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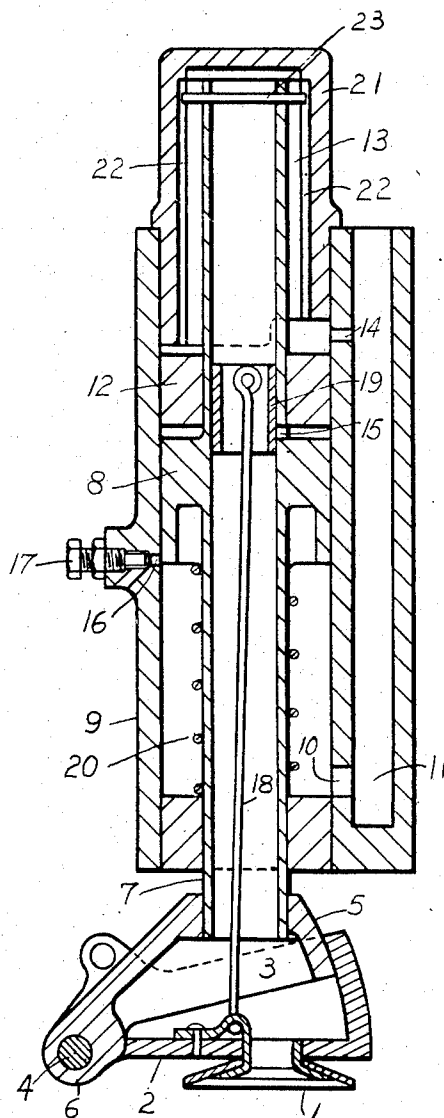
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SHEET SEPARATING MECHANISM

Filed May 8, 1946

2 Sheets-Sheet 1

FIG. 1.



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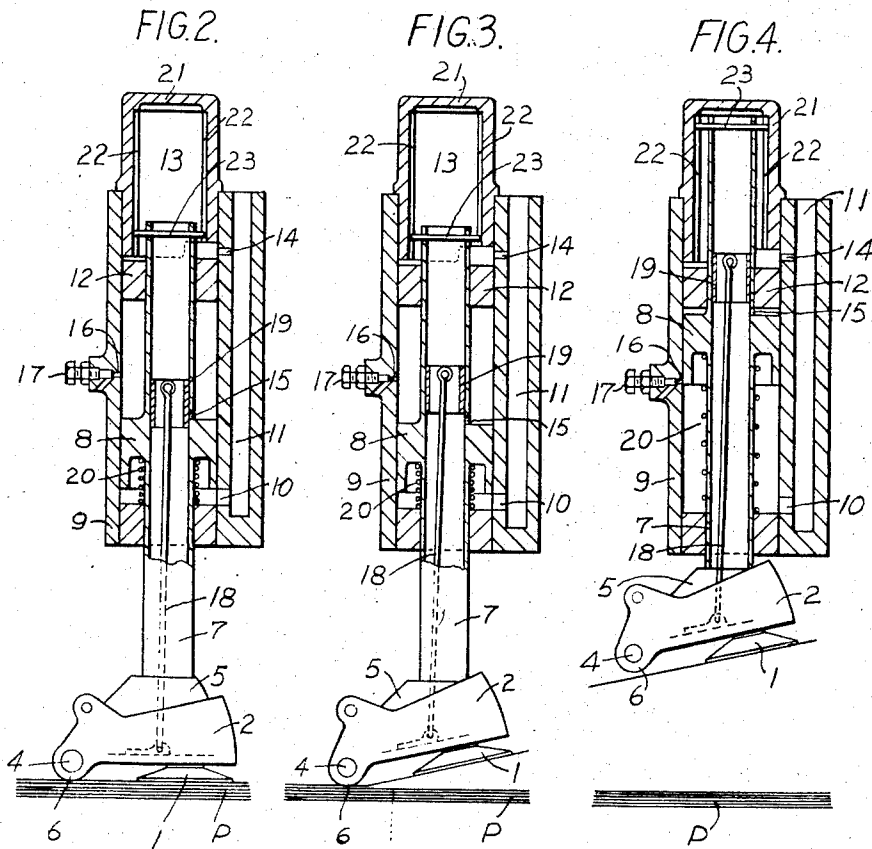
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2 Sheets-Sheet 2



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SHEET SEPARATING MECHANISM

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10 Claims. (Cl. 271-26)

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This invention relates to mechanism for separating sheets singly from a pile; while the invention is concerned with such mechanism for general use, it is especially concerned with mechanism intended to separate the top sheet of a pile of paper or card-board for the purpose of enabling that sheet to be taken to a printing machine.

