Jan. 21, 1964 A. FUX 3,118,664

PNEUMATIC SHEET STACKING MECHANISM

Original Filed Sept. 21, 1960 3 Sheets-Sheet 1

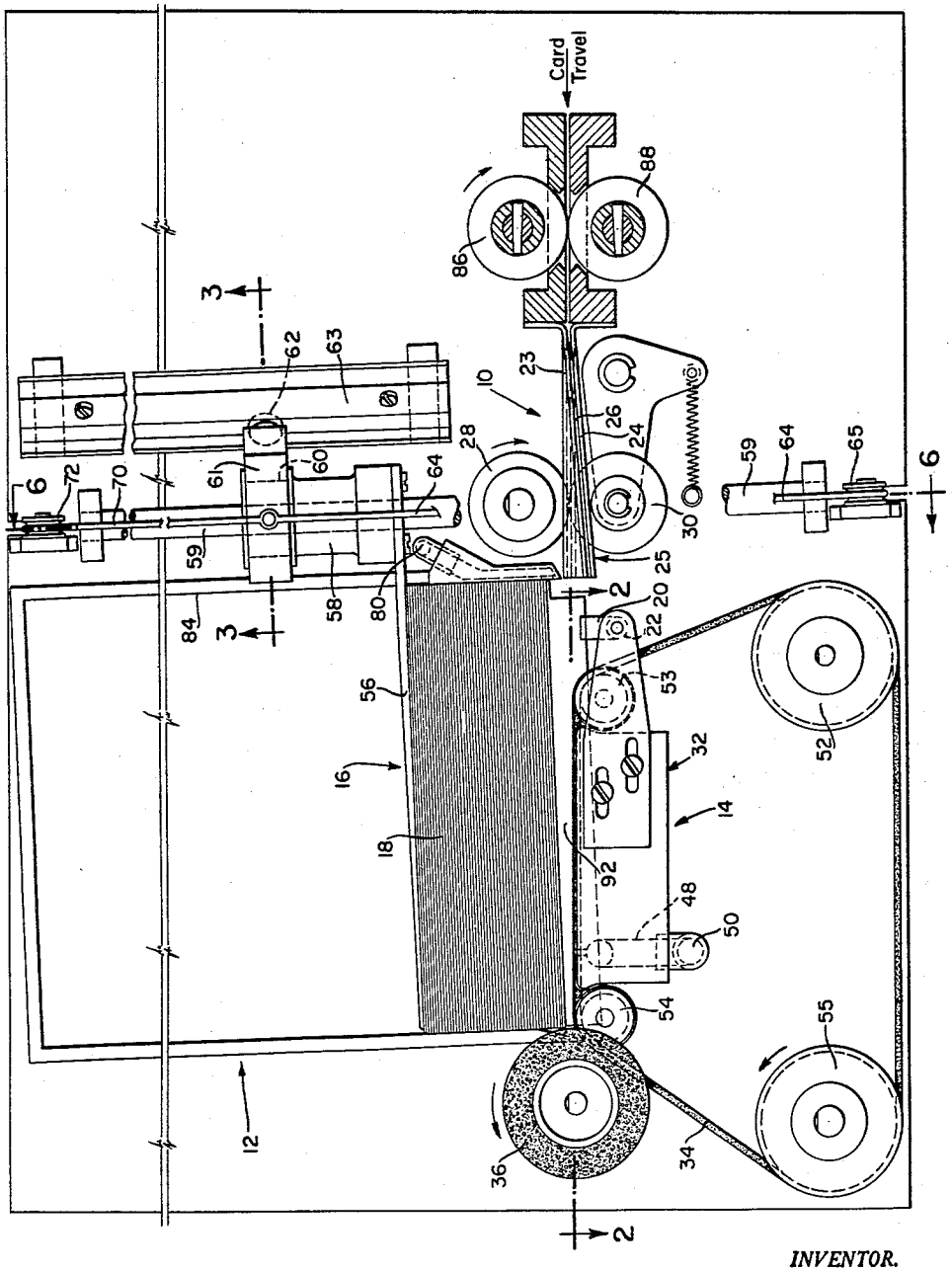

Fig. 1

INVENTOR.
AIME FUX

BY
Samuel Kane
ATTORNEY

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PNEUMATIC SHEET STACKING MECHANISM

