Jan. 30, 1934. A. WINKLER ET AL 1,945,248

DEVICE FOR REMOVING FROM A PILE OF SHEETS THE SHEET LOWERMOST AT THE TIME

Filed Dec. 12, 1932 2 Sheets-Sheet 1

Fig. 1

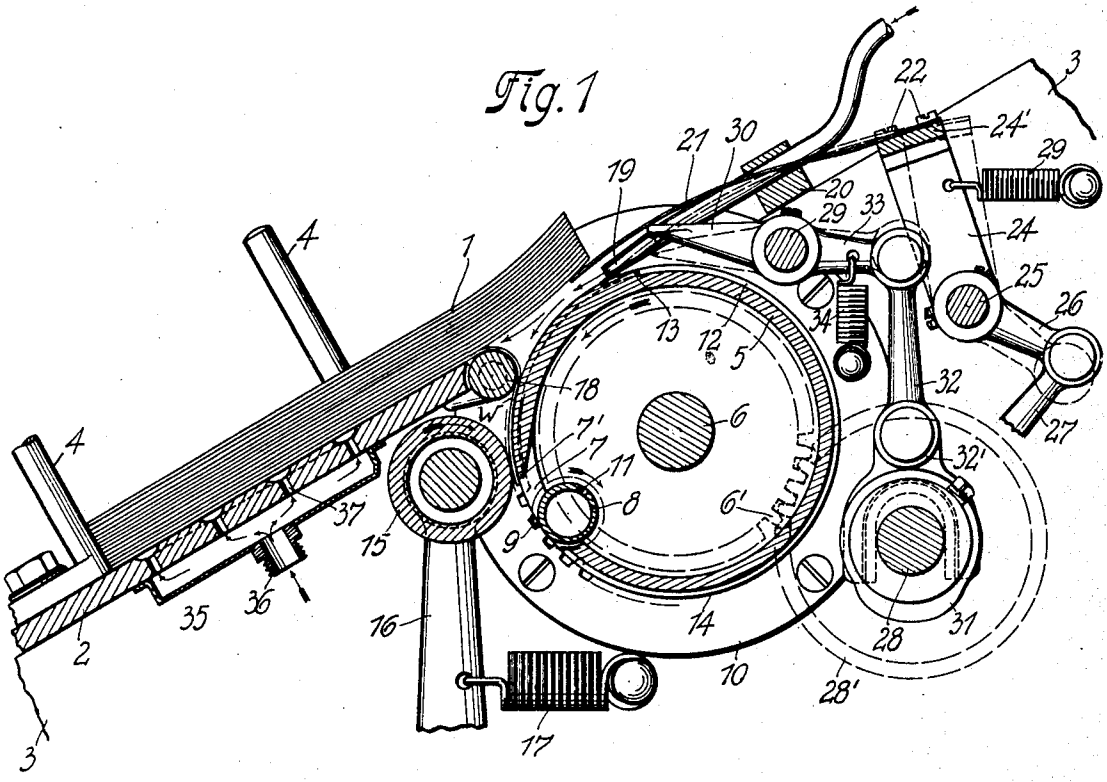
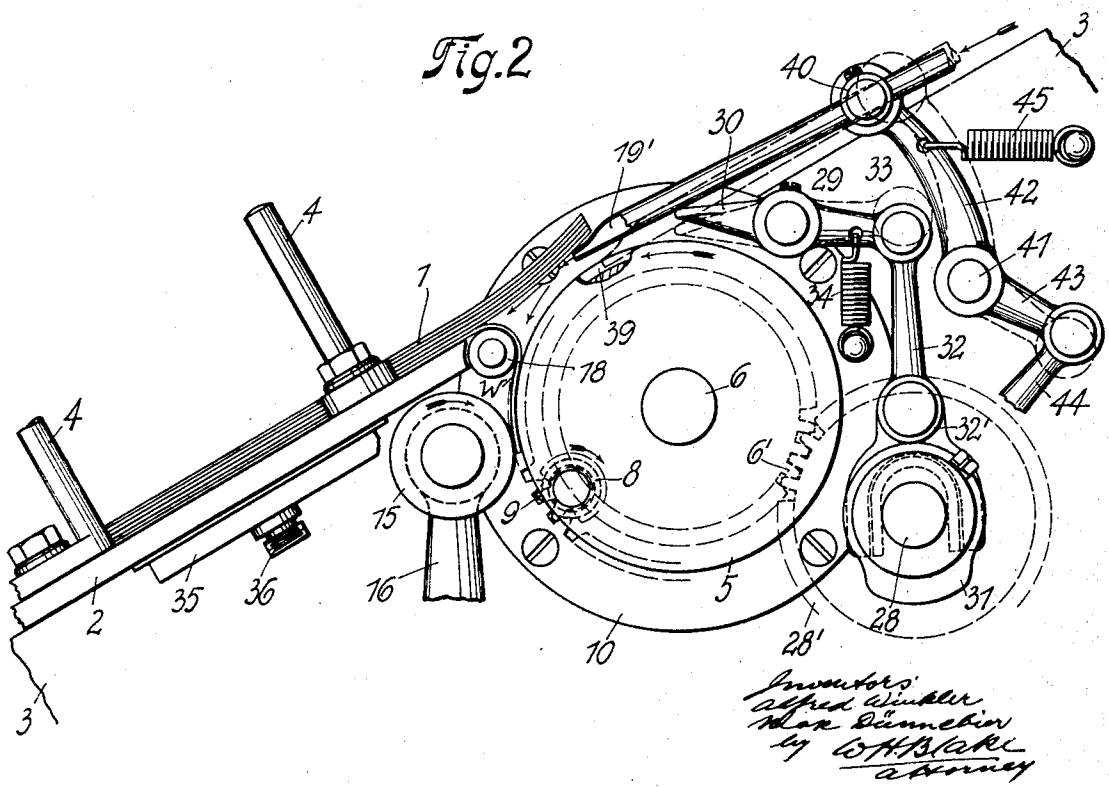


