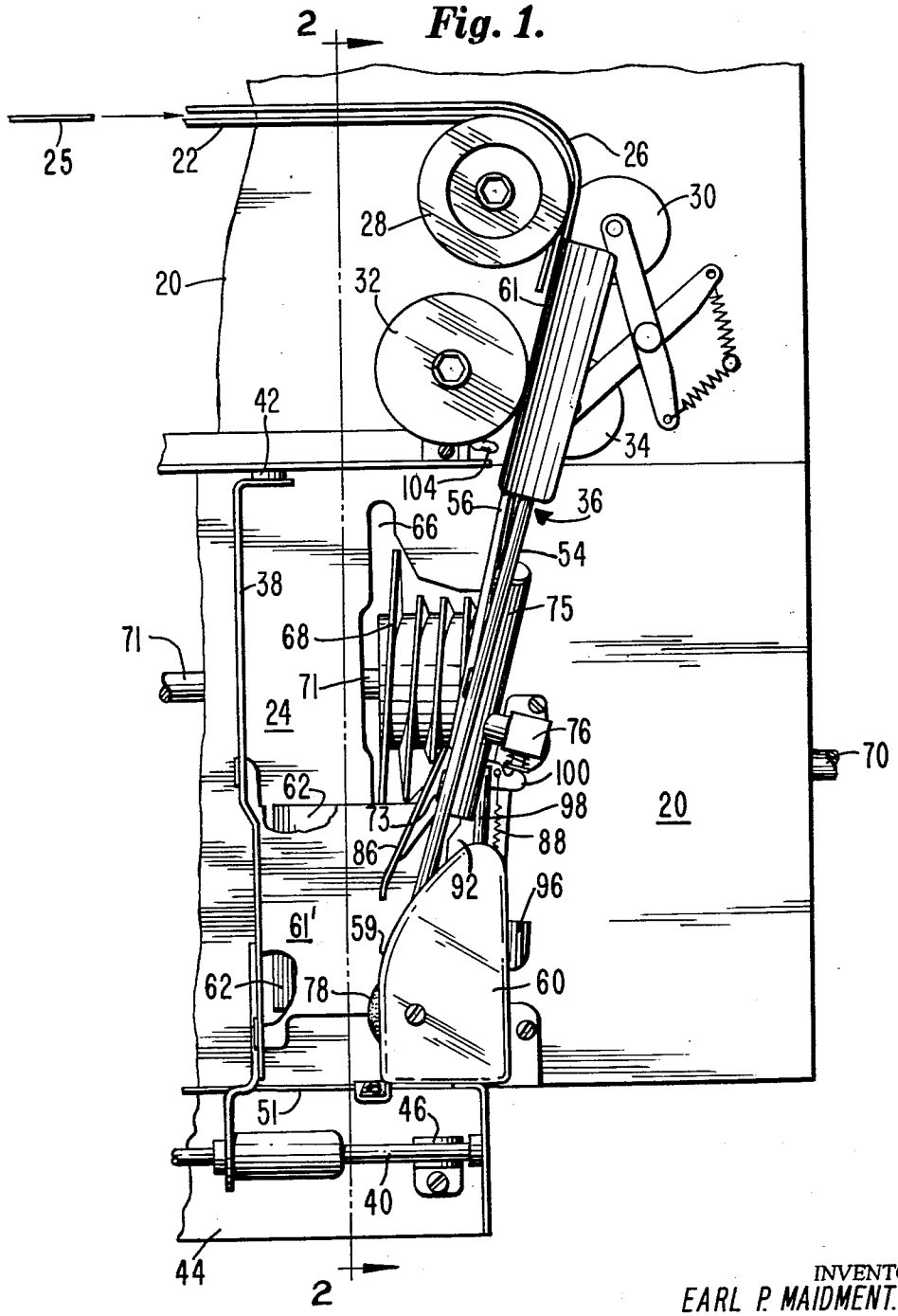
May 5, 1964 E. P. MAIDMENT 3,131,932

DOCUMENT STACKING DEVICE

Filed June 18, 1962 3 Sheets-Sheet 1

Fig. 1.



