Dec. 18, 1962 D. M. McBEAN ET AL 3,068,816

APPARATUS FOR SIMULTANEOUSLY SEWING A PLURALITY OF BUTTONS ON OR BUTTONHOLES IN A FABRIC

Filed June 8, 1959 10 Sheets-Sheet 1

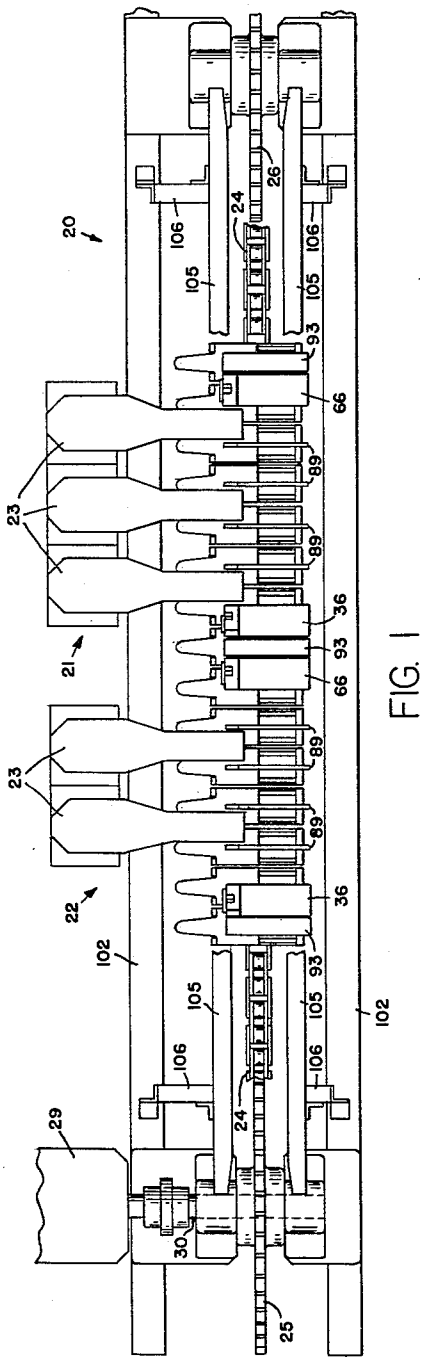


FIG. 1

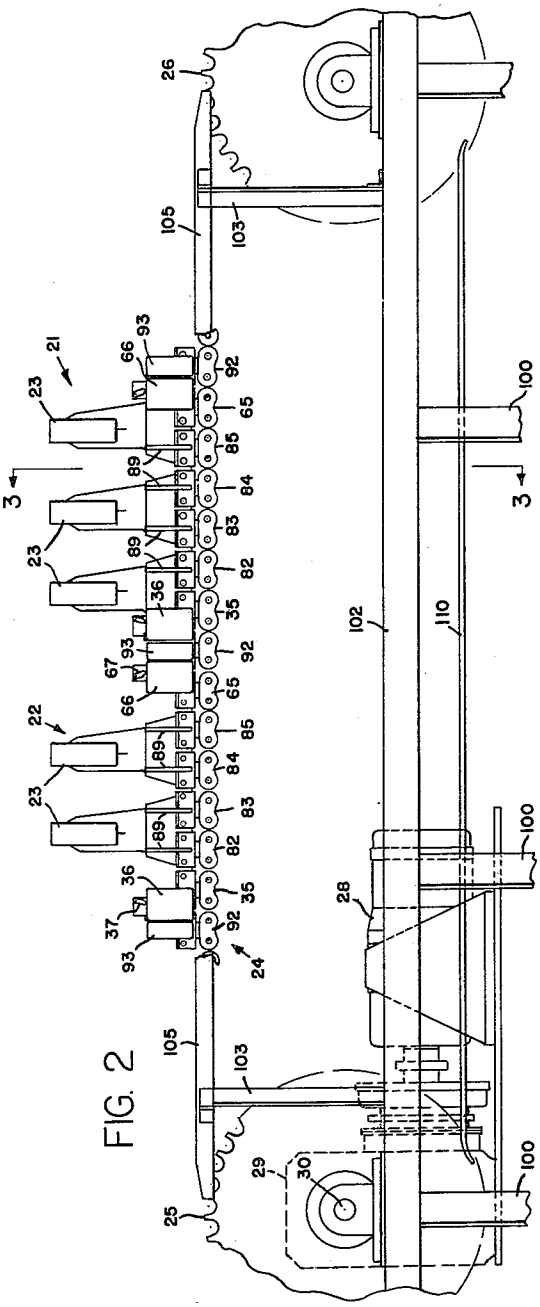


FIG. 2

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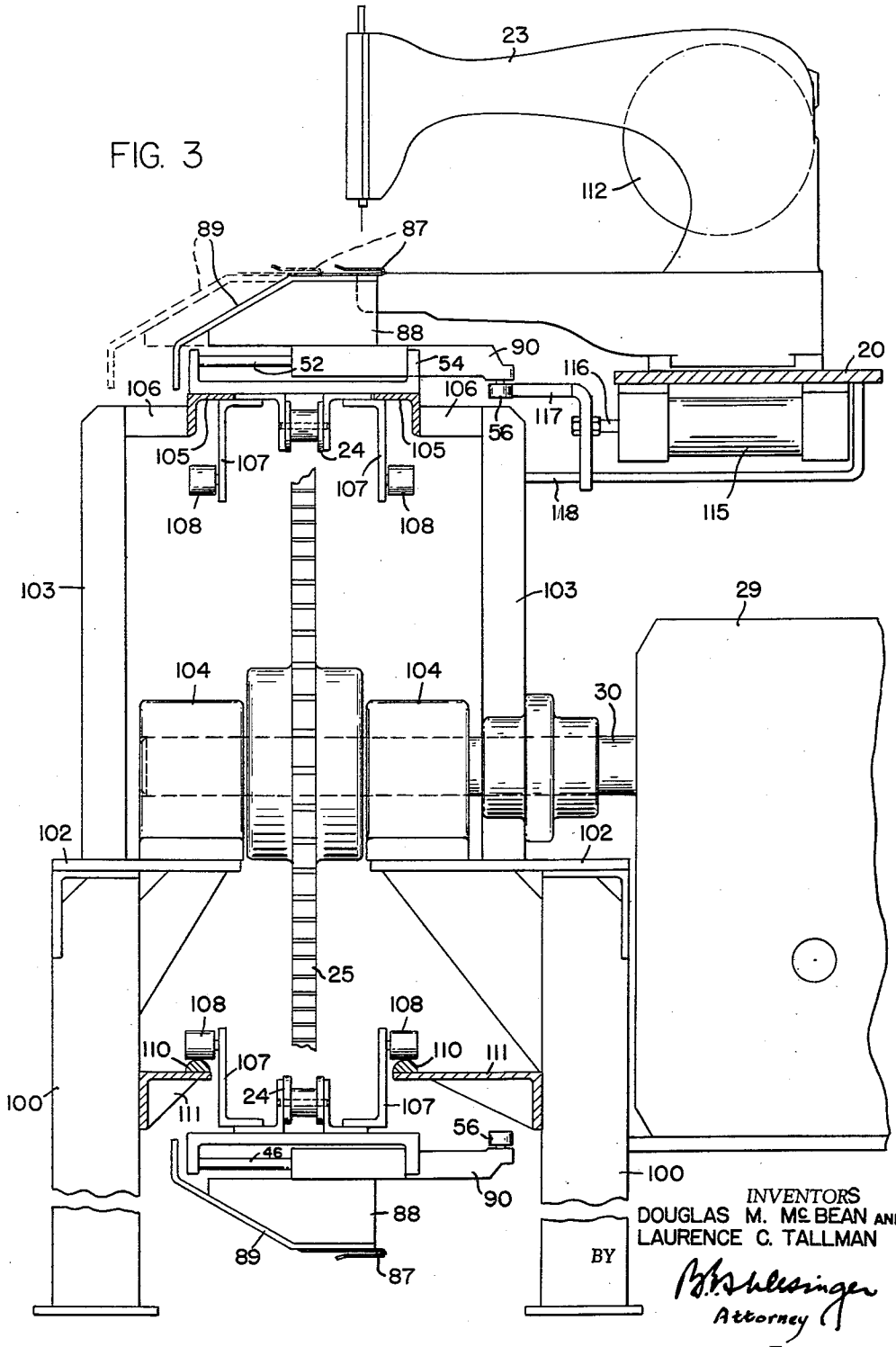
Attorney

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APPARATUS FOR SIMULTANEOUSLY SEWING A PLURALITY OF BUTTONS ON OR BUTTONHOLES IN A FABRIC

Filed June 8, 1959 10 Sheets-Sheet 2

FIG. 3



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Dec. 18, 1962 D. M. McBEAN ET AL 3,068,816

