Dec. 27, 1966 W. HOLMS ETAL 3,294,394

SHEET HANDLING APPARATUS

Filed Aug. 25, 1964 3 Sheets-Sheet 1

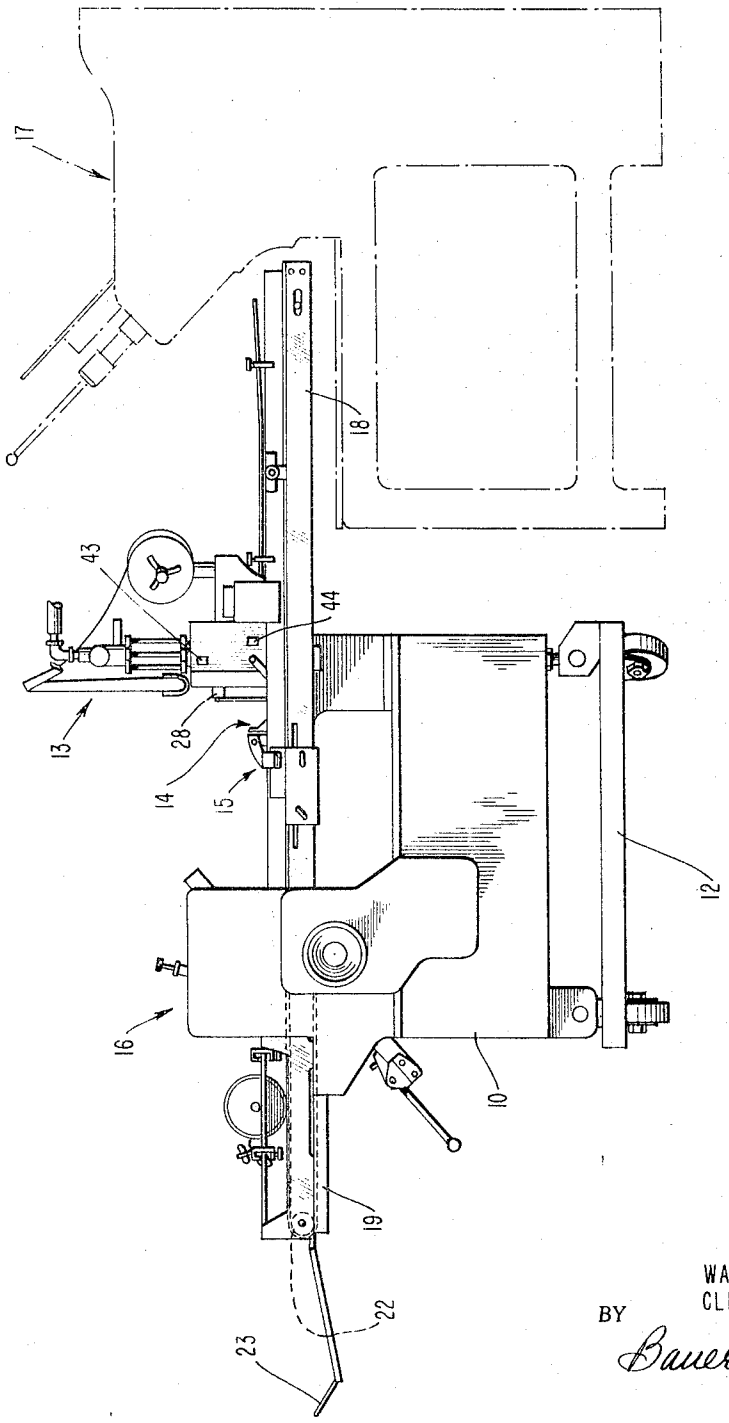


FIG. 1

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Filed Aug. 25, 1964 3 Sheets-Sheet 2