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DOCUMENT STACKING DEVICE

Filed June 18, 1962 3 Sheets-Sheet 2

Fig. 2.

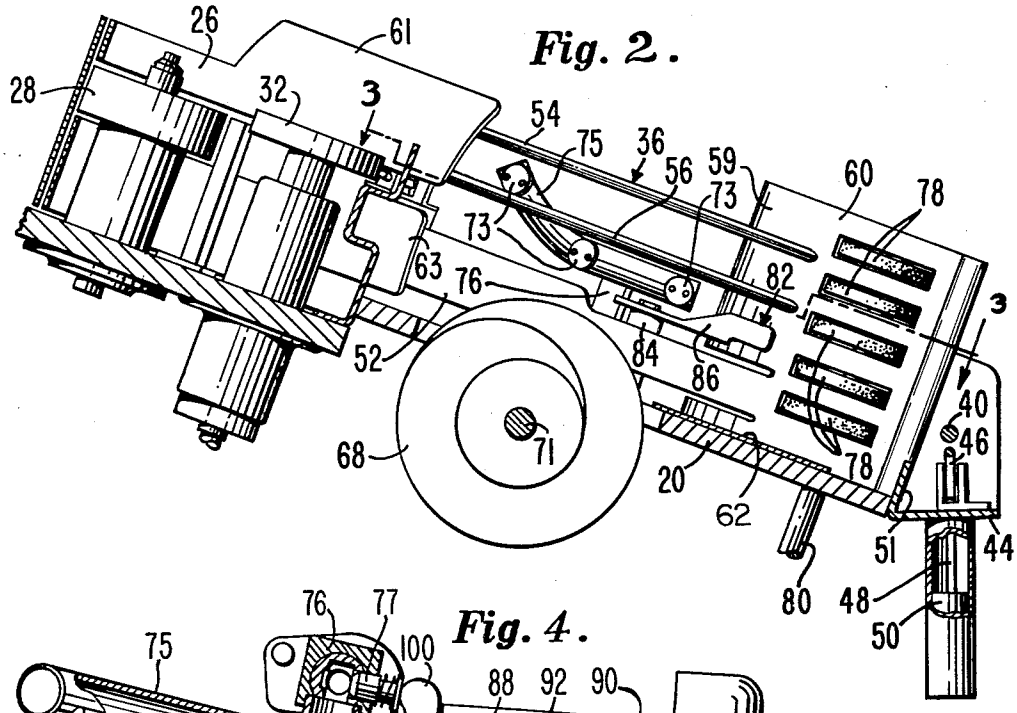


Fig. 4.

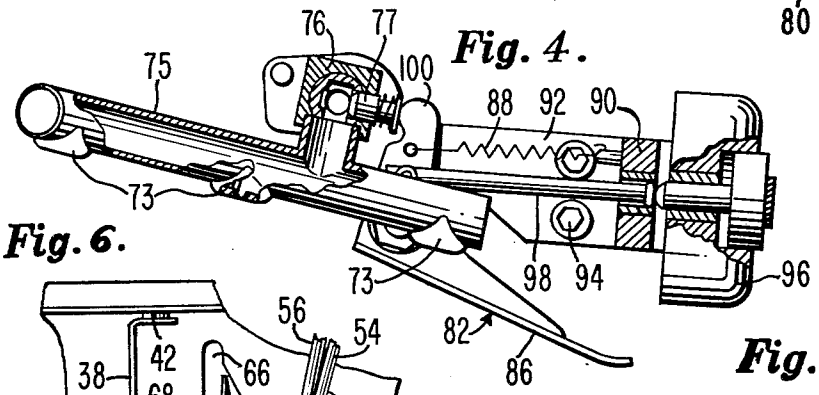


Fig. 6.

