Aug. 8, 1961 K. H. GULICK 2,995,359

SHEET FEEDER

Filed Aug. 18, 1958 2 Sheets-Sheet 1

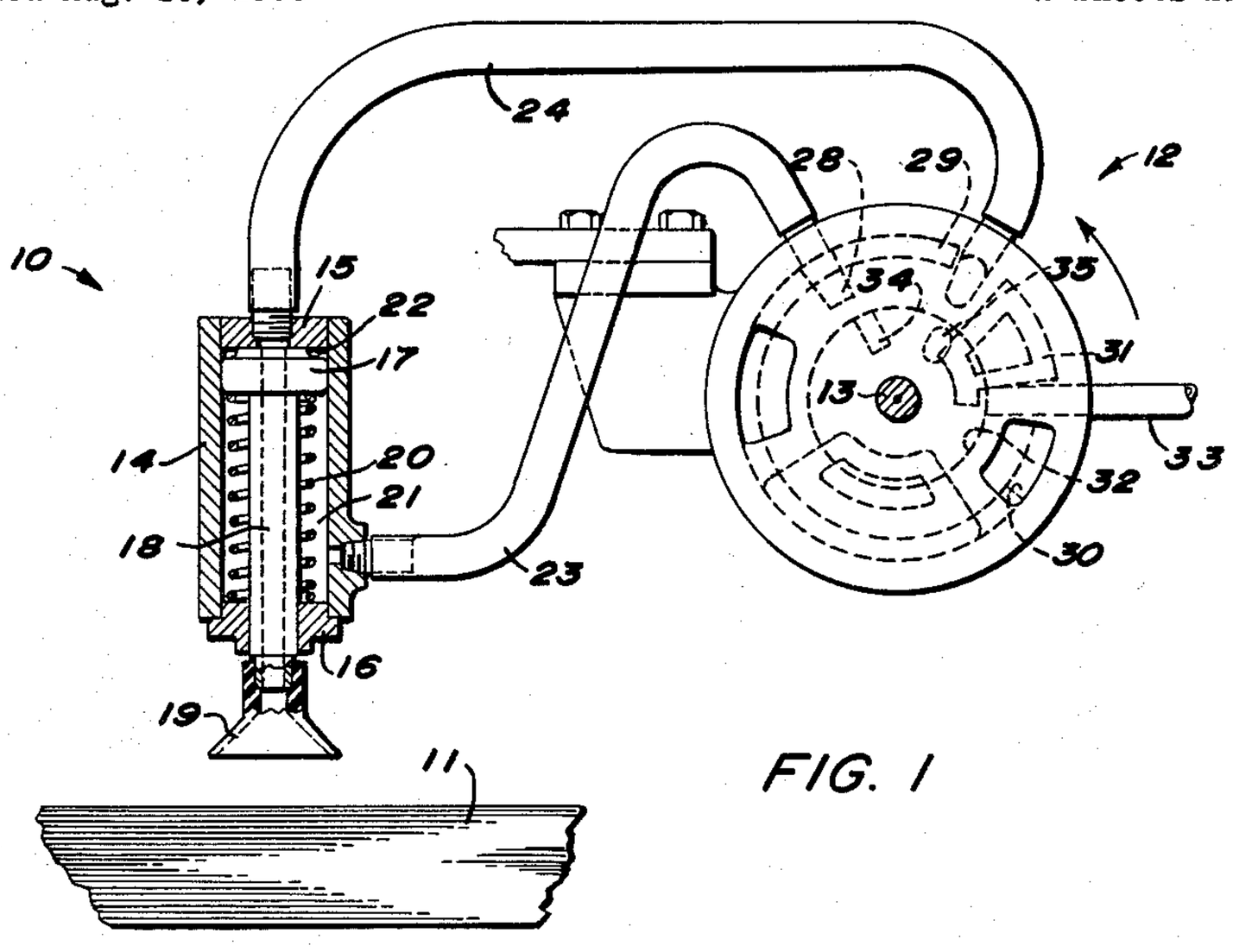