According to the present invention, a sheet separating mechanism comprises a movable carrier having a foot or pad and a sheet taking device movable on the carrier relatively to the foot and the mechanism includes also means to move the carrier towards the pile until the pad and the taking device are in operative disposition with respect to the top sheet whereafter in automatic sequence the device is operated to move relatively to the foot to bend the top sheet about the foot and then the pad and device are moved away from the pile to take or separate the top sheet from it. The arrangement thus is such that the carrier moves towards the sheet until (within the limits of movement of the carrier) the foot and taking device are operative to engage and take the sheet, thus accommodating any irregularities of the surface of the sheet (e. g. buckles or waves). Then the bending and separating operation takes place automatically.

The bending and separating actions preferably are controlled or initiated automatically by the taking device becoming effective in taking a sheet but the actions may be initiated by a timing arrangement which would be synchronised with the movement of the carrier.

Usually the carrier and the sheet-taking device are operated by suction and preferably the control of suction is so effected that when the device, in the form of a sucker, is in operative position to "suck" a sheet to it, the resulting closure of the sucker causes it to move to effect the bending of the sheet and this movement of the sucker may be utilised positively to control the suction applied to move the sucker and the foot (or more precisely their carrier) after the sucker has moved through a predetermined distance.

Preferably also the operation of the carrier away from the pile is effected firstly at a slow rate and then at a quicker rate, this facilitating the separation of the sheet by avoiding suction effects between the top sheet and that below it.

The invention is illustrated in the accompanying drawings in which Figure 1 is a sectional elevation and Figures 2-4 are similar views but to a smaller scale showing the parts in different positions.

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Referring to the drawings 1 indicates a pneumatic sucker carried by a sheet taking component 2 which, with a carrier component 5, defines a chamber 3 to which suction is applied through a tube 7; the component 2 is pivoted at 4 so that, assuming the opening in the sucker 1 is closed, the component 2 will be caused to rock on the pivot 4 in an anti-clockwise direction.

The tube 7 is attached to but passes through a double-acting piston 8 in a double-ended cylinder 9 open at its lower end through a port 10 to a suction line 11, the tube 7 passing at its upper end beyond the piston 8 through the upper cylinder-wall 12 to an upper chamber 13 to which the suction line is also open through a port 14.

With the parts so far described, the cylinder 9 is stationary and forms in effect the support from which the mechanism is carried; when suction is applied to the line 11 only the lower side of the piston 8 is subjected to suction, the upper chamber 13 being open to atmosphere through the bore of the tube 7 and the opening in the sucker 1; thus the piston 8 is caused to be lowered until as is shown in Figure 2 the foot 6 engages the top sheet of a pile P at which time the sucker 1 is in a position to take the sheet. The opening of the upper chamber 13 to atmosphere is now closed by the sheet, the opening in the sucker thus constituting a control device, and the suction effect is now set up in the lower chamber 3 which results in the pivoted component 2 being rocked and thus causing the sucker 1 thereon to bend the sheet about the foot 6 (as is shown in Figure 3).

In order to effect the lifting of the now bent-up top sheet, there is a passage 15 in the tube 7 above the piston 8 which places the upper side of the piston open to the suction effect set up in the bore of the tube 7. This passage 15 is of small area, as compared with the area of the bore of the tube 7 so that the suction operation resulting in the bending of the sheet is relatively unaffected by the existence of the passage 15. When however the rocking of the component 2 has been completed the suction effect on the upper side of the piston builds up.

The effective area of the lower side of the piston 8 is smaller (by the area of the external diameter of the tube 7) than the areas which are available on the upper side, and hence through this differential of piston area subjected to suction, the piston 8 is now caused to move upwards carrying with it the foot 6, the sucker 1 and the sheet or at least that part of the sheet in the region of the sucker. This continues until

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the parts reach the position shown in Figure 4 when suction is cut-off and the separated sheet is taken away by some sheet forwarding device (not shown) and the parts return to the position shown in Figure 1 where they remain until suction is again applied.

In order to cause the piston 8 to have firstly a slow upward movement and then a faster movement, the cylinder 9 has, above the piston 8 when in its lowest position, a "leak" to atmosphere through an opening 16: this leak prevents the application of full suction to the upper side of the piston until the piston has moved upwardly sufficiently to close the leak whereupon the full suction effect is applied and the piston moves more rapidly. The leak is adjustable to enable the initial speed to be regulated, and for this purpose the opening 16 is provided with an adjustable needle valve 17.

To enable a somewhat more rapid operation of the pivoted component 2 which would, to some slight extent be delayed by the "bleed" from the bore of the tube 7 through the small passage 15, there could be employed a valve arrangement closing this opening until the component 2 has been operated. For this purpose the component 2 is linked by a link 18 to a valve sleeve 19 mounted in the bore of the tube 1. This sleeve 19 normally closes the opening as seen in Figures 1 and 2 to hold the suction effect from the upper side of the piston, but when the component 2 carrying the sucker 1 has pivoted as has been described, the valve sleeve 19 is moved to expose the opening 15 to allow suction to be applied to the upper side of the piston.

A spring 20 can be provided to balance the weight of the parts.

