Aug. 30, 1932. A. WINKLER ET AL 1,875,189

PROCESS AND APPARATUS FOR THE SEPARATION OF FOLDED OR INDIVIDUAL SHEETS

Filed Dec. 24, 1930 2 Sheets-Sheet 1

Fig. 1

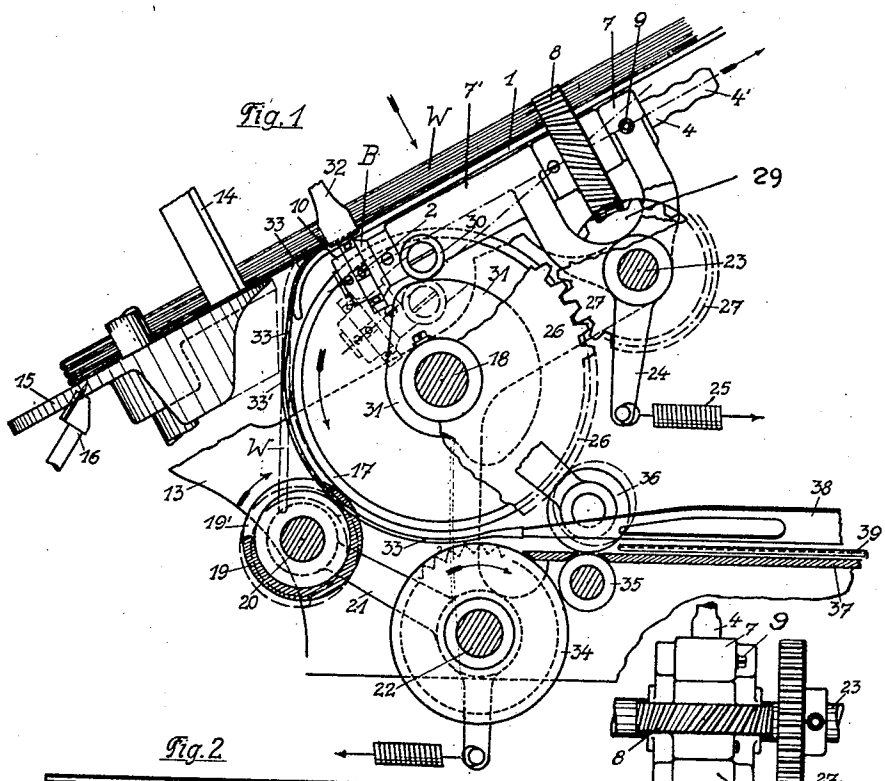
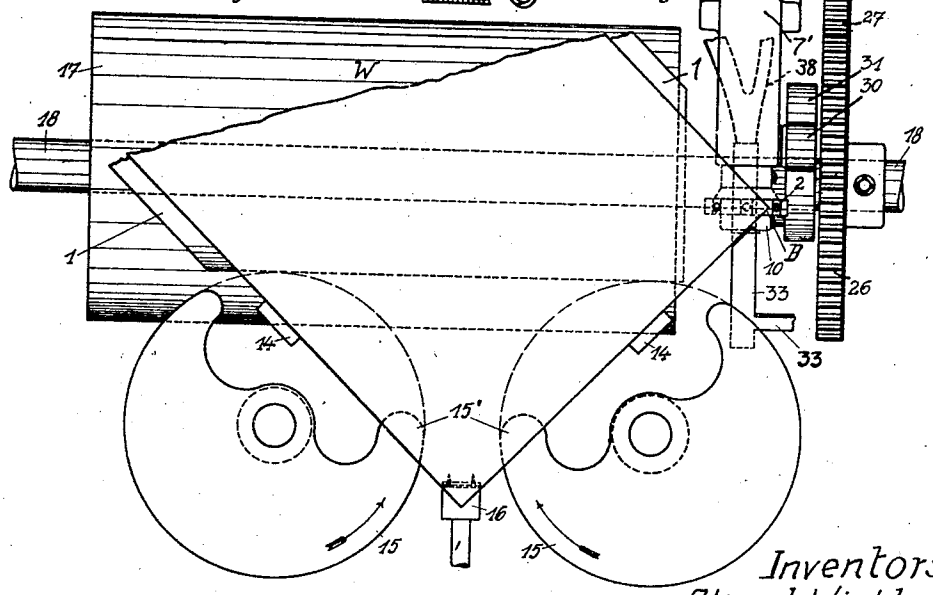


