Feb. 5, 1963 L. MESTRE 3,076,196

STAPLING MACHINE

Filed Sept. 30, 1960 5 Sheets-Sheet 1

FIG. 1.

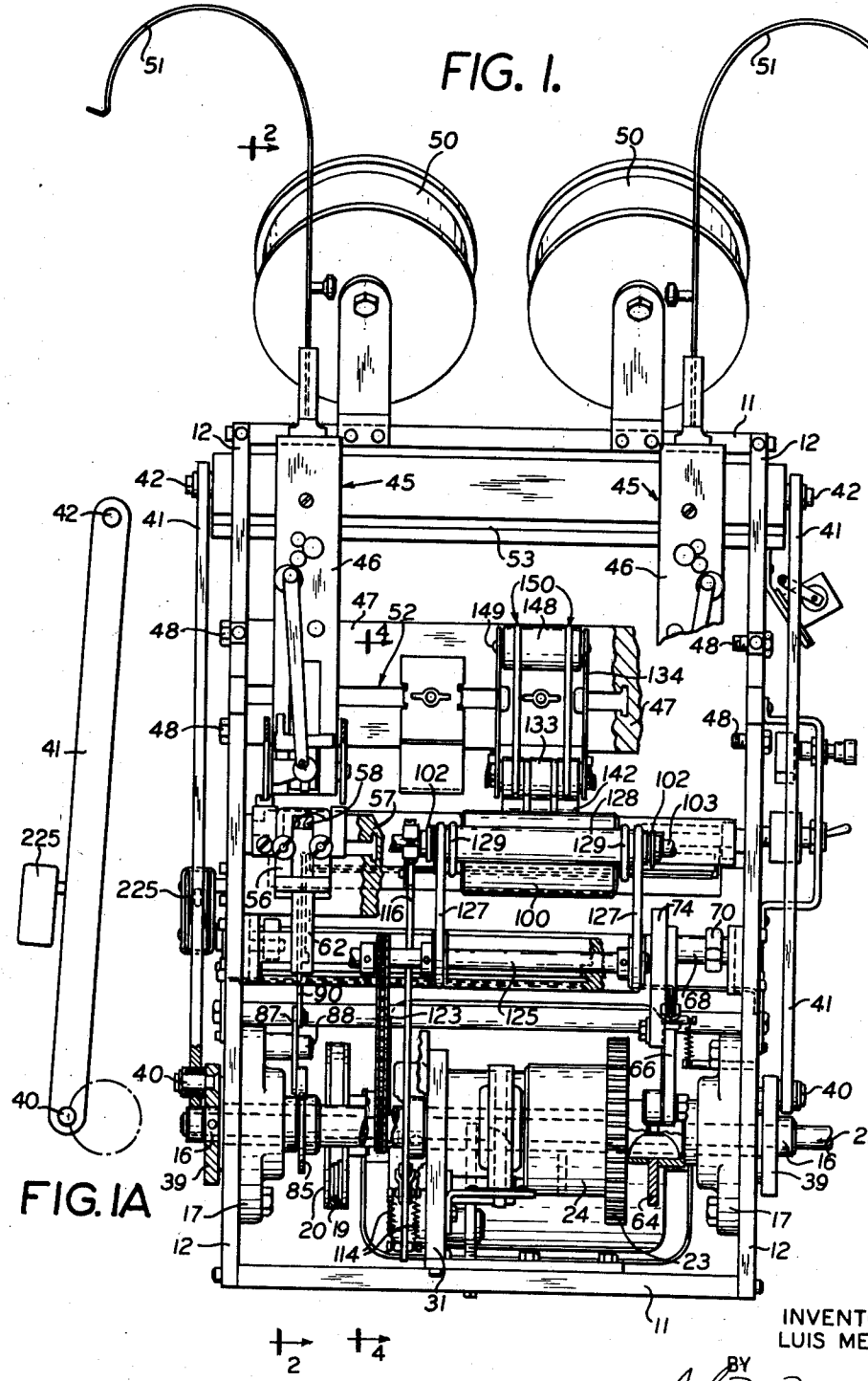


FIG. 1A

INVENTOR
LUIS MESTRE

BY

John M Montstream

ATTORNEY.

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FIG. 9.

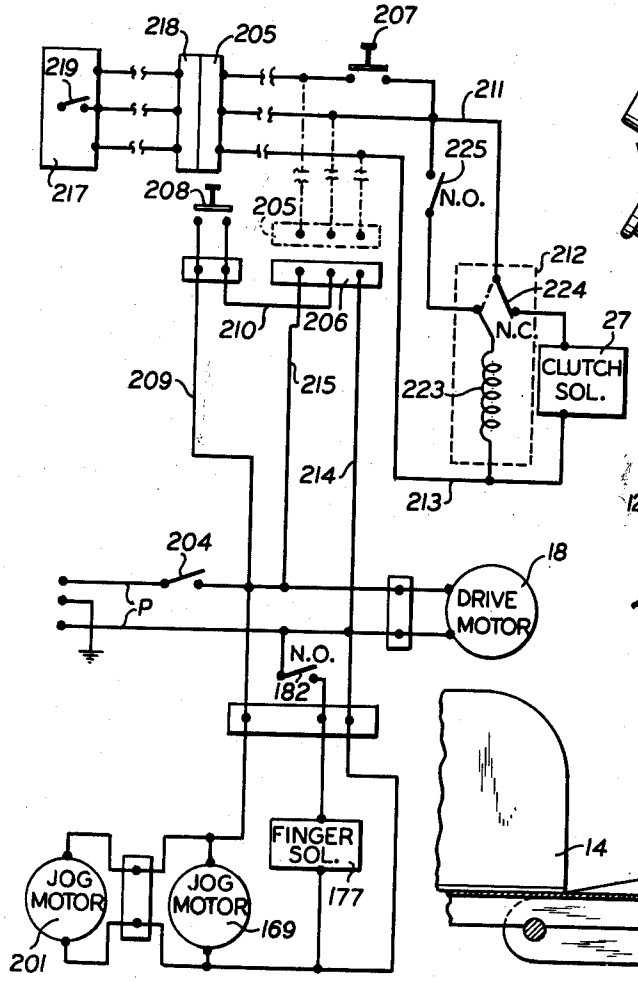


FIG. 2.

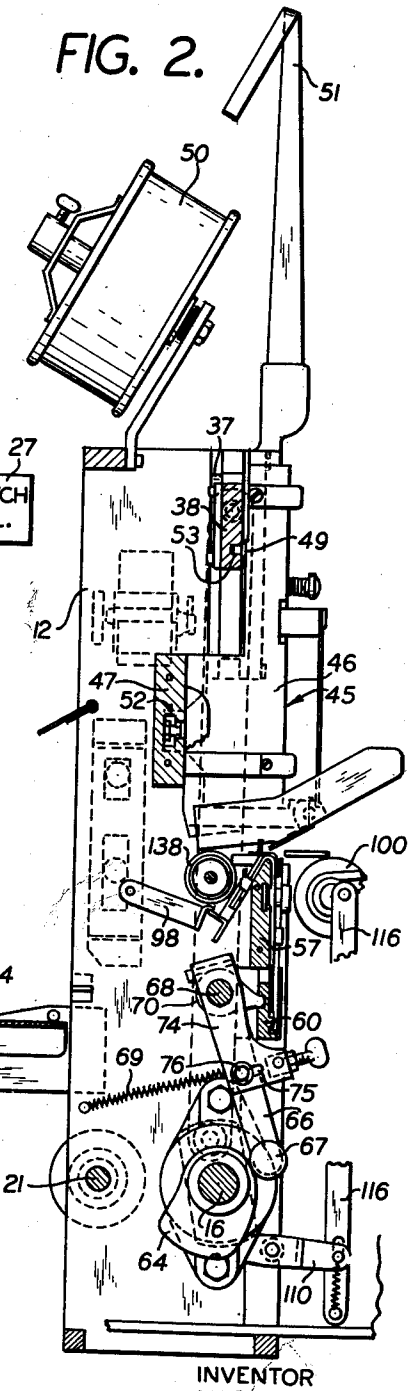
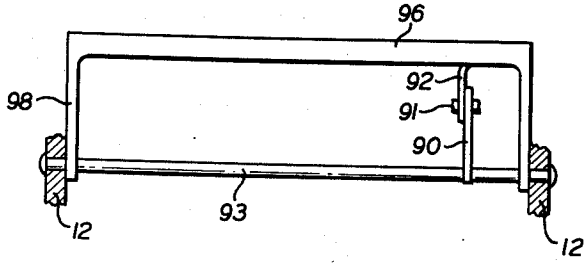


