Jan. 12, 1954 T. A. RIBICH 2,665,907

AIR CONTROL MECHANISM FOR PNEUMATIC SHEET SEPARATORS

Filed Sept. 6, 1950 4 Sheets-Sheet 1

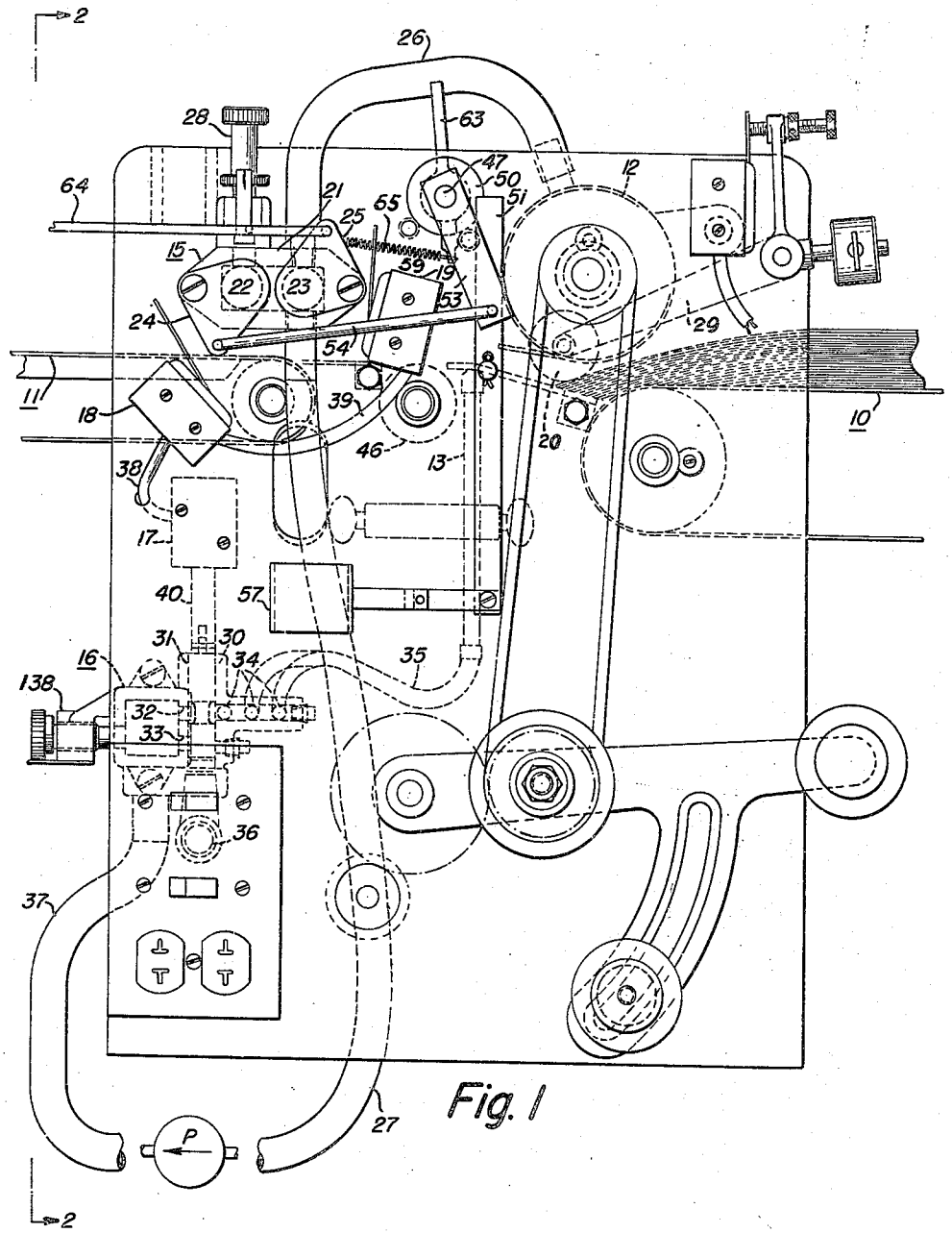


Fig. 1

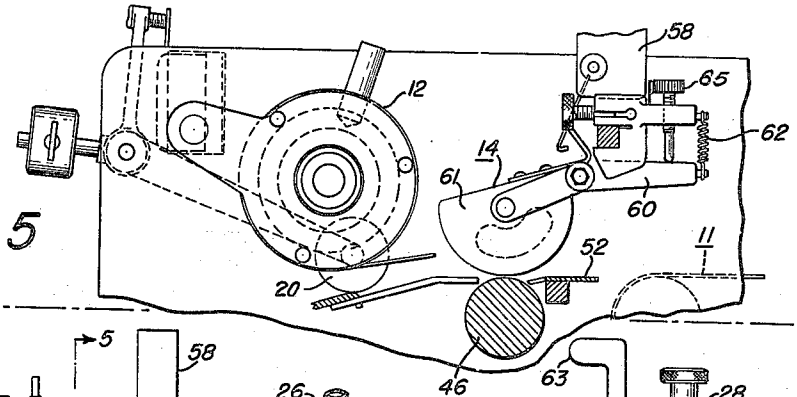
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Fig. 5



