

June 29, 1937.

G. SPIESS

2,085,612

SHEET SEPARATING DEVICE

Filed Feb. 8, 1936

5 Sheets-Sheet 1

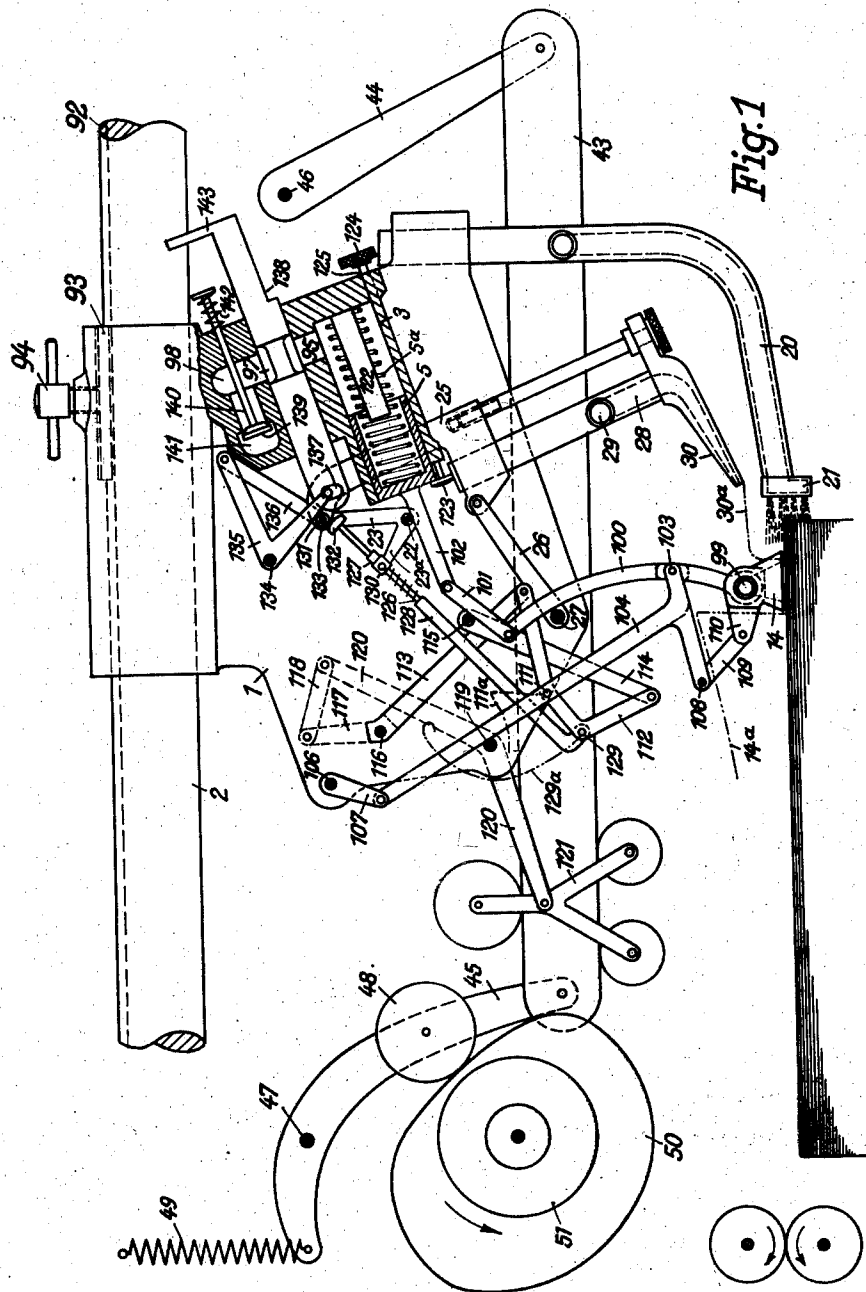


Fig. 1

