees later in the rotation of the drum when the projection **70** will again be retracted by striking the arm **73** in the deenergized state of the solenoid.

Referring now to FIG. 6, the control circuit for the apparatus of my invention is shown. As indicated, the apparatus is provided with a start pushbutton PB1, which when momentarily depressed and released closes and then opens two circuits. The first circuit comprises an energizing circuit for the clamp release solenoid S1, and the second circuit causes the energization of a conventional relay R1 to close its front contacts *a* and *b*. These circuits will be completed when the AC line is energized, and may be interrupted when desired by a conventional main switch in one side of the line, not shown.

A second energizing circuit for the relay R1 extends over a manually operated switch SW1, the button sensing switch SW2 in its closed position, a front contact *a* of a relay R4 closed when the relay is energized, and the switches SW3 and SW4 in series. The switch SW1 is provided with manual and automatic positions, to provide for step-by-step or automatic sequential action, respectively. A stick circuit for the relay R1 is closed over its own front contact *a* and includes the arm switch SW5 actuated by the button feeding attachment **2** in its normal position. It will be recalled that the arm switch SW5 is momentarily changed to its opposite position by the cam **81**, and will thus open the holding circuit for the relay R1, toward the end of the stroke of the arm **62** of the button feeding attachment.

A button feeding attachment actuating solenoid S2, which has an output shaft connected to the arm **104** that starts the operation of the button feeding attachment described above, has an actuating circuit closed over the front contact *b* of the relay R1 in the energized state of the relay.

A conventional relay R2 has an energizing circuit which is closed when the arm switch SW5 is momentarily actuated, and the relay is provided with a stick circuit extending over its own front contact *a*, the front contact *a* of a slow pickup relay R5, and over the contacts of the position switches PS1 and PS2 in parallel.

The stop solenoids S3 and S4 have alternately closed circuit paths extending over the orientation switch SW6 in one of its states, and over the front contact *b* of the relay R2, closed when that relay is energized.

The relay R5 and a parallel slow pickup relay R6 have energizing circuits closed over either of the position switches PS1 and PS2. The relays R5 and R6 are arranged in a conventional manner to pick up about one-half second after they are energized, and to release quickly.

A conventional relay R3 has an energizing circuit closed over either of the motor start switches MS1 and MS2, which it will be recalled were arranged to be actuated by the stop solenoids S3 and S4 when energized. A stick circuit for the relay R3 is provided which extends over its own front contact *a* and the back contact *b* of the relay R4, closed when that relay is released.

The drive motor **32** has an energizing circuit extending over the front contacts *b* and *c* of the relay R3 in the energized state of the relay, providing current from the AC line to cause the motor to run in a forward direction. The motor circuit has an open state with the relay R3 released and the relay R6 energized, and a state in which DC is applied across its terminals when the relay R6 is released and the relay R3 is released. The purpose of this last mentioned circuit for the motor **32** will be brought out in the description of operation, which follows.

Referring first to FIG. 6, assume that the AC line is energized. With the drum **5** in the position shown in FIG. 4, the position switch PS1 will be closed by the cam **47** acting on the roller actuator **46**. The relays R5 and R6 will accordingly be energized, and the circuit for the motor **32** will be open. Other apparatus in FIG. 6 will be in the condition shown. Referring to FIG. 5, the clamp **7** will be raised as shown, and the clamp **7***a* will be in engaged position, but without an attached shirt front.

Next, assume that a shirt front **6** is placed on the machine as indicated in FIG. 1, and that it has been brought down so that its end extends beneath the clamp **7**. The operator now depresses the pushbutton PB1 in FIG. 6, and the clamp solenoid S1 will be energized, pulling the pin **73** in FIG. 5 away to release the projection **70** to cause the clamp **7** to be brought down to hold the shirt front **6**. At the same time, the relay R1 will be energized and will complete a stick circuit over its front contact *a* and the arm switch SW5 in the position shown.