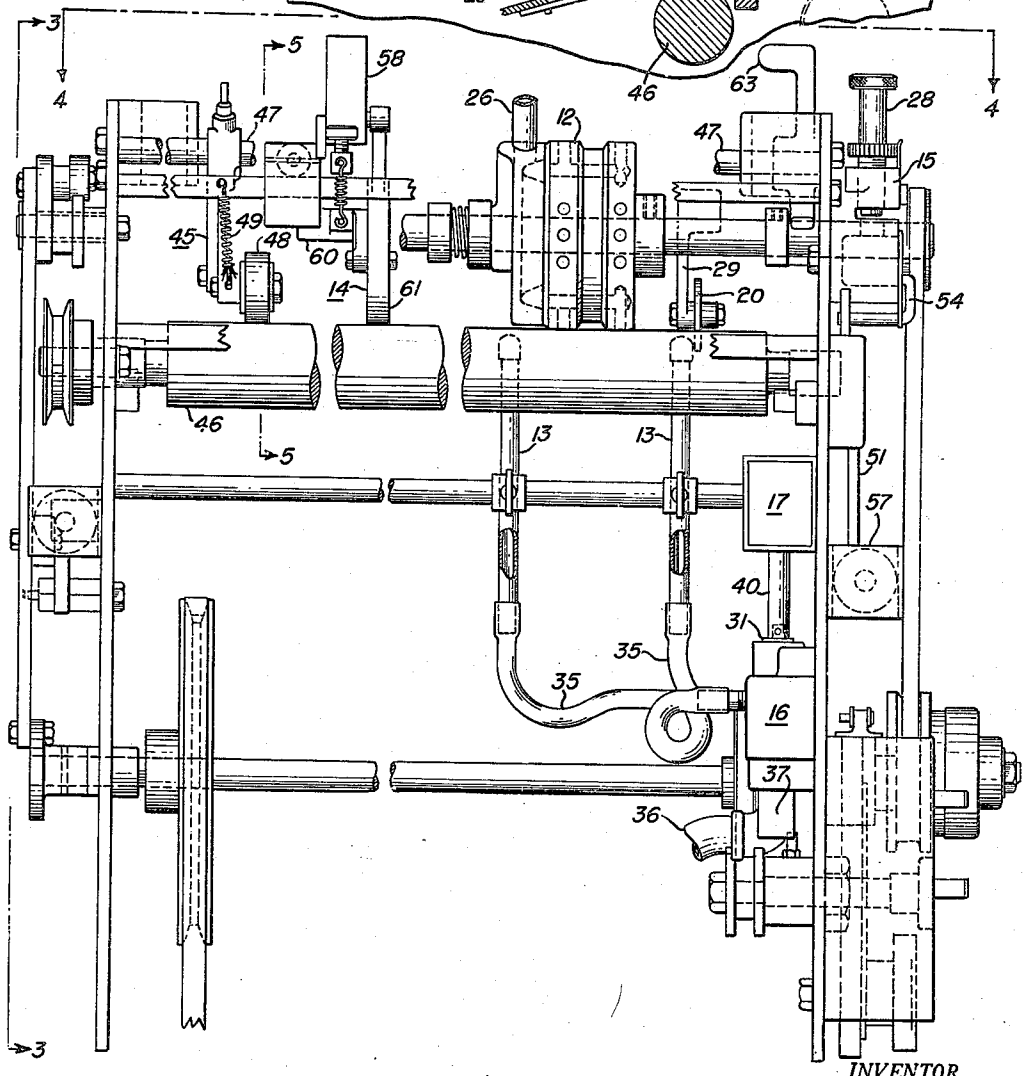


Fig. 2

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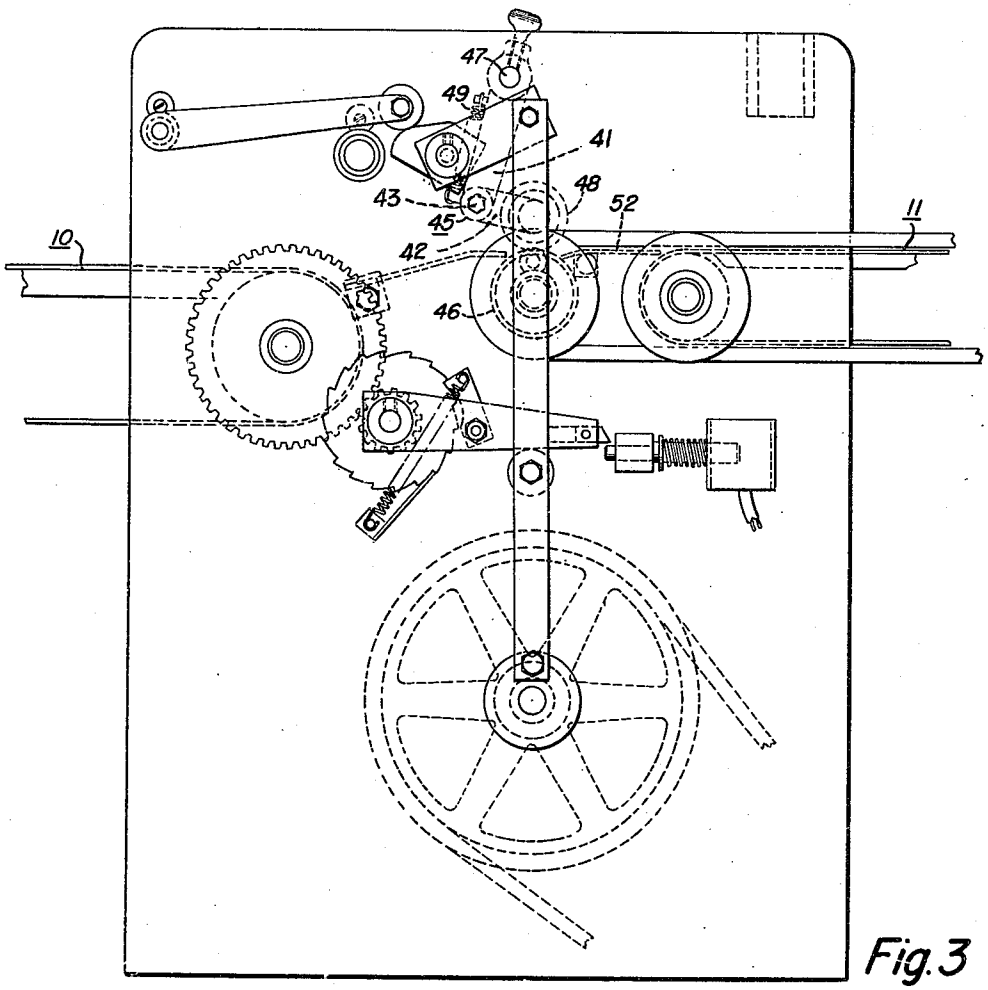


Fig. 3

