March 24, 1942. P. E. FLOWERS ET AL 2,277,218

SEMI-AUTOMATIC WIRE STITCHER

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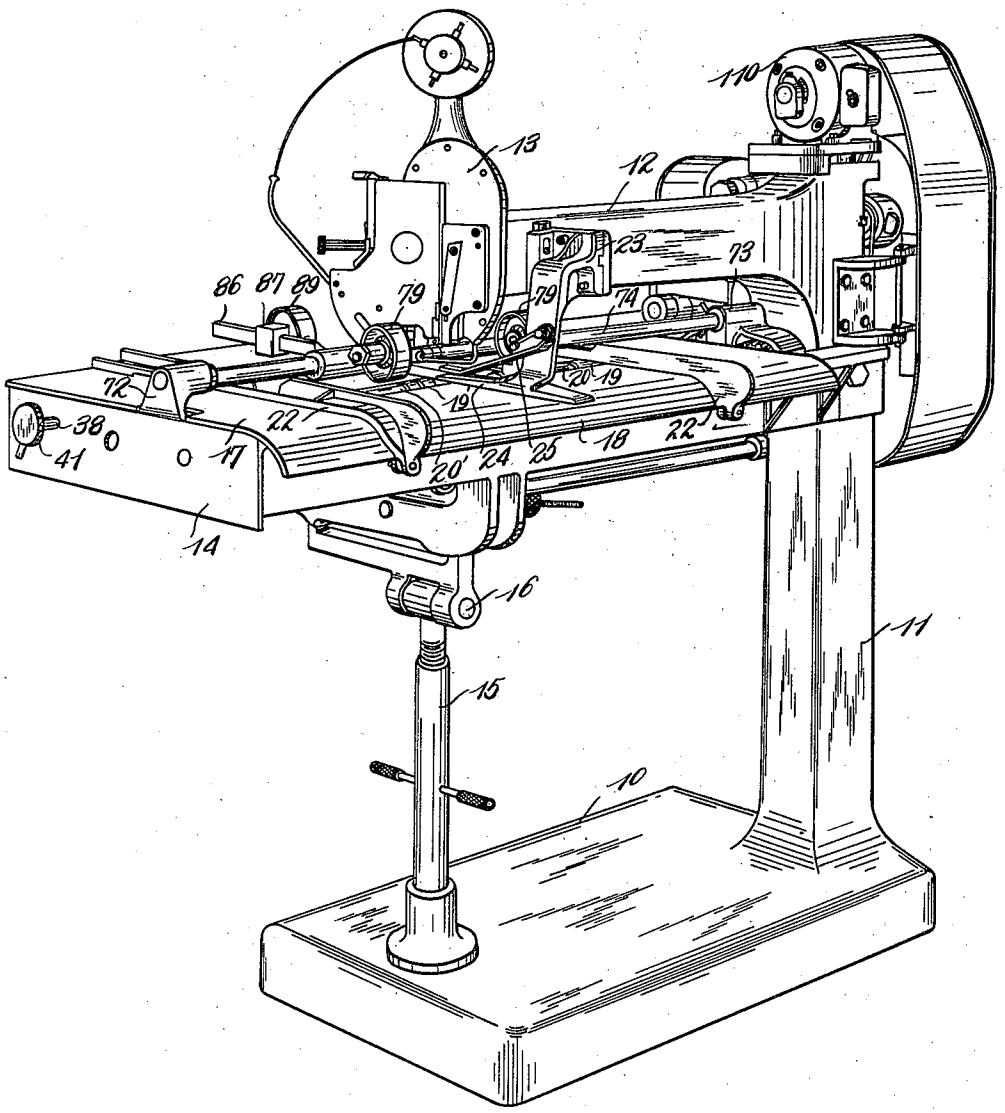


FIG. 1

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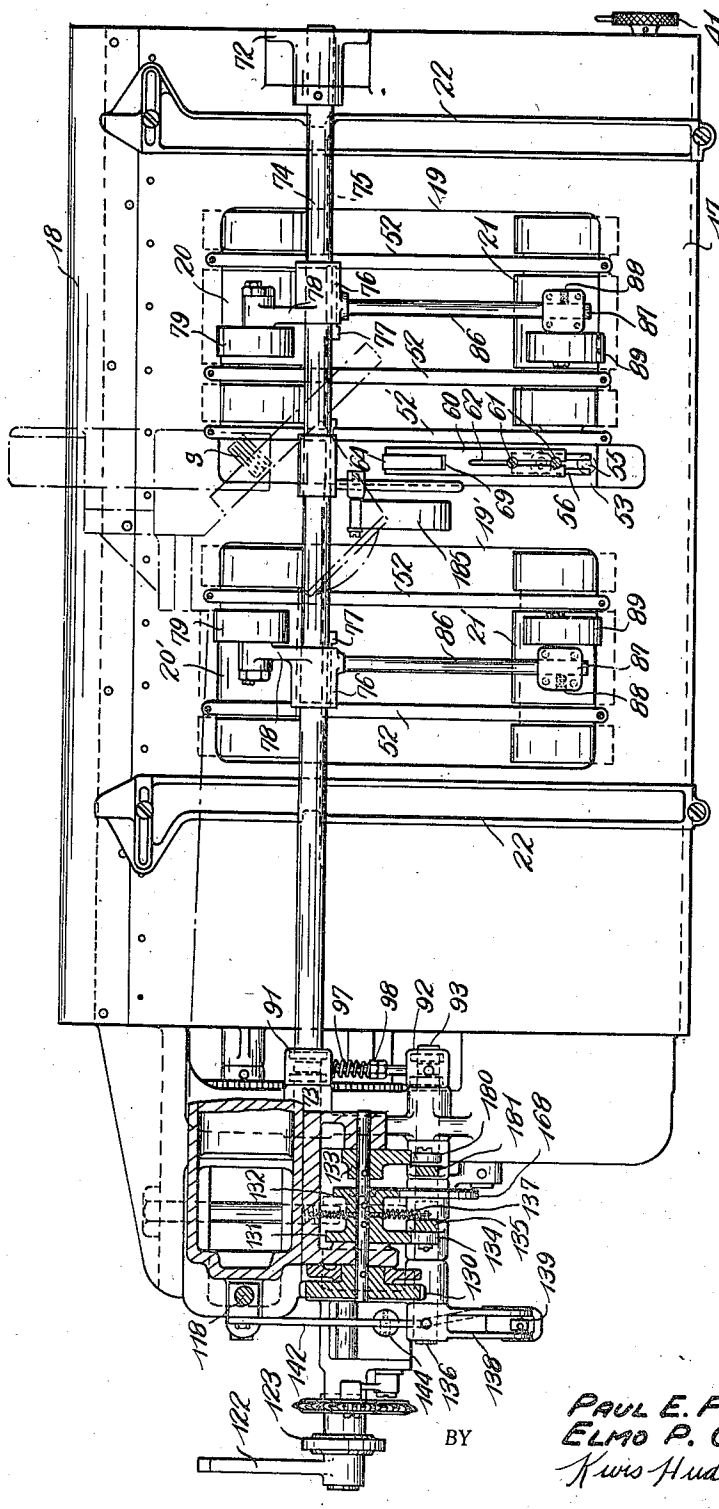