Original Filed Sept. 21, 1960 3 Sheets-Sheet 2

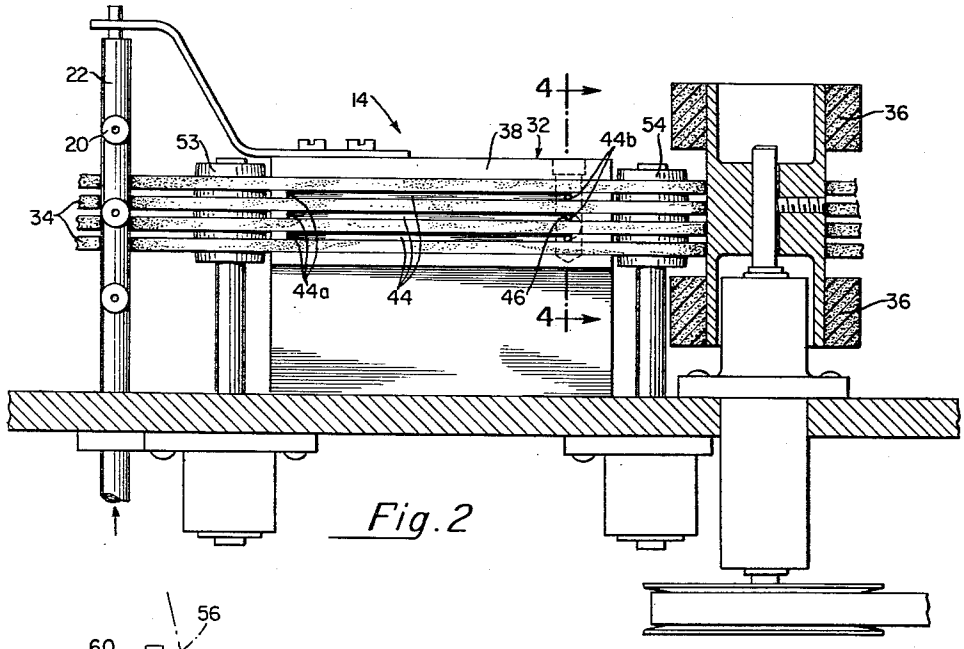

Fig. 2

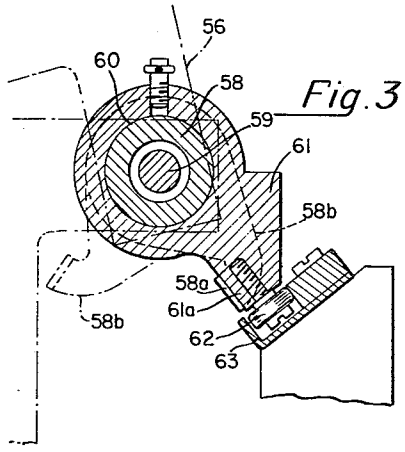

Fig. 3

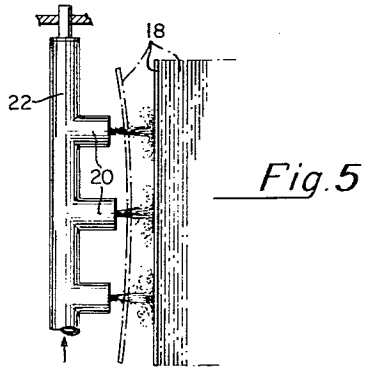

Fig. 5

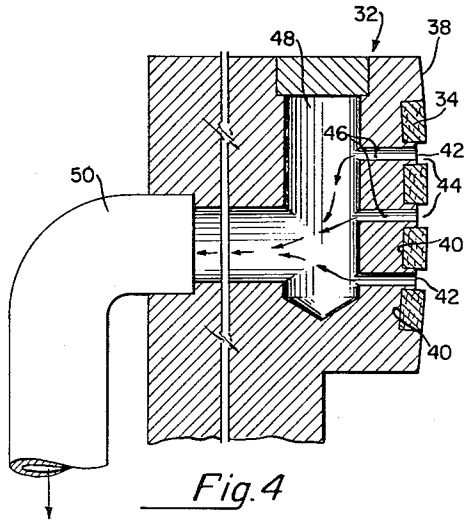

Fig. 4

INVENTOR.
AIME FUX

BY
Samuel Kane
ATTORNEY

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PNEUMATIC SHEET STACKING MECHANISM