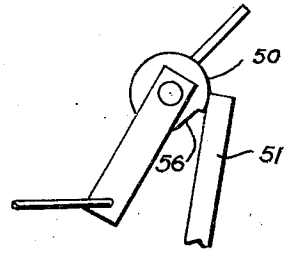


Fig. 6.

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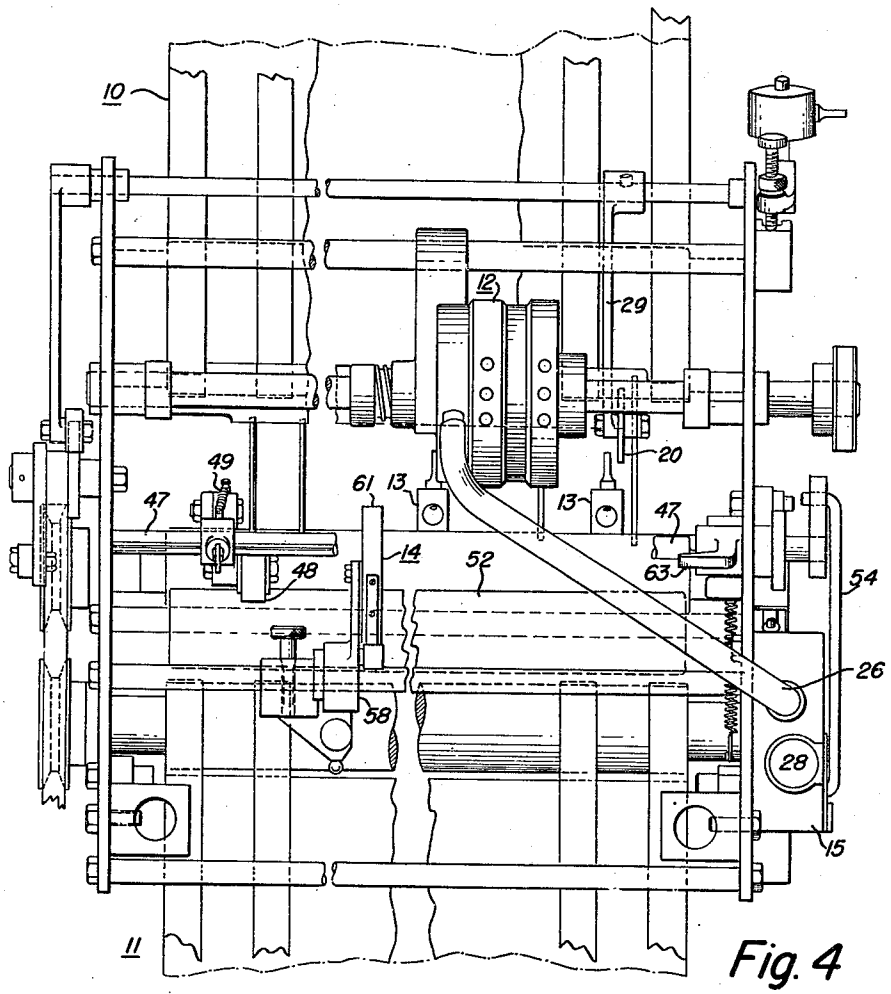


