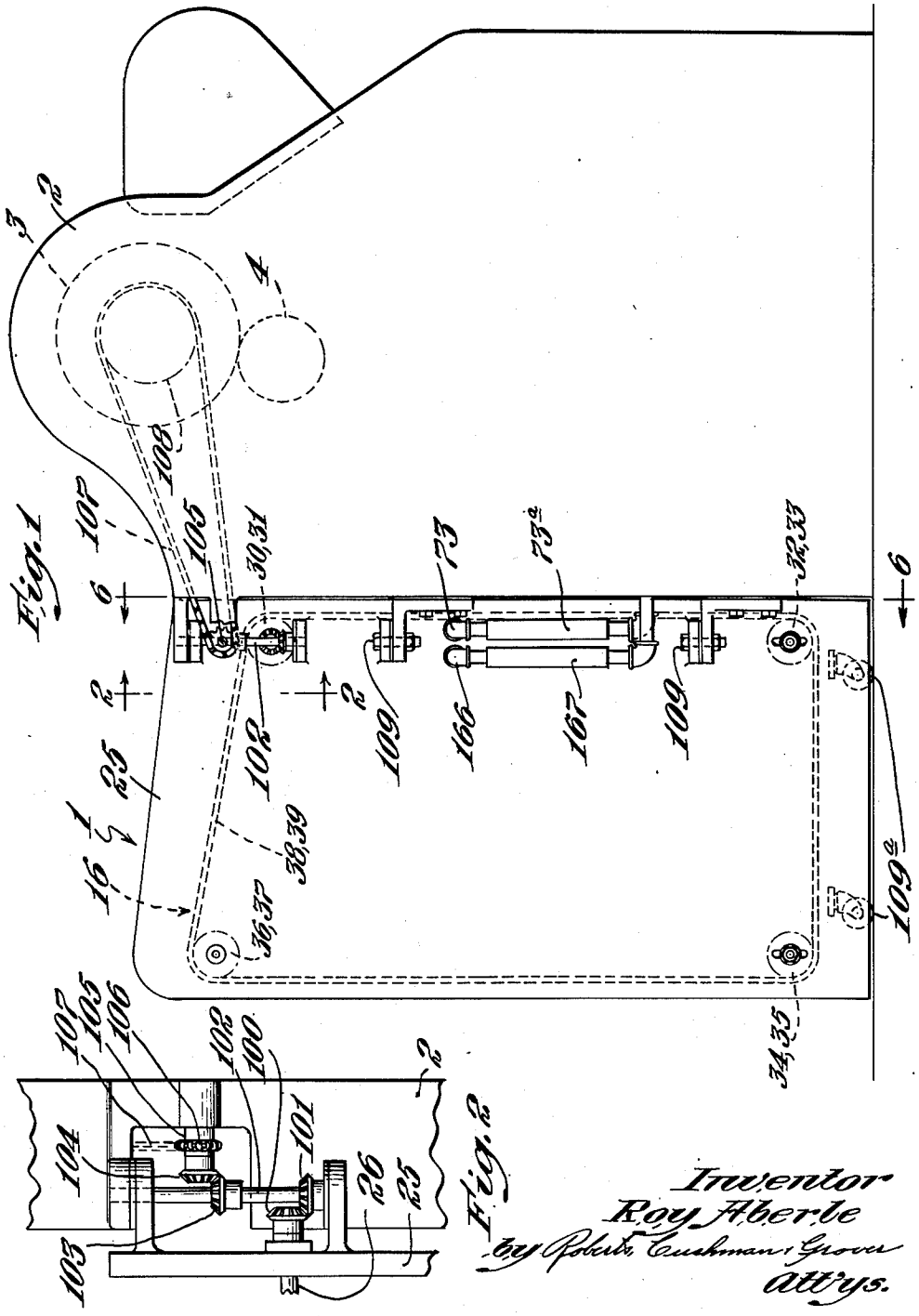
Feb. 21, 1950 R. ABERLE 2,497,849

SHEET FEEDING MACHINE

Filed April 25, 1945 8 Sheets-Sheet 1



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SHEET FEEDING MACHINE

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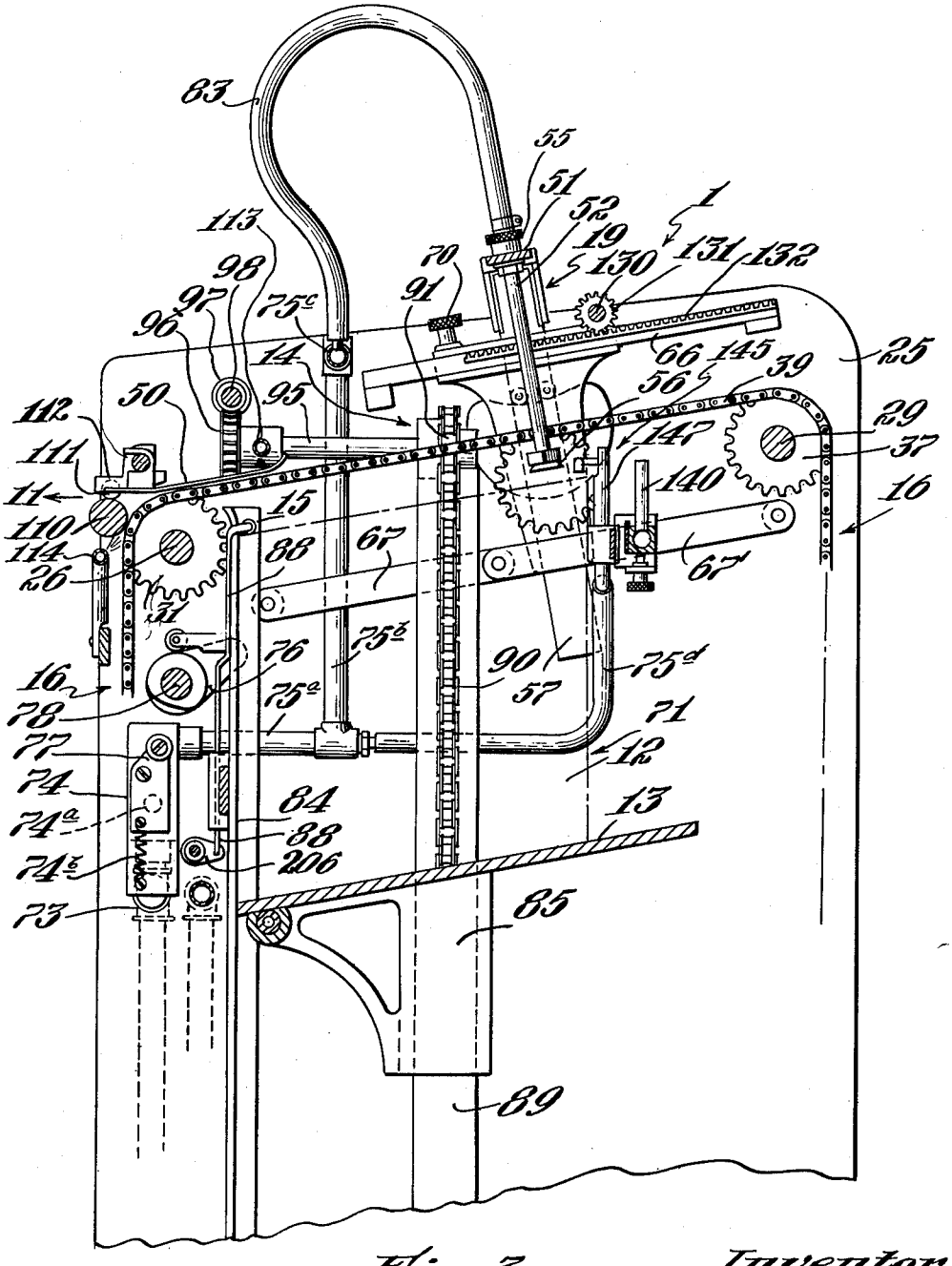