Original Filed Sept. 21, 1960 3 Sheets-Sheet 3

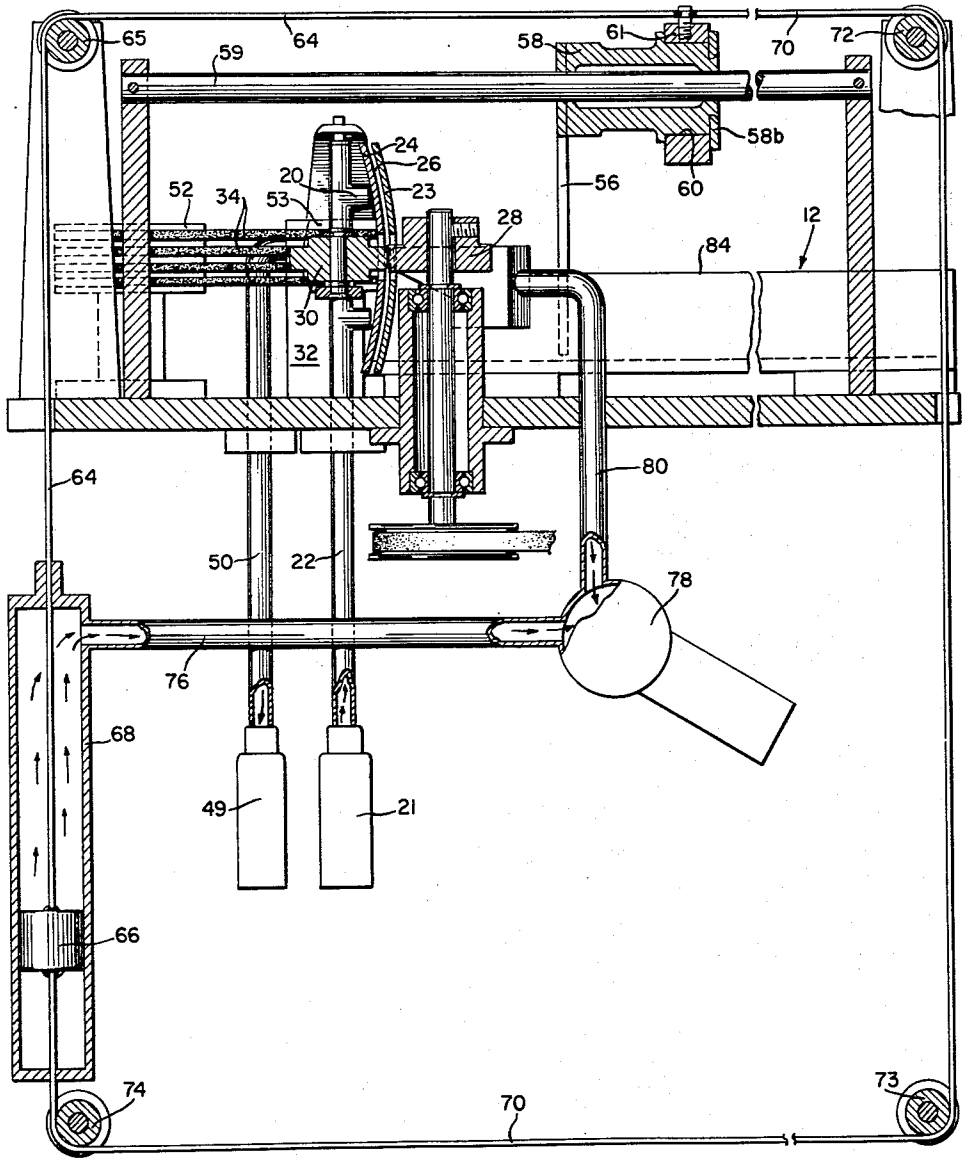

Fig. 6

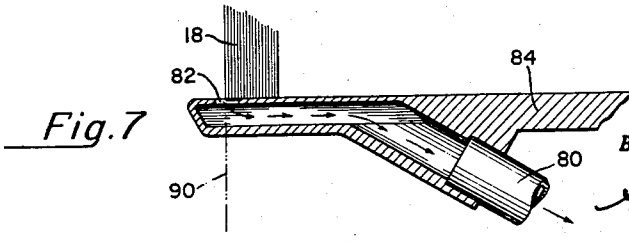

Fig. 7

INVENTOR.
AIME FUX

BY Samuel Kane
ATTORNEY

United States Patent Office 3,118,664 Patented Jan. 21, 1964

3,118,664

PNEUMATIC SHEET STACKING MECHANISM

Aime Fux, Philadelphia, Pa., assignor to Burroughs Corporation, Detroit, Mich., a corporation of Michigan

Original application Sept. 21, 1960, Ser. No. 57,418. Divided and this application July 27, 1961, Ser. No. 131,957

3 Claims. (Cl. 271—87)

This application is a division of a copending application of Aime Fux, Serial No. 57,418, filed September 21, 1960, and entitled "Pneumatic Sheet Stacking Mechanism."

