

March 8, 1938.

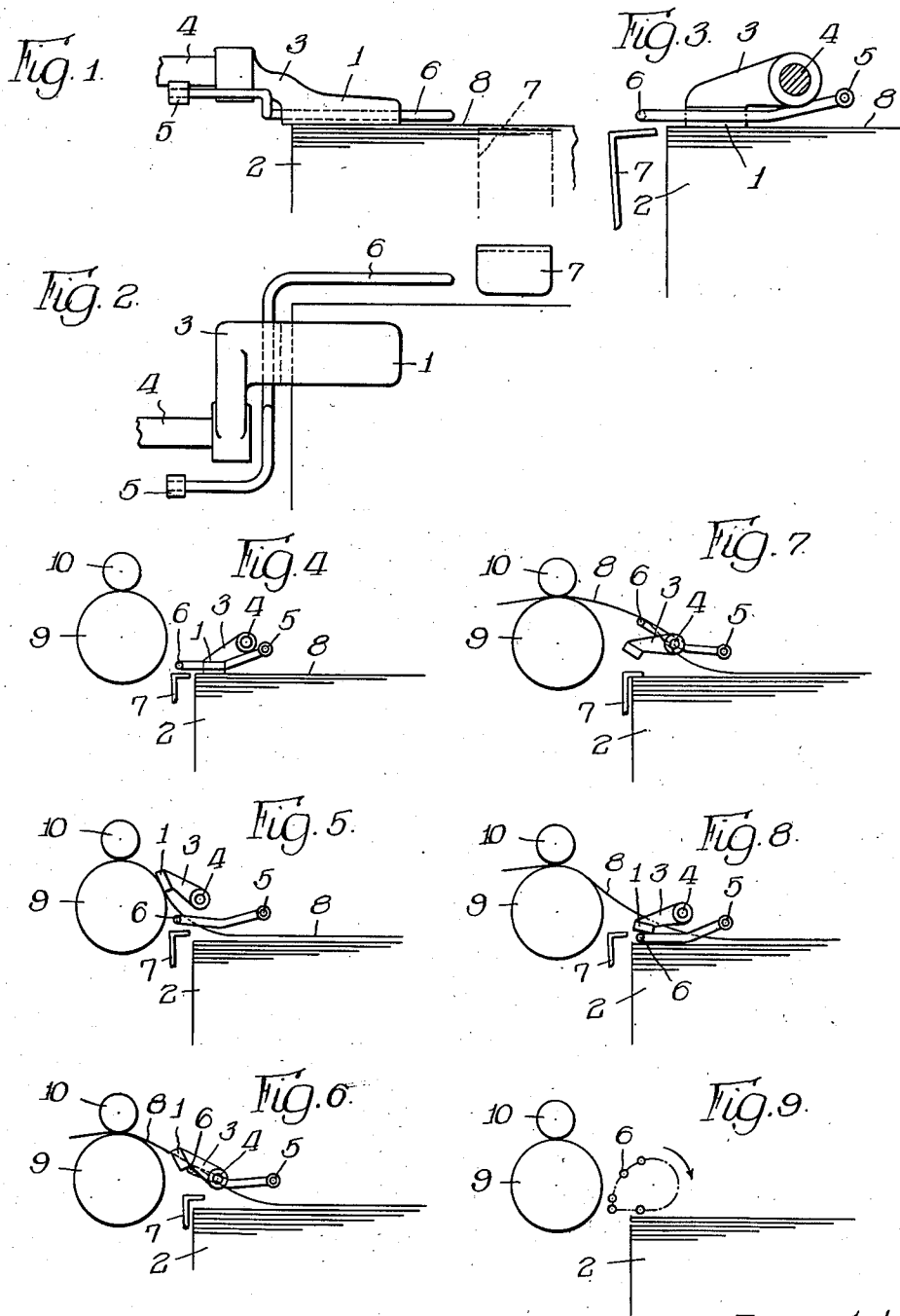
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2,110,175

