

May 22, 1956

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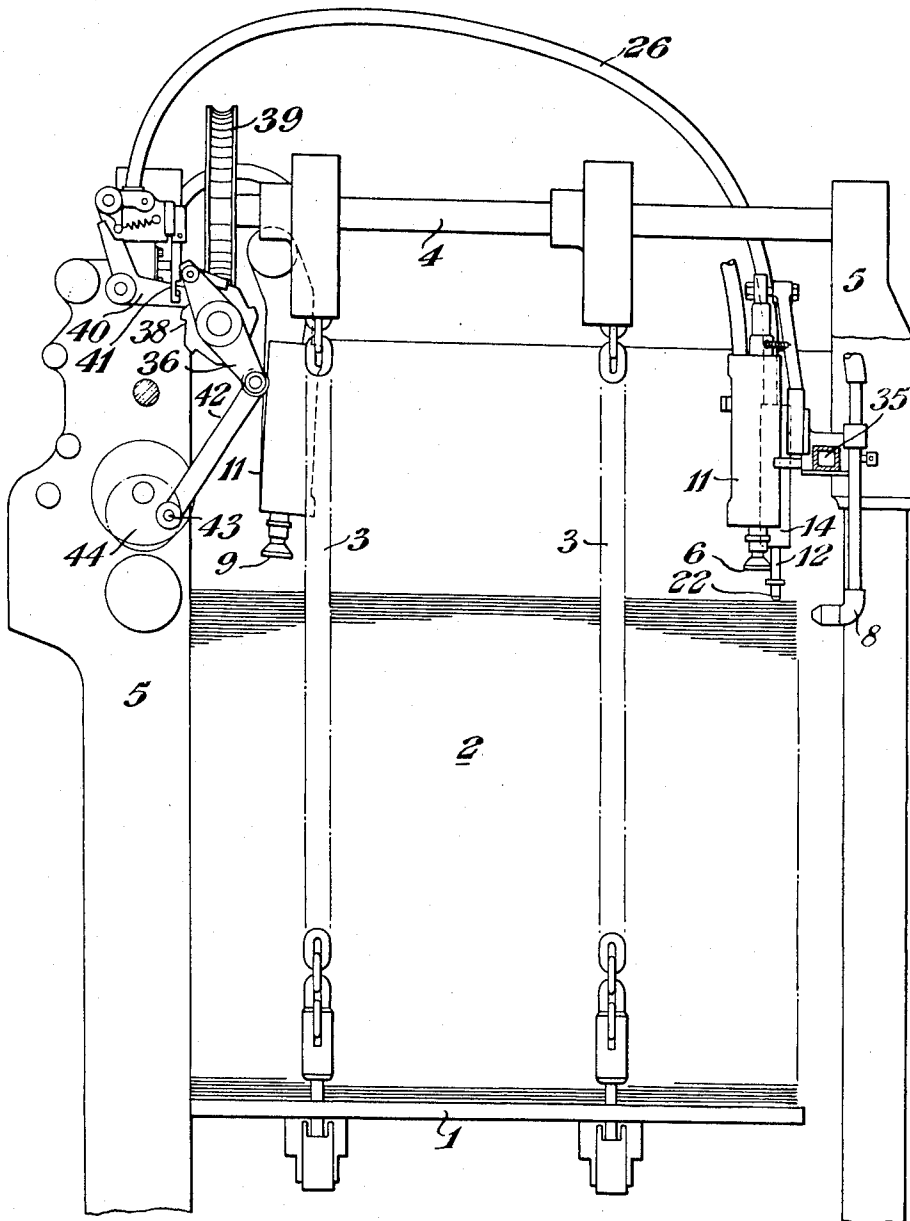
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APPARATUS TO MAINTAIN THE TOP OF A PILE
OF SHEETS AT A SENSIBLY CONSTANT HEIGHT

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3 Sheets-Sheet 1

FIG. 1.