Fig. 3

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SHEET FEEDING MACHINE

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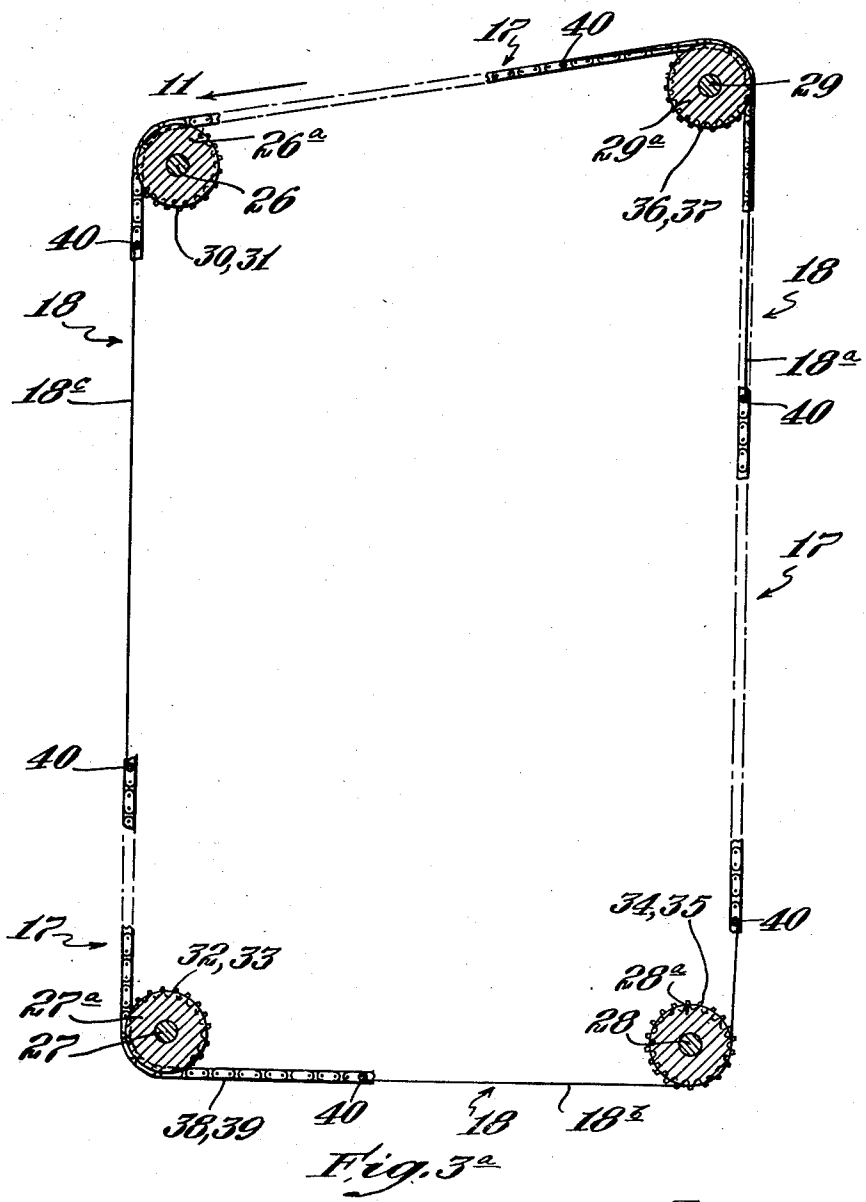


Fig. 3a

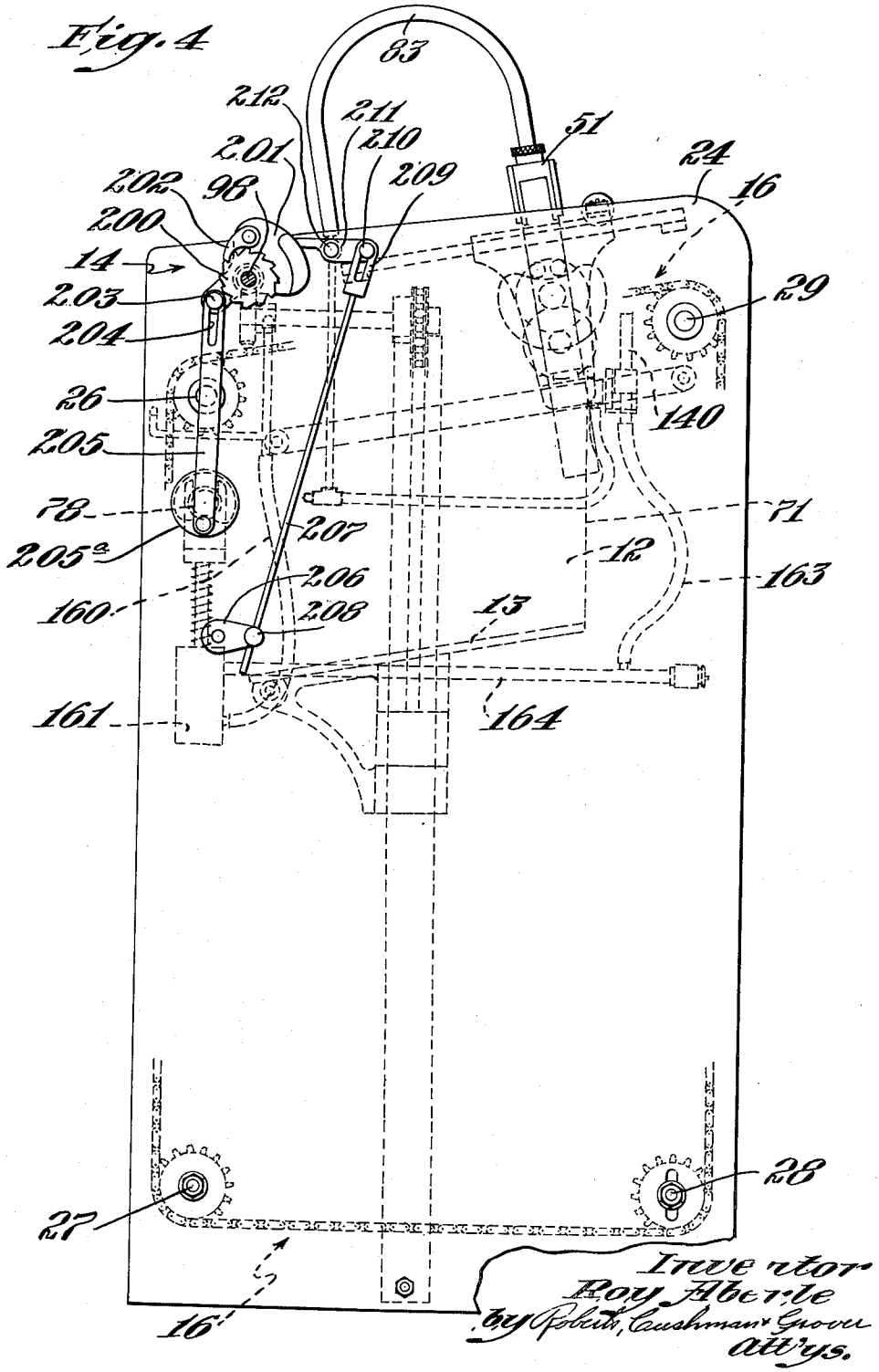
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SHEET FEEDING MACHINE