Fig. 4

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AIR CONTROL MECHANISM FOR PNEUMATIC SHEET SEPARATORS

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Application September 6, 1950, Serial No. 183,401

3 Claims. (Cl. 271—57)

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This invention relates to paper folding machines and in particular to a device for shutting off the air blast in the paper separating part of the machine when the suction is shut off.

In many paper folding machines, papers are carried into the machine on a conveyor in a long stack form and the top sheet of paper is removed from the stack by a paper separator device so that the sheets of paper may be individually folded. These paper separator devices generally use a suction wheel and an air blast with the air blast directed into the forward edge of the stack of papers and the suction wheel engageable with the top sheet of paper in the stack to move it forward. The air blast separates the top sheet of paper from the stack and the suction wheel sucks the top sheet against itself and moves the top sheet only forward.

Once in a while two sheets of paper will stick together and if the machine is not stopped, these two sheets of paper will pass into the folding part of the machine together. To prevent two sheets of paper passing into the folding part of the folding machine, a two sheet detector is installed on the machine, which detector operates according to the thickness of material passing through it. Thus, when the detector encounters papers thicker than a single sheet of paper, the detector stops further removal of the top sheet of paper from the stack of papers until the machine is again started in operation by hand. In the past, the air blast against the forward edge of the stack of papers has continued even though the top sheet of paper was not being removed from the stack of papers. In this condition, however, the continuous air blast soon mutilated the edges of the sheets of paper and sometimes would gradually blow the papers off the stack.

Therefore one of the objects of the invention is to provide an electrical control which may be either manually operated or automatically operated by the two sheet detector to shut off the air blast when the separator device is not operating.

Another object of the invention is to provide the air feed device for a paper manipualting machine with an air blast means and a by-pass means wherein the air blast means is directed towards a suction wheel and the stack of papers and the by-pass means is directed away from the suction wheel and the stack of papers.

Another object of the invention is to provide a positive and simple electrically operated valve structure which directs an air blast into the edge of the stack of papers only while the sheets of

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paper are being removed from the top of the stack.

Another object of the invention is to provide a positive and simple valve structure which directs an air blast into the edge of the stack of papers only while the sheets of paper are being removed from the top of the stack.

Another object of the invention is to electromechanically operate a suction valve upon and by operation of a multi-sheet detector.

Another object of the invention is to electrically interassociate the suction and by-pass valves on a paper separating machine.

Other objects and a fuller understanding of this invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a front side elevational view of the paper separation portion of a folding machine;

Figure 2 is taken along the line 2—2 of Figure 1, with certain parts omitted for purposes of clarity;

Figure 3 is a back side elevational view of the machine taken along the line 3—3 of Figure 2;

Figure 4 is a top view of the machine as taken along the line 4—4 of Figure 2;

Figure 5 is a fragmentary cross-sectional view taken along the line 5—5 of Figure 2; and

Figure 6 is a diagrammatic illustration of the cam, designated by reference character 50, and the holding lever, designated by reference character 51, in the release position of these elements, to better illustrate their form and function.