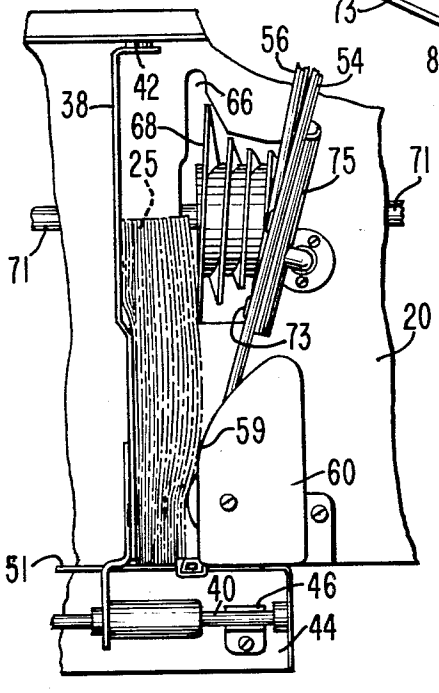
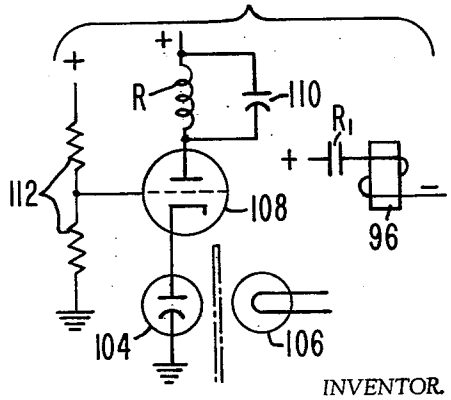


Fig. 5.



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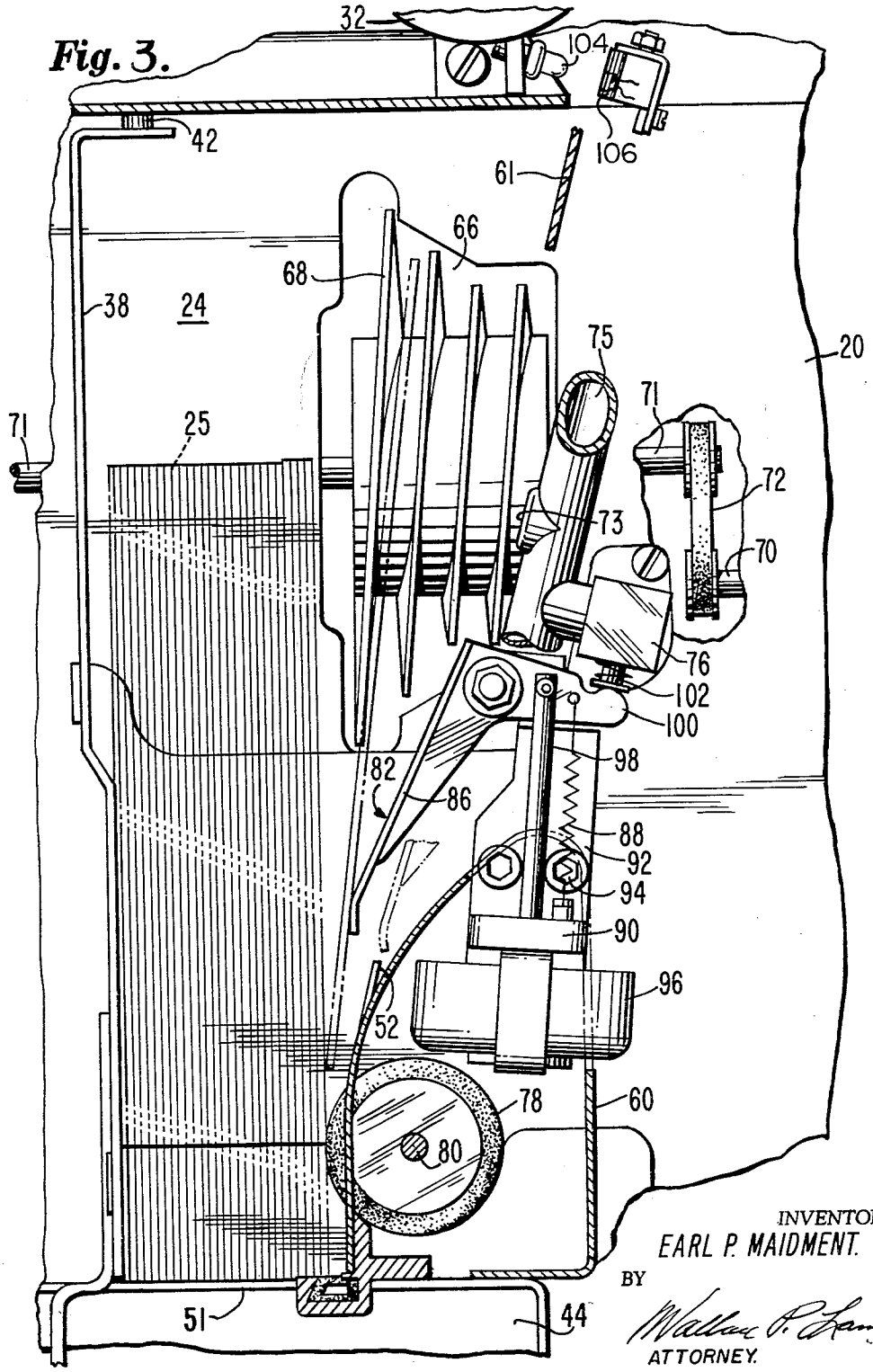
DOCUMENT STACKING DEVICE

