

Feb. 19, 1963

E. P. MAIDMENT

3,078,089

DOCUMENT STACKING DEVICE

Filed April 5, 1961

3 Sheets-Sheet 1

Fig. 1.

20, 22, 24, 28, 30, 32, 34, 36, 38, 40, 42, 43, 44, 46, 48, 50, 52, 54, 56, 57, 59, 60, 62, 64, 65, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98

Fig. 8.

20, 38, 44, 48, 50, 52, 54, 56, 59, 60, 62, 64, 65, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98

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3 Sheets-Sheet 2

Fig. 6.

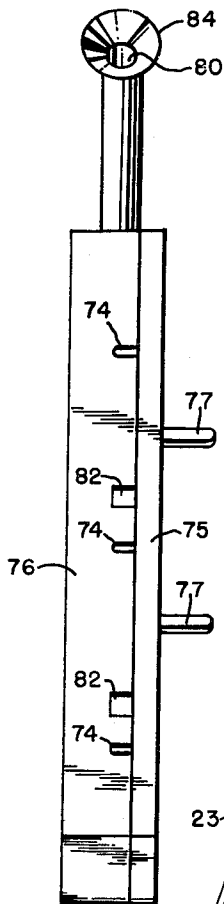


Fig. 9.

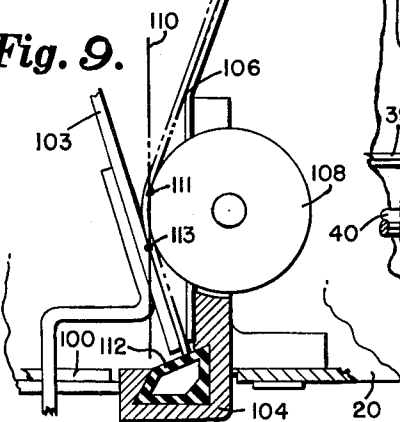
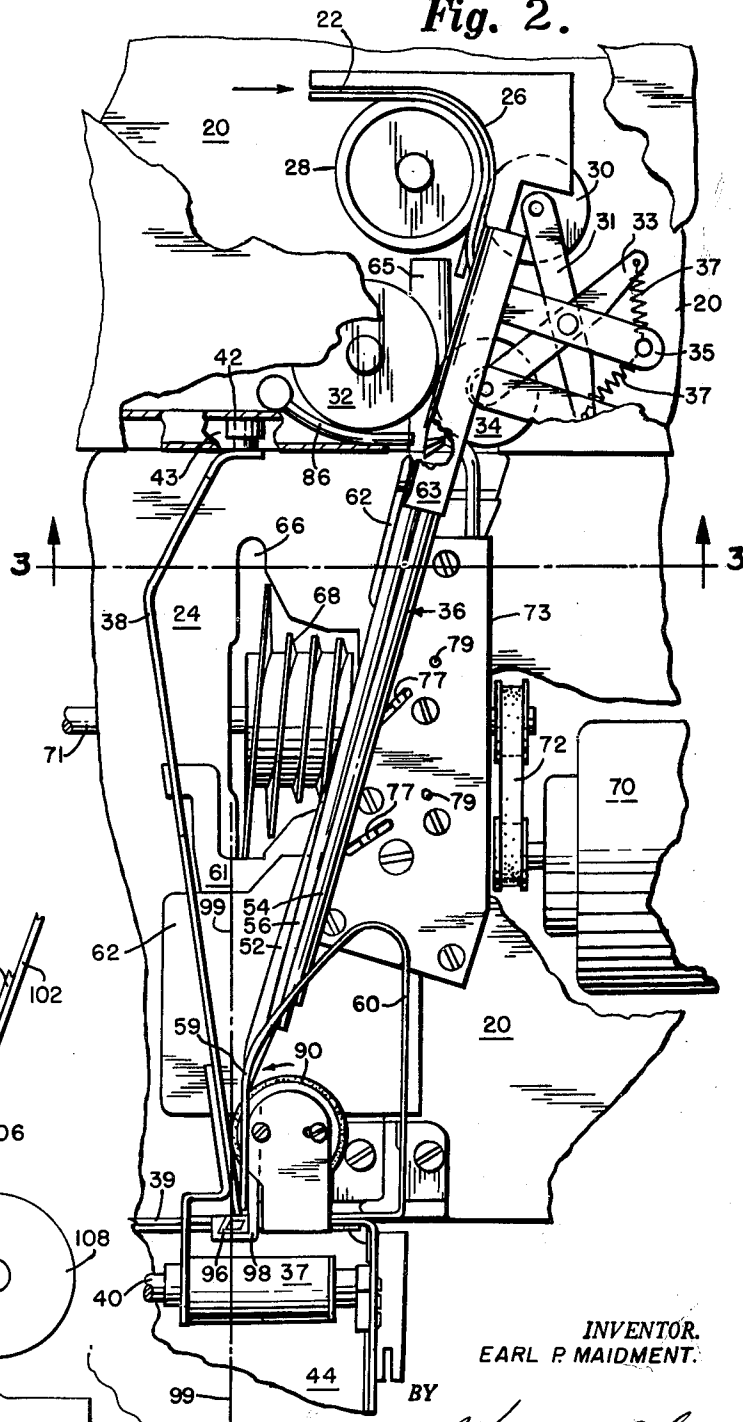