Fig. 2



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Fig. 3

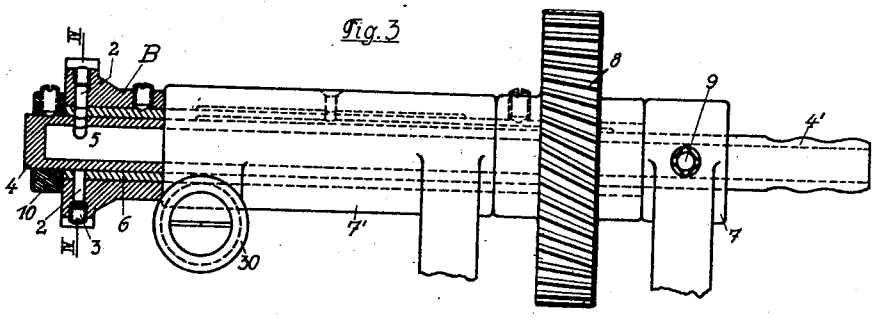


Fig. 4

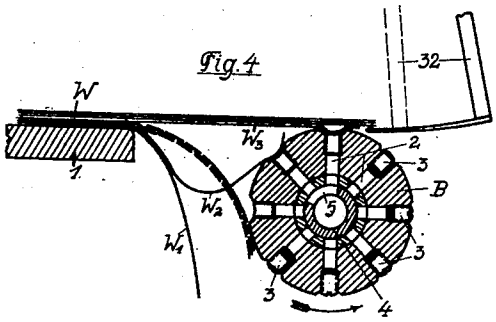


Fig. 5

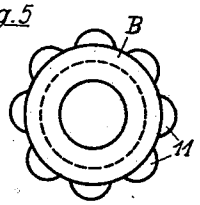


Fig. 6

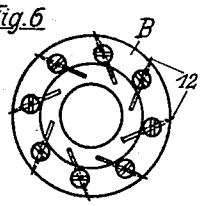


Fig. 7

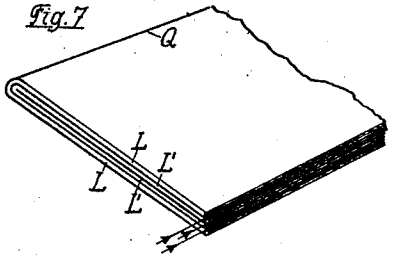
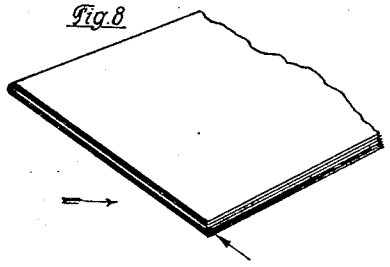


Fig. 8



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UNITED STATES PATENT OFFICE

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PROCESS AND APPARATUS FOR THE SEPARATION OF FOLDED OR INDIVIDUAL SHEETS

Application filed December 24, 1930, Serial No. 504,530, and in Germany June 6, 1929.

This invention relates to a process and apparatus for the separation of folded or individual sheets and relates more particularly to the handling of groups of folded sheets arranged within each other and to the accurate separation of such sheets to permit the introduction of other sheets or groups, to the removal of sheets or groups of sheets from their stacks and the insertion of the sheets of newspapers or periodicals into each other in the assembling of individual parts to form books and the like.

The apparatus may be embodied in a newspaper inserting machine and is particularly adapted for use in the assembling of singly or doubly folded sheets which can not easily be opened at their exact centers or other definitely predetermined place for the introduction of other parts by the employment of the usual suction devices which engage the sheets simultaneously from above and below.

When it is necessary to open a group of sheets at the exact center thereof or at another predetermined place in order to permit of the introduction of an additional sheet or sheets, trouble has heretofore been experienced when effecting the operation by hand and also when attempts were made to employ mechanical means for this purpose.

One object of the present invention is to provide a method according to which the desired number of sheet corners are moved away from the remaining corners by bending until the group of sheets is opened at the center or at the desired place.

A further object of this invention is to provide apparatus comprising a rotary sheet turner having means whereby it engages and moves the desired number of sheet corners successively and thus opens the group of sheets at the desired place and a still further object is to provide the sheet turner with suction, cam or needle means capable of adjustment or variation to suit the number of sheets requiring manipulation in order to open the group at the desired place.