Filed June 18, 1962 3 Sheets-Sheet 3

Fig. 3.



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United States Patent Office

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3,131,932

DOCUMENT STACKING DEVICE

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Filed June 18, 1962, Ser. No. 203,298
4 Claims. (Cl. 271—87)

This invention relates generally to sheet handling apparatus and particularly to check stacking apparatus.

It is an object of the invention to provide for a high speed sheet handling apparatus, an improved sheet stacking apparatus which will stack sheets on edge with little or no danger of the occurrence of sheet jams.

Another object of the invention resides in the elimination of stack bulge that tended to create sheet jams.

Another object of the invention is to provide for a sheet stacking device having an air jet to urge the trailing end of a sheet toward the stack, a control system for the air jet responsive to the approach of a sheet so as to insure that the air is applied only to a trailing end portion of the sheet.

Specifically, it is an object of the invention to provide a sheet striker located substantially at the apex formed by the last sheet of the stack and a sheet guideway so as to overcome a tendency of the sheets to bulge and to operate the striker in response to the approach of a sheet.

Other objects of the invention will become apparent from the following description, taken in connection with the accompanying drawings in which:

FIG. 1 is a plan view of sheet stacking apparatus embodying features of the invention;

FIG. 2 is a vertical cross sectional view, taken along the line 2—2 of FIG. 1;

FIG. 3 is an enlarged fragmentary plan view, taken substantially along the line 3—3 of FIG. 2;

FIG. 4 is an enlarged plan view of certain parts shown removed from the stacker and partly in section;

FIG. 5 is a diagrammatic illustration of a control system for certain operating components of the sheet stacking device; and

FIG. 6 is a view similar to FIG. 3 illustrating a check stacking problem caused by stack bulge and overcome by the present invention.