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5 Sheets-Sheet 2

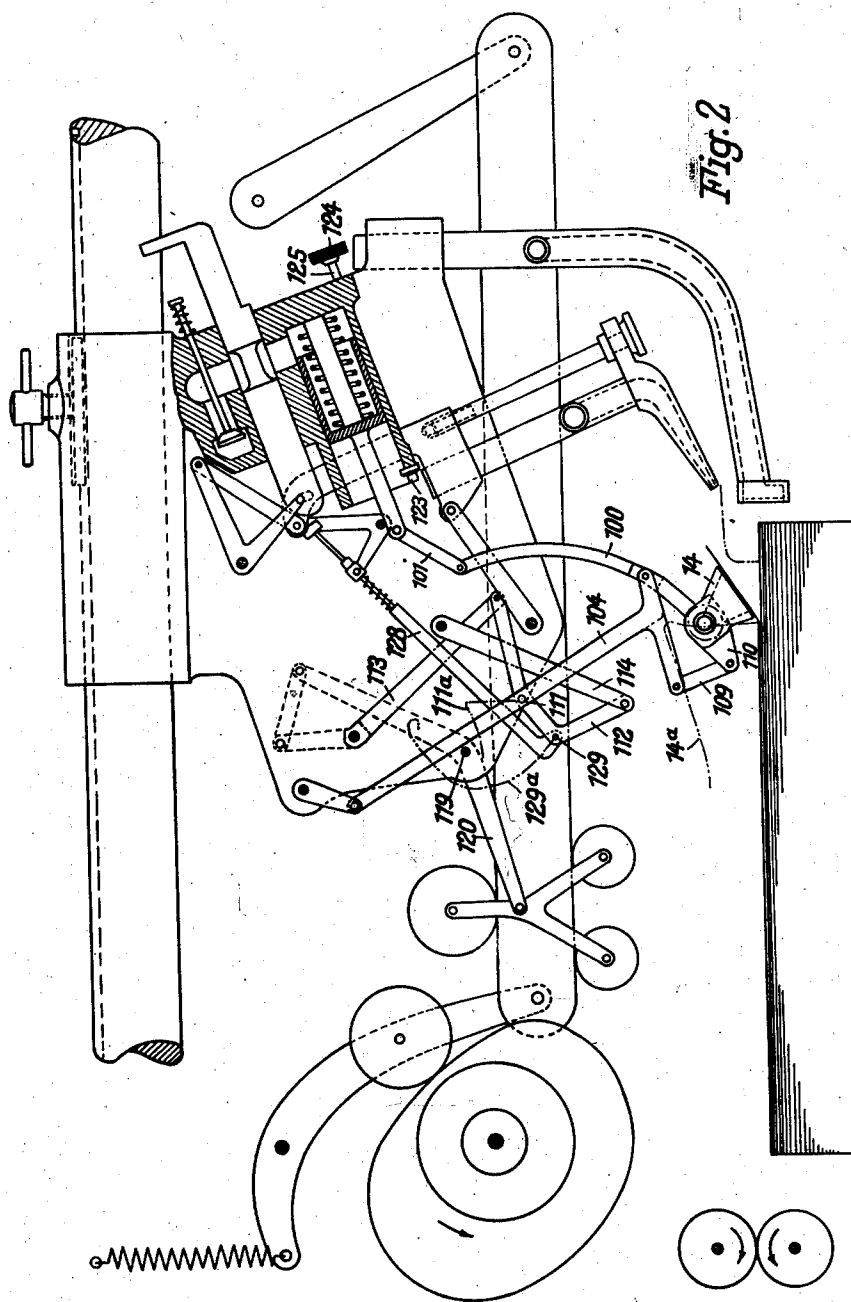


Fig. 2

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5 Sheets-Sheet 3

