Nov. 12, 1957 G. W. TEBBS 2,812,941

SHEET SEPARATING MACHINES

Filed April 13, 1954 2 Sheets-Sheet 1

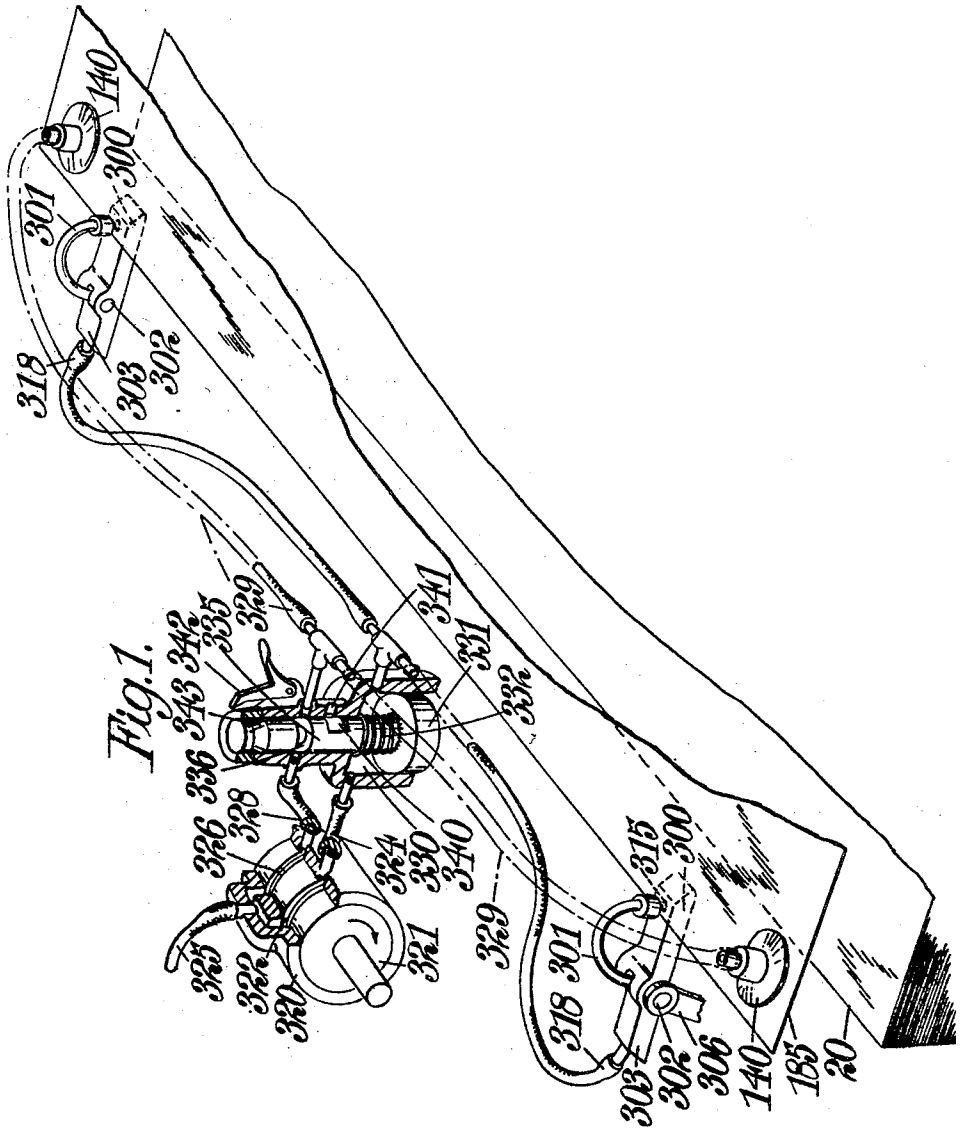


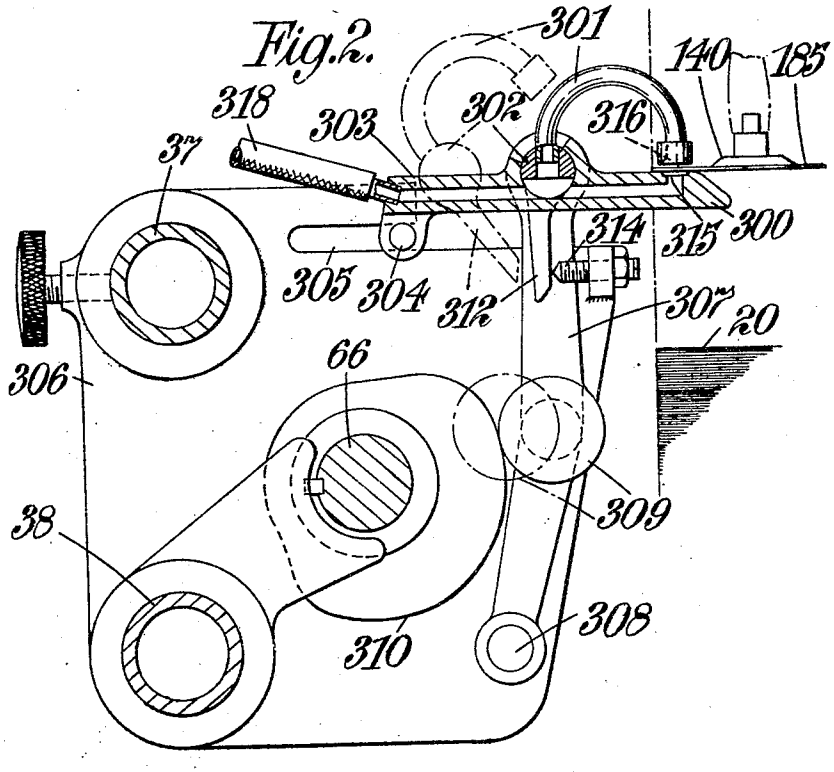
Fig. 1.

Nov. 12, 1957 G. W. TEBBS 2,812,941

SHEET SEPARATING MACHINES

Filed April 13, 1954 2 Sheets-Sheet 2

Fig. 2.



United States Patent Office 2,812,941 Patented Nov. 12, 1957

2,812,941

SHEET SEPARATING MACHINES

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Application April 13, 1954, Serial No. 422,950

Claims priority, application Great Britain April 14, 1953

11 Claims. (Cl. 271—56)

The invention relates to machines for separating sheets of paper, card or the like one by one from the top of a pile and is concerned with machines of this kind in which, as an initial step in the separation of each sheet an edge portion of the sheet is elevated from the pile. Examples of machines of this kind are described in patent specification No. 2,108,702 and in the specification of my application Serial No. 348,313, filed April 13, 1953, now Patent No. 2,761,679, issued September 4, 1956. Usually machines of this kind are associated with means for removing the separated sheets from the pile. Such removing means are also described in the above-mentioned specifications.

Machines of the above kind are commonly employed to supply individual sheets to printing presses, creasing machines and other machines operating on individual sheets.

It is important that if, in the operation of such a separating machine, two or more sheets should adhere, this should immediately be detected and the separation of further sheets be prevented or a warning be given. It is an object of the present invention to provide improved means which operate at an early stage in the separation of the sheets, to detect failure properly to separate a sheet from the underlying sheet on the pile.

According to the invention a sheet separating machine of the above kind is provided with means operable on the elevated edge portion of each sheet for detecting if an edge portion of a second sheet is improperly adhering thereto and with means responsive thereto on detection of such a second sheet for stopping separation of further sheets or effecting the operation of a warning device.

