Dec. 25, 1962 A. SCHWEBEL 3,070,367

SHEET SEPARATING AND FEEDING DEVICE

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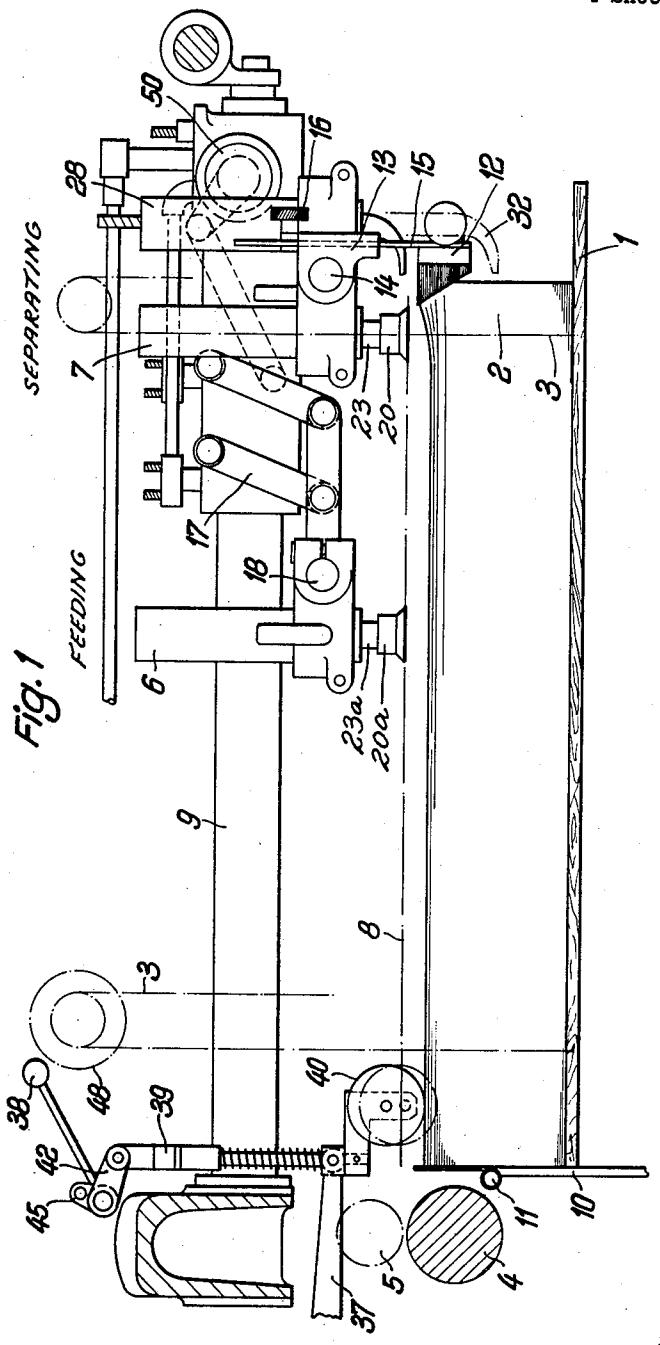


Fig. 1

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Fig. 3

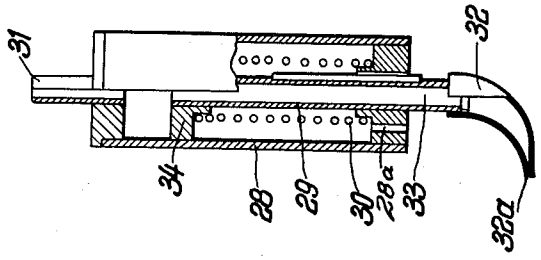
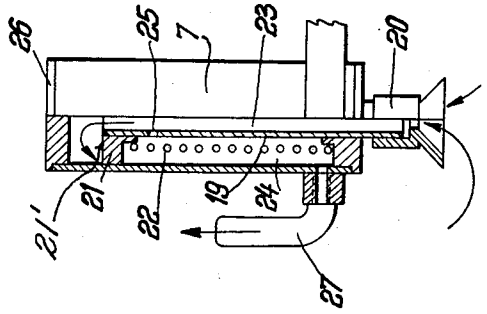


