May 22, 1951 A. P. BATTEY 2,554,320

SHEET FEEDING MECHANISM

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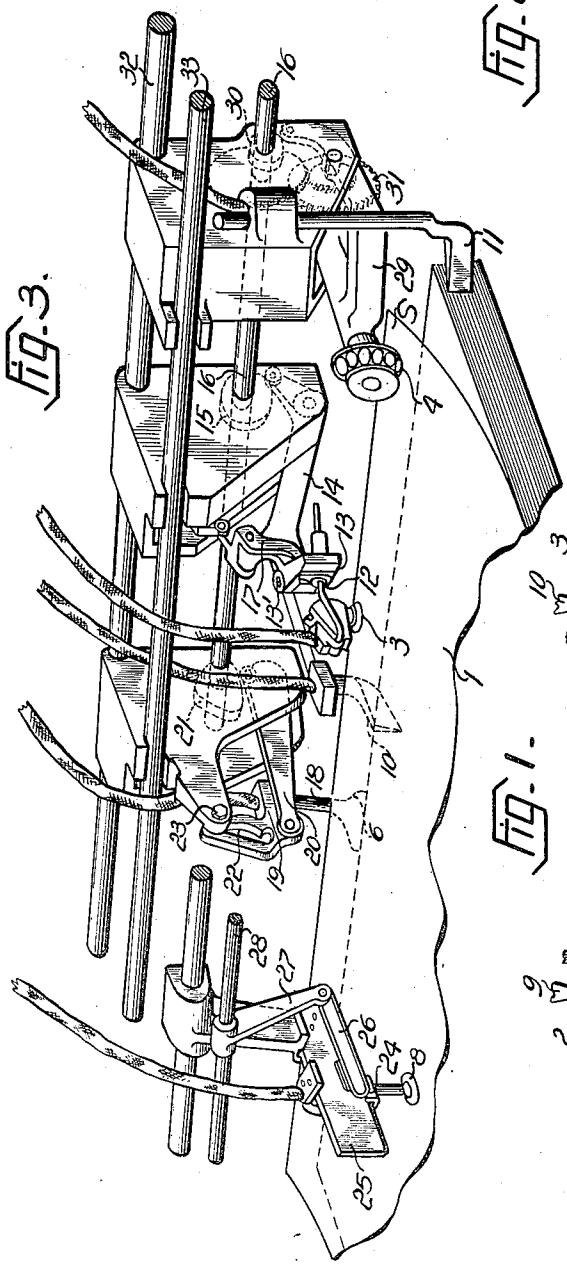


Fig. 3.

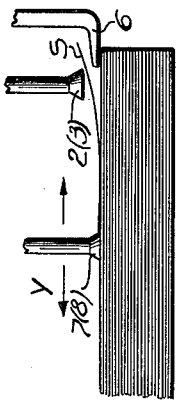


Fig. 2.

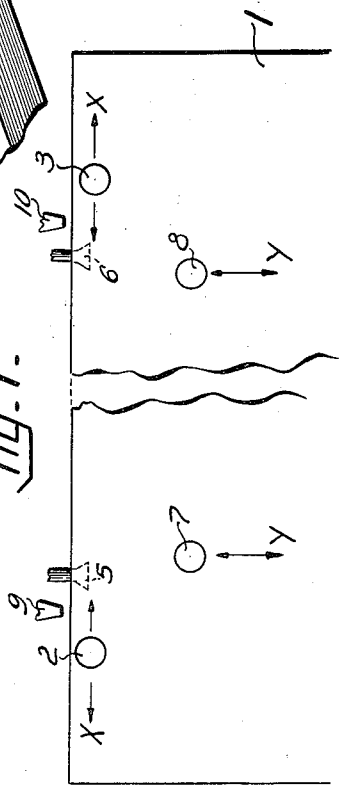


Fig. 1.

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SHEET FEEDING MECHANISM

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This invention relates to sheet feeding mechanism especially intended for feeding sheets to a printing (or other) machine and more particularly but not exclusively for feeding sheets by the system known as "stream feeding" in which the sheets travel from the supply position to the printing machine in partly lapped formation.