The paper separating device illustrated in the drawings is positioned between first and second conveyors which are disposed in end to end relationship. In this instance, the conveyor 10 conveys the stack of paper into the separating device and the conveyor 11 conveys the individual sheets of paper away from the paper separating device towards the paper folding part of the machine. The paper folding part of the machine is not illustrated in the drawings or described herein since it is a conventional design. The conveyor 10 operates in a stepped movement to keep a continuous supply of paper at the paper separator. A sensor wheel 20, as best shown in Figures 1, 2, and 4, is mounted by a swinging arm 29. This sensor wheel 20 raises and lowers in a rapid tapping motion at one side of the paper being fed, and through associated control mechanism, causes the conveyor 10 to feed more paper when the wheel 20 approaches too closely to the conveyor surface. Thus, when the separator has removed the top sheets from the stack of papers,

the conveyor 10 again steps the stack of papers into the separator. The conveyor 11 moves continuously to carry the individual sheets of paper away from the paper separator as the individual sheets of paper have been removed from the top of the stack. The embodiment of the invention illustrated employs a suction wheel 12 for attracting the stop sheet from a stack of paper as that sheet is lifted by an air blast, and to move that sheet forward off the stack. Also, an air blast device 13 is provided in a position to blow air into the edge of the stack and between the sheets of paper to separate the top sheet from the other sheets in the stack. As is illustrated in Figures 1, 2 and 4 of the drawings, the air blast device 13 is in the form of tubes, also identified by the number 13, having nozzles at the upper end thereof directing the air generally towards the suction wheel and into the forward edge of the stack of papers. The air suction wheel 12 is of standard design found in paper separating devices and is rotating when it engages the top sheet of paper to push that sheet of paper in a forward direction. In Figure 1 of the drawings, the suction wheel 12 moves the sheet of paper from right to left over top of the air blast nozzles of the air blast device 13 and onto the conveyor 11.

As is best illustrated in Figures 4 and 5, of the drawings, a two sheet detector 14 is located between the suction wheel 12 and the conveyor 11 to stop the paper separating device if more than one sheet of paper is moved on to the conveyor 11 at a time. The suction wheel 12 and the air blast device 13 may be connected through suitable valves to an air pump P illustrated diagrammatically in Figure 1 of the drawings. The suction wheel 12 is connected to the intake of the pump and the air blast tubes 13 are connected to the outgoing side of the pump. Between the air pump P and the suction wheel 12 is a suction valve 15 and between the air blast tubes 13 and the pump P is a by-pass valve 16. The by-pass valve 16 is operated by a solenoid 17 controlled by micro-switches 18 and 19 which are aligned to be operated by the suction valve 15.

The suction valve 15 comprises a hollow housing 21 having suction ports 22 and 23 in one wall thereof opening to atmosphere. A first plate 24 pivotally mounted on the housing 21 normally closes the suction port 22 while the separator is operating and a similar second plate 25 is pivotally mounted on the housing 21 to cover the suction port 23 while the machine is operating. A flexible tube 26 interconnects the hollow housing 21 of the suction valve 15 and the suction wheel 12. A tube connection 27 connects the hollow housing 21 to the suction pump P, or other suitable device which will provide a suction through the valve 15 and the suction wheel 12. The amount of suction in the suction wheel 12 may be closely regulated by a bleeder 28 mounted on the suction valve 15 to permit entry of air therein to control the amount of suction desired in the suction wheel 12. When either of the plates 24 or 25 are moved from the suction ports 22 or 23, air is sucked through these ports, thus removing the suction from the suction wheel 12.

The by-pass valve 16 is of the sliding piston valve type and comprises a housing having a cylinder 30 with a piston 31 therein and first and second ports 32 and 33 respectively in the wall of the cylinder 30. An exit port 34 in the wall of the cylinder 30 is interconnected with the air blast tubes 13 by means of flexible tubin 35. The by-pass valve 16 is also provided with an exhaust port 36 which is directed away from the suction wheel 12 to direct a stream of air away from the forward edge of the stack of papers, which forward edge is close to the suction wheel 12.

In operation, air enters the by-pass valve 16 from the air pump P through the tube 37, passes through the cylinder 30 and either into the air blast tubes 13 or out through the exhaust 36. The solenoid 17 controls the position of the piston 31 in the valve 16 whereby the valve simultaneously controls the air blast means and the by-pass means and permits air to enter a desired one only of these means.

In Figure 1 of the drawings, the valve 16 is illustrated with the piston down and the solenoid 17 non-energized. Thus the valve 16 is illustrated as directing air into the air blast tubes 13 by means of the opening of a path between ports 32 and 34 in the valve. The exhaust port 36 exhausts the air blast when the valve is positioned with the piston 31 pulled up from the position shown in Figure 1 by the solenoid 17 to prevent the air going through the air blast tubes 13, and to provide a path between the port 33 and the exhaust 36. In this manner, a continuous pumping air pump may be used for the pump P to provide a continuous supply of air to the by-pass valve 16. A bleeder 138 may be fastened to the by-pass valve 16 to regulate the pressure of the air going from the pump into the valve 16 and further into either the air blast tube 13 or the exhaust port 36.