Fig. 2



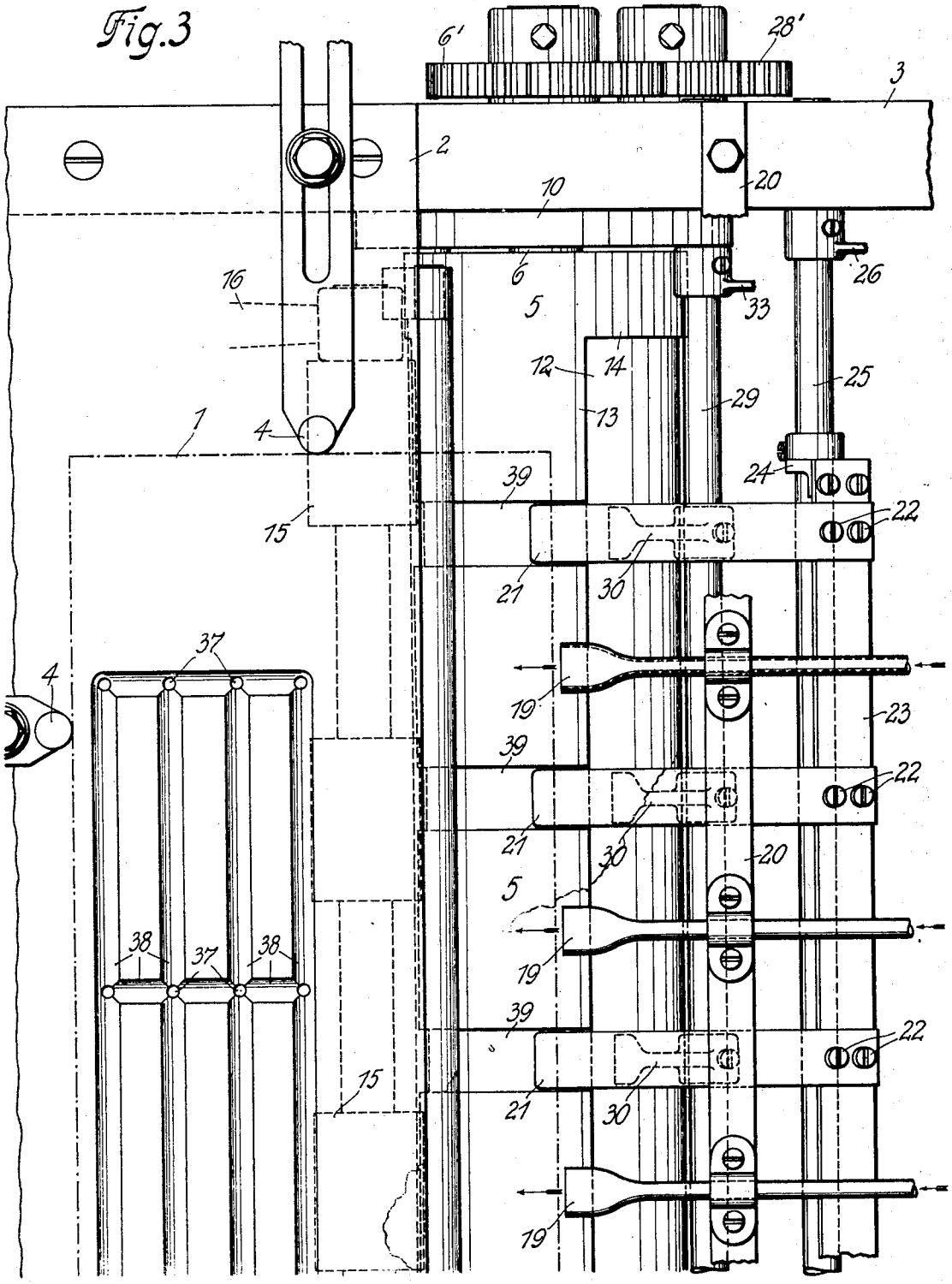
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DEVICE FOR REMOVING FROM A PILE OF SHEETS THE SHEET LOWERMOST AT THE TIME

Filed Dec. 12, 1932 2 Sheets-Sheet 2

Fig.3



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1,945,248

DEVICE FOR REMOVING FROM A PILE OF SHEETS THE SHEET LOWERMOST AT THE TIME

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Application December 12, 1932, Serial No. 646,892, and in Germany July 17, 1931

13 Claims. (Cl. 271—29)

In the United States Patent 1,834,565 of 1 December, 1931, there is described a device for removing individual sheets from the bottom of a pile. Each sheet, in the case of the device referred to, is folded once simultaneously with its removal. Said patent relates to the feature that a current of compressed air is blown from both sides of the pile into the space under the pile which is enclosed by the bottom of the pile and by the two withdrawing rollers or feed rollers, which space in transverse section is similar to a triangle. This current of compressed air impedes in the first place an objectionable sagging of the lower sheets of the pile between the two withdrawing rollers and when the lowermost sheet in its continued course between the two withdrawing rollers is bulged out opposite the rest of the pile, the current of compressed air comes into action in such a way that it relieves the lowermost sheet, which is now running in between the withdrawing rollers while a fold is being formed, from the pressure of the rest of the pile. In this manner it prevents the next sheet in consequence of the friction which would otherwise exist between itself and the sheet in the act of being withdrawn, from being dragged along with the latter and simultaneously withdrawn and folded, or at all events it prevents the next sheet from suffering such a change in position that on its subsequent withdrawal it may not be possible to fold it exactly.

