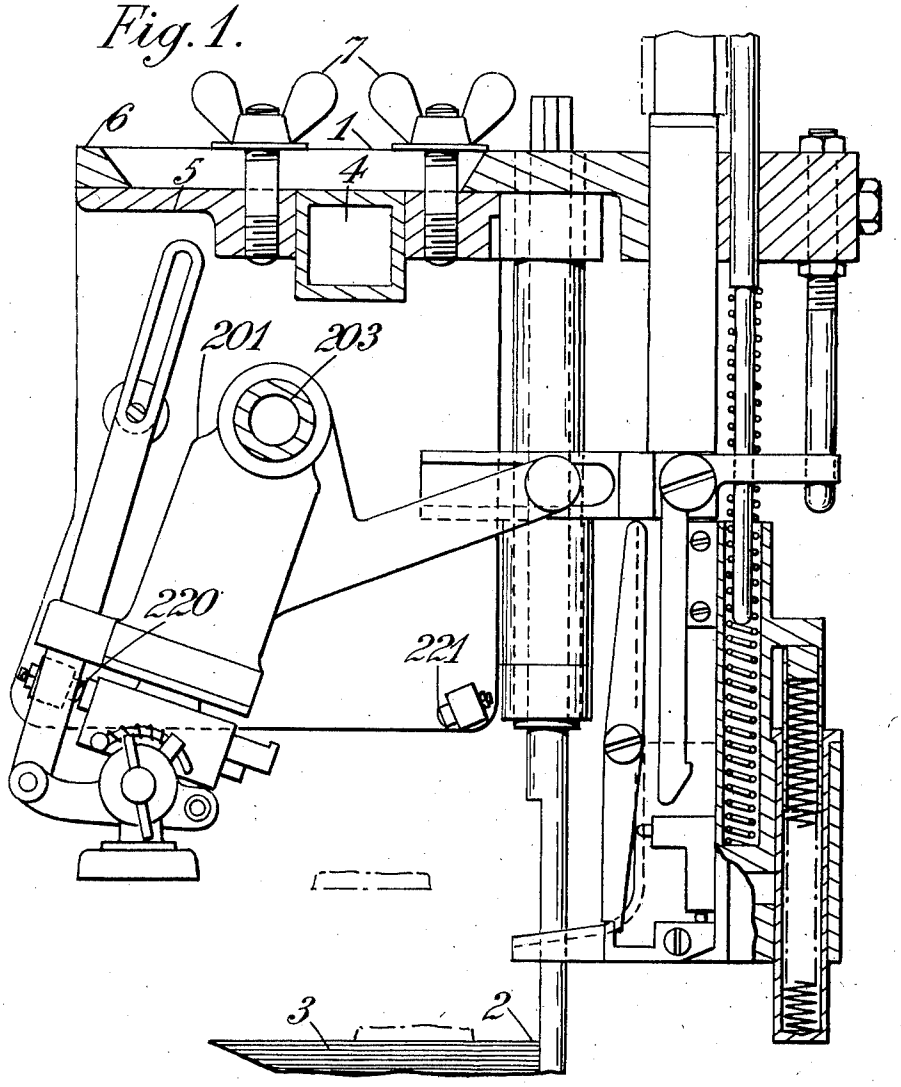
April 1, 1952 H. T. BACKHOUSE 2,591,116

SHEET SEPARATING AND FORWARDING MACHINE

Filed April 21, 1949 2 SHEETS--SHEET 1

Fig. 1.