FIG. 1

FIG. 2

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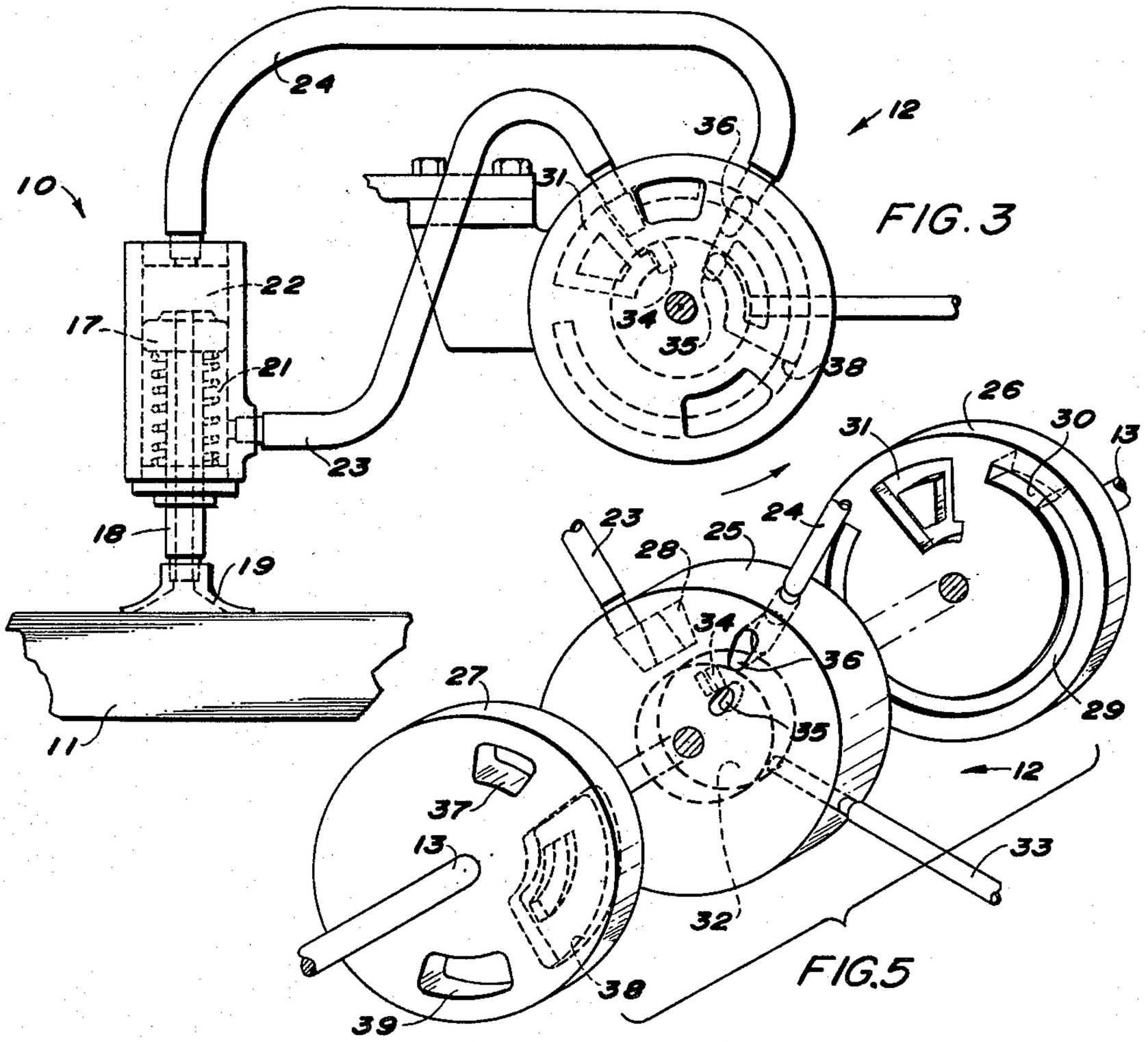