APPARATUS FOR SIMULTANEOUSLY SEWING A PLURALITY OF BUTTONS ON OR BUTTONHOLES IN A FABRIC

Filed June 8, 1959 10 Sheets-Sheet 3

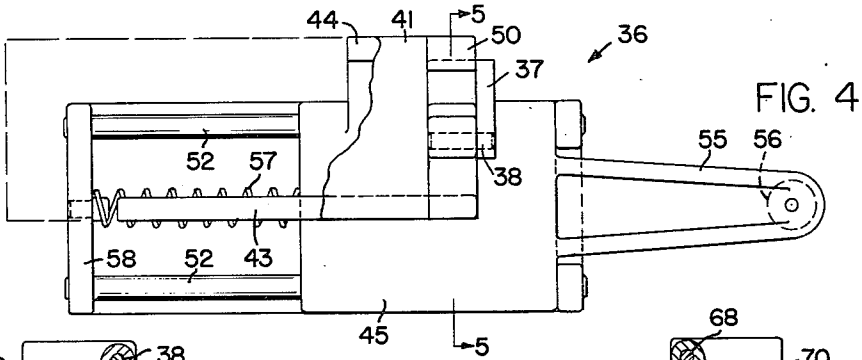


FIG. 4

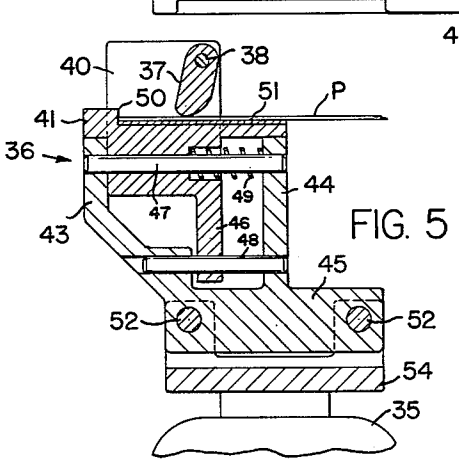


FIG. 5

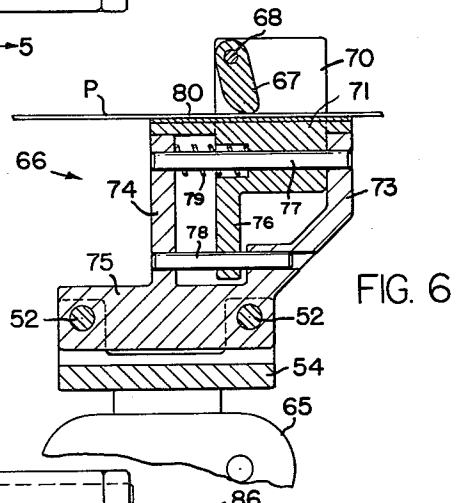


FIG. 6

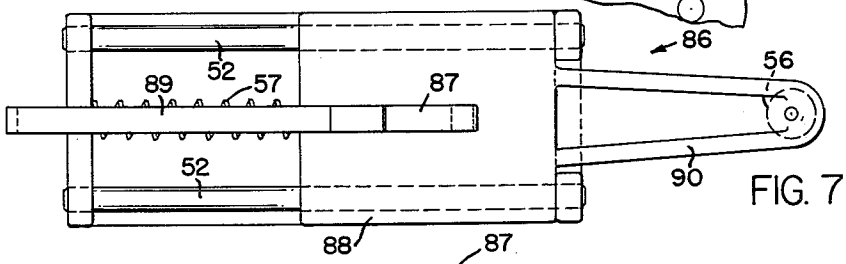


FIG. 7

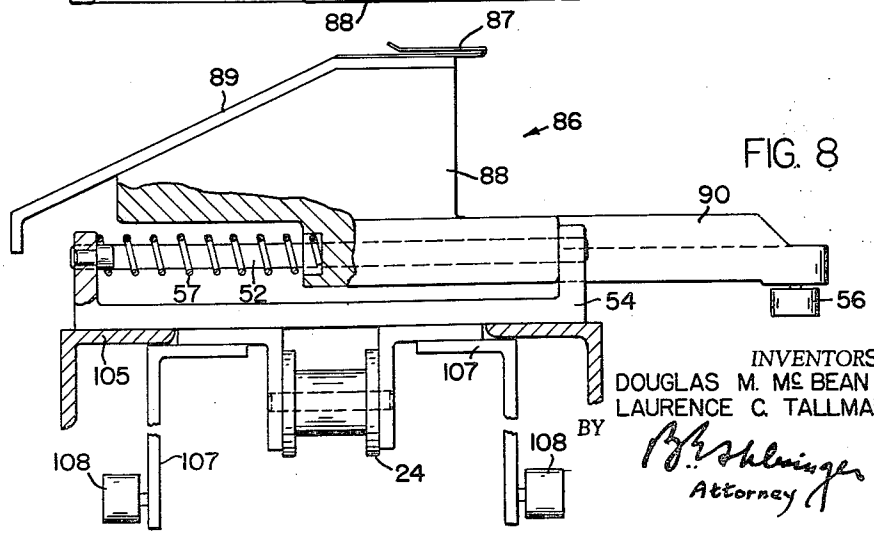


FIG. 8

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Dec. 18, 1962 D. M. McBEAN ET AL 3,068,816

APPARATUS FOR SIMULTANEOUSLY SEWING A PLURALITY OF BUTTONS ON OR BUTTONHOLES IN A FABRIC

Filed June 8, 1959 10 Sheets-Sheet 4

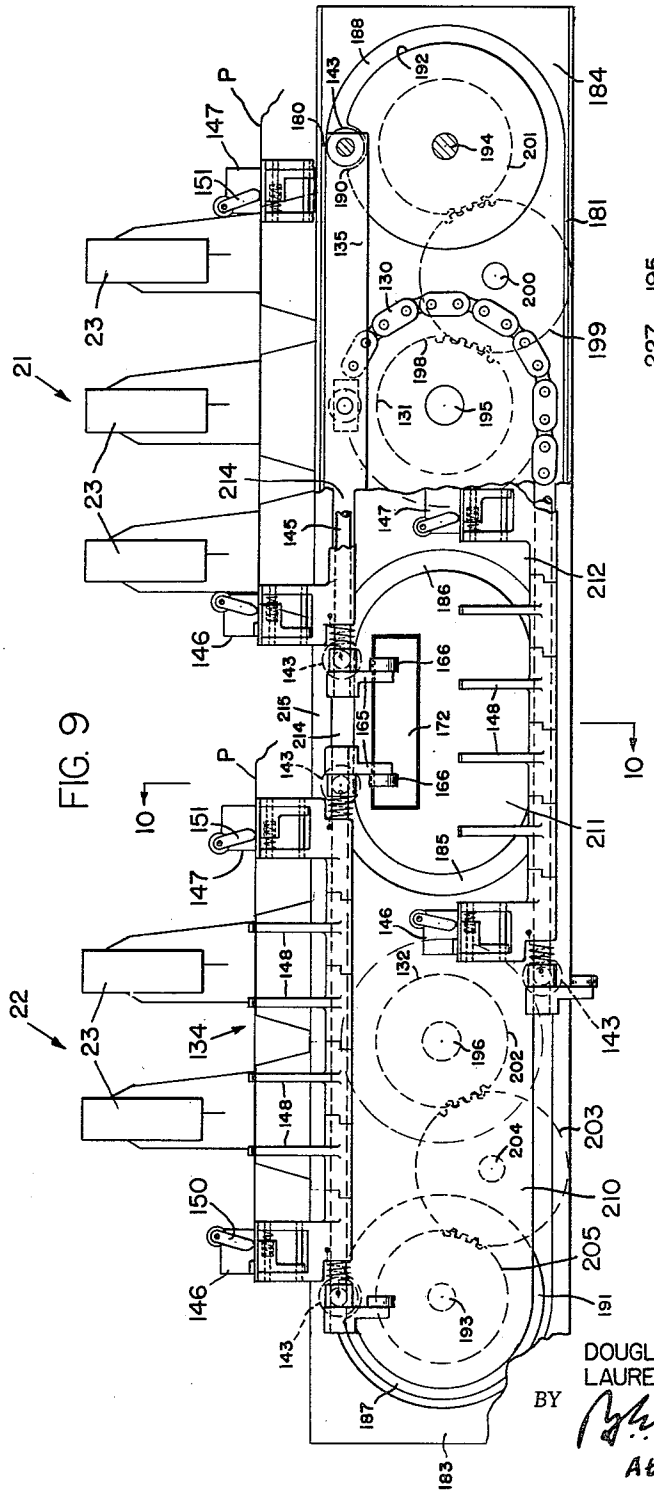


FIG. 9

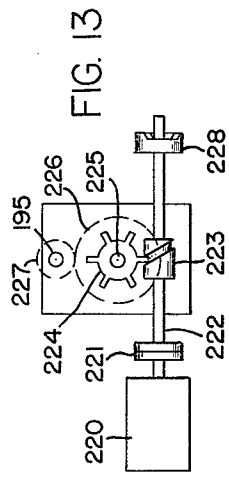


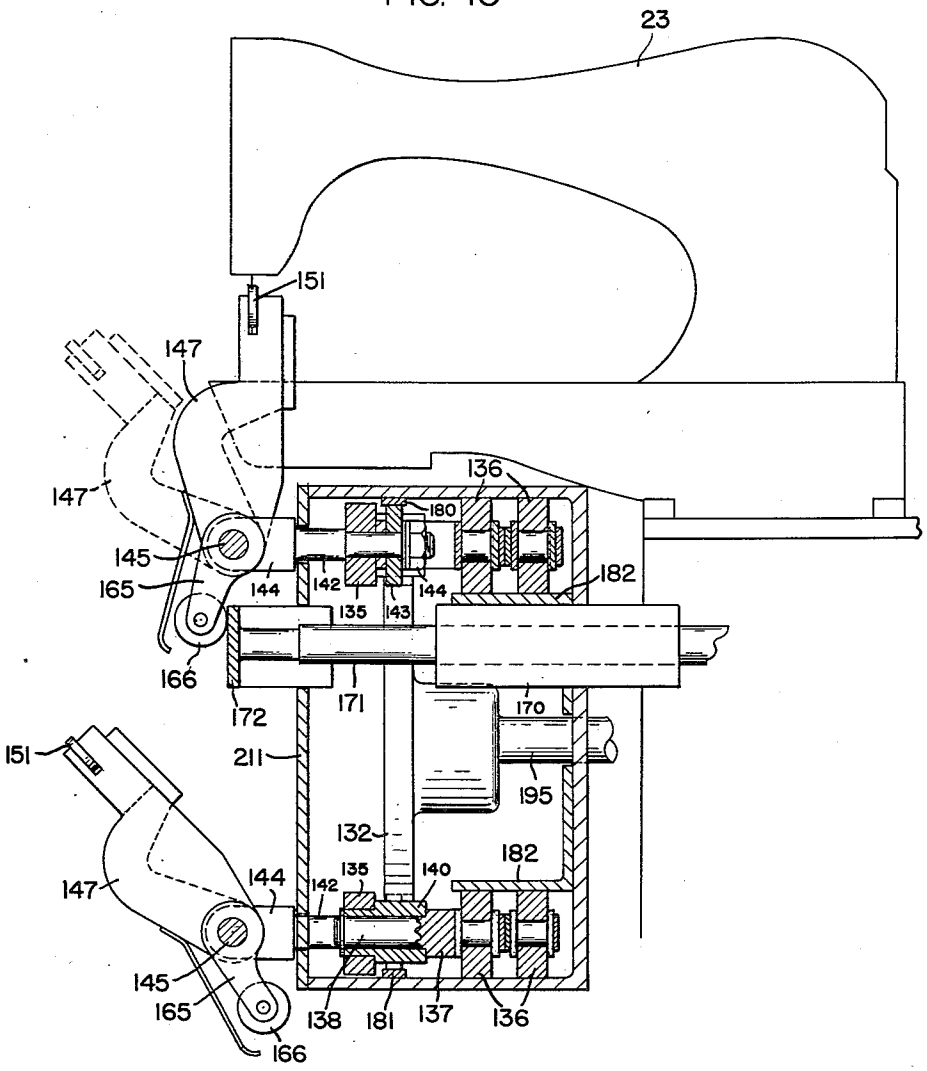
FIG. 13

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FIG. 10



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Dec. 18, 1962 D. M. McBEAN ET AL 3,068,816