The invention is more especially concerned with that kind of mechanism in which the rear end of the top sheet of a stack of sheets is engaged by sheet lifting devices commonly in the form of pneumatic suckers which when elevated lift the rear end of the top sheet away from the stack, a presser foot or feet then being inserted between the lifted sheet and the stack and allowed to drop on to the stack so as to hold and prevent movement of all sheets except the lifted one when the lifted sheet is moved forward. To separate the lifted sheet over the whole of its surface from the stack, an air blast is directed forwardly between the lifted rear end of the top sheet and the top of the stack, and it is common to form the presser foot hollow to constitute an air jet for that purpose. The sheet is then engaged by forwarding devices also commonly in the form of pneumatic suckers which take the sheet from the lifting devices and are operated to enable the sheet to be forwarded to the printing machine.

Proposals have been made to stretch sheets by separating the lifting pneumatic suckers which lift the top sheet from a stack and present the stretched part of the sheet to a pneumatic forwarding device. In one such proposal the lifting suckers were disposed at the rear end of the sheet and pneumatic forwarding devices in the form of pneumatic suckers were arranged to grip the sheet in the region of the stretched portion of the sheet between the lifting suckers when these latter suckers were at or near the end of their lifting operation.

Now, the present invention utilises sheet lifting devices which are moved apart to stretch the top sheet as it is lifted from the stack but according to this invention the forwarding devices are disposed to engage the top sheet in a region where the sheet is not (or is not substantially) lifted or strained by the action of the lifting devices. The lifting devices are, with the presser foot and air blast nozzle, disposed to operate on the rear part of the sheets i. e. near their trailing edges regarded in their direction of feed to the printing machine and thus the forwarding devices (preferably in the form of pneumatic suckers) are disposed forwardly of the rear part of the sheet and preferably between the rear edge

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and the centre of the sheet where they exercise an efficient control. Obviously as the forwarding devices operate forward of the part of the sheet which is raised and stretched to facilitate sheet separation, these devices are enabled to effect their forwarding action by a movement which is in line more or less with the natural flat or horizontal condition of the sheet the sheet being at this part but little raised from the stack. This enables the forwarding devices to handle without difficulty sheets of different thicknesses; it may be observed that for thicker sheets the control is obviously exercised advantageously nearer the centre of gravity of the sheet. While affording the advantages referred to, the invention also enables the sheet feeder to be applied to what is commonly known as a "stream feeder" system where the leading edge of one sheet lies under the trailing part of the preceding sheet, the sheets passing in this fashion to sheet conveyors such as endless belts or rollers which convey the "stream" to the printing machines. The conveyors may travel either at a constant speed or have a variable speed or "slow down" motion timed to each cycle of operations to reduce the speed at which the sheet is delivered to the registering apparatus on the printing machine.

Reference will now be made to the accompanying drawing in which Figures 1 and 2 are respectively diagrammatic plan and side elevation while Figure 3 is a perspective view of the mechanism according to this invention at one side of a sheet stack it being understood that similar mechanism would be provided at the other side of the stack.

Referring to the drawings 1 indicates a stack of sheets from which sheets are to be taken and forwarded one at a time from the top, the stack being carried on a table which in the usual way is raised automatically to maintain the top of the stack at an approximately constant level as sheets are removed.

Disposed in a line over and parallel with the rear edge of the stack are two sheet lifting devices in the form of pneumatic suckers 2, 3. These suckers 2, 3 are arranged for movement not only towards and away from the stack but also laterally towards and away from one another as indicated by the arrows X.

There are also provided two "combing" wheels of which only one is shown at 4 and which are disposed one at each outer side of the lifting suckers 2, 3 to effect the formation of bulges at or near the rear corners of the sheets these bulges being engaged by the lifting suckers. Between

the lifting suckers is arranged one (or more) and as shown two nozzles 5, 6 formed to provide a presser foot to engage and hold the second sheet of the stack (and in consequence the other sheets of the stack) near or at its trailing edge.