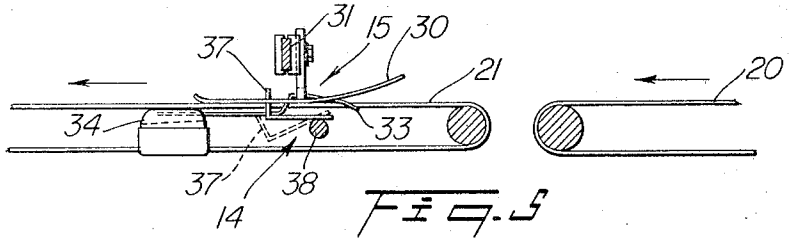


Fig. 5

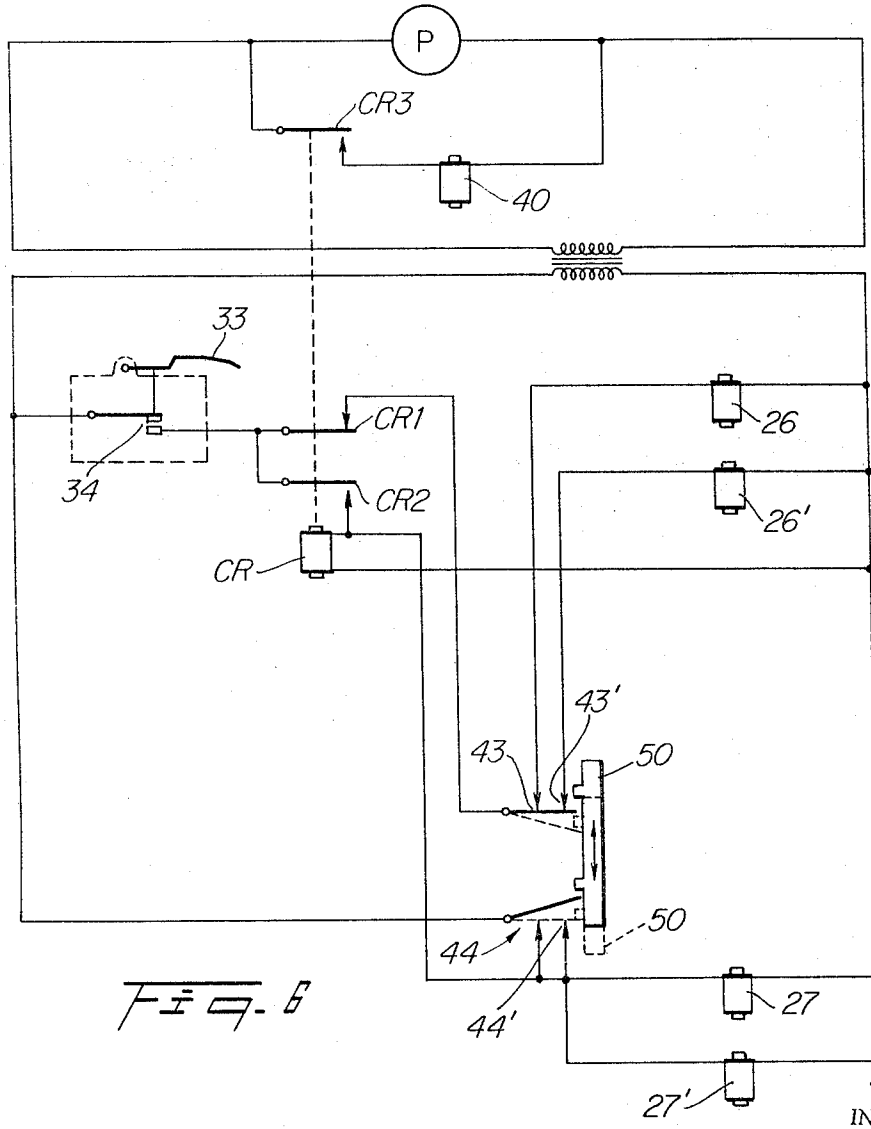


Fig. 6

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SHEET HANDLING APPARATUS

Filed Aug. 25, 1964 3 Sheets-Sheet 3

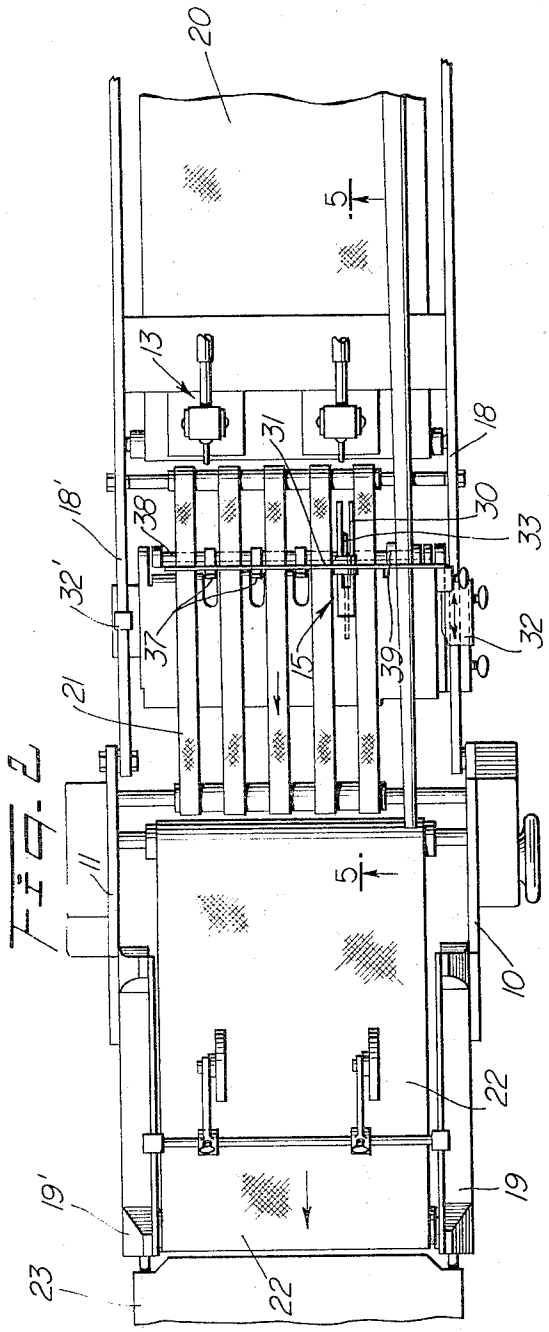


FIG. 2

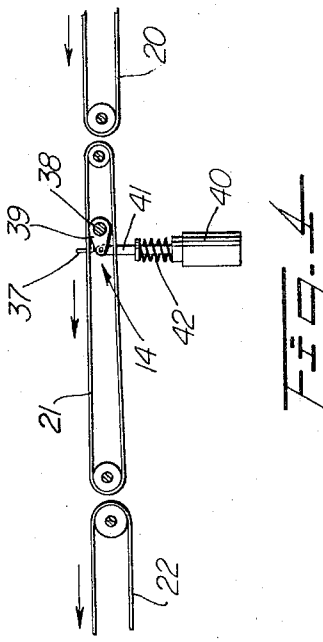


FIG. 4

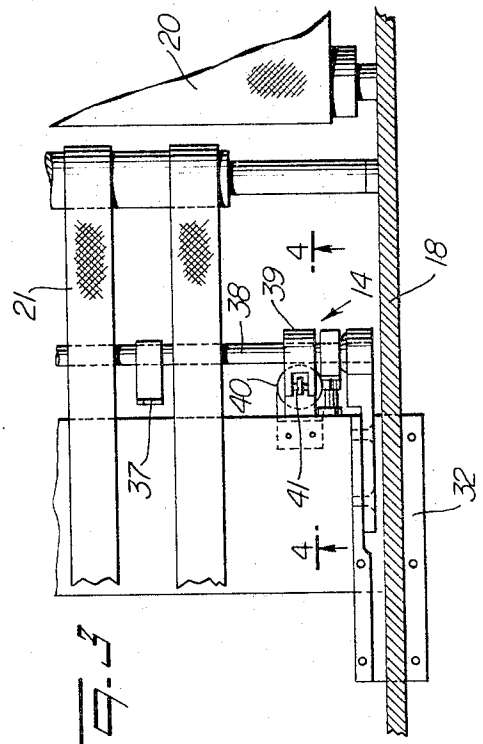


FIG. 3

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SHEET HANDLING APPARATUS

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10 Claims. (Cl. 270—37)

This invention is directed to a signature handling apparatus and more particularily to an apparatus for stapling a partially folded signature and folding the same at the stapled area.