Fig. 2



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Fig. 4

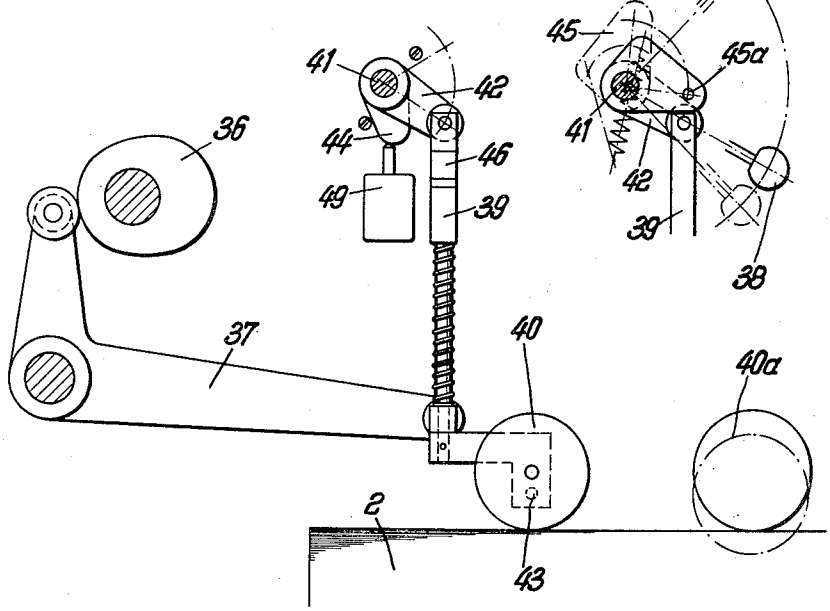
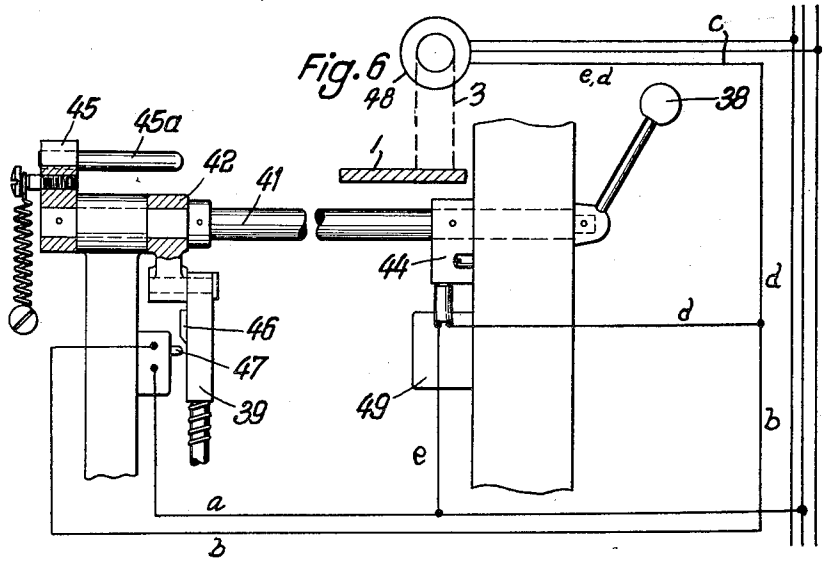


Fig. 5

Fig. 6



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SHEET SEPARATING AND FEEDING DEVICE