With the mechanism so far described, the combing wheels are first lowered to the top sheet indicated at S and rotated to create the bulges near the rear corners of the top sheet of the stack; the lifting suckers 2, 3 are now rendered operative to take the sheets at the crest of the bulges so formed; the combing wheels are, with the presser feet 5, 6 now raised and then the lifting suckers 2, 3 are lifted and moved apart, the presser feet being also swung rearwardly clear of the rear edge of the top sheet S; these operations overlap to some extent so that the operation described causes the rear part of the top sheet S to be lifted and also stretched, the presser feet being clear of the sheet to allow its being lifted. This is the position of the parts shown in Fig. 3. The presser feet then continue their operation by being lowered and moved forwardly below the lifted and stretched rear edge of the top sheet S and so comes into contact with the second sheet to hold it as is shown in Figure 2; when the feet are in engagement with the second sheet air under pressure is supplied to the nozzle which directs the air forwardly between the top and second sheet of the stack and so assists in separating the two sheets.

In addition to the mechanism described, there are provided forwarding pneumatic suckers 7, 8 which are disposed over the sheet stack ahead of the lifting suckers 2, 3 and preferably between the centre and the rear edges of the sheets and in any case beyond the region in which the stretching of the top sheet between the lifting suckers has any appreciable effect.

These forwarding suckers 7, 8 of which there would be as shown at least two disposed in a line parallel with the rear edge of the sheets, could be arranged for a reciprocating movement as indicated by the arrows Y in a plane more or less parallel with the desired direction of sheet feed to effect the desired forwardly action: in addition they may have a raising and lowering motion imparted to them so as (in combination with the control of vacuum applied) to take charge of and release a sheet. These forwarding suckers 7, 8 and the lifting suckers are timed in their operation so that when suction is applied to the forwarding suckers it is released from the lifting suckers 2, 3 whereby the sheet is freed from restraint by the lifting suckers at the time that the forwarding suckers take charge of the top sheet S to effect their feeding operation. During part of the feeding operation, the air blast may continue to be directed between the top and second sheets to assist the forwarding suckers 7, 8 in the forwarding operation.

During the forwarding operation of the suckers 7, 8 the leading end of the top sheet S will pass to the control of the usual feed rollers or belts operating to feed the sheet to the printing machine, this sheet, when the "stream feeder" system is employed, being trapped, at its leading end, below the preceding sheet.

The forwarding mechanism may include a drop roller which is lifted to allow of the free passage of the leading edges of the sheets and then lowered to control and feed the sheets.

The mechanism for effecting the operation of the various parts may be of any known form: Figure 3 shows an arrangement of the mechanism which is so well-known that only a brief description of the mechanism will be sufficient, it being understood that this invention is not concerned with the mechanism but with the disposition of parts operating on the sheets.

The pneumatic suckers 2, 3 are carried each by an arm 12 supported by a bracket 13 pivotally carried about a vertical pivot 13^1 at the outer end of an arm 14 operated by a cam 15 on a shaft 16. As this cam rotates, the arm 14 is rocked to raise and lower the suckers 2, 3. The bracket 13 is caused by a fixed plate 17 to rock about the vertical pivot 13^1 as the bracket is raised and lowered and this imparts the movement of one sucker 2 away from the other sucker 3 to effect stretching of the sheet.

The presser feet 5, 6 are each carried by supports 18 depending from a plate 19 on an arm 20 caused to rock by a cam 21, the plate 19 having in it a cam slot 22 engaged by a fixed pin 23 so that as the arm 20 is rocked to raise and lower the foot 5 (or 6) the plate 19 is itself caused to rock by the cam 22 to swing the foot rearwardly to clear the lifted top sheet S and then forwardly between that sheet and the top of the stack.

The forwarding suckers 7, 8 are carried each on a slider 24 mounted on a fixed guide bar 25, the slider being coupled by a link 26 to an arm 27 on a shaft 28 which is caused to oscillate: thus the sucker 7 (or 8) is caused to reciprocate forwardly on its forwarding movement and rearwardly on its return movement.

The combing wheels 4 are rotatable each in a pivoted bracket 29 controlled by a cam 30 on the shaft 16, the cam raising and lowering the combing wheel which is rotated about its own axis by gearing indicated at 31.

The nozzles 9, 10 are carried from the arms 14 so that these nozzles can be adjusted laterally with the lifting sucker assembly.

The various parts are arranged for lateral adjustment (i. e. across the width of the sheet) by being slidable on guide rods 32, 33.

