April 25, 1939. H. T. BACKHOUSE 2,156,139

SHEET FEEDING MACHINE

Filed Nov. 3, 1937 2 Sheets-Sheet 1

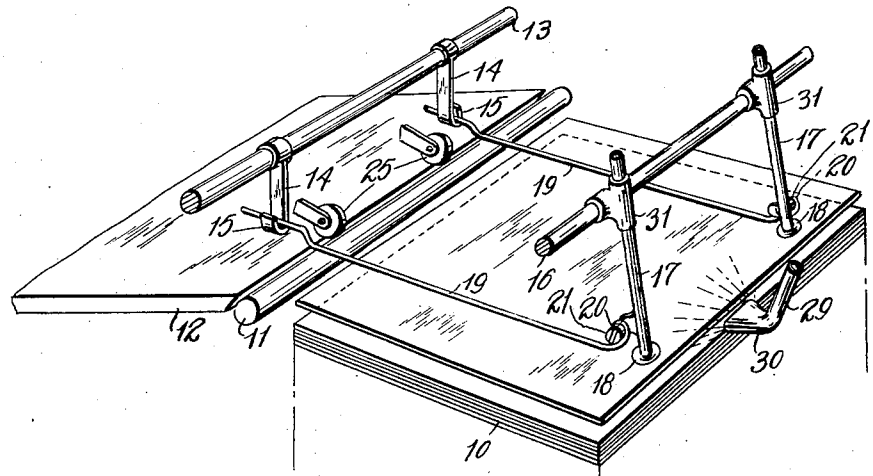



FIG. 1

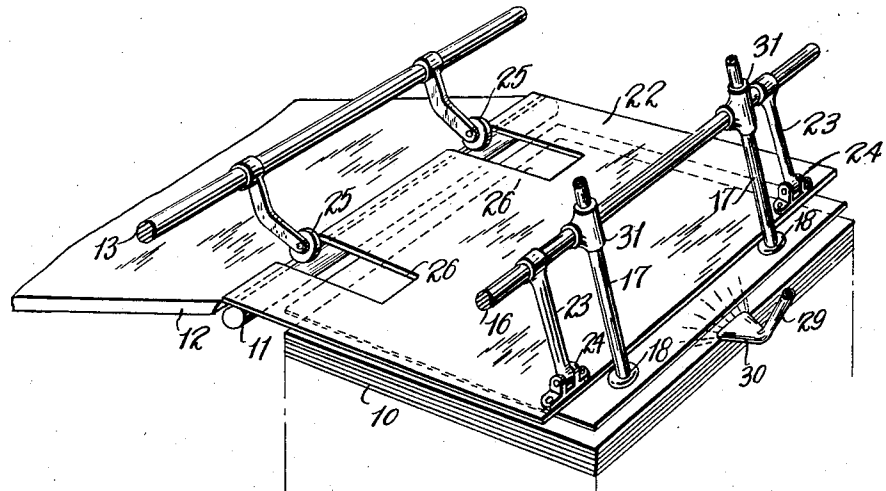



FIG. 2

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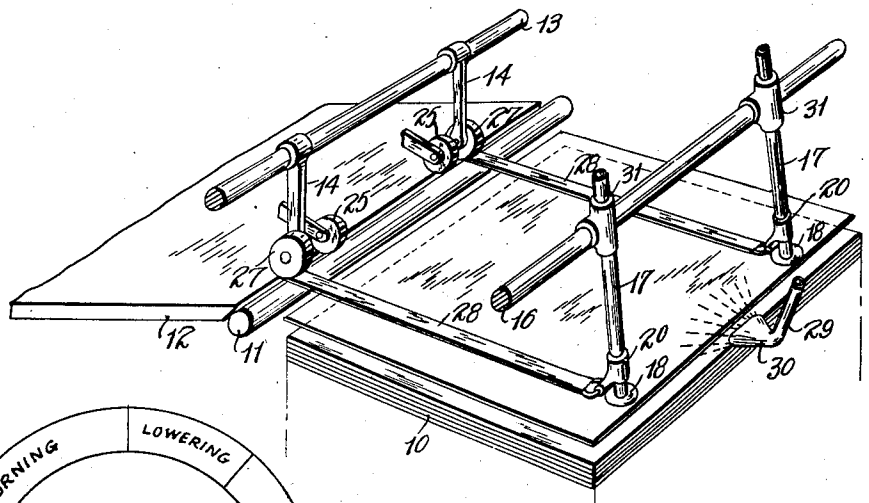



