June 5, 1956 A. P. BATTEY 2,749,119

PNEUMATIC SHEET-TAKING APPARATUS

Filed Sept. 22, 1951 3 Sheets-Sheet 1

FIG. 1.

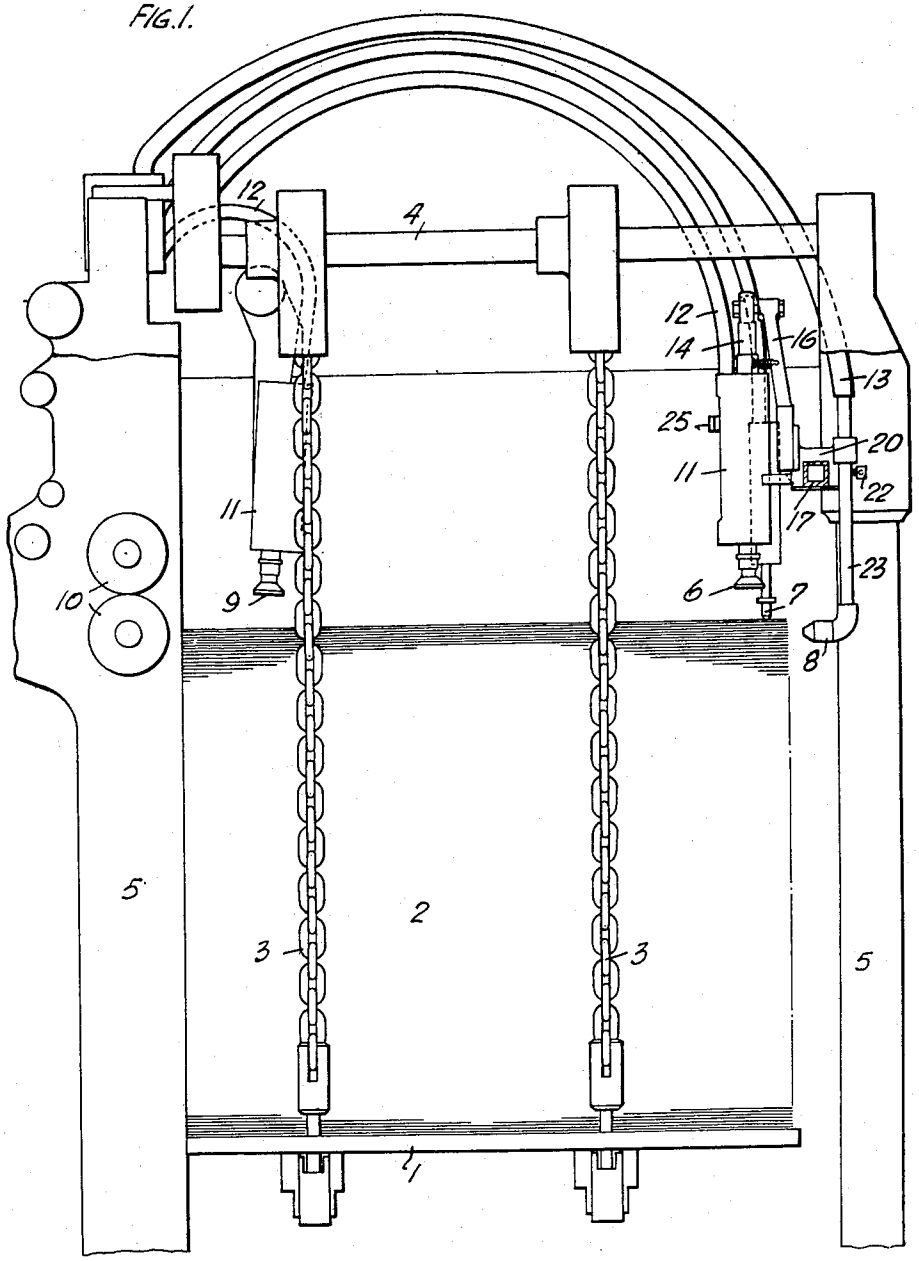
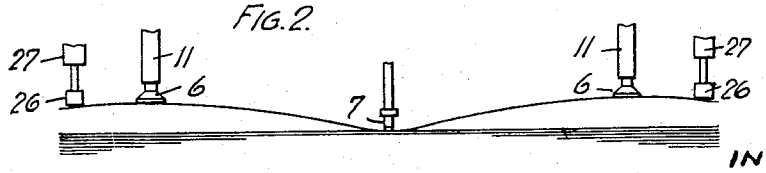


FIG. 2.