For purposes of illustrating the invention, the drawings show a portion of a document sorter which includes a supporting structure having an elongated bed 20 that is inclined downwardly at one side of the structure. Mounted on the bed 20 and extending longitudinally thereof is a document raceway 22 along which documents, such as bank checks, are transported on edge and at high speed by suitable feed means, such as a belt (not shown). Extending laterally and downwardly from the raceway 22 there is shown one of a number of bins 24 wherein checks, as at 25, received from the raceway 22 are stacked on edge. For a more complete understanding of the document sorter, reference may be had to the patents of Felice V. Palasciano, No. 3,022,907, issued February 27, 1962, John W. Smith, No. 2,970,836, issued February 7, 1961, and No. 2,944,813, issued July 12 1960.

In communication with the raceway 22 a curved guide member 26 guides a check into the bight of a pair of feed rollers 28 and 30 which in turn feed the check downwardly to the bight of a second pair of feed rollers 32 and 34 that are located near the upper end or entrance to the bin 24.

The bin 24 has a stationary side structure and guide for checks entering the bin, the structure being designated generally by the numeral 36. The bin 24 also includes a laterally movable side or stack back-up plate 38. As shown in FIG. 2, the guide 36 is substantially aligned with the bights of the pairs of rollers 28, 30 and 32, 34

to define a path of travel of checks along a line disposed at an acute angle to the back-up plate 38. Preferably, the back-up plate 38 is normal to the raceway 22 and is movable broadside toward and away from the guide structure 36, the back-up plate being slidably supported at one end thereof on a shaft 40 and at the other end by a roller 42. A sheet metal bracket 44 supports the shaft 40 and also a pulley 46 for a weight member 50 that is attached by a cord 48 to the movable back-up plate 38. It will be apparent that as the check stack increases in number of checks, the back-up plate 38 is moved by the check stacking action to expand the bin capacity against the action of the weight 50 acting to return the back-up plate to the empty bin position. An upturned flange 51 of the bracket 44 extends along the lower side edge of the bed 20 to retain the checks and thus defines the bottom wall of bin 24.

As shown more clearly in FIG. 2, the guide structure 36 may comprise a lower rail 52, an upper rail 54, and an intermediate rail 56. The intermediate rail 56 and upper rail 54 may be secured at their upper ends by a suitable bracket (not shown) to the bed 20 and at their lower ends to the curved wall 59 of a housing 60 that is formed integral with bracket 44 and partly forms the check guide member or structure 36. The lower guide rail 52 is preferably formed of sheet metal having a leg or base 62 above bed plate 20 to overlap a similar base flange 61' on the backing plate 38, as shown in FIG. 1. The rail 52 extends upwardly from the base 62 in the form of a flange which is formed with a twist as shown to cause a check guided therealong to assume a slight twist the purpose of which is to give added rigidity to the thin flexible sheet. At the feed rollers 32 and 34, upper and lower transversely curved guide plates 61 and 63 respectively overlie the guide structure 36 and cooperate with structure 36 to curve and twist the checks to impart added rigidity thereto.

In the bed 20, within the bin 24, a clearance opening 66 is provided for a worm feed screw 68 that rotates about an axis transverse to the direction of travel of checks entering the bin. The purpose of the feed screw 68 is to move the trailing end of each check over toward the back-up plate 38 in sufficient time to assure that the leading edge of the next check positions behind the preceding check. Any suitable electric motor (not shown) may be provided to drive the feed screw 68 through a suitable belt and pulley drive connection 72 between the motor shaft 70 and a driven shaft 71 onto which the feed screw is fixed for rotation therewith. The worm screw 68 is rotated in a direction counter to the direction of travel of the checks entering the bin 24 or counterclockwise as seen in FIG. 2, the thread of the screw being a left hand thread to move the check laterally toward the back-up plate 38. Consequently, in addition to moving the trailing end of a check away from the guide 36, the worm 68 also functions to decrease the speed of travel of the check.