FIG. 3

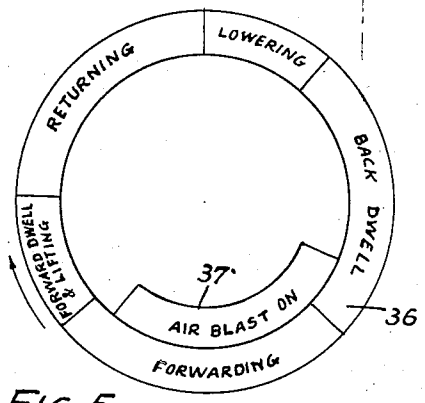



FIG. 5.

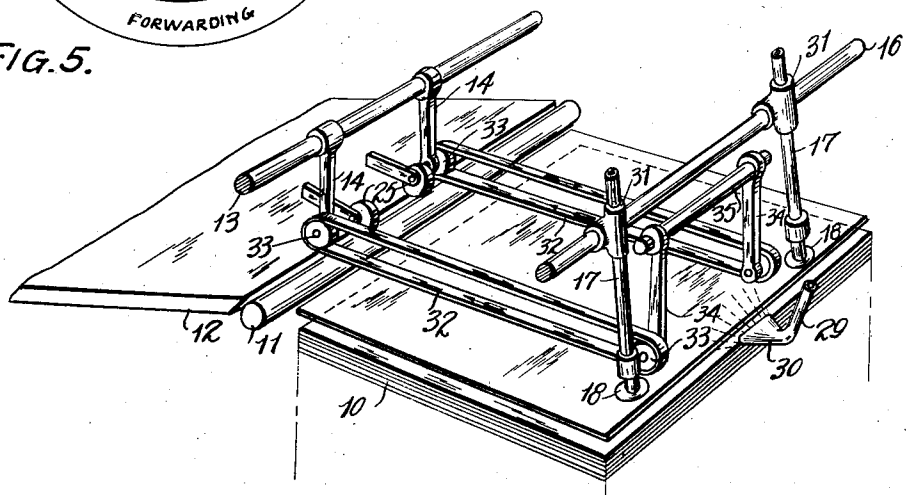



FIG. 4

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# UNITED STATES PATENT OFFICE

2,156,139

## SHEET FEEDING MACHINE

Headley Townsend Backhouse, London, England

Application November 3, 1937, Serial No. 172,551
In Great Britain November 17, 1936

6 Claims. (Cl. 271—27)

This invention consists in improvements in or relating to automatic sheet feeding machines and applies especially, though not exclusively, to machines of the type in which the operations of separating and forwarding the sheets are effected either wholly or in part from the rear edge of a pile of sheets considered in the direction of movement of the sheets towards a press or other mechanism to which they are to be delivered, and in which the sheets are fed successively in what may be termed a stream of sheets conveniently, though not necessarily, in a partially underlapping formation. An example of a machine of this type to which the present invention is applicable is described in my prior application for patent, Serial No. 738,500, filed August 4, 1934.

In such machines it is usual to employ an air blast to assist in separating the sheets and forwarding them on to a feed board or conveyor. The air blast impinging beneath the rear edges of the separated sheets gives them a tendency to billow up, and this tendency is commonly overcome by the use of smoothers consisting generally of suitably shaped strips of metal or other material adjustably located above the pile of sheets in such a position that the separated sheets, moving towards the press or other mechanism, pass beneath the smoothers and are restrained by them from billowing up under the influence of the air blast. In certain cases, particularly where the forwarding of the sheets is controlled entirely from the rear edge of the pile the friction exerted by the fixed smoothers on the surface of the sheets may be sufficient to disturb or impede their forward movement; and it is an object of the present invention to overcome this drawback.