Fig. 2.



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3 Sheets-Sheet 3

Fig. 3.

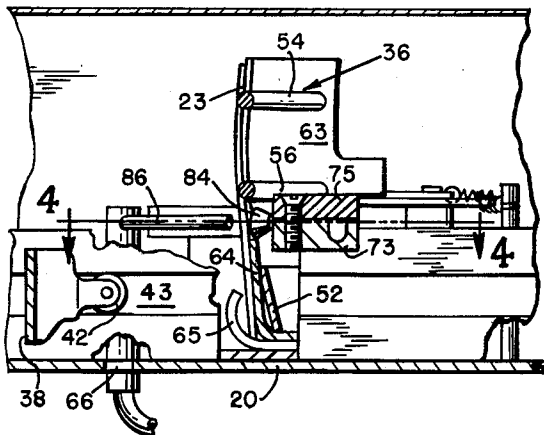


Fig. 7.

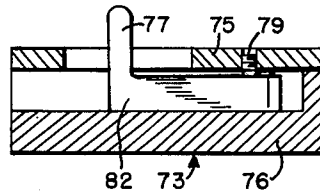


Fig. 4.

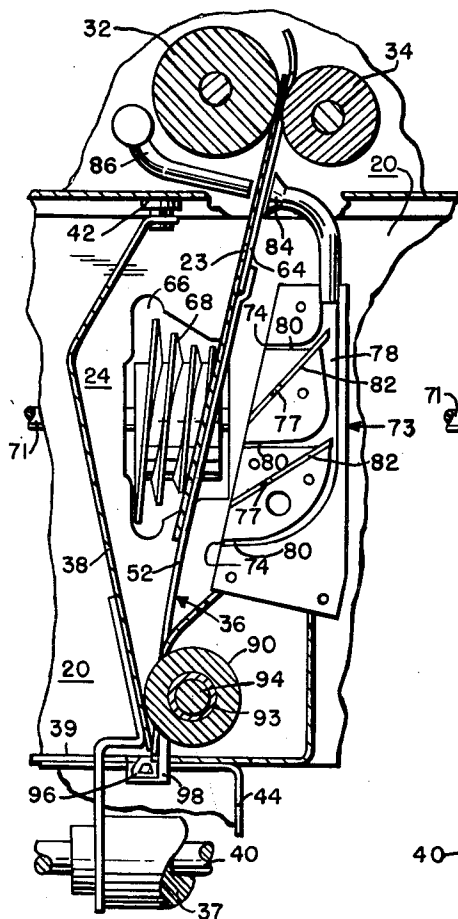
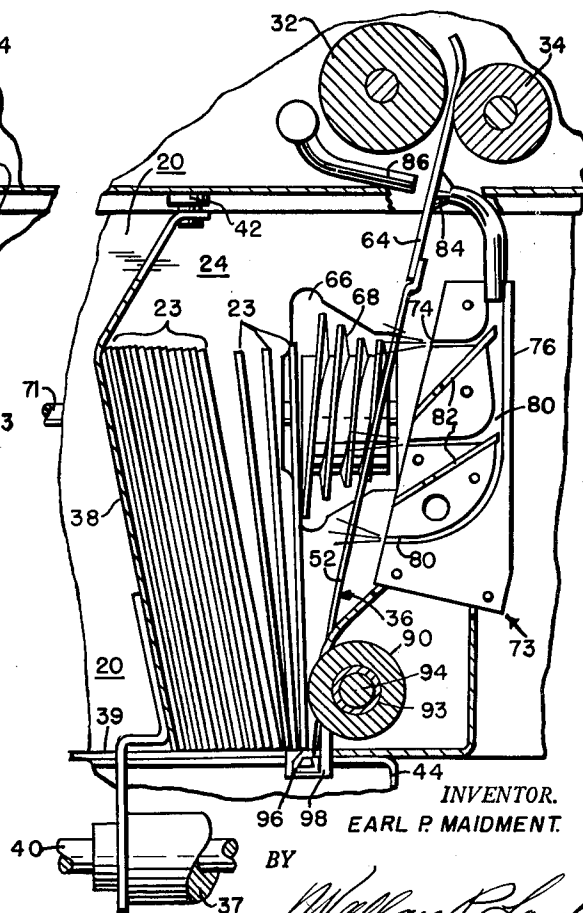