Fig. 2

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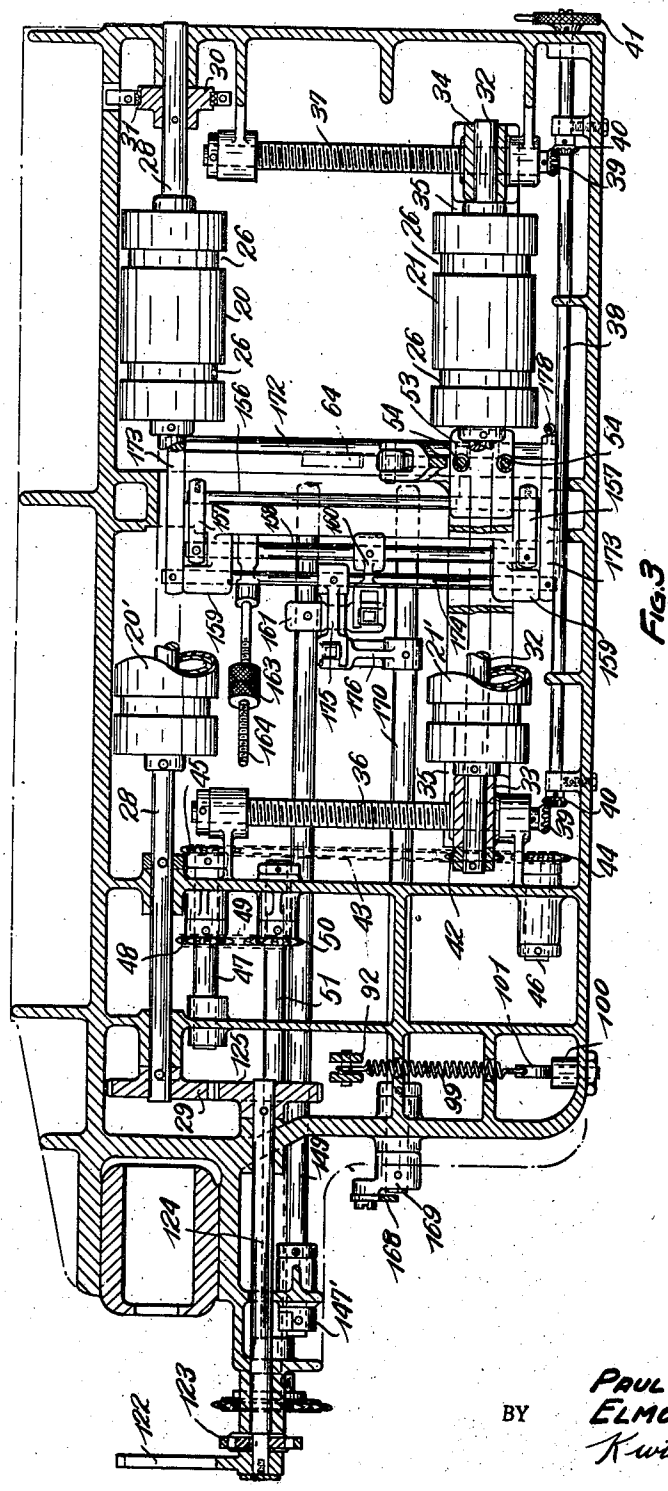


Fig. 3

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SEMI-AUTOMATIC WIRE STITCHER

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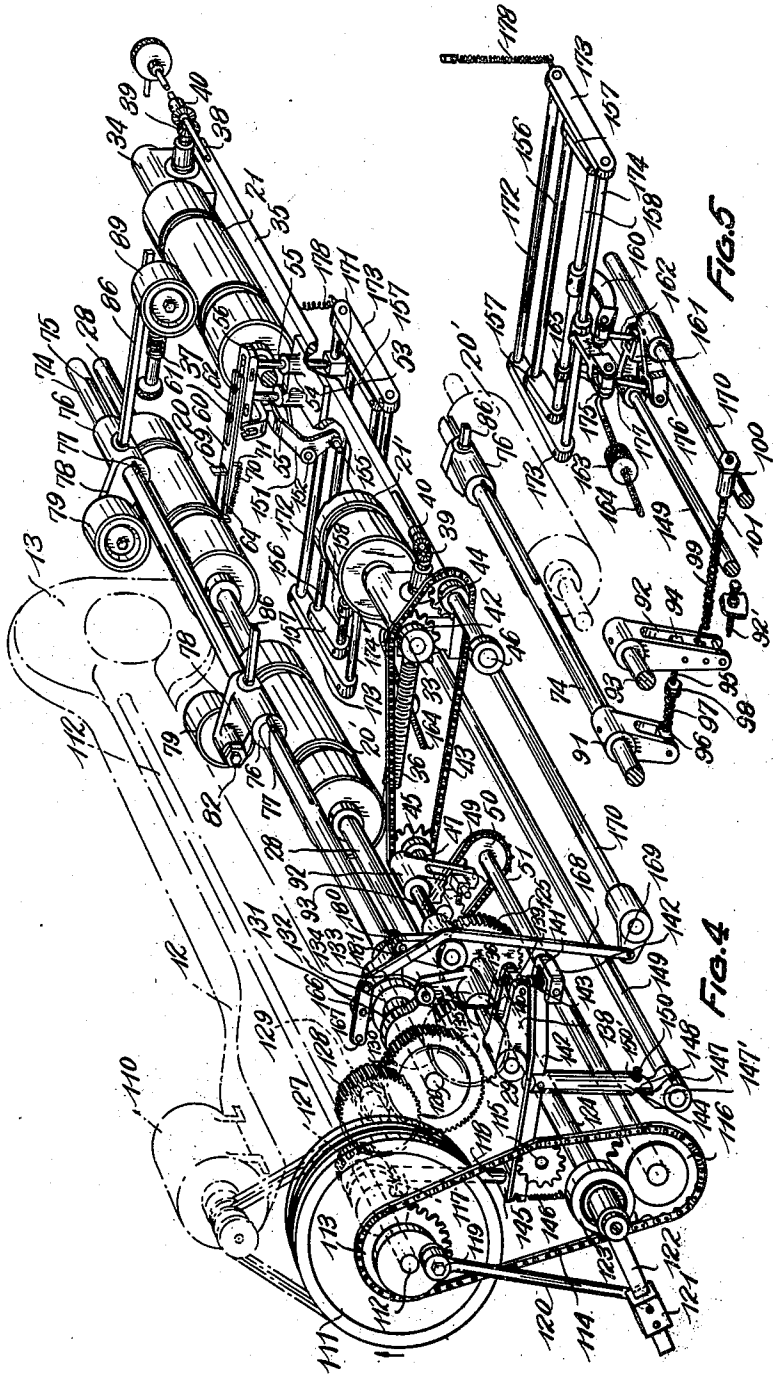


FIG. 4

FIG. 5

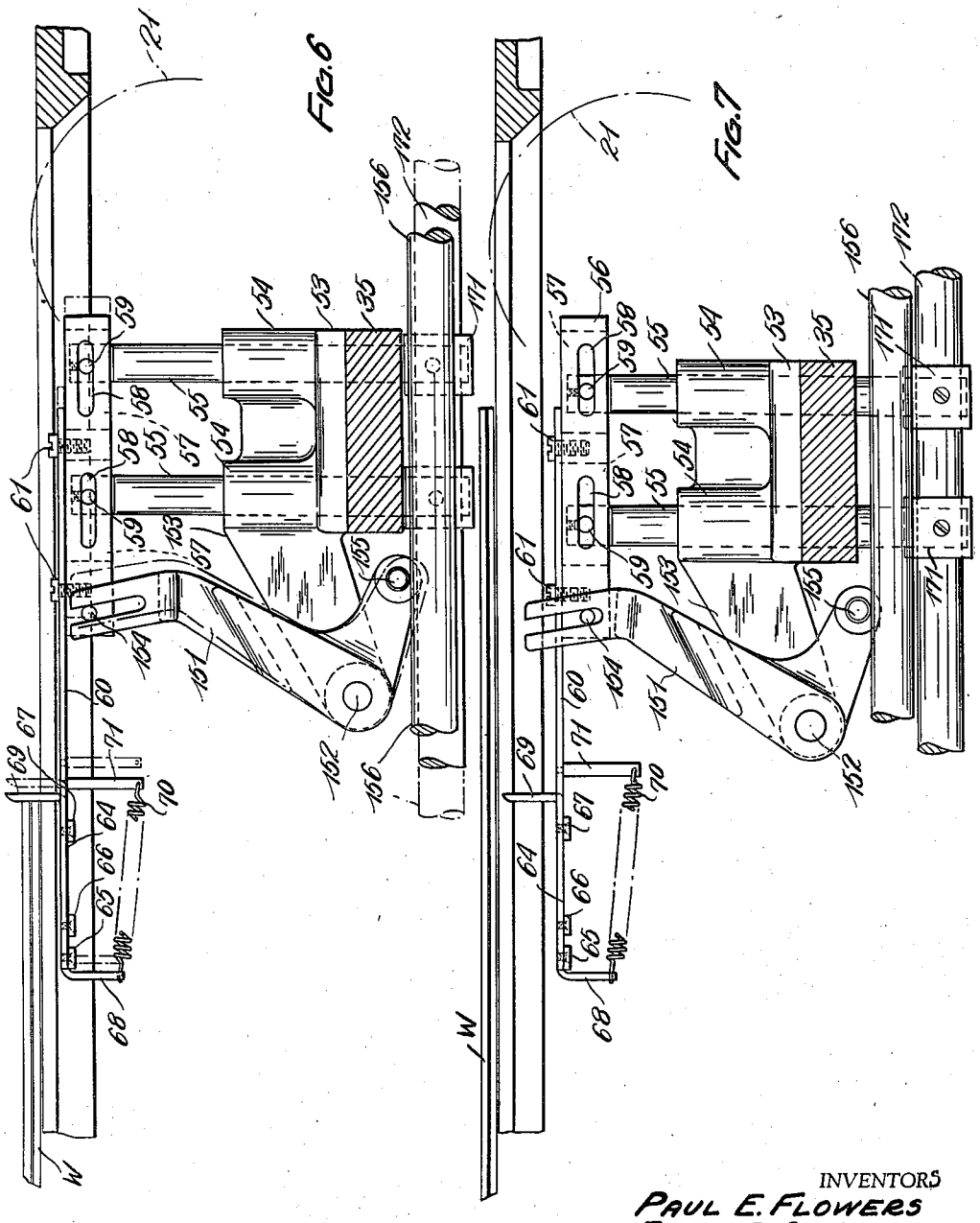
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SEMI-AUTOMATIC WIRE STITCHER