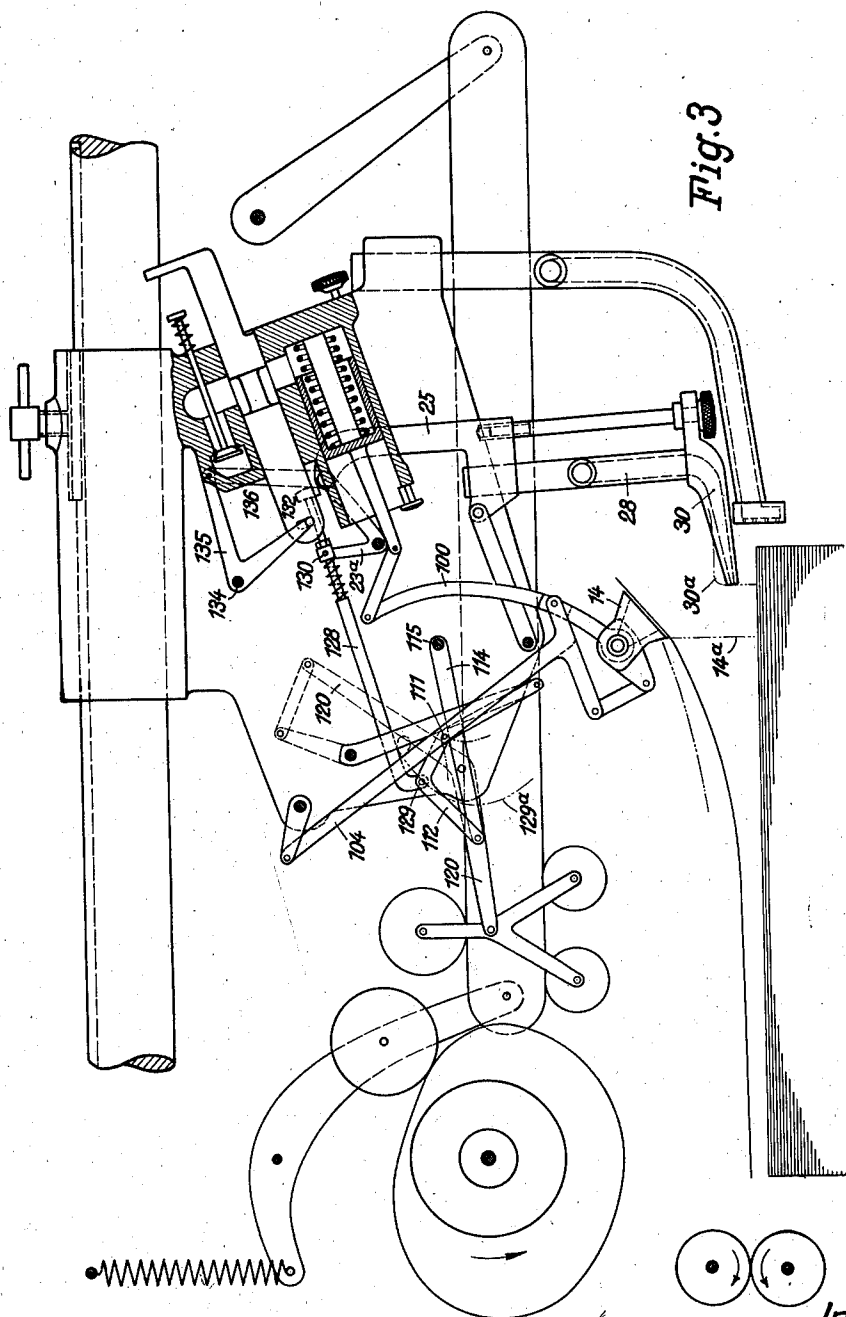


Fig. 3

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5 Sheets-Sheet 4

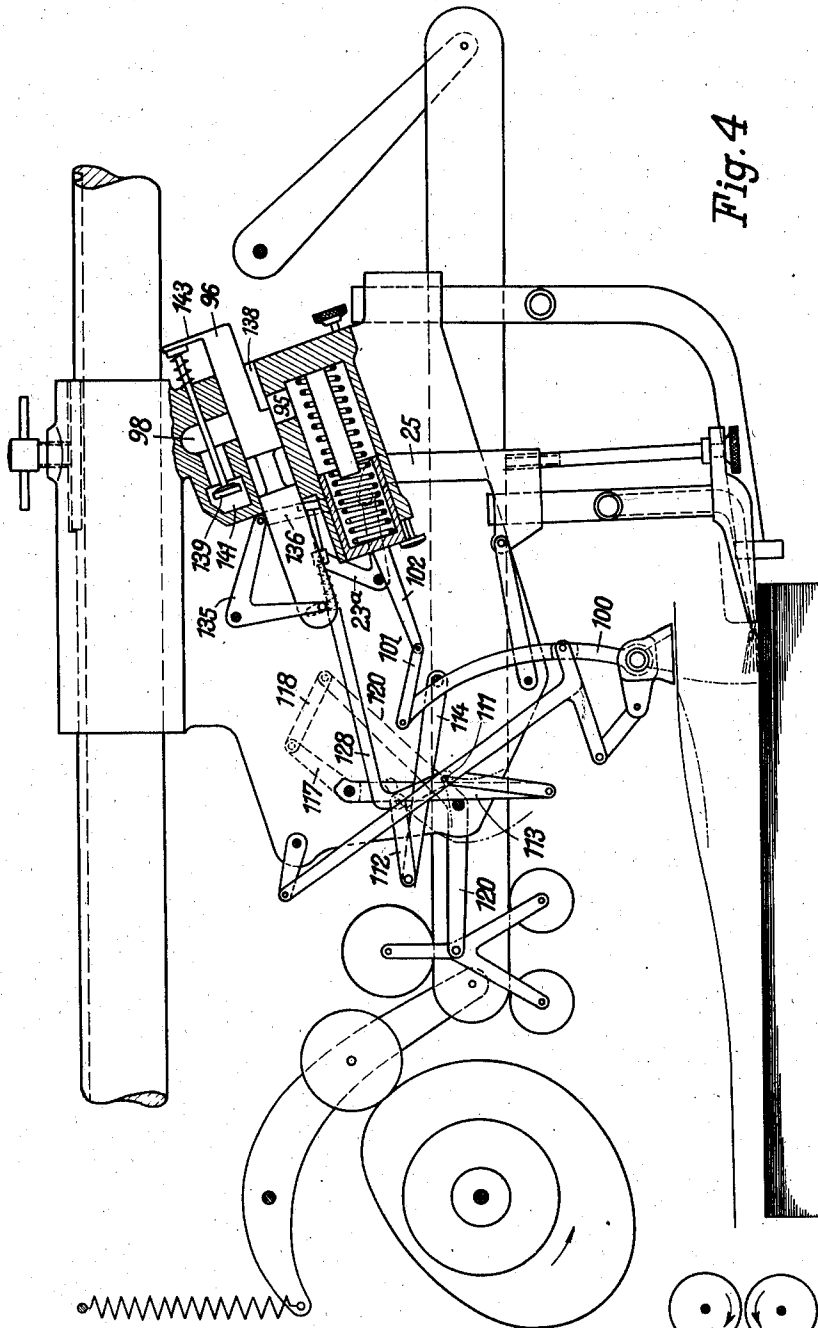


Fig. 4