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Fig. 7

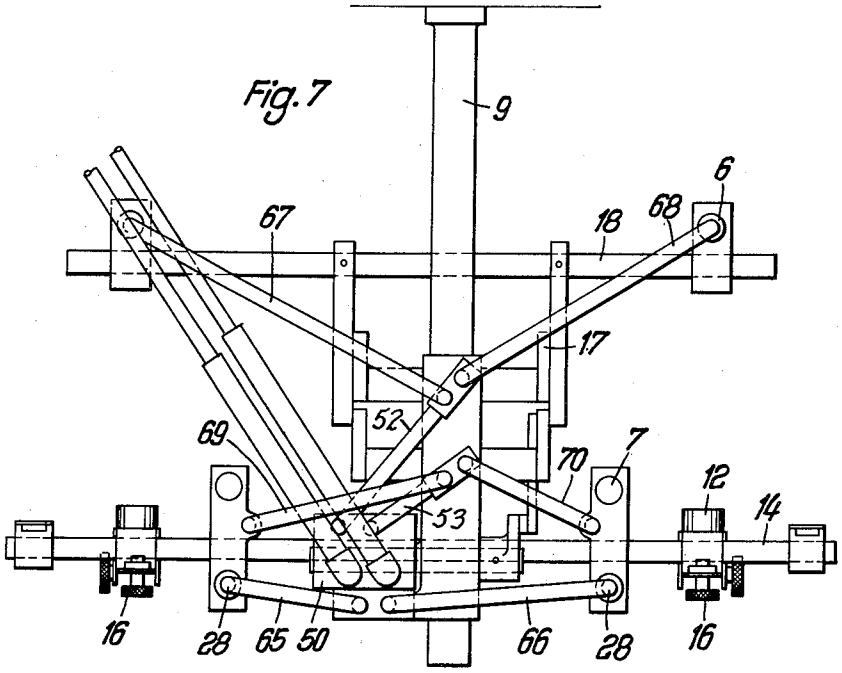
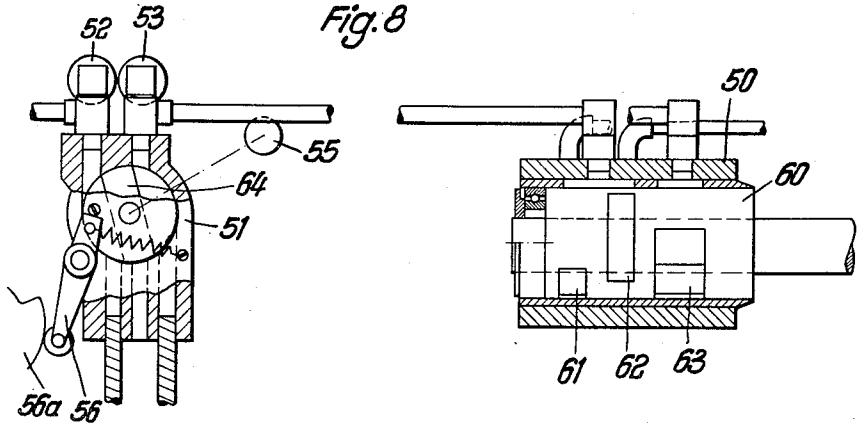


Fig. 8



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United States Patent Office 3,070,367 Patented Dec. 25, 1962

3,070,367

SHEET SEPARATING AND FEEDING DEVICE

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Filed Aug. 13, 1958, Ser. No. 754,759
Claims priority, application Germany Nov. 9, 1957
7 Claims. (Cl. 271—26)

This invention relates to pneumatic sheet feeding devices such as are used in printing and the like machines to separate the sheets from a pile and to feed them singly and successively into the machine by means of suction nozzles and in which, preferably, means are provided for blowing air sideways into the upper sheets of the pile, and other means for controlling the height of the pile surface while the sheets are being fed into the machine.

The invention has for its main object the removal of a number of disadvantages which are present in the hitherto used feeding devices of the aforesaid type and to provide a pneumatic separating and feeding device which shall be of simple construction, automatic in operation and reliable in its function.

Another object of the invention is the provision of means for so supporting and arranging the separating nozzles as to render them selfcontained in their operation by a novel way of air distribution, and the elimination of the mechanical means which hitherto had to be resorted to for the raising and lowering of the air nozzles.

A further object of the invention rests in the provision of a device of the aforesaid type in which the air entering the suction nozzle, instead of being sucked off again, is used to practically its whole volume and in conjunction with the tension produced by the vacuum in the cylinder, to force the suction nozzle downward onto the pile of sheets to be conveyed. The means for attaining this object include a suction port or conduit arranged close to the bottom of the suction cylinder below a piston head therein and a communication between the cylinder and a hollow plunger to which the suction nozzle is fitted.

In accordance with a still further object of the invention, air blowing nozzles are provided which, similar to the suction nozzles, are carried at the end of hollow plungers. These plungers are guided in pressure cylinders in which they are moved downwardly by air which is admitted into the cylinders and through the plungers into the blowing nozzles. The arrangement, according to the invention, is such that the air, while moving the plunger and the nozzle downwardly, accumulates in front of the jet opening in the nozzle through which it is then forced by the pressure of the succeeding volumes of air.

