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METHOD AND APPARATUS FOR WITHDRAWING LOWEST SHEETS

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Fig. 2

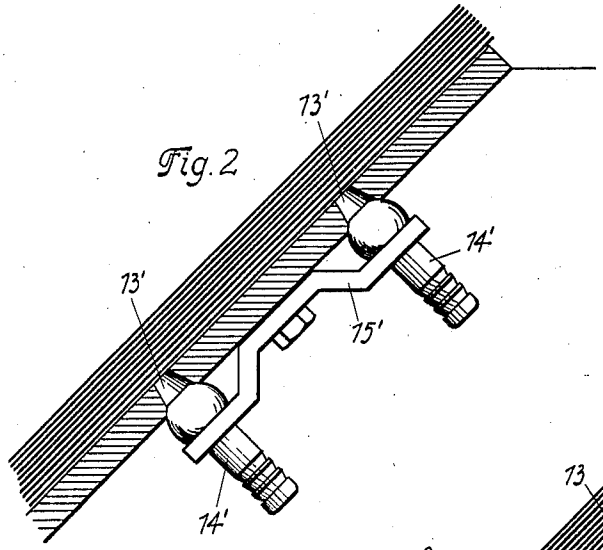
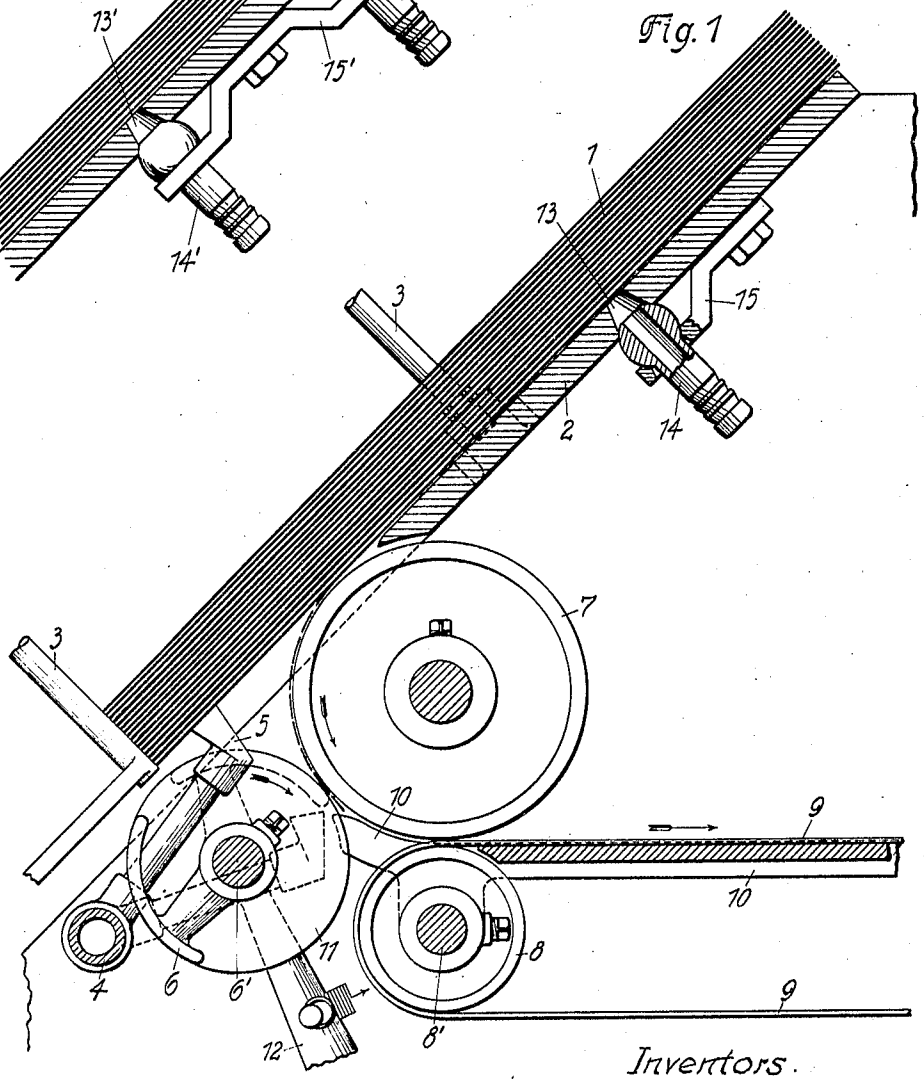


Fig. 1



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METHOD AND APPARATUS FOR WITHDRAWING LOWEST SHEETS

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9 Claims. (Cl. 271—29)

This invention relates to a method of and apparatus for facilitating the withdrawal of the lowest sheet or sheets from a stack of folded or unfolded sheets or leaves or the like.