With the relay R1 energized, the button feeding attachment actuating solenoid S2 will be energized to actuate the shaft **104** indicated schematically in FIG. 6 and in FIG. 1, causing the button feeding attachment **2** to actuate the lever **136** to start the sewing machine **1** and sew the first button at the first location. At the completion of this operation, the sewing machine **1** will actuate the arm **164** to cause the button feeding machine to place a new button on the sewing machine, and at the end of the stroke of the arm **62** of the button feeding attachment to accomplish the last named purpose, the arm switch SW5 will be momentarily actuated by the cam **81**, opening the circuit for the relay R1 and allowing it to release, and closing the energizing circuit for the relay R2. The relay R2 will complete its stick circuit over its own front contact *a* and the front contact *a* of the relay R5, energized as described above, and over the closed contact of the position switch PS1.

With the relay R2 energized and the orientation switch in the position shown with the apparatus in the condition shown elsewhere in the drawings, the stop solenoid S3 will be energized, pulling its associated latch **58** out of engagement with the keeper in the first stop cam **47**. At the end of the stroke of the solenoid S3, it will momentarily close motor start switch MS1. Referring again to FIG. 6, with the motor start switch MS1 closed, the relay R3 will be energized and will complete its stick circuit over its own front contact *a* and the back contact *b* of the deenergized relay R4. AC current will then be supplied to the motor **32** over the front contacts *b* and *c* of the relay R3, and the motor will drive the drum away from the initial position. As this occurs, the stop switch SW3 will close, the position switch PS1 will open and the relays R5 and R6 will be deenergized. The release of the relay R6 prepares the DC circuit for the motor **32**, but it is not yet closed at this time. The release of the relay R5 will prepare the pickup circuit for the relay R4, but this circuit will not yet be closed because neither of the position switches PS1 or PS2 is closed.

When the drum **5** has rotated sufficiently, the second cam **48** will engage the actuator **46** for the position switch PS1 to close it. As the cam **48** approaches the latch **58**, the latch is cammed up over the edge of the cam **48** against the force of the spring **62** so that it falls into the keeper. The relays R5 and R6 will not yet pick up, being delayed as described above, and the relay R4 will be picked up over the back contact *a* of the relay R5. With the relay R4 picked up, the stick circuit for the relay R3 will be interrupted and this relay will release. The first button sewn on the panel will now close the button sensing switch SW2. At the same time, the closed front contact *a* of the relay R4 will complete the pickup circuit for the relay R1 over closed contacts of the switches SW1, SW2, SW3 and SW4, whereupon the relay R1 will be picked up and close its holding circuit over its front contact *a* and the arm switch SW5 in its normal position.

When the relay R3 is released with the relay R6 not yet picked up because of its time delay, DC current is applied from the battery B over the back contacts *a* and *b* of the relay R6 and the back contacts *b* and *c* of the relay R3 to the motor **32**, causing the motor to lock at the nearest poles and urging the drum **5** forward with the rear edge of the latch **58** engaging the rear face of the slot in the cam **48**. The motor thus briefly holds the latch firmly against the rear edge of the keeper cam, applying some tension to the shirt front as determined by the tension arm **15**.

When the relays R5 and R6 pick up at the end of their delay period, the DC circuit just described is broken and the circuit for the relay R4 is broken, causing it to release. Opening the DC circuit permits the cam latch to relax toward the center of the keeper, there being provided from about $\frac{1}{32}$ to $\frac{1}{16}$ inch clearance for this purpose. The fabric is thereby loosened sufficiently to allow the button to be moved during the sewing operation.