This invention relates generally to sheet feeding machines and more particularly to a high speed mechanism for stacking sheets individually in succession in pile or stack formation.

An object of the invention is to provide a mechanism for sheet feeding and the like machines which will stack sheets at high speed in a receptacle or stacking bin without the danger of mutilating the leading edge of the sheets ordinarily encountered in high speed stacking.

Another object of the invention is to provide a high speed stacking mechanism for stacking sheets in succession and with means to assure that the sequence or order of the sheets will be preserved.

Another object of the invention is to provide such a mechanism in which an incoming successive sheet delivered into a stacking bin or receptacle will not come into sliding contact with a previously delivered sheet in the receptacle, thus to prevent friction between adjacent sheets and to better preserve their condition.

A more specific object of the invention is to provide a stacking mechanism for sheet items and the like wherein the stack height or location of the top or end of a stack of sheets in a stacking receptacle is controlled automatically by the position of the top or endmost sheet of the stack.

A further object of the invention is to provide a pneumatic control for a stack support or follower which may be utilized in a machine either for stacking sheets against the support or follower or for supplying sheets to be fed from a stack initially placed against such stack support or follower.

In accordance with the above objects and first considered briefly in its broad aspects, the invention utilizes a pneumatic decelerating mechanism for slowing down sheets delivered rapidly into a stacking bin or receptacle. The decelerating mechanism may be so adjusted, if desired, such that the momentum of the slowed-down sheets will enable them to reach a registration edge in the stacking bin, however, there is preferably provided means, regarded as part of the decelerating mechanism, when used, for feeding the slowed-down sheets through a short distance to the registration edge. The stacking mechanism is so arranged that when an incoming sheet reaches a predetermined position in the stacking bin, preferably at the registration edge, the sheet will be rapidly removed from the path of the next incoming sheet and deposited on or against a stack support or stack follower. The stack support or stack follower responds to the incoming sheets and moves or adjusts itself automatically under the control of a pneumatic mechanism thereby to maintain the stack height or location of the top or end of the stack of sheets in the receptacle at a predetermined position.

The invention will be more clearly understood when the following detailed description of the preferred embodiment thereof is read in conjunction with the accompanying drawings in which:

FIG. 1 is a plan view of a stacking mechanism constructed in accordance with the invention;

FIG. 2 is an enlarged sectional view taken along line 2—2 of FIG. 1, illustrating a sheet decelerating mechanism;

FIG. 3 is an enlarged detail of guide means for a stack follower plate;

FIG. 4 is an enlarged sectional view taken along line 4—4 of FIG. 2;

FIG. 5 shows a plurality of nozzle elements, shown also in FIG. 2 and illustrating the flow of compressed air therefrom directed toward a sheet stack;

FIG. 6 is a sectional view taken along line 6—6 of FIG. 1; and

FIG. 7 is an enlarged detail of certain elements of a pneumatic control for the stack follower plate.

Turning now to the drawings and more particularly to FIGURE 1 thereof, the illustrated embodiment of the invention comprises a sheet delivery mechanism 10, a sheet stacking receptacle or bin 12, a suction decelerating mechanism 14 for slowing sheets delivered into the stacking receptacle 12 by the sheet delivery mechanism 10, and a stack follower mechanism 16, most of which is shown in FIG. 6, for positioning the sheets or cards 18 in the stacking receptacle 12 in stack formation and for maintaining the end sheet of the stack at a predetermined reference position, as will be explained more fully hereinafter. Arranged between the decelerating mechanism 14 and the sheet delivery mechanism 10 is a series of blast nozzles 20 (see also FIGS. 2 and 5) connected to a source of compressed air 21 (FIG. 6) by means of a hose 22.

The sheet delivery mechanism 10 comprises stationary sheet guide members 23 and 24 (FIG. 6) which are spaced apart a distance slightly greater than the thickness of a sheet or card 18 and formed gradually toward their exit region 25 (FIG. 1) to provide a curved or trough-like chute guideway 26 (FIG. 6) therebetween. The sheets or cards 18 are delivered individually through the guideway 26 by means of a power driven roller 28 and a cooperating pressure roller 30 which extend through suitable openings in the guide members 23 and 24.