FIG. 3

FIG. 5

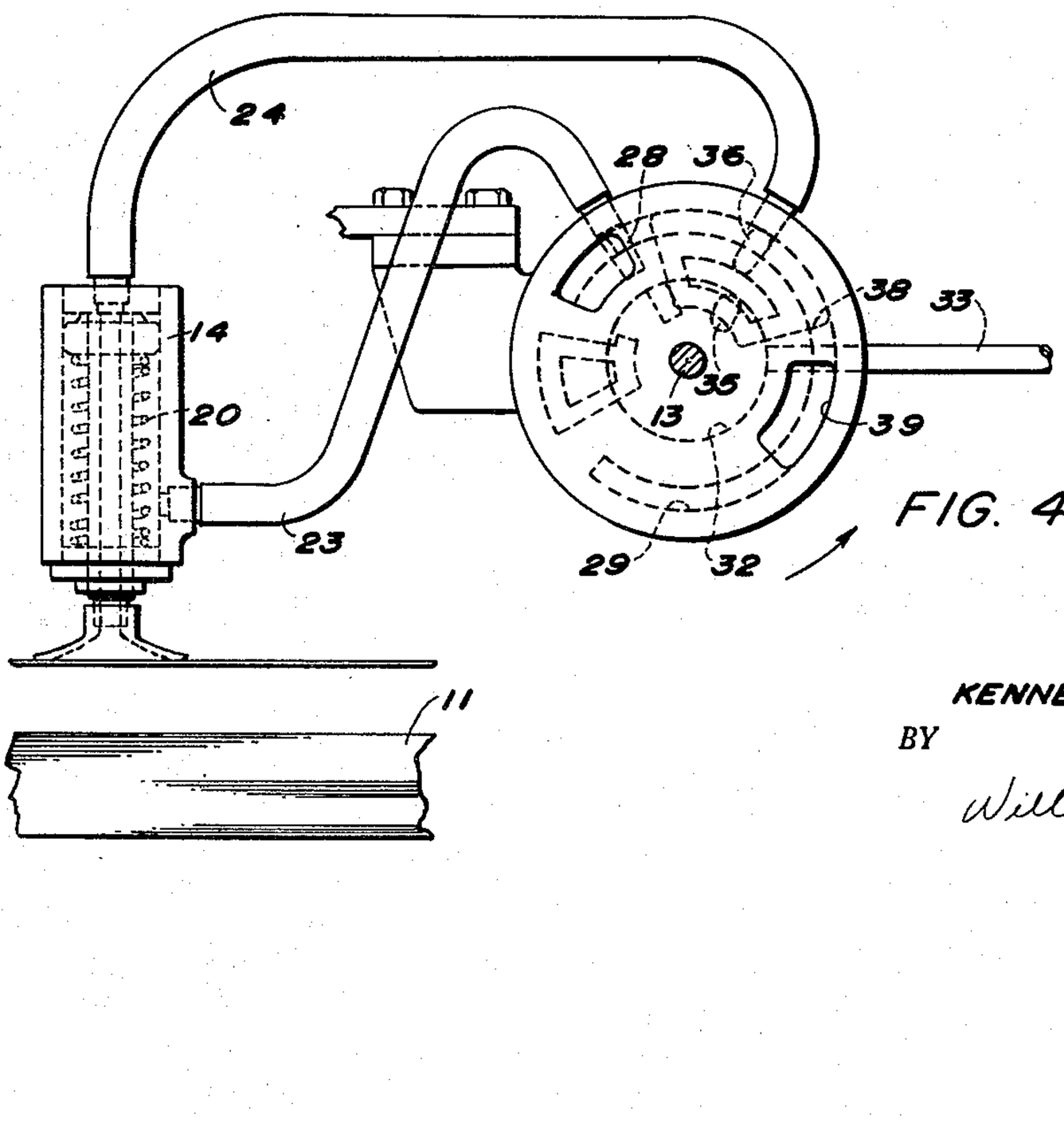

FIG. 4

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SHEET FEEDER

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5 Claims. (Cl. 271—26)

This invention relates to pneumatically actuated sheet separating suckers of the type which lift the top sheets from a pile one at a time.

The principal object of this invention is to provide for fast action sheet separating, particularly of relatively heavy, impervious sheet material such as sheet metal or cardboard.

Another object of the invention is to provide for the rapid application of full vacuum to the suction mouth of a sheet separating sucker of the double-acting type.

A still further object is to provide a fast acting reciprocating sucker the mouth of which is supported above and out of contact with the pile when the sucker is inactive.

Another object is to provide separately controlled pneumatic lines to a double-acting sucker, one for actuating the sucker toward a pile of sheets and the other for grasping the top sheet and then actuating the sucker away from the pile.

Still another object is to provide a double-acting sucker as above described in which the application of pneumatic forces is timed with the sheet handling machine to operate through a valving cycle once for each sheet fed.

Other objects and advantages will be apparent from the following description in which reference is made to the accompanying drawings.

According to the invention a double-acting pneumatically reciprocated sucker of the so-called telescoping type comprises a cylinder and a piston reciprocated therein. The piston supports on a tubular stem connected thereto a suction mouth which seizes the top sheet of a pile. The piston is urged away from the pile by a spring when the sucker is inactive, and is reciprocated toward the pile by the application of vacuum to that chamber of the cylinder in which the spring is located. Upon engagement of the suction mouth with the top sheet of the pile, timed vacuum is applied to the other side of the piston and through the stem to the suction mouth. The connections to the opposite chambers in the cylinder are independent of each other, enabling the stem carrying the suction mouth to be evacuated quickly, and preferably fully to permit rapid evacuation to the suction mouth and quick seizing of the sheet. After the suction mouth has taken the sheet, the application of vacuum to the first chamber is discontinued and atmospheric pressure is admitted therein. This enables the vacuum in the second chamber to cause rapid raising of the sheet through a combination of forces including the vacuum acting upon the effective area of the piston, the relative difference of pressures in the two chambers, and the assisting force of the spring.