The shirt positioning apparatus is now locked in the second position, and actuation of the solenoid S2 by closure of the front contact *b* of the relay R1 commences a new cycle of sewing, followed by button repositioning, and terminating with the actuation of the arm switch SW5 to pick up the relay R2, as before. This sequence of operation will continue until the apparatus has been successively positioned by the cams **49** and **50**. When the sewing cycle following the engagement of the latch **58** with the cam **51** has been completed, and the button feeding attachment has completed its cycle and placed a new button in the sewing machine clamp, the arm switch SW5 will be actuated to pick up the relay R2 and actuate the stop solenoid S3 over the orientation switch SW6, as before. The motor start switch MS1 will again be energized, causing the relay R3 to pick up and the motor **32** to begin to run. This action will continue until the cam **47** reaches a position 180 degrees displaced from the position shown in FIG. 4, at which time the stop switch SW4 will be opened by the extension **52** on the cam **47** and the position switch PS2 will be actuated by the associated faces on the cam **47**. Operation of the relays R5 and R6 to sequentially pick up the relay R4, releasing the relay R3, apply DC current to the motor M32, and then release the DC current, will be as before. However, the relay R4 will be ineffective to initiate a new sewing cycle because the stop switch SW4 will now be open. The apparatus will remain in this condition until a new operation is commenced by placing another shirt front on the machine and actuating the pushbutton PB1 as before.

At about 135 degrees from the position shown in FIG. 4, in the direction of motion described, the projection **70** on the lever **69** associated with the clamp **7***a* strikes the camming bar **74** and causes the clamp **7***a* to open up and release the first shirt front, allowing it to drop down on the drape rack **12**. Just before the clamp **7***a* reaches the sewing location, it is released by the camming bar **74**, and the clamp rides through the sewing station in closed position. As the clamp **7***a* passes through the sewing station, going towards the location shown for the clamp **7** in FIG. 5, the projection **70** will strike the arm **73** of the clamp release solenoid S1, and the clamp will be raised to the position shown for the clamp **7** in FIG. 5, in position to receive the next shirt front. A second shirt front may then be placed in position as indicated in FIG. 1, and the second sewing cycle initiated by depressing

the start buttom PB1. During this second cycle, the cams 47, 48, 49, 50 and 51 will cooperate with the upper position switch PS2 and the upper stop solenoid S4 to successively bring the shirt front to the positions for sewing on the several buttons. At the end of the second cycle, the apparatus will be brought to rest in the position shown in FIG. 4 by the position switch PS1 and the stop switch SW3 acting to prevent a continuation of the drive.

Recalling that the operation of the apparatus to cause it to step from one position to the next as the button feeding attachment completes its operation is dependent on the pickup circuit for the relay R1 which extends over the switch SW1, it will be apparent that by putting this switch in its manual position, operation following the depression of the pushbutton PB1 will simply consist in a single cycle operation of the sewing machine and the button feeding attachment followed by a single motion of the drum to the next latched position. Thus, by putting the switch SW1 in its manual position, the apparatus may be conditioned to operate one step at a time.

While I have described my invention with respect to the details of a particular preferred embodiment thereof, many changes and variations will be apparent to those skilled in the art upon reading my description, and such can obviously be made without departing from the scope of my invention.

Having thus described my invention, what I claim is:

1. A rotary fabric positioner, comprising a support, a fabric clamp mounted on said support, an alternating current induction motor having a stator and a rotor connected to rotate said support in a predetermined sense in response to alternating current applied to said motor to carry said clamp in a circular path, said rotor and stator having a set of stable relative angular positions to the nearest of which the rotor is driven when the motor is energized with direct current, a set of cams adjustably mounted on said support for movement therewith in a closed path and each formed with a keeper for a latch, a latch having a cam engaging portion comprising a cam surface for riding over a cam and entering the keepers with clearance, latch control means fixed with respect to said rotor and comprising means yieldably urging said latch to an extended position in the path of the keepers on said cams at a location to enter the keepers just ahead of a position at which said rotor is in one of its stable positions with respect to the stator in said sense of rotation of the support and retracting means operable when energized to retract the latch out of the path of the cams, switching means actuable to a first state, a second state, and a third state, means controlled by said switching means in its first state for applying alternating current to said motor, means controlled by said switching means in its second state for applying direct current to said motor, means actuated by said latch control means when energized for setting said switching means to its first state, control means actuated by each cam as it encounters said latch during rotation of said drum to set said switching means to its second state, and time delay means actuated by each cam as it encounters said latch during rotation of said drum to set said switching means to its third state a predetermined time after said latch enters the keeper in the cam.