The air issuing from the jets of the blowing nozzles blows down along the pile between the uppermost sheets thereof, while preliminary separating brushes are provided to move up and down the edge of the pile in confromity with the blowing nozzle and in timed relation to the separating and feeding means in order to facilitate the separation of the sheets.

Yet another object of the invention rests in the provision of a tracer roll which also moves in timed relation to the separating and feeding means to control the position of the pile surface, and which closes a circuit for the lifting of the pile after the latter has decreased to a predetermined level, and to become effective as an end switch when lowered by means of a handle.

Separating and feeding devices are known in which the downward movement of the suction nozzle is used to tension a spring. Both the downward movement and the release of the suction tension, in this case, are controlled by cams or eccentrics, which means, that the up and down movement of the nozzles is effected wholly independently of the suction effect.

In another device of the type to which the invention refers, the suction nozzles are kept in contact with the pile by means of a spring and, when the suction is started, take the sheet upward thereby tensioning the spring. As soon as the suction ceases, the tensioned spring causes the suction nozzle to fling back onto the pile surface.

Still another device is known in which the up and down movements of a suction plunger is controlled by the subpressure so as to tension a spring which, after having attracted a sheet by the suction nozzle, returns the latter into its upper position. This device suffers the disadvantage that the suction effect of the air when the latter arrives through the suction plunger in the space above the same, is already spent to a great extent owing to the continuous withdrawal of air. Devices of this type, therefore, are very unreliable and can not be used in high efficiency printing machines.

A pneumatic separating and feeding device in accordance with the invention is diagramaticaly illustrated in the accompanying drawings by way of example. In these drawings:

FIG. 1 shows a side elevation, partly in section, of the pneumatic separating and feeding mechanism.

FIG. 2 is a part-sectional elevation of a separating and/or feeding nozzle.

FIG. 3 is a view similar to FIG. 2 of a blowing nozzle.

FIG. 4 illustrates a front elevation of the pile end closing switch, while

FIG. 5 is a detail showing part of the said switch.

FIG. 6 is a side view, partly in section, of the pile end closing switch in accordance with FIG. 4.

FIG. 7 is a plane view of FIG. 1 on a reduced scale, and

FIG. 8 a section through the air controlling means.

Referring to FIG. 1, the pile table is denoted by the numeral **1**, on which is positioned a pile **2** of sheets to be separated and fed into a machine such as a printing machine or the like. The pile table **1** is suspended in substantially known manner on chains **3** at either side of the device. Arranged in front of the pile is the feed roller **4** and the guide or pressure roller **5** between which a sheet **8** after its separation from the pile by the nozzle **7** and after it has been raised above the said pile is conveyed into the machine. The sheet separating and feeding means, comprising suction and blowing nozzles, fanning brushes, positioning abutments, and other elements as are required for the separation of the sheets from the pile, are formed into a self-contained aggregate and slidably positioned above the pile on a shaft **9** so as to be capable of adjustment to any size of sheets to be conveyed.

Positioned in front of the pile and in the vicinity of the feed roller **4**, are abutment rails **10** and a movable stop **11**. The fanning brushes **12** can be moved together with their holders **13** along a shaft **14** in accordance with the width of the sheets. They are preferably arranged in pairs and so as to bear with about the upper halves of their bristled heads on the edge of the pile. They can be raised and lowered with their extended back **15** in the holders **13**; abutment screws **16**, or the like, being provided to limit their movement in both directions. A particular advantage of this arrangement rests in that the brushes are thus capable of partaking in the receding or rising movement of the pile surface, so that no alterations in the conditions for an orderly separation of the topmost sheet from the pile can take place.

The separating and feeding means which separate the top sheets from the pile **2** by suction and feed them to the rollers **4** and **5**, consist of the cylinders **6** and **7**, which are mounted, preferably in pairs, on the shafts **18** and **14** respectively, and of which shaft **18** (FIGS. 1 and 7) is supported on a system of parallelogram levers **17**. Arranged within the cylinders, as shown for example by

the cylinder 7 in FIG. 2, is a hollow plunger 19 carrying at its lower end a nozzle 20 of preferably resilient material such as rubber or the like. The said nozzle is only pushed onto the plunger so it can be easily removed and replaced by another nozzle of different type or shape. At its top the plunger 19 is provided with a piston head 21 adapted to slide in the cylinder 6 and to serve as a spring plate for a compression spring 22 which tends to urge the plunger into its upper position. An orifice 25 in the wall of the plunger permits communication of the interior 23 of the plunger with the chamber 24 of the cylinder. A cylinder cover 26 provides an airtight closure of the cylinder during the withdrawal of the air from the chamber 24 via the conduit 27 at the lower end of the cylinder.