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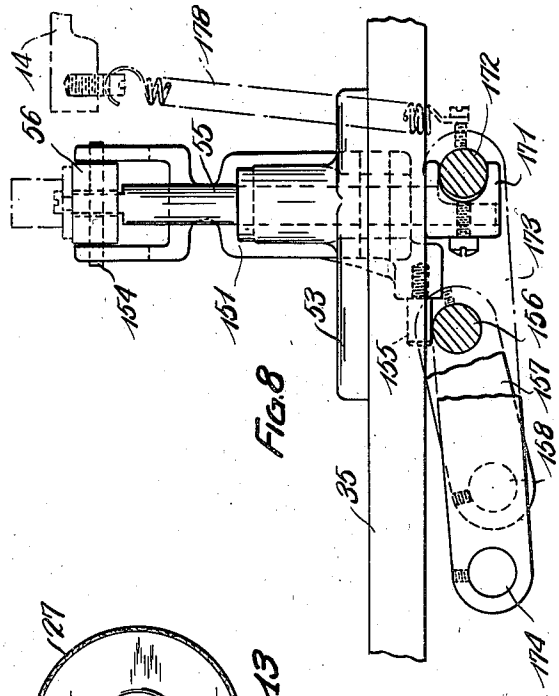


Fig. 8

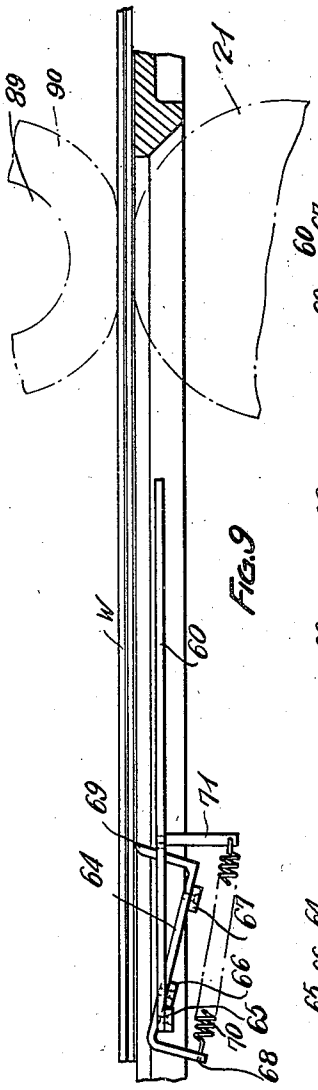


Fig. 9

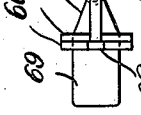


Fig. 11

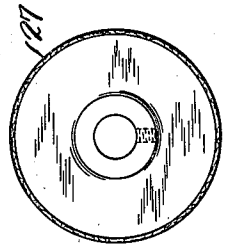


Fig. 13

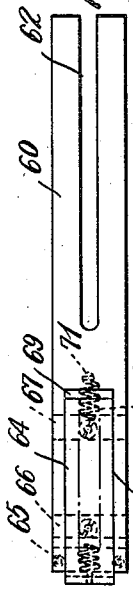


Fig. 10

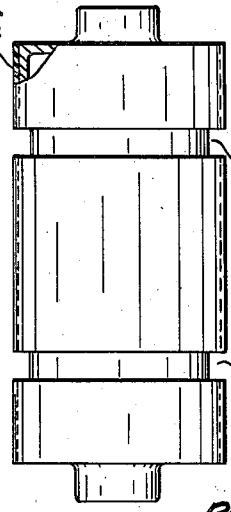


Fig. 12

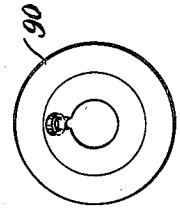


Fig. 15

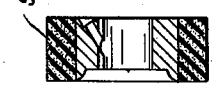


Fig. 14

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SEMI-AUTOMATIC WIRE STITCHER

Filed March 30, 1940 7 Sheets-Sheet 7

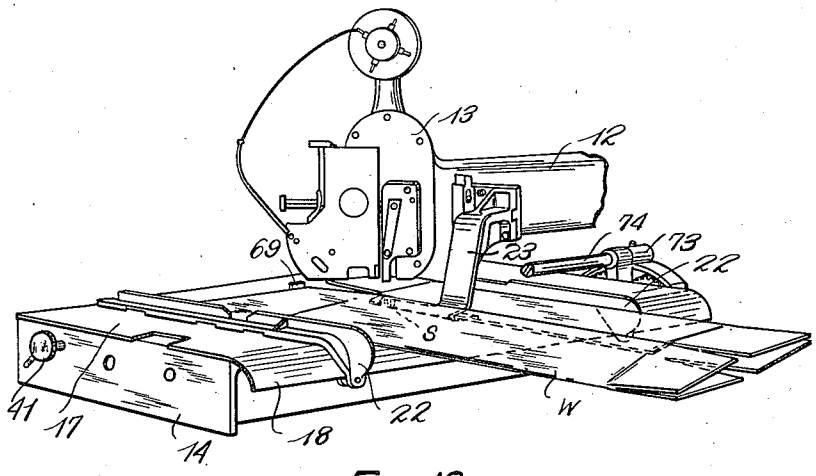


FIG. 18

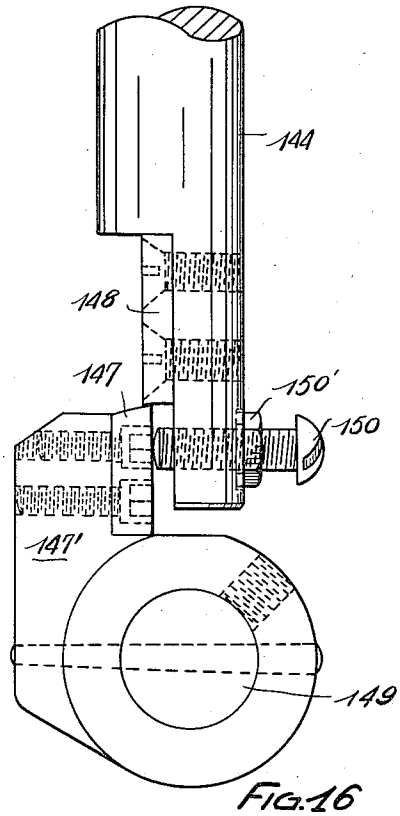


FIG. 16

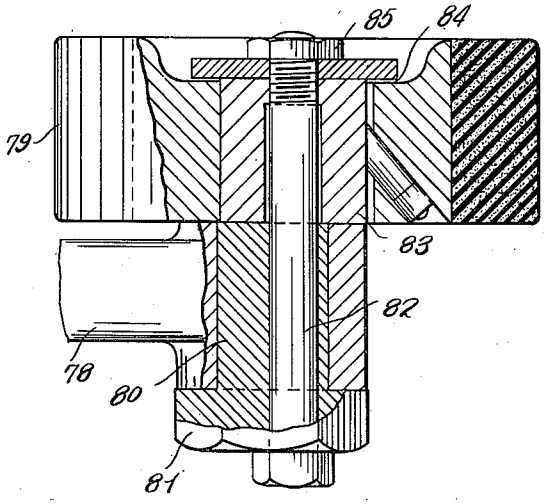


FIG. 17

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Patented Mar. 24, 1942 2,277,218

UNITED STATES PATENT OFFICE

2,277,218

SEMIAUTOMATIC WIRE STITCHER

Paul E. Flowers, Mount Gilead, and Elmo P. Crim, Dayton, Ohio, assignors to Harris-Seybold-Potter Company, Cleveland, Ohio, a corporation of Delaware

Application March 30, 1940, Serial No. 326,934

30 Claims. (Cl. 1—11)

This invention relates to improvements in semi-automatic wire stitchers, more specifically stitchers for closing the longitudinal seam of a box blank, adapted to be set in operation by the insertion of the work blank into the machine, after which a predetermined number of stitches are made, the work being advanced step by step between stitches and being discharged automatically after the stitching is completed.