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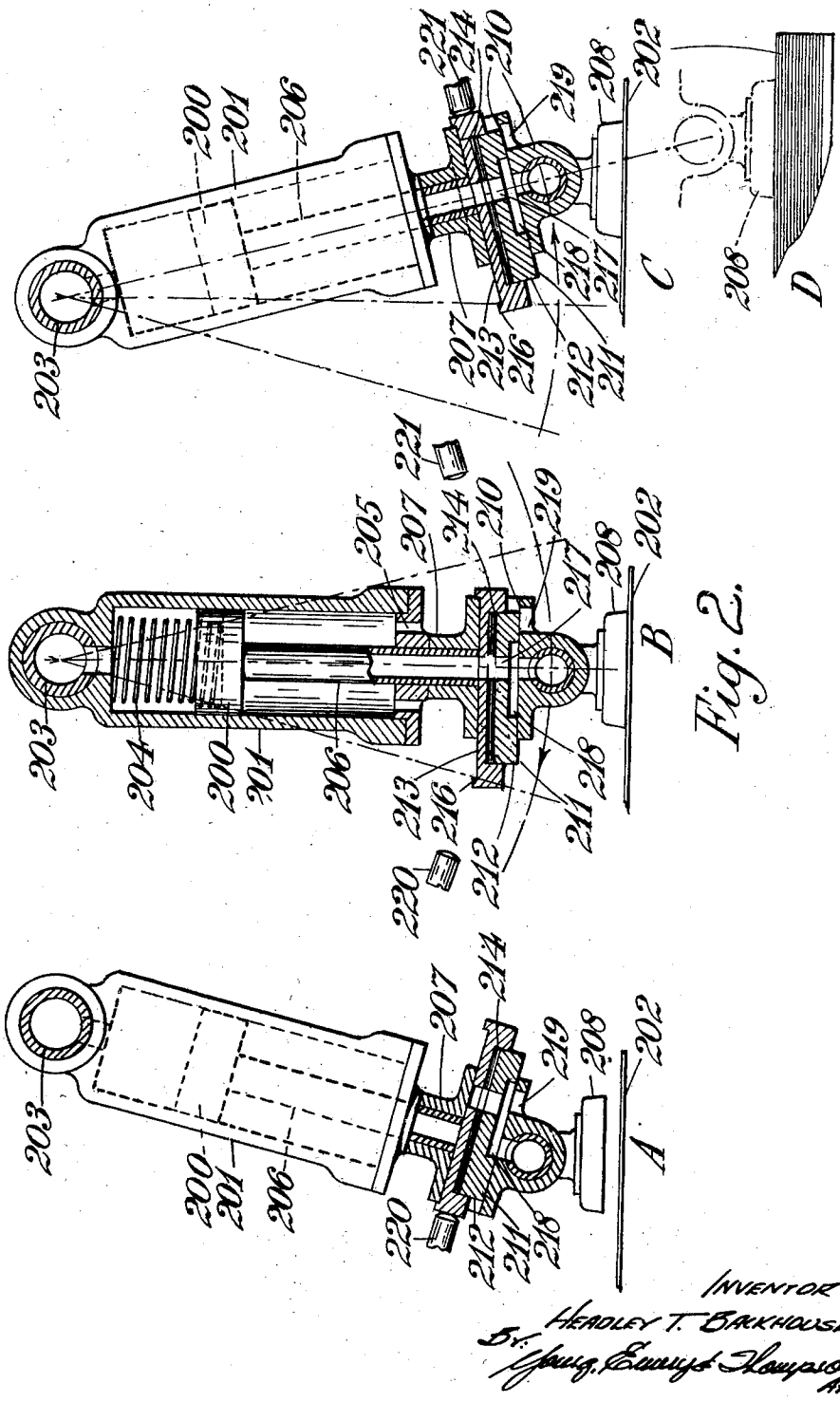


Fig. 2.

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SHEET SEPARATING AND FORWARDING MACHINE

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In Great Britain April 22, 1948

6 Claims. (Cl. 271—26)

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The invention relates to sheet separating and forwarding machines of the kind (herein referred to as the kind described) in which a suction gripper operating at or near the rear edge—considered in relation to the ultimate direction of forwarding the sheets—of the upper surface of a pile of sheets of paper, card or other material, is lowered into gripping engagement with each uppermost sheet of the pile in turn and is then, while gripping a rear portion of the sheet, raised and given a movement over the top of the pile towards the front of the pile to forward, or to control the forwarding of, the sheet to conveyor or like means (e. g., rollers gripping the front edge of the sheets) for removing the sheet from the pile, the suction gripper then releasing the sheet and returning to the initial position to engage the next sheet of the pile. Machines of this kind may be arranged to feed the sheets singly or in the form of a stream of partly overlapping or partly underlapping sheets and may be employed to feed the sheets to a printing or other machine operating on individual sheets. It is an object of the invention to provide an improved form of machine of the kind described of relatively simple construction and of high operating speed.