SHEET FEEDING MECHANISM

Filed Jan. 10, 1936

3 Sheets-Sheet 1



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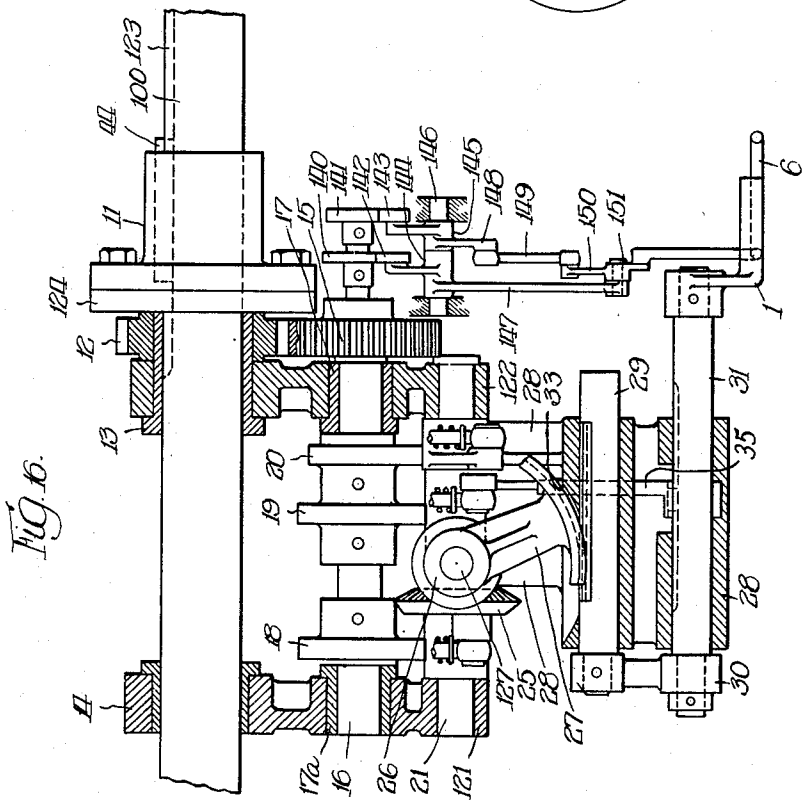
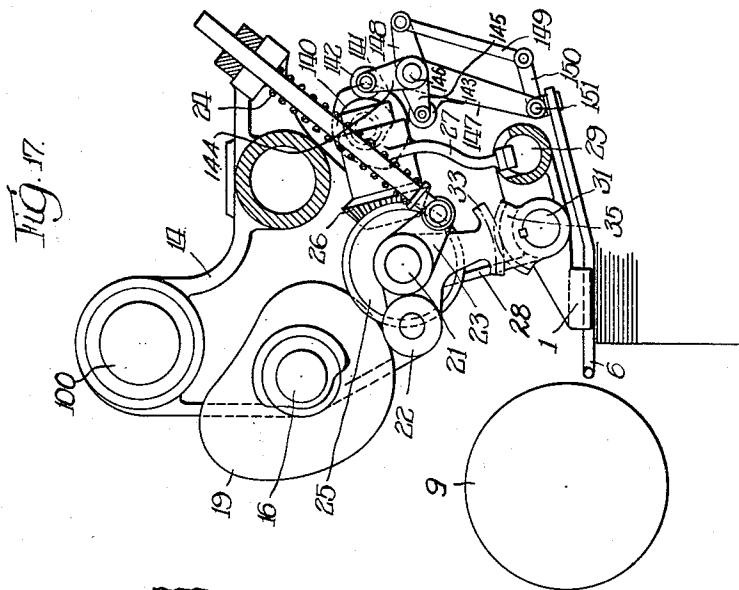
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,110,175

SHEET FEEDING MECHANISM

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Application January 10, 1936, Serial No. 58,464
In Germany January 15, 1935

13 Claims. (Cl. 271—27)

This invention relates to improvements in sheet separating and forwarding mechanism more particularly suitable for use in that class of sheet feeding apparati which are intended for handling sheets in superimposed relation, it being understood, however, that the invention may be applied with equal advantages to sheet feeding apparati where sheets are separated and forwarded individually in successive order.

I have found that in sheet feeding mechanisms where the sheets to be conveyed are separated from a stack by means which engage the sheets adjacent the lateral edges and then, after having advanced a sheet to forwarding means and released it, moves around the lateral edges of such sheet and beneath it in order to engage and separate the next following sheet, it is difficult to maintain a gap between a separated sheet and the top sheet of the stack adequate to permit the separating means to enter without obstruction beneath such separated sheet. Therefore it is one of the primary objects of my invention to provide simple and effective means whereby this can be accomplished effectively.