FIG. 10.



INVENTOR
LUIS MESTRE

BY John M Montstream

ATTORNEY.

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STAPLING MACHINE

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FIG. 3.

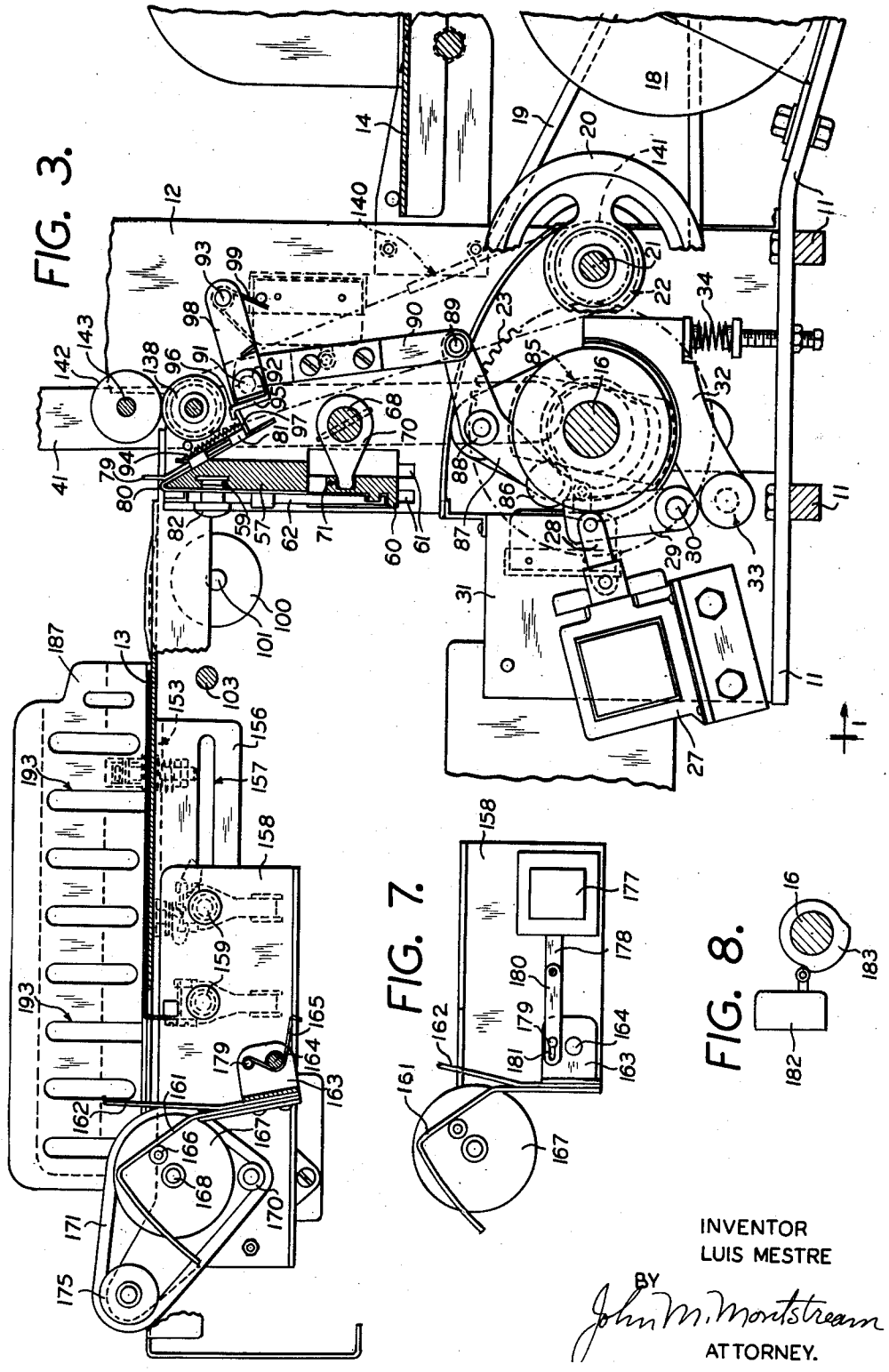


FIG. 7.

FIG. 8.

INVENTOR
LUIS MESTRE

BY
John M. Montstream
ATTORNEY.

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STAPLING MACHINE

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FIG. 4.