In one construction according to the invention the detecting means comprise a pair of members movable above and below the elevated sheet portion respectively into superposed closely adjacent relation (i. e. separated by more than the thickness of one sheet and, for example, by the thickness of two or three of the sheets) the members having opposed orifices to which suction may be applied whereby if two sheets are elevated together they will, in manner known per se, tend to separate under the action of the suction and seal both orifices whereas a properly separated single sheet can seal only one of the orifices, there also being means operable on sealing of both of the orifices to stop the operation of the machine, or a part thereof and/or to operate a warning device. The members may be in the form of a pair of hinged jaws and cam means may be provided for moving the jaws above and below the elevated sheet portion, for closing the jaws into the adjacent relation aforesaid, for opening the jaws and for moving them clear of the sheet to facilitate removal of the sheet.

In cases where the machine has one or more suction-operated devices on which the machine depends for effecting separation of the sheets there may be provided, in carrying out the invention, means operable by closure of both of the orifices as aforesaid for preventing the application of suction to the suction-operated device and so of stopping continued operation of the machine to separate sheets. For example, there may be a suction-operated piston and cylinder, bellows, diaphragm and chamber or equivalent device open to a source of suction and to the two orifices aforesaid, the arrangement being such that so long as at least one of the two orifices is open the device remains inoperative but is operated by suction building up within the device on closure of both of the orifices and there may be a valve operable directly or indirectly by the piston and cylinder or equivalent to prevent application of suction to the suction-operated devices and/or to release suction already applied thereto. In machines such as those described in the above-mentioned specifications in which the sheets are elevated by suction grippers, the means operable by closure of both orifices as above described may be arranged to prevent application of suction to the grippers.

In many cases it will be desirable to provide two or more pairs of jaws or other orificed members, as described above, for operation at spaced positions along the elevated edge portions of the sheets. All the orifices of such members may be connected to the same suction-operated piston and cylinder or equivalent device and the arrangement be such that the device is operated when more than half of the total number of the orifices are sealed.

As an example of how the invention may be carried into effect, one specific construction of the detecting means, applied to the machine forming the subject of my said patent will now be described with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic perspective view of the detecting means, and

Figure 2, which is also to some extent diagrammatic, is a view showing the detecting device at one side of the machine.

In the following description reference numerals below 300 refer to corresponding parts shown in the drawings in this specification and in the drawings in my said patent.

The machine to which the invention is applied embodies, in the manner described and illustrated in my said patent, suction grippers 140 which are lowered on to the uppermost sheet of a pile 20 adjacent the front corners thereof and are then moved upwardly and outwardly to elevate the front edge portion of the uppermost sheet and to tauten that portion, the front of the sheet then being as shown at 185. The raised and tautened portion 185 of the sheet is then transferred to mechanical grippers carried on upwardly moving chains. There are two sets of suction and mechanical grippers adjacent the two front corners of the pile respectively. The suction grippers are carried on a sub-frame which descends as the pile is consumed and which includes cross-bars 37, 38 and a driving shaft 66. The suction grippers with their mechanical operating mechanism are carried on separator units mounted on the bars 37, 38 outside the gripper chains.

In accordance with the present invention there are provided on the sub-frame a pair of devices for detecting if a second sheet adheres to the underside of the elevated portion 185 of the top sheet. The devices are located between the two separator units and the adjacent gripper chains.

Each device comprises a pair of jaws 300, 301 pivoted together at 302 somewhat like a pair of pliers. The jaw 300 has a tubular extension 303 with a roller 304 at its end. The roller operates in a guide slot 305 in a bracket 306 adjustably secured to the bars 37, 38. Pivotally attached to the pivot 302 of the jaws there is an upwardly extending lever 307 fulcrumed to the bracket 306 at

308. The lever carries a roller 309 serving as a follower for a cam 310 on the shaft 66. Consequently as the cam 310 rotates, the lever 307 is rocked and the jaws are given a substantially horizontal reciprocatory sliding movement controlled by the guide slot 305. The roller is held against the cam by a spring (not shown).