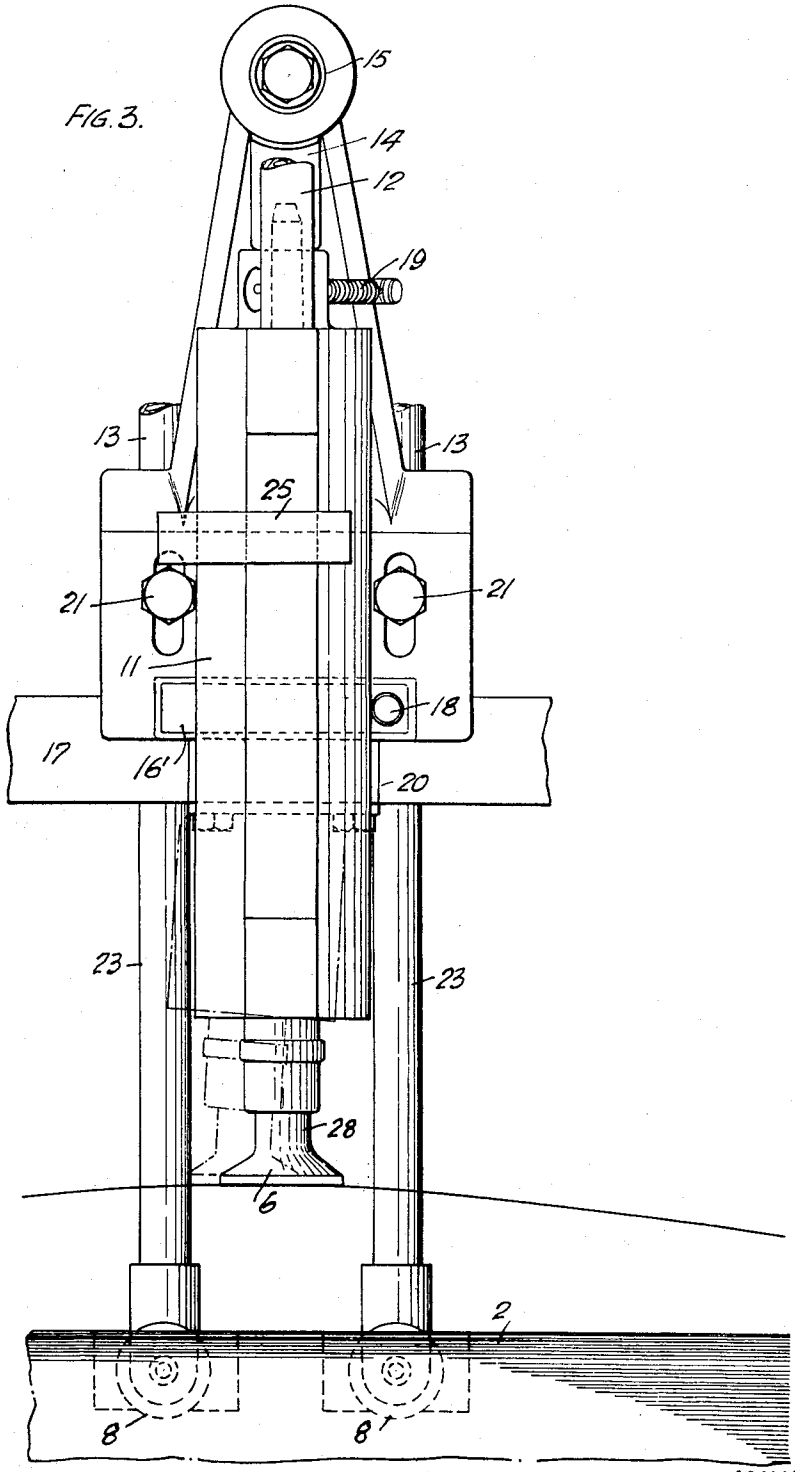
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PNEUMATIC SHEET-TAKING APPARATUS

Filed Sept. 22, 1951 3 Sheets-Sheet 2

FIG. 3.