The invention is not limited to the case in which separation of the sheets is effected with the aid of an air blast although it is particularly suitable in such circumstances.

Hereinafter and in the appended claims where it is stated that the sheets are moved towards their "delivery" positions this is to be understood as meaning a position to which the sheets are moved by the feeding means for any preferred subsequent use. Generally, although not necessarily, this delivery position coincides with the commencement of a feed board or conveyor by which the sheets are passed to a printing press; and although in the following description reference may be made to such parts the invention is to be understood as not necessarily limited in its application to feeding paper sheets for use in a printing press.

According to the present invention an automatic sheet feeding machine comprises in combination sheet separating and forwarding mechanism operative to raise the sheets successively and to move them towards their delivery position, and a smoother or smoothers each of which serves to restrain or limit upward movements of the sheets as they are forwarded and which (smoother) itself moves forwardly with the sheets as the latter are fed in turn to their delivery position. By reason of the forward movements of the smoother the friction to which reference has above been made as having a tendency to disturb or impede the forward movement of the sheets, is eliminated.

The invention also includes an automatic sheet feeding machine comprising in combination means including an air blast for separating the topmost sheet from the pile, means to grip and feed the topmost sheet to its delivery position, and a smoother or smoothers each of which serves to restrain upward movement of the sheet during the forwarding movement of the gripping means and which is so constructed and actuated as to move forwardly with each successive sheet as it is fed towards the delivery position.

In order that the invention may be more clearly understood some preferred examples will now be described with the aid of the accompanying drawings, in which

Fig. 1 is a perspective view of a feeder embodying the invention, only such essential parts of the mechanism as are necessary for a complete understanding of the invention being shown.

Figs. 2, 3 and 4 are similar views of modifications.

Fig. 5 is a timing diagram showing the movements of the sheet handling suckers with relation to the period of the air blast.

Referring first of all to Fig. 1, 10 represents a pile of sheets from which the uppermost sheets are to be fed successively on to a feed roll 11 and thence to a feed board or conveyor 12 by which the sheets are fed in succession to a printing press or other mechanism with which they are to be employed. The parts 11, 12 represent what has been referred to above as the "delivery" position for the sheets 10.

Above the feed roll 11 is a rail 13 parallel with the feed roll and furnished with two depending arms 14 terminating at their lower ends clear of the feed board 12 in hooked portions 15.

Above what is to be considered as the rear edge of the pile of sheets 10, that is to say the edge remote from the feed roll 11, is another rail 16

to which are secured pipes 17 terminating in suckers 18. The rail 16 is traversed backwards and forwards in relation to the feed roll 11 in known manner and is also controlled for up and down movements in order that the suckers can be first lowered towards the topmost sheet which has been partially separated and lifted off of the pile until the sheet is gripped thereby, then the rail is moved bodily forward towards the feed roll so that the topmost sheet is moved in the grip of the suckers to the feed roll and subsequently the suckers are actuated to release the sheet; the rail 16 is then slightly raised and is returned towards the rear edge of the sheet pile whereupon these movements are repeated.

As an alternative to the up and down movements of the rail 16 the pipes 17 and suckers 18 may be arranged for a telescoping movement to effect raising and lowering of the suckers.

Smoothers 19 are provided of known pattern but instead of remaining stationary as before they are now each anchored at 20 to an associated pipe 17 by joints which permit them to move about an axis 21 parallel with the surface of the pile of sheets. The smoothers 19 can slide freely backwards and forwards in the hooks 15 so that in this manner the object of the invention is achieved in that the smoothers not only perform the function which they have performed hitherto but also move forwardly with the sheets as the latter are fed in turn to their delivery position.