One of the objects of the invention is the provision of a machine of the character stated which shall be capable of operating upon blanks of a wide range of sizes effectively and with a minimum amount of time required for the set-up for any particular job.

Another object of the invention is the provision of improved work feeding and delivery roller means adapted to grip the work firmly and evenly without excessive pressure and without marring the surface or damaging any printing thereon.

Another object is the provision of improved roller means in the feeding and delivery mechanisms adapted to engage the lower surface of the work regardless of its width, and drop rollers adjustable crosswise of the work path so as to exert pressure to cause traction upon the lower rollers at the most advantageous location in the work.

Another object is the provision of adjustability for the delivery mechanism toward and away from the feeding mechanism so as to handle to the best advantage work blanks of different lengths.

A further object is the provision of improved trip mechanism for starting the operation of the stitching means and feeding mechanism when the forward edge of the work is pushed into the machine by the operator.

Still another object is the provision of means for adjusting the trip means toward and away from the work feeding means in order that the distance between the front edge of the blank and the first stitch may be regulated, the trip being preferably mounted upon the carriage for the delivery mechanism.

Another object is the provision of control means for the trip mechanism so constituted that it will function in all positions of adjustment of the trip mechanism.

Another object is the provision of driving means for the delivery mechanism which shall be unaffected by the adjustment of the latter.

Another object is the provision of cam control means for throwing out the clutch at the end of a series of stitches of predetermined number and a separate cam means for lifting the feed drop rollers and lowering the delivery drop rollers, whereby these two operations may be separately adjusted for the best results.

Other objects and features of novelty will appear as we proceed with the description of that embodiment of the invention which, for the purposes of the present application, we have illustrated in the accompanying drawings, in which

Fig. 1 is a perspective view of a machine embodying the invention.

Fig. 2 is a plan view, partly in section, taken above the machine table and below the stitcher head.

Fig. 3 is a horizontal sectional view taken slightly below the surface of the machine table and looking downward.

Fig. 4 is a perspective view of the feeding and delivery mechanisms and associated parts including the control means.

Fig. 5 is a fragmental perspective view showing certain portions of the mechanism somewhat more in detail.

Fig. 6 is an elevational view on a larger scale showing the trip mechanism in condition to be actuated by the forward movement of the work, viewed from the column end of the machine.

Fig. 7 is a similar view showing the trip after being operated and withdrawn downwardly below the level of the advancing work.

Fig. 8 is an end view of the trip mechanism.

Fig. 9 is a side view of the trip bar and trip finger in the positions which they occupy while the work delivery mechanism is functioning.

Fig. 10 is a plan view of the trip bar and trip finger.

Fig. 11 is an end view of the same.

Fig. 12 is an elevational view of one of the elongated driven rollers employed in the work feeding and work delivery mechanisms.

Fig. 13 is an end view of the same.

Fig. 14 is a central sectional detail view of one of the drop rollers.

Fig. 15 is an end view of the same.

Fig. 16 is a detail elevational view on a large scale of the clutch trigger mechanism.

Fig. 17 is a detail sectional view on a large scale of a drop roller showing an adjustable mounting for the same.

Fig. 18 is a diagrammatic perspective view showing the relation of certain parts of the machine at the time the stitching and intermittent feeding operations are started upon a given piece of work.

In Fig. 1 of the drawings the machine is illustrated as comprising a base 10, an upright column or standard 11, a head supporting arm 12, and a stitcher head 13. These parts are common to most wire stitchers. The position taken by the operator of wire stitchers is usually in front of the head at the end of the base opposite the column. The novel features of the present machine are to be found principally in the table

construction which supports and feeds the work while it is being stitched. The machine is somewhat special in character and is designed for closing the longitudinal seam of a box blank of the nature of that illustrated in Fig. 18. The blank is fed crosswise of the arm 12 and the operator stands to one side of the base 10. However, for the purposes of the present application, the front and back of the machine will be designated with respect to the direction of travel of the work, and that side of the machine which the operator faces will be termed the front of the machine.

The table generally is indicated at 14. At one end it is pivotally supported upon the column 11, and at or near the other end it is supported from the base by an adjustable leg 15 with a hinge connection 16 at its upper end permitting a limited adjustment of the table. The top of the table consists of a heavy metal sheet 17 curved downwardly at its front end, as shown at 18, and provided with suitable openings 19 and 19' for lower positively driven feed rollers 20, 20' and delivery rollers 21, 21'. The work is fed between guide bars 22 mounted upon the table top 17 and adjustable toward and away from the stitch line to accommodate work of different widths. Alternate forms are shown in Figs. 1 and 2.

23 is a bracket mounted on one side of arm 12 and carries at its lower end an anvil plate 24 and an anvil at its rear extremity properly positioned with respect to the stitch forming and driving mechanism in head 13. Bracket 23 also carries a spring presser plate 25.

The rollers 20, 20' and 21, 21', which may be identical, are hollow castings formed with annular grooves 26, see particularly Fig. 12, and covered on their outer peripheries with rubber 27. The two rollers 20, 20' are both fixed upon a single shaft 28 by means of pins, set screws or the like. They are positioned on the shaft on opposite sides of the stitch line. At one end of the shaft there is a gear 29 (Fig. 3) pinned to the shaft through which it is driven, and at the other end there is a small drum 30 around which a brake band 31 extends. This brake is adjustable so as to impose a slight drag on the shaft 28 and thus guard against its coasting beyond the point intended.

The rollers 21, 21' are also mounted upon a single shaft 32 which has bearing at its ends in two blocks 33 and 34 that are fixed upon a bar 35 which is arranged at right angles to the direction of work travel. The blocks 33 and 34 are carried upon two shafts 36 and 37 that are mounted in bearings in the table framework. These shafts are threaded through the major portion of their lengths and extend through threaded openings in the blocks. When these shafts are turned in the same direction and at the same speed the bar 35 with its shaft 32 and its rollers 21, 21' is caused to move toward or away from the shaft 28 and its rollers 20, 20'. The shafts 36 and 37 are turned by means of a cross shaft 38 through the intermediacy of bevel gears 39 and 40. Shaft 38 is operated by a knurled wheel 41 pinned to the shaft outside the table where it is readily accessible to the operator.

Means are provided for rotating shaft 32, which means is adapted to function in all positions of adjustment of the shaft. In the present embodiment this means comprises a sprocket wheel 42 fixed to shaft 32 and engaging a chain 43 which runs over sprockets 44 and 45 that are fixed upon short shafts 46 and 47 respectively journaled in the table frame. On the same shaft with sprocket 45 there is another sprocket 48 driven by a chain 49 running over that sprocket and a sprocket 50 on a shaft 51 which is continuously driven by means later to be described.

The space between rollers 20, 20' and rollers 21, 21' is bridged by metal strips 52 secured at their ends to the table and extending through the annular grooves 26 in the rollers somewhat below the upper surfaces thereof. The opening 19 in the table top, which is a little wider than the opening 19' is bridged by a further strip 52' arranged adjacent the inner ends of one pair of feeding and delivery rollers. As will be obvious these strips provide the necessary support for the work as it travels over the openings 19, 19'.

On the bar 35 between rollers 21 and 21' there is secured a block 53 having two guides 54 in which are slidably mounted posts 55 on the upper reduced ends of which is mounted a support 56. This support is provided with vertical slots 57 into which the ends of posts 55 extend and with horizontal slots 58 for the reception of pins 59 that are mounted in holes drilled in the posts 55. The support 56 is therefore adapted to have limited movement longitudinally but can move vertically only in conjunction with the posts 55. A trip bar 60 is adjustably mounted upon the support 56, being held in adjusted position by means of two screws 61 which extend through a slot 62 in bar 60 into threaded holes in the support.