The jaw 301 has a downwardly extending tail 312 and is urged, by a spring (not shown) to rotate anti-clockwise (as viewed in Figure 2) about the pivot 302. The tail 312 is arranged to engage with an adjustable stop 314 fixed to the bracket 306, shortly before the jaws reach the end of their movement to the right towards the pile 20, whereby during the remainder of the movement the jaw 302 is rotated downwardly from the open position shown in dash lines to the closed position shown in full lines.

In the operation of the machine as so far described, as the cam 310 rotates—once for each sheet separated and elevated from the pile—the jaws are moved to the right and the lower jaw 300 is introduced beneath the lifted edge of the sheet. At the same time the upper jaw 301 is rocked downwardly to close on to the top of the sheet. When in the closed position the jaws are separated by slightly more than the thickness of the sheet. Adjustment of the stop 314 determines the amount of separation.

Each of the two jaws 300, 301 has an internal passageway. The passageways terminate in opposed orifices 315, 316 in the two jaws and lead from these orifices through the pivot 302 and tubular extension 303 to a flexible connection 318 to a source of suction. The suction may be applied to the orifices continuously but in the present example it is applied only at the time when the jaws are closed on to a sheet. In either arrangement the result is that if there are two sheets between the jaws they will be drawn by the suction against the two jaws respectively and so close both orifices. If there is only one sheet then it may be drawn to close one or other of the orifices, but not both.

The application of the suction to the orifices 315, 316 at the appropriate times is controlled by a rotary valve 320. The rotor 321 of the valve has an interrupted circumferential groove 322 which operates (when the jaws close onto a sheet) to put a pipe 324, which leads through pipes 318 to the orifices, into communication with a pipe 325 connected to the source of suction. The rotor also has a second interrupted groove 326 which serves to put a pipe 328 leading through pipes 329 to the grippers 140 into and out of communication with the suction pipe 325 at the appropriate times to cause the grippers to take hold of the sheets and to release the sheets.

Connected between the pipe 324 and the pipes 318 there is a suction cylinder 330 containing a piston 331 urged downwardly by a spring 302. The arrangement is that if, abnormally, two sheets are raised together and are received between both pairs of the jaws 300 and 301 they will, as described above, seal both of the orifices 315 and 316 in each pair and so permit the suction to build up in the cylinder 330 and the piston to be raised thereby. The relative proportions of the orifices and of the suction supply line to the cylinder are so chosen that even if only three of the four orifices 315, 316 are sealed, the suction in the cylinder will be sufficient to lift the piston. On the other hand if there is, as in the normal operation of the machine, only one sheet raised and received between the jaws 300 and 301 then only one of the two orifices in each pair of jaws can be sealed and the two orifices remaining open allow sufficient air to enter the cylinder 330 to prevent the suction rising to an extent sufficient to lift the piston 331.

The piston carries a rod 335 which operates as a valve in the suction pipe line 328, 329 leading to the grippers 140. The rod has a circumferential groove 336 which, when the piston is in its normal, lower, position, puts the pipe 329 into communication with the pipe 328 and so opens the grippers 140 to the suction control valve 320.

The rod 335 also has a groove 340 which, when the piston is lifted, opens the pipes 329 to a port 341 leading to the atmosphere. Therefore when the piston and rod 335 are lifted by the suction in the cylinder 330 resulting from the sealing of the jaw orifices by two sheets, the grippers 140 are cut off from the suction by the body of the rod closing the pipe 328 and the grippers are opened to atmosphere through port 341. The machine is therefore stopped from operating to separate further sheets. Once lifted by the suction the piston and rod are held in the raised position by a latch 342 engaging in a notch 343 in the rod, the latch being manually releasable when desired.