Fig. 5.



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3,078,089

DOCUMENT STACKING DEVICE

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10 Claims. (Cl. 271-71)

This invention relates generally to sheet handling apparatus and particularly to a sheet or check stacking device therefor.

It is an object of the invention to provide an improved sheet stacking device for receiving, decelerating and stacking thin sheets delivered thereto in free flight at high velocity.

Another object of the invention is to provide for a sheet stacking device having air jets to urge sheets into stacked relationship, an improved arrangement and control of the air jets to apply air to a sheet in timed relationship to the position of the sheet enroute in the stacking device and without need of valves, switches, or similar controls.

Another object of the invention is to provide for a sheet stacker of the above mentioned character, an improved tapered pocket construction formed in part by a movable, stack back-up plate that is inclined at an acute angle to an opposite side of the pocket to provide a tapering throat and tilted stack to facilitate stacking of the sheets.

In connection with the next preceding object, it is a further object of the invention to provide an improved stacker pocket construction in which the stacker back-up plate is inclined to support the stack in tilted relation to the pocket end wall and also one which directs or guides each sheet to a fulcrum about which the sheet is pivoted into stacked relationship.

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 perspective view of my sheet stacking device shown in association with a fragment of a sheet handling apparatus;

FIG. 2 is a fragmentary plan view;

FIG. 3 is a vertical sectional view, taken along the line 3-3 of FIG. 2;

FIG. 4 is a fragmentary horizontal sectional view of the stacker device illustrating the positions that the operating parts will assume prior to the feeding of sheets thereto;

FIG. 5 is a view similar to FIG. 4 and illustrating how sheets are stacked by said stacking device;

FIG. 6 is a side view of an air jet manifold shown removed from the sheet stacking device;

FIG. 7 is a cross sectional view of the manifold of FIG. 6;

FIG. 8 is a fragmentary plan view illustrating the position of a sheet in the device just prior to the stacking of the sheet, and

FIG. 9 is a view similar to FIG. 8 showing a modification.

For purposes of illustrating the invention, the drawings show a portion of a document or check sorter which includes a supporting structure having an elongated bed 20 that is preferably inclined downwardly at one side of the structure. Mounted on the bed 20 and extending longitudinally thereof is a check raceway 22 along which checks 23 are singly fed and transported on their side edges at high velocity by suitable feed means, such as a belt (not shown). Extending laterally and downwardly from the raceway 22 there is a check stacking device which includes a bin or pocket 24 into which the checks are singly fed from the raceway in free flight and at high velocity. It will be understood that the document or check sorter will normally include a number of the pockets

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24 laterally positioned along the lower side edge of the bed plate 20. For a more complete understanding of the document sorter reference may be had to the copending applications of John W. Smith, S.N. 798,744, filed March 11, 1959, now U.S. Patent No. 2,970,836, and S.N. 773,592, filed November 13, 1958, now U.S. Patent No. 2,944,813, which are assigned to the same assignee as the present application.