In addition to the air jets provided by the presser feet 5, 6 other air jets would be supplied from nozzles 9, 10 which could as shown be disposed to direct air jets in a vertical plane at the upper rear part of the stack: these jets are intended to pre-condition the stack for the removal of the top sheet as described and hence these jets would be rendered operative as early as possible in the cycle of operations. It is however preferred to carry these nozzles 9, 10 from the assembly of the suckers 2, 3 as has been described so that the nozzles 9, 10 are adjustable with the assembly for the suckers 2, 3; this however necessitates that the nozzles 9, 10 are lifted and lowered in step with the lifting and lowering of the suckers, 2, 3 and it thus follows that the timing of operation of the nozzles 9, 10 is governed by the timing of operation of the suckers 2, 3. As the arrangement of this invention provides forwarding suckers 7, 8 which are disposed to take the top sheet of the stack at a zone clear of the influence by the lifting suckers 2, 3 which in the preesnt case do not transfer the lifted and stretched edge of the top sheet to the forwarding suckers, it is possible to lower the lifting suckers 2, 3 and hence the nozzles 9, 10 at an early time and so to afford a prolonged period for the operation of the nozzles 9, 10. In fact in the present case the function of the lifting suckers 2, 3 is mainly to lift and stretch the rear edge of the top sheet S to facilitate the introduction of air jets

between that top sheet and the next sheet of the stack to ensure the separation of the top sheet S from the stack and the forwarding of that sheet alone by the forwarding suckers 7, 8.

To assist further in the separation of the sheets, other nozzles, only one of which is shown at 11 in Figure 3 can be provided to direct air jets at the side of the stack; these jets may in some cases enable the combing wheels 4 to be dispensed with.

The bars 25 may be mounted at their rear ends for adjustment about vertical axes; this would enable the bars to be adjusted in relation to the edges of the stack to enable the direction of movement followed by the sliders 24 to be set to suit the individual stacks being handled, the bars being of course locked in the selected position.

What I claim is:

1. In mechanism to take and forward sheets from a stack, the combination of sheet-lifting devices, means to support said devices in spaced relationship at the rear end portions of the top sheet of the stack, means to raise and move apart the said devices to raise and strain the rear end of the top sheet, a combined presser-foot and air-blast member, means to introduce the said member between the lifted and strained top sheet and the next sheet of the stack, means to supply air under pressure between the lifted and strained portion of the top sheet and the next sheet, sheet forwarding devices, means to hold said forwarding devices in position to engage said top sheet ahead of the position of the lifting devices and beyond the area raised and strained thereby, and means to operate said forwarding devices to forward the top sheet from the stack.

2. In mechanism to take and forward sheets from a stack, the combination of sheet-lifting devices, means to support said devices in spaced relationship at the rear end portions of the top sheet of the stack, means to raise and move apart the said devices to raise and strain the rear end of the top sheet, a combined presser-foot and air-blast member, means to introduce the said member between the lifted and strained rear part of the top sheet, sheet forwarding devices, means to hold said forwarding devices in position to engage said top sheet ahead of the position of the lifting devices and beyond the area raised and strained thereby, and means to operate said forwarding devices to forward the top sheet from the stack.

3. In mechanism to take and forward sheets from a stack, the combination of sheet-lifting devices, means to support said devices in spaced relationship at the rear end portions of the top sheet of the stack, means to raise and move apart the said devices to raise and strain the rear end of the top sheet, combined presser-foot and air-blast members, means to introduce the members between the lifted and strained top sheet and the next sheet of the stack to supply air under pressure between the lifted and strained portion of the top sheet and the next sheet, means to direct air under pressure against the rear edge portions of the upper part of the stack, sheet forwarding devices, means to hold said forwarding devices in position to engage said top sheet ahead of the position of the lifting devices and beyond the area raised and strained thereby, and means to operate said forwarding devices to forward the top sheet from the stack.

4. In mechanism to take and forward sheets from a stack, the combination of sheet-lifting devices, means to support said devices in spaced

relationship at the rear end portions of the top sheet of the stack, means to raise and move apart the said devices to raise and strain the rear end of the top sheet, a combined presser-foot and air-blast member, means to introduce the said member between the lifted and strained rear part of the top sheet, means to direct air under pressure against the rear edge portions of the upper part of the stack, sheet forwarding devices, means to hold said forwarding devices in position to engage said top sheet ahead of the position of the lifting devices and beyond the area raised and strained thereby, and means to operate said forwarding devices to forward the top sheet from the stack.