The arrangement described above operates to stop the separation of additional sheets but not to stop the mechanical operation of the machine. If the latter is desired, the movement of the piston 331 (or of a piston in a second cylinder to which suction or compressed air is admitted under the control of the piston rod valve) may be arranged to place a latch or abutment to effect an operative connection between a moving sensing member and a trip member for mechanically stopping the machine. For example the piston may operate to engage the latch described in my specification No. 422,951, filed April 13, 1954, with the arm on the trip shaft and so effect disengagement of the driving clutch. Alternatively the piston 331 may operate a switch controlling a driving motor for the machine or an electrically operated driving clutch.

The invention may be used in combination with that described and claimed in the specification of my application No. 422,951, filed April 13, 1954.

The invention may be applied to machines such as those described in specification No. 2,108,702 which operate to elevate the rear edges of the sheets and may be used, by operation on the elevated rear edges, to detect should two or more sheets be elevated together.

I claim:

1. A sheet separating and forwarding machine having means for lifting an edge portion of each uppermost sheet in turn of a pile of sheets and means for forwarding the sheet from the pile after lifting as aforesaid characterized by detecting means operable on the elevated edge portion of each sheet before operation of the forwarding means for detecting if an edge portion of a second sheet is improperly adhering to the said elevated edge portion and comprising a pair of members movable above and below the elevated sheet portion respectively into superposed closely adjacent relation in which they are separated by only a little more than the thickness of a single sheet, the members having opposed orifices to which suction may be applied whereby if two sheets are elevated together they will seal both orifices whereas a properly separated single sheet can seal only one of the orifices and also characterized by means responsive to sealing of both of the orifices for stopping separation of further sheets.

2. A machine as claimed in claim 1 in which the members when in the aforesaid closely adjacent relation are separated by a distance of slightly more than the thickness of two sheets.

3. A machine as claimed in claim 1 in which the members are in the form of a pair of hinged jaws and cam means are provided for moving the jaws above and below the elevated sheet portion, for closing the jaws into the adjacent relation aforesaid, for opening the jaws and for moving them clear of the sheet to facilitate removal of the sheet.

4. A machine as claimed in claim 1 which has at least one suction-operated device on which the machine depends for effecting separation of the sheets and in which the responsive means are operable by closure of both of the orifices as aforesaid to prevent the application of suction to the suction-operated device and so of stopping continued operation of the machine to separate sheets.

5. A machine as claimed in claim 4 in which the responsive means comprise a suction-responsive device which is open to the source of suction and to the two orifices aforesaid, the arrangement being that so long as at least one of the two orifices is open the device remains inoperative but is operated by suction building up within the device on sealing of both of the orifices, in combination with a valve controlling application of suction to the suction-operated sheet-separating device, said suction-responsive device being arranged to effect operation of the valve to prevent such application of the suction when the device operates on closure of both orifices.

6. A machine as claimed in claim 5 in which the suction-responsive device is a suction-operated piston and cylinder.

7. A machine as claimed in claim 4 in which the suction-responsive means comprise a suction-responsive device which is open to a source of suction and to the two orifices aforesaid, the arrangement being that so long as at least one of the two orifices is open the device remains inoperative but is operated by suction building up within the device on closure of both of the orifices, in conjunction with a valve controlling an air inlet to the suction-operated sheet separating device, said suction responsive device being arranged to effect operation of the valve to

open the air inlet when the device operates on closure of both orifices.

8. A machine as claimed in claim 7 in which the suction-responsive device is a suction-operated piston and cylinder.

9. A machine as claimed in claim 4 in which the suction-operated device is a suction gripper which elevates the sheets and the means operable by closure of both orifices are arranged to prevent application of suction to the gripper.

10. A machine as claimed in claim 1 in which there are two pairs of orificed members positioned for operation at locations spaced apart along the elevated edge portions of the sheets.

11. A machine as claimed in claim 10 in which the orifices of all of the members are connected to the same suction operated device for stopping the machine operation and the arrangement is such that the device is operated when more than half of the total number of the orifices are sealed.

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