A control valve 50 (FIG. 8) of any known or convenient type and which forms no part of the invention, permits of withdrawing the air from the cylinder chamber 24 through the suction conduit 27, whereas the air which enters the interior of the suction plunger 19 is not sucked off but is allowed to move the plunger downwardly by pressing on the piston head 21 in conjunction with the full tension prevailing in the cylinder, until the top sheet of the pile is attracted by the nozzle, as at 8 in FIG. 1, whereby the nozzle 20 is closed.

In continuation of the process just described the air in the hollow plunger 19 and in the chamber above the piston head is also sucked off, whereby the tensional forces in the chambers are compensated and the plunger, with the top sheet adhering to it is lifted by the spring 22 and thus returned into its initial position.

The cylinder 6 is of substantially the same construction as the cylinder 7 just described, but its plunger 23*a* and nozzle 20*a* do not take part in the separation but only in the feeding of the sheet. This is to say that the plunger 23*a* in cylinder 6 is lowered by the air acting on its piston head, such as 21, just a slight amount until it contacts with the sheet 8 after the same has been raised by the returning nozzle 20 as shown in FIG. 1. At this moment the air in the cylinder 7 is cut off so that the sheet is supported by the nozzle 20*a* of the cylinder 6 only, which immediately is moved by the parallelogram levers 17 in the direction of and between the feed roller 4, 5, after which the suction air also in this cylinder 6 is cut off and the sheet 8 is carried on by the rollers 4, 5 into the printing or other mechanism of the machine, while the cylinder 6 itself is returned by the parallelogram levers 17 into its initial position.

The aforedescribed action of separating and feeding the top sheet of the pile may be enhanced by the employment of blowing nozzles 32 which move up and down in timed relation to the separating means in order to blow air in between the sheets at the top of the pile (FIGS. 1 and 3). The arrangement of the blowing nozzles is similar to that of the suction nozzles, consisting of a cylinder 28 in which a blowing plunger 29 is movable in vertical direction and urged upwardly by a compression spring 30. Air enters the cylinder via the socket 31 and leaves it by the nozzle 32 through the jet opening 32*a* which is of comparatively broad and narrow formation.

Compressed air is supplied to the blowing plunger 29 in timed relation to the operation of the suction means and accumulates at the lower end of the passage 33 in front of the jet 32*a*, whereby it acts in common with the air pressure on the piston head 34 to move the plunger 29, 32 downwardly against the action of the spring 30 and, at the same time, to blow air in between the upper sheets of the pile, a vent hole 28*a* being provided to return accumulated air from the cylinder into the atmosphere. During the intervals in the admission of the air as regulated by the control valve 50, the plunger is returned into its initial position by the compression spring 30 in the cylinder.

It stands to reason that the wholly air-operated separating, feeding and blowing means 6, 7, and 28 are less subjected to wear than the mechanically controlled means which have hitherto been employed. They are also most simple in construction and arrangement and require hardly any attention to keep them in workable condition.

The suction air and the blowing air are released for distribution through the control valve 50 by means of a hand lever 55 operating a distribution valve 51 (FIG. 8). The correct timing for the actuation of the hand lever is controlled in substantially known manner by a cam 56*a* and cam lever 56 in timed relation to the feeding of the sheets from the pile. The air distribution valve 51 with its graduated scale (not shown) and the control valve 50, as also the regulatable suction and blowing air means 52, 53 are arranged directly adjacent their places of use so that the air conduits 65 and 66 can be made very short, as shown in FIG. 7, and disturbances caused by the hitherto usual length of the conduits eliminated.