In an alternative form of the invention as shown in Fig. 2 the reciprocating smoothers 19 are replaced by a single smoother in the form of a sheet 22. This sheet may be of any preferred material, for example transparent material such as Celluloid, and is suspended at its rear edge from arms 23 which are secured at their upper ends to the rail 16 and are articulated at their lower extremities at 24 to provide swivel joints similar to those at 20 of the previous construction. In this form of the invention the pull out or feed roll 11 is shown as having associated feed wheels 25 between which and the pull out roll the paper sheets are fed. In order to accommodate feed wheels 25 the sheet 22 is slotted at 26 inwardly from the forward edge thereof. In this case the front edge of the smoother is not suspended from a rail such as 13, and the weight of the sheet-like smoother maintains the forward edge in its requisite position relatively to the sheets. The parts 17 and 18 are similar to the correspondingly numbered parts in Fig. 1.

In either form of the invention thus far described, the forward ends of the smoothers, instead of merely sliding over supports of fixed height may be pivoted to links swinging in vertical longitudinal planes.

In a further alternative form of the invention as illustrated in Fig. 3 the parts 11, 12, 13, 16, 17 and 18 are arranged similarly to the corresponding parts in Fig. 1 and from the rail 13 depend arms 14 which, however, differ from the correspondingly numbered arms in Fig. 1 in that at their lower extremities they support spring drums 27. The smoothers now take the form of spaced flexible bands 28 leading from connections 20 on the pipes 17 to the spring drums 27, the springs of which tend at all times to wind up the bands so that as the rail 16 is approached towards the rail 13 the bands will be wound up on the drums. In operation, with each forward stroke of the forwarding mechanism 16, 17, 18, the bands 28 are brought in by the spring winding mechanism and thereby constitute smoothers which move forwardly with the sheets as they are fed to their delivery position. On the return movement of the rail 16 the bands 28 are drawn outwardly and in so doing wind up the springs in the drums 27.

In each example a pipe 29 terminating in a nozzle 30 is illustrated and serves the purpose of supplying an air blast to the rear edge of the pile of sheets for the purpose already described. Suitable means, well understood in the art, are employed for moving the nozzle 30 into and out of position so that it will not be in the way when the rear edge of a sheet is being lifted from the pile. The blast of air delivered by the nozzle is interrupted intermittently. While the timing of the air blast may be varied to suit conditions, I prefer to so regulate it that no winding of the sheet occurs during the time that the sheet separating and lifting means are functioning and the suckers 18 are returning to their initial position after delivering a sheet.

It is within the invention to modify the mechanism so that the rail 16 is only controlled for backward and forward movement and does not receive an up and down movement, in which case the smoothers will remain constantly at any suitable height above the pile of sheets that may be desired; and this height may be made adjustable by sliding the pipes 17 in adjustable holders 31 carried on the rail 16.

In place of bands 28 wires may be provided and it is to be further understood that the invention is not limited to any particular number of smoothers such as 19 or 28.

An advantage of the spring controlled bands of the construction illustrated in Fig. 3 is that when the forwarding means is adjusted to suit a change in the size of the sheets being fed the bands automatically adjust themselves to such change.

In a still further example of the invention as illustrated in Fig. 4, the bands 28 and spring drums 27 of Fig. 3 may be replaced by endless bands 32 passing over rollers 33 carried by the arms 14 and additional arms 34 positioned near the rear edge of the sheet pile 10 and depending from a fixed rail 35. Means, not illustrated, may be provided in such an arrangement for rotating the bands 32 continuously or intermittently so that the lower laps of the bands move in the feed direction of the sheets 10.

In Fig. 5 the divisions of the outer ring 36 indicate the movements of the suckers 18, reading in the direction of the arrow. The inner sector 37 indicates the period of activity of the air blast with respect to the timing of the cycle of movements of the suckers 18. More or less variation is permissible, but as will be obvious to those skilled in the art it is essential that the air blast be turned on after the suckers have taken the sheet, which they do during their back dwell. It is desirable also that the blast be turned on before the suckers begin their forward movement because, as heretofore stated, the air blast assists in the forwarding movement. As soon as the forwarding movement of the sheet is completed and its front edge is taken by the pull out rollers 11 and 25 there is obviously no occasion for further winding of that particular sheet, and the air blast is turned off at approximately that time as the diagram shows. The fact that the air blast is off during the return movement of the suckers and smoothers facilitates that movement. If the air blast were continued during the return movement of the smoothers, their movement would

produce a rearward drag upon the sheets of the stream.

