May 5, 1942. C. W. HARROLD 2,282,224

SHEET FEEDER

Filed Aug. 3, 1940

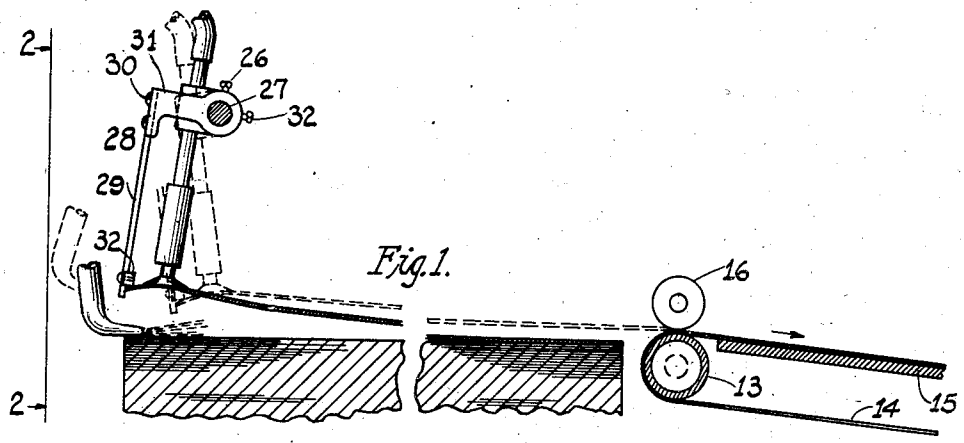


Fig. 1.

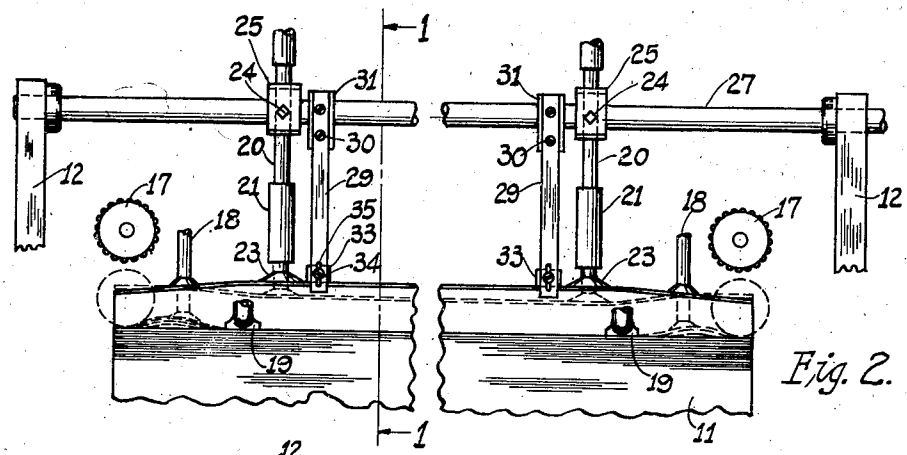


Fig. 2.

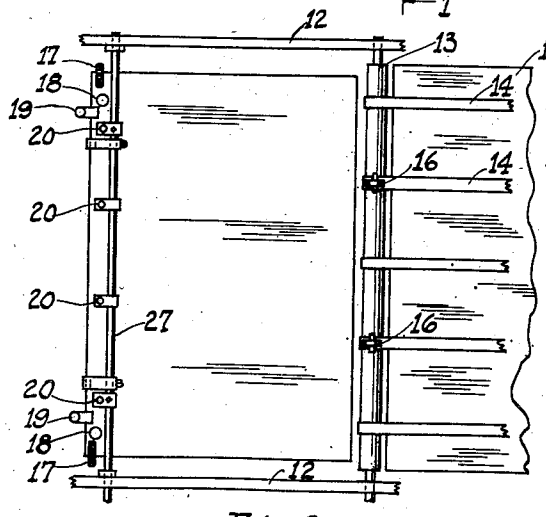


Fig. 3.