With these and other objects in view the invention consists in the method and apparatus hereinafter described with reference to the accompanying drawings and particularly pointed out in the appended claims, it being understood that various changes in the form and arrangement may be made without departing from the spirit of the invention or sacrificing any of the advantages thereof.

In the drawings:

Fig. 1 shows part of a newspaper inserting machine, partly in side view and partly in section, Fig. 2 is a view of part of the above apparatus looking in the direction of the arrow in Fig. 1; Fig. 3 is a view partly in longitudinal section showing the sheet turner; Fig. 4 is a cross section through the line IV—IV of Fig. 3; Figs. 5 and 6 are front views showing two modified forms of the sheet-turner; Fig. 7 shows one example of the work, consisting of two double folded parts inserted one within the other; Fig. 8 shows another example of the work, consisting of four sheets folded once and inserted into each other.

In Figs. 7 and 8 two different forms of work pieces are shown; Fig. 7 showing a form which is customary with ordinary daily newspapers where two doubly folded parts are assembled one within the other. The parallel longitudinal folds of both parts are designated by L and L′ and the cross fold by Q. If another work piece is to be inserted, it is usually a matter of indifference at which of the three places (designated by three arrows) this insertion takes place. In this case it is possible therefore to use the heretofore customary suction devices applied from above or from below at that corner of the work which in the drawing is located at the bottom, because an opening or separation at one of the three points indicated by the arrows is bound to result.

In Fig. 8, however, there is shown a work piece consisting of four sheets each folded only once and inserted into each other, i. e., a sixteen-page work piece whose page numbers for example may run from 1 to 8 and from 17 to 24 and to which there must be inserted an additional part with the missing page numbers 9 to 16 and consisting of two sheets folded singly and inserted into each other.

In this case the insertion must take place exactly in the center at the point indicated by

the right hand arrow if the proper arrangement of the page numbers and the proper composition sequence is to be obtained. This opening in the center cannot be effected by ordinary suction devices acting simultaneously from above and below, because in that case it would be left to chance how many sheets the suction device would move.

By the process according to the present invention the opening of such work pieces in their center is effected in a positive manner. Referring to Fig. 4 the work-piece W corresponds to the lower part of Fig. 8 as seen in the direction of the left-hand arrow, and consists of three sheets singly folded and inserted into each other, and supported upon a plate 1. The sheet separator or turner B is provided with suction channels 2 and revolves in the direction of the arrow while bearing with its circumference against the lower side of the work piece W. In the example shown (where three sheets are singly folded and inserted into each other) it is necessary that the sheet turner B bends off three individual corners so that the sheets are separated at the center. Consequently, of the eight suction channels 2 provided in all in the sheet turner B, five are plugged or closed by means of screws 3. Of the three suction channels which remain open (and which in the drawings lie horizontally towards the left, at 45 degrees to the left upwards and vertically upwards,) the last one as regards the direction of the rotation of the sheet turner, i. e. the one pointing vertically upward, is just beginning to function. The sheet corner W_1 originally located at the bottom was moved by the suction opening 2 pointing horizontally towards the left, the following sheet corner W_2 was seized by the suction opening pointing at 45 degrees upward to the left and is still in the bulged condition, while the third sheet corner W_3 is still at the under side of the work piece and has just been seized by the suction opening 2 pointing vertically upward. When the sheet turner B has turned in the direction of the arrow, through 135 degrees from the position shown on the drawings, the bent-down sheet corners W_1, W_2, W_3, occupy the position shown in dotted lines. It can also be seen that the suction opening 2 directed at 45 degrees upward to the right, during the further rotation of the sheet turner B from the position shown, comes into contact with the sheet corner which lies above W_3, on which however it has no effect because it is closed by a screw 3; the same being also the case with the four ensuing suction openings.

From the above it will be seen how in the first place this process starts the opening of the work piece at one of its loosely lying corners in such manner that, at this point, space is provided for the entrance of a member which effects the further opening. The proper beginning and cessation of the suction effect is ensured by the arrangement of the sheet turner B together with a sleeve 6 enclosing and turning about a hollow shaft 4, to one of whose ends 4′ the suction line of a rotary air pump is connected. Near the inner end of the bore hole of the shaft 4 a slot 5 extends over a part of the circumference and coincides with the suction channels 2 in the sheet turner 8 and in the sleeve 6 carrying it, so that the suction effect begins as soon as one of the unclosed suction channels 2 registers with the slot 5 of the shaft 4 (Fig. 4). In the arm 7′ of a double forked bearing body (Fig. 3) rotates the sleeve 6 which at its free end carries the sheet turner B, and between the two bearing arms 7 and 7′ is mounted a spiral gear 8 for the drive which will be hereinafter described. The sleeve 6 only reaches as far as the inner front surface of the bearing arm 7, but does not extend through the latter; but the hollow shaft 4 extends through said arm 7 and is secured therein by means of a set screw 9. By adjusting the shaft 4 in the bearing arm 7 the beginning of the suction effect can thus be regulated. In order to prevent longitudinal displacement of the shaft 4 when loosening the set screw 9, a collar 10 is provided thereon at its closed end projecting beyond the sheet turner B.