The invention is not limited to the precise form of sheet feeding machine which has been illustrated in its simplest essentials in the accompanying drawings. It may, for example, include combers and additional suckers as described in the prior application already referred to, and may have also any other parts usual in sheet feeding machines or desirable in such machines in addition to the smoothers constituting the main feature of the present invention.

Having thus described my invention, I claim:

1. In mechanism for feeding sheets to a printing press or other sheet handling machine of the type in which means are provided for separating and lifting rear portions of the uppermost sheet and forwarding the sheet to advance its front edge to delivery position, and in which means are provided for winding the uppermost sheet after its said rear portions are separated from the pile, a smoother arranged above the pile extending in the direction of movement of the sheets, and means for causing said smoother to travel forward during the forward travel of the sheet.

2. In mechanism for feeding sheets to a printing press or other sheet handling machine of the type in which means are provided for separating and lifting rear portions of the uppermost sheet and forwarding the sheet to advance its front edge to delivery position, and in which means are provided for winding the uppermost sheet after its said rear portions are separated from the pile, a smoother arranged above the pile extending in the direction of movement of the sheets, said smoother having a reciprocating movement backward and forward in the direction of sheet travel and being operatively associated with the sheet forwarding means to move forwardly and backwardly therewith.

3. In mechanism for feeding sheets from the top of a pile to a printing press or other sheet handling machine of the type in which means are provided for separating and lifting rear portions of the uppermost sheet and forwarding the sheet by said portions to advance its front edge to delivery position, and in which means are provided for winding the uppermost sheet after its said rear portions are separated from the pile, a smoother arranged above the pile, the rear end of the smoother being articulated to the sheet forwarding means, and supporting means for the forward end of the smoother permitting movement of the latter in a forward and backward direction, whereby the smoother moves forward with the sheet at the same speed as the sheet during the travel of the latter toward its delivery position.

4. In mechanism for feeding sheets from the top of a pile to a printing press or other sheet handling machine of the type in which means are provided for separating, lifting, winding and forwarding the uppermost sheet comprising suckers arranged to grip the sheet and to move it forward toward sheet delivery position and then to return for the next sheet, a plurality of elongated smoothers operatively connected with the said suckers extending forwardly therefrom in the direction of sheet travel, and means for guiding the forward ends of said smoothers, whereby the latter travel forwardly with the sheet to its delivery position and return with the suckers against the direction of sheet travel after the sheet is in the delivery posiiton.

5. In mechanism for feeding sheets from the top of a pile to a printing press or other sheet handling machine of the type in which means are provided for separating, lifting, winding and forwarding the uppermost sheet comprising suckers arranged to grip the sheet and to move it forward toward sheet delivery position and then to return for the next sheet, a plurality of elongated smoothers operatively connected with the said suckers extending forwardly therefrom in the direction of sheet travel, means for guiding the forward ends of said smoothers, whereby the latter travel forwardly with the sheet to its delivery position and return with the suckers against the direction of sheet travel after the sheet is in the delivery position, the operation of the winding means being interrupted during the rearward movement of the suckers and smoothers.

6. In mechanism for stream feeding sheets from the top of a pile to a printing press or other sheet handling machine of the type in which means are provided for separating, lifting, winding and forwarding the uppermost sheet comprising suckers arranged to grip a rear portion of the sheet and to move it forward a distance equal to a fraction of its length beneath the next preceding sheet, pull out means through which the stream of sheets is caused to travel, said pull out means being arranged to grasp the forward edge of each sheet in turn as it is delivered by the forwarding suckers, a smoother mounted above the pile with which the stream of sheets engage while winded during their forward travel to the pull out means, and means for moving said smoother forward during the forward travel of each uppermost sheet to said pull out means.

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