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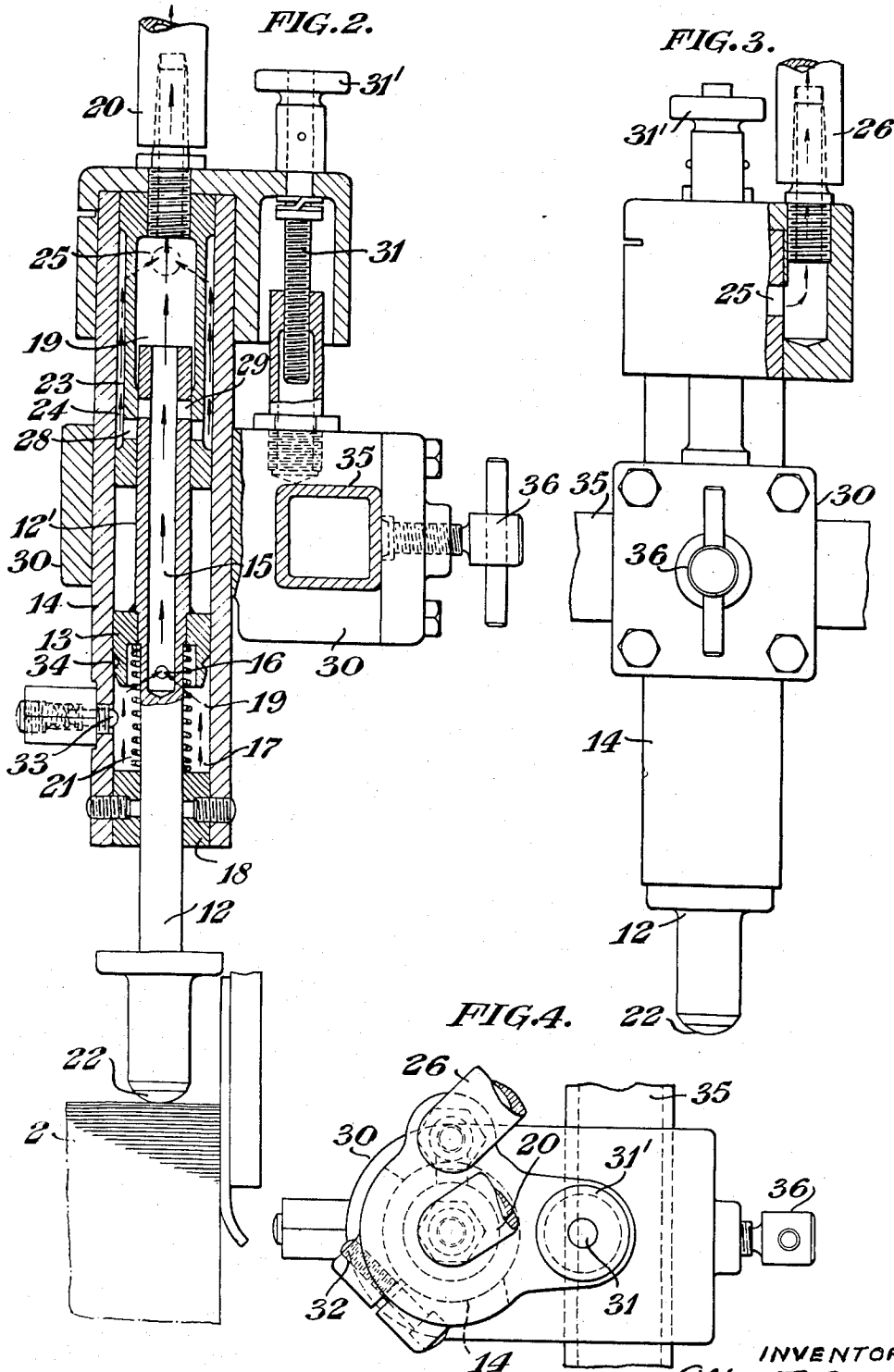
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3 Sheets-Sheet 2