The seizure of the individual sheet corners, instead of being effected by suction may be effected by other means. Fig. 5 shows a sheet turner equipped with eight removable rubber cams or protuberances 11 of which at any time there may be attached to it only as many as there are sheet corners to be bulged and bent. Fig. 6 shows another form of sheet turner which carries eight needles 12 which are removable or adjustable and may be caused to project slightly beyond the circumference and may thus serve to seize, bulge and bend the sheet corners. Here, too, the number of the needles inserted is chosen according to the number of sheet corners to be bent. The needles 12 may be controlled during the rotation of the sheet turner so that after the sheet corner is bent they will occupy a position which is advantageous for their disengagement from the paper.

The total number of the suction channels 2, of the rubber cams 11 and the needles 12 which are arranged on the sheet turner, may be chosen at will, and care must be taken to have the sheet turner revolve in proper timed relation to the machine to make a full number of revolutions for each work operation, as is hereinafter more fully explained.

In Figs. 1 and 2 the drawing-in device of a newspaper inserting machine is shown in its essential parts with a sheet turner according to this invention cooperating therewith. For a clearer understanding of the operation these Figs. illustrate the means for separating the lowermost work piece and withdrawing

same from the stack although this forms no part of the present invention.

On the inclined stack plate 1 carried by the side cheeks 13 of the machine rests the stack comprising the superimposed work pieces, the lowermost of which is to be pulled into the machine and there opened at its center so that an additional part can be introduced. The stop pieces 14 engage the edges of the work pieces on the plate 1 and thus support the stack thereon. The lower corners of the work pieces Figs. 1 and 2 correspond to the left hand corners Figs. 7 and 8 which may be termed closed corners so that open corners are located at the right hand side (Fig. 2) of the plate 1 for cooperation with the sheet turner. The lower closed corners of the work pieces project beyond the bent front edge of the plate 1 and are supported by two pulling-in bells 15 revolving towards each other in the direction indicated by the arrows at Fig. 2. Between the said bells 15 under the closed corners of the work pieces a needle device 16 is provided whose needles during their properly controlled upward movement penetrate intermittently into the lowermost work piece and bulge it up in such manner under the work piece above it, near the closed corner, that the tongues 15′ of the bells 15 may penetrate into the intermediate space thus created. During the further rotation of the bells 15 the work piece is bent down in the well known manner and is caused to bear against the circumference of a drum 17, which with its shaft 18 turns in the side cheeks 13 in proper timed relation to the apparatus. This vertically downward position of the bent-off closed corner is indicated by dotted lines in Fig. 1. In this position the closed corner reaches into the recess 19′ of a roller 19 whose shaft 20 is supported by spring actuated levers 21 swinging on a shaft 22. During the further rotation of the roller 19 the closed corner is then seized by the rear edge of the recess 19′, so that the said corner is brought between the drum 17 and the roller 19 and the work is now forcibly pulled out from beneath the stack.

The closed corner of the work piece leading in this manner (and lying, in Fig. 2, at the bottom and in Figs. 7 and 8 at the left,) now passes by suitably arranged guides, not shown, over two roller parts 34 mounted on the shaft 22 at a slight distance from each other and provided at their front surface edges facing each other with teeth for facilitating the seizure of the said leading corner, and from thence the corners pass between roller parts 35 and 36 which feed the work pieces forward and finally deposit the same on the machine table 37. With ordinary dailies, i. e. with work such as is shown for example in Fig. 7, the opening now takes place at the corner lying at the bottom in this figure which corresponds to the right hand corner in Fig. 2, by means of two suction devices not shown which are arranged near the point of discharge of this corner from the drum 17 and the roller parts 34. Between the corners removed from each other by the suction devices there then enters immediately during the further movement of the work piece the point of the splitting rail 38 arranged at a suitable distance above the machine table 37, which rail is so constructed and arranged that on account of its width and height increasing towards the rear it completes the opening of the work piece to an extent sufficient for the introduction of the drive-in knife 39 indicated in Fig. 1 without or with another work piece carried thereby.