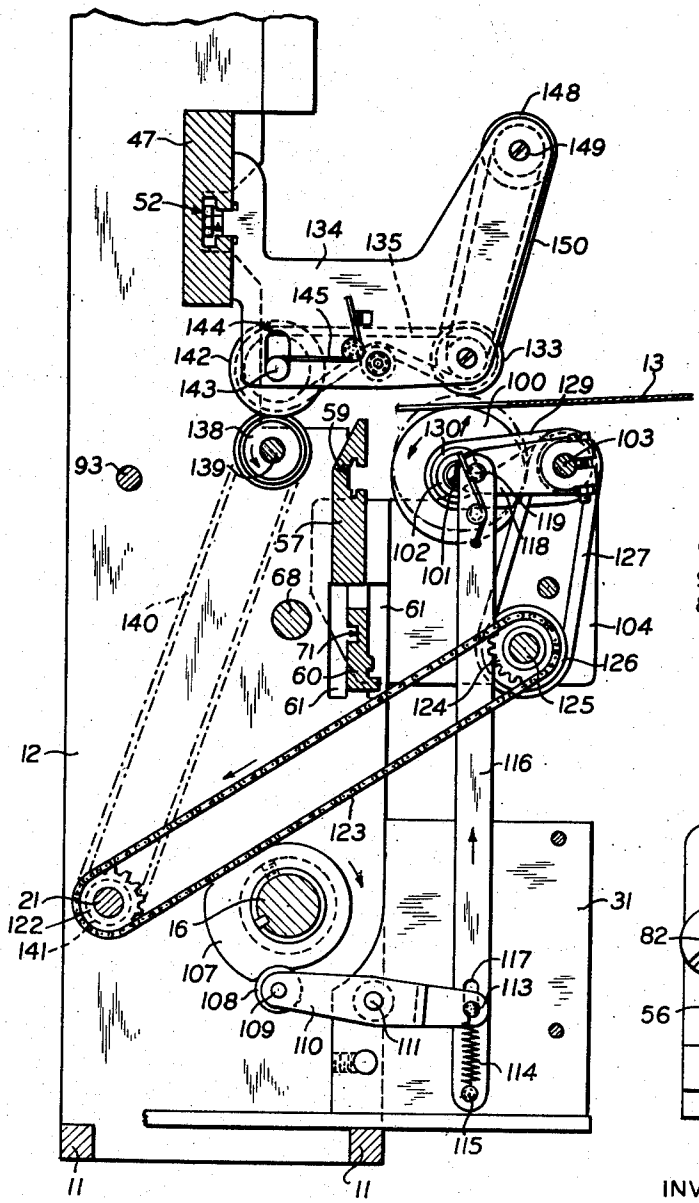


FIG. 11

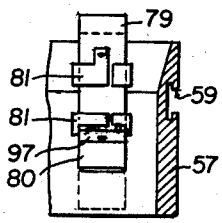
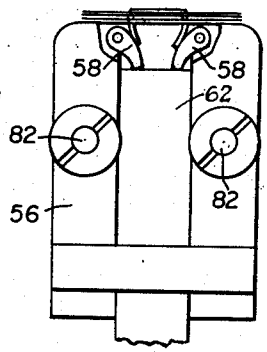


FIG. 12



INVENTOR
LUIS MESTRE

BY John M Montstream

ATTORNEY.

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FIG. 5.

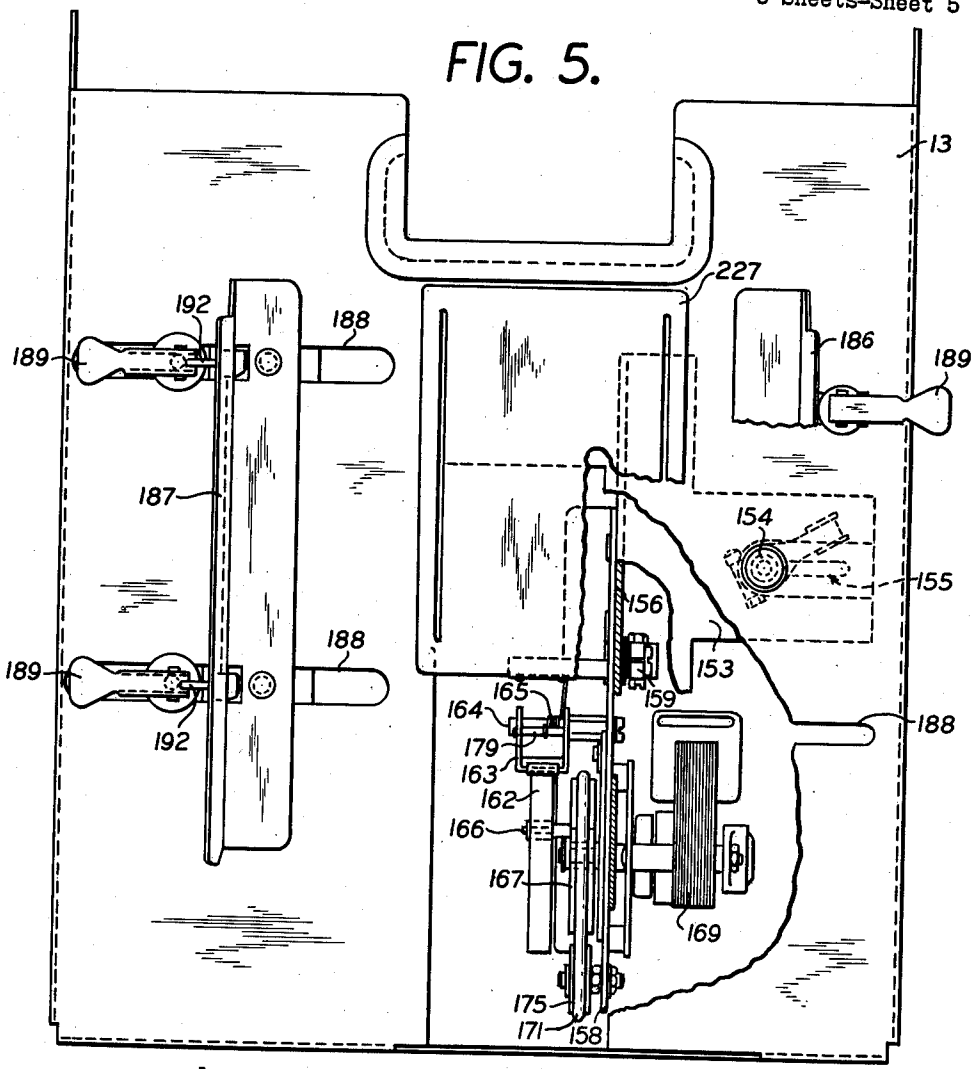
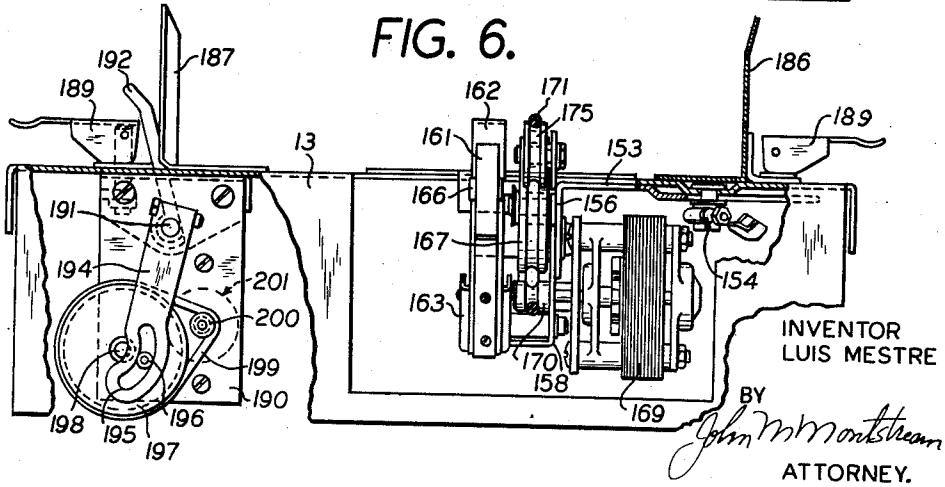


FIG. 6.



INVENTOR
LUIS MESTRE

BY John M. Montstream

ATTORNEY.

United States Patent Office 3,076,196
Patented Feb. 5, 1963

3,076,196

STAPLING MACHINE

Luis Mestre, 305 E. 46th St., New York, N.Y.

Filed Sept. 30, 1960, Ser. No. 59,739
19 Claims. (Cl. 1—7)

The invention is directed to a stapling machine in which a book of sheets in proper order are stapled together on a receiving platform and then the book is ejected automatically underneath the stapling heads to a delivery means. The operation of the machine may be initiated manually. When sheets are fed to the receiving platform by a collating machine and the proper number of sheets have been piled thereon, the stapling machine operates automatically from a signal generated at the collator to staple an edge of the book which secures the sheets together and thereafter eject the book. The book is then fed to a delivery means on the other side of the stapling means. The stapling machine may function by hand positioning a book or plurality of sheets in the stapling machine and then the operator manually closes a switch to actuate the stapling machine.

An object of the invention is to construct a stapling machine which automatically assembles a book of sheets in stapling position, then staples the sheets, after which the stapled book is fed or ejected under the stapling heads to a delivery means on the other side of the stapling means.