At its front end the trip bar 60 has a wider slot 63 formed therein for the reception of a trip finger 64. A cleat 65 is secured to the bifurcations at the front extremity of bar 60 on opposite sides of the slot 63, and the finger 64 has two cleats 66 and 67 which are of the same length as cleat 65 and underlap the bifurcations of the bar 60. The finger 64 is Z-shaped, having a downturned flange 68 at its forward end and an upturned flange 69 at its rear end. A tension spring 70 is connected between the flange 68 and a post 71 fixed in the bar. The spring tends to hold the body portion of finger 64 flush with the bar 60, cleat 65 in engagement with flange 68 preventing longitudinal movement and cleats 66 and 67 preventing movement of the rear end of the finger upwardly beyond the surface of bar 60. Flange 69 is adapted to extend upwardly through opening 19 in the table top into position for engagement with the front end of the work W, as indicated in Figs. 6 and 18 of the drawings. After such engagement the operator pushes the work forward to the extent approximately indicated by the dotted lines in Fig. 6, which movement accomplishes the release of the clutch, the starting of the stitcher and the intermittent movement of the drive rollers, as will later appear.

The framework of the table comprises bearing supports 72 and 73 in which there is journaled a rock shaft 74 positioned above the table sufficiently to clear the work and the work guides 22 and arranged somewhat to the rear of the stitcher head 13. Shaft 74 has a keyway 75. Two hubs 76 are adjustable lengthwise of the shaft and are adapted to be located in selected positions by keys 77. Short arms 78 extend forwardly from hub 76 and rotatably support drop rollers 79. In order that the height of these rollers may be adjusted relatively to the arms 78, the ends of these arms are bored to take

cylindrical plugs 80 provided with a hex end 81 to enable the plug to be turned to any desired angular position. Plug 80 is bored eccentrically to receive the shank of a bolt 82 which extends centrally through a trunnion 83 upon which the roller is journaled to turn freely. A washer 84 prevents the roller from running off its trunnion, and the trunnion is locked to the plug 80 by means of a nut 85.

Arms 86 of polygonal cross section extend rearwardly from hubs 76. On these arms blocks 87 are mounted for adjustment toward and away from the hubs 76 and are adapted to be locked in selected positions by set screws 88. In these blocks drop rollers 89, which may be identical with rollers 79, are mounted for free rotation, the mountings preferably including eccentric means for adjustment similar to the means above described with respect to rollers 79.

All of the rollers 79 and 89 are preferably covered with a relatively thick layer of sponge rubber indicated at 90 in the drawings. This soft material has several advantages which are of considerable importance. In the first place when the rollers are dropped onto the work they do not mar the work, secondly the rebound is taken up by the cushioning effect of the sponge rubber and the tendency of the rollers to bounce is reduced or eliminated, and thirdly the grip of the rollers is spread over a fairly large surface, as indicated in Fig. 9, providing a positive feed by the lower driven rollers, thereby eliminating slippage and the consequent blurring or smudging of any printing that may have been done upon the work blank.

During the feeding operation the drop rollers 79 are down and in engagement with the work under spring pressure. During the discharge of the work the drop rollers 89 are similarly caused to exert downward pressure on the work so as to insure good traction between the work and the driven rollers 21, 21'. To accomplish this alternate pressure against the work on the feed rollers and on the delivery rollers shaft 74 is caused to rock between two positions, the necessary movement for this purpose being imparted to a bifurcated crank 91 pinned to the shaft, see Fig. 5. Crank 91 is in turn swung from one position to the other by a bifurcated crank 92 fixed to a shaft 93 that is oscillated by a cam, as will presently appear. Between the bifurcations of crank 92 there is pivotally mounted a block 94 in which is fixed a rod 95 that extends loosely through a hole in a block 96 pivotally mounted between the bifurcations of crank 91. A coil spring 97 encircles rod 95 and presses at one end against block 96 and at the other end against nuts 98 threadably mounted on rod 95 for adjustment purposes. A head on the forward end of rod 95 is adapted to abut block 96 when crank 92 is swung anti-clockwise, as viewed in Fig. 5, and thereby imparts similar movement to crank 91, causing rollers 79 to descend. At this time a tension spring 99 attached at one end to a cross pin in crank 92 and at the other end to the frame exerts a pull on crank 92 and through rod 95 upon crank 91, thereby putting downward pressure on the drop rollers 79. An adjustable stop 92' limits the swing of crank 92 under the influence of the spring. 100 is a bushing rotatably mounted in the table frame, see Fig. 3, and internally threaded to take a threaded pin 101 in which the rear end of spring 99 is anchored. A hex head on the bushing externally of the table frame enables the operator to turn the bushing and thereby move pin 101 inwardly or outwardly for regulating the tension of spring 99. On the other hand, when crank 92 is swung in the clockwise direction nuts 98 working through spring 97 exert pressure lifting the rollers 79 and depressing the rollers 89. After the latter engage the work above rollers 21, 21' the final movement of crank 92 serves to compress spring 97 to exert the necessary gripping pressure upon the work. The degree of this pressure may be regulated by adjustment of the nuts 98.

Control mechanism

In the operation of the machine stitches are taken between successive feeding movements of the rollers 20, 20' until a predetermined number of stitches have been made, the stitches being spaced evenly throughout the length of the seam. The forward drop rollers are in their depressed position during the feeding operation. The motor drives delivery rollers 89 continuously and works through a clutch to impart feeding impulses intermittently to rollers 20, 20' as well as to operate the stitching mechanism. When the predetermined number of stitches have been made the clutch is thrown out automatically, interrupting the feeding movement and the stitching, and at the same time the forward drop rollers are lifted and the rear drop rollers are lowered to operative position under the necessary spring pressure. The continuously rotating delivery rollers 21, 21' thereupon discharge the finished work quickly. The trip mechanism, as soon as it has performed its function of starting the stitcher and work feeding rollers, descends below the level of the work path and remains there until the stitching is finished. At that time the trip bar rises to operative position, but the resilient mounting of the trip finger enables the flange 69 thereon to ride upon the lower surface of the tail end of the work, as indicated in Fig. 9, until the work passes that flange, when the trip finger rises to operative position again as shown in Fig. 6. We will now describe with some particularity the mechanism at present employed for accomplishing the operation and control of the different elements of the machine.

An electric motor 110 is suitably mounted on an adjustable plate at the top of column 11. This motor drives, preferably through multiple V-belts, a fly-wheel 111 which is journaled upon a shaft 112 that extends through arm 12 and is operatively connected with the stitch forming and driving mechanism in stitcher head 13. A sprocket wheel 113 is fixed to fly-wheel 111 and therefore drives continuously a chain 114 which runs over an idler sprocket 115 and a sprocket 116 on shaft 51, previously referred to.

117 represents a clutch adapted to couple or uncouple fly-wheel 111 and shaft 112. This clutch may be of a well-known type similar to that disclosed in Lawrence Patent 1,708,274, and is normally held out of engagement by a throw-out rod 118. When the latter is retracted downwardly the clutch elements engage and the rotation of shaft 112 begins.

When shaft 112 rotates a pin 119 mounted on a disk at one end of the shaft beyond fly-wheel 111 revolves and reciprocates a connecting rod 120 which is pivotally mounted on an arm 122 projecting radially from one element of a roller ratchet 123, the other element thereof being attached to a shaft 124 upon the inner extremity

of which is pinned a gear 125 which meshes with gear 29 attached to shaft 28 as previously described. Therefore as the arm 122 swings downwardly shaft 28 turns through part of a revolution to impart feeding movement to the rollers 20, 20'. When the arm 122 swings upwardly however the roller clutch 123 is ineffective and the shaft 28 stands still.

Shaft 126 is a cam shaft which is driven from shaft 112 by a train of gears 127, 128, 129 and 130. A series of three cams 131, 132 and 133 are pinned to this shaft. Cam 131 is the clutch releasing cam which functions at the end of the work period to swing a follower 134 clockwise as viewed in Fig. 4. This follower is carried at the upper end of a crank 135 fixed to a shaft 136 that is aligned with but separate from shaft 93. A spring 137 acts to hold the follower 134 up against its cam. On the shaft 136 there is a laterally extending bifurcated crank 138 which carries between its bifurcations a pivoted block 139 having a hole therethrough for loosely receiving a headed pin 140 the lower end of which is fixed in another block 141 that is pivotally mounted in the U-shaped end of a bar 142. Pin 140 is surrounded by a coil spring 143 which bears upon both of the blocks 139 and 141. Bar 142 is a lever which under certain conditions fulcrums around a pivot pin in the upper end of a vertical trigger rod 144 and under other conditions fulcrums about its pivotal support in block 141. Its forward end is bifurcated to straddle a pin in a block 145 at the base of throw-out rod 118. A coil spring 146 tends to swing bar 142 counterclockwise about its fulcrum in trigger rod 144 and tends to keep throw-out rod 118 in its lowered position. Rod 144 is normally held up by a hardened trigger plate 147 secured to a short crank 147' that is pinned to a shaft 149, see Figs. 4 and 16. Trigger rod 144 is preferably furnished with a hardened plate 148 against the lower end of which trigger plate 147 bears. The extent of underlap between plates 147 and 148 is adapted to be regulated by a set screw 150 threaded through a hole in rod 144 and held in adjusted position by a lock nut 150'. When shaft 149 turns to withdraw trigger plate 147 from engagement with wear plate 148 trigger rod 144 drops and rod 142 swings downwardly about its fulcrum in block 141, lowering throw-out rod 118 and permitting the clutch to engage. On the other hand, when rod 144 is in its raised position and the crank 138 is swung downwardly bar 142 is tilted on its fulcrum at the upper end of rod 144 and the throw-out rod 118 is raised, disconnecting the clutch.