Positioned between the guide rails 52 and 56 are air nozzles 73 arranged to direct air jets to blow a trailing end portion of each check broadside into threaded engagement with the feed screw 68. In the present construction there are three of the nozzles 73 on a head 75 which is connected to a valve body 76 which in turn is connected to a suitable source of compressed air. A normally open valve member 77 in the valve body 76 is operable to interrupt flow of air to the air jets 73.

Within the housing 60 there is a plurality of vertically spaced friction drive rollers 78 that project through clearance slots in housing wall 59 to engage and feed each check toward the bottom of the check bin. The friction rollers 78 are fixed onto a common shaft 80 for rotation together, the shaft being driven by any suitable drive

means in a counterclockwise direction, as viewed in FIG. 3. The rollers **78** are preferably made of a material having a high coefficient of friction, such as rubber or rubberized material to grip the checks. Also, the rollers **78** are rotated at a rate such that their surface or peripheral speed is considerably less than the speed of the checks whereby the roller peripheries function as a friction brake to reduce the speed of the checks as well as assure their full travel to the end **51** of the bin.

I have found that as the number of checks in the bin **24** stack increases, a correspondingly increasing bulge in the check stack develops and eventually prevents travel of checks down to the feed rollers **78** and thus to the bin end wall **51**. The stack bulge is toward the stationary side of the bin and a pressure area is created in the region of the rollers **78** and curved wall **59** where surface friction between the bulging last check stacked and the next check creates the problem, as illustrated in FIG. 6. To overcome this condition, I provide a striker member **82** which is adapted to give the stack a sharp blow each time a check is injected into the bin, the blow being struck where the bulge tends to develop so as to prevent the development of the bulge to the point where the above mentioned difficulty arises.

The striker member **82** is positioned along the check guide structure **36** between the feed screw **68** and the feed rollers **78**, the striker member being pivotally mounted on the upper end of a tubular spacer member **84** which is mounted on and suitably secured to the bed plate **20**. An arm **86** of the striker member **82** extends from its pivot generally in the direction of travel of the checks, and normally projects into the path of check travel, as shown. A thrust member or helical coil spring **88** is the actuator of the striker member **82**, the spring being under tension and normally holding the striker member with striker arm **86** in the path of check travel. One end of the spring **88** is anchored to the upright leg **90** of a bracket which has its horizontal leg **92** fixed securely to the bed plate **20** by screws **94**. Also mounted on the upright leg **90** of the bracket there is a solenoid **96** the armature of which is connected by a connecting rod **98** to an arm **100** of the striker member **82**. To the arm **100** is also connected the stem **102** of the normally open air controlling valve member **77**. The solenoid **96** is energized in response to the approach of a check to the entrance to the bin **24**, the solenoid being electrically connected to a photoelectric cell **104** which normally receives light from the usual electric lamp **106**. As shown in FIG. 3, the cell **104** and lamp **106** are mounted on the bed plate on opposite sides of the entrance to the bin such that passing checks will block the light from the cell for a short interval.

With reference particularly to FIG. 5, the circuit of the cell **104** is a well known circuit utilizing a triode **108** having its cathode connected to ground through the cell and its anode or plate connected to a suitable potential by a conductor containing a relay coil R with a parallel capacitor **110**. A potential divider **112** connected to a suitable biasing source provides for the proper potential on the triode grid so that the relay coil R will be energized, in the well known manner, when the light from lamp **106** is blocked by a check. The relay coil R has a pair of normally open contacts R1 in series circuit with the solenoid **96**. As a consequence, when a check enroute into the bin **24** blocks the light from the cell, the solenoid **96** is pulsed, or is energized for the interval required for the check to pass by the cell. This pulsing of the solenoid causes it to retract the striker member **82** out of the path of the approaching check, as illustrated in FIG. 3 by dot and dash lines, and then release the striker in time for the spring **88** to pivot the striker against the sheet. As previously mentioned, the striker member **82** imparts a blow to the stack which prevents the development of stack bulge, and urges the stack away from the rollers **78** to insure continued travel of the checks down to the end of the bin. At the same time that the striker member **82** is retracted, the solenoid **96** pushes the valve member **77** to closed position to discontinue flow of air from the air jets, the air flow being resumed when the striker is released. This action of the valve member **77** is timed such that the air streams are applied only to a trailing end portion of the check as it is only the trailing end portion of the check that is desired to be urged into feeding relationship with the feed screw **68**. That is, air flow from the jets is interrupted to prevent displacement of the leading edge of the check from its guideway **36**.