Another object of the invention is to construct a stapling machine having means for jogging the sheets into alignment against a locating stop and to use this jogging means to project the stapled book of sheets through the machine under the stapling heads to a delivery tray on the other side of the stapling means.

Another object of the invention is to construct a stapling machine in which a constantly rotating ejection or feed roller is normally positioned below the receiving platform and when the book has been stapled, this ejection roller is moved upwardly into engagement with the stapled book to eject or feed the same through the machine under the stapling heads onto a delivery means or tray.

A still further object is to construct a stapling machine having a retractible stop adjacent the plane of movement of the stapling means which stop drops below the level of the receiving platform after the book has been stapled so that the book may be discharged or ejected through the machine under the stapling heads to a delivery means on the other side.

Another object is to construct a stapling machine in which there is a belt feed associated with the sheet jogging means.

Another object is to construct a stapling machine having a feed roller normally positioned below the receiving platform and raised into contact with the book of sheets after they have been stapled together to eject or feed the book through the machine to the delivery means on the other side of the stapling heads and having a cooperating pulley and a belt means to direct the sheets downwardly onto the receiving platform as they are fed thereon.

A still further object is to construct a stapling machine which can be attached to the delivery end of a collating machine and a switch operated on and by the collating machine which automatically sets the stapling machine into operation.

Other objects of the invention will be more apparent from the following description when taken in connection

with the accompanying drawings illustrating preferred embodiments thereof in which:

FIG. 1 is an end view of the stapling machine from the delivery means side;

FIG. 1A is a view of a connecting link operating a switch;

FIG. 2 is a side view of the machine with parts in section as taken on line 2—2 of FIG. 1;

FIG. 3 is an enlarged view of the lower portion of the stapling machine;

FIG. 4 is an enlarged sectional view through the machine taken on line 4—4 of FIG. 1 showing the book ejecting means;

FIG. 5 is a top view of the receiving platform partly cut away to show the forward jogging means;

FIG. 6 is an end view of the forward jogging means and the lateral jogging means;

FIG. 7 is a view showing the forward jogging means and kick ejecting means therefor;

FIG. 8 is a view showing the kicker switch and cam;

FIG. 9 is a circuit diagram;

FIG. 10 is a detail view of a stop operating lever.

FIG. 11 is a front view of the stop means; and

FIG. 12 is a view of the staple clinching anvil from the rear with the spring not shown.

The stapling machine includes a frame **11** having a pair of uprights **12** which are spaced apart a distance wide enough so that a sheet and hence a book of sheets will pass therebetween. The book of sheets to be stapled is positioned on a receiving tray or platform **13**. The book of sheets to be stapled may be manually placed thereon for stapling. The stapling machine may be located to receive a set of sheets directly from a collator which deposits each sheet in proper sequential order on the receiving platform as will be described hereinafter. After stapling, the book is ejected through the machine and under the stapling heads to a delivery means or tray **14** on the opposite or forward side of the machine.

A main shaft **16** which is journaled in bearings **17** carried by the uprights, is located below the level of the receiving platform. The main shaft is driven from a motor **18** carried by the frame. The drive connection is a pulley (not shown) on the motor shaft, a belt **19** and pulley **20** on an auxiliary shaft **21** which shaft is journaled in the frame uprights **12**. The auxiliary shaft carries a gear **22** which meshes with a gear **23** forming a driving input for a clutch **24** of any suitable kind which is normally disconnected from the main shaft. This clutch also functions such that after engagement, the main shaft will rotate one revolution and then the clutch is automatically disengaged.

A solenoid **27** is connected by means of a link **28** with a clutching lever **29** which lever is pivoted on a pivot **30**. The solenoid and pivot are mounted on a bracket **31** forming a part of the frame. Operation of the solenoid and clutching lever connects the clutch with the main shaft for one revolution whereupon the clutch disconnects automatically. Such clutches are well known. A brake shoe **32** pivoted on a pivot **33** presses into contact with the clutch periphery and aids in limiting the rotation of the main shaft to one revolution. The brake shoe is pressed into contact with the clutch periphery by a spring **34**.

Stapling mechanism is provided, two stapling means being shown, each including a stapling head above the receiving platform. Operating means are provided to

move the heads up and down to staple the sheets together. The upper end of each upright **12** carries upper guide means shown as slots **37**. An upper slide bar **38** is mounted in the upper guide means so that the upper slide bar may reciprocate vertically. This slide bar moves down and up for one revolution of the main shaft and to this end operating means is connected with the main shaft. The operating means shown includes a crank plate **39** at each end of the main shaft and outside of the uprights and each crank plate carries a crank pin **40**. A connecting link **41** is pivoted at its lower end to each crank pin and the upper end of this link is pivotally connected with the slide bar by a pivot **42**. When the crank plate rotates one revolution, the upper slide bar moves downwardly and upwardly.

The stapling means may be of any construction and has a stapling head **45**. Each head includes a fixed part **46** which is secured to an upper cross bar **47** which bar is secured to the uprights by bolts **48** and forms a part of the frame. The stapling head also includes a movable part **49** which part is operated by the upper slide bar **38** so that the movable part of each stapling head moves downwardly and upwardly therewith to press the staple through the book of sheets. With the stapling heads shown, the movable part is connected with the upper slide bar **38** to reciprocate the same. The stapling heads particularly shown are of the type which forms its own staple from a continuous wire and then presses the formed staple through the sheets of the book. To such stapling heads are shown carried by the upper cross bar and the movable part **49** being connected with upper slide bar. The wire for each stapling head is fed from a supply roll **50** carried at the upper end of the uprights which wire passes around the wire loop supports **51** to its stapling head. The position of each stapling head may be adjusted laterally with the fixed part being secured in a groove **52** on the upper cross bar and the movable part being operatively connected in a groove **53** in the upper slide bar which enables lateral adjustment of the stapling heads to be made without affecting the drive connection with the movable part of the stapling head.

Each stapling means, FIG. 1, also includes an anvil **56** of known construction for each stapling head which anvil is carried by a lower cross bar **57** located below the level of the receiving platform **13** and secured to the uprights **12**. The anvil particularly shown is of the type which presses the protruding ends of the staple against the book of sheets. The anvil for each stapling head includes a pair of oppositely pivoted staple closing levers **58** which when pressed upwardly press the protruding ends of the staple to closed position. Each anvil is adjustable in the slot **59** in the slide bar. Operating means is provided to operate the staple closing levers which means includes a lower slide bar **60** mounted for vertical reciprocation on the uprights in a guide such as spaced bars **61** carried by each upright **12**. The lower slide bar carries a staple closing lever operator **62** which is slidable in a guide forming a part of the anvil **56** carried by the cross bar. The end of the lever operator is located beneath the staple closing levers so that when the lower slide bar moves upwardly, the staple closing lever operator moves upwardly therewith to engage the closing levers and pivot the same upwardly and close the staple ends.

Operating means is provided to reciprocate the lower slide bar **60** up and down once for each revolution of the main shaft and in timed sequence so that after the staples have been pressed through the sheets, the staple ends are closed. This operating means includes a cam **64** (FIGS. 1, 2), secured to the main shaft. A cam lever **66**, having a cam follower **67** engaging the cam, is connected with an oscillating shaft **68** mounted in the uprights. A spring **69** propels the lever so as to keep the cam follower against the cam. This oscillating shaft has a pair of oscillating levers **70** secured thereto. The end of each oscillating lever is received in a connecting slot **71** (FIG. 3) in the lower slide bar so that oscillation of the operating shaft pivots the oscillating levers upwardly and downwardly once for each revolution of the main shaft. The slot enables the position of the anvils to be adjusted laterally for different lengths of books and maintain connection with the lower slide bar.