This device according to the United States Patent 1,834,565 cannot be employed for various reasons in the case of sheet-withdrawing devices of the ordinary kind in which the individual sheets must be removed from underneath a pile without simultaneously being folded once and consequently throughout their full extent, the reason for this impossibility being first and foremost that in their case a space permanently enclosed by the pile and the withdrawing or feeding elements does not exist for the lateral introduction of a current of compressed air which moreover might spread out also between the lowermost sheet and the rest of the pile.

The present invention is a device which serves, even in the case of such sheet withdrawing or feeding devices as those which remove from the bottom of a pile the individual sheets without simultaneously folding them, to introduce a current of compressed air between the lowermost sheet to be removed and the rest of the pile lying above it, so that in this case also the above mentioned advantageous action of the compressed air can be utilized.

The present invention also consists in the provision of means by which the introduction of the compressed air between the sheet to be removed and the rest of the pile in the case of sheet withdrawing or feeding devices of the above-mentioned kind is facilitated and the intended action enhanced.

The invention also embraces the feature that in the case of sheet feeding devices of the above-mentioned kind there are provided, in combination with the means for introducing compressed air between the sheet to be removed and the rest of the pile, other additional means, which are known per se and by means of which in case of need, that is, when manipulating certain sorts of papers, compressed air is also introduced between the pile-supporting plate and the lowermost sheet of the pile.

Finally the invention also embraces means for advantageously distributing the compressed air introduced between the pile-supporting plate and the lowermost sheet of the pile.

For the purpose of introducing the compressed air between the sheet to be removed and the rest of the pile there are provided according to the invention compressed air nozzles, by means of which the compressed air is blown from the front or forward side of the pile, at which the separation of the sheet lowermost at the time commences, between the pile and the lowermost sheet which is in the act of being separated at the time. The action of the current of compressed air introduced in this manner is particularly advantageous because in this case the distribution of the air can be effected very uniformly and consequently it is possible to employ a comparatively low air pressure.

As means for facilitating such a supply of compressed air and for enhancing its action pile-supports are employed which, after the separation of the sheet lowermost at the time has started and before the withdrawal proper of said sheet begins, raise the rest of the pile at its forward edge by a certain amount from the removing means, so that the current of compressed air can enter at its full force unimpeded between the pile and the sheet in the act of being removed. The means for introducing the compressed air from the forward side of the pile and the means for raising the forward end of the pile may be arranged separated from one another or however they may be so united that they serve both purposes simultaneously.

In order to be able to introduce simultaneously with the compressed air introduced from

in front between the pile and the sheet in the act of being removed a current of compressed air between the latter and the pile-plate, means, known per se, are employed. For this purpose there is provided in the pile-plate at least one opening, which admits the compressed air and by means of which the compressed air is blown under the pile. In order to distribute this compressed air uniformly under the pile, there are provided in accordance with the present invention in the upper surface of the pile-supporting plate, which surface is in contact with the pile, channels which run in various directions and which are connected with the air supply openings in the pile-supporting plate.

In the accompanying drawings embodiments of devices according to the present invention are represented by way of example.

Fig. 1 is a vertical section through a sheet removing device which serves to remove, without folding, the individual sheets from the bottom of a pile and in the case of which the devices according to the invention are employed.

Fig. 2 is a side elevation of a sheet removing device, shown with one of the side cheeks absent, in combination with a second form of construction of the devices according to the invention.

Fig. 3 is a plan of the device according to Fig. 1.

Variations in the construction and also in the arrangement as a whole and variations in the individual parts are obviously possible without departing from the invention.