The control valve 50 (FIGS. 7 and 8) substantially consists of a cylinder 60 which rotates once for each sheet fed into the machine. The cylinder 60 is provided with three ports 61, 62, and 63, which are controlled to connect, at their respective intervals, the separating nozzles 7 by the port 61 from the socket 53 over the conduits 69, 70. The feed nozzles 6 from the socket 52 over the conduits 67, 68 by the port 62, and the blowing air nozzles 28 by the port 63 over the conduits 65, 66.

The distributing valve 51 serves to admit the suction and the blowing air to the control valve 50 by the actuation of the valve plate 64 through the hand lever 55. The said valve plate is locked and unlocked by the aforesaid cam 56*a* and the cam lever 56 in timed relation to the feeding of the sheets, which ensures the hand lever to be absolutely "fool-proof" and operable only when the separating nozzles are lowered into contact with the surface of the pile.

It is necessary that the top sheet of the pile must maintain a certain distance from the separating and feeding means and, in particular, from their nozzles if the device is to operate free of disturbance. For that reason certain lifting means operable in dependence of the pile surface are provided to function in conjunction with the sheet separating means. These lifting means, in accordance with the invention, are such as to be capable of being used as end switches, which is a further simplification of the construction and in the manipulation of the device.

Referring to FIGS. 1, 4 and 5, a cam 36 is provided which acts on a bell crank lever 37 to move the same together with the sheet separating and feeding means 7 and 6 in timed relation to the feeding of the sheets, whereby a tracer roll 40 and its holder 39 are raised and lowered in relation to the pile 2; the holder 39 being suspended from a lever 42 and moved by the rocking shaft 41. If required by the kind of work or the quality of the sheets, the tracer roll 40 may be adjusted somewhat lower as indicated at 43. Thumb levers 44 and 45 and a hand lever 38 are also arranged upon the rocking shaft 41, as will presently be described.

If during the separation of the sheets the top surface of the pile recedes, the tracer roll 40 with its holder 39 will follow, until it reaches the position 40*a* in FIG. 5. This causes an abutment 46 on the holder (FIGS. 4 and 6) to encounter the button of a switch 47 and thereby to close the circuit via the lines *a* and *b* to the lifting motor 48 and the line *c* to the main. The chains 3 are now set in motion and lift the pile table 1 until its former position is reestablished and the abutment 46 moved out of contact with the switch button 47, while the switch 49 becomes interrupted. As soon as the table 1 has reassumed its normal position and the roller 40 reattained the position of FIG. 4, the switch 47 is cut out again and the switch 49 closed over the wires *d* and *e*, *a* to the motor 48 and back over the wire *c* to the main.

When the handle 38 is turned so that the thumb lever 44 shortcircuits the working circuit and the switch 49

and the tracer roll 40 is pressed into the position 40*a* (FIG. 5) by the thumb lever 45 owing to the pin 45*a* pressing on the lever 42, the tracer roll is in a position of readiness to be used as a limit switch.

The upward movement of the new pile for taking up its correct position in relation to the separating means becomes interrupted when it strikes the roll 40. The pile then returns into its initial position with the thumb levers 44, 45 and the hand lever 38, whereby the circuit to the lifting motor 48 and, therewith, the lift of the pile is again interrupted at the switch 49.

The limit switch which has been in its position of rest, is not in a position of working readiness as a means for controlling and tracing the position of the top surface of the pile.

What I claim is:

1. In a pneumatic sheet separating and feeding device comprising in combination a platform supporting a pile of sheets to be fed in succession; means for raising said platform so as to maintain the top of said pile of sheets at a substantially constant level; a pair of horizontally arranged feeding rollers disposed adjacent the forward end of said pile of sheets; first suction means mounted for longitudinal and lateral adjustment above said pile of sheets near the rear end thereof said first suction means being movable in a vertical direction by differential pressure to engage, hold, and lift the top sheet of said pile; vertically reciprocating blowing means movable in timed relationship with the vertical movement of said first suction means by compressed air downward past the rear edge of said pile of sheets for separating the lower sheets from each other from said lifted top sheet mounted for longitudinal and lateral adjustment together with said first suction means; brushes mounted for longitudinal, vertical and lateral adjustment engaging the rear upper edge of said pile of sheets and supporting sheets raised by said bowing means; second suction means mounted for longitudinal and lateral adjustment above said pile of sheets in spaced relation to said first suction means movable in a vertical direction by differential pressure to engage and hold said lifted and separated upper sheet and movable in a longitudinal direction toward said pair of feeding rollers after said first suction means have released said uppermost sheet, means correlating the action of the first and second suction means and the blowing means, and height-sensing means for said pile of sheets movable in synchronism with said first and second suction means for energizing said lifting means.