APPARATUS FOR SIMULTANEOUSLY SEWING A PLURALITY OF BUTTONS ON OR BUTTONHOLES IN A FABRIC

Filed June 8, 1959 10 Sheets-Sheet 6

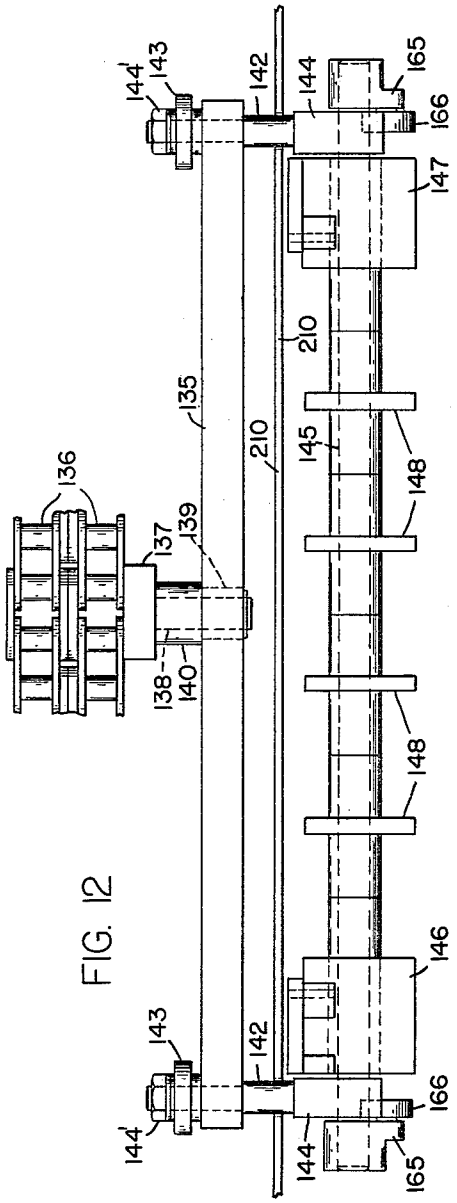


FIG. 12

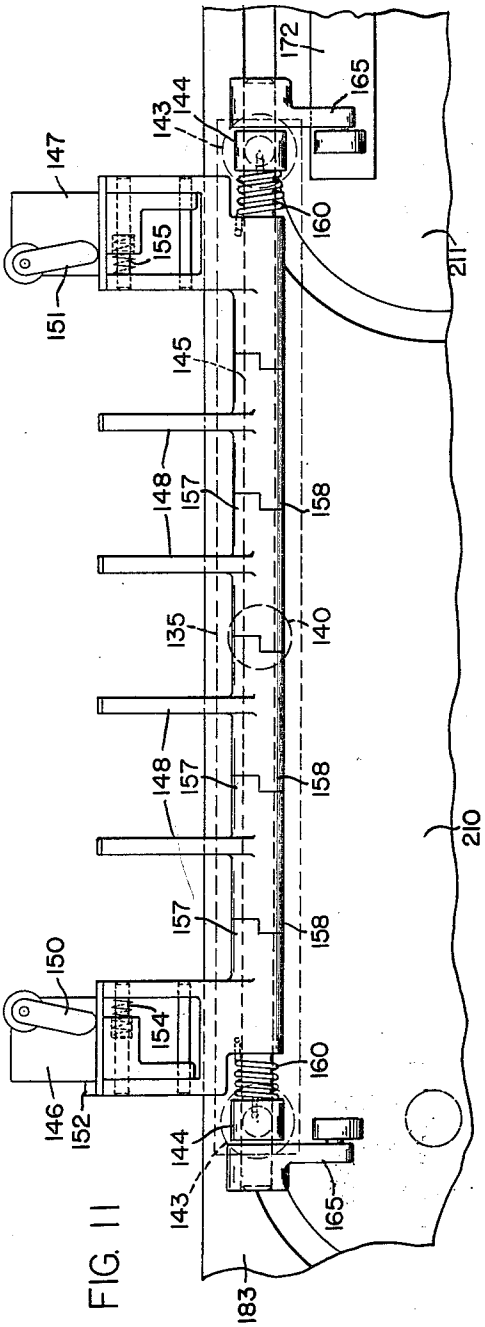


FIG. 11

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APPARATUS FOR SIMULTANEOUSLY SEWING A PLURALITY OF BUTTONS ON OR BUTTONHOLES IN A FABRIC

Filed June 8, 1959 10 Sheets-Sheet 7

FIG. 14

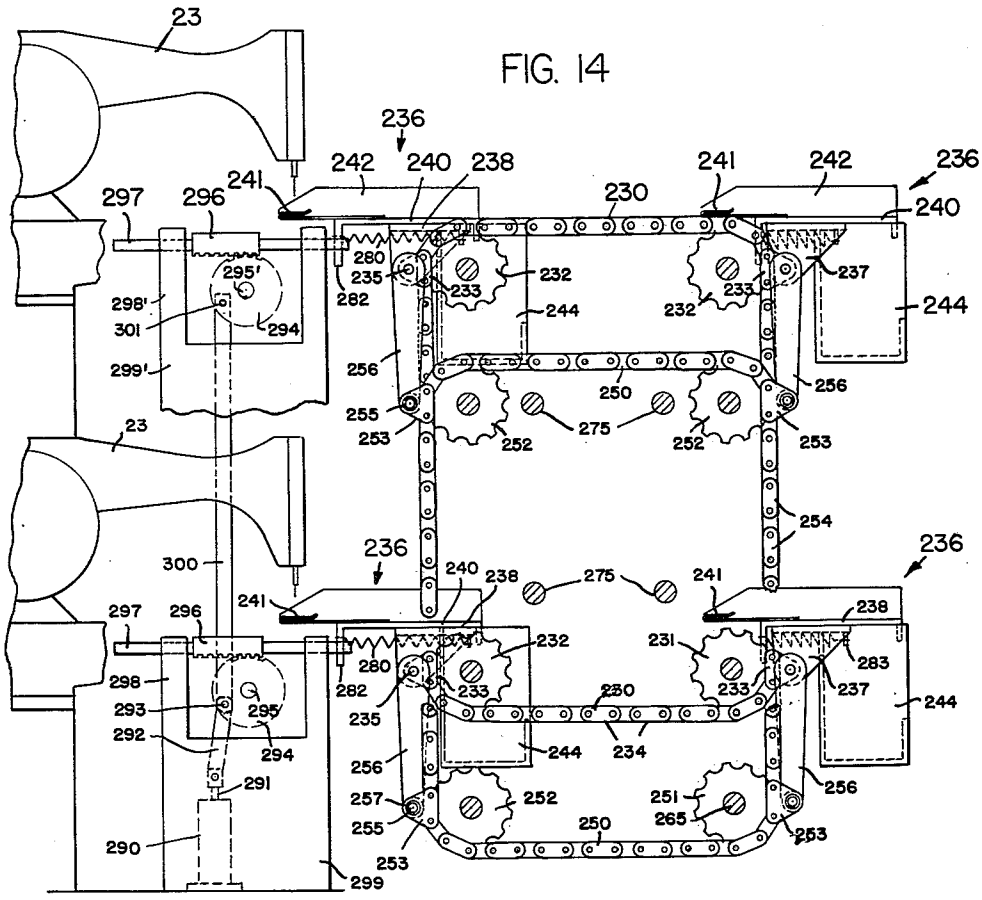
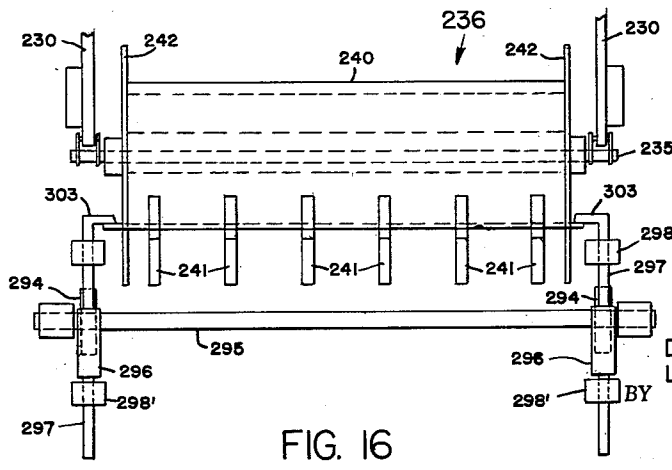


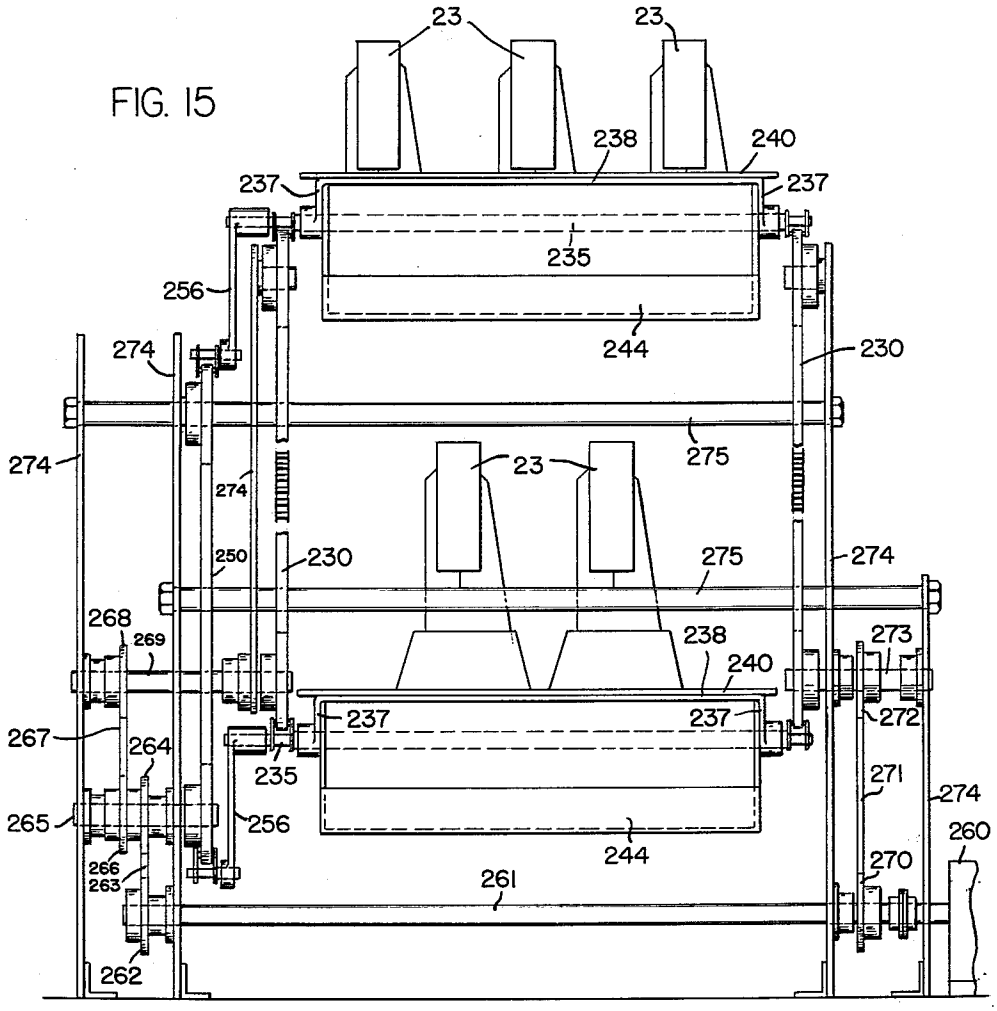
FIG. 16



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APPARATUS FOR SIMULTANEOUSLY SEWING A PLURALITY OF BUTTONS ON OR BUTTONHOLES IN A FABRIC
Filed June 8, 1959 10 Sheets-Sheet 8

FIG. 15



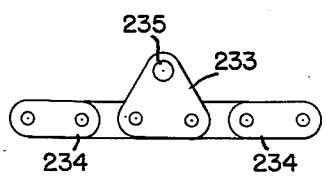


FIG. 17

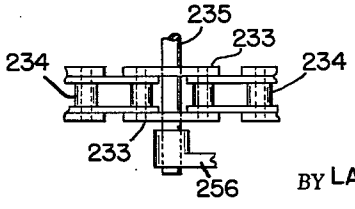


FIG. 18

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APPARATUS FOR SIMULTANEOUSLY SEWING A PLURALITY OF BUTTONS ON OR BUTTONHOLES IN A FABRIC

Filed June 8, 1959 10 Sheets-Sheet 9

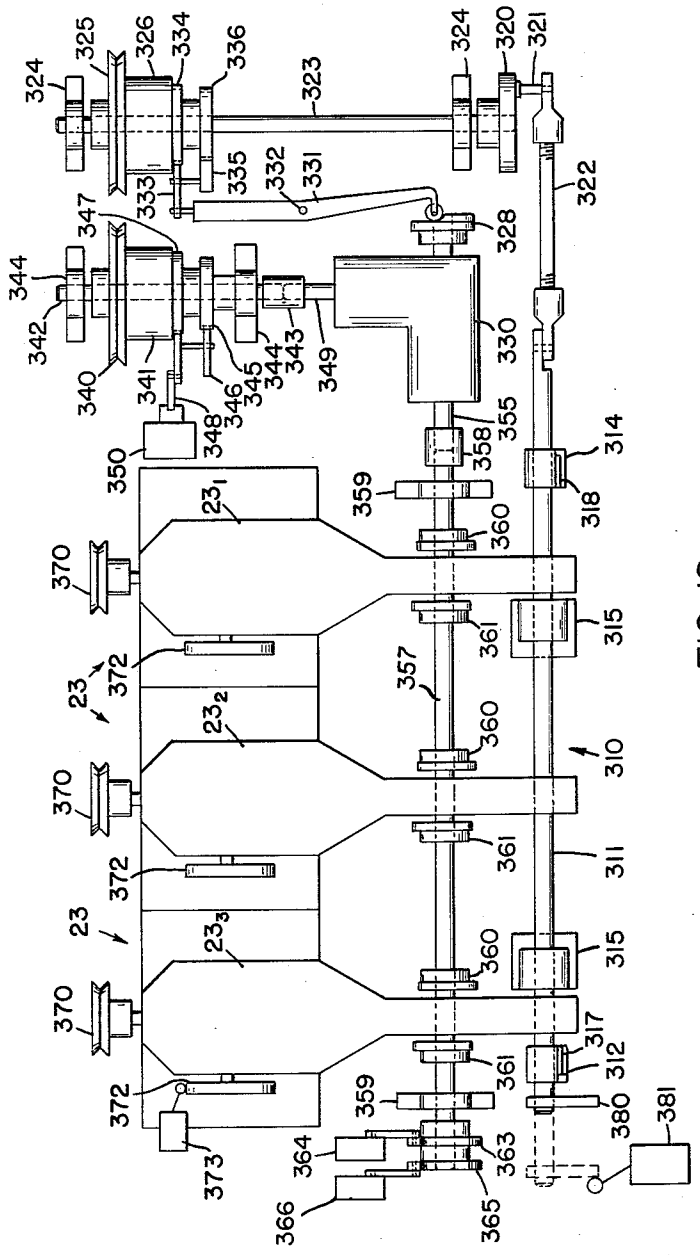


FIG. 19

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APPARATUS FOR SIMULTANEOUSLY SEWING A PLURALITY OF BUTTONS ON OR BUTTONHOLES IN A FABRIC