As shown in FIG. 2, the raceway 22 curves partially about a feed roller 28 and then downwardly toward the pocket 24, the feed roller and a pressure roller 30 cooperating to feed the checks 23 in the general direction of the pocket. From the bight of the rollers 28, 30 the checks 23 are fed to the bight of a second pair of feed rollers 32 and 34 which are located adjacent the upper end of entrance to the pocket 24. The pressure rollers 30 and 34 may be rotatably mounted respectively on a pair of arms 31 and 33, pivoted on a common support 35 and yieldingly held against their respective feed rollers by springs 37.

The pocket 24 is bounded on one side thereof by a stationary guide member, designated generally by the numeral 36, and on the other side by a movable side wall or stack back-up plate 38. An upwardly directed flange 39 of a bracket 44 extends along the lower edge of the bed 20 and provides the end wall of the pocket 24. As shown, the guide member 36 extends downwardly from the bight of the feed rollers 32 and 34 and defines a path of travel for the checks 23, the guide member preferably extending at an acute angle to the raceway 22 with respect to the pocket 24. The stack back-up plate 38 is movable over and longitudinally of bed 20 in broadside relationship toward and away from the guide member 36, the back-up plate being mounted at its lower end on a sleeve 37 which is slidable along a shaft 40, and at its upper end on a roller 42 retained in a guideway 43. The sheet metal bracket 44 supports the shaft 40 and also a pulley 46 for a yieldable member or weight 50 which is attached by a cord 48 to the movable back-up plate 38 to urge the plate toward the guide member 36.

As is shown more clearly in FIGS. 1 and 3, the guide member 36 is preferably a fabricated open work structure comprising a lower rail 52, an upper rail 54, and an intermediate rail 56, vertically spaced apart, as shown. The intermediate rail 56 and upper rail 54 may be secured at their upper ends to an extension member 57 of the raceway 22 and at their lower ends to a housing 60 which, in the present construction, is an integral part of the bracket 44 and forms a lower part of the fabricated guide member 36. The lower guide rail 52 is preferably formed of sheet metal having a leg or flange 62 spaced slightly above and substantially parallel with bed 20 to overlap a similar flange 61 on the backing plate 38. At the feed rollers 32 and 34, upper and lower curved guide plates 63 and 64 respectively overlie the guide rails 52, 54 and 56 and cooperate with a curved guide plate 65 to curve and twist the checks to impart added rigidity thereto as the check enters the pocket 24. The guide rail 52 extends upwardly from the bed 20 and is also preferably formed with a twist so that the twist and accompanying rigidity of a check is maintained as the check proceeds into the pocket 24.

In the bed 20, within the pocket 24, there is provided a clearance opening 66 for a worm feed screw 68 that rotates about an axis transverse to the path of travel of checks entering the pocket. An outer margin of the screw thread 68 projects upwardly through the bed 20 into the pocket and aids to feed the lower edge of the check near its trailing edge over toward the back-up plate 38 in sufficient time to assure that the leading edge of the next check entering the pocket will position behind the preceding check. Any suitable drive means, such as an electric motor 70 may be provided to drive the feed

screw 68 through a suitable belt and pulley drive connection 72, connecting the motor shaft to the driven shaft 71 of the feed screw 68. In the present construction, the feed screw 68 is driven in a direction counter to the direction of travel of the checks into the pocket 24, the thread of the feed screw being a left hand thread to move the check toward the back-up plate 38. It will be understood that the left hand screw thread, rotating counter to the direction of check travel functions to decelerate the check while at the same time functions to move the check to the stack in time to avoid the leading edge of the next check enroute into pocket 24.