The decelerating mechanism 14 comprises a stationary suction shoe 32 (FIGS. 2 and 4) and preferably a slow-moving conveyor in the form of a series of endless belts 34 which cooperate with the suction shoe 32 for transporting each delivered sheet or card 18 at a decelerated rate of speed to a registration surface in the stacking receptacle 12 which, in the present embodiment, takes the form of power driven slow moving rollers 36 (FIGS. 1 and 2), preferably faced with a resilient material such as rubber.

The suction shoe 32 is provided in its sheet or card engaging face 38 (FIG. 4) with a plurality of spaced apart elongated slots 40 for slidably guiding the belts 34, the face 38 being curved transversely to substantially correspond with the curvature of the guideway 26 at the exit thereof. The belts 34 cooperate with inner surfaces 42 of the suction shoe 32 to form elongated shallow suction spaces or grooves 44 which terminate at their ends 44*a* and 44*b* (FIG. 2) where the surfaces 42 run out to the face 38. Each of the spaces or grooves 44 communicates with one of a plurality of minute passages or ports 46 opening at its inner end into a cavity 48 in communication with a source of vacuum such as a pump 49 (FIG. 6) by means of a hose 50. The belts 34 pass around idler pulleys 52, 53 and 54 (FIG. 1) and a power driven roller 55.

The stack follower mechanism 16 comprises a follower plate 56 secured to a bearing 58 slidably and rockably mounted on a fixed guide shaft 59. The bearing 58 is journalled at one end 60 (FIG. 3) in a guide fitting 61 provided with a roller 62 arranged to ride in a fixed way 63. A lug 61*a* on the guide fitting 61 is in the path of movement of an offset 58*a* of a stop member 58*b* secured

to the bearing 58 to limit downward movement of the follower plate 56 whenever it is rocked or lowered into the stacking receptacle 12.

A cable 64 (FIG. 6) is secured at one end to the guide fitting 61, passes about an idler pulley 65 and is secured at its opposite end to the top of a gravity responsive weight or piston 66 slidably mounted in a vertical cylinder 68. A second cable 70 is similarly connected at one end to the guide fitting 61, passes about idler pulleys 72, 73 and 74 and has its opposite end connected to the bottom of the piston 66. A hose 76 leading from a source of vacuum, such as a pump 78, communicates with the cylinder 68 above the piston 66, and a hose 80 leading from the vacuum pump 78 communicates with an inlet opening 82 (FIG. 7) in a side wall 84 of the stacking receptacle 12.

The various members of the stack follower mechanism 16 are suitably chosen with respect to weight, vacuum pressure, friction, etc. such that the piston 66 tends to drop and move the stack follower plate 56 toward the decelerating mechanism 14 but is controlled in so doing by the size of the inlet opening 82. If the inlet opening 82 is closed sufficiently, the vacuum pump 78 will reduce the pressure above the piston 66 to such an extent that the piston will rise and move the follower plate 56 away from the decelerating mechanism 14. On the other hand, if the inlet opening 82 is sufficiently open, the pump 78 will then draw sufficient air through the inlet opening 82 so that the reduced pressure above the piston 66 will not be sufficient to overcome the tendency of the piston to drop and the piston will therefore move the follower plate 56 toward the decelerating mechanism 14.

In the operation of stacking cards, a card 18 is delivered into the guideway 26 between the curved plates 23 and 24 by associated feed rollers 86 and 88 (FIG. 1) and fed into the stacking receptacle 12 by the delivery rollers 28 and 30. Compressed air is supplied continuously by the source 21 to the nozzles 20 but is ineffective to deflect the leading portion of the card 18 out of the path of feeding so long as a portion of the card is still in the guideway 26. The resistance of the card to deflection is obtained by the curved or trough-like formation imparted to the card by the curved guideway 26 which gives it stiffness and rigidity. Suction is applied continuously by the pump 49 through the hose 50 to maintain the cavity 48 (FIG. 4) at a reduced pressure. The incoming card passes across the curved face 38 of the suction shoe 32 until its leading edge reaches the position 44*b* (FIG. 2) where the grooves 44 terminate or run out at the fact 38. At this time the card has substantially sealed the grooves 44 and is under the decelerating effect of the suction applied to these grooves through the ports 46, cavity 48 and hose 50. When the card has substantially sealed the grooves 44, as just described, its trailing edge will have left the nip of the delivery rollers 28 and 30, but will still be in the guideway 26, and the card will then be under the control of the suction through the shoe 32 and the cooperating continuously rotating slow moving belts 34. The belts 34 transport the card the remaining short distance into the stacking bin 12 until its leading edge registers against the resilient surface or rotating rollers 36, at which time the trailing portion of the card has left the guideway 26 and is free to be acted upon effectively by the compressed air issuing from the nozzles 20. Because of the curved, rigid formation of the card at this time, the air issuing from the nozzles 20 will not bend the trailing portion of the card away from the leading portion but will blow the entire card away from the suction shoe 32 and belts 34 and stack it against the follower plate 56.