Filed June 8, 1959 10 Sheets-Sheet 10

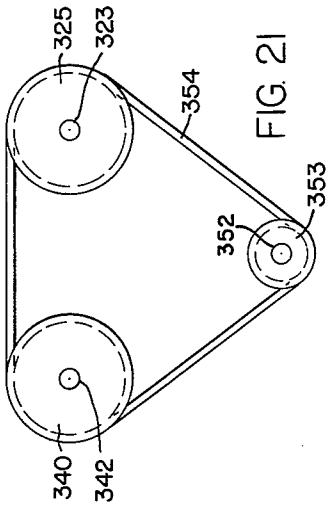


FIG. 21

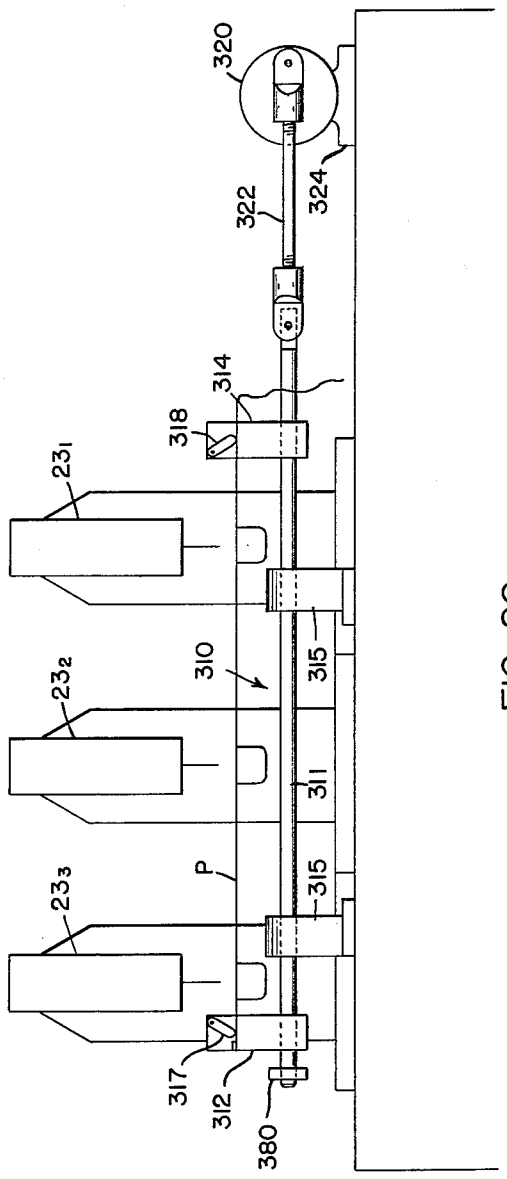


FIG. 20

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United States Patent Office 3,068,816 Patented Dec. 18, 1962

3,068,816

APPARATUS FOR SIMULTANEOUSLY SEWING A PLURALITY OF BUTTONS ON OR BUTTONHOLES IN A FABRIC

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Filed June 8, 1959, Ser. No. 818,917
15 Claims. (Cl. 112—65)

The present invention relates to a sewing apparatus, and more particularly, to apparatus for sewing a plurality of buttons on, or a plurality of button holes in, a shirt or other garment simultaneously.

Men's shirt fronts customarily have five buttons aside from the collar button. Heretofore, it has been necessary to sew these buttons on the shirt panel one at a time. The operator has had to position a button in the button-holding jaws of the sewing machine, to position the shirt panel, on which the buttons are to be sewed, under the button and needle, to actuate the machine to sew the button on the panel, to pull the shirt panel away from the machine to break the thread, to shift the panel longitudinally to bring a new part of the panel into position to receive the next button, to put another button into the jaws of the machine, to operate the machine to sew this second button on the panel, to pull the shirt panel away again, and to proceed as before until the third, fourth, and fifth buttons have been sewn on the panel in the manner described.

This prior method is slow, laborious, and tiring to the operator. In addition it requires most skillful operators; it takes long years of training to position the buttons quickly and to locate the shirt panel correctly the five different times required for the five different buttons, and avoid any error.

The buttonholes of a shirt are sewed in much the same manner as the buttons; so for the buttonholes, too, there are involved much the same time-consuming movements, measurements, and sewing operations as required for the buttons.

One object of the present invention is to provide a machine set-up which will permit of sewing two or more buttons on, or buttonholes in, a shirt simultaneously.

Another object of the invention is to enable all of the buttons or buttonholes to be sewed on the front panel of a shirt without having to manually reposition the shirt panel.

A further object of the invention is to provide apparatus which will permit of sewing all of the buttons or buttonholes on a shirt front with only one handling of the shirt panel and automatically once the operation is started.

Another object of the invention is to provide apparatus which will enable the buttons, or buttonholes, to be sewed on a shirt panel in much less time and more efficiently and economically than has hitherto been possible.

Another object of the invention is to provide apparatus for performing a plurality of sewing operations by machine on a piece of fabric, that will require only a single positioning of the fabric, and will render it unnecessary to reposition the fabric for each sewing operation.

Other objects of the invention will be apparent hereinafter from the specification and from the recital of the appended claims when read in conjunction with the accompanying drawings.

In the drawings:

FIG. 1 is a plan view, with parts broken away, showing a plurality of standard sewing machines arranged in two groups, and showing mechanism constructed according to one embodiment of this invention for conveying

a shirt panel from one group to the other to sew the five buttons on the shirt panel in a single set-up and automatically;

FIG. 2 is a front elevation, partly broken away, further showing the machines and the indexable conveyor for the shirt panel;

FIG. 3 is a section, on an enlarged scale, taken on the line 3—3 of FIG. 2, looking in the direction of the arrows, and showing also in dotted lines one of the supports for the shirt panel in its withdrawn position, ready for indexing;

FIG. 4 is a plan view, on an enlarged scale, and partly broken away, of one of the clamps used on the conveyor, for holding a shirt panel at the collar end of the panel;

FIG. 5 is a section taken on the line 5—5 of FIG. 4 and showing fragmentarily a shirt panel gripped by the clamp;

FIG. 6 is a similar section of one of the clamps used on the conveyor for holding a shirt panel at the tail end thereof;

FIG. 7 is a plan view of a clamp for holding the panel at an intermediate point along its length;

FIG. 8 is a side elevation of this clamp showing also fragmentarily and in section the supporting means therefor;

FIG. 9 is a front elevation, partly broken away, of a gang sewing machine arrangement and an indexable conveyor therefor constructed according to another embodiment of the invention;

FIG. 10 is a section, on an enlarged scale, taken on the line 10—10 of FIG. 9, looking in the direction of the arrows;

FIG. 11 is a front elevation, on an enlarged scale, of one of the pallets or fixtures provided on the conveyor for carrying shirt panels in the apparatus shown in FIG. 9;

FIG. 12 is a plan view thereof, showing the manner in which the fixture is rotatably secured to the indexable conveyor chain;

FIG. 13 is a more or less diagrammatic view illustrating one type of drive that may be employed for the mechanism shown in FIGS. 9 to 12 inclusive;

FIG. 14 is a fragmentary side elevation of a gang sewing machine arrangement and conveyor therefor constructed according to still another embodiment of the invention;

FIG. 15 is a front elevation of the parts shown in FIG. 14;

FIG. 16 is a partial plan view of one of the slide plates of this apparatus showing the means for moving the same to and from operative position;

FIG. 17 is a fragmentary side elevation of a portion of one of the fixture-carrying chains used in this embodiment of the invention;

FIG. 18 is a plan view of this portion of the chain;

FIG. 19 is a plan view illustrating more or less diagramatically a still further embodiment of the invention;

FIG. 20 is a front elevation of this embodiment; and

FIG. 21 is a detail of the drive in this embodiment of the invention.

In the apparatus illustrated in the drawings the need for manually shifting the shirt panel relative to a sewing machine, to effect sewing of different buttons thereon succeessively, is eliminated. Instead a gang of sewing machines is employed; three buttons, the top, bottom, and middle buttons, respectively, are sewed on the shirt panel simultaneously in one position; and then the shirt panel is indexed through use of an indexable conveyor to bring it into position where the two remaining buttons are sewed on the panel simultaneously. By using a button feeding mechanism, which forms no part of the present

invention, the whole operation can be performed automatically.

In one embodiment of the invention five sewing machines are used, which are arranged in line in the same horizontal plane with three machines disposed at the first sewing station and two at the other station; and the shirt panels are moved successively from the first to the second station by an indexable endless conveyor. The sewing machines are arranged along the upper reach of this conveyor, and a completed shirt panel can be removed from, and a new panel can be placed on, the lower reach of the conveyor, or while the conveyor is traveling over one of the sprockets over which the conveyor moves. The shirt panels are moved clear of the machines at one station, prior to indexing of the conveyor, by movement of the clamps, which hold each panel, rectilinearly in a direction at right angles to the path of travel of the conveyor. To hold each shirt panel taut during sewing of the buttons thereon there is a clamp for the top of the panel and a clamp for the bottom of a panel; and the two clamps are spring-pressed away from one another, the clamp for the top of the panel being pressed by a slightly stronger spring than the clamp which engages the bottom of the panel.

In a second illustrated embodiment of the invention, the sewing machines are again arranged in line and at two spaced stations in two groups of three and two machines, respectively, but here each panel is moved away from the machines prior to indexing of the conveyor by rocking the clamps, which hold the panel about an axis that extends in the direction of movement of the conveyor.

In the third illustrated embodiment of the invention, the sewing machines are arranged in two banks, one above the other, the upper bank comprising three machines, and the lower bank comprising two machines. Here the conveyors are vertically disposed; and here the clamps which hold each panel are moved horizontally to clear the panel from the machines prior to indexing the conveyor.

In a fourth illustrated embodiment of the invention only three sewing machines are used. The first operation is to sew the top, middle, and bottom buttons on the shirt panel. Then the panel-carrying fixture or conveyor is indexed to shift the panel relative to the machines and the second and fourth buttons are sewed on the panel by two of the machines, the third machine being idle during the sewing of these two buttons on the panel.

Referring now to the drawings by numerals of reference, and first to the embodiment of the invention shown in FIGS. 1 through 8, **20** denotes a frame on which are mounted two groups, **21**, **22**, respectively, of conventional industrial type sewing machines **23**. The group **21** comprises three machines; and the second group **22** comprises two machines. All of the machines are mounted on the upper surface of the frame **20** at one side thereof in line with one another, but the two groups of machines are spaced apart along this line.