The contrivances within the scope of the invention can be employed with any kind of sheet removing devices in which the sheets are removed from the bottom of a pile without being simultaneously folded, and their applicability is in no way limited to the special kind of such sheet removing devices chosen as an example for the purposes of illustration in the drawings. Said kind is constructed as follows:

The pile 1 of sheets rests on the supporting plate 2, which is secured to the side cheeks or walls 3 of the machine. Adjustable pile-stops 4 ensure the correct position of the pile 1. At its front end the pile 1 extends over the supporting plate 2, so that it projects with its front edge a little over the crown of the drawing-in roller or feed roller 5, which is mounted, by means of its shaft 6, in the walls 3 and rotates in the direction indicated by the arrow. It is driven in the ordinary manner from the machine to which it is connected, the means for this purpose not being represented in the drawings. The drawing-in roller 5 is a hollow roller and has in its wall an opening 7 extending in its longitudinal direction. The opening 7 is terminated behind (the direction of rotation of the roller being considered the forward direction) by a suction roller 8 which is so mounted on the ends of the roller 5 that its peripheral surface projects a little beyond the peripheral surface of the roller 5. At the one end of the roller 5 the suction roller 8 carries a small toothed wheel 9, which engages with an internally toothed ring 10 mounted on one of the side walls 3 concentrically with the shaft 6, so that when the drawing-in roller 5 rotates the suction roller 8 revolves continuously in the opposite direction after the manner of a planet gear. Suction openings 11 arranged in a longitudinal row lead from the hollow interior of the suction roller 8 towards its outer surface and distributing or controlling devices for the suction-air, which are well known per se and which are not shown in the drawings, cause an action of the suction roller 8 which serves to separate a sheet from the pile, said action being elucidated below.

In the peripheral surface of the drawing-in roller 5 there is a recess 12, so that only a segmental portion of its peripheral surface and a running ring 14 at each of its ends remain at the level of the full diameter of the roller (see also Fig. 3). A counter-roller 15 is mounted on a pair of levers 16 and is pressed yieldingly against the drawing-in roller 5 by means of the tension springs 17 which engage said levers. The place at which said counter-roller 15 is applied against the drawing-in roller 5 is ensured by means of stops which are not shown in the drawings. Along that edge of the supporting plate 2 which is near the forward free end of the pile 1 there is mounted in said plate a freely running roller 18 of small diameter, which is set in rotation by means of the sheets running out under the pile. By these means the friction, at the fixed edge of the plate 2, arising on the passage of a sheet and the state of electric tension thereby produced in the paper is avoided.

Whereas the parts hitherto described do not belong to the present invention there follows below the exemplification or elucidation of the contrivances within the ambit of the invention.

In the case of the form of construction according to Figs. 1 and 3 the compressed air nozzles 19 are arranged in such a manner fixedly in a transverse bar 20 bolted on the side walls 3 that their ends are situated close in front of the forward end of the pile and are directed towards the supporting plate 2. These compressed air nozzles are connected in the customary way to a compressed air pump not shown in the drawings or to some other source of compressed air. Further, the movable leaf-springs 21 are provided, which serve as supporting tongues or supports for the free end of the pile. They are fastened by means of screws 22 to a common transverse rail 23 which connects together a pair of levers 24, which pair is bolted on the shaft 25 mounted on the side walls 3. The shaft 25 moreover carries the lever 26, with which the connecting rod 27 (shown broken off) engages, which rod is so moved by a cam, not illustrated, arranged on the shaft 28 that on the removal of each sheet there results an oscillatory motion of the pair of levers 24 and of the transverse rail 23 through the instrumentality of the lever 26 and of the shaft 25, the limiting positions of which motion are shown in Fig. 1 by representing these parts by means of full lines and lines composed of dashes. A tension spring 24' engaging the pair of levers 24 holds the roller of the connecting rod 27 permanently against the cam mounted on the shaft 28, which cam, as stated above, is not illustrated. The shaft 28 is driven from the shaft 6 and at the same speed in revolutions as the latter by means of two toothed wheels 6' and 28' mounted on both shafts. Simultaneously with the described motion of the pair of levers 24, which is directed away from and towards the pile 1, there is imparted to the supporting tongues 21 an additional motion, the limiting positions of which are likewise reproduced by means of full lines and of lines composed of dashes, which motion serves to raise the free end of the pile. For this purpose there are fixed on the shaft 29 and under the supporting tongues 21 the levers 30 which are oscillated to and fro in such a man-