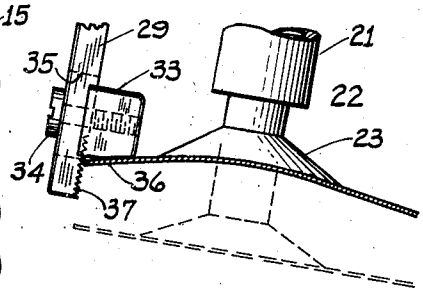


Fig. 4.

Charles W. Harrold.
Inventor.

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UNITED STATES PATENT OFFICE

2,282,224

SHEET FEEDER

Charles W. Harrold, University Heights, Ohio, assignor to Harris-Seybold-Potter Company, Cleveland, Ohio, a corporation of Delaware

Application August 3, 1940, Serial No. 350,431

5 Claims. (Cl. 271—27)

This invention relates to sheet feeders and more particularly to sheet feeders which operate upon the rear portion of each sheet to separate the same from the pile and forward it to conveying devices which remove the sheet completely from the pile, the speed of the conveyor preferably being such as to cause each sheet to partly overlie the next succeeding sheet to form a stream of lapped sheets.

Sheet feeders of this type are known in which each sheet is first lifted by two or more lifting suckers operating near the rear edge of the sheet into position to be taken by a set of two or more forwarding suckers. After the rear edge of the sheet is lifted blasts of air are directed underneath the sheet by nozzles which also rest on the next sheet to prevent movement thereof. The blasts are intended to separate the topmost sheet completely from the pile by a layer of forwardly moving air and to assist in forwarding the sheets. While this blast continues to blow the forwarding suckers are given a movement in the feeding direction to cause the sheet to advance into the bite of conveyor rollers which thereafter forward the sheet, the forwarding suckers being cut off and returned to their rearward position for the next sheet. In such feeders the sheet may receive its forward impetus partly from the blasts of air and partly from the forward motion of the forwarding suckers, depending upon the character and size of sheets being fed and the strength and distribution of the air blast. When relatively light sheets such as paper are being fed, the air blast is usually strong enough not only to separate the topmost sheet but to supply all the required forwarding impetus to the sheet, the forwarding suckers merely maintaining the rear edge of the sheet lifted to allow the blasts to blow under it and controlling the position and rate of forward movement of the sheet so that it reaches the conveyor in proper alignment and at the proper time. When heavy or stiff sheets are fed, the air blast while supplying some portion of the forwarding impetus is frequently insufficient in itself to separate such sheets from the pile or to move them forward. Under such circumstances the forwarding suckers tend to push the sheet forward and in doing so slip on the sheet causing the sheet to fail to reach the conveyor or to be fed into the conveyor out of time or in twisted position. Faulty feeding and frequent stoppage of the operating machine, such as a printing press, result.

Other feeders are known wherein the sheet is lifted by suckers near its rear edge into position where it is engaged by hook-like pushers which merely push the sheet forward to the conveyor after it is released from the lifting suckers. In such feeders the sheet is not positively controlled in its forward movement since there is nothing to oppose the effect of the air blast or the tendency of the sheet to buckle and drop away from the pushers. Such feeders therefore are not successful and in particular cannot be employed to feed relatively light paper stocks.

The present invention has for one of its principal objects the provision of a feeder capable of efficiently and reliably handling a wide range of weights, sizes and conditions of stock.

A further object is to provide in a feeder capable of efficiently feeding light weight or flexible stocks means particularly adapted to enable the feeder to feed efficiently heavy or stiff stocks.

Another object is to provide, in combination with a pair of spaced suction means arranged to sustain the rear edge of a sheet and move forward therewith and a pair of spaced conveyor rollers to which the sheet is to be fed, a pair of pushers, each associated with one of the suction means, arranged to engage the rear edge of the sheet held by the suction means and push it forward into the conveyor rollers without substantial slip of the suction means in the sheet.

Other objects lie in the details of construction and arrangement and operation of the parts and will be apparent from the following description and the accompanying drawing which illustrates one embodiment of the invention. In the drawing Fig. 1 is a side elevational view partly in section along the line 1—1 of Fig. 2, showing the invention and such additional parts of a feeder as are necessary.

Fig. 2 is an end elevational view of the mechanism in Fig. 1 looking in the direction of the arrows 2—2 of Fig. 1.