Preferably means are provided to adjust the position of the oscillating levers so that the position of the lower slide bar and hence the position of the upper end of the staple closing lever operator **62** may be adjusted. This adjusting means includes an adjusting lever **74** secured to the oscillating shaft therein and having a slot **75** which receives a lock bolt **76** secured to the cam lever. By shifting the position of the adjusting lever relatively to the cam lever, the position of the oscillating levers is adjusted.

Stop means are provided to locate the sheets making up a book, and to locate the individual sheets of the book as they are deposited on the receiving platform from a collator, in proper position with respect to the stapling means. The stop means, shown as a pair of spaced stops **79** (FIG. 3) is lowered to a position below the receiving platform after the sheets have been stapled so that the book is unobstructed thereby when it is ejected through the machine to the delivery means or tray **14**. Thereafter the stop means is again raised to stop position for the next books of sheets. To this end a pair of stop slides **80** are mounted at an angle on one side of the lower cross bar **57** and have a portion extending downwardly on the other side thereof. This cross bar has an upper edge approximately level with the receiving tray **13**, and an inclined forward surface against which the slide rests in order to avoid a feed roll. The stop slide provides a guide for a stop which is movable down, out of the way and then up to stop position. The guides shown for the stop are folded over side projections **81** carried by and forming part of the slide. A spring **94** attached to the stop slide and the stop normally propels the stop to its raised or stop position. The stop means are adjustable on the cross bar **57** through bolts **82** slidable in the slot **59** and passing through the downwardly extending portion of the slide **80**.

Stop operating means (FIGS. 1, 3) is provided to lower or depress the stops or stop means which operating means includes a stop cam **85** secured to the main shaft **16**. This cam is engaged by a cam follower **86** carried by a cam lever **87** which lever is pivoted between its ends on a pivot **88** carried by the frame or uprights **12**. The other end of the cam lever is pivotally connected through a pivot **89** with one end of a connecting link **90** and the upper end of this connecting link is pivotally attached by a pivot **91** carried by a bracket **92** to a U shaped stop operating bar **95** having arms **98**. The arms are pivotally mounted on a pivot bar **93** which is pivotally mounted on the frame or uprights. The stop operating bar **95** is long so that it engages and operates the two spaced stops **79**. A spring **99** carried by the pivot bar **93** normally propels the arms and the stop operating bar **95** to its up position and also through the link **90** and lever **87** maintains the cam follower **86** in contact with its cam **85**. The pivot bar preferably carries a shoulder or flange **96** which engages the lower end of the stop **79** and particularly a flange **97** carried by the lower end of the stop. When the main shaft rotates, the cam propels the cam lever in a clockwise direction, as shown in FIG. 3, which pulls the connecting link **90** downwardly and pivots the stop operating bar **95** downwardly to pull the stop **79** downwardly in its slide so that the upper end is retracted below the level of the receiving platform **13**. The cam is located so that the stop is moved downwardly out of the way about the time that the sheets are stapled or after the stapling means has stapled the book of sheets and the stapling heads have started their upward movement. Upon completion of one rotation of the main shaft, the bar **95** is raised by the spring **99** so that the

stop pull-up spring 94 moves its stop to its up or stop position for the next cycle.

Book ejecting means are provided to eject the stapled book of sheets from the receiving tray of the stapling machine underneath the stapling heads onto the delivery means or tray 14. Two forms of book ejecting means are shown. The means particularly shown (FIGS. 1, 4) includes a movable feed roll 100 rotatably mounted on a roll shaft 101 carried by spaced arms 102 which arms are fixed to a pivot shaft 103. The ends of the shaft are pivotally mounted on the frame in the uprights or brackets 104 attached thereto and forming a part of each upright. This feed roll normally rests below the level of the receiving tray 13 and hence is below contact with the bottom of the book. After the book has been stapled, the feed roll is raised and the book of sheets is pressed between the feed roll and a cooperating roll spaced thereabove as will be described hereinafter.

Means are provided to raise the feed roll 100, which means includes a feed roll cam 107 secured to the main shaft 16 which cam is engaged by a cam follower 108 rotatably mounted on a pin 109 carried by a cam lever 110. This lever is mounted between its ends on a pivot 111 carried by the uprights or particularly on the bracket 31 attached to the frame and forming a part thereof. The other end of the cam lever carries a pin 113 to which is attached a pair of springs or spring means 114. The other end of each spring is attached to a pin 115 carried by the lower end of a connecting link 116. A slot 117 extends through the link for the pin 113. This provides a spring operating connection between the cam lever and the connecting link. The upper end of the link is attached to a lever 118 by means of a pivot 119 and this lever is secured to the pivot shaft 103.

When the high land of the cam 107 engages the cam follower, the cam lever is moved counterclockwise (FIG. 4) so that the right hand end of this lever moves upwardly and pulls the link 116 upwardly by means of the connecting springs 114. The upward movement of the connecting link raises the feed roll 100 to engage the bottom of the book of sheets which is pressed between this feed roll and a cooperating feed roll 133 thereabove as will be described. It will be observed, therefore, that the springs 114 provide a connection which adjusts itself for different thicknesses of books. In addition, if the book is a thick one, the springs are stretched a greater amount and hence increase the pressure between the feed rolls for such thick book to effect a more positive ejection.

Means are provided to rotate the feed roll 100, which means includes a sprocket 122 carried on the auxiliary shaft 21, which sprocket carries a chain 123 which chain also passes around a sprocket 124 carried on a shaft 125 rotatably mounted in the brackets 104. This shaft carries a pair of spaced pulleys 126 around each of which passes a belt 127 and the pulley drives a wide pulley 128 rotatably mounted on the shaft 103. Two belts 129 are mounted in pulley grooves in the pulley 128, one belt being on each side of the feed roll and each belt drives a pulley 130 secured to the feed roll.

A cooperating feed roll 133 is rotatably mounted in a bracket means 134 carried by the upper cross bar 47 and rotated by a belt 135. The cooperating feed roll is fixed in position to pass the thickest book to be stapled by the stapler between this roll and the receiving tray. The bracket means is adjustable along the upper cross bar in the slot 52.

It may be desirable to have a secondary book feed means forwardly of the stop means such as for larger books which feed means includes a secondary feed roll 138 (FIG. 4) carried on a shaft 139 which shaft is mounted in the uprights 12 or frame. This roll is constantly driven such as by a chain or belt 140 (FIG. 4) driven from a duplicate sprocket 122 carried by shaft 21. The belt is driven by a pulley 141 secured to the auxiliary shaft 21. A cooperating feed roll 142 above the feed roll 138 is carried on a shaft 143 mounted in a slot 144 in the bracket means 134. A spring 145 presses the shaft 143 and cooperating feed roll 142 downwardly against the feed roll 138 and is rotated thereby.

Preferably means are provided with the book feeding means for directing downwardly the sheets which are delivered onto the receiving platform. This sheet directing means (FIGS. 1, 4) includes a pulley 148 mounted on a shaft 149 carried by the bracket means 134. Belt means such as a pair of spaced belts 150 pass around the pulley 148 and the cooperating feed roll 133 in suitable grooves therein and rear strand thereof of the belts is driven downwardly thereby.