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Fig. 4



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SHEET FEEDING MACHINE

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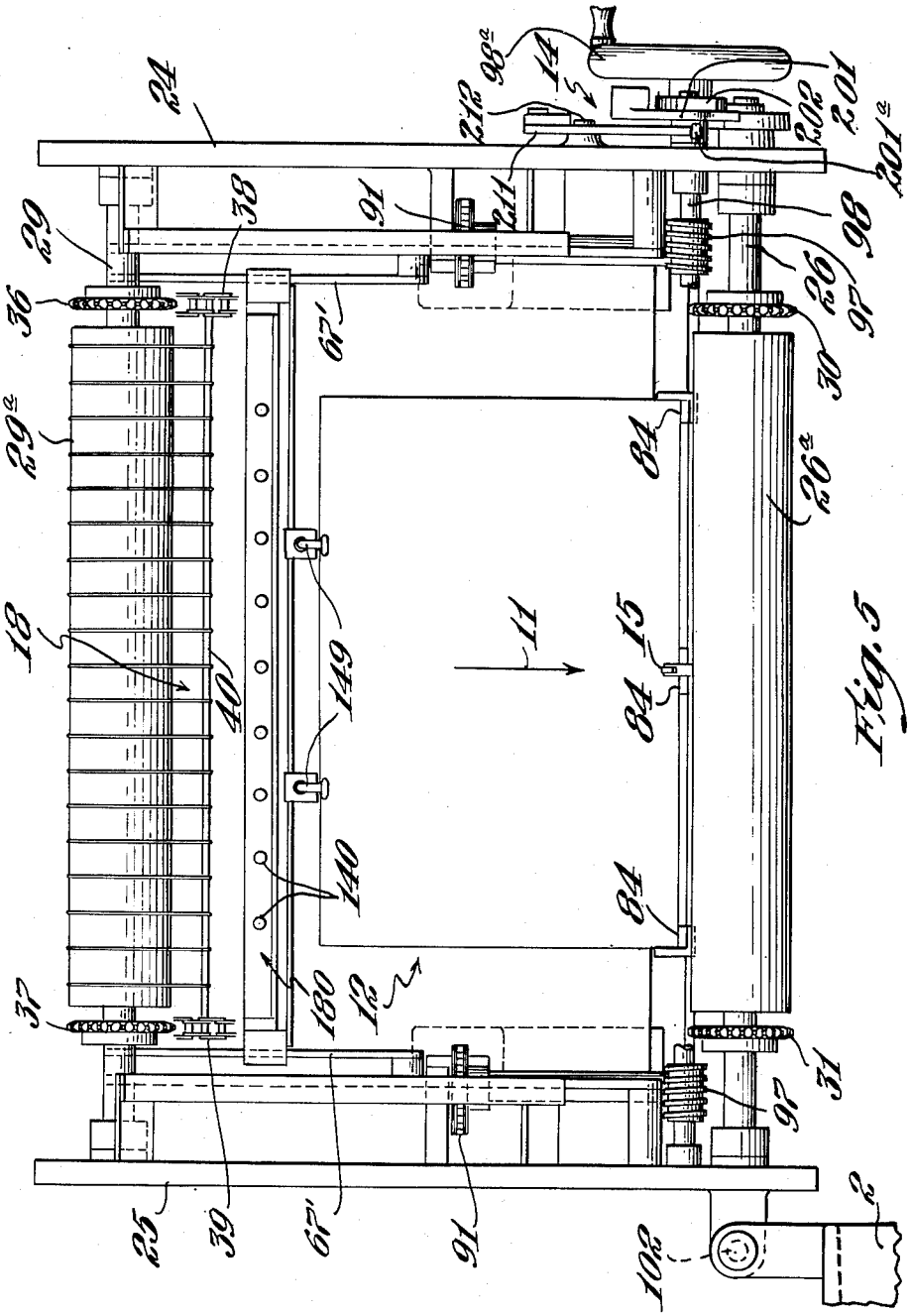