Mounted to travel in front of the two groups of sewing machines is an endless chain **24**. This chain is driven by a sprocket **25**; and it travels over an idler sprocket **26**. The sprockets **25** and **26** are journaled in a frame **20** for rotation on spaced, parallel axes; and the sprocket **25** is driven by a motor **28** (FIG. 2) through a conventional indexing mechanism **29** and shaft **30**. Sprocket **25** is secured to shaft **30**.

The links of the chain **24** are arranged in groups of seven. Six links of each group carry clamps for holding a shirt panel; and every seventh link is an idler. The first link **35** in each group carries a clamping member **36** which comprises a pivoted clamp arm **37** (FIGS. 5 and 6) that is pivotally mounted by means of pin **38** on a plate **40** that has a guide portion **41** which is slidable on the tops of two legs **43** and **44** of a bracket **45**. Pin **38** extends transversely of the direction of movement of the chain.

The guide portion **41** has an integral depending portion **46** which extends downwardly between the arms **43** and **44**. This depending portion slides on parallel guide pins **47** and **48** which are secured at opposite ends in arms **43** and **44**. The clamping arm **37** has a cam-like clamping surface at its bottom, which is adapted to be engaged manually with the top portion of a shirt panel P. A coil spring **49**, which surrounds the pin **47** and which is mounted at one end in a recess in the depending portion **46** and which abuts at its other end against the arm **44**, serves to put tension on the panel P to stretch it properly for sewing buttons thereon. The guide portion **41** has a gauging stop **50** projecting upwardly therefrom which extends transversely of the direction of travel of the chain, and against which the top edge of the shirt panel is seated. The upper face of guide portion **41** is preferably covered with duck **51**, or similar material, so as not to mark the cloth of the panel. The duck covering also provides excellent gripping friction for the panel.

Bracket **45** is mounted to slide on two parallel rods **52** which are secured at opposite ends in the upwardly directed flanges of a trough-like member **54** that is fastened to a link **35** of the chain. The bracket **45** has an arm **55** projecting from one side thereof. This bracket carries a roller **56**, the purpose of which will be described further hereinafter. A coil spring **57**, which is interposed between the bracket **45** and one flange **58** of the member **54**, serves to urge the bracket constantly in one direction on guide rods **52**.

The sixth link **65** in each group of seven links of the chain carries a clamping member **66** (FIG. 6), generally similar to clamping member **36**, which is adapted to clamp the tail of a shirt panel. This clamping member has a clamping arm or jaw **67** which is pivoted on pin **68** in the upright portion of a plate **71** that is slidable on arms **73**, **74** of a bracket **75**. This bracket, like bracket **45**, is slidable on pins **52** carried by a channel member **54** which is mounted on the link **65** of the chain, and, like bracket **45**, bracket **75** is constantly urged in one direction by a spring (not shown) similar to spring **57**.

Plate **71** has a depending portion **76** which slides on parallel pins **77** and **78** carried by bracket **75**; and plate arm **67** is reversed with reference to arm **37** and spring **79** that surrounds pin **77** and is interposed between depending portion **76** and the arm **74** of bracket **75**. Except that arm **67** is reversed with reference to arm **37** and spring **79** constantly urges plate **71** in the opposite direction from that in which spring **49** urges plate **41**, and except that plate **71** has no stop against which to seat the end of the shirt panel, the two clamping members **36** and **66** are alike. Spring **79** urges clamping jaw **67** away from clamping jaw **37**, and vice versa.

Thus the shirt panel is held under tension by the two clamping jaws **37** and **67**. However, to avoid excessive tension spring **49** is made slightly stronger than spring **79** so that the shirt panel will be held taut enough so that the buttons can be sewed properly thereon, without the panel being pulled out of shape. The top surface of plate **71** is covered with duck **80** to better frictionally hold the shirt panel.

The second, third, fourth, and fifth links **82**, **83**, **84** and **85** of each group of seven links of the chain carry shirt panel supporting guides, one of which is shown on an enlarged scale in FIGS. 7 and 8, and denoted as a whole at **86**. This guide comprises a U-shaped or reversely bent member **87**, into which the shirt panel can be slipped, but which will not exert any pressure or tension on the panel. Each member **87** is mounted on a block **88** which has a downwardly-inclined surface **89** which extends away from the machine and over which the panel drapes itself. Each block **88** is mounted to slide on two parallel rods **52**, and is constantly urged in one direction by a coil spring **57** that is interposed between block **88** and one flange of the associated channel shaped member **54** that is secured to the associated chain link **82**, **83**, **84** or **85**, as the case may be. Each

block 88 has an arm 90 projecting under the sewing machines, as shown in FIG. 3, when the block is in operative position, which carries a roller 56.

The seventh link 92 of each group of seven links of the chain is an idler link. It may merely carry a spacer block 93, or it may carry a cloth guiding member similar to member 87 (FIG. 8). Only a fragment of the chain is shown in FIGS. 1 and 2. It will be understood, however, that the links of the chain are arranged in groups of seven, comprising links 35, 82, 83, 84, 85, 65 and 92 all around the chain.

The frame 20 includes uprights 100 (FIG. 3), horizontal plates 102 supported thereby, and uprights 103 which are mounted on plates 102. The plates 102 support pillow blocks 104 in which shaft 30 is journaled.

The channel members 54, which carry the brackets 45 (FIG. 5) and 75 (FIG. 6), and the blocks 88 (FIG. 8), are guided on parallel tracks 105 (FIGS. 1, 2 and 3) as these brackets and blocks travel in the upper reach of the chain 24. Tracks 105 are supported from uprights 103 by straps 106. Angle arms 107 (FIG. 3) are secured at one end to wings on each of the links of the chain 24. Rotatably mounted on the free end of each arm 107 is a roller 108. These rollers are disposed to engage tracks 110 to support the lower reach of the chain. Tracks 110 are carried by brackets 111 which are secured to uprights 100 of the frame.

An air cylinder 115 (FIG. 3) is mounted beneath each group 21, 22 of sewing machines. Each of these cylinders 115 has a piston reciprocable therein which has a piston rod 116 secured thereto, on which a bar 117 is mounted. The lower end of each bar 117 is slidably mounted on a guide rod 118, that is secured to the frame. The front vertical faces of the two bars 117 are disposed to provide a continuous, substantially unbroken track against which the rollers 56 seat when the shirt panels, which are carried by the upper reach of the chain, are in operative position beneath the needles of the several sewing machines, and with which the rollers 56 engage as the chain is indexed along its upper reach.

When compressed air is admitted to the rear of either cylinder 115, the piston rod 116 associated therewith is moved forwardly, so that the bars 117 push the rollers 56 and the brackets 45, 88, respectively, on which they are mounted, forward. This moves the shirt panel clear of the needles of the sewing machines and breaks the threads, thereby releasing the panel from the sewing machines. As the fixtures, that are mounted on the several chain links, are carried forward, the springs 57 are compressed; and, when the pressure in the air cylinders 115 is released, these springs expand to carry the fixtures back to sewing position.

Preferably, the sewing machines in each group are synchronized with each other, and there is one drive motor for each group of machines. Each sewing machine may have its own standard button hopper and chuck, and will be provided with conventional means for moving the chuck so that its needle goes through different holes of a button successively. The cams 112, that control these operations on the three machines at the first sewing station, can be arranged to close respectively, three switches, which, when all are closed, will complete an electric circuit to a solenoid valve, causing that valve to be shifted to apply air pressure to the rear end of the piston in the cylinder 115 associated with that group of machines. This will cause the shirt panel at the first station to be moved clear of the three sewing machines at that station. Likewise, the cams 112 on the two sewing machines at the second station can be arranged to trip two switches (not shown) to close a circuit to a solenoid valve associated with the cylinder 115 that is associated with the second group of machines. Thus, the shirt panel at the second station will be moved clear of the two machines at that station.

To prevent the buttons from being pulled off the panels as they are moved clear of the sewing machines, the button chucks on the several machines will, of course, be opened just prior to movement of the panels away from the needles. This may be done also by cams 112.

When the two shirt panels are clear of the two groups of sewing machines, switches (not shown), which may be closed by the bars 117 or in any other suitable manner, will close an electric circuit to motor 28 (FIG. 2). This will index the chain to carry the shirt panel, which now has five buttons sewn thereon, from the second station to an unloading station, and to carry the shirt panel, which has three buttons sewn thereon, from the first station to the second station, and to carry a new shirt panel from a loading station to the first station.

The indexing mechanism may be of conventional design. As soon as the indexing operation is completed, the cams 112 on the sewing machines will have rotated far enough to cause the valves, which control the operation of the cylinders 115, to be reversed, and the shirt panels now at the two operating stations will be carried into operative position relative to the sewing machines by the springs 57.

In use of the apparatus described, the collar end of a shirt panel is slipped under the arm 37 (FIG. 5) of the clamp member 36 at the cloth loading station, and the top of the shirt panel is abutted against the stop lug 50. The panel is then inserted in the cloth guides 87 (FIG. 8); and the tail of the shirt panel is then slipped under the pivoted arm 67 (FIG. 6) of the clamp 66. The motor 28 is then actuated to cause the indexing mechanism to index the chain in a counter-clockwise direction, relative to FIG. 2, to carry the fabric panel into registry with the first group 21 of sewing machines, and to bring an empty group of cloth carrying fixtures to the loading station. The motor is then stopped. The sewing machines 23 at the first station then sew three spaced buttons on the panel. When this is completed the pistons in the air cylinders 115 are actuated to move the panel clear of the sewing machines. Then the chain is indexed, to move the panel to the second station, and to carry a new panel from the loading station to the first operating station. Then the air is released from the cylinders 115; and the springs 57 expand to bring the panels to sewing position. The sewing machines are then actuated to perform the sewing operations at the two sewing stations.

When the sewing machines have completed their operations at the two stations, the cams 112 will trip the air cylinders 115, to open the button chucks and move the two panels away from the machines. Then the switch is tripped that closes the circuit to the electric motor 28 and the chain is indexed to its next position. Then the operation proceeds as before, three buttons or buttonholes being sewn on a shirt panel by the first group 21 of sewing machines, and two buttons or buttonholes by the second group 22 of machines. The completed panel is carried from the second station to the unloading station, and a new panel is carried from the loading station to the first operating station. Either one or two operators can be employed to load and unload the apparatus; or alternatively, for example, the apparatus can be loaded by one operator, and unloaded mechanically.

The springs 49 (FIG. 5) and 79 (FIG. 6) permit the cloth to go with the pull of the button chucks to maintain a fixed tension on the cloth. They also insure proper orientation or location of the cloth with reference to the needles of the sewing machines. By making each spring 49 stronger than the spring 79 of its group, the top of the panel is always held to the stop 50 of its group against which it has been abutted originally, as above-described. This keeps the panel tight.

The spacing of the guides 87 permits of ready access to the needles and loopers of the sewing machines. The idler fixtures 93 provide space between the tail and collar

clamps of successive groups of fixtures, that is between successive pieces of cloth.

Obviously modifications can be made in the structure shown. Thus, for instance, the air cylinders **115** may be replaced by cams driven from motor **28**, thereby providing accurate and positive timing.

The modification of the invention, that is illustrated in FIGS. 9 through 12 inclusive, is designed to operate in a manner generally similar to the embodiment of the invention previously described. However, in this modification of the invention, the fixtures, which carry each shirt panel, are connected together so that they are moved bodily together to and from operative relation with the sewing machines. Each group of fixtures is pivotally mounted on a pallet to be swung to or from operative position; and each pallet is mounted on a chain that is indexed to move the different pallets successively from the first sewing station to the second sewing station and then to the loading-unloading station. In the embodiment shown, there are three pallets mounted on the conveyor, and there are three indexed positions for them. There is always one pallet at the combined loading and unloading station, and one pallet at each of the two sewing stations.