It has been mentioned that there is disclosed a second form of book ejecting or feeding means. This second form utilizes the feed rolls 138, 142 and also includes a kicker which projects the stapled book between these feed rolls. The kicker also forms a part of a sheet jogging means carried by the receiving platform 13 (FIGS. 3, 5 and 6). The jogging means will be first described. A first jogger bracket 153 is secured to the under side of the receiving tray 13 by suitable clamping means 154. This bracket has a slot 155 therein extending laterally so that the bracket may be moved laterally of the receiving tray and so that the jogger may be positioned midway between sheet guide rails 186, 187 mounted on the top of the tray. The bracket has a downwardly extending flange 156 (FIG. 3) having a longitudinally extending slot 157. A second jogger bracket 158 is secured to the flange by suitable clamping means 159 which extend through the slot 157. The second jogger bracket and hence the jogger means may be moved longitudinally of the flange 156 of the first jogger bracket hence relatively to the tray and the first bracket is movable laterally with respect to the tray. With this jogger bracket means formed by the two brackets, the position of the jogger may be adjusted towards and away from the stapling heads or stop means in accordance with the width of the sheets which are to be stapled and adjusted laterally as well. The second jogger bracket carries a pivot 164 on which pivot is mounted a jogging finger means including a finger bracket 163, a bar 161 and jogging finger 162, all of which are secured together. Means are provided to oscillate the jogging finger forwardly and rearwardly. A jogging eccentric 166 engages the back or rear surface or face of the jogging bar 161. The eccentric is mounted on a jogging wheel 167 carried on a shaft 168 mounted on the jogger bracket. This jogging wheel is driven from an independent jogging motor 169 having a pulley 170 and connected by a belt 171 with the eccentric wheel. As the eccentric wheel rotates the eccentric propels the jogging finger forwardly and the spring 165 returns the finger rearwardly and maintains the jogging bar 161 in contact with the jogging eccentric 166.

The eccentric wheel projects above the level of the receiving platform so that its periphery or the belt 171 serves as means to feed a sheet forwardly as a sheet is projected thereon and over the receiving platform from a collating machine. To further augment the forward feeding of a sheet, a second pulley 175 is mounted rearwardly of the eccentric wheel and the belt passes around this pulley also so that a sheet delivered on the receiving platform may engage the belt and be projected forwardly to the stop means or to the right of the jogger as shown in FIG. 3. The jogging finger engages the edge of a sheet or the edges of the piled sheets and projects them forwardly into contact with the stop means 79.

The book ejecting means has been described as including a feed roll means 138, 142 and a kicker. The kicker means includes the forward jogging finger 162 and a finger or kicker solenoid 177 also carried on the jogging means frame. The solenoid armature 178 is connected to a pin 179 carried by the jogging finger bracket by a connecting lever 180 which has a slot 181 at its end to

receive the pin. The slot permits the jogging finger to oscillate forwardly and rearwardly without interference from the solenoid lever and solenoid. A switch 182 (FIG. 8) is connected with the solenoid and the switch is operated in timed sequence from the main shaft 16. The switch is shown as being operated from a cam 183 carried by the main shaft. The operating land of the cam which closes the switch is located so that the switch is operated immediately after the stop means has been lowered out of the way below the level of the receiving platform 13. The cam land is relatively long to hold the jogging finger forward in event the book should buckle. Upon closing of the switch, the solenoid is energized which pulls the lever 180 and the jogging finger 162 to the right to push the stapled book underneath the stapling heads and onto the feed roll 138 which assists in projecting the book onto delivery tray 14. Since the eccentric engages the back surface of the bar, the solenoid may project the finger to the right as shown in FIG. 7, that is, it has freedom of movement in this direction without restraint from the eccentric by the kick given it by the solenoid. The receiving platform 13 with the jogging means is removable from the frame for adjustment, replacement, or repair.

Lateral jogging means are used to align the sheets laterally. A pair of spaced sheet guide rails 186, and 187 (FIG. 6) are mounted on the receiving platform with means for lateral adjustment of their position in slots 188 in the platform. Clamps 189 lock the rails in position. A lateral jogging means (FIGS. 5 and 6) is secured to one rail which includes a lateral jogger bracket or frame 190 having a pivoted shaft 191 which shaft carries a pair of spaced lateral jogging fingers 192. Each of said fingers projects through a lateral slot 188 in the receiving platform to project above the platform and into a slot 193 (FIG. 3) in the rail. The shaft has an eccentric arm 194 secured thereto which arm carries an arcuate slot 195 in which an eccentric pin 196 is received. The pin is carried by a wheel 197 mounted on a shaft 198 rotatably mounted in the bracket. This wheel also serves as a pulley for a belt 199 connecting the wheel with a pulley 200 of a lateral jogging motor 201 also carried on the lateral jogger bracket. Rotation of the eccentric pin 196 with the wheel 197 by the motor about the shaft 198, oscillates the arm 194 and its shaft 191 and also jogging fingers 192 which are secured to the shaft. When the slot 195 is on the side of the shaft 198 shown in FIG. 6 and the slot having a radius of arc the same as the radius of location of the eccentric pin 196 from the shaft 198, the jogging fingers are stationary while the pin 196 traverses the slot. Lateral jogging of the sheets aligns their edges on the rail spaced from the lateral jogging fingers.

It has been mentioned that the stapling machine may be operated manually as a separate unit if desired. It also may be positioned at the delivery end of a collating machine so that the sheets as they are withdrawn sequentially from the collator are delivered onto the receiving platform. When the proper number of sheets have been collated or piled on the receiving platform to make a book, a switch is operated at the collating machine to energize the clutch solenoid 27 of the stapling machine which starts the cycle of stapling of the book of sheets and ejection of the book upon the delivery platform so that the operations of collating and stapling are a continuous automatic operation.

The circuit diagram in FIG. 9 shows the circuit giving the stapling machine this adaptability of use. The power lines P are directly connected through a main switch 204 with the drive motor 18. If manual operation is desired, a connective plug or jack 205 with three connectors is plugged into a socket 206 with first, second and third connectors on the stapling machine. The manual operation may be either by a push button switch 207 on the stapling machine or a foot switch 208. For foot operation, the foot switch 208 is closed which closes a circuit from the power lines P through wire 209, the foot switch, wire 210 to the second connector of the socket 206 and plug 205, wire 211 through a normally closed relay switch 212 to the clutch solenoid 27, return wire 213, the third connector of plug 205 and socket 206 and return wire 214 to the other power line. If hand operation is desired, the push button or hand switch 207 is closed whereupon a circuit is completed from the power line through the wire 215 to the first connector of socket 206, and plug 205, to manual hand switch 207, wire 211, the relay switch 212, solenoid 27 and the return wires 213, 214 and the third connectors to the power line.

For operation of the stapling machine from a collator 217, the plug 205 is connected with a socket 218 on the collator which has a first, second and third connector. The second connector is connected with a switch 219, on the collator and closed thereby for connection with the second connector on the plug 205 and the wire 220. When the proper number of sheets have been drawn by the collator and delivered to the stapling machine, the switch 219 is closed automatically to energize the stapling machine clutch solenoid 27 which initiates the stapling machine operation. The patent to Luis Mestre 3,004,758, dated October 17, 1961 entitled Vertical Collating Machine, shows a collator having a switch which is operated at the proper time to initiate operation of a stapler as stated therein. The hand switch 207 remains in circuit for operation of the stapling machine, if desired.