Fig. 5

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SHEET FEEDING MACHINE

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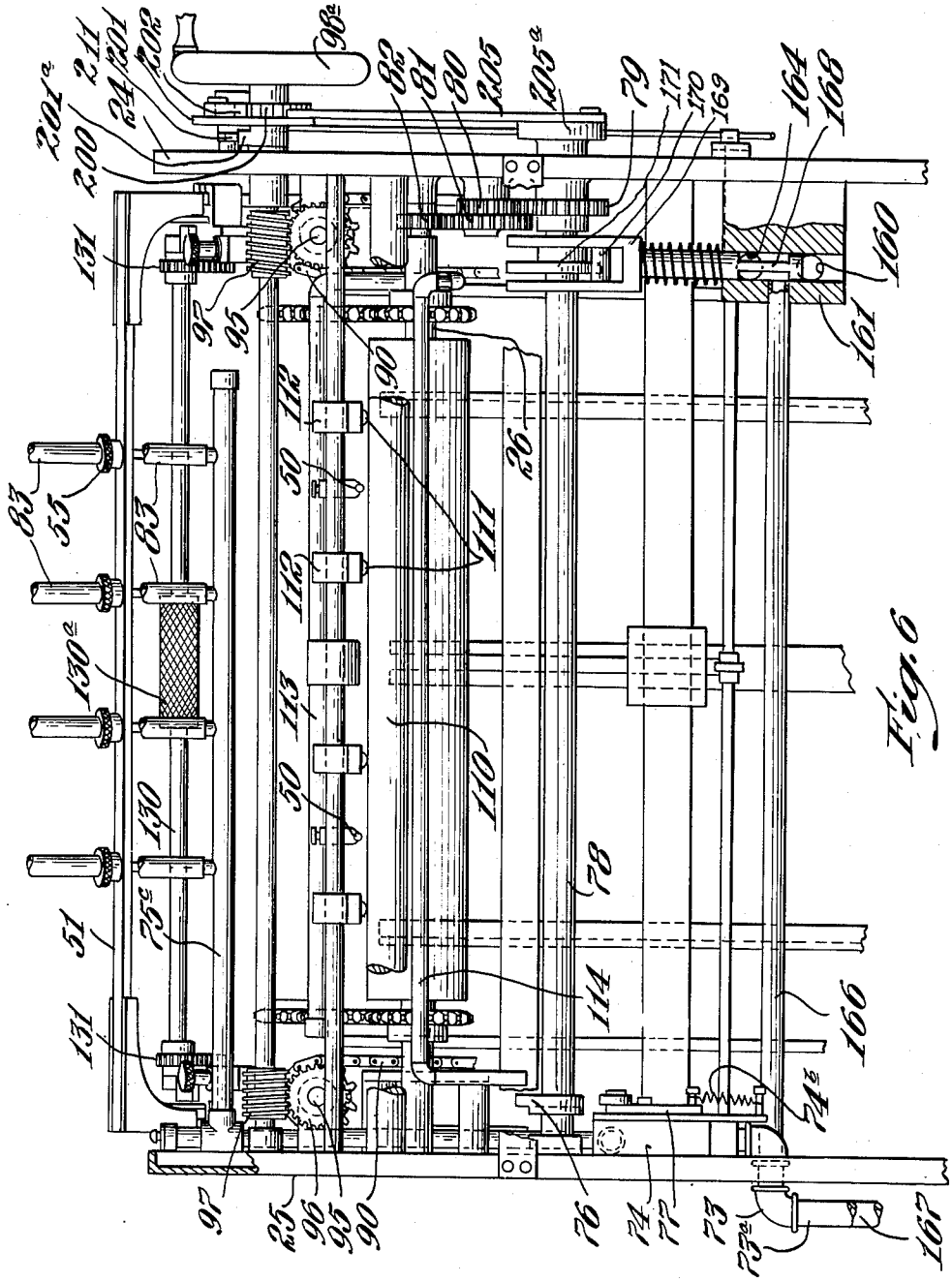


Fig. 6

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SHEET FEEDING MACHINE

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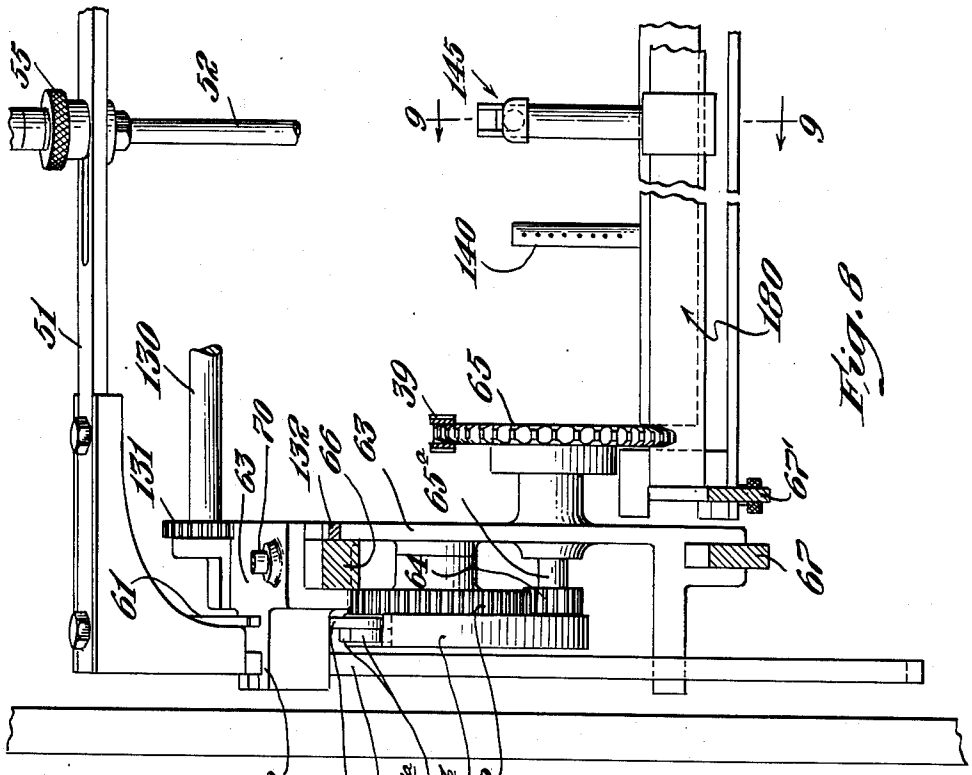