Fig. 3 is a plan view showing the arrangement of the suckers, pushers and conveyor rollers relative to the pile of sheets, and

Fig. 4 is an enlarged view of the mouth of one of the forwarding suckers and the pusher associated therewith.

Referring to the drawing, 11 represents a pile of paper from which sheets are to be fed in succession. The pile is supported by known means in the frame members 12 of the feeder and is gradually elevated in the usual way as sheets are removed. Near the forward end of the pile and journaled in frames 12 is a driven roller 13 around which are trained conveyor tapes 14 whose upper runs rest on the surface of feed

board 15. Above roller 13 are two freely turning conveyor wheels 16 which press the sheets against roller 13 and tapes 14 to cause the latter to advance the sheets toward the operating machine.

Above the rear portion of the pile near the corners are a pair of combing wheels 17 which are rotated and periodically raised and lowered onto the pile in known manner to comb a buckle in the top sheets as shown in dotted lines in Fig. 2. Adjacent the combers are lifting suckers 18 which grasp the topmost combed sheet and lift its rear edge above the pile. Air blast nozzles 19 are arranged to press on the pile after the topmost sheet is raised and to blow blasts of air under such raised sheet.

Approximately in line with lifting suckers 18 and near the rear edge of the pile are a plurality of forwarding suckers 20 located in position to grasp a sheet lifted by the lifting suckers 18. These forwarding suckers preferably are of the telescopic type provided with a cylinder 21 into which a piston 22 carrying the flexible rubber sucker mouth 23 is retracted when the mouth is sealed by a sheet, the piston being pushed outward by a spring (not shown) when there is no sheet over the mouth (see Fig. 4).

The forwarding suckers 20 are clamped by screws 24 in brackets 25 which in turn are secured by screws 26 to oscillating shaft 7 having bearings in the frames 12 of the machine. Shaft 27 is given periodic oscillations of desired magnitude by mechanism not shown so that the forwarding suckers 20 are swung in an arc from the full line position to the dotted line position of Fig. 1, the forward movement being sufficient to carry the front edge of a sheet held by these suckers into the bite between the conveyor wheels 16 and roller 13.

The above described mechanism is constructed and operated in well known manner, being embodied in a commercial machine illustrated in part in U. S. patent to Headley T. Backhouse No. 2,108,702, to which reference is made for further description of such mechanism.

In close proximity to the outermost forwarding suckers, I provide a pair of sheet pushers, generally indicated at 28, which comprise rigid bars 29 secured by screws 30 to brackets 31, which are adjustably fastened by set screws 32 to shaft 27. The bars 29 extend to a point below the position occupied by the rear edge of a sheet held by the sucker mouths 23 and are provided near their lower extremity with blocks 33 secured to the bars 29 by screws 34 extending through slots 35 into the blocks. The blocks thus form a ledge 36 against which the sheet may be raised, the position of the ledge being adjustable by means of the screw and slot. Preferably, although not necessarily, I provide grooves in the faces 37 at the lower ends of the bars 29 to avoid slipping of the edge of the sheet on the pushers.

Preferably I adjust the position of the pushers 28 so that the lower ends of bars 29 extend downward to a point well below the collapsed position of the forwarding sucker mouths 23 but above the downward or extended position of these mouths and well above the rest of the sheets of the pile. According to conditions I set the forward faces 37 of the pushers approximately in line with the rear edge of the pile or slightly in advance of said rear edge. When the pushers are set in the latter position the sheets, as they are lifted, are bent slightly by the ends of the pushers before their edges come in contact with faces 37. This bending in the region of the suckers 23 causes a second sheet, which may accidentally adhere to the top sheet, to be separated so that it will drop back on the pile.

Preferably also I adjust the position of block 33 on each of the pushers so that its lower face lies slightly below the position occupied by the sucker mouths 23 when holding a sheet. By such position the sheet is bent slightly in the region close to the sucker, this bending serving both to stiffen the sheet for the subsequent pushing action and to separate a second sheet which may accidentally be picked up.