Shaft 149 is oscillated to lower trigger rod 144 through connections with the sliding support 56 for the trip bar 60 and trip finger 64. These connections comprise a bell crank lever 151 pivotally mounted at 152 upon a bracket 153 integral with block 53. The upper end of this lever 151 is bifurcated to straddle support 56, as shown particularly in Fig. 8, and each bifurcation is itself bifurcated to straddle a pin 154 mounted in the support 56 and projecting from either side thereof. Movement of the sliding support 56 rearwardly therefore acts to depress the lower arm of bell crank 151 in which there is a pin 155 which bears upon a round rod 156 that is carried in the outer ends of two arms 157 which are pinned to a shaft 158 that is journaled in two frame brackets 159, see Fig. 3.

As shown particularly in Fig. 5, shaft 158 has pinned thereto a crank 160 which is operatively connected with a crank 161 through a pin 162 that is joined at its ends to the two cranks by universal joints, not herein illustrated in detail. Obviously therefore when rod 156 is depressed by the pin 155 on bell crank 151 cranks 160 and 161 are swung upwardly and shaft 149 is oscillated in the counterclockwise direction as viewed in Figs. 4 and 5, which throws the crank 147' out from under trigger rod 144, thereby releasing the clutch. As soon as the pressure tending to move support 56 rearwardly is relieved, as it is by the downward retraction of finger 64 presently to be described, then a weight 163 adjustably mounted on a rod 164 which is fixed in the crank 165 pinned to shaft 158 swings that shaft to elevate rod 156, which acts through bell crank 151 to slide support 56 forwardly to its normal longitudinal position, and also to turn back crank 147' ready to move the trigger plate 147 into engagement with the wear plate 148 as soon as the rod 144 is lifted, which occurs early in the work cycle.

The second cam on the cam shaft, cam 132, controls the up and down movement of the trip finger. This cam is circular except for a single depression into which a roller follower 166 is adapted to seat when the depression comes to the top position. Follower 166 is carried upon a short lever 167 which is pivoted at one end to the table frame and at the other end to the upper end of a long link 168 which extends down to and is pivotally connected with a crank 169 on a shaft 170.

The posts 55 extend downwardly through block 53 and bar 35, and at their lower ends carry yokes 171 between the horizontal legs of which a horizontal rod 172 is received. This rod is mounted in the free ends of a pair of arms 173 fixed to the ends of a rock shaft 174 which is likewise mounted in brackets 159. The latter shaft carries a crank 175. Another crank 176 fixed to shaft 170 is interconnected with crank 175 by a pin 177 and universal joints, not herein disclosed in detail.

At rest the follower 166 lies in the depression of cam 132. When the operator starts the work cycle engaging the clutch as previously described, follower 166 rides up onto the circular portion of the cam which rocks shaft 170 in the clockwise direction. This movement is transmitted through the crank 176, pin 177 and crank 175 to shaft 174 which through the arms 173 swings rod 172 downwardly, thereby exerting a downward pull on the posts 55 acting to lower the support 56 and with it the trip bar 60 and trip finger 64. This trip assembly remains in the lowered position until the cam shaft completes its revolution, whereupon follower 166 again drops into the cam depression and the shaft 170 rocks back to its original position, this action being assisted by a tension spring 178. When this occurs the last stitch will have been taken and the work will still overlie the trip finger and consequently the latter will be rocked by engagement of the flange 69 with the under surface of the work, as illustrated in Fig. 9. When the latter has been withdrawn however the spring 70 will immediately raise flange 69 to its operative position.

The third cam 133 controls the movement of rock shaft 74 upon which are mounted the drop roller brackets or hubs. Running upon cam 133 there is a roller follower 180 carried by a crank 181 fixed to shaft 93 which, as before described, carries crank 92 and through that crank swings shaft 74 back and forth. At the time the clutch

is thrown into engagement the rear drop rollers are down and the forward drop rollers are up out of operative position. The first thing that happens is the taking of a stitch, and while that is occurring the follower 180 is running down from the high spot of the cam, permitting crank 181 to turn counterclockwise, which movement is transmitted through cranks 92 and 91 to shaft 74, causing the rear drop rollers to rise and the forward drop rollers to descend to operative position. Hence when the first stitch has been taken the forward drop rollers are down in operative position ready to assist in the first intermittent feeding action. After the last feed movement the follower 180 again runs up onto the cam high spot and the rear drop rollers are thereby lowered to operative position to press the work into tractive relation with the continuously rotating delivery rollers.

A piece of curved spring steel 185 is mounted to bear upon the top of the work blank so that it cannot curl up and fail to engage the trip finger 64. By varying the speed of cam shaft 126 the number of stitches taken during the work cycle may be regulated. This may be done for example by interchanging gear 128 with gears of other sizes. The spacing of the stitches is controlled by the position of the block 121 on the arm 122 which regulates the angle through which the feed roller shaft turns at each stroke.

The trip finger, being mounted on the same carriage with delivery rollers 21, 21', is adjusted back and forth when the delivery rollers are adjusted. This is desirable because generally speaking the larger the carton blank the further back should be the position of the delivery rollers, and since the end flaps will also be larger the trip finger should be further back than it would be for a small carton. However, a supplemental adjustment of the trip finger alone and the clamping of it in desired position by screws 61, will usually be necessary. The extent of the push which the operator must give the work in order to trip the clutch is controlled within certain small limits by the adjusting screw 150 at the bottom of trigger rod 144. The point at which the stitch is made is indicated in Figs. 2 and 18 by the letter S.

Operation.—While the operation of the machine has been described to a considerable extent in the foregoing description of its parts, we will now set out the various movements in their proper sequence. Assuming that the machine has been set up for work of a given size and a given number of stitches spaced apart a given distance, the operator pushes a work piece into the machine between guides 22 until the forward edge of the work contacts upstanding flange 69 on the trip finger 64 and pushes the work against that finger with a slight pressure. The trip finger 64, trip bar 60, and supporting means 56 then slide rearwardly a short distance sufficient to carry the trigger plate on crank 147' out from under trigger bar 144, which lets in the clutch 117. The stitcher head then starts to form and drive the first stitch. Simultaneously the connecting rod 120 moves upwardly on its idle stroke. When the first stitch is finished the connecting rod 120 starts downwardly and shafts 124 and 28 turn through a predetermined angle to accomplish the first feeding movement. Immediately after the clutch is engaged cam 132 operates through the mechanism previously described to depress rod 172 and pull down the trip finger assembly against the action of spring 178. The trip finger assembly is therefore out of the way before the first feed movement begins and it immediately moves forward due to action of weight 163, which action also causes trigger plate 147 to return partially toward its original position. Almost immediately thereafter, the high spot of cam 131 moves out from under follower 134 relieving the pressure on spring 143 and permitting spring 137 to rock shaft 136 counterclockwise, lifting pin 140 through the head on its upper extremity and thereby raising the U-shaped end of bar 142 and the trigger rod 144 to a position slightly above that shown in Fig. 16. Weight 163 is then free to complete its movement of swinging shaft 158 so as to further lift rod 156, thereby swinging bell crank lever 151 to slide the trip finger back completely to its original longitudinal position and bringing trigger plate 147 into final position to engage trigger rod 144 when the latter is depressed at the end of the work cycle. Also at the beginning of the first stitching stroke the high spot of cam 133 moves out from under follower 180, enabling spring 99 to pull the forward drop rollers 79 down to operative position, and thereby clamp the work at about the instant of the first stitch. The alternate operation of the stitcher and the feeding rollers continues until the cam shaft 126 completes its revolution, whereupon cam 131 swings crank 138 downwardly, tilting bar 142 on its pivot in the top of trigger rod 144 and lifting throw-out rod 118 to disconnect the clutch. Concurrently, cam 133 acts to rock shaft 174 for lifting the forward drop rollers 79 and lowering the rear drop rollers 89 so that the continuously rotating delivery rollers 21, 21' may act to speedily discharge the work from the machine. The cam shaft then stops in the position illustrated in Fig. 4, at which time cam 132 permits spring 178 to raise the trip assembly once more, the trip finger 64 assuming a position as in Fig. 9 until the trailing edge of the work has passed on.