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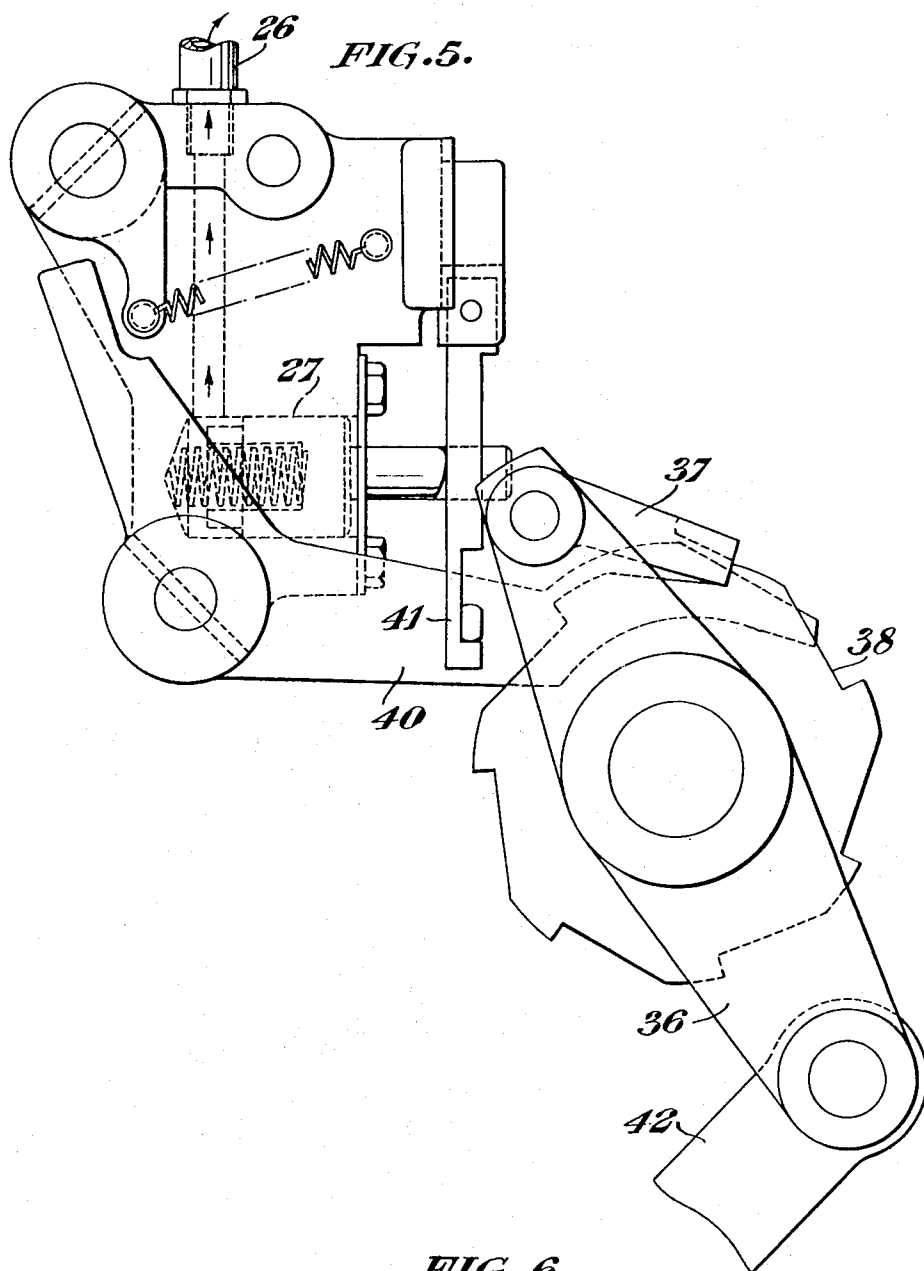
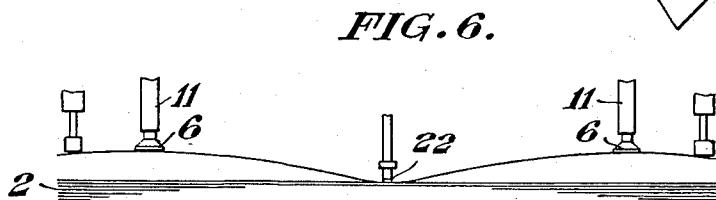
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3 Sheets-Sheet 3



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APPARATUS TO MAINTAIN THE TOP OF A PILE OF SHEETS AT A SENSIBLY CONSTANT HEIGHT

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3 Claims. (Cl. 271—31)

This invention relates to apparatus operating to maintain the top sheet of a pile of sheets at a sensibly constant height within the "reach" of means by which sheets are taken from the pile: such apparatus is commonly employed in connection with the delivery of sheets to printing and other machines which operate on the sheets.

The apparatus usually includes a top-sheet detector which is moved to "find" the level of the top sheet and when the extent of its movement exceeds a certain amount the detector operates some mechanism which will raise the pile bodily to return the top sheet to the required height.

Such apparatus usually employs pneumatic suckers as the means of taking the top sheet from the pile and the present invention has for its main object to provide a detector which will be operable also pneumatically preferably from the same source as the suckers thereby effecting a simplification of the installation.

Broadly stated the present invention consists in providing a sheet-height detector which is caused to carry out its searching operation pneumatically and which will exercise pneumatic control of the pile-raising mechanism.

The invention is illustrated in the accompanying drawings in which Figure 1 is a side elevation of a typical apparatus incorporating the device constituting the subject of the invention, Figures 2-4 are detail views of that device, Figure 2 being a vertical sectional elevation, Figure 3 a side elevation partly in section, Figure 4 a plan view, Figure 5 a detail view of the mechanism controlled by the device shown in Figures 2-4, and Figure 6 is a partial end view showing the position of the pile height detector and the suckers when a sheet is lifted from the pile.