The withdrawal of the lowest sheet or piece from a stack of folded or unfolded sheets or leaves or the like such as is employed with many different kinds of machines possesses considerable advantages over the withdrawal of the topmost piece. The most important advantages are that the stack can be replenished without any interruption in the operating process, and that the stack does not need to be continually adjusted in position as regards height as the withdrawal of the sheets proceeds, in order to ensure that the withdrawing implements operate effectively. On the other hand, when the lowest sheet is withdrawn from a stack, the weight of the entire stack which bears on this sheet acts in a disadvantageous manner owing to the high friction which is encountered during the withdrawal of a sheet from between the stack and the plate which carries the stack. This friction often results in the simultaneous withdrawal of a second sheet or of several sheets whereby trouble is caused and when the sheets are fed together to the machine in which they are subjected to further treatment, the percentage of rejects becomes high. The inclined arrangement of the stack which is frequently employed in order to reduce the pressure of a stack on the lowest sheet lessens this disadvantage but cannot entirely eliminate it.

The subject matter of the present invention is a method of and apparatus for withdrawing, or facilitating the withdrawal of, the lowest sheet of a stack of sheets or leaves whereby the friction between this and the stack lying above it as well as between it and the stack plate is reduced to such an extent that the withdrawal of the sheet can be effected with ease and without the aforesaid disadvantages. The method is characterized by blowing in compressed air at one or more places beneath the stack in such a manner that the compressed air is compelled to sweep between the stack and the plate which carries it and to escape therefrom. By this means there is formed between the lowest piece in the stack and the stack plate a thin cushion of air which eliminates the friction between the lowest sheet and the stack plate which otherwise occurs during the withdrawal of this sheet. Further the compressed air which spreads out and sweeps between the stack and the stack plate has the effect of causing the lowest sheet to vibrate in undulatory movements, of the kind which can be observed when air is blown under a sheet of paper, and which effect a release of the lowest sheet from the sheet above it.

The method in accordance with the invention is entirely independent of the means employed for initiating the separation of the lowest sheet of the stack and for withdrawing it from under the stack, it may indeed be employed with any suitable or well known type of apparatus which can be used for this purpose and both with ordinary feeding apparatus, in which the sheet is withdrawn from the stack in its full size without being simultaneously folded once, as well as with those apparatus which are known as roller or fold feeding apparatus which, simultaneously with the withdrawal of the sheet from the stack, effect a single folding of the sheet.

In connection with the last-mentioned type of apparatus it must be mentioned that with these it is already known to blow compressed air into the space which is enclosed, above the line of contact of the two rollers which effect the withdrawal of the sheet and its folding, between these rollers and the lowest sheet of the stack. This feature however is not equivalent to that by which the method of the present invention is characterized because in the former case the object of blowing in the compressed air is only to separate the sheets when several stick together and are gripped simultaneously and to hold back those lying above the lowest sheet. At the same time in that case the compressed air assists the entry of the bulge in the sheet formed by the two feed rollers between these rollers for the purpose of converting the bulged portion into a fold. A reduction of the friction between the lowest sheet and the rest of the stack and the stack plate, which occurs when the lowest sheet is withdrawn, cannot be effected by means of this known apparatus.

Referring to the drawing Fig. 1 shows, by way of example, a vertical longitudinal section of a constructional embodiment of an apparatus for carrying out the method in accordance with this invention, and Fig. 2 is a sectional detail view showing modified means for the application of air pressure.

In the example illustrated at Fig. 1 it is assumed that the feeding apparatus is of the type in which the lowest sheet of the stack 1 is withdrawn in its full size, i. e., unfolded, from the stack. The stack 1 rests with the greater part of its surface on the inclined stack plate 2 and is held on its correct position by the stops 3. Below the part of the stack which projects beyond

the stack plate 2 there is arranged the apparatus which initiates the separation of the lowest sheet from the stack and effects its complete withdrawal from under the stack. It consists, in the example which has been selected for purposes of illustration, of one or more suction devices 5 which can swing about the hollow suction shaft 4 and which initiate the separation of the sheet from the stack by gripping the sheet in the neighborhood of its front edge when they are in their highest position which is shown in full lines in the drawing and bending it down so far that it can be seized by the roller segments 6 which rotate in the direction indicated by the arrow and place the sheet in contact with the counterroller 7 as indicated by the dotted line *w*. The sheet is then positively gripped between the roller segment 6 and the counterroller 7 and withdrawn from under the stack by a pre-determined amount which is so great that the front edge of the sheet arrives between the roller 7 and the band 9 which passes round the roller 8 which then effect the complete withdrawal of the sheet from the stack and simultaneously convey the sheet away for further treatment. The guides 10 conduct the sheet after it emerges from the segments 6 and the roller 7 between the latter and the band 9 which co-acts therewith. To the shaft 6' of the roller segments 6 there are fixed running rings 11 which run on the roller 7 and thereby secure the segment 6 in position relatively to the roller 7. The shaft 6' is journalled in levers 12 which are acted upon by tension springs so that the running rings 11 are permanently pressed against the roller 7 while, when a sheet is gripped between the segments 6 and the roller 7, the former can spring back to a slight extent corresponding to the thickness of the paper at the time. The shaft 8' of the band roller 8 can also be resiliently journalled in levers so that the band 9 is also permanently pressed against the roller 7. This is however not illustrated in the drawing.