All operations are automatic except the folding of the carton blank into the shape illustrated in Fig. 18, positioning it between the guides 22 and pushing it against the trip finger. The operator is then free to immediately take up another blank and fold it while the previous blank is traveling through the machine. One attendant is therefore able to handle a large volume of work.

Having thus described our invention, we claim:

1. In a semi-automatic wire stitcher, a stitcher head, two elongated feed rollers arranged on opposite sides of the stitch line adapted to engage the under surfaces of the work, means for driving said rollers, a pair of drop rollers mounted above said feed rollers adapted to engage the upper surfaces of the work, and means permitting the adjustment of said drop rollers toward and away from said stitch line.

2. In a semi-automatic wire stitcher, a stitcher head, a pair of elongated feed rollers arranged one on each side of the stitch line adapted to engage the under surfaces of the work, means for driving said rollers, a pair of drop rollers mounted above said feed rollers adapted to engage the upper surfaces of the work, and means permitting the adjustment of said drop rollers toward and away from said stitch line, the rollers of one of said pairs being covered with soft rubber.

3. In a semi-automatic wire stitcher, a stitcher head, feed rollers arranged on opposite sides of the stitch line adapted to engage the under surfaces of the work, means for driving said rollers, a pair of drop rollers mounted above said feed

rollers adapted to engage the upper surfaces of the work, and means for lowering said drop rollers into driving relation with said feed rollers, said drop rollers being covered with relatively thick sponge rubber, whereby the tendency of the drop rollers to bounce is reduced and whereby the pressure required for accurate feeding of the work is reduced.

4. In a semi-automatic wire stitcher, a stitcher head, a feed roller adapted to engage the under surface of a work sheet and advance it beneath said stitcher head, a delivery roller arranged behind said feed roller to take the sheet after it is released by said feed roller, means for driving said feed roller and delivery roller, and means for adjusting said delivery roller toward and away from said feed roller without interrupting the drive to the delivery roller.

5. In a semi-automatic wire stitcher, a stitcher head, work feeding means adapted to advance the work step by step beneath said stitcher head, delivery rollers arranged on opposite sides of the stitch line, means for adjusting said delivery rollers toward and away from said feeding means, and driving means for said delivery rollers operative in all positions of adjustment of the delivery rollers.

6. In a semi-automatic wire stitcher, a stitcher head, work feeding means adapted to advance the work step by step beneath said stitcher head, work delivery means arranged to the rear of said feeding means, means for adjusting said work delivery means toward and away from said work feeding means, and drive connections for said delivery means adapted to function in all positions of adjustment of said delivery means.

7. In a semi-automatic wire stitcher, a stitcher head, work feeding means adapted to advance the work step by step beneath said stitcher head, a carriage adjustable back and forth toward and away from said work feeding means, delivery roller means mounted on said carriage adapted to discharge the work rapidly, and drive means for said delivery roller means arranged to remain in operative relation throughout the range of adjustment of said carriage.

8. In a semi-automatic wire stitcher, a motor, a driven shaft operatively connected with said motor, a stitcher head operatively connected with said driven shaft, work feeding means operatively connected with said driven shaft for advancing the work step by step beneath said stitcher head, work delivery means arranged to the rear of said feeding means, means for adjusting said work delivery means toward and away from said work feeding means, and driving means operatively connected with said driven shaft and with said delivery means adapted to function in all positions of adjustment of said delivery means.

9. In a semi-automatic wire stitcher, a motor, a driven shaft, a clutch intermediate said motor and said driven shaft, work feeding mechanism, work delivery mechanism, stitching mechanism operated through said driven shaft, means for controlling the operation of said feeding and delivery mechanisms, the operation of said control means being started through motion derived from the insertion of the work and being continued through motion derived from said driven shaft, means controlled by said shaft for uncoupling said clutch, and means for shortening or lengthening the distance between said feeding and delivery mechanisms.

10. In a semi-automatic wire stitcher, a motor, a stitching mechanism, work feeding mechanism, work delivery mechanism, means for rendering said stitching mechanism and said feeding mechanism operative and inoperative, means for rendering said delivery mechanism operative when said stitching mechanism is rendered inoperative and vice versa, and means for shortening or lengthening the distance between said feeding and delivery mechanisms.

11. In a semi-automatic wire stitcher, a table, a motor, a stitching mechanism arranged above the table, a work feeding roller extending upwardly through said table, a delivery roller extending upwardly through said table behind said feeding roller, means controlled by movement of the work for rendering said feeding roller and stitcher operative, means for rendering said feeding roller inoperative and said delivery roller operative, and means for shortening or lengthening the distance between said feeding and delivery rollers.

12. In a semi-automatic wire stitcher, a table, a motor, a stitching mechanism arranged above the table, a work feeding roller extending upwardly through the table, a delivery roller extending upwardly through the table behind said feeding roller, means controlled by movement of the work for rendering said feeding roller and said stitcher operative, cam controlled means for rendering said stitching mechanism and feeding roller inoperative and said delivery roller operative, and means for shortening or lengthening the distance between said feeding and delivery rollers.

13. In a semi-automatic wire stitcher, a stitcher head, feed roller means extending on opposite sides of the stitch line adapted to engage the under surfaces of the work, delivery roller means arranged behind said feed roller means, means for driving said feed and delivery roller means, a transverse rock shaft, brackets mounted upon and adjustable lengthwise of said shaft, drop rollers carried by said brackets adapted to be lowered into operative relation with said feed roller means when the rock shaft is shifted to one position, drop rollers carried by said brackets adapted to be lowered into operative relation with said delivery roller means when the rock shaft is shifted to another position, means for adjusting said delivery roller means toward and away from said feed roller means, and means for adjusting said last named drop rollers on said brackets toward and away from said rock shaft for maintaining the drop rollers in operative relation with the delivery roller means in various positions of adjustment of the latter.

14. In a semi-automatic wire stitcher, a stitcher head, feed roller means extending on opposite sides of the stitch line adapted to engage the under surfaces of the work, delivery roller means arranged behind said feed roller means, means for driving said feed and delivery roller means, a transverse rock shaft, brackets carried thereby, and drop rollers mounted upon said brackets adapted to engage the work above said feed and delivery roller means, selectively when the rock shaft is turned in one direction or the other, said drop rollers being covered with relatively thick sponge rubber, whereby the tendency of the drop rollers to bounce is reduced and whereby the pressure required for accurate feeding of the work is reduced.

15. In a semi-automatic wire stitcher, a stitcher head, a support for the work as it moves beneath said head, means for feeding the work intermittently between stitches, a trip finger nor-

mally extending upwardly past said support into the path of the work in a position to be engaged by the front end of the work when it reaches approximately the position for the first stitch, means set in motion by the engagement of the front end of the work with said trip finger for starting the operation of said stitcher head and said feeding means, means for retracting said finger downwardly after it functions to start the operation of the stitcher head and for elevating said trip finger again after the forward end of the work has passed beyond the position of the trip finger, and yieldable means permitting the trip finger to ride upon the under surface of the work without damaging or reengaging the latter.

16. In a semi-automatic wire stitcher, a stitcher head, a support for the work as it moves beneath said head, means for feeding the work intermittently between stitches, a trip bar beneath said support adapted to move a short distance from its normal position forwardly in the direction of work travel, a vertically movable support for said bar, a trip finger carried by said bar normally extending upwardly past said first named support in the path of the work, means set in motion by the engagement of the front end of the work with said trip finger for starting the operation of said stitcher head and said feeding means, means for retracting said vertically movable support downwardly after it functions to start the operation of the stitcher head and moving it up again after the forward end of the work has passed beyond the position of the trip finger, and yieldable means carried by the trip bar permitting the trip finger to ride on the under surface of the work.