An object of the invention is to provide an apparatus for automatically stapling together a plurality of signatures at a predetermined location on said signatures.

Another object of the invention is to provide an apparatus for stapling a partially folded signature and for thereafter folding said signature along the stapled area.

Another object of the invention is to provide an apparatus for utilizing the leading edge of a moving signature to actuate a means for applying stapling means to said signature.

Another object of the invention is to provide means in a signature stapling apparatus for assuring a single operation of the stapling means for each signature.

A still further object of the invention is to provide a signature handling apparatus which will staple a partially folded signature and which will sequentially fold the signature along the stapled area without the necessity of synchronizing the operation of the folding means and the stapling means.

The above and further objects and novel features of the invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

FIG. 1 is a side elevational view showing the general arrangement of the various parts of the apparatus;

FIG. 2 is a top plan view of the apparatus on FIG. 1 without the buckle folders;

FIG. 3 is an enlarged fragmentary top plan view showing in greater detail the signature stop mechanism;

FIG. 4 is a side elevational view of the actuating means for the signature stop mechanism taken along line 4—4 of FIG. 3;

FIG. 5 is a side elevational view of the signature detecting mechanism taken along line 5—5 of FIG. 1; and

FIG. 6 is a schematic wiring diagram.

Turning now to the drawings and particularly to FIGS. 1, 2 and 5, the apparatus comprises a pair of spaced apart frame members 10 and 11 secured to a base member 12 which may be mounted on rollers or be made stationary. Secured between the frame members 10 and 11 are a stapling mechanism 13, a sheet stopping mechanism 14, a sheet detecting mechanism 15 and a conventional buckle-type folder 16. The frame members 10 and 11 have frame extensions 18, 18' and 19, 19' at each side thereof. An endless belt 20 is operatively secured between the frame extensions 18 and 18' and extends from the outer end of the frame extensions to a position adjacent the stapling mechanism. The outer end of the frame extension 18, 18' and of the endless belt 20 is positioned adjacent the discharge end of a conventional buckle-type folder 17 which is secured to its own frame so that partially folded signatures are conveyed from folder 17 to the stapling mechanism. A plurality of endless tapes 21 are operatively secured between the frame members 10, 18 and 11, 18' and have one end positioned adjacent the end of belt 20 and the other adjacent the folder 16. There is a space between the end of belt 20 and the end of tapes 21 for the positioning and operation of the stapling mechanism. The belt 20 and the tapes 21 operate at the same lineal speed for conveying signatures from the folder 17 past the stapling mechanism and into the folder 16. An endless belt 22 is operatively secured between the frame extensions 19 and 19' for conveying the folded signatures from the folder 16 to a signature stacking mechanism 23. The stapling mechanism 13 is a commercially available air actuated wire stitching unit such as made by Acme Steel Company, Chicago, Illinois, Model L. In such a stapler a solenoid actuated air valve 26 controls the compressed air to cause the stitcher head to move downwardly and to drive a wire staple through the signature. A solenoid actuated air valve 27 directs compressed air into the mechanism to cause the stitcher head to move upwardly away from the signature to its uppermost position in preparation for another cycle of operation. The stitcher mechanism 13 is slidably mounted on a suitable frame 28 which extends between the frame members 18 and 18'. Conventional locking mechanism (not shown) such as wing nuts may be used to secure the stitcher head at any desired position between frame members 18 and 18'. It is to be understood that more than one stapling mechanism 13 may be mounted on the frame 28. When a plurality of stapling mechanisms are used, they are operated simultaneously whereby a plurality of staples may be driven into the signature in a line at right angles to the path of movement of the signature. It is also to be understood that signatures may be fed onto the end of endless belt 20 from a pile of signatures by any conventional signature feeding means as well as directly from the conventional folding apparatus 17.