While I have shown and described the sheet stacking device in considerable detail, it will be appreciated that many variations of the device may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. In a sheet handling apparatus having means to feed a sheet on edge along a path of travel, a sheet stacking device comprising a stationary bin side wall defining a part of the path of travel and inlet to the bin, a bin end wall to limit travel of a sheet, a stack back-up member forming the other side of the bin and biased toward said stationary bin wall forming therewith an acute angle having its apex toward the bin end wall, an air jet positioned along said stationary wall to direct an air stream transversely to the path of sheet travel to urge a sheet toward said back-up member, a normally open valve member controlling said jet, a sheet striker member positioned along said stationary wall between said air jet and the bin end wall, said striker member movable to tamp the sheet stack, a power element operatively connected to and for actuating said striker member and said valve member, and a control member responsive to the passing of a sheet past a predetermined point enroute in the bin to activate said power element.

2. In a sheet handling apparatus having means to feed a sheet on edge along a path of travel, sheet stacking apparatus comprising a sheet guide member defining a part of the path of sheet travel and a stationary side of a bin having an end wall, a movable back-up member forming the other side of the bin and biased toward said guide member, said guide member and back-up member forming an acute angle therebetween with the apex toward said end wall, an air jet positioned along said guide member to direct a stream of air transversely of the path of travel toward said back-up member, a normally open electrically operated valve member controlling said air jet, a switch member positioned along the path of sheet travel anteriorly to said air jet and responsive to the passing of a sheet to close said valve member, and an electrically operated sheet striker member positioned along said guide member posteriorly to said air jet and controlled by said switch member.

3. In a sheet handling apparatus having means to feed a sheet on edge along a path of travel, a sheet stacking apparatus comprising a stationary sheet guide member defining a part of the path of sheet travel, said guide member forming one side of a bin and inlet thereto, means forming an end wall of the bin, a movable back-up member forming the other side of the bin and biased toward said guide member, said guide member and back-up member converging toward said end wall, an air jet positioned along said guide member and arranged to direct an air stream transversely of the path of sheet travel and closer to said end wall than to said inlet, a normally open valve member controlling said jet, a sheet striker member positioned along said guideway between said air jet and said end wall and operable to strike and urge a sheet toward said back-up member, an electrically operated actuator operatively connected to and for actuating said valve member and said striker member, and a switch member positioned at said inlet and controlling said actuator in response to the passage of a sheet past said switch member.

4. In a sheet handling apparatus having means to feed a sheet on edge along a path of travel, a sheet stacking apparatus comprising a stationary sheet guide member defining a part of the path of sheet travel, said guide member forming one side of a bin and inlet thereto, a movable back-up member forming the other side of the bin and biased toward said guide member, means forming an end wall of the bin, said guide member and said back-up member converging toward said end wall, an air jet positioned along said guide member and directing a stream of air transversely across said path of travel in a direction to urge a sheet toward said back-up member, a normally open valve member controlling said jet, a pivotal sheet striker positioned along said guide member posteriorly of said jet and normally projecting into the path of sheet travel, a thrust member normally holding said valve member and striker member in their normal

positions, an electrically operated actuator operatively connected to said striker member and said valve, said actuator operable when energized to close said valve member and retract said striker member from the path of sheet travel, and a switch member positioned along said path of sheet travel anteriorly to said jet, said switch member responsive to the passing of a check past a predetermined point to energize said electrically operated actuator.

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