ner by means of the cam 31 through the instrumentality of the rod 32 and of the lever 33, to which said rod 32 is articulated and which is fixed on the shaft 29, that they simultaneously raise, during their motion towards and under the pile, the supporting tongues 21 and thereby transfer them into the position represented in full lines, whereby there is effected a yielding raising of the free end of the pile. The tension spring 34 which engages the lever 33 holds the roller 32' of the rod 32 in contact with the cam 31.

Underneath the pile-supporting plate 2 there is arranged an air-chamber 35 with a mouthpiece or union 36 for the supply of compressed air. From this air-chamber 35 passes a series of openings 37 through the supporting plate 2 to the upper surface of the latter, so that the compressed air is introduced into the air chamber 35 and passing through the openings 37 is compelled to flow through under the pile. In order to bring about a distribution of the compressed air under the pile 1 as uniform as possible, there are provided in the upper surface of the supporting plate 2 passages 38 running in various directions or crossing one another, into which the openings 37 of the supporting plate 2 open.

The mode of operation of the device according to Figs. 1 and 3 is as follows:—

In the case of the lowered position of the pile-supporting tongues 21 reproduced in Fig. 1 by lines composed of dashes the pile 1 lies with its free forward lower edge quite close above the segmental part 13 of the roller 5 and only barely on the tongues 21 the free ends of which moreover lie in turned-out channellings 39 (Fig. 3) in the roller segment 13, which are as deep as the deepened portion 12 of the drawing-in roller 5. When, while the free end of the pile is in this position, the peripheral surface of the suction roller 8 arrives in the closest proximity to the pile, its longitudinal row of suction openings 11 is also situated close under the pile and under the action of the suction air distributing or controlling apparatus, which is not illustrated, it sucks at this instant the lowermost sheet of the pile close to its front end and draws it away from the supporting tongues. On the rotation of the drawing-in roller 5 continuing the forward surface of the sheet sucked down then passes, in consequence of the rotation of the suction roller 8 in the opposite direction, through the opening 7 into the hollow interior of the roller 5. The end of the sheet is then peeled off the pile and bent downwards until it is pressed by the edge 7' at the opening 7 in the roller (which is the backward edge) against the roller 15 while simultaneously passing out of the interior of the roller again and is seized in this manner between said roller 15 and the segmental portion 13 of the roller 5. At this instant, at which the withdrawal proper of the sheet under the pile begins, the free end of the pile is raised by means of the pile-supporting tongues 21 and into the space so produced there is simultaneously blown by the nozzle 19 a strong current of air under the action of a distributing or controlling device which is not illustrated, which current raises the pile a little from the sheet w which is being run off.

The amount by which each leaf is at first drawn away from the pile depends on the size of the segment 13 of the roller 5 and the apparatus may be so contrived that the sheets are either drawn away immediately completely from the pile or that they are already between the rollers 5 and 15 formed up in echelons, one above and behind another. In what manner the sheets are conducted further from the rollers 5 and 15 is of no consequence as far as the present invention is concerned and the means for this purpose are consequently not shown in the drawings.

In the case of the manipulation of ordinary smooth papers there suffices for the purpose of removing the sheets in a perfectly satisfactory manner the current of compressed air introduced between the sheet in the act of being withdrawn and the pile even when this current is not completely able to do away with the friction between the two but on the other hand it alone may not be sufficient under some circumstances in the case of rough papers, for example, in the case of stamped or hammered papers, to guarantee removal with certainty from the pile. In such cases the additional introduction of compressed air under the pile becomes necessary and this is brought about by connecting a compressed air pipe to the inlet union 36, through which the compressed air passes via the chamber 35 through the openings 37 and the channels 38 of the supporting plate 2 to the under surface of the pile. There is thus formed at each side of the sheet in the act of being removed an air-cushion, by means of which the friction between the sheet and the rest of the pile on the one hand and the supporting plate 2 on the other hand, if not perfectly done away with, is at all events reduced to such an extent that a perfectly satisfactory removal of the sheet is effected even in the case of papers which are difficult to manipulate.