In operation the sheets are first combed by combers 17 and lifted at their rear corners by suckers 18 into such position that the rear part of the sheet may be taken by the forwarding suckers 20. The air blast nozzles then enter beneath the lifted sheet, descend onto the pile and emit blasts of air under the lifted sheet. As soon as the rear edge of the sheet is lifted suction in the forwarding suckers 20 is turned on and these suckers grip the sheet, the closing of the sucker mouths 23 serving to collapse the piston and cylinder and lift the mouths together with the adhering sheet to their uppermost position. The rear edge of the sheet is thereby carried past the ends of the bars 29 and in front of faces 37, and the upper surface of the sheet near its rear edge is carried up into contact with blocks 33 which limit its upward movement and cause a slight bend in the sheet.

The shaft 27 is then oscillated to move the forwarding suckers 20 and pushers 28 forward to advance the sheet to the conveyor wheels 16 and roller 13, the speed of forward movement being substantially equal to that of the conveyor at the time the front edge of the sheet is taken thereby. The position of the forwarding suckers and pushers at the time a sheet is entering the conveyor is shown in dotted lines in Fig. 1. During forward movement of the sheet the suckers are prevented from slipping on the sheet by the positive forwarding action of the pushers against the stiffened rear edge of the sheet. Thus any sticking of the sheets together near their front edges, or inability of the air blast to separate the sheets completely is overcome by the pushers and the sheet is positively advanced off the pile in proper timed relation to the conveyor. Furthermore the accurately adjusted position of the pushers causes each sheet to be advanced in correct alignment to the conveyor and twisted or out-of-position sheets are avoided. During the forward movement of the sheet the suckers 20 maintain the sheet raised so that its rear edge is kept in contact with the pushers 28 so that the air blasts from nozzles 19 will effectively assist in the separating and forwarding action.

Various changes in the details of construction and operation of my invention, particularly as regards the mounting, actuation and adjustment of the pushers, may be made without departing from the spirit of my invention.

What I claim is:

1. In a machine for feeding sheets from a pile, the combination with sheet separating and forwarding means comprising a pair of suction means arranged to grip a sheet near its rear edge on opposite sides of the center of the sheet and move forward with the sheet, air blast devices arranged to blow air under a sheet held by said suction means during forward movement of the latter, and conveying means for removing for-

warded sheets from the pile, of a pair of pushers, one near each of said pair of suction means, arranged and operated to engage the rear edge of a sheet held by said suction means and to move forward in unison with said suction means to push the sheet forward toward said conveying means.

2. In a machine of the class described, in combination, suction means arranged and operated to grip a sheet near its rear edge on opposite sides of the center of the sheet, lift said rear edge and move forward with the sheet, a pair of conveyor wheels arranged on opposite sides of the center of the sheet and co-operating with roller means to convey lifted and forwarded sheets from the pile, and a pair of sheet pushers, one on each side of the center of the sheet, arranged and operated to engage the rear edge of the sheet held by said suction means and push the sheet forward, the suction means maintaining non-slipping engagement with the sheet during forward movement thereof.

3. In combination, a sheet forwarding sucker of the telescopic type and a sheet pusher associated therewith comprising a face portion adapted to engage the rear edge of a sheet held by said sucker and a ledge portion arranged below the uppermost position of said sucker and adapted to engage the upper surface of the sheet near its rear edge.

4. In a machine for feeding sheets from the top of a pile, the combination with sheet separating and forwarding means comprising suction means arranged to grip a sheet near its rear edge, lift the sheet and move forward therewith, air blast means arranged to blow air under a sheet held by said suction means to substantially separate the sheet from the next underlying sheet, and conveying means for removing forwarded sheets from the pile, of sheet pushing means arranged and operated to engage the rear edge of a sheet held by said suction means and to move forward in unison with said suction means to push the separated sheet forward toward said conveying means.

5. In a machine for feeding sheets from the top of a pile, the combination with sheet separating and forwarding means comprising suction means arranged to grip a sheet near its rear edge and move forward with the sheet, air blast means arranged to blow air under a sheet held by said suction means during forward movement of the latter, and conveying means for removing forwarded sheets from the pile, of sheet pushing means arranged and operated to engage the rear edge of a sheet held by said suction means and to move forward in unison with said suction means to push the sheet forward toward said conveying means.

CHARLES W. HARROLD.