Referring firstly to Figure 1 there is shown a board 1 which supports a pile 2 of sheets, the board being supported by chains 3 or by other flexible supports. The chains depend from a shaft 4 which is supported by a frame 5 and which is operated at intervals to maintain the top of the pile 2 within the reach of pneumatic suckers (of which only one is indicated at 6) disposed over the rear end of the top sheet of the pile. Disposed behind the rear end of the pile are nozzles 8 to which air under pressure is supplied. Over the forward end of the top sheet of the pile 2 are forwarding pneumatic suckers (of which only one is indicated at 9). The suckers 6 and 9 are raised and lowered pneumatically by ram and cylinder arrangements 11 and the arrangement 11 of the suckers 9 is rocked to and fro so as in their forward movement to deliver the leading end of the top sheet to the nip of forwarding rollers.

Such an installation is in common use and for the purpose of understanding the present invention it is believed sufficient to describe briefly a typical operating cycle. The suckers 6 are lowered to the top sheet of the pile 2 and vacuum is applied to them to cause that sheet to adhere to the suckers as they are raised at which time the nozzles 8 deliver jets of air under pressure to assist

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in the separation of the top sheet. The suckers 9 are lowered at this time and vacuum is applied to them to cause the front end of the top and now separated top sheet to adhere to them and then the suckers 9 are swung forward to deliver the front end of the sheet to the forwarding rollers. When the suckers 9 are in charge of the sheet, vacuum is cut off from the suckers 6 to release the sheet and these suckers 6 then commence the next operating cycle to take the freshly exposed top sheet of the pile. The suckers 9 having delivered the sheet to the rollers the vacuum applied to them is cut off and the suckers 9 swing back to commence another operating cycle.

Obviously as the sheets are removed from the pile 2 the level of the pile falls and would ultimately drop to beyond the downward movement of the suckers 6. Provision has therefore to be made to turn the shaft 4 at intervals so as to raise the chains 3 and with them the pile board 1 and the pile 2 and the present invention is concerned with what may be termed a pile height detector to "sense" the position of the top sheet of the pile and a mechanism controlled by that detector to effect the raising of the pile.

Referring now to Figures 2-4 which show the detector in detail this comprises a downward rod extension 12 of a ram 13 mounted to slide in a vertical cylinder 14. An upward extension 12' of the rod 12 is bored out to provide a passage 15 which communicates through lateral openings 16 with a chamber 17 formed between one face of the ram 13 and the lower closed end 18 of the cylinder 14.

This passage is open at its upper end to a chamber 19 connected to the vacuum supply line 20 which conveys the vacuum effect to the pneumatic suckers 6 which are lowered on to the top sheet of the pile 2 and are then raised, vacuum being automatically applied to the suckers 6 when they approach the top sheet so as to take the sheet and then lift it whereupon the vacuum is cut-off to release the sheet to allow it to be taken away by the suckers 9 and the feed rollers.

As the chamber 19 is connected to the same vacuum line as the suckers 6 vacuum will be applied to and cut-off in the chambers 19 and 17 in phase with the supply and cut-off to the suckers. When the vacuum is applied the resulting drop in pressure in the chamber will cause the ram 13 to descend against the action of a return spring 21, the descent continuing until the lower end of the rod 12 (or more precisely a tip 22 on it) contacts the top of the pile 2. When the vacuum is cut-off the ram will rise under the action of the return spring 21, whereupon the action will be repeated, the descent of the ram 13 continuously increasing as sheets are taken from the pile 2.

In order to enable the movement of the ram to effect pneumatic control of the pile raising apparatus, the upward extension 12' of the ram 13 is slidable in a sleeve 23 secured in the upper end of the cylinder 14 and forming between itself and the inner wall of the cylinder a transmission chamber 24 which is connected through an opening 25 to a pneumatic line 26 extending to a second pneumatic ram and cylinder arrangement 27 (see Figure 5) to control the operation of the pile raising mechanism: this sleeve is formed with lateral passages 28 which are masked by the upward extension 12' of the ram 13 so long as the extent of downward "searching" movement is within the limits of the appropriate working height of the pile. When however the extent of downward movement exceeds that amount, openings 29 in the upward extension 12' register with the lateral passages 28 in the sleeve and so place the transmission chamber 23 open to the vacuum line 20 which effect is transmitted through the pipe line 26 to the ram and cylinder 27 to

cause the pile to be raised to restore the level of the top sheet.