As each of the signatures is moved along the belt 20 and the endless tapes 21, it is necessary to momentarily stop each of the signatures at a predetermined position and to simultaneously actuate the stapling mechanism. The signature stop mechanism 14 and the signature detecting mechanism 15 are more clearly shown in FIGS. 3, 4 and 5. The sheet stop mechanism 14 comprises a plurality of L-shaped fingers 37, each of which is secured at one end to a shaft 38. The shaft 38 has its ends mounted in suitable bearings in brackets 32, 32' which in turn are slidably mounted over the upper edges of frame members 18 and 18'. An operating lever 39 is secured to one end of shaft 38. The lever 39 is in turn connected to a spring-loaded electromagnet 40 having an operating shaft 41 which is normally retained in an extended position as shown in FIG. 4 whereby the stop fingers 37 are retained in operating position in the path of movement of a signature along the tapes 21. When the stop fingers 37 are in operative position to stop a signature, the tapes 21 and belt 20 frictionally slide under the stopped signature. When the electromagnet 40 is energized the shaft 41 is moved downwardly against the pressure of spring 42 thus rotating shaft 38 and the fingers 37 in a counterclockwise direction as viewed in FIGS. 4 and 5. The signature is thus released for movement by the tapes 21 into the folder 16. The sheet detecting mechanism comprises a bifurcated and arcuately shaped signature hold-down member 30 which is held above and spaced from the endless tapes 21 by a transverse member 31 extending between brackets 32, 32'. An inverted U-shaped finger member 33 has one end secured to a microswitch 34 secured by suitable means to brackets 32, 32' and is positioned to extend through the bifurcated portion of the hold-down member 30 as shown in FIGS. 2 and 5. The outer end of finger 33 extends below the plane surface of the tapes 21. Thus, the leading edge of a signature traveling on the tapes 21 will depress finger 33 below the plane surface of said tapes. The

switch 34 is of the type which is normally open when the finger member 33 is in its uppermost position. When the finger member 33 is depressed by the advancing signature the switch is closed and remains closed until the entire signature has passed over it. Since the stop fingers 37 and the sheet detecting means are mounted to brackets 32, 32', it is possible to selectively locate these units at various distances from the stapling means thus controlling the location of the staples in each fed signature.

Switches 43 and 44 are secured to the stapling means and are positioned adjacent the path of movement of the stitcher head of the stapling mechanism 13. Switch 43 is positioned at the upper end of the path of movement of the stitcher head and switch 44 is positioned adjacent the lowest end of the path of movement. Suitable means 50 movable with the stitcher head actuates switch 43 as the stitcher head leaves and returns to its uppermost position and actuates switch 44 as the stitcher head moves into and out of stapling position relative to a signature being stapled. Switch 43 is held closed when the stitcher head is in its uppermost position and is opened as the stitcher head moves downward. Switch 44 is normally open and is closed when the stitcher head reaches stapling position relative to a signature. As shown in the wiring diagram in FIG. 6, electrical current from a power source P enters the control circuit through a transformer. When the normally open micro switch 34 is closed in response to a signature depressing the finger 33, current will flow through the normally closed contact CR–1 of the control relay CR and through the held closed switch 43 adjacent the stitcher head to energize the solenoid actuated air valve 26 whereby the stitcher head is driven by air pressure downwardly toward the stopped signature. As the stitcher head moves downward it opens the normally closed switch 43. As the stitcher head reaches its stapling position with the signature, it closes the normally open switch 44. The closing of switch 44 simultaneously performs two functions. First, it supplies current to the solenoid actuated air valve 27 thereby causing the stitcher head to move to its uppermost position. Secondly, it energizes the control relay CR. The energizing of CR causes the normally closed contact CR–1 to open and normally open contacts CR–2 and CR–3 to close. As soon as the stitcher head leaves its operating position adjacent the signature, switch 44 is automatically opened. The control relay CR, however, will remain energized by current flowing through the closed switch 34 and the previously closed contact CR–2. As long as the control relay CR remains energized the contact CR–1 remains open and the solenoid operated air valve 26 which drives the stitcher downwardly cannot be energized. Therefore, the stitcher head does not repeat its cycle of operation even though the upward movement of the stitcher head to its uppermost and starting position closes switch 43. When the control relay CR is energized the contact CR–3 is closed thus energizing the electromagnet 40 for causing the stop fingers 37 to be rotated out of the path of the signature thus releasing the signature for movement along the tapes 21. As soon as the trailing end of the signature passes the finger 33 of the sheet detecting mechanism, the finger is released for its upward movement thus opening the switch 34. When the switch 34 is opened, the control relay CR is deenergized and the contacts CR–2 and CR–3 are opened and the contact CR–1 is closed. Thus, the circuit is reset for another cycle of operation and the stop fingers 37 are automatically moved by spring 42 into the path of the signatures on tapes 21. The next cycle occurs as soon as the leading edges of the following sheet depresses the finger 33 and closes switch 34.