As already explained above, the opening of work pieces according to Figs. 7 and 8 cannot be effected at the center or other exactly predetermined place by ordinary suction devices, and the sheet turner B is therefore employed. Before the commencement of the pulling out of the lowermost work piece from beneath the stack the sheet turner B is located beneath the work piece corner to the right in Fig. 2 which corner is lowermost at Fig. 8. In Fig. 4 this corner of the lowermost work piece is seen in the direction of the left-hand arrow of Fig. 8. The doubly forked bearing body 7, 7′ of the sheet turner B swings on the shaft 23 Figs. 1 and 2 supported by the side cheeks 13 and has an arm 24 actuated by a tension spring 25. The operation of the sheet turner B is effected in the following manner.

On the shaft 18 of the drum 17 is a spur gear 26 which engages a spur gear 27 of half its size secured to the shaft 23. On this shaft 23, in the lower fork of the bearing body 7, 7′ is also secured a spiral gear 29 which drives the spiral gear 8 secured on the sleeve 6 carrying the sheet turner B. It will thus be seen that the shaft 23 and the sheet turner B, in the example chosen, make two revolutions for every work-piece operation and for every revolution of the drum 17. During every second revolution of the sheet turner B a definite number of sheet corners is bent down in the manner described.

As soon as this bending down of the sheet corners and consequently the opening of the work corner has taken place, the sheet turner B, swinging around the shaft 23, moves downward into the position indicated by dotted lines at Fig. 1, and consequently its open suction channels remain without effect during one revolution of the sheet turner for every work-piece operation. For the purpose of swinging down the sheet turner B, a roller 30 is mounted upon its bearing arm 7′, and is kept by the action of the said spring 25, in engagement with a cam 31 secured on the shaft 18 of the drum 17.

Simultaneously with the commencement of the downward movement of the sheet turner

B, the tongue 32 shown at Figs. 1 and 4 swings in under the stack corner and thus separates from the rest the bent-off sheet corners, during the lowering of the sheet turner B. In order to retain this central splitting or separation at the corner, during the pulling out of the lowest work piece from beneath the stack there is provided a curved guide 33 following the path of the corner during the extraction, which guide 33 adjoins the tongue 32 in the swung-in position of the latter, so that the opened corner moves with one half above and one below it. By means of an arm 33′ or in some other suitable manner the curved guide 33 is mounted on the machine frame. At its lower end the guide 33 is so connected with the splitting rail 38 that the latter forms a continuation thereof. In this manner, during the entire length of the extraction of a work piece from beneath the stack the tongue 32 and the guide 33 are located in the first place between the two halves of the opened corner of the work piece and during the further conveyance of the work piece over the machine table 37, the splitting rail 38 then enters into the opening thus created, completing in the manner already described the opening of the work piece for the entrance of the drive-in knife 39, (Fig. 1).

The intermittent swinging inwardly and outwardly of the tongue 32 can be effected in any desired manner and as the means for effecting this movement is well known in the art they are not shown in the drawings.

The same process and the device of this invention may be used for the central separating or splitting of several sheets singly folded and inserted into each other, and it is of course also possible to open an individual sheet singly folded. The invention is not limited to the handling of sheets singly folded or folded and inserted into each other, but may be used to open exactly in the center sheets doubly folded and inserted into each other if the pulling-in device is properly arranged in the stack. It will be understood that work pieces as shown at Fig. 7 can either be laid in the stack in such a way that the sheet turner operates at the corner lying at the bottom in Fig. 7 provided, of course, the individual layers inserted into each other are sufficiently flexible to permit of the proper bulging and bending; otherwise the sheet turner may be caused to operate at the corner which would be on the right-hand side in Fig. 7 if this figure had not been broken away; this corner being made up at all times of individual sheet layers and it being therefore suitable for the operation in question.

The process according to this invention can also be used for taking a definite number of individual unfolded sheets from a stack containing the same, if, for example, instead of the needle apparatus 16 in Figs. 1 and 2, a sheet turner according to this invention be utilized; in which case the sheet turner would then be eliminated at the stack corner on the right-hand side in Fig. 2.

Finally the process according to this invention can also be used in cases where it is desired to separate from the upper side of a stack a definite number of parts or sheets.