Fig. 6

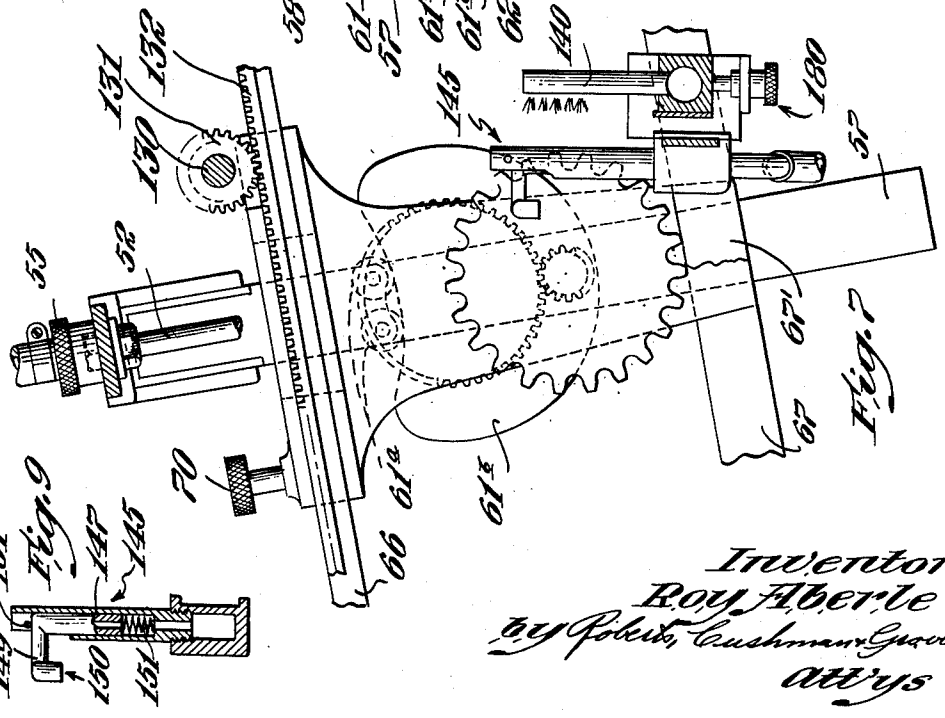


Fig. 7

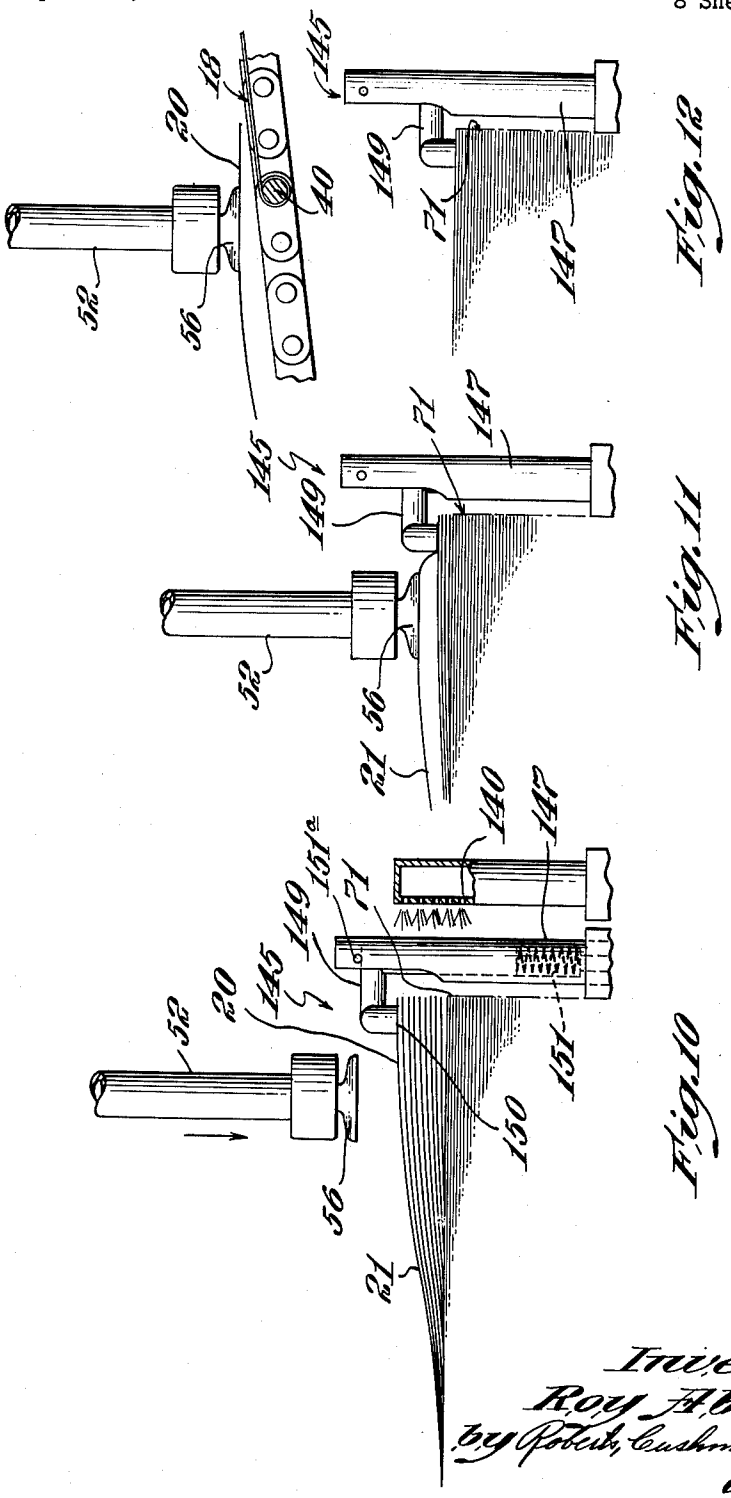
Fig. 9

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SHEET FEEDING MACHINE

Filed April 25, 1945 8 Sheets-Sheet 8



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2,497,849

UNITED STATES PATENT OFFICE

2,497,849

SHEET FEEDING MACHINE

Roy Aberle, Portland, Maine, assignor to Southworth Machine Company, Portland, Maine, a corporation of Maine

Application April 25, 1945, Serial No. 590,225

19 Claims. (Cl. 271—12)

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This invention relates to mechanism for feeding stacked sheets of paper successively, and is especially adapted for use in feeding sheets to a printing machine such for example as a high-speed lithographic press.

An object of the invention is to provide a mechanism adapted to handle stacks of paper of various sheet lengths, the mechanism being adapted first to lift the edge portion of the sheet which is to constitute the trailing edge portion when the sheet is carried away from the stack, and including a conveyor to carry the sheet away from the stack, with provision for having the leading edge of the conveyed sheet occupy a substantially uniform position on the conveyor regardless of the sheet length.

The invention involves a feeder of the type in which sheet picker mechanism moves through an open portion of a conveyor, into and out of the space enclosed by the conveyor, lifts up the trailing edge portion of the top sheet of the stack and holds such edge portion above the conveyor until a closed portion of the conveyor enters between this top sheet and the other sheets of the stack and completely separates this top sheet from the stack, whereupon the sheet is released to travel with the conveyor.

An object of the invention is to provide for adjustment of the position of the sheet picker mechanism to accommodate stacks of paper of various sheet lengths, and to provide for setting back the cycle of movement of the picker mechanism when the picker mechanism is moved in the direction in which the sheets are carried by the conveyor, and for setting forwardly the cycle of movement of the picker mechanism when the picker mechanism is moved opposite to the direction in which the sheets are carried by the conveyor.

A preferred form of mechanism for thus setting the cycle of movement of the picker mechanism back or forwardly in accordance with the adjustment of the position of the picker mechanism includes a chain movable with the conveyor and a sprocket in constant mesh with the chain and shiftable with the picker mechanism when the latter is so adjusted, with driving connections between the sprocket and the picker mechanism. The chain is preferably itself one of the chains which supports and drives the conveyor.

A further object of the invention is to provide for fanning out the trailing edge portions of the top sheets of the stack preparatory to engagement of the picker mechanism with the top sheet.

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Another object is to provide for bending the trailing edge portion of the top sheet of the stack so as to break the attraction between the top two sheets and aid in preventing any but the top sheet from being lifted above the level of the closed portion of the conveyor, and a further object is to provide improved mechanism for holding the next to the top sheet down.

A further object is to correlate with the movement of the conveyor the actions of the suction picker mechanism that moves in and out of the space enclosed by the conveyor, and to correlate with the suction picker mechanism the action of sheet-fanning and hold-down mechanism that act on the stack within the space enclosed by the conveyor.

A further object is to provide an interconnection between the sheet-feeding mechanism and a sheet-treating machine such, for instance, as a printing press, that will maintain timed relation between the feeding mechanism and the sheet-treating machine but will permit the sheet-feeding mechanism to be swung to give access to the entrance end of the sheet-treating machine.

Other objects and advantageous features of the invention will be apparent from this specification and its drawings wherein the invention is explained by description and illustration of a preferred example.

In the drawings, in which similar reference characters designate corresponding parts throughout the several views,

Fig. 1 is a side elevation of a sheet-feeding mechanism according to this invention, operatively connected to a lithographic printing machine.