2. The apparatus of claim 1, further comprising tensioning means fixed with respect to said stator for yieldably engaging a fabric article one end of which is held by said clamp, whereby when a fabric article is held by said clamp and engaged by said tensioning means and said retracting means is energized, said support is rotated until said control means is actuated and said latch is forced against one edge of a keeper in one of said cams and then released, causing the article to be advanced under tension and then slackened.

3. A rotating fabric positioner, comprising a drum journalled for rotation about a predetermined axis, a fabric clamp mounted on the periphery of said drum, an alternating current induction motor having a stator and a rotor connected to rotate said drum in a predetermined sense in response to alternating current applied to said motor, said rotor and stator having a set of stable relative angular positions to the nearest of which the rotor is driven when the motor is energized with direct current, a set of cams adjustably mounted on said drum for movement therewith over a closed path and each formed with a keeper for a latch, a switch fixed with respect to said stator and closed by each of said cams in a different rotated position of said drum within a predetermined range of positions, a latch mounted for movement to first and second positions each fixed with respect to said stator, said latch being located in its first position to extend into the keeper on each of said cams in different rotated positions of the drum corresponding to the positions at which said switch is closed and located in its second position to be withdrawn from the path of the cams, said latch being located just ahead of a position at which said rotor is in one of its stable positions with respect to the stator in said sense of rotation of the drum, means for yieldably urging said latch to its first position, release means actuable to move said latch to its second position, said latch having a cam engaging portion comprising a cam surface for riding over a cam and into the keeper therein and said portion being movable over a limited range within the keeper upon rotation of said drum, switching means actuable to a first state, a second state and a third state, means controlled by said switching means in its first state for applying alternating current to said motor, means controlled by said switching means in its second state for applying direct current to said motor, means controlled by said latch in its second position for actuating said switching means to its first state, means controlled by said switch for setting said switching means to its second state when said switch is closed, time delay means controlled by said switch for setting said switching means to its third state a predetermined time after said switch is closed, and tensioning means fixed with respect to said stator for yieldably engaging a fabric article one end of which is held by said clamp, whereby when a fabric article is held by said clamp and engaged by said tensioning means and said release means is actuated, said drum is rotated until said switch is closed and said latch is forced against one edge of a keeper in one of said cams and then released, causing the article to be advanced under tension and then slackened.

4. In combination, button sewing means operative when actuated to sew a button on a piece of material at a predetermined location, button feeding means operative when actuated to actuate said sewing means and controlled by said sewing means to supply another button to said sewing means after each sewing operation is completed, a support rotatably mounted adjacent said sewing means, clamp means on said support having an open position and a closed position for holding one end of a fabric article in one of a set of sewing positions at said location dependent on the rotated position of said support within a predetermined range of rotated positions, fabric guiding and tensioning means mounted adjacent said sewing means opposite said clamp for yieldably guiding and tensioning said fabric, means actuated by said button feeding means for rotating said support to bring a fabric article grasped by said clamp and engaged by said guiding and tensioning means to a subsequent sewing position in said set when a button has been supplied to said sewing means, a switch biased to a first position and located for actuation to a second position by said support in a rotated position of said support beyond said range, means controlled by said switch and said support and responsive to the rotated position of said support in the first position of the switch for actuating said button feeding means when the support reaches each position corresponding to one of said sewing positions in said set except the first, means controlled by said button feeding means and said switch in its first position to rotate the support beyond

said range until said switch is actuated to its second state by the support means after the last sewing position has been reached and the button replaced, and means fixed with respect to said sewing means for actuating said clamp to release a fabric article held thereby at a rotated position of said support between the position corresponding to the last sewing position in said set and the position at which said switch is actuated.