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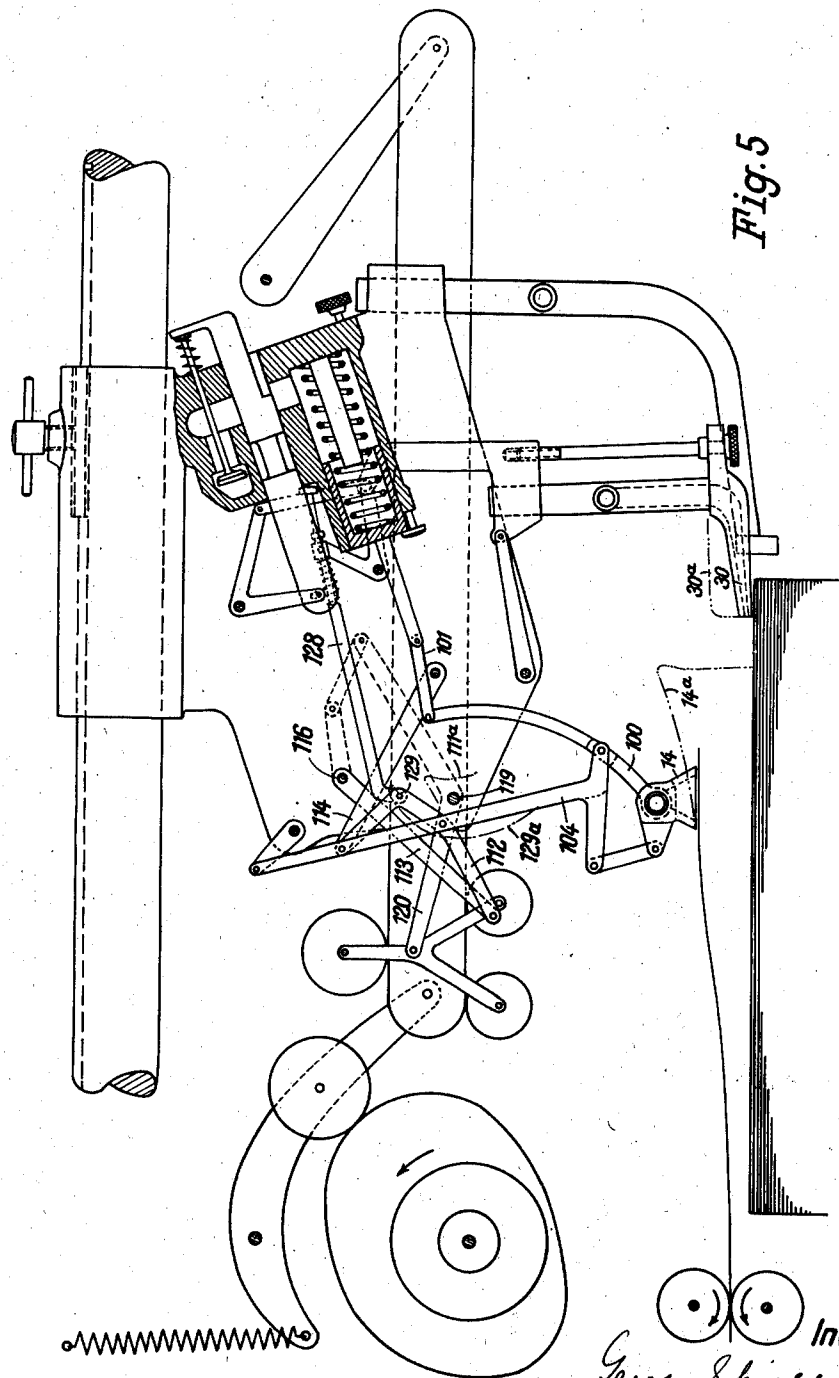
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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