Disposed on the other side of the guide member 36 from the feed screw 68 is an air exhaust manifold 73 located between the pocket entrance and the pocket end wall 39. The manifold 73 has a number of outlets 74 arranged to direct streams of air between rails 52 and 56 into and transversely of the pocket 24. These air streams are provided to aid in the movement of each passing check broadside into threaded relation with the feed screw 68 and the check against the stack. The manifold 73 comprises a body 76 having a main air passage from which branch passages 80 lead respectively to the outlets 74 that are spaced apart longitudinally of the path of check travel. Manually adjustable valve members 82 may be provided to regulate the distribution of air to the branch passages 80 from the main passage 78, this adjustment being made at the factory and the valve members 82 fixed in adjusted positions by set screws 79. The valve members 82 are adjusted so that the forces exerted by the three air streams issuing from outlets 74 differ from each other, the air stream from the first in line of the three outlets 74 exerting the greater forces and the others exerting successively lesser forces with respect to the direction of check travel. A flat cover 75 is attached, such as by screws, to the top of the manifold body and in the cover are slots through which project handles 77 of the valve members 82 for access in adjusting air distribution to the several outlets 74.

An inlet 84 to the main passage 78 is disposed on the same side of the guide member 36 as the manifold 73 and is positioned at the pocket entrance, facing in a direction transverse to the direction of check travel. On the other side of the guide member 36 from the manifold inlet 84 there is an air jet 86 aligned to discharge air into the manifold inlet 84, the jet being connected to a suitable source of compressed air (not shown). The inlet 84 and the jet 86 are in spaced apart alignment on opposite sides of the guide member 36 and thus in the path of travel of checks into the pocket 24, the arrangement being such that communication between the jet and the manifold inlet 84 is interrupted by a passing check until the trailing edge of the check passes between the jet and inlet. Thus, air discharged from the manifold outlets 74 is timed by the passing check in accordance with the length of the check so that discharge from the outlets 74 does not occur until the trailing edge of a check has passed between the aligned jet 86 and manifold inlet 84. Air issues continuously from the jet 86 and, under control of a passing check, is applied only to a rear portion of the check, and without the need of air valves, switches, etc.

Within the housing 60 there is a plurality of axially vertically spaced friction rollers 90 which have their peripheries projecting through the housing side wall to engage and feed each check toward the check abutment member or end wall 39 of the pocket 24. The friction rollers 90 are fixed onto a tubular shaft 93 which is journaled on a fixed shaft 94 vertically disposed to the bed 20, the tubular shaft being rotatable by any suitable drive means, preferably in a counterclockwise direction, as viewed in FIG. 2. Also, the rollers 90 are preferably made of a material having a relatively high coefficient of friction, such as rubber, for gripping the checks. Further, the rollers 90 are driven such that their surface

or peripheral speed is considerably less than the speed of the checks whereby the roller peripheries function as a brake to decelerate the checks, as well as, assure full travel of the checks to the pocket end wall 39.

In the pocket end wall 39 there is an interruption in which is inserted a resilient check bumper member 96 against which the leading edge of each of the checks strike to reduce damage to the checks. The bumper member 96 may be made of a suitably resilient plastic material, or rubber or any other suitably resilient material. A channel shape metal retainer 98 is provided for the bumper member 96 and is secured in and to the sheet abutment flange 92 and to the adjacent wall 59 of the roller housing 60. The resilient bumper member 96 is located at the lower end of the guide member 36 or wall 59 and forms a junction therewith to which the leading edge of the check is directed by the stack back-up member 38. This is accomplished by having the guide member 36 and the back-up member 38 arranged to converge relative to each other toward the pocket end wall 39, the point of convergence or intersecting, at least of the lower rail 52, being anterior to end wall 39 with respect to the direction of sheet travel. Also, as shown in FIGS. 2 and 8, the back-up plate 38 or that portion against which the sheets are stacked is at an acute angle to a reference line 99 which is normal to pocket end wall 39 and tangent to the peripheries of rollers 90. As a consequence, a check approaching the bumper member 96 is diverted by the stack back-up plate 38 which now assumes the sheet guiding function and directs the leading edge of the check to the juncture of guide member 36 and pocket end wall 39, causing the check to bend about the rollers 90, as illustrated in FIG. 8, the purpose being to keep the check from bouncing back after striking the bumper 96. At about the same time that the check reaches the bumper 96, the trailing edge of the check opens the air intake 84 of the manifold 73 and air streams issuing from outlets 74 pivot the check about the peripheries of rollers 90, as a fulcrum, and lay the check on the stack.