As was previously stated, the piston 31 is controlled by the solenoid 17 which in turn is controlled by the switches 18 and 19. In this particular instance, the piston 31 is co-axially aligned with the armature 40 of the solenoid and extends from the end of the armature. The solenoid has been positioned directly over the cylinder 30 whereby the weight of the armature and the piston 31 cause the piston to drop down, thus providing the opening or path between the port 32 and the exit port 34 so that the air blast will be directed through the tubes 13 and in the general direction of the suction wheel 12 into the forward edge of the stack of papers on conveyor 10. Upon energization of the solenoid 17 by either of the micro-switches 18 or 19, the armature 40 is raised, thus raising the piston 31, thereby closing ports 32 and 34 and opening port 33 to form a path between port 33 and the exhaust 36 to by-pass air through the exhaust port 36 to atmosphere in a region remote from the region of the suction wheel 12 and the forward edge of the papers on conveyor 10.

The switches 18 and 19 are electrically connected in parallel whereby closing of either switch will cause energization of the solenoid 17 to effect by-passing of the air from the tubes 13 through the exhaust port 36.

In the drawings, the wires electrically connecting the switches 18 and 19 with the solenoid 17 are identified by the reference characters 38 and 39. These switches 18 and 19 are preferably of the micro-switch type and it is understood that when referring to a micro-switch, any switch which may be used in the place of a micro-switch is also within the scope of the invention.

The switch 18 is aligned with the plate 24 on the suction valve 15 so that pivotal movement of the plate 24 to uncover the suction port 22 causes the plate 24 to engage the operating switch arm of the switch 18 and close the switch 18 to energize the solenoid 17. Similarly, the plate 25 en-

gages the switch arm of the switch 19 to energize the solenoid 17 when the plate 25 is pivoted to uncover the opening 23 in the suction valve 15. Thus, by spacing the plates and switch arms there is provided a lost motion means which provides a time lapse from the time the vacuum is broken until the air blast is cut off by actuation of the first by-pass valve. With this arrangement, soon after the suction is removed from the suction wheel 12 by opening either of the suction ports 22 or 23, the respective micro-switch 18 or 19 causes energization of the solenoid 17 to move the piston 31 upwardly and thereby by-pass the air blast out through the exhaust 36.

The time lag also operates in reverse. This invention provides the only such machine which permits the air blast to be reinstated after shutdown without simultaneously reinstating the vacuum. The plates 24 and 25 may be moved toward their closed position far enough to separate from the switch arms, and yet not close off the ports. Therefore, the air blast can be operated while the second by-pass valve is still bled to atmosphere. This feature is very desirable in permitting a perfect setting of the air blast without interference by the suction wheel 12.

The cover plate 24 is mechanically pivoted by a follower wheel device 45 which is electro-mechanically controlled by the two sheet detector 14. The paper separator device is provided with a driven roll 46 over which each sheet of paper is pushed by the suction wheel 12. The follower wheel device 45 is carried by a pivotal shaft 47 bearingly mounted in the supporting structure of the paper separator and extending through the front wall thereof near the suction valve 15. This follower wheel device 45 has a knee-action mounted follower wheel 48 spring biased by means of a knee-action spring 49 and urged against the driven roll 46. (See Figures 2 and 3.)

The follower wheel 48 is driven by surface contact with the roll 46. Paper feeds between the roll 46 and the wheel 48. The primary purpose of the follower wheel device 45 is to snap forward upon the conveyor table 52 and hold a paper which has passed beyond the roll 46 improperly. That is, if the feeding suction wheel 12 should by some chance feed a multiple number of sheets of paper, then the purpose of the follower wheel device 45 is to jump forward and hold the multiple papers and prevent advance of the papers on to the conveyor 11 into the subsequent operation. The two sheet detector 14, as best illustrated in Figure 5, is positioned close to the roll 46 and serves the purpose of indicating the presence of more than one sheet of paper passing over roll 46. If more than one sheet of paper passes this two-sheet detector 14, an electrical signal is sent out by the detector 14. The electrical signal is employed to cause the follower wheel device 45 to snap forward and catch the multiple sheets before they can advance to the conveyor 11.

In Figures 1 and 3, the shaft 47 is indicated as extending across the entire machine. In Figure 1, there is provided a cam 50 having a notch 56 therein as best illustrated in Figure 6 of the drawings. The cam 50 is keyed to shaft 47, and therefore is non-rotative with respect to the shaft 47, or in other words, rotates with the shaft 47 in driving and driven relationship. An arm 59 carried by the shaft 47 projects downwardly therefrom and serves as a fastening device upon which a spring 55 is hooked. The spring 55 is turn is carried by a fixed member upon the frame of the machine. The spring 55 is under tension and consequently tends to rotate the shaft 47 in a clockwise direction as viewed in Figure 1.