Preferably the circuit includes a safety means so that switches 207 and 208 are ineffective at the end of the stapling cycle. It is for this reason that the relay 212 is used which has a coil 223 which opens the normally closed switch 224. The coil is energized by a normally open switch 225. This switch is closed near the end of the cycle in any suitable manner, however, a novel operating connection is shown (FIG. 1) in that the switch is closed by the connecting link 41 when it is near the limit of its outward movement on the return or up stroke or movement. Closing of this switch energizes the relay coil 223 to swing the two way switch 224 to its dotted line position where it is connected with the coil. If, therefore, the hand switch 207 or foot switch 208 should inadvertently or purposely be held closed when the switch 225 closes and the switch 224 is pulled to its other position where the wire 211 is connected with coil 223, then the coil continues to be energized and hold the switch 224 disconnected from the clutch solenoid 27. The clutch solenoid therefore cannot be energized and the clutch opens and halts the stapling machine positively upon completion of one cycle. In order to set the stapling machine into another cycle of operation, a switch 207 or 208 must be opened which deenergizes coil 223 and restores the switch 224 to its connection between wire 211 and the clutch solenoid 27.

There is disclosed herein, cam means carried by the main shaft for operating the feed roll 100 and the stop means 79 in timed sequence with each other and with operation of the other mechanism of the stapling machine. These operations occur in timed sequence for one rotation of the main shaft 16. Other forms of stapling means may be used operable from the upper slide bar 38. Since some known stapling means do not have movable anvil parts, for such stapling means a lower slide bar may be dispensed with.

The forward feed rolls 138, 142 are not essential with the movable feed roll means 100, 133. They do, however, assure more positive ejection of the book after the book has passed between the rolls 100, 133. The forward feed roll means are more desirable with the kicker type of book ejecting means although the driven roll 138 alone may be used in conjunction therewith. If the kicker type of book ejecting means is not used the switch 182 and kicker solenoid 177 are dispensed with. A plate 227 may be adjustably carried by the receiving platform to

close the opening as much as possible provided for adjustment of the forward jogging means.

With the stapling machine connected with a collating machine 217, FIG. 9, and the jack 205 connected with the plug 218 as shown in full lines, the sheets are delivered one at a time in proper order from the collating machine. Each sheet of a book passes over the belt 171, FIG. 3, onto the receiving tray 13 with the forward edge of the sheet engaging the stop means 79. As the sheets of the book pile up the forward jogger 162 keeps the sheets aligned against the stop means and the lateral joggers 192 align the sheets laterally against the rail 186. When the sheets of one book have been so collected on the receiving tray 13, the collator closes the switch 219 which energizes the clutch solenoid 27 through wire 211 and switch 224 to rotate the main drive shaft 16 through one revolution. The upper slide bar 38, FIG. 2, is reciprocated downwardly by means of the crank plates 39 and links 41 which carries the movable part 49 of each stapler head 45 downwardly and drives a staple through the book of sheets. At the bottom of the stroke of the upper slide bar 38, the cam 64 engages the cam follower 67 to oscillate levers 66, 74 and 70 which reciprocates the lower slide bar 60 and the staple closing lever operator 62 upwardly to pivot upwardly the staple closing levers 58 and close the ends of the staple.

With the book of sheets stapled together, the stop cam 85, FIG. 3, engages the cam follower 86 to operate the linkage 87, 90, 98 and move the stop operating bar 95 downwardly. This stop operating bar engages the flange 97 on the lower end of the stop means 79 and pulls the latter downwardly out of the way. Shortly thereafter the feed means operates for ejecting the stapled book through the stapler onto the delivery tray 14. In the construction shown this may include solely the driven feed roll 100, FIG. 4, and its cooperating roll 133. The feed roll 100 is normally below the receiving tray 13 and is movable upwardly by being mounted on arms 102, FIG. 1, which arms are pivotally mounted on pivot shaft 103. The feed roll 100 is raised by a cam 107 engaging the cam follower 108 to operate the linkage 110, 116, 118, 103, and 102 to raise the periphery of this roll above the receiving tray 13 and into contact with the book of pages between it and the cooperating feed roll 133. The feed roll 100 is rotated from the shaft 21, chain 123, the shaft 125, pulley 126, belt 127, pulley 128, FIG. 1, belt 129 and pulley 130. This is sufficient to eject the book of sheets from the receiving tray 13 although additional means are shown and may be used. The additional book ejecting means includes a driven roller 138 on the forward side of the stop means which presses the book of sheets between it and its cooperating feed roll 142 to assure the ejection of the book of sheets.

Additional ejecting means may be provided and is shown which utilizes the forward jogger finger 162, FIG. 7. This additional ejecting means includes a solenoid 177 which snaps or kicks the jogger finger 162 forwardly and engages the rear edge of the book of sheets to give it a forward kick. This kick given the jogger finger 162 and the book normally is sufficient to eject the book without the ejecting roll 100 and the feed rolls 138, 142. However, to assure ejection at all times it will be used with feed rolls 138 and 142. The book ejecting means, therefore, may be the feed rolls 100 and 133 alone, or these feed rolls with the feed rolls 138, 143, or the forward jogger finger 162 and solenoid alone, or the forward jogger finger with the feed rolls 138, 143, or all three.

In order to assure that the clutch solenoid 27 is not held energized and so that the clutch releases at the end of one revolution, the circuit thereto is broken by opening the relay switch 224, FIG. 9. The normally open switch 225, is engaged by the connecting link 41 (FIG. 1), in the last portion of its movement to close switch 225 and this energizes relay winding or coil 223 to open the normally closed switch 224. Opening of this switch deenergizes the clutch solenoid 227. In order to secure a second operation it is then necessary to again close switch 219 on the collator or switch 207.

The forward jogger finger 162, FIG. 3, is driven by a separate motor 169, FIG. 6 which drives the pulley 170 and belt 171 to rotate the jogging wheel 167 and its jogging eccentric 166. This eccentric engages the jogging bar 161 to move it and the finger forwardly against the tension of the spring 165 and oscillates the jogger or jogging finger 162 against the rear edge of the sheet of the book as they are piled on the tray 13. This construction leaves the jogging bar 161 and jogging finger 162 to be propelled forwardly by the solenoid 177.

The side or lateral joggers 192 are driven from a separate motor 201, FIG. 6, which drives a pulley 200, belt 199, wheel 197 and eccentric pin 196. This eccentric pin is received in a slot 195 carried by a lever 194 and oscillates this lever and the jogging finger 192 connected therewith. When the lever 195 is on the right of the shaft 198, the jogger finger 192 is not oscillated during the period when the eccentric pin 196 traverses the arcuate slot 195.

For manual operation of the stapler, the jack 205 is connected with the plug 206 whereupon a book of sheets is placed on the receiving tray 13 with the forward edges against the stop means 79 whereupon the hand switch 207 is closed and the clutch solenoid sets the machine into operation for one stapling operation as described. In the alternative the foot switch 208 may be used which is in parallel with switch 207.

This invention is presented to fill a need for improvements in a stapling machine. It is understood that various modifications in structure, as well as changes in mode of operation, assembly, and manner of use, may and often do occur to those skilled in the art, especially after benefiting from the teachings of an invention. This disclosure illustrates the preferred means of embodying the invention in useful form.