Referring now to FIGS. 10 through 12 inclusive by numerals of reference, **130** denotes an endless conveyor chain that is driven by a drive sprocket **131** and that passes around an idler sprocket **132**. Three pallets **134**, of identical construction, are mounted on the chain **130**. Each pallet includes an elongate bar **135** (FIG. 12) that is carried from two adjacent links **136** of the conveyor chain by a bracket **137** which has a stud **138** integral with it that is journaled by means of a bushing **139** in the bar **135**. A spacer **140** separates bracket **137** from the bar. Bracket **137** is welded or otherwise secured to the chain links. Mounted at opposite ends of the bar **135** are studs **142**. Each of these studs has a roller **143** journaled on it adjacent one end and has an ear **144** (FIG. 10) at its opposite end. Journaled in the two ears **144** is a rod **145**. The rollers **143** are held on the studs **142** by nuts **144'**.

The shirt panel supporting devices are mounted for pivotal movement on this rod **145**. These devices are generally similar to the devices **36**, **86** and **66** of the previously described embodiment of the invention. There are two end clamping members **146** and **147**, respectively, that are generally similar in structure and operation to the clamping members **36** and **66**, respectively; and intermediate these two end clamping members are four guide members **148**, that are generally similar in structure and operation to guide members **86**. The clamping members carry pivoted clamping arms **150** and **151**, respectively; and clamping member **146** is provided with a stop lug **152** against which the collar end of a shirt panel can be abutted. This clamping member also has a stronger spring **154** than spring **155** of end clamping member **147**.

The shirt panel supporting devices **146**, **148**, **147** of each group are rotatably mounted on the associated shaft or rod **145**, and are keyed together for pivotal movement, each supporting device having an offset portion **157** (FIG. 11) at one end that engages with an offset portion **158** at the adjacent end of the next succeeding cloth supporting device. Coil springs **160**, which are disposed adjacent opposite ends of shaft **145**, and each of which is connected at one end to one of the ears **144** and at its opposite end to the adjacent cloth supporting device, serve constantly to urge the cloth supporting devices to retracted, inoperative positions.

Keyed to each rod **145** at opposite ends thereof are two arms **165**, each of which carries a roller **166**. To move the shirt panels to sewing position at the sewing stations, an air cylinder **170** (FIG. 10) is mounted on the frame of the machine between the two sewing stations. A piston, which is reciprocable in this cylinder, has a piston rod **171** secured to it which carries at its front end a bar **172** that is disposed to engage against the two rollers **173** that are carried, respectively, by the trailing end of the rod **145** which is then at the second sewing station and by the leading end of the rod **145** which is then at the first sewing station. Thus, as long as there is air pressure on the rear end of the piston which is in cylinder **170**, the cloth supporting devices will hold the shirt panels at the two stations in position to have buttons sewn thereon. When the air is exhausted from the rear end of the cylinder, however, springs **160** will swing the supporting devices and shirt panels away from the machines.

As the pallets move along with the chain the rollers **143** (FIG. 12) of the pallets roll on horizontal upper and lower tracks **180**, **181**, respectively, provided on the frame of the apparatus. The chain **130** itself may be supported from sagging by angle plates **182** (FIG. 10) which are secured to the frame.

The upper and lower tracks are connected at their corresponding ends by curved guides **183**, **184** (FIG. 9), and intermediate their ends the upper and lower tracks are connected by two confronting arcuately-curved guideways **185** and **186**. The guideway **185** is parallel to the arcuately-curved guide groove in guideway **183**; and the arcuately curved guide groove **186** is parallel to the arcuately curved guide groove **188** in the guide member **184**. The guide grooves **185** and **187** and the guide grooves **186** and **188** are spaced apart equal to the distance between the two rollers **143** (FIG. 12) carried by a bar **135**.

The bars **135** are of such length that the rollers **143** at the distal ends of the two bars **135** which are at any given time at the sewing stations are positioned to be engaged in recesses **190** of cam plates **191**, **192** (FIG. 9). These plates are secured to shafts **193**, **194**, respectively, that are mounted parallel to the drive shaft **195** on which drive sprocket **131** is mounted, and to the shaft **196** on which idler sprocket **132** is mounted.

The cam **192** is driven from drive shaft **195** to make one revolution per revolution of sprocket **131**. The drive is through a spur gear **198** which is secured to drive shaft **195**, a spur idler gear **199** which is mounted on a stud **200**, and a spur gear **201** that is secured to shaft **194**. Similarly cam **191** is driven from shaft **196** to make one revolution per revolution of sprocket **132**. This drive is through a spur gear **202** that is secured to shaft **196**, an idler **203** that is rotatably mounted on a stud **204**, and a spur gear **205** that is secured to cam shaft **193**.

The guide way **187** is bounded by plate **183** and by a plate **210** which is convexly at its end adjacent plate **183** and concavely curved at its opposite end. Guideway **185** is formed by the concavely curved end of plate **210** and the adjacent convexly curved end of a flattened oval plate **211**. The guideway **186** is formed by the convexly curved right hand end of the plate **211** and the confronting concave arcuate end of plate **212**. Plates **183**, **210**, **211**, **212**, and **184** may be secured in any desired manner at the front of the frame of the apparatus. The guideways **187**, **185**, **186**, **188** are of a width to receive the shafts **142** (FIG. 12).

When the chain is indexed, then, cam **191** will move the roller **143**, which is at the left hand end (FIG. 9) of the bar **135** that is at the second sewing station, downwardly, and the shaft **142** on which this roller is mounted will travel donwardly in guide groove **187**. Simultaneously the shaft **142** on which the roller **143** is carried at the right hand end of this bar **135** will travel downwardly in guide groove **185**. Thus, this bar **135**, and in fact the whole pallet **134**, have a bodily movement in the nature of a curved parallelogram movement. This will cause the pallet **134** which has been at the second sewing station to be moved to the loading-unloading position, centrally of the lower reach of the chain, the position shown at the bottom of FIG. 9. While this is going on the pallet **134**, which has been at the first sewing station, will be moved to the left to the second sewing station, the roller

143 at the right hand end of the bar 135, which is associated with this pallet, moving out of the recess 190 in cam 192 and this bar 135 and the associated pallet being moved bodily to the left. The slot 214, which is formed between an upper plate 215 at the front of the frame and the plates 212, 211 and 210 accommodates the shafts 142 (FIG. 12) of this bar 135 during this movement. While this is going on, also, the pallet 134, which has been at the loading-unloading station, and which now carries a new shirt panel, will have moved by operation of cam 192 and of the chain to sewing station No. 1. The roller 143 at the right hand of the bar 135 which is carried by this pallet will be engaged by the recess 190 of cam 192 and the shaft of this roller will travel through guideway 188 while the shaft of the roller which is carried at the left hand end of this bar will move through guideway 186. Thus this pallet will also have a generally curved parallelogram movement.

Of course, prior to indexing, the button chucks of the machines at the two sewing stations will be released, and the air cylinder 170 (FIG. 10) will be evacuated to allow springs 160 (FIG. 11) to swing the cloth supporting devices clear of the machines.

The drive to shaft 195 may be of any suitable type. Thus, as shown in FIG. 13, it may comprise a motor 220, an electrically-operated clutch 221, a cam shaft 222 connectable with the motor by the clutch 221, a worm or barrel cam 223, a cam wheel 224 having arms, which may carry rollers (not shown) adapted to engage in the groove of cam 223, an output shaft 225, a spur gear 226 secured to shaft 225, and a spur pinion 227 that meshes with gear 225 and is secured to sprocket shaft 195. The cam shaft 222 also carries a face cam 228. This face cam should be shaped to shift the valve that controls cylinder 170 (FIG. 10) to effect in and out movement of the actuator bar during 90° of rotation of the shaft 222. The members 223, 224 should be shaped so that during the remaining 270° of rotation of the camshaft 222 the output shaft 225 is indexed through 120°; and the gearing 226, 227 should provide a three to one reduction to cause the sprocket shaft to rotate through a full revolution for 120° of rotation of the sprocket shaft. The control mechanism can include, for example, an electrical switch at each sewing machine that is arranged to close when the needle of the machine is raised at the end of each sewing operation. The electrical switches on the sewing machines can be arranged so that when all five switches are closed, the electric clutch 221 is closed. When the indexing operation is completed and the cloth supporting devices are in their newly indexed positions they may be arranged to trip electromagnetically, as through a solenoid, the means for restarting the sewing machines.

In the embodiment of the invention illustrated in FIGS. 14 through 16 inclusive, the sewing machines are arranged in two banks, one above the other. The upper bank of sewing machines includes three machines that are disposed to sew the top, middle, and bottom buttons, respectively, on the shirt panel. The two sewing machines of the lower bank are arranged to sew on the shirt panel the two buttons between the top and middle buttons and between the middle and bottom buttons, respectively. To achieve these results the two sewing machines of the lower bank are disposed, not beneath two of the machines of the upper bank, but out of registry with all three of the machines of the upper bank; the two sewing machines of the lower bank align vertically with the spaces between the three machines of the upper bank.

The two banks of sewing machines are mounted on a frame that also supports the chains 230 that carry and guide the panel-carrying fixtures. There are two of these fixture-carrying chains 230. They are mounted to travel in parallel vertical paths in front of the two banks of sewing machines. Each of the fixture carrying chains 230 is mounted to travel over a drive sprocket 231 and three idler sprockets 232. These four sprockets are mounted for rotation about parallel, horizontally extending axes, and are located at the four corners, respectively, of an imaginary rectangle. The two drive sprockets 231 are axially aligned, and so are the two idler sprockets in corresponding corners of the respective rectangles of the two fixture-carrying chains. Each of the fixture carrying chains 230 carries four plates 233 (FIG. 17). These plates are fastened to links 234 of the two chains. The plates of each chain are equi-distantly spaced from one another around the chain; and the respective plates of one chain are aligned with the respective plates of the other chain. Mounted on each pair of aligned plates 233 is a rod 235. Secured on each rod are a pair of axially-spaced arms 237 which are integral with and support the base 238 of a cloth-carrying fixture. Slidably mounted on each base 238 is a plate 240. Six aligned resilient clamps 241 (FIGS. 14 and 16), that are generally U-shaped, and that are similar to clamps 87 (FIG. 3), are secured in uniformly spaced relation to the upper surface of each plate 240, to hold the shirt panel resiliently.

Each plate 240 is provided with side walls 242. One of these walls 242 provides a gage stop against which the collar end of the shirt panel can be abutted. A basket or pocket 244 is secured to the undersurface of each of the bases 238, to hold the portion of the shirt panel that projects over the edge of the slidable plate 240.

Mounted below each of the drive sprockets 231 at the left hand side of the machine, as viewed in FIG. 15, is a drive sprocket 251, and mounted below each of the idler sprockets 232 at this same side of the machine is an idler sprocket 252. These sprockets 251, 252 are mounted for rotation about horizontally extending axes that are parallel to each other and that are disposed at the four corners of an imaginary rectangle that is downwardly displaced from the corresponding imaginary rectangle formed by the axes of the sprockets 231, 232 at that side of the machine. A chain 250 travels over the set of sprockets 251, 252.

There are four plates 253 secured to links 254 of the chain 250 equi-distantly about the chain. Each plate 253 is connected at its lower end by a pin 255 and slot 257 with a guide lever arm 256 that is rigidly mounted at its upper end on one of the rods 235. Hence, as the fixture carrying chains 230 and the fixture guide chain 250 are moved through their respective paths, the arms 256 maintain the cloth carrying fixtures 236 in horizontal positions.