The mode of operation of the form of construction according to Fig. 2 is the same as that according to Fig. 1. In its construction it is differentiated from the latter by the compressed air nozzles 19, not being fixed but movable in such a manner that they simultaneously act as pile-supporting tongues and so dispense with the necessity of providing special supporting tongues. For this purpose they are fastened in the transverse bar 40, which is revoluble in the pair of levers 42 bolted on the shaft 41. Further, on the shaft 41 there is arranged the lever 43 with which the push-rod 44 engages, which is so moved by a cam (not shown) mounted on the shaft 28 that on each removal of a sheet a movement of the compressed air nozzles 19' takes place towards and away from the pile 1. The tension spring 45 holds the roller of the push-rod 44 in contact with its co-operating cam, which is not illustrated. Simultaneously with their movement to the pile the compressed air nozzles 19' together with the pile end resting on them are raised by means of the lever 30 fixed on the shaft 29. The motion of the lever 30 is effected in the same manner as that described above with reference to Fig. 1. In this manner there is brought about the motion of the compressed air nozzle 19' represented as regards the limiting positions by the lines formed of dashes and by the full lines in Fig. 2. The position of the compressed air nozzles 19' at the commencement of their movement directed towards the pile and upwards is such that the forward edge of the pile barely rests on them, as is also the case as regards the pile-supporting tongues shown in Fig. 1. The sheet of the pile which is lowermost at the time can consequently in this case also readily be withdrawn from the nozzles 19' under the action of the suction roller 8. In this case also the current of compressed air begins to pass out of the nozzles at the instant at which the sheet in the act of be-

ing removed is seized forcibly between the roller 5 and its counter-roller 15, and at which its withdrawal proper from the pile 1 begins.

What we claim is:

1. In a sheet feeding device, the combination with means for separating and withdrawing from a pile of sheets the sheet lowermost at the time without simultaneously folding it, of means for directing a current of compressed air between the lowermost sheet in the act of being withdrawn and the rest of the pile above it and lifting the latter off said lowermost sheet.

2. In a sheet feeding device, the combination with means for separating and withdrawing from a pile of sheets the sheet lowermost at the time without simultaneously folding it, of means for directing a current of compressed air towards the front of the pile and between the lowermost sheet in the act of being withdrawn and the rest of the pile above it and lifting the latter off said lowermost sheet.

3. In a sheet feeding device, the combination with means for separating and withdrawing from a pile of sheets the sheet lowermost at the time without simultaneously folding it, of a plurality of nozzles arranged in front of the pile for directing a current of compressed air towards the front of the pile and between the lowermost sheet in the act of being withdrawn and the rest of the pile lying above it and lifting the latter off said lowermost sheet.

4. In a sheet feeding device, the combination with a plate for supporting a pile of sheets, of means for separating and withdrawing from said pile of sheets the sheet lowermost at the time without simultaneously folding it, means for directing a current of compressed air between the lowermost sheet in the act of being withdrawn and the rest of the pile above it and lifting the latter off said lowermost sheet and means for introducing simultaneously with said current, a current of compressed air between said sheet and the pile-supporting plate.

5. In a sheet feeding device, the combination with a plate for supporting a pile of sheets, of means for separating and withdrawing from said pile of sheets the sheet lowermost at the time without simultaneously folding it, means for directing a current of compressed air towards the front of the pile and between the lowermost sheet in the act of being withdrawn and the rest of the pile above it and lifting the latter off said lowermost sheet and means for introducing simultaneously with said current, a current of compressed air between said sheet and the pile-supporting plate.