A locking lever 51 is pivotally carried by the frame of the machine and engages into the notch 56 of cam 50 and holds the cam 50 and shaft 47 against the tendency to rotate clockwise under the urge of spring 55.

Referring to Figure 3 of the drawings, it may be seen that clockwise rotation of shaft 47 in Figure 1 represents a counterclockwise rotation of shaft 47 in Figure 3. Therefore, the follower wheel device 45, which is in the form of a knee action device carrying the follower wheel 48 on the end thereof, is under a constant urge by the spring 55 to advance towards the conveyor table 52. That is, when the shaft 47 rotates in a counterclockwise direction as viewed in Figure 3, the lever arm 41 and the lever arm 42 will swing to the right in Figure 3 about the pivot 43 and snap the wheel 48 forward upon table 52. However, the lever 51 engaged in the notch 56 prevents such movement when engaged as shown in Figure 1.

The lever 51 is disengaged from the notch 56 by a drive imparted from a solenoid 57 actuating the end of lever 51 on the side thereof opposite the pivot from the end which is engaged into the notch 56. Reference was made to an electrical impulse sent out by the two sheet detector 14. This electrical impulse energizes the solenoid 57 and disengages the lever 51 from the notch 56. Thus, the presence of more than the desired quantity of paper between the detector 14 and the roll 46 causes the solenoid 47 to disengage the lever 51 from notch 56 and thereby release the shaft 47 to rotate under the urge of spring 55. The spring 55 has considerable leverage and inherent power, and consequently the previously described snap action of the follower wheel device 45 will take place instantly and the wheel 48 will jump out upon table 52 where it will press downwardly upon the paper which passed under the detector 14 and hold that paper upon the table 52 and prevent its advance on to the conveyor 11. The wheel 48 is driven only by reason of its contact with roll 46 and consequently when the wheel 48 jumps out upon the stationary table 52 it will come to rest immediately and hold the papers on top of the table 52 until they are later removed by the operator.

The pivot shaft 47 is provided with a crank arm 53. Interconnecting the pivot plate 24 on the suction valve 15 and this crank arm 53 is a link 54, as best illustrated in Figure 1. When the shaft 47 is released to rotate and snap the follower wheel device forward, the pivot plate 24 is swung by means of this crank arm 53 and link 54, thereby opening the suction port 22 and cutting off suction from the suction wheel 12. As has been previously described, the pivotal movement of this plate 24 operates the switch 18 and solenoid 17 to cause the by-pass valve 16 to by-pass air intended for the air blast tubes 13. The air is by-passed through the exhaust 36 and into the atmosphere at a region remote from the suction wheel 12.

The two sheet detector 14 is of standard construction comprising a support 60 adjustably mounted on the supporting structure of the machine and supporting a cam feeler 61 in cooperative association with the driven roll 46. This cam feeler 61 may be moved towards and away from the driven roll 46 to regulate the distance therebetween so that the cam feeler is moved if more

than a single sheet of paper passes therebetween. Adjustment of the feeler 61 is provided by a spring 62 and an adjustment screw 65. The spring tends to urge the end of the support 60 in one direction, and the screw forces the support 60 in the other direction. By moving the screw downwardly in a direction illustrated in Figure 5, the cam wheel 61 is raised away from the roller 46 to allow a thicker paper to pass without detection, and conversely rotating the screw to raise the end of the support 60 will allow the spring 62 to rotate and lower the cam feeler 61 for detection of thinner paper sections passing over the roll 46. When more than a single sheet of paper passes between the cam feeler 61 and the driven roll 46, the cam feeler 61 is partially rotated and operates the switch 58. As soon as the switch 58 is operated, the solenoid 57 is energized to unlock or move the locking lever 51 from cam 50 to permit pivotal and forward movement of the follower wheel device 45.

It is thus seen that the present device not only electro-mechanically interconnects the two sheet detector 14 to the suction valve 15 and the by-pass valve 16, but also provides means for catching the plurality of sheets of paper removed from the top of the stack to prevent them simultaneously moving on to conveyor 11 as a group. These sheets of paper may be removed by hand and run through the separator again so that they will be separated. As soon as the two sheet detector detects a thickness of more than one sheet of paper being removed from the top of the stack, it catches those papers, and causes the opening of the suction valve 15 to remove suction from the wheel 12. The air blast or by-pass valve 16 is thereby operated and by-passes the air blast from the tubes 13 through the exhaust 36 as hereinbefore described.