The cloth supporting fixture shown at the upper left in FIG. 14 is located at the first sewing machine station, the station which is at the upper bank of three sewing machines. The cloth supporting fixture shown in the lower left hand corner in this figure is at the second sewing station, the station having two sewing machines. The cloth supporting fixture shown at the upper right in FIG. 14 is at the loading station; and the cloth supporting fixture shown at the lower right hand corner in FIG. 14 is at the unloading station. To index the fixtures from station to station, the chains 230 and 250 are driven by a suitable indexing mechanism which may be of conventional construction. This mechanism may include an indexing mechanism in box 260, a shaft 261 driven thereby, a sprocket 262 carried by this shaft, a chain 263, a sprocket 264 secured to the shaft 265 to which the drive sprocket 251 for chain 250 is secured, a sprocket 266 secured to this same shaft, a chain 267, and a sprocket 268 secured to the shaft 269, to which the drive sprocket for one of the drive chains 230 is secured. The drive sprocket for the other drive chain 230 is driven by a sprocket 270 which is secured to shaft 261, a chain 271, and a sprocket 272, which is secured to the shaft 273 to which the drive sprocket for this other chain 230 is secured.

The several shafts 261, 269, 263 are mounted in the uprights 274 of the frame of the apparatus. These uprights are tied together by horizontal tie rods 275.

Prior to indexing the fixtures, the two fixtures at the sewing stations are moved out of operative relation with the sewing machines at these stations. The fixtures are as a matter of fact constantly spring-pressed to retracted positions by coil springs **280**, one of which is carried by each fixture. One end of each spring **280** is connected to a depending lug **282** (FIG. 14) on the associated plate **237** and the opposite end of this spring is connected to a pin **283** carried by the associated base **238**.

The fixtures are moved to operative position by operation of an air cylinder **290** mounted on the frame of the apparatus. A piston reciprocable in this cylinder is connected by a piston rod **291** and a link **292** to crank-pin **293** carried by a gear **294**. There is one of these gears **294** secured at each end of a shaft **295** that is mounted in the frame of the machine for rotation about a horizontal axis. Each gear **294** is mounted to mesh with a rack **296** that is carried by a rod **297** which is reciprocable in arms **298** of a bracket **299** that is disposed directly beneath the lower sewing station. One of the gears **294** is also connected through pin **293**, a drag link **300**, and a pin **301** with a gear **294'**. There is one of these gears at each end of a shaft **295'**. Each of these gears meshes with a rack **296** that is mounted on a rod **297** that is reciprocable in arms **298'** of a second bracket **299'** that is disposed directly beneath the upper sewing station.

A hook **303** is integral with and disposed at the outer end of each rod **297**. Each hook **303** engages behind the lug **282** of the plate **238** which at that time is disposed in operative relation with the hook. To move the slide plates **240** at the two sewing stations to sewing position, compressed air is admitted to the lower end of air cylinder **290**; and as long as the cylinder **290** is under such pressure, the shirt panels are in operative relation with the sewing machines at the two sewing stations. When the air is exhausted from the lower end of cylinder **290**, the springs **280** retract the slides **240**, pulling the shirt panels clear of the machines. Of course, before this occurs, the button chucks of the machines will be released.

Suitable control mechanisms, similar to those previously described in connection with the other embodiments of the invention, are provided to operate this apparatus, so that the machine operator has ample time to load and unload the shirt panels in the fixtures.

In operation of this apparatus, a shirt panel is inserted in the clamps **241** of the panel-carrying fixture which is at the loading station, with the side edge of the panel, along which the buttons are to be sewed, against the bights of these clamps **241**. The index drive **260** is then actuated to cause the chains **230** and **250** to carry the loaded fixture to the upper sewing station. The control mechanism then causes the hooks **303** to move slide plate **240** of this fixture to bring the shirt panel beneath the needles of the sewing machines at the upper station. When the sewing operation is completed at this station, the control mechanism operates to cause the air cylinder **290**, which is associated with the shirt supporting device that is at this station, to be exhausted, to permit the spring **280** associated therewith to move the shirt panel clear of the sewing machines. The index drive for the chain then operates again to carry this panel from the first sewing station to the second sewing station, and to carry a newly loaded fixture to the first sewing station. The air cylinders **290** are then operated to cause the slide plates at the two stations, to carry the two shirt panels beneath the needles of the sewing machines at the two stations. During sewing operations, the operator is loading another fabric panel on the third fixture. When the sewing operation is completed, the slides are again withdrawn from operative position, the index drive is again actuated to index the chains; and so the operation proceeds, with the machine operator placing a fresh panel on a fixture at the loading station, and removing a completely sewn panel from a fixture at the unloading station, once for each index of the chains.

In the embodiment of the invention illustrated in FIGS. 19 and 20, only three sewing machines are employed. These machines are arranged in line with one another in the same horizontal plane. The five buttons are sewn on the shirt panel in two separate operations as in the previously described embodiments of the invention, the top, middle, and bottom buttons, for instance, being sewn on the panel in the first operation and the other two buttons in the second operation, as before. Here, however, the indexing of the shirt panel, after the first operation, is not from one group of machines to another, but merely from position of registry with the three machines to a position of registry with two of the machines only, the three machines being on uniformly-spaced centers and the shirt panel being shifted half the distance between machine centers. After the fourth and fifth buttons are sewed on the panel the panel-holding fixture is indexed back to its starting position, and the completed work is removed therefrom and a new shirt panel is loaded therein.

The sewing machines **23** employed in this embodiment of the invention may be conventional industrial type sewing machines the same as employed in the previously described embodiments. For a conventional shirt front where the buttons are to be spaced from one another on three and one-half inch centers, the three sewing machines will be spaced seven inches apart on centers. The shirt panel is carried in an indexable fixture **310** comprising a rectangular bar **311**, and at least a top clamping assembly **312** and a tail clamping assembly **314**. The bar **311** is slidable in bearings **315** carried by the base of the apparatus. The clamping assemblies **314** and **312** may be identical, respectively, with the clamping assemblies **36** and **66** (FIGS. 5 and 6). The pivoted self-tightening clamping arms or fingers **317** and **318** of these clamping assemblies will tighten down on the cloth by self-camming action and hold the shirt panel rigidly. If desired, however, blocks with clips thereon, similar to clamps **241**, may also be mounted on bar **311** between clamping assemblies **314** and **312** to help support the shirt panel. All the clamping assemblies may be mounted to be adjutable along bar **311**.

The fixture **310** is intermittently indexed first from right to left and then from left to right alternately by a crank **320** which is connected by a crank pin **321** and an adjustable turnbuckle type link **322** with the right hand end of bar **311**. Pin **321** may be adjustable on the crank plate in conventional manner to change the throw of the crank, namely, the stroke of bar **311**. Crank **320** is carried by and is rigidly secured to a shaft **323** which is journaled in bearings **324** fastened on the top of the table on which the sewing machines are mounted.

The crankshaft **323** is rotated in one direction only and 180° at a time. For this purpose, the shaft **323** is driven from a continuously running motor (not shown) through a pulley **325**, and an over-running type clutch **326**. The clutch **326** is engaged periodically in correct timed relation to the other functions by operation of a face cam **328**. Cam **328** is secured on the output shaft of a standard angular gear unit **330**. Cam **328** oscillates a bell crank **331** which is pivoted at **332** intermediate its ends.

The bell crank operates a stop dog **333** and a latch dog **335**. Dog **333** is positioned to engage alternately in one of two diametrally opposite slots in a plate **334** that is secured to the driven end of the clutch **326**. Dog **335** is positioned to engage alternately in one of two diametrally opposed slots in a cam **336** that is secured to shaft **323**. When the dog **333** is engaged in one of these slots the shaft **323** will be stationary, and the driving end of the clutch will simply slip. When the dogs **333** and **335** are disengaged from plate **334** and cam **336**, respectively, shaft **323** and crank **320** will be rotated through clutch **326**. Cam **328** insures engagement of dogs **333** and **335** at the proper times in the cycle. Dog **335** assures positive stop of the crank so that the crank rotates

just 180° at a time and stops always with the crank pin at one end or other of the stroke of bar 311.

Cam 328, as stated, is driven from the gear box 330. The gearing of this box is in turn driven from a motor (not shown) through a pulley 340, a conventional one-revolution clutch 341, a shaft 342, a conventional coupling 343, and a shaft 349 tha is connected thereby to shaft 342. Shaft 342 is supported by bearings 344.

Clutch 341 may be similar to clutch 326 except that the stop cam 345 associated with clutch 341 has only one slot in it. Dog 346 is positioned to engage this slot. The driven part of clutch 341 has a stop plate 347 secured to it which also is provided with only one slot. This slot is adapted to be engaged by a stop dog 348 which is mounted to operate with dog 346, so that the two move together into or out of engagement with their respective plates 345 and 347.

A solenoid 350, when energized, disengages the dogs 346 and 348. When the solenoid is deenergized the dogs are returned to engaging positions by spring action.

Separate motors may be used for driving the two pulleys 325 and 340, but preferably a single motor is employed for driving them, a drive such as shown in FIG. 21 being used. Here 352 is the motor shaft, 353 is the drive pulley, and 354 is a belt which drives pulleys 325 and 340 from pulley 353.

The angle drive 330 not only drives cam 328 but also a shaft 355. The angle drive provides a 2 to 1 reduction to shaft 355 whereby one revolution of input shaft 349 results in half a revolution of output shaft 355. Shaft 355 is rigidly coupled to cam shaft 357 through a conventional coupling 358. Therefore, for one revolution of clutch 341 cam shaft 357 is rotated half a revolution. In other words every time clutch 341 is engaged shaft 355 rotates 180°; and every time clutch 326 is engaged shaft 323 rotates 180°.

The cam shaft 357 is journaled in bearings 359. Secured to this cam shaft 357 are three axially spaced cams 360 which actuate conventional button inserting devices (not shown) that place buttons in conventional button chucks (not shown) of the three sewing machines. Secured to the cam shaft 357 also are three cams 361 which raise and lower the button chucks in time with the other functions of the apparatus. Secured to shaft 357 also are cams 363 and 365 which actuate conventional limit switches 364 and 366, respectively, whose function will be described hereinafter. The cams 363 and 365 are so formed that limit switch 364 is tripped during the first half revolution of shaft 357, and that limit switch 365 is tripped during the second half revolution of shaft 357.

The sewing machines are driven in synchronism by means of a single drive motor through pulleys 370. Each sewing machine has a control cam 372 driven in time with its needle. Each control cam is adapted to operate a limit switch 373, the purpose of which will appear hereinafter. Only one of the limit switches 373 is shown in FIG. 1 for clarity in illustration.

In use of the last-described embodiment of the invention, a shirt panel is placed in the clamp assemblies 312 and 314 being stretched between them. The operator then trips, for instance, a foot-operated electric switch (not shown) which closes an electric circuit to solenoid 350, to energize this solenoid. This causes dogs 346 and 348 to be disengaged from stop plates 345 and 347, and enables clutch 341 to drive shaft 349 through a single revolution and shaft 357 through half a revolution (180°) before these dogs lock up again automatically. As the cam shaft 357 revolves, the cams 360 feed buttons into the button chucks, and then the cams 361 lower the button chucks of the three machines to sewing position. When the button chucks reach their down positions, bringing the buttons into contact with the shirt panel, the cam 363 momentarily trips the limit switch 364. This closes an electric circuit to, for instance, electromagnetic clutches that control the drives to pulleys 370. This drive is preferably through a drive shaft (not shown) that extends below the table top on which the sewing machines are mounted; and each pulley 370 is belted to a pulley on this drive shaft so that all three sewing machines are synchronized so that all the needles and all the button chucks operate in unison.

The pulleys 370 make the prescribed number of revolutions required to sew three (the top, middle, and bottom) buttons on the shirt panel. Then the cams 372 trip the limit switches 373. This momentarily deenergizes an electromagnetic clutch which connects the sewing machine drive motor with the drive pulleys 370, and stops drive pulleys 370. Through suitable braking mechanism and other suitable stopping mechanism the sewing machines may be stopped with their needles in up position.