Another object of the invention resides in the provision of means whereby a sheet, after having been forwarded and released by the sheet separating means, will be raised above the latter and held in such position until the separating means has entered the gap beneath it.

A further object is to provide means whereby the top sheet of a stack will be held down while the sheet separating means enters the gap between a previously separated sheet and said top sheet.

Other objects of the invention will be apparent from the following description and appended claims.

A preferred form of mechanism embodying the principle of my invention is illustrated in the accompanying drawings; in which:

Figure 1 shows the arrangement of the cooperating parts in front elevation;

Figure 2 is a plan view of the parts illustrated in Figure 1;

Figure 3 is a side elevation of the same parts;

Figures 4 to 8 inclusive are diagrammatic views illustrating the successive steps whereby the purpose of my invention may be accomplished;

Figure 9 shows the preferred curvilinear path imparted to one of the members embodied in the mechanism disclosed;

Figures 10 to 14 inclusive are plan views in which the sheet engaged by the suction means has been omitted and show merely the relative posi-

tions of the suction nozzle or nozzles and associated parts at different points of the cycle of operation, the positions corresponding respectively with those represented in Figures 4 to 8;

Figure 15 illustrates diagrammatically a modified form of operation of the separating means and cooperating member whereby a sheet is raised above said means;

Figure 16 is a partial section in front elevation of the mechanism whereby motion is imparted to the various cooperating elements of this device; while

Figure 17 represents a side elevation of the mechanism illustrated in Figure 16.

Referring to Figures 1 to 3, the suction nozzle 1, one of which may be arranged adjacent each one of the front corners of a stack of sheets, as will be readily understood, is shown in a position ready to separate the top sheet from the stack 2. Said nozzle is mounted on an arm 3 secured to a shaft 4 by means of which it is given the required movements. Any suitable mechanism, such as is disclosed for example in my co-pending application for U. S. Letters Patent Serial No. 601,380, filed March 26, 1932, may be provided for pivoting said shaft, moving it slowly forward horizontally and then swinging it upwardly in order to present a sheet to the forwarding means and, after releasing said sheet, swing around its lateral edge and down onto the next sheet to be separated. According to this form of construction, I provide a holder 5 on which is mounted a rod 6 of any suitable form such as shown in Figures 1 to 3.

The operation of this mechanism is as follows: When the suction nozzle 1 is about to engage the top sheet of the stack 2 as shown in Figures 4 and 10, the free end of the rod 6 is located adjacent the front edge of the stack 2 and in its lowermost position.

Preferably I also provide a hold-down finger 7 to cooperate with said rod in order to assure the required gap beneath a previously separated sheet and the top sheet of said stack. In Figure 4 this finger is shown in its lowermost position and immediately in front of the stack.

When, as is illustrated in Figures 5 and 11, the nozzle 1 together with the sheet 8 engaged thereby has advanced towards a sheet forwarding roller 9 or the like, the rod 6 as well as the finger 7 will simultaneously have reached a slightly raised position as shown. After the nozzle 1 has transferred the sheet 8 to said forwarding means, and as soon as said nozzle has moved sidewise beyond the lateral edge of the stack 2, the upward move-

ment of the rod 6 is accelerated so that it will engage and raise the free end of the sheet already engaged by the forwarding rollers 9 and 10, see Figures 6 and 12. The finger 7 by that time will have moved toward the stack 2 so that its projecting portion will assume a position immediately above the front edge of the stack 2.

At that particular moment when, according to Figures 7 and 13, the suction nozzle 1 again begins to move inwardly and towards the stack to a position beneath the sheet 8, the rod 6 has been raised to an extent that the sheet 8 will be supported above said nozzle in order to clear the latter so that it may readily enter beneath said sheet and move down into engagement with the next following sheet. Simultaneously the top sheet which is to be separated next will be held down momentarily by said finger 7, thereby assuring the required space for the suction nozzle to enter between the sheet 8 and said top sheet.