After a signature has been stapled, it is fed into the single folder 16 which is of the conventional buckle type. The stop means of said buckle folder is set to fold the signature along the stapled area. The stapled and folded signatures are then fed onto belt 22 which desposits them into the signature stacking means 23. When more than one stapling means is used the control valves and switches are connected in parallel relationship with the corresponding valves and switches as shown in the schematic wiring diagram.

The operation of the apparatus constructed in accordance with the present invention will be clearly understood from the foregoing description, and while said description and the accompanying drawings set forth more or less particularly one embodiment of the invention, it is to be expressly understood that said invention is not limited to said embodiment. Various changes may be made therein, particularly in the design and arrangement of the parts illustrated, as well as in the mode of operation and manner of use, without departing from the spirit and scope of the invention, as will now be clear to those skilled in the art.

What is claimed is:

1. In a signature handling apparatus the combination of a first signature folding means, a second signature folding means spaced from said first folding means, continuously operating means to convey signatures in a predetermined path between said first and second folding means, signature stop means adjacent said path and normally operatively positioned in said path to stop a signature, means to selectively move said signature stop means out of said path, signature detecting means positioned in said path and actuated by the passage of a signature toward said stop means, signature fastening means operatively positioned adjacent said path, means activatable in response to said detecting means upon passage of a signature to move said signature fastening means into fastening position relative to a stopped signature, and means responsive to movement of said fastening means into signature fastening position to return the latter to its non-fastening position and to activiate said means to move the stop means out of said path whereby the fastened signature is released by said stop means to be fed into said second folding means.

2. A signature handling apparatus as defined in claim 1 wherein said means to move the stop means is automatically deactivated by said detecting means to permit return of the stop means to normal operative position when the fastened signature has passed said detecting means.

3. In a signature handling apparatus the combination of a continuously operating means for conveying signatures in a predetermined path, means to sequentially feed signatures into said path, signature folding means for receiving signatures from said conveying means, signature stop means normally positioned in said path for stopping a signature at a selected location in said path, means to move said stop means out of said path, signature detecting means positioned at a predetermined location adjacent said path and actuated by the presence of any portion of a signature at said last-named location, signature fastening means operatively positioned adjacent said path, means to move said fastening means in a cycle from a starting position into fastening position relative to a signature and back to said starting position, and means responsive to movement of the signature fastening means into fastening position to activate said stop means, moving means whereby the fastened signature is released by said stop means to be fed into said folding means.

4. In a signature handling apparatus the combination of continuously operating means for conveying signatures in a predetermined path, means to sequentially feed signatures into said conveying means, signature folding means for receiving signatures from said conveying means, signature stop means normally positioned in said path for stopping a signature at a selected location in said path, means to move said stop means out of said path, signature detecting means positioned at a predetermined location adjacent said path and actuated by the presence of any portion of a signature at said last-named location, signature fastening means operatively positioned adjacent

said path, first means to move said fastening means from a first position into a second position in operative engagement with a signature, second means to move said fastening means to said first position from said second position, means responsive to said detecting means to activate said first means to move the fastening means, means responsive to the movement of said fastening means into said second position to activate said second means to move the fastening means to said first position and to simultaneously activate said means to move said signature stop means out of said path, and means responsive to the movement of the fastening means to to deactiviate said first means to move the fastening means to to prevent the reactivation thereof while the signature remains in operative relation with the detecting means.