It is preferred to arrange the sucker assembly to be adjusted in its angular setting so as to enable the line of action of the sucker 1 to be set diagonally to a sheet when the sucker is set to operate on the corner of the sheet. This can be effected by constituting the upper chamber 13 in a cap 21 which can be angularly adjusted on the cylinder 9 and locked in the selected position and by forming in the cap 21 grooves 22 slidably receiving the ends of a pin 23 in the tube 7.

If desired the mechanism of this invention may be arranged to move bodily in a direction more or less parallel with the top of the pile so that the top sheet which has been gripped and separated is taken to sheet forwarding mechanism for printing or other treatment. Thus the cylinder 9 which forms the support for the mechanism could be carried on an arm which is mounted to swing. When such forwarding arrangements are employed, an interlocking device could be provided to prevent the forwarding action until the piston 8 has completed its upward movement.

The construction referred to is given solely by way of example for other forms of mechanism affording the same operating cycle could be employed.

What I claim is:

1. A sheet separator comprising a carrier having a sheet-bending foot, a sheet-taking sucker movably supported by the carrier, suction operated means to move the carrier and sucker together in two directions and to move the sucker relative to the carrier, and suction control means operated by the movement of the sucker relative to the carrier on engagement of a sheet by the sucker to reverse the movement of the carrier and to raise the sheet.

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2. A device to separate a sheet from a pile of sheets, the said device including a carrier having a sheet-bending foot, a sucker movably carried by said carrier, suction operated means to move the carrier in a direction to carry the sucker towards the pile, suction operated means to move the sucker relative to the carrier to bend a sheet about the foot, and suction control means operated by movement of the sucker relative to the carrier on engagement of a sheet by the sucker to reverse the movement of the carrier and lift the bent sheet.

3. A device to separate a sheet from a pile of sheets and comprising a cylinder having a double-acting differential area piston operable by suction, a carrier connected to the piston, a pneumatic sucker movable on the carrier and having a suction connection to one side of the piston and a valve arrangement operable by movement of the sucker relative to the carrier to apply suction to both sides of the piston simultaneously.

4. A device to separate a sheet from a pile and comprising in combination a cylinder having a double-acting differential area piston operable by suction, a carrier connected to the piston, a pneumatic sucker movable on the carrier, means to apply suction to the sucker device and to one side of the piston, a valve controlling the application of suction to the other side of the piston, and means coupling the movable sucker to the valve whereby the valve is opened when the sucker device is moved on the carrier.

5. A device to separate a sheet from a pile of sheets and comprising a cylinder having a double-acting differential area piston operable by suction, a carrier connected to the piston, a pneumatic sucker movable on the carrier and controlling a suction connection to one side of the piston, and having also an opening disposed to be closed by the taking of a sheet, and means to apply suction to both sides of the said piston.

6. A device to separate a sheet from a pile and comprising in combination a cylinder having a double-acting differential area piston operable by suction, a carrier connected to the piston, a pneumatic sucker movable on the carrier and having also an opening disposed to be closed by the taking of a sheet, means to apply suction to the sucker device and to one side of the piston, a valve controlling the application of suction to the other side of the piston, and means coupling the movable sucker to the valve whereby the valve is opened when the sucker device is moved on the carrier.

7. For separating a sheet from a pile of sheets, mechanism comprising a differential area double-acting piston and cylinder arrangement, means placing one end of the cylinder open to suction, a tubular carrier connected to the piston and itself open to suction, a second suction operated device carried by the carrier and subjected to suction therethrough, the movable part of the said second device being pivoted and having an apertured sucker to take a sheet, a valve slidable within the tubular carrier to control the said opening and means connecting the valve to the movable part of the second device.

8. A device to separate a sheet from a pile and comprising a cylinder having a double-acting piston operable by suction, a carrier connected to the piston, a sucker mounted on the carrier for movement therewith to engage the sheet and also movable relative to the carrier on engagement of the sucker with the sheet, and suction control means operated by such relative movement of

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the sucker to subject one side of the piston to suction to produce movement of the sucker towards the pile of sheets and then to subject the other side of the piston to suction to bend the sheet against the carrier and to reverse the movement of the carrier and lift the bent sheet.

9. A device to separate a sheet from a pile and comprising in combination a cylinder having a double-acting differential area piston operable by suction, a carrier connected to the piston, a sheet taking component movable on the carrier, a pneumatic sucker carried by the said component, means to apply suction to one side of the piston to move the sucker into engagement with a sheet and to move the said component relative to the carrier and thereby apply suction to the other side of the piston to separate and lift the sheet.

10. For separating a sheet from a pile of sheets, mechanism comprising a cylinder and a double-acting piston having a relatively small effective area on one side and a larger area on the other side, a valve device placing one end of the cylin-

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der open to suction, a tubular carrier connected to the piston and itself open to suction, a member carried on the carrier and movable relative thereto by suction, the said member being connected to operate the valve and having an apertured sucker to take the sheet.

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