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SHEET SEPARATING DEVICE

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In Germany October 22, 1935

10 Claims. (Cl. 271—27)

This invention relates to sheet separating devices for sheet feeding machines.

There are sheet separating devices known from the feeding direction and which are displaceable as a whole in the feeding direction along a guiding and supporting bar. In such separating devices the different operations required for the separation of the sheet from the pile are not derived from a controlling shaft displaceable with the separating device, but the control of the different working operations is effected in such manner that they are brought about partly by means of the vacuum in the suction conduit arising during the sucking up of the sheet, through the medium of a sniffing piston, and partly by means of a lifting bar extending in the direction of displacement and controlled by a lifting cam provided on a stationary control shaft. The allotment of control of the various operations in these known devices is such that by means of the vacuum in the air conduit the suction member together with the sheet sucked up from the pile is lifted up and the separating blower is brought into operative position, whilst by means of the lifting bar and control shaft respectively the forward movement of the suction member in the feed direction, the return of the suction member into the position of readiness and the return of the separating blower are controlled, the automatic switching on and off of the suction and blast air being effected in coordination with the different movements of the suction member and separating blower. With this arrangement of the separating device the vacuum in the suction conduit has to carry out a comparatively large amount of work, and the swinging of the separating blower into operative position as also the return of the suction member into sucking up position are effected by force closure.

The present invention proposes to provide a sheet separating device differing from these known devices in that the vacuum in the suction conduit brings about the tipping of the suction member together with the sucked-up part of the sheet, whilst the further necessary working operations, namely the raising of the suction member together with the sucked-up part of the sheet, the swinging over of the separating blower into operative position, the forward movement of the suction member for the delivery of the separated sheet to the device for conveying it onwards, the return of the separating blower into a position of readiness and the return of the suction mem-

ber into sucking up position are brought about by a lifting bar extending in the direction of feed. The arrangement is, according to the invention, such that the different devices and linkages are in positive connection with the lifting bar. The lifting bar itself may be in positive connection with the driving part of the control shaft in one or both directions of stroke. The switching on and off of the suction and blast air is effected automatically in dependence on the corresponding movements of the suction member and the separating blower.

The advantage of the arrangement of the separating device according to the invention resides in a considerable simplification of the construction and operation, particularly when the sheet dimensions are altered, inasmuch as there is no gearing which has to be adjusted, whilst the suction power is lessened and all operations are positively controlled.

By way of example, one form of the invention is illustrated in the accompanying drawings, in which Figures 1 to 5 each show an elevation with certain details in section in various working positions, Fig. 1 showing the device in the position during the sucking up of a pile sheet; Fig. 2, in the tipping position of the suction member; Fig. 3, in the raised position of the suction member; Fig. 4, in the position before the beginning of the forward movement; and Fig. 5, at the end of the forward movement of the suction member.

Referring to the drawings, the support 1 of the separating device is slidably guided on the supporting bar 2 extending in the direction of feed above the sheet pile, is secured against rotation by a key 93 sliding in a groove 92 of the bar 2 and is adapted to be fixed in position by means of a tommy-screw 94. On the support 1 the suction cylinder 3 is mounted, the opening 95 of which is controlled by a slide valve 96 and is put in communication in the position shown in Fig. 1 with a suction air space 98 through the medium of a recessed part 97 of the slide valve, said suction air space being connected on the one hand with the air pump and on the other hand, by means of a conduit, not shown, with a pipe 99 on which the suction air nozzles 14 are arranged. The nozzle pipe 99 is fixed to a lever 100, which is forked at its lower end and the upper end of which is connected by an articulated bar 101 with a fixed extension 102 of the piston 5 of the suction cylinder 3. The lever 100 is further pivotally connected at 103 to a lever 104, which is pivotally connected at its upper end at 105 with a link member 107 fulcrumed at 106 on the sup-

port 1. The lower end of the lever 104 is further pivotally connected at 108 by means of a rod 109 with a nozzle arm 110.