6. In a sheet feeding device, the combination with a plate for supporting a pile of sheets, of means for separating and withdrawing from said pile of sheets the sheet lowermost at the time without simultaneously folding it, a plurality of nozzles arranged in front of the pile for directing a current of compressed air towards the front of the pile and between the lowermost sheet in the act of being withdrawn and the rest of the pile above it and lifting the latter off said lowermost sheet and means for introducing simultaneously with said current, a current of compressed air between said sheet and the pile-supporting plate.

7. In a sheet feeding device, the combination with a plate for supporting on its upper surface a pile of sheets, said plate having an opening passing through it and a plurality of channels on said upper surface running in various directions and communicating with said opening, of means for separating and withdrawing from said pile of sheets the sheet lowermost at the time without simultaneously folding it, means for directing a current of compressed air between the lowermost sheet in the act of being withdrawn and the rest of the pile above it and lifting the latter off said lowermost sheet and means for introducing simultaneously with said current, a current of compressed air through said opening in said pile-supporting plate.

8. In a sheet feeding device, the combination with a plate for supporting on its upper surface a pile of sheets, said plate having an opening passing through it and a plurality of channels on said upper surface running in various directions and communicating with said opening, of means for separating and withdrawing from said pile of sheets the sheet lowermost at the time without simultaneously folding it, means for directing a current of compressed air towards the front of the pile and between the lowermost sheet in the act of being withdrawn and the rest of the pile above it and lifting the latter off said lowermost sheet and means for introducing simultaneously with said current, a current of compressed air through said opening in said pile-supporting plate.

9. In a sheet feeding device, the combination with means for separating and withdrawing from a pile of sheets the sheet lowermost at the time without simultaneously folding it, of means for raising, after the separation from the pile of the sheet lowermost at the time has started the rest of the pile at its forward edge, and separate means for directing a current of compressed air towards the front of the pile and between the lowermost sheet of the pile in the act of being withdrawn and the rest of the pile above it and lifting the latter off said lowermost sheet.

10. In a sheet feeding device, the combination with means for separating and withdrawing from a pile of sheets the sheet lowermost at the time without simultaneously folding it, of means for raising, after the separation from the pile of the sheet lowermost at the time has started, the rest of the pile at its forward edge, said raising means themselves being adapted to direct a current of compressed air towards the front of the pile and between the lowermost sheet of the pile in the act of being withdrawn and the rest of the pile above it and lifting the latter off said lowermost sheet.

11. In a sheet feeding device, the combination with means for separating and withdrawing from a pile of sheets the sheet lowermost at the time without simultaneously folding it, of resilient means for raising, after the separation from the pile of the sheet lowermost at the time has started, the rest of the pile at its forward edge, and separate means for directing a current of compressed air towards the front of the pile and between the lowermost sheet of the pile in the act of being withdrawn and the rest of the pile above it and lifting the latter off said lowermost sheet.

12. In a sheet feeding device, the combination with means for separting and withdrawing from a pile of sheets the sheet lowermost at the time without simultaneously folding it, of a plurality of resilient movable pile-supporting tongues for raising, after the separation from the pile of the sheet lowermost at the time has started, the rest of the pile at its forward edge, and separate means for directing a current of compressed air towards the front of the pile and between the lowermost sheet of the pile in the act of being

withdrawn and the rest of the pile above it and lifting the latter off said lowermost sheet.

13. In a sheet feeding device, the combination with means for separating and withdrawing from a pile of sheets the sheet lowermost at the time without simultaneously folding it, of a plurality of movable pile-supporting nozzles for raising, after the separation from the pile of the sheet lowermost at the time has started, the rest of the pile at its forward edge and for directing a current of compressed air between the lowermost sheet and the rest of the pile at its forward edge and lifting the rest of the pile off said lowermost sheet.

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