5. In mechanism to take and forward sheets from a stack, the combination of sheet-lifting devices, means to support said devices in spaced relationship at the rear end portions of the top sheet of the stack, means to raise and move apart the said devices to raise and strain the rear end of the top sheet, a presser-foot mechanism, means to introduce the mechanism between the lifted and strained top sheet and the next sheet of the stack to supply air under pressure between the lifted and strained portions of the top sheet and the next sheet, sheet forwarding devices, means to support and constrain the forwarding devices for movement in sheet-forwarding direction and to hold the devices in position to engage the top sheet ahead of the position of the lifting devices and beyond the area raised and strained thereby, means to move the forwarding devices in sheet forwarding direction and means to adjust the setting of the supporting means for the sheet forwarding devices in relation to the stack.

6. In mechanism to take and forward sheets from a stack, the combination of sheet-lifting devices, means to support said devices in spaced relationship at the rear end portions of the top sheet of the stack, means to raise and move apart the said devices to raise and strain the rear end of the top sheet, a combined presser-foot and air-nozzle member, means to introduce the said member between the lifted and strained rear part of the top sheet, sheet forwarding devices, means to support and constrain the forwarding devices for movement in sheet forwarding direction and to hold the devices in position to engage the top sheet ahead of the position of the lifting devices and beyond the area raised and strained thereby, means to move the forwarding devices in sheet forwarding direction and means to adjust the setting of the supporting means for the sheet forwarding devices in relation to the stack.

7. For forwarding sheets singly from a stack, means to lift and strain the rear end portion of the top sheet of the stack, means to introduce between the raised part of the top sheet and the next sheet of the stack a member to hold the next sheet of the stack and to supply air under pressure between the two sheets, and means to take the top sheet at a zone ahead of the raised portion and to forward the sheet.

8. For forwarding sheets singly from a stack, means to lift and strain the rear end portion of the top sheet of the stack, means to introduce between the raised part of the top sheet and the next sheet of the stack a member to hold the next sheet of the stack and to supply air under pressure between the two sheets, means to direct air under pressure against the upper part of the rear portion of the stack, and means to take the top sheet at a zone ahead of the raised portion and to forward the sheet.

9. For forwarding sheets singly from a stack, means to lift and strain the rear end portion of the top sheet of the stack, means to direct air under pressure against the upper portion of the rear end of the stack, the said two means forming a unitary structure, means to introduce between the raised part of the top sheet and the next sheet of the stack a member to hold the next sheet of the stack and to supply air under pressure between the two sheets, and means to take the top sheet at a zone ahead of the raised portion and to forward the sheet.

10. For forwarding sheets singly from a stack, means to create a bulge in the rear part of the top sheet of the stack, means to engage the bulged portion of the top sheet to lift and strain the said rear end portion of the top sheet, means to introduce between the raised part of the top sheet and the next sheet of the stack a member to hold the next sheet of the stack and to supply air under pressure between the two sheets and means to take the top sheet at a zone ahead of the raised portion and to forward the sheet.

11. For forwarding sheets singly from a stack, means to create a bulge in the rear part of the top sheet of the stack, means to engage the bulged portion of the top sheet to lift and strain the rear end portion of the sheet, means to introduce between the raised part of the top sheet and the next sheet of the stack a member to hold the next sheet of the stack and to supply air under pressure between the two sheets, means to direct air under pressure against the upper part of the

rear portion of the stack and means to take the top sheet at a zone ahead of the raised portion and to forward the sheet.

12. For forwarding sheets singly from a stack, means to create a bulge in the rear part of the top sheet of the stack, means to engage the bulged portion of the top sheet to lift and strain the rear end portion of the top sheet, means to direct air under pressure against the upper portion of the rear end of the stack, the said two means forming a unitary structure, means to introduce between the raised part of the top sheet and the next sheet of the stack a member to hold the next sheet of the stack and to supply air under pressure between the two sheets, and means to take the top sheet at a zone ahead of the raised portion and to forward the sheet.

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