The invention provides a machine for separating individual sheets one at a time from the top of a pile and for forwarding the sheets from the pile and comprising a suction gripper operating adjacent the rear edge of the upper surface of the pile and having an open mouth for suction engagement with the sheets, a co-operating piston and cylinder with an operative connection to the gripper arranged for suction operation to effect raising and lowering of the gripper, means for moving the gripper, when raised, back and forth over the pile, a conduit leading from the gripper mouth to the cylinder, a valve in the conduit having a port leading to the atmosphere and means for operating the valve, the machine being arranged for operation in a cycle in which the gripper is lowered into engagement with the uppermost sheet with the conduit open, the port aforesaid closed and suction applied to the cylinder so that the closing of the mouth of the gripper by the sheet seals the cylinder from the atmosphere and enables the suction to build up in the cylinder to effect relative movement between the piston and cylinder to raise the gripper with the rear portion of the sheet; the raised gripper is moved in the forwarding direction over the top of the pile, the valve is then operated to open the port and to close the conduit thereby to open the gripper mouth to atmospheric pressure to release

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the sheet and to maintain the suction in the cylinder; the gripper is then moved back over the pile; the valve is operated to open the conduit thereby to admit air to the cylinder and the gripper is then lowered to begin a new cycle.

In this specification, where appropriate, and in the appended claims, the term "piston and cylinder" is used to include the equivalents of a diaphragm and chamber or collapsible bellows.

In the preferred form of the invention the gripper is carried by the movable element of the piston and cylinder to effect the raising and lowering of the gripper and the piston and cylinder are arranged for bodily reciprocation or oscillation to effect the movements of the gripper over the pile.

The cylinder may be continuously connected during the cycle to a source of suction.

A specific embodiment of a sheet separating and forwarding machine according to the invention will now be described by way of example and with reference to the drawings in which:

Figure 1 is a side view, partly in section, of the machine, and

Figure 2 is a view showing the cylinder and valve in three positions.

The machine forming the subject of the example and shown in Figures 1 and 2 has two lifting and forwarding units 1 positioned in spaced relation above the rear edge 2 of the pile 3 of sheets and supported from a common bar 4 of square section extending transversely across the pile. The two units are of similar construction and for the sake of clarity the following description relates to only one of the units.

Depending from the above-mentioned square section bar 4 there is a bracket 5 which is adjustably clamped (by plate 6 and screws 7) to the bar for sliding adjustment along the length of the bar. The depending portion of the bracket is forked and embraced within the arms of the fork there is a cylinder 201 having its mouth directed downwardly and supported at its uppper end by a rocket shaft 203 below and extending parallel to the square section bar. The shaft is supported in the two arms 12 of the bracket and in operation has oscillatory movements imparted to it by means forming no part of the present invention.

The cylinder 201, above the piston, is continuously open to a source of suction through the hollow shaft 203 from which the cylinder is dependent. The piston is urged outwardly of the cylinder, i. e. in the downward direction, by a spring 204 and the lower end of the cylinder is open through holes 205 to atmospheric pressure.

A tubular piston rod 206 passes out through a guideway 207 in the bottom of the cylinder and carries one or more suction grippers 208. The mouths of the grippers are connected to the upper end of the cylinder through the piston rod. Outside the cylinder the piston rod is enlarged and formed with a transverse guideway 210 of rectangular section and extending in the direction of movement of the cylinder. Within this guideway there is a closely fitting slide 211. The slide is divided into two parts longitudinally of which one part 212 is received within a recess in the other 213 and there is a strip 214 of rubber between the two parts urging them apart into pressure engagement with the walls of the guideway thereby to effect a seal and to ensure sufficient frictional resistance to the movement of the slide that it shall not be displaced inadvertently. The part 213 of the slide has lips 216 arranged to engage the ends of the guideway and to limit the movement of the slide. The guideway intersects the connection between the sucker mouth and the cylinder and the slide has a throughway 217 which, when the slide is at the forward limit of its movement in the guideway puts the sucker mouth into communication with the cylinder. The slide also has a groove 218 on its undersurface extending forwardly from the throughway. This groove co-operates with a port 219 in the wall of the guideway to put the sucker mouth into communication with the atmosphere when the slide is at the rearward limit of its movement (as shown in Figure 2A), the slide when in this position sealing off the connection to the cylinder.

The machine incorporates two stop fingers 220, 221 which engage the ends of the slide near the limits of the forward and backward movements of the cylinder respectively and by such engagement push the slide through the guideway during the remainder of the movement of the cylinder.