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PNEUMATIC SHEET-TAKING APPARATUS

Filed Sept. 22, 1951 3 Sheets-Sheet 3

FIG. 4.

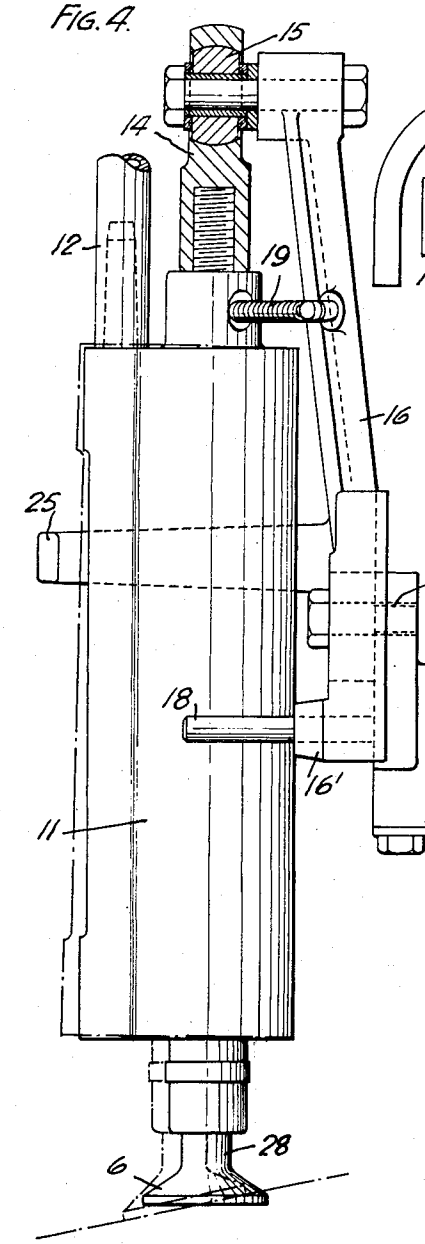
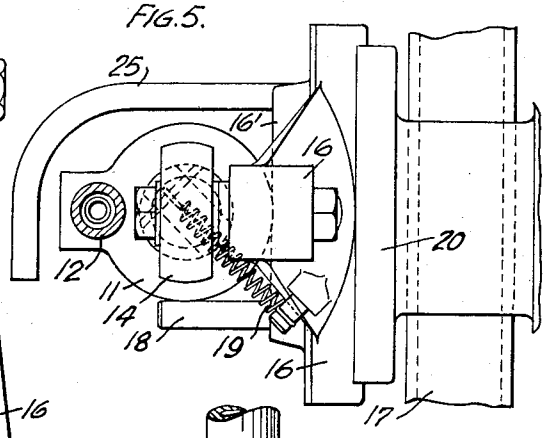


FIG. 5.



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2,749,119

PNEUMATIC SHEET-TAKING APPARATUS

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Application September 22, 1951, Serial No. 247,791

1 Claim. (Cl. 271—26)

This invention relates to sheet-taking apparatus of the well-known kind employing pneumatic suckers which are carried by pneumatic reciprocatory ram and cylinder arrangements by which the suckers are lowered on to a sheet and are then raised to lift the engaged part of the sheet by suction applied to the sucker.

It is common to use such arrangements in combination with presser feet which operate to hold down the top sheet of a pile of sheets while the sucker is raised to carry with it the corner of the top sheet. By this means, the corner of the sheet is bent and this facilities the separation of the top sheet from the pile. Usually a pair of ram, cylinder and sucker arrangements are used, one for each corner region at the rear end of the sheet.

It is obvious that while the corner of the sheet is being bent, the position of the zone of engagement of the sucker tends to shift towards the centre of the sheet. The sucker however is constrained to move along a rectilinear path by reason of the reciprocatory action of the ram and cylinder which raises the sucker at this time.

The ram and cylinder assembly is usually set in a fixed position normal to the plane of the top sheet of the pile and on account of the change in position due to the bending of the corner of the sheet this normal arrangement tends to impose a strain on the sheet and may in some cases make it difficult to obtain satisfactory feeding of the sheets.

A proposal has been made to set the ram and cylinder arrangement at a fixed angle to the normal to the sheet, the angle of set being calculated to enable the rising of the sucker to approximate to the change in position of the engaged part of the sheet.