In the drawings:

FIG. 1 is a schematic side elevational view of a double-acting sucker of the invention and its timing valve, partly in section, illustrating the positon of the parts at rest.

FIG. 2 is a view similar to FIG. 1 in which the parts are in their positions in which the sucker has been reciprocated into contact with the pile but vacuum has not yet been applied to the suction mouth.

FIG. 3 is a similar view in which the parts are in their positions in which vacuum has just been applied to the sucker while in its sheet-seizing position.

FIG. 4 shows the parts in sheet-raising position prior to the sheet being forwarded to the sheet handling machine.

FIG. 5 is an exploded isometric view of the valve utilized in connection with the invention.

Referring now to FIG. 1, a pair of sheet lifting suckers 10 (only one of which is shown) are located above a pile of sheets 11 and are controlled by a rotary valve 12 mounted on a shaft 13 driven from a sheet handling machine (not shown) once for each sheet fed. The suckers 10 may perform both the action of lifting the top sheet from the pile and forwarding it to the sheet handling machine, or only lift the sheets and transfer them to a separate pair of forwarding suckers. Preferably, since the suckers are designed for rapid actuation, they also perform the forwarding action to prevent any loss of time in transferring the sheet from one set of suckers to another prior to forwarding.

Each sucker 10 comprises a cylinder 14 having end caps 15 and 16 and a piston 17 reciprocable between the ends of the cylinder 14. A tubular stem 18, preferably integral with the piston 17 extends through the end cap 16 and has carried on its outwardly extending end a rubber suction mouth 19 which grasps sheets in the well-known manner. A spring 20 maintains the piston 17, stem 18, and suction mouth 19 in their positions away from the pile 11 when the sucker 10 is inactive. The spring 20 may be one which merely supports the weight of the piston and stem.

The piston 17 defines within the cylinder a chamber 21, hereinafter designated the first chamber, and a chamber 22, hereinafter designated the second chamber. Hose connections 23 and 24 are connected to chambers 21 and 22, respectively. The other ends of these hose connections 23 and 24 communicate with the rotary valve 12 in the manner now to be described with reference to FIG. 5.

The valve 12 comprises a stationary member 25, a first rotary member 26 cooperating with the hose 23, and a second rotary member 27 cooperating with the hose 24. Both members 26 and 27 are fixed to the shaft 13 and have their side faces in close-fitting contact with the adjacent side faces of the stationary member 25 in the usual manner. For clarity, because of the overlapping effect of the members 25, 26 and 27 when viewed from the side, cut-outs or recesses in the members 25 and 26 cooperating with the hose 23 have been shown with sharp corners, whereas the cut-outs or recesses for the members 25 and 27 cooperating with the hose 24 have been shown with rounded corners.

Referring again to FIG. 1, the first step in the actuation of the sucker 10 to lift the top sheet from the pile 11 is accomplished by applying vacuum to the first chamber 21. Prior to this time, the chamber 21 is connected to atmospheric pressure since the hose 23 is connected to an opening 28 on the far side of the stationary member 25 and communicates at that time with an annular recess 29 in the corresponding face of the member 26, which recess is in turn connected to atmosphere by means of hole 30 passing transversely through the rotary member 26. Now, as a recess 31 comes opposite and communicates with the opening 28 upon counterclockwise rotation of the rotary members, vacuum from a chamber 32 in the stationary member 25 is connected to the first chamber 21 of the cylinder 14. Chamber 32 has vacuum constantly communicated thereto from a pipe 33 connected to a source of vacuum which is not shown. The chamber 32 has an opening 34 to the far face of the stationary member 25 and an opening 35 to its near face. It will be seen in FIG. 2 that the recess 31 connects the openings 28 and 34 and thus provides vacuum from the valve chamber 32 through the line 23 to the first chamber 21

of the cylinder 14. Evacuation of the chamber 21 urges the suction mouth 19 toward and into contact with the top of the pile to the FIG. 2 position.

During the travel of the suction mouth 19 to the top sheet of the pile, the second chamber 22 will be connected to atmospheric pressure through the suction mouth 19 and the stem 18, and through hose 24 and openings 36 and 37 in members 25 and 27 respectively. This enables fast downward reciprocation as compared to the conventional double-acting sucker which has vacuum on the top of the piston from the start.