Operation

A check is fed into the pocket 24 by the feed rollers 32, 34 and at the entrance to the pocket passes between the air jet 86 and the air inlet 84 intercepting the air stream from jet 86 and consequently stopping air discharge from the manifold outlets 74. The discharge of air from outlets 74 is discontinued at this time so that the leading edge of the check will not be blown toward back-up plate 38, but instead will continue to follow along the guide member 36. When the trailing edge of the check has passed between the air jet 86 and manifold inlet 84, communication between the compressed air source and the manifold 73 is re-established in time such that the streams of air issuing from manifold outlets 74 blow the trailing end portion of the check into threaded engagement with the feed screw 68. As the check is being directed toward its rubber bumper member 96 by the combined functions of the inclined back-up plate 38 and the air streams from manifold outlets 74, deceleration of the check is effected by the friction rollers 90 which then move the check down until the leading edge of the check abuts the rubber bumper member 96 and at about this same time, the air streams from outlets 74 pivot the check on the rollers 90 as a fulcrum and lay the check flat against the inclined back-up plate or inclined stack as the case may be.

In FIG. 9 which is a view similar to FIG. 8, there is shown a modification of the pocket construction in which a wall 100, transverse to the direction of sheet travel forms the end wall of the pocket and a stationary guide member 102 and a movable back-up plate 103 form the side walls of the pocket. Wall means in the form of a bracket 104 forms a corner of the pocket to which an end portion of the stationary guide member 102 is conveniently secured, the guide member 102 terminating at point

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106 insofar as its guiding function is concerned. A rounded fulcrum member 103 projects through the bracket 104 transversely into the pocket and a sheet, as at 23, is bent around the fulcrum as illustrated. To accomplish this, the guide and back-up members 102 and 103 respectively are disposed in planes vertical to the bed 20 and at acute angles respectively to a vertical plane 110 which extends between said members and is normal to the pocket end wall 100 and tangent to the rounded fulcrum member 103. As shown, the plane of the guide member 102 intersects plane 110, as at 111, anteriorly to the fulcrum member 103, and the plane of the back-up member 103 intersects plane 110, as at 113 posteriorly to fulcrum member with respect to the direction of check travel. As a consequence, the check guiding function is transferred from guide member 102 to the back-up member 103 which then directs the leading edge of the sheet 23 to the corner of the pocket. In order to avoid or decrease damage to the leading edge of the sheet, I provide a resilient diaphragm 112 across the pocket corner and to induce movement of the sheet toward the back-up member 103 I arrange the diaphragm substantially normal to the plane of the back-up member. As in the FIG. 8, the bending or partial wrapping of the sheet about the rounded surface of the fulcrum member 103 increases surface contact therewith with accompanying braking force and increasing opposition to the bouncing back of the sheet after it strikes the diaphragm 112. When the sheet reaches the diaphragm 112, the air flow is resumed to the air outlets 74 and the sheet is pivoted about the fulcrum member 103 to the back-up member or sheet stack. In the case of heavy stiff sheets or cards, these may be sufficiently tensioned, by being bent around the fulcrum 103, to cause the upper portion of the card to flip over onto the stack without the aid of the air streams.

While I have shown and described my sheet stacking device in considerable detail, it will be understood by those skilled in the art that many variations may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In a machine having means to feed a sheet of paper edgewise along a guided path of travel, a sheet stacking device for the machine comprising a sheet guide member extending along the path of travel and forming a side of a sheet stacking pocket and entrance thereto, said guide member having an opening therethrough, an air jet adjacent said entrance directing a stream of air from the pocket side of said guide member across the path of travel of the sheet and through said opening, a sheet abutment member forming an end wall of the pocket and having a junction with said guide member, a movable back-up plate forming the other side wall of the pocket and movable away from said guide member to accommodate an increasing number of sheets in the pocket, an air manifold having a plurality of air outlets on the other side of said guide member from said air jet and directing air streams through said guide member to urge a passing sheet toward said back-up plate, and said manifold having an inlet on the said other side of said guide member in registry with said air jet to receive air from the latter following the passing of a sheet between said jet and inlet.