During the downward movement of the nozzle 1, the rod 6 is again lowered so that it will pass said nozzle to its right, as viewed in Figures 8 and 14, and then beneath it to the left. Simultaneously the finger 7 is raised slightly, moved away from the stack and then lowered, whereupon the nozzle together with the rod 6 and said member 7 will again have reached the position shown in Figure 4.

In order to more clearly indicate the curvilinear path followed by the rod 6 during its movement described with reference to Figures 4 to 8, I have shown in Figure 9 merely the contour of said path with respect to the stack 2 and the forwarding roller 9.

It will be understood, however, that instead of moving to the right around the nozzle 1 from its position shown in Figure 7, the rod 6, by suitably changing its configuration and manner of mounting as will be described herein with reference to Figure 15, may be returned from above said nozzle to its original position shown in Figure 4 in a path to the left around said nozzle. The starting position of the rod 6 as shown in Figure 4 is preferred because in such position, namely in front of the leading edge of the stack, the rod 6 does not interfere with the sheet to be raised by the nozzle 1, and because the sheet by means of the nozzle 1 is brought into a position above said rod so that the latter during its upward movement is certain to engage the sheet from beneath. It is possible also to impart to the rod 6 a lateral movement in addition to its curvilinear movement, similar to the movement imparted to the suction nozzle 1, so that it will reach its position beneath the sheet from the side, similar to the nozzle itself. Due to the smaller dimensions of said rod as compared with said nozzle, such an arrangement is readily possible.

The finger 7 merely serves to improve the function of the mechanism described and does not form an essential part of my invention.

As indicated hereinabove, the mechanism whereby the reciprocating movements are imparted to the suction nozzles 1 may be of a construction similar to that disclosed in said copending application for U. S. Letters Patent, and in connection with which I make reference to Figures 16 and 17.

It will be seen that in Figure 16 certain parts, such as the shaft 21, rack 29 and the shaft 31, are shown swung away from their proper operative positions. This showing is intentional in order to more clearly illustrate these and their associated parts.

According to this preferred form of construction, a shaft 21 is supported by bearings 121 and 122. On said shaft 21 is secured a rock arm 28 which is provided with two bores which extend parallel to the shaft 21. In one of said bores is arranged a rack 29 which by means of the gear segment 27 is moved to and fro within said bore, but does not rotate. Said rack 29 is connected with a shaft 31, see Figure 17, which is arranged and may be slid within the other bore by means of a bracket 30, in such a manner that the shaft 31 will follow the longitudinal movement of the rack 29, but is able to simultaneously turn about its own axis. On the inner end of the shaft 31 is mounted the suction nozzle 1 which, as will be seen from the arrangement described, will make a combined movement, namely from right to left as viewed in Figure 16, turning upwards by pivoting about the axis of shaft 31, and swinging from left to right by pivoting about the axis of shaft 21, see Figure 17.

The device just described derives its motion from the main shaft 100, this being accomplished in the following manner. By means of a longitudinal groove 123, Figure 16, and a key 44 fastened to a flanged hub 11, the shaft 100 drives said hub which latter can be adjusted longitudinally of said shaft. The flange on hub 11 is bolted onto a flange 124 so that the angle of transmission may be suitably changed. The flange 124 and a pinion 12 are secured to a collar 13, said pinion driving another pinion 15 which is carried by a shaft 16 which latter has its bearings in bushings 17, 17a. Three cams 18, 19, 20 are keyed to the shaft 16, which cams respectively produce the three motions of the separating nozzle 1 mentioned above.

The reciprocating motion of the rock arm 28 is accomplished by means of the cam 20 and suitable associating parts, see Figure 17.

The reciprocation of the nozzle or nozzles 1 is produced by the cam 19. A gear segment 33 is loosely mounted on shaft 21, which segment is formed with an arm carrying a roller 22 which rides over the cam 19. Said roller 22 is kept in contact with the cam 19 by means of a spring 24. The segment 33 meshes with another segment 35 within the bore of which the shaft 31 is shifted lengthwise while it follows the rotary motion of the segment 35. This may be accomplished by any suitable means such as a key-way and key connection indicated in Figures 16 and 17.