Now according to this invention the ram and cylinder assembly is supported, from a point above the sheet engaging face of its sucker, for free universal swinging movement from a datum position at least within limits corresponding to movement of the sucker from the side edge towards the longitudinal centre of the sheet and parallel with the length of the sheet, usually from the rear edge towards the front edge of the sheet.

The datum position would generally be the vertical normal to the plane of the top sheet of the pile, this being the optimum position enabling the sucker to take hold of the sheet initially. As the sucker is raised to bend the sheet, the assembly is enabled, by the universal movement, to swing to enable it to accommodate itself with a shelf-adjusting action to the change in the position of the part of the sheet held by the sucker. The invention thus enables straining of the sheet to be avoided and moreover it is self-accommodating to the requirements of the different classes of sheet material which require to be handled.

It will be understood that when as is usual a ram, cylinder and sucker assembly is provided for each rear corner of a sheet, the assemblies would be set to have their free movement within the limits towards one another and towards the front of the sheet.

It would usually be desirable to bias the ram, cylinder and sucker assembly to its datum position by a relatively light spring which would offer no appreciable resistance to the permitted universal movement.

The support for the assembly can be afforded by any normal universal joint (e. g. a ball or a Hooke's Joint) and the limit can be set by lugs set to engage the outer wall of the cylinder of the assembly, the spring operating to urge the cylinder against those lugs.

The invention is illustrated in the accompanying drawing in which Figure 1 is an end elevation of a sheet feeder incorporating apparatus according to the invention, Figure 2 a diagrammatic end elevation to a smaller scale showing the disposition of the parts essential to this invention and Figures 3, 4 and 5 are detail views of that apparatus, Figure 3 being an end elevation, Figure 4 a side elevation and Figure 5 a plan view.

Referring firstly to Figure 1, there is employed a board 1 which supports a pile 2 of sheets, the board 1 being itself carried by chains 3 or other flexible supports. These chains depend from a shaft 4 carried by a frame 5, the chains being operated at intervals to maintain the top sheet of the pile 2 at a sensibly constant level at which that top sheet is within the "reach" of a pneumatic sucker 6 disposed over the rear edge of the top sheet. The rear edges of the sheets are also engaged by a presser foot 7. Disposed behind the rear edge of the pile 2 are nozzles 8 to which air under pressure is supplied at intervals to assist in separation of the top sheet of the pile 2 and to facilitate its being forwarded to the machine which is to operate on the sheets by forwarding pneumatic suckers 9 which pass the leading end of the sheet between forwarding rollers 10.

The various suckers are carried by supports which usually are formed by cylinders 11 which contain rams by which the suckers are raised and lowered. Suction is applied to the various suckers and their cylinders through flexible pipes 12 and air under pressure is supplied to the nozzles 8 through flexible pipes 13 the control of suction and pressure air being effected in relation to the speed of the machine.

The mechanism so far referred to is very well known and it is believed to be sufficient to say that the suckers 6 are lowered on to the top sheet, the suction causes the suckers to take hold of the rear end of the sheet and then the suckers 6 are lifted. During this time the presser foot 7 engages the top sheet so that the rear end of the top sheet is bent up about the foot by the lifting of the suckers 6 as is shown most clearly in Figure 2. Air is supplied to the nozzles 8 when the suckers 6 are lowered and the air supply is maintained during the lifting of the suckers so that the top sheet is conditioned to be taken and carried forward by the forwarding suckers 9.

The present invention is concerned with the suckers 6. It will be seen that as the suckers 6, having taken charge of a sheet, are caused to rise to bend the sheet about the presser foot 7, the distance, measured along a straight line joining the zones at which the suckers engage the sheet, tends to become smaller due to the bending of the sheet.

This tendency to shorten obviously places strain on the sheet which remains held by the suckers and it is the purpose of this invention so to arrange the suckers 6 that they can accommodate themselves to the sheet and thus avoid straining it.