Fig. 2 is a fragmentary vertical section on the line 2—2 of Fig. 1 showing the driving interconnection between the main cylinder of the printing machine and the feeding mechanism.

Fig. 3 is a central vertical sectional view of the feeding mechanism.

Fig. 3ª is a diagrammatic view, from the same point of view as Fig. 3, showing the conveyor.

Fig. 4 is a side elevation of the feeding mechanism.

Fig. 5 is a plan view of the feeding mechanism with certain parts removed showing a fragment of the press to which the feeding mechanism is attached.

Fig. 6 is an elevation of the feeding mechanism as viewed from its delivering end, that is, as viewed from the left of Figs. 3 and 4 and from the line 6—6 of Fig. 1.

Fig. 7 is a fragmentary view of the picker mech-

anism, separator mechanism and hold-down mechanism of Fig. 3 on a larger scale.

Fig. 8 is a fragmentary view of the mechanism of Fig. 7 as viewed from the left side of Fig. 7.

Fig. 9 is a vertical sectional view on the line 9—9 of the hold-down mechanism of Fig. 8.

Fig. 10 is a diagrammatic view of a suction picker nozzle, a suction stripper nozzle and an air blast for fanning the trailing edge portions of the top sheets of the stack.

Fig. 11 is a view similar to Fig. 10 showing a subsequent position of the stripper nozzle.

Fig. 12 is a view similar to Fig. 11 showing a subsequent position of the suction picker nozzle.

A preferred form of feeding machine according to this invention is indicated generally at 1 in Fig. 1 and shown as combined with a lithographic printing press 2 of the general type described in my United States Patent No. 2,257,490. The press includes a main drum 3 serving both as a carrier for the lithographic sheet or plate and as the platen member in printing, and includes a rubber covered offset or blanket drum 4 of half the circumference of the main drum 3. For simplicity of illustration the various other sheet handling elements of the press, such as the sheet conveyor mechanism and the movable paper stops are not shown, it being sufficient to refer to said patent as showing suitable constructions by which all of these mechanisms are driven from the drums 3 and 4, it being understood that these drums are themselves positively driven by a suitable motor. This press may be referred to as illustrative of one form of sheet-treating machine with which the feeding mechanism of the present invention is adapted to be combined.

As indicated in Figs. 4 and 5 a stack 12 of paper is carried upon the upper surface of a table 13 which is automatically elevated by elevating means indicated generally by the reference character 14 controlled by a paper stack control feeler roller 15 as hereinafter described. The leading edges of the sheets, as they lie in the stack 12, are abutted against and aligned by stationary vertical guides 84 (Fig. 3), and the paper stack table 13 may, as shown, be mounted at an inclination to the horizontal.

A conveyor 16, having open portions 17 alternating with relatively closed portions 18 is mounted for continuous travel around the paper stack 12, clockwise as seen in Fig. 1 and counterclockwise as seen in Figs. 3, 3a and 4. Single sheet-elevating picker mechanism indicated generally at 19 is adjustably positionable lengthwise of the direction of travel of the conveyor past the picker mechanism and is reciprocatable up and down in timed correlation with the movement of the conveyor 16 so that a portion of the mechanism 19 may go down through the open portions 17 of the conveyor and then lift the right hand edge portion 20 (Figs. 10–12) of the top sheet 21 of the stack 12, up above the path of the conveyor, as hereinafter described more fully. The sheet elevating picker mechanism 19 maintains the portion 20 of the sheet 21 in an elevated position above the level of the conveyor 16 thereat so that a relatively closed portion 18 of the conveyor may pass beneath the sheet 21 and complete the separation of this sheet from the stack. When the sheet 21 is completely superposed upon a closed portion 18 of the conveyor, the picker mechanism 19 releases its temporary hold upon the sheet 21 and allows the same to fall by gravity upon the portion 18. The closed portion 18 of the conveyor, moving to the left (Fig. 3a), toward the printing press, transports the sheet 21 into the press in the direction of the arrow 11 (Figs. 3 and 3a).

The frame of the feeding mechanism consists primarily of two spaced vertical frame plates 24 and 25, maintained in substantially fixed relation to each other by suitable tie bars well known in the art.

Trunnioned between the inner opposed surfaces of the plates 24 and 25 are a plurality of axles 26, 27, 28 and 29, free to rotate in bearings on plates 24 and 25. The axles 26–29 inclusive, carry keyed thereupon pairs of sprockets 30—31, 32—33, 34—35, 36—37 (see Figs. 1 and 3). Encircling and engaged with the sprockets 30, 32, 34 and 36 is a sprocket chain 38; while encircling the sprockets 31, 33, 35 and 37 in a sprocket chain 39. Joining the chains 38 and 39 are cross bars 40. These bars in addition to interconnecting the chains 38 and 39 at the extremities of said bars, have attached thereto carrier cords which constitute the relatively closed portions 18 of the conveyor, the three sets of carrier cords being indicated respectively by reference characters 18a, 18b and 18c. Each of said sets of cords may for example include nineteen cords as shown in Fig. 5.

Three sets of cords 18a, 18b and 18c travel substantially in the same planes as the chains 38 and 39 and are supported in this course of travel by rollers 26a, 27a, 28a and 29a fixedly mounted upon the respective axles 26–29.

Thus, with the carrier cords, carrier bars and chains, as well as the rollers, axles and sprockets, the conveyor 16 moves as a unit. The carrier cords form, together with the carrier bars, the three relatively closed portions 18 of the conveyor 16 while the spaces between the outer free edges of the opposed pairs of carrier bars form the relatively open portions 17 of the conveyor 16.

As the cords pass around the roller 26a on axle 26 the sheet leaves the path of the cords and passes into the printing machine in the direction of arrow 11, preferably passing over a smooth stationary bar 110 and beneath a plurality of light smooth balls 111 which are loosely mounted in brackets 112. Preferably guide wires 50 are provided above the conveyor to keep the sheet from being displaced from the upper course of the conveyor and to guide the sheet in between the bar 110 and the balls 111.

Axle 26 is driven through bevel gears 100 and 101 (Fig. 2) from a vertical shaft 102 which in turn is driven by bevel gears 103 and 104 from a stub shaft 105 mounted on the frame of the printing press. Stub shaft 105 is driven through a sprocket 106 by a chain 107 from a sprocket 108 on the shaft of main cylinder 3 of the printing press. Thus the movement of axle 26, the sprockets 30, 31 thereon, chains 38 and 39 and the rest of the conveyor, is in timed relation to the printing operation of the press. For each rotation of the main cylinder 3 of the press the conveyor 16 delivers one sheet to the press.