2. In a machine having means to feed a sheet of paper edgewise along a path of travel, a sheet stacking device for the machine comprising a sheet guide member extending along the path of travel and forming one side boundary and entrance to a sheet stacking pocket, a sheet abutment member forming an end wall of the pocket, a sheet stack back-up member oppositely disposed to said guide member in broadside relationship thereto, said back-up member forming the other side of the pocket and movable away from said guide member, an air exhaust manifold having a plurality of air outlets on the other side of

said guide member from said back-up member and directing air streams transversely of the pocket to blow the sheet toward said back-up member, said manifold having an air inlet on the same side of said guide member as the air outlets to receive air through an opening in said guide member, and an air jet on the other side of said guide member from said inlet to direct an air stream into the latter and interceptable by a sheet enroute into the pocket.

3. In a machine having means to feed a sheet of paper edgewise along a guided path of travel, a sheet stacking device for the machine comprising a sheet guide member extending along the path of travel and forming a side of a sheet stacking pocket and entrance thereto, a sheet abutment member forming a junction with said guide member and an end wall of the pocket, a movable back-up plate forming the other side of the pocket and movable away from said guide member, yieldable means urging said back-up plate toward said guide member, an air jet adjacent the entrance to the pocket and directing a stream of air from the pocket side of the said guide member across the path of travel of the sheet and through an opening in said guide member, an air manifold having a plurality of air outlets on the other side of said guide member from said back-up plate and directing air across the path of sheet travel intermediate the entrance and abutment member to move the sheets against said back-up plate, said manifold having an air inlet on the said other side of said guide member spaced from and in alignment with said air jet to receive air therefrom following the passing of a sheet between said jet and inlet, said guide member and said back-up plate converging toward each other in the direction of and terminating adjacent said abutment member, and a feed roller adjacent said abutment member operable to feed a sheet down to said junction against the opposing action of said yieldable means and disengaged from the sheet by air from said outlets moving the sheet away from said roller.

4. In a machine having means to feed a sheet edgewise along a guided path of travel, a sheet stacking device for the machine comprising a sheet guide member extending along the path of travel and forming one side boundary of a sheet stacking pocket, and entrance to the latter, a movable back-up plate oppositely disposed in broadside relationship to said guide member and forming the other side of said pocket, yieldable means urging said back-up member toward said guide member, a sheet abutment member forming an end wall of the pocket and a junction with said guide member, driven roller means projecting through said guide member into the path of sheet travel adjacent said junction and operating to move a sheet to seat the leading edge thereof against said end wall, air outlets directed to discharge air through said guide member into and transversely of said pocket, said air outlets located between the pocket entrance and the end wall of the pocket, an air inlet common to and in communication with said air outlets, said air inlet arranged on one side of the path of sheet travel in communication with a source of compressed air on the other side of path of travel of the sheet anteriorly to said outlets for discontinuation of air flow by a sheet passing between the source and the inlet, said back-up plate angularly disposed to direct the leading edge of a sheet to the junction of said guide member and end wall and bend the sheet over the roller means as a fulcrum about which the sheet is pivoted toward the back-up plate by air from said outlets.

5. In a machine having means to feed a sheet of paper edgewise along a path of travel, a sheet stacking device for the machine comprising a pocket end wall extending transverse to the path of sheet travel, a sheet guide member forming one side of the pocket and entrance thereto, said guide member extending from the pocket entrance toward said end wall, wall means forming a juncture with said end wall to receive the leading edge of the sheet, a sheet stack back-up member forming the opposite side wall

of the pocket and extending substantially to said end wall, said back-up member movable broadside away from said guide member under the pressure of accumulating sheets, said guide member and said back-up member converging toward said end wall respectively at acute angles to a plane between said members and normal to said end wall at said juncture, said guide member intersecting said plane anteriorly to said juncture with respect to the direction of sheet travel, and yieldable means urging said back-up member toward said guide member.