5. Apparatus for sequentially performing sewing operations at a sequence of spaced locations on an article of fabric, comprising sewing means responsive to an applied input signal to sequentially perform a sewing operation and produce an output signal, a support rotatably mounted adjacent said sewing means, clamp means mounted on said support for holding a fabric article in one of a series of sewing positions on said sewing means in dependence on the rotated position of said support, a set of position locating means mounted on said support for rotation therewith, position control means fixed with respect to said sewing means and located in position for sequential engagement by said position locating means upon rotation of said support, a stop switch fixed with respect to said sewing means, said stop switch being biased to a first position and being located for actuation to a second position by the first of said position locating means in a rotated position of said support beyond the position at which the last position locating means engages the position control means, drive means controlled by said stop switch, said position control means and said sewing means and set to a second state by said position control means upon engagement by any of said position locating means and operable in its first state to rotate said support in its first state in a predetermined sense, means responsive to engagement of said position control means with any of said position locating means for supplying an input signal to said sewing means, and manually operable means for applying an input signal to said sewing means to initiate a sewing cycle.

6. Button sewing means responsive to a start signal to sequentially sew a button on a piece of material at a predetermined location and prepare another button for sewing, signal producing means controlled by said button sewing means for producing an output signal when a button has been sewn and another button has been prepared for sewing, material positioning means comprising a material clamp for holding a piece of material and rotary positioning means settable to first and second states for rotating said clamp about a predetermined axis in its first state to carry the material through a range of movement including a set of sewing positions with respect to said sewing means and holding said clamp against rotation in its second state, a switch biased to a first state and actuable to a second state, means rotatable with said clamp for actuating said switch to its second state at which the material is beyond said range, angular positioning means rotatable with said clamp for producing position signals at each of a set of angular positions of said clamp at which the material is within said range, means controlled by said switch in its first state for applying the signals from said sensing means to set said rotary positioning means to its second state, manually actuable mean for applying a start signal to said button sewing means, means responsive to the output signal from said button sewing means to set said drive means to its first state to rotate the clamp until the next sensing means signal is applied, and means controlled by said sensing means and said rotary positioning means in its second state for supplying a start signal to said button sewing means.

7. In combination, button sewing means responsive to a start signal to sequentially sew a button on a fabric article at a predetermined location and prepare another button for sewing, signal producing means controlled by said button sewing means for producing an output signal when a button has been sewn and another button has been prepared for sewing, article positioning means comprising a fabric clamp having an open position and a closed position for holding a fabric article and rotary positioning means actuable to first and second states for rotating said clamp about a predetermined axis in its first state to carry a fabric article held by the clamp through a range of sewing positions with respect to said sewing means and holding said clamp against rotation in its second state, first angular position sensing means rotatable with said clamp for supplying signals to set said drive means to its second state at each of a set of angular positions of said clamp, manually actuable means for applying a start signal to said button sewing means, means responsive to the output signal from said button sewing means for setting said drive means to its first state to rotate the clamp until the next sensing means signal is supplied, second position sensing means rotatable with said clamp and actuated from a first to a second state at a predetermined rotated angle of said clamp beyond the range of operation of said first sensing means, means controlled by a signal from said first sensing means, said second sensing means in its first state, and said positioning means in its second state for supplying a start signal to said button sensing means, and means controlled by said second position sensing means in its second state for setting said positioning means to its second state.

8. The apparatus of claim 7, further comprising means connected to said clamp for yieldably urging it to its closed position and clamp actuating means fixed with respect to said sewing means and located for engagement with said clamp to set the clamp to its open position over a range of rotated positions between the range of operation of said first sensing means and the position at which said second sensing means is actuated to its second state.

9. In combination; a sewing means including a sewing station and operable when actuated to sequentially sew a button on a fabric article at the sewing station, actuating means for actuating said sewing means to sew a button on a fabric article; first signal producing means to produce a first signal when the sewing of the button by the sewing means has been completed; button feeding means to supply sequentially a button to said sewing means for the sewing operation; button feeding actuating means to actuate the button feeding means and responsive to the first signal; a second signal producing means to produce a second signal; and an article positioning means comprising a drum adapted to be rotated through a series of work positions, a releasable fabric clamp on the drum for holding one edge of a fabric article, and means to drive the drum to one of a series of sewing positions, said means actuated by the second signal, the drum carrying the fabric on its surface through a portion of a circular path.