As the cards 18 are stacked in succession against the follower plate 56, the follower plate will be adjusted automatically to maintain the end of the stack of cards at a predetermined equilibrium or reference position 90 (FIG. 7). This occurs as each card gradually closes the inlet opening 82 to diminish the suction applied therethrough by the pump 78 and to cause a corresponding increase in suction by the pump 78 on the top of the piston 66 so that the piston will rise a corresponding distance and move the follower plate 56 in the direction away from the decelerating mechanism 14 until the end card of the stack reaches the equilibrium or reference position 90.

In order to assure that an incoming succeeding card will not interfere with the trailing portion of a previous card being stacked by the compressed air issuing out of the nozzles 20, and to assure further that succeeding adjacent cards will not slide one upon the other, the follower plate 56 is preferably inclined to the face 38 of the suction shoe 32 to provide a tapered or funnel-shaped entrance region 92 (FIG. 1) for incoming cards. Also, the resilient surfaces or rollers 36 are preferably rotated, and continuously, to maintain the leading portion of the cards firmly against the stack and out of the way of incoming cards.

As described earlier, the decelerating mechanism 14 preferably includes the suction shoe 32 and the slow moving belts 34, however, in certain stacking operations it may be advantageous to omit the belts 34. In such case, the decelerating mechanism would be constituted by the suction shoe alone together with its source of vacuum and hose connection and the suction therethrough suitably regulated to enable the momentum of the sheets or cards to carry them the full distance into the stacking receptacle.

While there has been shown a specific structure exemplary of the principles of the invention, it is to be understood that this is but one embodiment thereof and that the invention may be constructed in a variety of shapes, sizes and modifications without departing from the true spirit and scope thereof. Accordingly, it is to be understood that the invention is not to be limited by the specific structure disclosed but only by the subjoined claims.

What is claimed is:

1. In a pneumatic mechanism for stacking sheets, cards and the like, a sheet stack follower movable in a generally horizontal direction and against which sheets are to be deposited on edge individually in a stack, a gravity responsive weight for moving said sheet stack follower toward a reference position, a flexible coupling connecting said sheet stack follower and said gravity responsive weight, and pneumatic means for controlling said gravity responsive weight to maintain the end sheet of a stack of sheets to be deposited against said stack follower at said reference position as said sheets are deposited individually in said stack of sheets.

2. In a pneumatic mechanism for handling sheets and the like articles, a sheet stack follower movable in a generally horizontal direction and against which sheets are to be deposited in a stack or from which sheets are to be removed from a stack thereagainst, a gravity responsive weight for moving said sheet stack follower and a stack of said sheets thereagainst toward a reference position, flexible cable means coupling said sheet stack follower and said gravity responsive weight to enable the former to be moved reciprocably by the latter, and pneumatic means for controlling said gravity responsive weight to maintain the end sheet of said stack at said reference position as sheets are deposited in or removed from said stack of sheets.

3. In a pneumatic sheet stacking mechanism, a sheet receptacle having an inlet opening adapted to be closed gradually by an edge of successive sheets deposited in said receptacle, a stack follower in said receptacle, a vertical cylinder, a gravity responsive piston in said cylinder disposed in the lower portion thereof, means connecting said piston to said stack follower for movement of the latter by said piston in opposite directions in said receptacle, means for conducting air under vacuum pressure from said inlet opening and the upper portion of said cylinder above said piston, and a single source of said vacuum

pressure coupled to said last mentioned means, and wherein said piston will move said stack follower in one direction when said inlet opening is closed to a predetermined extent and move it in the opposite direction when said inlet opening is open to a predetermined extent.

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