The operation of the machine is as follows.

As the cylinder approaches the rearward limit of its movement the valve slide is engaged by the stop finger 221, which pushes the slide to the forward limit of its travel with respect to the cylinder and thereby opens the upper end of the cylinder to atmospheric pressure through the sucker mouth (as shown in Figure 2C). This destroys the suction in the cylinder which held the piston raised and allows the piston and sucker to drop on to the top of the pile (i. e. to the position shown in Figure 2D). Immediately the sucker engages the sheet the sucker mouth is sealed, by the sheet, and suction is again built up in the cylinder which causes the piston and sucker to rise lifting the rear edge portion of the sheet. The cylinder then moves forwardly carrying the sheet until near the limit of its forward travel, the valve slide is engaged by the other stop which pushes the slide rearwardly with respect to the cylinder and opens the sucker mouth to atmosphere while at the same time sealing off the connection to the cylinder (as shown in Figure 2A). This releases the grip of the sheet but retains the piston in its elevated position. The cylinder then swings backwardly and towards the rearward limit of its movement the next cycle of operations is begun by movement of the valve slide to put the cylinder into communication with the atmosphere.

I claim:

1. A machine for separating individual sheets one at a time from the top of a pile and for forwarding the sheets from the pile comprising a suction gripper operating adjacent the rear edge of the upper surface of the pile and having an open mouth for suction engagement with the sheets, a cooperating piston and cylinder with an operative connection to the gripper arranged for suction operation to effect raising and lowering of the gripper, means for moving the gripper, when raised, back and forth over the pile, a conduit leading from the gripper mouth to the cylinder, a two-position shut-off valve in the conduit between the gripper mouth and the cylinder and having a port leading to the atmosphere, the valve in one position shutting the atmospheric port and opening the conduit and in the other position shutting the conduit and opening the gripper mouth to the atmospheric port and means for moving the valve from the first position to the second near the end of the operative forward movement of the gripper and for moving the valve back to the first position near the end of the operative backward movement of the gripper, the machine being arranged for operation in a cycle in which the gripper is lowered into engagement with the uppermost sheet with the conduit open, the port aforesaid closed and suction applied to the cylinder so that the closing of the mouth of the gripper by the sheet seals the cylinder from the atmosphere and enables the suction to build up in the cylinder to effect relative movement between the piston and cylinder to raise the gripper with the rear portion of the sheet, the raised gripper is moved in the forwarding direction over the top of the pile, the valve is then operated to open the port and to close the conduit thereby to open the gripper mouth to atmospheric pressure to release the sheet and to maintain the suction in the cylinder; the gripper is then moved back over the pile, the valve is operated to open the conduit thereby to admit air to the cylinder and the gripper is then lowered to begin a new cycle.

2. A machine as claimed in claim 1 in which the valve comprises a reciprocable shuttle in the conduit between the gripper mouth and the cylinder and movable with the gripper mouth over the pile and the operating means for the valve comprising a stop arranged to be engaged by the shuttle near the end of the forwarding movement and thereby to move the shuttle to connect the atmospheric port to the gripper mouth and to close the conduit to the cylinder.

3. A machine as claimed in claim 2 in which the operating means includes a second stop arranged to be engaged by the shuttle near the end of the backward movement and thereby to move the shuttle to close the atmospheric port and to open the conduit to the cylinder.

4. A machine as claimed in claim 2 in which the shuttle valve comprises a slide constrained for reciprocation in a guideway extending transversely to the aforesaid conduit in the direction of movement of the cylinder, the slide has a throughway arranged to effect communication between the gripper and the cylinder when the slide is at the forward limit of its reciprocatory movement and the slide has a passageway positioned at least in part in front of the throughway, extending lengthwise of the slide and so arranged that when the slide is at the rearward limit of its reciprocatory travel the passageway puts the gripper into communication with the atmosphere while the body of the slide seals off the conduit to the cylinder.

5. A machine as claimed in claim 4 in which the slide is divided lengthwise into two portions

and there is between the two portions a layer of resilient material urging the portions apart into frictional and sealing engagement with the walls of the guideway.

6. A machine as claimed in claim 1 in which the gripper is held raised during the backward stroke by the suction in the cylinder.

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