After the plurality of papers have been removed from between the follower wheel 48 and the conveyor table 52, the suction may be returned to the suction wheel 12 and the air returned to the air blast tubes 13 by manually resetting the pivot shaft 47. The pivot shaft 47 is easily returned to its running position wherein the pivot plate 24 covers the suction port 22 and the locking lever 51 locks into cam 50 by moving a small handle 63. In Figure 1 of the drawings, the component parts of the two sheet detector, the knee-action follower wheel device and the valves are illustrated in operating position with a stack of papers positioned on the conveyor 11 so that the top sheet thereof may be moved from the conveyor 10 on to the conveyor 11.

An elongated manually and longitudinal handle 64 fastened to cover plate 25 provides manual control of the suction valve 15 and therethrough the air blast by-pass valve 16. By providing means for by-passing or redirecting the air blast when the suction is not on the suction wheel, papers on the conveyor table 10 do not become mutilated and disarranged. This control, both manual and automatic, of the air blast on the forward edge of the stack of papers has greatly increased the efficiency of the machine as well as greatly reducing the shut down time of the machine.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A paper-feeding machine having control mechanism to provide both automatic and manual means to stop the feeding operation of the machine without stopping the mechanical movement thereof comprising, bulk delivery means to hold a stack of paper, a rotatable suction wheel mounted with the periphery of the wheel a distance above the said stack of paper and out of contact therewith, an air nozzle directed toward the edge of the stack of paper, whereby an air blast delivered therethrough will lift paper from a stack and push it upwardly against said suction wheel, air pump means providing a flow of air to said air nozzle, first by pass valve means between said air pump means and said nozzle, said by-pass valve means having a first position directing air from said pump means to said nozzle and a second position directing air from said pump means to atmosphere to thereby inactivate said air nozzle, vacuum pump means drawing a low pressure upon said vacuum wheel, second by-pass valve means between said vacuum pump means and said vacuum wheel, said second by-pass valve having a first and second port openable to atmosphere for breaking the vacuum on the vacuum wheel, automatic detector means for determining the presence of more than one sheet of paper advanced together by the suction wheel, control means responsive to said detector means operating to open said first port of the second by-pass valve upon detection of excess feed to thereby break the vacuum on the vacuum wheel and prevent further feed, manual control means for the second port of the second by-pass valve to stop the feed at any desired time, lost motion means responsive to operation of both the control means and the manual control means, said lost motion means operating said first by-pass valve from said first position to said second position after a time lapse from the break of the vacuum, said lost motion means providing operation of said first by-pass valve from said second position to said first position without closing of said ports of the second by-pass valve means.

2. A paper-feeding machine comprising, a paper advancing mechanism having a sub-atmosphere pressure system of attracting paper thereto, a vacuum line leading to said paper advancing mechanism, a control valve in said vacuum line, said control valve having a first and second port opening to atmosphere, first and second cover means to close each said port, manual means to remove said second cover means from said second port and break the vacuum in said vacuum line, a multiple feed detector to determine the advancing of excessive paper by said paper advancing mechanism, control means responsive to said detector to remove said first cover means from said first port and break the vacuum in said vacuum line, an air nozzle directed toward said paper advancing means in a direction transverse to the position to be occupied by a stack of paper positioned for feeding by said advancing means, air supply means feeding air under pressure through an air line to said air nozzle, a valve in said air line to stop the flow of air, electrical power drive means to actuate said air line valve, and switch means to energize said electrical power drive means, said switch means positioned to be actuated by cover means of either said first or second port as said cover

means is removed to break the vacuum to said paper advancing mechanism, whereby the vacuum and air blast are broken in sequence upon detection of excess feed.

3. A paper-feeding machine comprising, a paper advancing mechanism having a sub-atmosphere pressure system of attracting paper thereto, a vacuum line leading to said paper advancing mechanism, a control valve in said vacuum line, said control valve having a first and second port opening to atmosphere, first and second cover means to close each said port, manual means to remove said second cover means from said second port and break the vacuum in said vacuum line, a multiple-feed detector to determine the advancing of excessive paper by said paper advancing mechanism, a micro-switch positioned to be actuated by said detector, electrical power drive means controlled by said micro-switch to remove said first cover means from said first port and break the vacuum in said vacuum line, an air nozzled irected toward said paper advancing means in a direction transverse to the position to be occupied by a stack of paper positioned for feeding by said advancing means, air supply means feeding air under pressure

through an air line to said air nozzle, a valve in said air line to stop the flow of air, electrical power drive means to actuate said air line valve, and switch means to energize said electrical power drive means, said switch means positioned to be actuated by the cover means of either said first or second port as said cover means is removed to break the vacuum to said paper advancing mechanism, whereby the vacuum and air blast are broken in sequence upon detection of excess feed.

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