2. In a pneumatic sheet separating and feeding device comprising in combination a platform supporting a pile of sheets; means for lifting said platform so as to maintain the top of said pile of sheets at a substantially constant level; a pair of feeding rollers disposed in front of said sheets; a central guide rail provided above said pile of sheets extending in a horizontal, longitudinal direction over the entire length of said platform; a slide member arranged for longitudinal adjustment on said central guide rail; a first supporting member mounted on said slide member and extending rectangularly and horizontally toward both sides of said central guide rail across the entire width of said platform; first suction means mounted for lateral adjustment on said first supporting member, said first suction means being movable in a vertical direction by differential pressure and disposed to engage, hold and lift the rear end of the top sheet; vertically reciprocating blowing means mounted for lateral adjustment with said first suction means on said first supporting member, said blowing means being movable by compressed air downward in timed relationship with the vertical movement of said first suction means past the rear edge of said pile of sheets for separating the lower sheets from each other and from said lifted top sheet; brushes mounted for lateral adjustment on said first supporting member engaging the rear upper edge of said pile of sheets, holding them spread apart and facilitating the separation of said uppermost sheet; a second supporting member spaced forwardly in parallel relation to said first supporting member and extending over the entire width of said platform, said second supporting member being connected with said longitudinal slide member by a parallel linkage assembly for moving said second supporting member in timed relation to the action of said first suction means; second suction means mounted for lateral adjustment on said second supporting member and being movable in a vertical direction by differential pressure to engage, hold and lift said separated upper sheet moving the latter in a longitudinal direction toward said pair of feeding rollers after said first suction means have released said sheet, means correlating the action of the first and second suction means and the blowing means, and height-sensing means for said pile of sheets movable in synchronism with said first and second suction means for energizing said lifting means.

3. In a pneumatic sheet separating and feeding device comprising in combination a platform supporting a pile of sheets to be fed in succession; said platform being suspended on chains engaging sprockets drivably connected with an electric motor, a tracing roll engaging the top of said pile of sheets being arranged at the free end of a bell crank lever actuated by a cam to lift said tracing roll in timed relation with the feeding of said sheets, cam means connected with said bell crank lever adjacent said tracing roll closing a switch actuating said motor to lift said platform when a predetermined lower level of the top of said pile of sheets is attained and opening said switch for deenergizing said motor when a predetermined level of the top of said pile of sheets is reached, a pair of horizontally arranged feeding rollers disposed adjacent the forward end of said pile of sheets; first suction means mounted for longitudinal and lateral adjustment above said pile of sheets near the rear end thereof, said first suction means being movable in a vertical direction by differential pressure to engage, hold and lift the top sheet of said pile; vertically reciprocating blowing means movable by compressed air downward in timed relationship with the vertical movement of said first suction means past the rear edge of said pile of sheets for separating the lower sheets from each other and from said lifted top sheet; brushes mounted for longitudinal, vertical and lateral adjustment engaging the rear upper edge of said pile of sheets and supporting sheets raised by said blowing means; second suction means mounted for longitudinal and lateral adjustment above said pile of sheets in spaced relation to said first suction means movable in vertical direction by differential pressure to engage and hold said lifted and separated upper sheet and movable in a longitudinal direction toward said pair of feeding rollers after said first suction means have released said uppermost sheet, and means correlating the action of the first and second suction means and the blowing means.