The foregoing description is given solely for the purpose of enabling the method of operation of the apparatus illustrated in the drawing to be understood and is of no importance in so far as the actual invention is concerned. The separation of the lowest sheet from the stack and its withdrawal from under the stack can be effected by any other suitable form of apparatus without affecting the present invention in any way. For the purpose of carrying into effect the method in accordance with the invention there may be employed the apparatus which is hereinafter described and illustrated by way of example in the drawing.

In the stack plate 2 there is provided an opening 13 through which compressed air is blown under the stack. The supply of compressed air to the openings 13 may be effected through a simple fixed connecting piece to which the compressed air piping, which is in connection with the blower, is joined. In the example illustrated in the drawing instead of a fixed connecting piece there is provided an adjustable nozzle portion 14 one end of which is in the shape of a ball which is ground into the edge of the conically formed opening 13 and is pressed against this edge of the opening by means of a flat iron bracket 15 which is passed over the nozzle portion 14 and fixed to the stack plate 2. To the free end of the nozzle portion 14 there is joined a compressed air pipe which is in connection with a blower or pump. By means of the apparatus illustrated in the drawing it is possible to adjust the nozzle portion 14, in so far as this may be necessary, in various angular positions to the stack plate 2 and thereby direct the current of compressed air in any desired direction. The compressed air which arrives under the stack through the opening 13 is compelled to distribute itself under the stack and, spreading out under its entire surface, to emerge again at the edges of the stack. The stack consequently no longer rests directly on the stack plate 2 but on the layer of compressed air thus formed over the stack plate and on the withdrawal of the lowest sheet, if the pressure of the air be regulated to be sufficiently high corresponding to the weight of the stack, the friction against the stack plate is entirely obviated. At the same time the current of air spreading out below the lowest sheet of the stack imparts an undulatory vibratory movement to the lowest sheet and in part also to the sheets above it whereby the release of the sheets from one another is assisted. In this way the lowest sheet can be withdrawn from under the stack without trouble even if the stack be very high.

Fig. 2 shows a modified arrangement in which a pair of nozzle portions 14' similar to the portion 14 are secured to the stack plate by means of a bracket 15' so that compressed air is applied to the stack through two separate openings 13'.

What we claim is:

1. A method of withdrawing the lowest piece from contact with the piece adjacent thereto in a stack of folded or unfolded sheets or pieces which comprises introducing compressed air between the lowermost piece and the stack supporting plate at a pressure sufficient to cause the lowermost piece to vibrate or flutter.

2. A method of withdrawing the lowest piece from a stack of folded or unfolded sheets or pieces which comprises supplying compressed air to the stack at a pressure sufficient to support the weight thereof and to cause vibration of the lowest piece.

3. A method of withdrawing the lowest piece from a stack of folded or unfolded sheets or pieces which comprises introducing compressed air through the stack supporting plate to spread outwardly at a high velocity and support the weight of the stack by forming an air layer between said plate and the lowest sheet and vibrating said sheet by said high velocity.

4. A method of withdrawing the lowest piece from a stack of folded or unfolded sheets or pieces which comprises admitting compressed air to the stack at a velocity sufficient to vibrate the lowest piece between the next piece and the stack supporting plate and to support the weight of the stack and to reduce the friction between the upper and lower faces of the lowest piece and the stack and supporting plate respectively, to permit easy withdrawal of the vibrating piece from between the next piece and said plate.

5. Apparatus for withdrawing the lowest piece from a stack of folded or unfolded sheets or pieces which comprises a stack supporting plate, means for the admission of compressed air between the stack and the plate at a velocity sufficient to vibrate the lowest piece in the stack and to form a stack supporting air layer upon the plate, and means for withdrawing the lowest piece from between the next piece and the plate.

6. Apparatus for withdrawing the lowest piece from a stack of folded or unfolded sheets or

pieces which comprises a stack plate, an air opening in the plate, an attachment for the supply of compressed air to said opening at a pressure and velocity sufficient to vibrate the lowest piece, and means for withdrawing the lowest piece from between the next piece and the plate.

7. Apparatus for withdrawing the lowest piece from a stack of folded or unfolded sheets or pieces which comprises a stack plate, an opening for the passage of air through said plate, an adjustable attachment for directing compressed air through said opening in angular relation to the stack, and means for withdrawing the lowest piece from between the next piece and the plate.

8. Apparatus for withdrawing the lowest piece from a stack of folded or unfolded sheets or pieces which comprises a stack plate, openings for the passage of air through the plate, a plurality of nozzles attached to the underside of the plate for supplying compressed air to said openings at a velocity high enough to cause fluttering of the lowermost piece, and means for withdrawing the said piece.

9. Apparatus for withdrawing the lowest piece from a stack of folded or unfolded sheets or pieces which comprises a stack plate, an air opening therein, a nozzle for the supply of compressed air, a ball-and-socket joint between the said opening and nozzle, and means for withdrawing the lowest piece from between the next piece and the plate.

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