For that purpose, instead of as usual mounting the cylinders 11 of the suckers 6 fixedly in position they are mounted to swing. This is effected as is shown best in Figures 3–5 by extending from the upper ends of each of those cylinders 11 a lug 14 which at its upper end has a transverse bore formed to cooperate with a part ball support 15 comprising an annular member formed with

a periphery having a spherical curvature and secured to the upper end of a bracket **16** which is carried by a rail **17**. The free universal pendently swinging movement of the cylinder **11** on the support **15** is limited to its useful movement between a line from the outside edge of the sheet towards the longitudinal centre line of the sheet and from the rear edge towards the front edge of the sheet. Between those limits, the cylinders **11** can obviously swing freely as the sheet is bent about the gripper feet **7** and so the suckers accommodate themselves to the sheet and avoid straining the sheet.

The limit of movement is imposed on the cylinders **11** in the one direction by a lug **16'** on the bracket **16** itself and in the other direction by a pin **18** secured to the bracket as is shown most clearly in Figure 5. To impose a light return force to the cylinder **11** so that it assumes a normal initial position in readiness to take a sheet, a light spring **19** may be fitted.

In general the initial position of the cylinders **11** of the two suckers **6** would be normal to the plane of the top sheet of the pile **2**, and of course it will be understood that the two cylinders would be respectively right handed and left handed as regards one of the limits of their permitted free movement, i. e. while both cylinders **11** would be free to swing in a longitudinal direction from the rear to the front edge of the top sheet, one would be free to swing transversely only from the left hand side of the sheet towards the longitudinal centre of the sheet while the other would be free to swing transversely only from the right-hand edge towards that centre.

The brackets **16** are adjustable as to height with respect to the rail **17**, this being achieved by mounting on the rail brackets **20** on which the brackets **16** are adjustable by bolt or slot connection **21**. The brackets **20** themselves can be slid along the rail **17** and locked in selected positions by bolts **22** and these brackets **20** may serve to carry tubes **23** which support the nozzles **8** and convey pressure air to them from the flexible pipes **13**.

In order to prevent each of the cylinders **11** of the suckers **6** from being accidentally swung in their free directions to an excessive amount a lug **25** may extend from the bracket **16** and around the cylinder **11**, the bracket leaving such ample clearance with respect to the cylinder **11** that the free movement of the cylinder is unimpeded by the lug **25** during the range of movement likely to be encountered in practice.

As is shown in Figure 2 freely supported guided weights **26** are preferably disposed over the rear corners of the sheet, these weights being free to rise and fall on guides **27**. In the case of sheets of stiff material (e. g. tin sheets) the corners of the sheet are apt when raised by the suckers **6** to have an excessive upward cant. However the provision of the guided weights **26** avoids this defect by imposing sufficient restraint on those corners to give them a reverse bend as shown.

The presser foot **7** may be of any usual form but as shown it is of the form described in the pending application Serial No. 247,792, filed September 22, 1951, in which the presser foot functions also as a detector for the height of the pile **2** as is fully described in that application.

To compensate for the different angles which the face of the sucker **6** engaging the sheet has to assume due to the raising and bending of the sheet the sucker can be carried by a flexible connection such as a ball and socket joint or as shown the sucker itself may be formed with a flexible neck **28** which will allow the necessary variation in position of the sucker face.

What I claim is:

In a sheet feeder for a printing machine, a pile support, a presser foot to engage the top sheet of a pile on the support, means for advancing a sheet from the pile and means for separating the top sheet of the pile to enable it to be taken by the advancing means, the said separating means comprising a pair of cylinders located over positions near the rear edge and inward from each side edge of the pile and having rams carrying pneumatic suckers arranged to be lowered to the top sheet of the pile and then raised to bend the sheet and separate it from the pile, and in combination, means for pendently supporting the cylinders of the separating means for swinging movement of the suckers and means for swinging the suckers inwardly toward the center of the pile when lifting and bending a sheet, and forwardly when the sheet is being advanced by the said advancing means, a pair of brackets fixed on the machine, an annular part ball member secured to each bracket and formed with a periphery having a spherical curvature, a lug on the upper part of each cylinder having a transverse bore formed to cooperate with the periphery of the part ball member, first stops on the brackets to limit the range of swinging movement of the cylinders outwardly and backwardly, spring means to hold the cylinders resiliently against the stops in a datum position determined by the stops, second stops on the bracket to limit the extent of swinging movement inwardly and forwardly, and a pair of restraining weights supported over points nearer the rear corners of the pile than the points engaged by the suckers, each weight having a guide restricting it to motion in a vertical direction when it is engaged by a sheet being lifted by the suckers and thereby reducing the height to which the corners of the sheet are raised.

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