The feeding machine 1 is preferably connected to the printing machine 2 by hinges 109 (Fig. 1), in addition to the above-described geared connections of which the vertical shaft 102 constitutes in effect a hinge pin. The vertical axis of the hinges 109 is in prolongation of vertical shaft 102. Thus the feeding mechanism can be swung about this vertical axis in a counterclockwise direction as viewed in Fig. 5, completely exposing the entrance end of the printing machine for any necessary adjustments or repair to either

the printing machine or the feeding machine. Rollers 109a on the base of the feeding machine support this machine from the floor and enable it to be swung about the vertical axis as above described. In this swinging of the feeding machine, the mechanical connections between the axle 26 of the feeding machine and the main cylinder 3 of the printing machine are retained in mesh, so that when the feeding mechanism is returned to its normal position with relation to the printing machine, the timing between the printing mechanism and the conveyor and other parts of the feeding mechanism is undisturbed by the feeding machine having been swung.

Air blast nozzles 113 are preferably provided, adapted to blow air downwardly on the sheet on the conveyor, insuring good frictional contact between the sheet and the cords of the conveyor as the sheet is advanced into the press.

Air blast nozzles 114 are preferably provided, adapted to blow air generally upwardly to aid in separating the sheet from the cords as the cords pass around the roller 26a and to aid in causing the sheets to follow the guide wires 50 in passing from the cords of the conveyor to the bar 110 and balls 111.

The paper elevating or picker mechanism 19 includes a plurality of suction pick-up fingers 52, for example, four, mounted in a horizontal support member 51. The pick-up fingers are vertically and horizontally adjustable within the member 51 and adapted to be held clamped thereto by suitable rotatable clamps 55. The pick-up fingers at their lower ends open into rubber cups 56.

In the uppermost position of the horizontal support member 51 the cups 56 of the pick-up fingers 52 are in a position above the plane of the upper course of travel of the conveyor.

Each end of the support member 51 has depending therefrom a slide member 57 mounted in a channeled guide 58 in a carriage 63 for movement of the support member 51 and its pick-up fingers 52 perpendicular to the upper course of travel of the conveyor.

Each carriage 63 is slidably mounted upon two guide bars 66 and 67 (Figs. 3, 7 and 8) secured to the frame of the machine and substantially parallel with the upper surface of the table 13, with the top sheet 21, and with the upper course of the conveyor.

The carriages 63 at the opposite sides of the machine may be shifted in unison, lengthwise of the upper course of travel of the conveyor, by rotating a shaft 130 which is mounted at its ends in the two carriages. Shaft 130 carries adjacent its ends pinions 131 which mesh with stationary rack bars 132 beside the guide bar 66, and carries a knurled handle 130a.

The upper portion of each carriage 63 is provided with a set screw 70 adapted to clamp the carriage to the guide bar 66 in any desired position of the carriage.

By virtue of the adjustability of the carriage 63 just described, the suction cups 56 of the pick-up fingers 52 may be adjustably positioned so that they may engage the topmost sheet 21 in the stack 12 at a point adjacent the edge 71 thereof (Fig. 10) and this relative positioning may be maintained even when the length of the sheet 21 differs from that shown in the drawings.

Thus, with shorter sheets than shown in the drawings, the right-hand edge 71 of the stack and the right-hand edge portion 20 of the topmost sheet will lie farther to the left in Figs. 3, 4 and 10, and the carriage 63 and its suction pick-up fingers will be correspondingly shifted to the left, that is, in the direction of feed of the sheets. The conveyor 16 moves in timed relation to the printing cycle, for instance, as shown, in timed relation to the rotation of the cooperating printing rolls 3 and 4 of the press. The leading edge of each sheet of the stack, that is, the edge that goes first out of the feeding machine, is positioned against vertical guides 84, regardless of the length of sheet. The suction pick-up fingers are caused to release the sheet in timed relation to the cycle of travel of the conveyor, as hereinafter described. Thus when the sheet 21, stripped from the stack by the conveyor, is released by the suction pick-up fingers 52, the leading edge (left edge in Figs. 3 and 4) will occupy substantially the same position on the conveyor regardless of the length of the sheet. This is advantageous in preserving constancy of timing of the arrival of the leading edges of sheets of any lengths at the various positions at which they are received by moving parts of the printing press.

The picker mechanism has a cycle of up and down movement in timed relation to the cycle of movement of the conveyor such that the pick-up fingers 52 reach down beneath the level of the conveyor, engage the trailing edge portion of the top sheet of the stack and lift such edge portion above the level of the conveyor, all while an open portion 17 of the conveyor is passing the pick-up fingers. Provision is made for setting back the cycle of movement of the picker mechanism relative to the cycle of travel of the conveyor when the picker mechanism is shifted in the direction of travel of the conveyor (for feeding shorter sheets) and for setting forwardly the cycle of movement of the picker mechanism relatively to the cycle of travel of the conveyor when the picker mechanism is adjusted in a direction opposite to the direction of travel of the conveyor (for feeding longer sheets). Due to this provision, the open portions 17 of the conveyor can be relatively short and still provide adequate clearance for the picker mechanism in both extremes of lengthwise adjustment of the picker mechanism, relative to the conveyor, it being assured that in no position of lengthwise adjustment of the picker mechanism will the pick-up fingers either descend so soon as to strike a closed portion of the conveyor or be down at the level of the conveyor so late as to be struck by a closed portion of the conveyor.

A preferred mechanism for thus setting the cycle of movement of the picker mechanism back or forwardly in accordance with the lengthwise position of the picker mechanism preferably includes a sprocket and driving connections from the sprocket to the picker mechanism, the sprocket and the said driving connections being shiftable lengthwise with the picker mechanism.

Thus the carriage 63 (Fig. 8) preferably is provided with a vertically slidable member 61 connected at its top to the supporting member 51 and carrying at its lower end cam follower rollers 61a adapted to ride on the surface of a cam 61b carried by the carriage 63, to cause the supporting member 51 and its pick-up fingers 52 to reciprocate as the cam 61b rotates. Cam 61b is adapted to be rotated by a gear 62, fixed thereto, and a pinion 64, shaft 65a, and sprocket 65, also carried by the carriage 63. The sprocket 65, at an upper tangent thereof, is adapted to

mesh constantly with a chain movable in timed relation to the conveyor. Preferably, this chain is one of the chains at the conveyor, for instance, as herein shown, the chain 39.

Ordinary rotation of the sprocket 65 by the chain 39 during normal running of the machine causes the support member 51 and the pick-up fingers 52 to reciprocate up and down in timed relation with the cycle of movement of the chain 39 and conveyor. Shifting the picker mechanism in the direction of travel of the conveyor imparts a backward rotation to the sprocket 65, that is, turns the sprocket reversely to its normal movement, and so sets back the cycle of movement of the picker mechanism relative to the cycle of travel of the conveyor. Similarly, shifting the picker mechanism in a direction opposite to the direction of travel of the conveyor sets the cycle of movement of the picker mechanism forwardly relative to the cycle of travel of the conveyor.

The suction within the fingers 52 and cups 56 is provided through a pipe 73 (Fig. 3) connected through a flexible connection 73a (Fig. 1) to any suitable source of suction or air at reduced pressure within the casing of the printing press. Pipe 73 communicates with a valve 74 and pipes 75a, 75b and 75c (Fig. 3), pipe 75c being connected by flexible tubes 83 to the several fingers 52.