The arrangement of this invention is not only simple to install: it has an operating advantage which follows from the use of the intermittent vacuum as applied to the suckers 6 of which two would be used one at each side of the detector, as shown in Figure 6. Vacuum is applied to the suckers 6 to lower them to the top sheet and is maintained while they are raised. Vacuum is applied to the detector for the same period and thus the detector having moved down with the suckers 6 to engage the top sheet of the pile, the rising movement of the suckers will leave the detector down on the pile 2 and as a result the sheet lifted by the suckers 6 will be bent upwardly about the detector which is maintained down by the sustained vacuum and this action will facilitate the separation of the top sheet from that below it.

It may be desirable in some cases to raise the detector before the suckers 6 which lift the sheet, in which event the suction to the detector would be controlled by a separate valve from that controlling the suckers.

The initial setting of the height of the detector assembly is arranged to be adjusted by mounting the cylinder 14 to slide vertically in a supporting bracket 30 and by providing an adjusting screw arrangement 31 having an operating button 31' to adjust the cylinder up and down in the bracket which is split and provided with a clamping bolt 32 to lock the cylinder in the adjusted position.

A limit is imposed on the extent of searching movement of the detector and on the operation of the pile raising gear controlled by the second ram and cylinder 27 and this limit is set by a spring loaded ball 33 which is carried by the cylinder 14 and snaps into a groove 34 in the ram 13 in the limiting position, the ram remaining held until the pile 2 is raised by some other pile raising mechanism than that controlled by the detector: in reaching this limiting position the openings 29 in the upward extension 12' of the detector ram have moved past the lateral openings 28 in the sleeve 23 so that these openings are again masked to hold the second ram and cylinder 27 and its pile raising gear inactive.

The bracket 30 supporting the assembly is carried by a supporting hollow bar 35 along which the bracket can be slid to any desired position and then locked by a thumb bolt 36.

The pile raising gear controlled by the second ram and cylinder arrangement can be of any usual form: for example the usual continuously oscillating arm 36 having on it a pawl 37 to drive a ratchet wheel 38 may be used, the ratchet wheel operating through worm and worm-wheel gear 39 to drive the shaft 4 and so to raise the chains 3 to elevate the pile.

The action of the pawl 37 is regulated by a guard plate 40 which in one position holds the pawl clear of the ratchet wheel 38 so that the arm 36 oscillates idly. The guard plate is latched in this position by a latch 41 which however is controlled by the ram and cylinder ar-

range ment 27 so that when, under the control of the detector assembly, suction is applied through the line 26 to that ram and cylinder the latch 41 is withdrawn, the guard plate 40 drops and the pawl is rendered active to turn the shaft 4. This continues until the pile 2 has been raised whereupon suction is cut off from the ram and cylinder arrangement 27 and the latch 41 becomes re-set.

In the arrangement shown in Figure 1, the pawl arm 36 is continuously operated by a link 42 connected to a crank pin 43 on a constantly rotating disc 44.

What I claim is:

1. In a device for feeding sheets from a pile carried on a support that is raised by means actuated by suction from a vacuum system, and having a pair of sheet lifting members positioned over the rear corners of the pile and energized intermittently from the vacuum system to lift the adjacent corners of the sheets, and in combination, a combined suction operated pile height detector and sheet-bending member positioned centrally between the said sheet lifting members and actuated by the said vacuum system simultaneously with the said sheet lifting members, to press each sheet down while its corners are being lifted by the sheet lifting members, and thereby to bend each sheet transversely to its path of travel, the said pile height detector and sheet-bending member comprising a cylinder, a ram fitted to slide in the cylinder, a rod secured to the ram and having axial and radial passages and a sheet engaging tip, a sleeve having a radial passage and secured within the cylinder and slidably supporting the rod, said radial passages in the rod and the sleeve coacting as a valve to open the vacuum supply and activate the said means for raising the support as required to maintain the top of the pile at a desired elevation, and means to support the said cylinder in such position that the tip of the rod will be moved into engagement with the uppermost sheet of the pile when suction is applied to the cylinder by the vacuum system.

2. A pile height detector as defined in claim 1 in which a transmission chamber is formed between the inner wall of the cylinder and the outer wall of the sleeve over a major portion of the peripheral surface of the sleeve intermediate its ends.

3. A pile height detector as defined in claim 1 and having a sleeve formed with a reduced diameter at a mid-portion and extending part way toward each end to provide a transmission chamber between the sleeve and the cylinder.

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