4. In a pneumatic sheet separating and feeding device comprising in combination a platform supporting a pile of sheets to be fed in succession; said platform being suspended on chains engaging sprockets drivably connected with an electric motor; a tracing roll engaging the top of said pile of sheets being arranged at the free end of a bell crank lever actuated by a cam to lift said tracing roll in timed relation with the feeding of said sheets; cam means connected with said bell crank lever adjacent said tracing roll closing a switch actuating said motor to lift said platform when a predetermined lower level of the top of said pile of sheets is attained and opening said switch for deenergizing said motor when a predetermined level of the top of said pile of sheets is reached; a second switch provided to stop said motor lifting said platform when the original height of the pile has been reattained; a hand lever provided for manually actuating means engaging and lowering said cam means connected with said bell crank lever so as to place said first switch in readiness to serve as a limit switch; a pair of feeding rollers

disposed in front of said sheets; a central guide rail provided above said pile of sheets extending in horizontal, longitudinal direction over the entire length of said platform; a slide member arranged for longitudinal adjustment on said central guide rail; a first supporting member mounted on said slide member and extending rectangularly and horizontally toward both sides of said central guide rail across the entire width of said platform; first suction means mounted for lateral adjustment on said first supporting member said first suction means being movable in vertical direction by differential pressure and disposed to engage, hold and lift the rear end of the top sheet; vertically reciprocating blowing means mounted for lateral adjustment with said first suction means on said first supporting member, said blowing means being movable by compressed air in timed relationship with said first suction means past the rear edge of said pile of sheets for separating the lower sheets from each other and from said lifted top sheet; brushes mounted for lateral adjustment on said first supporting member engaging the rear upper edge of said pile of sheets holding them spread apart and facilitating the separation of said uppermost sheet; a second supporting member spaced forwardly in parallel relation to said first supporting member and extending over the entire width of said platform, said second supporting member being connected with said longitudinal slide member by a parallel linkage assembly for moving said second supporting member and in timed relation to the action of said first suction means; second suction means mounted for lateral adjustment on said second supporting member and being movable in vertical direction by differential pressure to engage, hold and lift said separated upper sheet moving the latter in longitudinal direction toward said pair of feeding rollers after said first suction means have released said sheet.

5. A pneumatic sheet separating and feeding device according to claim 1 in which said blowing devices each comprises a substantially vertically arranged cylinder closed at both ends by plates, a piston slidably arranged within said cylinder and urged upwardly by a compression spring; a hollow piston rod open at both ends extending through said piston and the lower endplate of said cylinder and carrying on its outwardly extending end an arcuately shaped blowing nozzle communicating through said hollow piston rod with the cylinder space above said piston, said blowing nozzle being provided with a narrow horizontally extending jet opening; an inlet for compressed air provided at the upper end of said cylinder; and a vent hole provided in the lower end plate of said cylinder, said compressed air the outlet of which being restricted by said jet opening causing said piston to move downwardly against the action of said spring.

6. A pneumatic sheet separating and feeding device according to claim 4, in which a control valve of any suitable type, such as rotatable valves, is arranged adjacent said suction and said blowing means connecting said first and said second suction means with a source of negative air pressure and said blowing means with a source of positive air pressure in timed relation.

7. In a pneumatic sheet separating and feeding device comprising in combination a platform supporting a pile of sheets to be fed in succession; means for raising said platform so as to maintain the top of said pile of sheets at a substantially constant level; a pair of horizontally arranged feeding rollers disposed adjacent the forward end of said pile of sheets; first suction means mounted for longitudinal and lateral adjustment above said pile of sheets near the rear end thereof, said first suction means being movable in a vertical direction by differential pressure to engage, hold, and lift the top sheet of said pile; vertically reciprocating blowing means movable by compressed air downward past the rear edge of said pile of sheets for separating the lower sheets from said lifted top sheet mounted for longitudinal and lateral adjustment together with said first suction means; brushes mounted for longitudinal, vertical and lateral adjustment engaging the rear upper edge of said pile of sheets and supporting sheets raised by said blowing means; second suction means mounted for longitudinal and lateral adjustment above said pile of sheets in spaced relation to said first suction means movable in a vertical direction by differential pressure to engage and hold said lifted and separated upper sheet and movable in a longitudinal direction toward said pair of feeding rollers after said first suction means have released said uppermost sheet, means correlating the action of the first and second suction means and the blowing means, height sensing means for said pile of sheets movable in synchronism with said first and second suction means for energizing said raising means, said first and second suction means each comprise a substantially vertically arranged cylinder closed at both ends by plates and being provided with a suction port at its lower end communicating with a suction line; a piston slidably arranged with said cylinder and urged upwardly by a compression spring; a hollow piston rod open at both ends extending through said piston and the lower end plate of said cylinder and carrying on its outwardly extending end a suction cup communicating through said hollow piston rod with the cylinder.

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