10. The apparatus of claim 9, in which said article positioning means comprises a drum on which said clamp is mounted, a series of position determining cams adjustably mounted on said drum and each formed with a latch keeper, a retractable cam latch having a retracted position and biased to an extended position for engaging a different one of said keepers in each of said series of sewing positions and holding the drum against rotation, drive means actuable to a first state for rotating said drum and a second state, means controlled by said second signal for sequentially setting said cam latch to its retracted position and then releasing it, means controlled by said latch in its retracted position for setting said drive means to its first state, means controlled by said cams at rotated positions corresponding to said series of sewing positions for setting said drive means to its second state, and stop control means actuated by one of said cams at a rotated position beyond the position corresponding to the last sewing position for setting said drive means to its second state.

11. The apparatus of claim 10, further comprising

means for engaging and releasing said clamp over a range of rotated positions between the rotated position at which said stop control means is actuated and the position corresponding to the last sewing position.

12. In combination, a motor having a rotatable drive shaft, a support mounted on said drive shaft for rotation therewith about a predetermined axis, clamp means mounted on said support and means for actuating said clamp to a closed position for holding an article on said support and to an open position, a set of cams mounted on said support each located at a different angular position about said axis, each cam having a first cam surface and a latch keeper, a first of said cams having a second cam surface, a first switch fixed with respect to said motor and located in position to be actuated from a first state to a second state by the first cam surface of said cams at a different angle of said support for each cam, a second switch fixed with respect to said motor and located in position to be actuated from a first state to a second state by the second cam surface of said first cam at a rotated angle of said support beyond the angle at which the first switch is actuated by the last cam, latch means fixed with respect to said motor and means for actuating said latch means to a disengaged position and an engaged position in which said latch means engages each of said keepers at a rotated angle of said support at which the cam actuates the first switch, switching means having first and second states and actuated to its first state by said latching means in its disengaged position and said second switch in its first state for supplying power to said motor to rotate said support, means actuated by said first switch in its second state for setting said switching means to its first state and producing an output signal, and means fixed with respect to said motor for engaging and opening said clamp means at a rotated angle of said support between the angle at which the last cam actuates the first switch and the angle at which the first cam actuates the second switch.

13. The apparatus of claim **12**, further comprising sewing means responsive to said output signal for sequentially performing a sewing operation on a fabric article held at one end by said clamp and second signal producing means producing a second signal, and switching means controlled by said second signal for actuating said latch means to its disengaged position.

14. The apparatus of claim **13**, further comprising fabric guiding and tensioning means located adjacent said sewing means and opposite said clamp for yieldably engaging a fabric article held at one end by said clamp and guiding the article smoothly under tension to said sewing means, and in which said sewing means performs a button sewing operation, said latch means engages said keepers with clearance, and said motor is an alternating current induction motor, and further comprising means actuated by said switching means in its first state for applying a short pulse of direct current to said motor to urge a cam engaged by the latch means forward and then allow it to relax to slacken the fabric and permit slight motion thereof during the sewing operation.

15. Rotary positioning apparatus for flexible articles, comprising a support provided with an article support surface and an arcuate article guide having a surface conforming to a cylindrical segment separated from said support surface by a work space, resilient means mounted on said support for yieldably engaging an article and urging it against said support surface, a drum rotatably mounted on said support, said drum having a radius substantially equal to the radius of said segment and being located adjacent said arcuate article guide, a releasable clamp mounted on the periphery of said drum and extending over said arcuate guide over a predetermined rotated angle of said drum, whereby a flexible article held at one end by said clamp, overlying said work space and engaged by said resilient means is drawn over said arcuate guide upon rotation of said drum and is held over the work space under uniform tension; and sequencing means responsive to a series of applied signals for rotating said drum to successive ones of a set of predetermined angles to bring a corresponding set of locations on a flexible article to the work space.

16. The apparatus of claim **15**, further comprising means located on said support for engaging and releasing said clamp at an angle of said drum between the first and the last of said set.

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PATRICK D, LAWSON, *Primary Examiner.*

JORDAN FRANKLIN, J. R. BOLER,
Assistant Examiners.