5. In a signature handling means as defined in claim 4 comprising means operative to return said signature stop means to said operative position in said signature path when the signature is moved by the conveying means out of operative relation with the detecting means.

6. In a signature handling apparatus the combination of a continuously operating means for conveying signatures in a predetermined path, means to sequentially feed signatures onto said conveying means, signature folding means for receiving signatures from said conveying means, signature stop means normally positioned in said path for stopping a signature at a selected location, a solenoid means for moving said stop means out of said path, signature detecting means positioned at a predetermined location adjacent said path and movable by the presence of any portion of said signature at said last-named location, a normally open switch means operable to be closed by said movement of said detecting means, signature fastening means operatively positioned adjacent said path, a first solenoid for controlling the movement of said fastening means into contact with a signature, a second solenoid for controlling the movement of the fastening means away from the fastened signature, a first switch normally closed and positioned adjacent said fastening means and being opened when the latter is moved toward a signature, a second switch normally open and positioned adjacent said fastening means and being closed when the latter is moved into contact with a signature, and circuit means for connecting said switches and said solenoids.

7. In a signature handling apparatus as defined in claim 6 wherein said circuit means comprises a source of power, a first circuit comprising a series connection of said switch means a normally closed contact of a control relay, said first switch, and said first solenoid, a second circuit comprising a series connection of said switch means, a first normally open contact off said control relay, and said control relay, a third circuit comprising a series connection of said second switch and said second solenoid, and wherein said second switch is also connected in series with said control relay of said second circuit, and a fourth circuit comprising a series connection of a second normally open contact of said control relay and said solenoid means for moving the stop means.

8. In a signature handling apparatus the combination of means to feed a signature in a predetermined path, movable stop means normally positioned in said path, means to move said stop means into said path, means to move said stop means out of said path, signature detecting means positioned at a predetermined location in said path and actuated by a signature passing said location, signature fastening means operatively positioned adjacent said path, first means to move said fastening means toward a signature in said path and into fastening position relative to said signature, second means to move said fastening means away from said fastening position, means responsive to the actuation of said detecting means to activate said first means, means responsive to the movement of said fastening means into fastening position to activate said second means and to activate said means to move said stop means out of said path, and means responsive to the operation of said fastening means to deactivate said first means and to prevent reactivation thereof while the signature is in operative relation with the detecting means.

9. In a signature handling apparatus the combination of means to feed a signature in a predetermined path, signature stop means, means for retaining said stop means in said path, means to selectively move said stop means out of said path, signature detecting means positioned at a predetermined location in said path and being actuated by a signature passing said location, signature fastening means, first means to move said fastening means from a position adjacent said path to an operative fastening position relative to said signature, second means to move said fastening means away from said signature, means responsive to the actuation of said detecting means to activate said first means, means responsive to the movement of said fastening means into fastening position to activate said second means and to simultaneously activate the means to move said stop means out of said path, and means responsive to the operation of said fastening means to prevent the further activation of said first means.

10. In a signature handling apparatus the combination of means to successively feed signatures in a predetermined path, stop means pivotally mounted adjacent said path, means for normally maintaining said stop means in said path, means for moving said stop means out of said path, signature detecting means operatively positioned at a predetermined location in said path and actuated by the presence of any portion of a signature at said location in said path, signature fastener means positioned adjacent said path, first means to move said fastener means from a first position to a second position to fasten a signature, second means to move said fastener means from said second position to said first position, means responsive to the actuation of said detecting means to activate the first means, and means responsive to movement of said fastener means toward said second position to activate said second means, said means for moving the stop means out of said path and means to block the activation of said first means.

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