At the moment the suction mouth 19 engages the pile, no vacuum is communicated to the mouth. Immediately thereafter, however, a recess 38 in the rotary member 27 connects the openings 35 and 36 and thus the valve chamber 32 with the hose 24 and second chamber 22 of the cylinders 14. The position of the parts at this time is shown in FIG. 3. Full vacuum is almost immediately applied to the upper chamber 22 and the suction mouth 19 since the opening in the stem can be and is preferably sufficiently large enough to enable rapid evacuation of the mouth and fast vacuum buildup for quick raising. Such enlargement is permitted since the application of vacuum to the chambers 21 and 22 is separately and individually valved. When the chamber 22 first has vacuum communicated thereto, vacuum remains in the first chamber 21 for a very short time interval, to insure obtaining a firm grip on the sheet before the suckers start to raise. Because of the larger upper area of the piston acted upon by vacuum as compared to the lower area, the suction mouth starts its upward travel as soon as the sheet is firmly gripped. Then, immediately after the mouth 19 has taken full grasp of the top sheet of the pile and is on its way up, the recess 31 passes the openings 28 and 34 and the annular recess 29 with its hole 30 connects the hose 23 to atmosphere. Upon so doing the piston 17 is rapidly urged upwardly in response to the vacuum in the second chamber 22, the higher relative pressure in the first chamber 21, the differential areas on the upper and lower sides of the piston, and the assistance of the spring 20.

The uppermost position of the parts of the sucker 10 when a sheet is held thereby is shown in FIG. 4. At this time, the pair of suckers 10 may either forward the sheet to the sheet handling machine or transfer it to forwarding suckers which do that job, as mentioned earlier. To release the sheet, it is necessary only to discontinue the vacuum in the hose 24. When a hole 39 in the rotary member 27 coincides with the opening 36 in the member 25, the hose 24 is connected to atmosphere and the grasp of the suction mouth on the sheet is released.

Various changes may be made in the details of construction without departing from the spirit and scope of the invention.

Having described my invention, I claim:

1. A sheet handling device comprising a cylinder and a pneumatically operable piston reciprocable therein, said piston including a hollow stem carried by the piston and extending outwardly of an end wall of the cylinder, said stem having a cavity communicating from its outer end to the remote side of the piston, a sucker mouth on the outer end of the stem, said sucker mouth being spaced from the top of a pile of sheets and movable into engagement therewith, spring means normally urging the sucker mouth away from the pile, a first pneumatic means connected to a source of vacuum and acting upon the piston to urge it in opposition to the spring means, and second pneumatic means independent of the first means and applying vacuum from the vacuum source to the side of the piston remote from the sucker mouth and through the stem to the sucker mouth, both of said pneumatic means including relatively unrestricted connections to the vacuum source and individual valve means operable in timed relation to the sheet handling device to control the first pneumatic means to actuate the sucker mouth toward and into contact with the pile, to next apply vacuum to the mouth through the second pneumatic means, and to then port that portion of the cylinder connected to the first pneumatic means to atmospheric pressure to enable rapid movement of the sucker mouth and the sheet held thereby away from the top of the pile in response to the action of the vacuum on the one side of the piston combined with the application of atmospheric pressure to the other side thereof.

2. A sheet handling device according to claim 1 wherein said cavity is relatively unrestricted.

3. A sheet handling device according to claim 1 wherein said valve means are mechanically connected to the sheet handling device to operate through a sequence timed directly therewith for each valving cycle.

4. A sheet handling device comprising a cylinder and a pneumatically operable piston reciprocable therein, said piston including a hollow stem on one side of the piston extending outwardly of the cylinder and having a relatively unrestricted cavity therein communicating to the other side of the piston, a first chamber in said cylinder on that side of the piston to which the stem is connected, a second chamber on the side of the piston remote from the first chamber, a sucker mouth on the outer end of the stem, the direction of movement of said sucker and piston being generally perpendicular toward and away from a pile of sheets, spring means in said first chamber surrounding the stem and normally urging the sucker mouth away from the pile, a relatively unrestricted vacuum connection to said first chamber, a relatively unrestricted vacuum connection to said second chamber independent of the connection to the first chamber, and independent valve means for each connection timed to operate through a valving cycle once for each sheet removed from the pile to apply vacuum to said first chamber to actuate the sucker mouth toward the pile and maintain it in contact with the pile, to next apply vacuum to the second chamber to cause the sucker mouth to grip a sheet of the pile, and to then port the first chamber to atmospheric pressure.

5. A sheet handling device according to claim 4 wherein both valve means are mechanically connected to the sheet handling device to operate through a sequence timed directly therewith for each valving cycle.

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