The cam 18 imparts a rocking motion to the bell-crank lever 23, see Figure 17, which is loosely mounted on shaft 21. On one arm of the bell-crank lever 23 is a roller which is kept in contact with cam 18 by means of a spring, the arrangement being similar to that described above in connection with cam 19 and its associated parts. The bell-crank lever 23 is rigidly secured to a bevel pinion 25, see Figures 16 and 17, which meshes with another bevel pinion 26 mounted on a pivot 127 which is carried by the shaft 21 so that it will rock together with the arm 28. The bevel pinion 26 moves with the segment 27 which meshes with the rack 29 and transmits lateral reciprocating motion thereto.

A preferred mechanism whereby the rod 6 or the like member is moved in a closed vertical path is disclosed in Figures 16 and 17. This mechanism includes two cams 140, 141 which are mounted to rotate once during every cycle of the sheet separating mechanism. Two rollers 142, 143 which are mounted on bell-crank levers 144 and 145 respectively ride over said cams in order to move

said rod 6 backward and forward and also up and down, as viewed in Figure 17. Said levers are pivotally mounted at 146.

It will be seen that lever 144 which carries the roller 142 is provided with an arm 147, the outer end of which is pivotally secured at 151 to the rod 6. Therefore, as the roller 142 follows the cam 140, the rod 6 will be reciprocated forward and backward. The arm 148 of the bell-crank lever 145 is pivoted to a link 149 and the outer end of the latter is in turn pivoted to a lever 150 secured at 151 to said rod 6. By the roller 143 following the surface of the cam 141, the arm 148 will be rocked up and down with the result that in addition to its forward and backward movement, the rod will be given an up and down movement, i. e. said rod will be moved in a vertical curvilinear path with relation to the suction nozzle 6, and cooperating with the latter in order to raise a sheet to thereby provide a space between a separated sheet and the top of the pile for said suction nozzle to enter and engage and separate the next sheet.

According to this arrangement, the path of the rod 6 will be in a clockwise direction as indicated in Figure 9.

In Figure 15 I have indicated a modified manner of operation of the rod 6 whereby sheets after having been separated are raised and held above the separating member 1 in order that the latter may enter into the space provided for engaging and separating the next sheet on the pile 2.

According to this arrangement I have provided a cam 128 mounted on a continually rotating shaft 129. A roller 130 provided at the outer end of the bell-crank lever 131 pivoted at 132 rides over the surface of the cam 128. The other arm of the bell-crank lever 131 is pivoted to a link 133, the outer end of which link in turn is pivoted to the arm 134 of a second bell-crank lever 135 pivotally mounted at 136. According to this modification, the rod 6 is secured to the outer end of the arm 135 so that during the rotation of the cam 128, the lever 135 will move up and down as indicated by the arrow so that in order to raise a sheet above the suction separator 1, the free end of the rod 6 will be moved backwardly i. e. to the right as viewed in Figure 15 and thereupon returned to its original position by moving to the left in front of said suction separator.

It will be readily understood that while I have illustrated some preferred forms of carrying my invention into effect, many modifications of the parts involved and arrangement thereof may be adopted with equal success and without departing from the principle of the invention, therefore I intend to cover any such modifications that will come within the scope of the appended claims.

I claim:

1. In sheet feeding mechanism, the combination of a sheet support, sheet forwarding means, sheet separating means for removing sheets from said support and transferring them to said forwarding means, and a member moving in a vertical curvilinear path and operatively associated with said separating means to raise a sheet above the latter, after the leading edge of said sheet has been engaged by said forwarding means.

2. In sheet feeding mechanism, the combination of a sheet support, sheet forwarding means, sheet separating means, movable around the lateral edge of a sheet engaged by said forwarding means to remove an underlying sheet from said support and transfer it to said forwarding means, and a

member moving in a curvilinear path and operatively associated with said separating means to raise a sheet above the latter after the leading edge of said sheet has been engaged by said forwarding means.

3. In sheet feeding mechanism, the combination of a sheet support, sheet forwarding means, sheet separating means for removing sheets from said support and transferring them to said forwarding means, and a member moving upwardly from beneath said separating means to raise a sheet above the latter, after said forwarding means has engaged the leading edge of said sheet, and thereupon move downwardly and past said separating means.