6. In a machine having means to feed a sheet of paper edgewise along a path of travel, a sheet stacking device for the machine comprising a pocket end wall for abutment by the leading edge of the sheet, wall means forming a corner of the pocket with said end wall to receive the leading edge of the sheet, a fixed sheet guide member forming one side of the pocket and entrance thereto, said guide member extending from the pocket entrance toward said end wall, a sheet stack back-up member forming the opposite side of the pocket and extending substantially to said end wall, said back-up member movable broadside away from said guide member under the pressure of accumulating sheets in the pocket, said guide member and said back-up member converging toward said end wall at acute angles respectively to a plane between said members and normal to said end wall at the juncture of the corner, said guide member intersecting and terminating substantially at said plane anteriorly to the juncture of the corner with respect to the direction of travel of the sheet, and a sheet fulcrum member projecting into the path of sheet travel between said juncture and the terminus of said guide member, and means operable to pivot the sheet about said fulcrum member toward said back-up member.

7. In a machine having means to feed a sheet of paper edgewise along a path of travel, a sheet stacking pocket construction comprising an end wall of the pocket and extending transversely of the direction of sheet travel, a stationary guide member forming one side of and an entrance to the pocket, said guide member extending toward and terminating in spaced relation to said end wall, a rounded fulcrum member at the terminus of said guide member forming a part thereof and projecting into the path of sheet travel, a movable back-up member forming the other side of the pocket and movable broadside away from said guide member under the pressure of accumulating sheets, said guide and back-up members converging respectively in planes at acute angles respectively to a plane normal to said end wall and tangent to said rounded fulcrum member, said back-up member terminating between said fulcrum member and said end wall and directing a leading edge portion of the sheet to bend over the rounded periphery of said fulcrum member, and yieldable means biasing said back-up member toward said fulcrum member.

8. In a machine having means to feed a sheet of paper edgewise along a path of travel, a sheet stacking pocket construction comprising an end wall transverse to the pocket, a stationary sheet guide member extending along the path of travel toward and terminating in spaced relation to said end wall, said guide member forming one side of the pocket and an entrance thereto, a resilient

bumper interposed in said end wall, wall means interposed between the terminus of said guide member and said end wall and forming a corner of the pocket with said bumper, a rounded fulcrum member interposed between the terminus of said guide member and said wall means and projecting transversely into the pocket, a movable back-up member forming the other side of the pocket and extending toward said bumper and terminating between said fulcrum member and said bumper, said guide and back-up members converging toward said end wall respectively in planes at acute angles to a plane therebetween normal to said end wall and tangent to said rounded fulcrum member, said back-up member directed to bend a leading end portion of the sheet over said rounded fulcrum member to pivot the sheet toward said back-up member, and yieldable means biasing said back-up member toward said fulcrum member.

9. In a machine having means to feed a sheet of paper edgewise along a path of travel, a sheet stacking pocket construction for the machine comprising an end wall transverse to the path of travel, wall means cooperating with said end wall to form a corner of the pocket, a sheet guide member, a sheet guide member forming one side of the pocket and an entrance thereto and extending toward said corner, a movable stack back-up member forming the other side of the pocket and movable broadside away from said guide member under the pressure of accumulating sheets in the pocket, a rounded fulcrum member projecting transversely into the pocket toward said back-up member, said guide and back-up members respectively in planes at acute angles respectively to a plane extending therebetween and normal to said end wall and tangent to said rounded fulcrum member, the planes of said guide and back-up members intersecting said normal plane respectively anteriorly and posteriorly to said fulcrum member in the direction of sheet travel, and a resilient diaphragm across said corner for abutment by the leading edge of the sheet and in a plane normal to the plane of said back-up member.

10. In a machine having means to feed a sheet of paper edgewise along a path of travel, a sheet guide member forming an extension of the path of travel and one side and inlet of a sheet stacking pocket, an end wall cooperable with said guide member in the formation of the pocket, a movable back-up member forming the other side of the pocket, said back-up member biased broadside toward said guide member and movable away from said guide member by the pressure of accumulating sheets in the pocket, an air jet on the other side of said guide member from said pocket and normally directing a stream of air within and across the pocket toward said back-up member, and means forming an air inlet in communication with said jet and controllable in response to the travel of sheet enroute into the bin past a predetermined point along said guideway so as to effect an air blast only against a trailing end portion of the sheet.

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