The lever 104 is pivotally connected approximately at the middle at 111 with an angle member 112 which forms the coupling of a rectangular linkage and which pivotally connects the free ends of the arms 114 representing the crank and wing of said rectangular linkage. The arm 114 swings around the pin 115 fixed to the support 1, whilst the arm 113 is mounted on the shaft pin 116 which is journaled in the frame and provided with a second arm 117. The latter is pivotally connected by means of a link bar 118 with the one arm of a two-armed lever 120, which is fulcrumed at 119 in the support 1, and the other arm of which is pivotally connected to the bearing frame 121 of a roller triangle, the rollers of which embrace the lifting bar 43.

The sucking-up position of the separating nozzles 14 shown in Fig. 1 is thus determined on the one hand through the positioning of the lifting bar 43 by means of the above-described linkage, and on the other hand by means of the position of readiness of the snifting piston 5, which it assumes under the action of a compression spring 5a through the medium of the linkage 100, 101, 102. The position of the lifting bar 43 is determined by the lifting cam 50 and by the weight of the lifting linkage, assisted by a spring 49 which might be replaced by a counter cam.

The stroke of the suction piston 5 is limited by a stop 123 provided in the interior of the suction cylinder 3. The sucking-up position (Fig. 1) of the suction nozzles 14, i. e., the angular position of their suction surfaces with regard to the pile surface, is adjustable by means of an exterior adjusting stop 123 for the suction piston 5, which stop is arranged at one end of an adjusting spindle 125 provided with an adjusting button 124 and guided on the cylinder body. In the position of adjustment of the stop 123 shown in Fig. 1 the suction surfaces of the suction nozzles are parallel to the pile surface, whilst in Fig. 2 a position of adjustment of the piston stop 123 is shown in which the piston stroke is shortened and in consequence of this the nozzles are slightly tipped in sucking-up position. This adjustment of the suction nozzles is for example suitable when the rear pile edge is rolled upwards. If, however, the edge of the pile is bent downwards, then it is advantageous to employ the oppositely inclined position of the nozzles which is effected by bringing the piston stop 123 into the other limiting position by means of the adjusting spindle 125 and thus increasing the piston stroke. The adjustment of the suction nozzles with regard to the pile surface is regulatable during operation, inasmuch as the suction cylinder 3 is mounted so as to be stationary.

The separating blower and pile feeling member for the adjustment of the pile transport, which consists of the holder 25, the pipe 28 and the blast nozzle member 30, forms the coupling of a rectangular linkage, the crank arm 23 of which is mounted so as to be capable of swinging around the fixed pin 22 and the wing 26 of which is mounted so as to be capable of swinging around the fixed pin 27 of the support 1. Similarly, the separating blower and pile feeling device is subjected to the action of a spring 126 which has the tendency to swing it out of the position of readiness shown in Fig. 1 into the operating position shown in Fig. 4. The separating blower and pile feeling member is locked in its position of

readiness (Fig. 1) against the action of said spring by a locking stop 127. Both the spring 126 and the locking stop 127 are mounted on a driving rod 128, which is pivoted at 129 to the curved coupling bar 112, and enclose a cubical sliding member 130, with which the free end of a second arm 23a of the crank 23 of the blower linkage is pivotally connected. The free end of the driving rod 128 contacts by means of a buffer 132 with the arcuate stop surface of a stop roller 135 mounted at the end of a crank arm 23.

During the movement of the rectangular linkage 113, 114, 112 by means of the lifting bar 43, the coupling point 129 describes the path 129a. In the course of this movement of the coupling point 129 the driving rod 128 acts in the first place as a push rod against the roller 133, which is mounted on the link pin connecting the crank arm 23 with the holder 25, and thereby causes the blower and feeler to swing over in the first place into the position shown in Fig. 3 until the roller 133 slides off from the stop surface of the buffer 132. From this moment onward, the connection of the blower holder 25 and of the driving arm 23, 23a respectively with the driving rod 128, is caused to be a resilient one by the action of the spring 126 and as soon as the blowing nozzle member applies itself as a feeler to the pile, the spring 126 is compressed whilst the driving rod 128 slides without hindrance in the cubical slide member 130.

On a pin 134 fixed in the support 1 a bell crank lever 135, the one arm of which is pivotally connected by means of a link bar 136 with the link pin 131, and the other arm of which is pivotally connected by means of a slotted link 137 with the suction air control valve 96, is mounted so as to be capable of swinging. In consequence of this connecting linkage, the air control valve is also displaced during the swinging motion of the separating blower and pile feeler and arrives finally in the position shown in Fig. 4 in which it interrupts the connection between the internal space of the suction cylinder 3 and the suction space 98 and established connection between the internal space of the cylinder and the external air by means of the control opening 95 and a flattened part 138 at its upper end.