Although the drawings and the above specification disclose the best mode in which we have contemplated embodying our invention, we desire to be in no way limited to the details of such disclosure for in the further practical application of our invention, many changes in the form and construction may be made as circumstances require or experience suggests without departing from the spirit of the invention within the scope of the appended claims.

What we claim is:

1. A method for the separation of folded or individual sheets in a stack which comprises successively bulging and bending a plurality of said sheets to form an opening at the desired place between a group of sheets and the stack and subsequently removing the group of sheets from the stack while maintaining said opening therein.

2. Apparatus for the separation of folded or individual sheets in a stack comprising a variable device located at one corner of the stack for successively bending a variable number of sheets away from the stack and means to be inserted between the bent sheets and the stack to continue the separation.

3. Apparatus for the separation of folded or individual sheets in a stack comprising a rotary device located beneath one corner of the stack for successively bending down a variable number of sheet corners away from the stack, and an independent member for insertion between the bent sheets and the stack to preserve the separation.

4. Apparatus for the separation of folded or individual sheets comprising a rotary device located at one corner of the stack, a plurality of individually controllable members mounted on said device for successively engaging a predetermined number of sheets to first bulge and then separate a number of sheets from the remaining sheets.

5. Apparatus for the separation of folded or individual sheets in a stack, comprising a rotary member located beneath one corner of the stack, a group of members carried on said device for successively engaging a predetermined number of sheets to bend the corners of said sheets to form a group away from the remaining sheets in the stack.

6. Apparatus for the separation of folded or individual sheets in a stack comprising a rotary member located at one corner of the stack, a series of means on said member for engaging, bulging and bending a series of sheets successively from the remaining sheets

n the stack, and means for moving the rotary member into and out of the operative position.

7. Apparatus for the separation of folded or individual sheets in a stack comprising a rotary member located beneath one corner of the stack, a plurality of means on said member for engaging and bending a predetermined number of sheet corners successively from the remaining sheets in the stack, and means for swinging the rotary member towards and away from the stack.

8. Apparatus for the separation or opening of sheets in a stack comprising a variable member for successively bending a predetermined number of sheet corners to form an opening at the desired place, a member for penetrating said opening, means for withdrawing the sheets from the stack and means for preserving said opening during such withdrawal.

9. Apparatus for the separation or opening of sheets in a stack comprising a rotary member for bending a predetermined number of sheet corners to form an opening at the desired place, a swinging blade to penetrate said opening, means for withdrawing the sheets from the stack in a direction diagonal of the sheets and means for preserving said opening during such withdrawal.

10. Apparatus for the separation of folded or individual sheets in a stack comprising a rotary swinging member adapted to cooperate with the sheets at one corner, means on said member for successively engaging a predetermined number of sheets to bulge and bend the same to form an opening, swinging means for penetrating the opening to preserve the separation of the sheets, and means for swinging said rotary member into and out of cooperative engagement with the stack.

11. Apparatus for the separation of folded or individual sheets comprising a rotary member, a plurality of suction passages in said member for the successive manipulation of a series of sheets, means for closing certain of said passages and means for the supply of suction thereto.

12. Apparatus for the separation of folded or individual sheets comprising a rotary member, a plurality of suction apertures in said member for successive engagement with and manipulation of a series of sheets, means for closing certain of said apertures, means for the supply of suction to said member, and means for moving the member into and out of the operative position.

13. Apparatus for the separation of folded or individual sheets in a stack comprising a suction member, means on said member for successively engaging a plurality of said sheets and an adjustable sleeve for the regulation of the commencement and ending of the suction effect.

14. Apparatus for separating individual or folded sheets in a stack comprising a frame, a variable suction device carried by said frame, a sleeve member adapted to turn in said frame to control the commencement and termination of the suction and means for varying said device to operate a predetermined number of sheets to provide an opening at the desired place.

15. Apparatus for separating individual or folded sheets in a stack comprising a movable frame, a rotary suction device carried by said frame, a sleeve member adapted to turn in said frame to control the commencement and termination of the suction, means for modifying said device to operate a predetermined number of sheets to provide an opening at the desired place, and means for moving said frame into and out of the operative position.

16. Apparatus for the separation of folded or individual sheets comprising a rotary member located adjacent to a corner of a stack of sheets, a plurality of removal needles carried by said member for engaging and opening a series of sheets successively and means for rotating said member to cause the separation of a predetermined number of said sheets.

In testimony whereof we have signed our names to this specification.

ALFRED WINKLER.
MAX DÜNNEBIER.