What is claimed is:

1. A stapling machine for stapling a book of sheets comprising a frame including a pair of uprights spaced apart a distance to pass a book of sheets therebetween and having a top, a receiving platform mounted on the frame on one side of the pair of spaced uprights and below the top thereof, the receiving platform constituting the sole receiving means for the sheets, a main shaft mounted on the frame on a level below the receiving platform and crosswise relatively to the receiving platform and in the region of the uprights, a normally disengaged clutch for connection with the main shaft and operable when engaged to disengage upon one revolution of the main shaft, means to engage the clutch, an upper slide bar, means mounting the upper slide bar on the uprights for vertical movement and above the level of the receiving platform, at least one stapling means each including a stapling head mounted on the frame, each stapling head having a movable part operable by the upper slide bar, means connecting the main shaft with the upper slide bar to reciprocate the latter and said movable part of the stapling head up and down once for each rotation of the main shaft, stop means, means mounting the stop means on the frame adjacent to the stapling means and on the opposite side thereof from the receiving platform and for movement above and below the level of the receiving platform, means connecting the main shaft with the stop means to lower the same below platform level after the stapling means has stapled the book and started its upward return and to hold the stop means down for a duration to allow the book to pass thereover and thereafter to raise the stop means for each revolution of the main shaft, book ejecting means carried by at least one of the parts including the frame and the receiving platform to eject the stapled book beneath the head of the stapling means to said delivery means, and means connected with the main shaft to operate the

book ejecting means after said movable part of the stapling means head has lifted from the book.

2. A stapling machine as in claim 1 in which the book ejecting means includes lower movable feed roll, means mounting the movable feed roll below the receiving platform and for movement of its periphery above the level of the receiving platform, a cooperating feed roll mounted above the movable feed roll and the receiving platform, and the means for operating the stop means and the movable feed roll being cam means secured to the main shaft and connected with the movable feed roll mounting means and the stop means to operate the same, and means to continuously rotate at least one of the feed rolls.

3. A stapling machine as in claim 2 including a second feed roll means mounted on the frame forwardly of the stop means including at least one feed roll having its periphery level with the receiving platform, and means to rotate the said feed roll means.

4. A stapling machine for stapling a book of sheets comprising a frame including a pair of uprights spaced a distance to pass a book of sheets therebetween and having a top, a receiving platform mounted on the frame on one side of the pair of spaced uprights and below the top thereof, the receiving platform constituting the sole receiving means for the sheets, a main shaft mounted on the frame on a level below the receiving platform and crosswise relatively to the latter, a normally disengaged clutch for connection with the main shaft and operable when engaged to disengage upon one revolution of the main shaft, means to engage the clutch, an upper slide bar, means mounting the upper slide bar on the uprights for vertical movement and above the level of the receiving platform, at least one stapling means including a stapling head mounted on the uprights adjacent to the upper slide bar, means connecting the main shaft with the upper slide bar to reciprocate the latter and said stapling means up and down once for each rotation of the main shaft, stop means, means mounting the stop means on the frame adjacent to the stapling means and on the opposite side thereof from the receiving platform and for movement above and below the level of the receiving platform, means connecting the main shaft with the stop means to lower the same below platform level after the stapling means has stapled the book and started its upward return and to hold the stop means down for a duration to allow the book to pass thereover and thereafter to raise the stop means for each revolution of the main shaft, book ejecting means carried by at least one of the parts including the frame and the receiving platform to feed the stapled book beneath the head of the stapling means to the delivery means, and means to operate the book ejecting means after said stapling means head has lifted from the book.

5. A stapling machine as in claim 4 including a lower slide bar, means mounting the lower slide bar below the level of the receiving platform and for vertical movement, said stapling means including movable anvil means, means connected with the lower slide bar to operate the anvil means, and means connecting the lower slide bar with the main shaft to reciprocate the same up when the movable part of the stapling head is down and down, the reciprocation occurring once for each revolution of the main shaft.

6. A stapling machine as in claim 4 including forward sheet jogging means mounted below the receiving platform, the jogging means including pivoted jogging finger means having a back surface and a finger projecting above the receiving platform, means to oscillate the finger means including eccentic means engaging the back surface thereof, means to drive the eccentric means, a kicker solenoid connected with the finger means, and a switch operated from the main shaft in timed sequence and electrically connected with the solenoid.

7. A stapling machine as in claim 6 including feed roll means rotatably mounted on the frame forwardly of the stop means including at least one feed roll having its periphery level with the receiving platform, and means to rotate said feed roll means.

8. A stapling machine as in claim 4 including forward jogging means carried by and below the receiving platform, the jogging means including a pivoted jogging finger projecting above the receiving platform, a jogging motor, and means connecting the jogging motor with the jogging finger to oscillate the finger.

9. A stapling machine as in claim 8 in which the means connecting the jogging motor with the jogging finger is an eccentric pin engaging the back surface of the lever, means propelling the lever into contact with the eccentric, a solenoid connected with the pivoted jogging finger to pull the same forwardly, a switch connected with the solenoid, and means operated from the main shaft to close the switch after the stop means has been lowered below the level of the platform.

10. A stapling machine as in claim 9 including forward feed roll means mounted forwardly of the stop means including at least one feed roll with its periphery level with the receiving platform, and means to drive said feed roll means.

11. A stapling machine as in claim 9 in which the means connecting the jogging motor with the jogging finger is a rotating wheel projecting above the receiving platform, and the jogging motor driving the projecting portion of the wheel in a forward direction towards the stop means.

12. A stapling machine as in claim 8 in which the means connecting the jogging motor with the jogging finger is a wheel projecting above the receiving platform, an eccentric carried by the wheel and engaging the jogging finger, a pulley rearwardly of the wheel and extending above the receiving platform, a belt extending between the pulley and the wheel to form a forward sheet feeder, and the jogging motor driving the belt forwardly towards the stop means.

13. A stapling machine as in claim 4 in which the upper slide bar operating means includes an eccentric carried by the main shaft on each side of the uprights, and a connecting link between the eccentric and the upper slide bar.

14. A stapling machine as in claim 13 in which said stapling means includes an anvil mounted on the frame on a level with the receiving platform and having staple closing levers, a lower slide bar mounted on the frame below the level of the receiving platform and for vertical reciprocation, closing lever operating means connected with the lower slide bar and engaging the staple closing levers upon upward movement of the said slide bar, and operating means connecting the main shaft and the slide bar to reciprocate the latter.

15. A stapling machine as in claim 4 including sheet deflecting means mounted on the frame above the receiving platform, the sheet deflecting means including an upper and a lower pulley, the upper pulley being rearwardly of the lower pulley, belt means passing over the pulleys and providing an inclined rearward span between the pulleys, and connecting means to constantly rotate one of the pulleys for downward movement of the belt means on rearward span.

16. A stapling machine as in claim 4 in which the ejecting means includes a movable feed roll, means mounting the feed roll below the receiving platform and rearwardly of the stop means and for raising a portion thereof above the receiving platform, means to rotate the feed roll, a cooperating feed roll mounted in fixed position above the movable feed roll, and operating means connecting the main shaft with the movable feed roll to raise the same after the stop means has been lowered and thereafter lower the same.

17. A stapling machine as in claim 16 in which the operating means for the movable feed roll includes a cam secured to the main shaft and a connection between the cam and the movable feed roller, the connection includ-

ing a cam lever operated by the cam, a connecting link connected with the movable feed roll, and a spring means connection between the cam lever and the connecting link.

18. A stapling machine as in claim 16 including a forward book feed means including at least one feed roll forwardly of the stop means and level with the receiving platform, and means to rotate said feed roll.

19. A stapling machine as in claim 4 including means to adjust the position of the stop means, a U-shaped lever having arms and a bar connecting the arms, mounting means pivotally mounting the U-shaped lever at the ends

of the arms, and the stop means being engaged and operated by the bar of the U-shaped lever.

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