The suction air space 98 connected with the air pump through a control valve, not shown, is further connected by a bore 140 controlled by a valve 139 with an air space 141, which is connected by means of an air conduit, not shown, with a snifting cylinder which operates the control gear of the pile lifting device. The valve 139, which is held in closed position by means of a spring 142, is lifted off from its seating by striking against the end of the valve rod 140 by means of a carrier 143 provided on the control valve 96, when the foot of the feeler, in consequence of the diminished height of the pile surface, goes correspondingly far downwards (Fig. 4) until it comes to rest on the pile surface.

By displacement of the support 1 on the rod 2 and fixing the same in place the separating device is adjusted according to the dimensions of the sheet. By the displacement the parts of the separating device are not altered in their relationship to one another. In the position shown in Fig. 1, which is determined on the one hand by the cooperation of the lifting cam 50 and the spring 49, and on the other hand by the piston spring 5a and the piston stop 123, the sucking up of the sheet takes place after the space 98 and the nozzle pipe 99 have been put in communica-

tion with the air pump 1a. During this time the loosening blower 20, 21 is in action whilst the separating blower 30 is inoperative. When the uppermost sheet of the pile jumps up to the suction nozzles 14 and closes them, a vacuum is produced in the snifting cylinder 3 connected with the suction nozzles by means of the space 98, the recessed part 97 of the control valve 96 and the cylinder control opening 95, whereby the piston 5 is drawn in into the cylinder while compressing the spring 5a. The movement of the linkage 100, 101, 110, 109 thereby produced causes a tipping motion of the suction member or members 14 around their front end together with the sucked-up part of the sheet, as is shown in Fig. 2

During the upward movement of the lifting bar 43 which now takes place owing to the action of the control cam 50, the rectangular linkage consisting of the parts 113, 114, 112 is set in motion through the medium of the roller triangle 121, the driving lever 120 and the connecting linkage 118, 117, the point of application 111 of the coupling of the suction lifting linkage 129 and the moving linkage of the separating blower and pile feeler describing meanwhile the curves indicated in the figure by the reference numerals 111a and 129a, respectively.

The lifting linkage for the separating suction member passes in the meantime first from the position shown in Fig. 2 into the position shown in Fig. 3, in which the suction member is raised but is not yet moved into the tipped position. Simultaneously, the driving rod 128 for moving the separating blower and pile feeler is displaced by the movement of the rectangular link coupling 112. At the commencement of this movement the rod 128 with its impact buffer 132 has positively initiated the movement of the separating blower and pile feeler 25, 28, 30. At the moment at which the impact buffer 132 has slid off from the roller 131, the further drive of the separating blower and feeler takes place by force closure by the action of the spring 126 on the bell crank lever 23, 130. During this movement of the separating blower and pile feeler the lower edge of its bowing nozzle describes the curve 30a, which runs approximately horizontally in its first part and nearly rectilinearly in its second part.

In the further course of the upward movement of the lifting bar 43, the rectangular linkage 113, 112, 114 moves into the position shown in Fig. 4. During this movement no noticeable displacement of the point of application 111 of the coupling of the linkage for lifting the suction member takes place, so that said linkage does not alter its adjustment with regard to the position shown in Fig. 3. On the other hand, the point of application 129 of the coupling of the driving linkage 128 of the separating blower and pile feeler 25, 28, 30 undergoes a further displacement which causes a vertical downward movement of the blower and feeler, as a result of which the tip of the separating blower foot 30 is caused to bear resiliently on the pile surface and the blowing nozzle closing means is brought into the open position. During this movement of the separating blower and pile feeler, the control valve 96 is further displaced by means of the connecting link 136 and the bell crank lever 135 into the position shown in Fig. 4, and the internal space of the snifting cylinder 3 is shut off from the air space 98 and put in communication with the open air by means of the flattened part 138. As a result of the release of the vacuum the piston 5 is returned under the pressure of the spring 5a

into initial position. In consequence of the movement of the tipping linkage 101, 100 associated therewith from the position shown in Fig. 4, the suction nozzles 14 are tipped back, so that their suction surfaces together with the sucked-up part of the sheet again lie parallel or approximately parallel to the pile surface.

In Fig. 4 it has been assumed that the height of the pile surface in consequence of the removal of the sheets has sunk below the normal height necessary for the proper operation of the separating device. As a result of the larger descent of the separating blower and pile feeler thereby rendered possible in placing itself on the pile, the control valve 96 is displaced to a corresponding extent so that its carrier 143 has lifted the valve 139 from its seating and thereby placed the space 141 to which the air conduit of the snifting cylinder controlling the pile feed lock is connected, in communication with the space 98, i. e., with the suction conduit of the pump within which a vacuum prevails owing to the action of the sucked-up sheet. In this way the pile feed is operated.