4. In sheet feeding mechanism, the combination of a sheet support, sheet forwarding means, sheet separating means for moving sheets from said support and transferring them to said sheet forwarding means, and a member moving in a closed curvilinear path and operatively associated with said sheet separating means, to raise a sheet above the latter means after the leading edge of said sheet has been engaged by said forwarding means, to thereby provide a space beneath said sheet for said separating means to enter and engage the next following sheet.

5. In sheet feeding mechanism, the combination of a sheet support, sheet forwarding means, sheet separating means arranged to move around the lateral edge of a sheet to be forwarded and to convey sheets from said support and transfer them to said sheet forwarding means, and a member arranged to move in a closed curvilinear path and operatively associated with said sheet separating means to raise a sheet above the latter means after the leading edge of said sheet has been engaged by said forwarding means to thereby provide a space beneath said sheet for said separating means to enter and engage the next following sheet.

6. In sheet feeding mechanism, the combination of a sheet support, sheet forwarding means, sheet separating means for conveying sheets from said support and transferring them to said forwarding means, a member moving in a curvilinear path and operatively associated with said separating means to raise a sheet above the latter after the leading edge of said sheet has been engaged by said forwarding means, and means cooperating with said member for holding down the top sheet on said support for maintaining a space above the latter while the preceding sheet is being forwarded.

7. In sheet feeding mechanism, the combination of a sheet support, sheet forwarding means, sheet separating means for conveying sheets from said support and transferring them to said forwarding means, a movable member operatively associated with said separating means, means for moving said member above said separating means after the leading edge of a sheet has been engaged by said forwarding means, for the purpose of raising and holding said sheet above said separating means and thereby maintaining a space between the said sheet and the top sheet on said support while the former sheet is being advanced by said forwarding means.

8. In sheet feeding mechanism, the combination of a sheet support, sheet forwarding means, sheet separating means for removing sheets from said support and transferring them to said forwarding means, and a substantially horizontal rod moving in a vertical curvilinear path for the purpose of raising a sheet above said separating

means and supporting it after the latter has transferred the leading edge of a sheet to said forwarding means.

9. In sheet feeding mechanism, the combination of a sheet support, sheet forwarding means, sheet separating means for conveying sheets from said support and transferring them to said forwarding means, and a substantially horizontal rod moving in a vertical curvilinear path and around said separating means for the purpose of raising a sheet above said separating means, and thereupon returning to its starting position.

10. In sheet feeding mechanism, the combination of a sheet support, sheet forwarding means, reciprocating sheet separating means for conveying sheets from said support and transferring them to said forwarding means, a movable member operatively associated with said separating means, and means for moving said member above said separating means after the leading edge of a sheet has been engaged by said forwarding means, for the purpose of raising a sheet above said separating means and supporting it during the return stroke of the latter in order to provide a space beneath said sheet to accommodate said separating means for engaging a successive sheet.

11. In sheet feeding mechanism, the combination of a sheet support, sheet forwarding means, sheet separating means arranged adjacent the front corners of a pile of sheets for conveying sheets from said support and transferring them to said forwarding means, a member moving in a curvilinear path and operatively associated with said separating means to raise a sheet above the latter after the leading edge of said sheet has been engaged by said forwarding means, and

means cooperating with said member for holding down the top sheet on said support for maintaining a space above the latter while said separating means enter between the top of said pile and the sheet being forwarded.

12. In sheet feeding mechanism, the combination of a sheet support, sheet forwarding means, sheet separating means for removing sheets from said support and transferring them to said forwarding means, means for moving said separating means around the lateral edges of a separated sheet, and a member moving in a vertical curvilinear path and operatively associated with said separating means to raise a sheet above the latter, after the leading edge of said sheet has been engaged by said forwarding means and while said separating means move around the lateral edges of a separated sheet to enter between the top of said pile and the sheet being forwarded.

13. In a sheet-feeding mechanism, the combination of a sheet-pile support, sheet-forwarding means, sheet-separating means, means to operate said sheet-separating means to cause it to remove the sheets individually in succession from the top of the pile, transfer them in succession to said sheet-forwarding means and return to its initial sheet-removing position around the lateral edge of the transferred sheet, a sheet-raising-member, and means to move said member to raise each sheet after its leading edge has been engaged by said forwarding means to facilitate the entrance of said separating-means beneath the sheet as it completes its passage around the lateral edge of the sheet.

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