17. In a semi-automatic wire stitcher, a stitcher head, a support for the work as it moves beneath said head, means for feeding the work intermittently between stitches, a trip bar beneath said support arranged longitudinally with respect to the direction of work travel, a trip finger mounted on said bar for adjustment longitudinally of the bar, a vertically movable support for the bar upon which the bar is mounted for limited movement backward and forward in the direction of work travel, said trip finger normally extending upwardly past said first named support, means set in motion by the engagement of the front end of the work with said trip finger for starting the operation of said stitcher head and said feeding means, means for retracting said vertically movable support downwardly after it functions to start the operation of the stitcher head and moving it up again after the forward end of the work has passed beyond the position of the trip finger, and yieldable means carried by the trip bar permitting the trip finger to ride on the under surface of the work without damaging or re-engaging the latter.

18. In a semi-automatic wire stitcher, a stitcher head, a support for the work as it moves beneath said head, means for feeding the work intermittently, a trip finger having two parts at right angles to each other, one part lying normally beneath the path of travel of the work and parallel to said path and the other part at one end of the first part normally extending upwardly into the path of the work, yieldable means tending to hold the trip finger in said normal position, means set in motion by the engagement of the front end of the work with said finger for starting said stitcher head and said intermittent feeding means, and means for lowering said finger after it functions to start the operation of the stitcher head, said finger being adapted to ride upon the under surface of the work as it moves forward.

19. In a semi-automatic wire stitcher, a stitcher head, supporting means for the work as it moves beneath said head, said supporting means comprising a feed roller intermittently driven and a delivery roller continuously driven, a rock shaft extending transversely of the direction of travel of the work intermediate said rollers, drop rollers carried by said rock shaft in positions above the feed and delivery rollers adapted to engage the work one at a time depending upon the angular position of the rock shaft, means for swinging said rock shaft from one operative position to the other comprising two springs arranged beneath said supporting means, one of said springs being subjected to stress when the rock shaft is in one operative position to yieldably force one drop roller against the work and the other of said springs being subjected to stress when the rock shaft is in its other operative position to yieldably force the other drop roller against the work.

20. In a semi-automatic wire stitcher, a stitcher head, supporting means for the work as it moves beneath said head, said supporting means comprising a feed roller intermittently driven and a delivery roller continuously driven, a rock shaft extending transversely of the direction of travel of the work intermediate said rollers, drop rollers carried by said rock shaft in positions above the feed and delivery rollers adapted to engage the work one at a time depending upon the angular position of the rock shaft, means for swinging said rock shaft from one operative position to the other comprising a crank on the rock shaft, a second oscillatable crank, a link between said cranks limiting relative motion tending to separate the cranks but permitting motion of the cranks toward each other, a tension spring adapted to exert a pull on the second crank for transmission through said link to said first named crank, a compression spring interposed between the cranks for transmitting motion from the second crank to the first crank in a direction toward the latter, and means for swinging said second named crank from one position to the other timed with respect to the desired operation of said feed and delivery rollers.

21. In a semi-automatic wire stitcher, a stitcher head, supporting means for the work as it moves beneath said head, said supporting means comprising a feed roller intermittently driven and a delivery roller continuously driven, a rock shaft extending transversely of the direction of travel of the work intermediate said rollers, drop rollers carried by said rock shaft in positions above the feed and delivery rollers adapted to engage the work one at a time depending upon the angular position of the rock shaft, means for swinging said rock shaft from one operative position to the other comprising a crank on the rock shaft, a second oscillatable crank, a link between said cranks limiting relative motion tending to separate the cranks but permitting motion of the cranks toward each other, a tension spring adapted to exert a pull on the second crank for transmission through said link to said first named crank, a compression spring interposed between the cranks for transmitting motion from the second crank to the first crank in a direction toward the latter, means for swinging said second named crank from one position to the other timed with respect to the desired operation of

said feed and delivery rollers, and means for adjusting the degree of stress of said springs.

22. In a semi-automatic wire stitcher, a stitcher head, means for feeding the work intermittently, a transversely extending carriage adjustable back and forth parallel to the direction of work travel, a delivery roller rotatably mounted on said carriage, a trip bar also mounted on the carriage, a lever mounted on the carriage adapted to be actuated by said trip bar, a vertically movable horizontal rod operatively related to said lever for actuation in any position of said carriage, and means operatively connected with said horizontal rod and adapted to be set in motion by the vertical movement of the rod for starting the operation of said stitcher head and intermittent feeding means.

23. In a semi-automatic wire stitcher, a stitcher head, means for feeding the work intermittently, a transversely extending carriage adjustable back and forth parallel to the direction of work travel, a delivery roller rotatably mounted on said carriage, trip means mounted on said carriage, vertically movable supporting means for said trip means, guiding means for said supporting means mounted on said carriage, a vertically movable horizontal rod extending beneath said carriage parallel to the direction of work travel, an operative connection between said vertically movable supporting means and said rod slidable lengthwise of the latter, and means timed with respect to the travel of the work for moving said rod downwardly and upwardly to cause the trip means to descend for clearing the work and to ascend again to operative position.

24. In a semi-automatic wire stitcher, a stitcher head, means for feeding work intermittently beneath said stitcher head, a transversely extending carriage adjustable back and forth parallel to the direction of work travel, a delivery roller rotatably mounted on said carriage, an endless chain arranged parallel to the path of travel of the work, a sprocket engaging one run of said chain, said sprocket being operatively connected with said roller, and means for driving said chain, whereby the roller is rotated in all positions of adjustment of the carriage and whereby the carriage may be adjusted while the machine is in operation.

25. In a semi-automatic wire stitcher, a stitcher head, a feed roller for feeding the work intermittently beneath said head, a drop roller arranged above said feed roller and adapted to cooperate with the latter for feeding the work between them, a rock shaft upon which said drop roller is mounted, mechanism for driving said feed roller and for oscillating said rock shaft, said mechanism including a clutch, a cam shaft operatively connected with said mechanism for relatively slow rotation, means under control of the operator for engaging said clutch, two cams on said shaft, mechanism for disengaging said clutch under control of one cam, and mechanism for oscillating said rock shaft under control of the other cam.

26. In a semi-automatic wire stitcher, a stitcher head, a feed roller for feeding the work intermittently beneath said head, a drop roller arranged above said feed roller and adapted to cooperate with the latter for feeding the work between them, a rock shaft upon which said drop roller is mounted, mechanism for driving said feed roller and for oscillating said rock shaft, said mechanism including a clutch, a cam shaft operatively connected with said mechanism for relatively slow rotation, a trip finger arranged normally in the path of the work to be engaged by the front end of the work, means operatively connected with said trip finger for engaging said clutch, three cams on said cam shaft, mechanism for retracting said trip finger below the path of the work under control of one of said cams, mechanism for swinging said rock shaft to raise said drop roller under control of a second cam, and mechanism for disengaging said clutch under control of a third cam.

27. In a semi-automatic wire stitcher, a stitcher head, a feed roller for feeding the work intermittently beneath said head, a drop roller arranged above said feed roller and adapted to cooperate with the latter for feeding the work between them, a rock shaft upon which said drop roller is mounted, mechanism for driving said feed roller and for oscillating said rock shaft, said mechanism including a clutch, a cam shaft operatively connected with said mechanism for relatively slow rotation, a trip finger arranged normally in the path of the work to be engaged by the front end of the work, means operatively connected with said trip finger for engaging said clutch, three cams on said cam shaft, mechanism for retracting said trip finger below the path of the work under control of one of said cams, mechanism for swinging said rock shaft to raise said drop roller under control of a second cam, mechanism for disengaging said clutch under control of a third cam, and means permitting change in the speed of rotation of said cam shaft relative to the speed of the stitcher head.

28. In a semi-automatic wire stitcher, a stitcher head, work feeding means adapted to advance the work step by step beneath said stitcher head, work delivery means arranged to the rear of said work feeding means, trip mechanism for setting in operation the work feeding means and stitcher head, and means for adjusting said work delivery means and said trip mechanism as a unit toward and away from said work feeding means.

29. In a semi-automatic wire stitcher, a stitcher head, work feeding means adapted to advance the work step by step beneath said stitcher head, a carriage adjustable back and forth toward and away from said work feeding means, work delivery means mounted on said carriage adapted to discharge the work rapidly, trip mechanism also mounted on said carriage for setting in operation the work feeding means and the stitcher head, and drive means for said work delivery means operative in all positions of adjustment of the carriage.

30. In a machine of the class described, means for supporting and moving sheet material, comprising an elongated roller arranged beneath and adjacent the path of movement of the sheets, said roller having an annular groove therein, a fixedly mounted strip arranged beneath said path of movement and extending through said groove at the top of the roller, and means for adjusting the roller bodily along said path of movement, whereby the strip assists in the support of the work regardless of the position of the roller.

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