Closing of the limit switches 373 also momentarily energizes solenoid 350 causing cam shaft 357 to be rotated another half revolution. This raises the button chucks. During this half revolution of cam shaft 357, the cam 328 also is rotated half a revolution. This causes dogs 333 and 335 to be disengaged, allowing clutch 326 to drive shaft 323 and crank 320 through 180°. This imparts to bar 311 a complete stroke to the left. This shifts the shirt panel to a position where the second and fourth buttons are to be sewn on the panel by sewing machines 23_2 and 23_3. A multirevolution clutch (not shown) in machine 23_1 may be disengaged at the time of the shift of bar 311 to prevent machine 23_1 from operating during sewing of the second and fourth buttons on the panel by machines 23_2 and 23_3.

When bar 311 reaches its extreme left position a finger 380 on this bar trips a limit switch 381 again closing a circuit to solenoid 350 so that new buttons are placed in the button chucks of the two machines 23_2 and 23_3, these button chucks are lowered on the shirt panel and the machines operate to sew the second and fourth buttons on the panel. Then as before the button chucks are raised.

When the second sewing operation is completed and the button chucks are again raised, the cam 328 actuates lever 331, disengaging dogs 333 and 335, permitting crankshaft 323 to be driven again through half a revolution by clutch 326. The crank then moves bar 311 back to the right to the position shown in FIG. 19. The completed panel may then be removed from the fixture and a new panel located therein.

The fixture can be loaded manually. To speed up the operation an auxiliary set of holding clamps might be provided which would enable the operator to clamp a new shirt panel in place while buttons were being sewed on another panel.

Obviously, the number of buttons sewn on a shirt panel can be varied. Thus, if four buttons, instead of five, were to be sewn on a shirt panel, two machines only would be required in the set-up of FIGS. 19 and 20; and after sewing the first two buttons on, the shirt panel could be shifted, as described above, half the center distance between machines, to sew the other two buttons on the panel.

While the invention has been described in connection with the sewing of buttons on a shirt panel, it will be understood, as stated above, that it may be employed, also, in the sewing of buttonholes in a shirt panel. Moreover, while the invention has been described in connection with the sewing of five buttons on a shirt panel, obviously any number of buttons can be sewn on, or buttonholes can be sewn in, a shirt panel by suitable arrangement of the sewing machines, and the reference herein to five buttons is for illustrative purposes only. Furthermore, the invention is not restricted to the sewing of buttons on, or buttonholes in, shirt panels, but may be practiced in any multiple sewing operation on any fabric.

While the invention has been described in connection with four different embodiments thereof, then, it will be understood that it is capable of further modification, and this application is intended to cover any variations, uses,

or adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth, and as fall within the scope of the invention or the limits of the appended claims.

Having thus described our invention, what we claim is:

1. Apparatus for sewing buttons on and buttonholes in a piece of fabric comprising a plurality of spaced sewing machines constituting, respectively, a first and a second sewing station, one station, at least, comprising a plurality of sewing machines which are operative simultaneously and which are spaced apart a distance equal to twice the distance between the buttons or button holes, an indexable conveyor, fabric holding means on said conveyor, and means for intermittently indexing said conveyor from the first station to the second station to position the fabric at the second station so that sewing will be effected on the fabric intermediate the sewing operations effected at the first station.

2. Apparatus for sewing buttons on and buttonholes in a piece of fabric, comprising a plurality of sewing machines arranged in two banks one above the other and constituting, respectively, a first and a second sewing station, each bank comprising a plurality of sewing machines which are operative simultaneously and which are spaced apart a distance equal to twice the distance between the buttons or button holes, the machines of the two banks being spaced the same distance apart but the machines of the two banks being out of line with one another so that the machines of one bank will sew buttons or buttonholes on the fabric between the buttons or buttonholes sewn on the fabric by the machines of the other bank, an indexable conveyor, fabric holding means on said conveyor, and means for intermittently indexing said conveyor from the first station to the second station to move the fabric from one bank to the other to position the fabric at the second station so that sewing will be effected on the fabric intermediate the sewing operations effected at the first station.

3. Apparatus for sewing buttons and buttonholes in a piece of fabric comprising a plurality of spaced sewing machines constituting, respectively, a first and a second sewing station, each station comprising a plurality of sewing machines, a conveyor, fabric holding means mounted on said conveyor, means for indexing said conveyor intermittently to move the fabric from one station to another, means on the sewing machines for controlling the indexing operation and for actuating said indexing means when the sewing operations at the two stations have been completed, there being a plurality of machines at both stations, the machines of the two stations being aligned rectilinearly with one another, the machines at the two stations being operative simultaneously and being spaced apart a distance equal to twice the distance between the buttons or button holes, and the amount of the indexing movement being such that the fabric when moved from the first station to the second station will be positioned so that buttons or buttonholes will be sewed thereon intermediate the positions of the buttons or buttonholes sewed at the first station.

4. Apparatus for sewing buttons on and buttonholes in a piece of fabric, comprising a plurality of sewing machines arranged in two spaced groups, each group constituting a sewing station and comprising a plurality of machines operable in unison, an endless conveyor, a plurality of fabric holding members mounted on said conveyor, means for intermittently indexing said conveyor a predetermined distance to move the fabric from a loading station first to one of said stations and then to another of said stations and back to the loading station, and means at each sewing station for moving said holding means, after the indexing operation is complete, to bring the fabric into operative relation with the sewing machines at that station, the sewing machines at each station being spaced apart a distance equal to twice the distance between the buttons or button holes, said indexing means being operative upon indexing of said conveyor from the first station to the second station to position the fabric at the second station so that sewing will be effected on the fabric intermediate the sewing operations effected at the first station, said fabric holding means comprising a slide reciprocable on the conveyor in a direction at right angles to the conveyor.

5. Apparatus for sewing buttons on and buttonholes in a piece of fabric, comprising a plurality of sewing machines arranged in two spaced groups, each group constituting a sewing station and comprising a plurality of machines operable in unison, an endless conveyor, a plurality of fabric holding members mounted on said conveyor, means for intermittently indexing said conveyor a predetermined distance to move the fabric from a loading station first to one of said stations and then to another of said stations and back to the loading station, and means at each sewing station for moving said holding means, after the indexing operation is complete, to bring the fabric into operative relation with the sewing machines at that station, the sewing machines at each station being spaced apart a distance equal to twice the distance between the buttons or button holes, said indexing means being operative upon indexing of said conveyor from the first station to the second station to position the fabric at the second station so that sewing will be effected on the fabric intermediate the sewing operations effected at the first station, said fabric holding means comprising a member swingable on said conveyor about an axis parallel to the direction of travel of the conveyor.

6. Apparatus for sewing buttons on and buttonholes in a piece of fabric, comprising a plurality of sewing machines arranged in two spaced groups, each group constituting a sewing station and comprising a plurality of machines operable in unison, an endless conveyor, a plurality of fabric holding members mounted on said conveyor, means for intermittently indexing said conveyor a predetermined distance to move the fabric from a loading station first to one of said stations and then to another of said stations and back to the loading station, and means at each sewing station for moving said holding means, after the indexing operation is complete, to bring the fabric into operative relation with the sewing machines at that station, the sewing machines at each station being spaced apart a distance equal to twice the distance between the buttons or button holes, said indexing means being operative upon indexing of said conveyor from the first station to the second station to position the fabric at the second station so that sewing will be effected on the fabric intermediate the sewing operations effected at the first station, said fabric holding means comprises two clamping members for holding the fabric at its top and bottom, respectively, said two clamping members being spaced from one another longitudinally of the conveyor, each being spring-pressed, the two being spring-pressed in opposite directions to hold the fabric taut, and the spring pressure on one being slightly greater than that on the other.

7. Apparatus for sewing buttons and buttonholes on a piece of fabric comprising two spaced groups of sewing machines constituting, respectively, a first and second sewing station, each group comprising a plurality of sewing machines which are operative simultaneously and which are spaced apart a distance equal to twice the distance between the buttons or button holes, an endless conveyor, a plurality of brackets carried by said conveyor and spaced from one another along the conveyor, a shaft carried by each bracket, a plurality of fabric holders rotatable on each shaft and connected to rotate together, means for resiliently connecting said shaft to said fabric holders to rotate said fabric holders about the axis of said shaft on rotation of said shaft, means for intermittently indexing the conveyor to move the brackets from a loading station

to said first and second stations successively and back to said loading station, and means operative at each sewing station to swing a shaft on its axis when the sewing operation at that station has been completed, said indexing means being operative to index said conveyor from the first station to the second station to position the fabric at the second station so that sewing will be effected on the fabric intermediate the sewing operations effected at the first station.

8. Apparatus as claimed in claim 7 wherein means is provided for guiding each bracket to maintain the bracket horizontal throughout the whole of the movement of said conveyor.

9. Apparatus as claimed in claim 8 wherein said guiding means comprises a pair of studs secured in each bracket adjacent opposite ends of the bracket, respectively, a roller carried by each stud, spaced parallel upper and lower horizontal trackways on which said rollers ride, and a pair of curved arcuate guideways adjacent opposite ends of each sewing station and in which the pair of studs of a bracket can ride, the arcuate guideways opposite the two sewing stations being oppositely curved.

10. Apparatus for sewing buttons or buttonholes on a fabric comprising a movable conveyor, a pair of supports mounted on said conveyor and spaced from one another in the direction of movement of said conveyor, a self-tightening gripping member carried by each of said supports for releasably gripping the fabric at spaced points therealong, respectively, and spring means for biasing said supports away from one another to hold the fabric taut, one of said spring means being more powerful than the other.

11. Apparatus for sewing buttons or buttonholes on fabric comprising a plurality of sewing machines spaced from one another, a movable conveyor, a pair of supports mounted on said conveyor and spaced from one another in the direction of movement of said conveyor, a clamping arm pivotally mounted adjacent one end on each of said supports for pivotal movement about an axis at right angles to the direction of movement of said conveyor, each clamping arm having a cam-shaped gripping surface at its free end, each clamping arm constituting a self-tightening gripping member for releasably gripping the fabric at spaced points, respectively, spring means for biasing the two said supports away from one another to hold the fabric taut, one of said spring means being more powerful than the other, and means for periodically indexing said conveyor.

12. Apparatus for sewing buttons or buttonholes on fabric according to claim 11 wherein the butons or buttonholes, that are to be sewed, are spaced uniform distances apart, the sewing machines are spaced from one another on centers that are spaced apart twice the distance between the button or buttonhole centers, and the conveyor is indexed a distance between the button or buttonhole centers.

13. Apparatus for sewing buttons or buttonholes on fabric according to claim 11 wherein the buttons or buttonholes that are to be sewed, are spaced uniform distances apart, there are three sewing machines, the sewing machines are spaced apart twice the distance between the button or buttonhole centers, and the conveyor is indexed periodically first in one direction and then in the other a distance equal to half the distance between the machine centers.

14. Apparatus for sewing buttons or buttonholes on fabric at uniform distances apart comprising a plurality of sewing machines that are spaced from one another on centers which are twice the desired spacing of the buttons or buttonholes and that are operable simultaneously to sew simultaneously a plurality of buttons or button holes on the fabric at twice the desired spacing, a movable conveyor, means on said conveyor for holding the fabric, and means for periodically indexing said conveyor a distance equal to said desired spacing, whereby buttons or button holes may be sewed between the first set of button holes at the desired spacing.

15. Apparatus for sewing buttons or buttonholes on fabric as claimed in claim 14, wherein there are three sewing machines spaced from one another a distance equal to twice the desired spacing of the buttons or buttonholes, and in which the indexing means periodically indexes the conveyor through a distance equal to half the machine spacing.

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