In the further course of the stroke of the bar 43, which is transmitted by means of the linkage 120, 118, 117 to the rectangular linkage 114, 113, 112, the point of application 111 of the coupling of the nozzle lever 104 describes a curved path located to a greater extent horizontally in the direction of feed. This motion of the coupling point 111 is accompanied by a forwardly directed movement of the lower end of the nozzle lever 104 and consequently of the nozzles 14 together with the sucked-up sheet, during which the nozzles are simultaneously guided by the tipping lever 100 and the connecting linkage 109, 110 in such manner that the nozzle suction surfaces maintain their position parallel to the pile surface. The path of the nozzle tipping edge is indicated in the drawings by the reference numeral 14a.

In the position shown in Fig. 5 the sheet separated from the pile is gripped in known manner by the device for forwarding it onwards after the vacuum in the nozzle suction conduit has been eliminated by the opening of a valve flap in the suction conduit of the pump and consequently the sheet is released by the nozzles. Thereupon the return of the lifting bar 43 into initial position, shown in Fig. 1, begins, whereby the rectangular linkage together with the nozzle lever 104 connected with the coupling 112 and the driving rod 128 likewise connected with the coupling 112 and the driving rod 128 likewise connected to the coupling for the movement of the separating blower and pile feeler are returned into the initial position for the commencement of a new working operation.

I claim:—

1. Sheet separating device for sheet feeding machines, comprising separating means engaging the rear of the pile of sheets including a nozzled separating suction member, a suction conduit for said member, an air pump connection with said member, the part of the sheet sucked up by said separating member being automatically lifted by the suction force arising in said conduit and a cylinder upon closure of the suction opening by the sheet and the vacuum produced in said conduit during the sucking up of the sheet effecting the tipping of said suction member, a separating blower and pile feeler, a lifting bar extending in the direction of feed and operating linkages connecting said suction member and said separating

blower and pile feeler with said lifting bar for raising the suction member together with the sucked-up part of the sheet, swinging the separating blower and pile feeler into operative position, moving the suction member to deliver the sheet and returning the blower and the suction member.

5 2. Sheet separating device according to claim 1, wherein a roller triangle positively connects the operating linkages of the suction member and of the separating blower and pile feeler with the lifting bar.

10 3. Sheet separating device according to claim 1, wherein a coupling of a rectangular linkage controlled by the lifting bar controls the operating linkages of the suction member and the separating blower and pile feeler.

15 4. Sheet separating device according to claim 1, wherein a separating suction nozzle is linked to the end of a nozzle lever and is guided on a tipping lever by linkage connection of the nozzles with the nozzle lever.

20 5. Sheet separating device according to claim 1, comprising means for effecting the motion of the separating blower and pile feeler from a position of readiness into operative position at first positively but afterwards by force closure.

25 6. Sheet separating device according to claim 1, comprising means for rendering the suction position of the nozzle suction surface adjustable in correspondence with the pile surface and effecting the tipping of the nozzle.

30 7. Sheet separating device according to claim 1, wherein the nozzle together with the sucked-up part of the sheet is tipped back after the operation of lifting off from the pile before the beginning of the forward movement by the return of a

tipping piston into initial position after the admission of air into a cylinder has been effected by the lifting bar, and the suction surface is again parallel to the pile surface.

8. Sheet separating device according to claim 1, wherein a slide valve controlling the pressure in a tipping suction cylinder is operatively connected with the separating blower and pile feeler to cause said valve during the duration of the position of readiness, of the tipping and of the lifting movement of the suction nozzle and of the initial motion of the blower to maintain the interior of the cylinder in communication with the suction conduit and during the period of rest of the suction nozzles to connect the interior of the cylinder with the open air.

9. Sheet separating device according to claim 1, wherein a slide valve controlling the pressure in a tipping suction cylinder is operatively connected with the operating and driving linkage of the separating blower and pile feeler to cause said valve during the duration of the position of readiness, of the tipping and of the lifting movement of the suction nozzle and of the initial motion of the blower to maintain the interior of the cylinder in communication with the suction conduit and during the period of rest of the suction nozzles to connect the interior of the cylinder with the open air.

10. Sheet separating device according to claim 1, wherein a control valve controls by means of a carrier a valve by means of which a snifting piston controlling a pile locking device is set in operation.

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