Valve 74 is operated in proper sequence and correlation with the movement of the conveyor 16. A cam 76 intermittently engages a pivoted element 77 of the valve to admit air at atmospheric pressure to the valve 74, through an opening 74a uncovered by element 77, flexible tubes 83 and pick-up fingers 52, so as to break the suction with which the pick-up fingers hold the sheet.

Cam 76 is keyed to a shaft 78 (Fig. 6) which carries a gear 79 keyed thereto. Gear 79 meshes with a pinion 80, keyed to a gear 81, which, in turn, meshes with a pinion 82 keyed to the conveyor sprocket shaft 26. The shaft 26, through which the valve 74 is actuated as above described, is correlated to the traveling movement of the conveyor, and the operating connections from the shaft 26 to the valve 74 are so arranged that when the leading edge of each set of cords 18a, 18b and 18c reaches the leading edge of the top sheet of the stock, the paper sheet then being fully superposed upon the set of cords by travel of the set of cords underneath the sheet, the suction in the pick-up fingers 52 is broken and the sheet is released to be carried along with the cords with its leading edge in a predetermined position on the cords regardless of the length of the sheets and regardless of the lengthwise adjustment of the mounting for the picker mechanism. Thus in feeding from different stacks of different sheet lengths the sheets are released to the conveyor with their leading edges in substantially the same position adjacent to the leading edges of the closed portions of the conveyor, regardless of the length of the sheet. Following release of the sheet, the valve 74 is restored by a spring 74b to a position in which it causes the suction to be reapplied to the pick-up fingers. In due time the pick-up fingers move downwardly through an open portion 17 of the conveyor and again lift the right-hand edge portion 20 of the top sheet of the stack up above the path of the next approaching set of cords.

The feeding machine preferably includes means operating in conjunction with the pick-up fingers and conveyor for insuring that the trailing edge portion of only one sheet will be raised above the path of the conveyor at a time. The sheets in the stack may exert a considerable attraction upon each other, and it is desirable to break this attraction, insofar as it may exist between the trailing edge portions of the top and next to the top sheets, before the trailing edge portion of the top sheet is raised above the level of the conveyor. A preferred mechanism for this purpose will now be described.

A transverse support 180, slidably adjustable manually lengthwise of the machine on guide bars 67' at either side of the machine, carries a plurality of air blast nozzles 140. These nozzles are adapted intermittently to direct blasts of air against the upper portion of the face of the stack at which the trailing edge portions of the sheets lie, thus fanning out the top several sheets and accomplishing the first part of the elevation of the trailing edge portion of the top sheet.

A plurality of hold-down devices indicated generally at 145 are also carried by the support 180. Each hold-down device includes a vertical suction tube 147 and the several such tubes are connected by suitable connections, including a flexible conduit 75d, to the suction conduit 75a, (Fig. 3) so as to be subjected to suction at the same time as the picker fingers 52. An upper hollow element 149 of generally inverted J-shape has a vertical portion having a sliding fit within the tube 147 and a generally horizontal portion extending outwardly through a slot in the wall of tube 147, this horizontal portion overlying the trailing edge portion of the stack and terminating in a downwardly opening nozzle 150. Normally a spring 151 maintains the upper element 149 in a raised position slightly above the level of the stack, against a stop pin 151a.

In the operation of lifting a sheet from the stack the sheets are first fanned out by means of the air blasts from nozzles 140 as above described and as diagrammatically shown in Fig. 10. The top sheet is thus brought into contact with the hold-down nozzles 150. At this stage the leak valve closure 77 (Fig. 3) in the suction system is closed so that the suction of conduit 73 is applied to conduit 75a which in turn is in communication with the picker cups 56 and the hold-down nozzles 150. However, until the picker cups 56 also make contact with the top sheet, the open picker cups allow entrance of air into the suction system, and only a slight suction is present in the hold-down nozzles 150. The blasts of air from nozzles 140 are continued until the picker cups engage the top sheet.

When the downwardly moving suction picker cups 56 engage the top sheet as indicated in Fig. 11, air can no longer enter the suction system through either the hold-down nozzles 150 or the cups 56, the top sheet becomes firmly attached to the cups 56, and the degree of vacuum in the hold-down nozzles 150 and the tubes 147 increases, with the result of drawing the upper elements 149 of the hold-down devices downwardly (or more accurately stated, permitting atmospheric pressure to move these elements downwardly) toward or against the solid portion of the stack as indicated in Fig. 11, against the action of the springs 151, bending the trailing edge portion of the top sheet downwardly.

As the cups 56 then begin to rise with the engaged portion of the top sheet, the trailing edge portion of the top sheet is further bent as the rising cups 56 pull it from beneath the hold-down nozzles 150.

The bending of the trailing edge portion of the

top sheet, by the cooperating action of the hold-down nozzles and the picker cups breaks any attraction that may exist between the trailing edge portions of the top and next to the top sheets. Then when the top sheet has been withdrawn from beneath the hold-down nozzles 150, these nozzles exert their suction upon the next succeeding sheet, tending to hold it from being withdrawn.

The picker cups 56 rise above the conveyor in time to hold trailing edge portion of the sheet above the level of the conveyor when a relatively closed portion 18 of the conveyor passes beneath the sheet as diagrammatically shown in Fig. 12. Finally when the conveyor has completed the separation of the top sheet from the stack, the cam 76, (Fig. 3) opens the leak valve closure 77, breaking the suction in both the suction cups and the hold-down nozzles. The suction cups release the sheet, and the hold-down nozzles release their hold on the top of the stack and rise again to the position of Fig. 10.

The leak valve closure 77 then closes causing the suction conduit 73 to apply its suction to the open picker cups and hold-down nozzles, in preparation for the elevation of the next sheet from the stack.

The air blast nozzles 113 which blow air downwardly on the sheet on cords of the conveyor and the air blast nozzles 114 which aid in separating the sheet from the cords of the conveyor are in operation principally in connection with the delivery of a sheet from the feeding machine into the press or other sheet handling machine. Air blast nozzles 140 are in operation principally in connection with preparing the top sheet for elevation by the picker cups 56.

The air blast nozzles 113 and 114 are connected by a common conduit 160 (Fig. 4) to one exit of a two-exit piston valve 161 (Figs. 4 and 6). The air blast nozzles 140 are connected by a flexible conduit 163 and a conduit 164 to the second exit of the two-exit piston valve 161. Air under pressure is supplied to the interior of valve 161 through a conduit 166, communicating with any suitable source of compressed air within the framework of the printing press through a flexible connection 167 located adjacent to the axis of the hinged connection of the feeding machine to the press.

A piston 168, reciprocated by a yoke 169 which carries a cam follower roll 170 acted on by a cam 171 on shaft 76, directs the air alternately from valve 161 to conduit 164 leading to the air nozzles 140, and to conduit 160 leading to the air blast nozzles 113, 114. Thus at each rotation of shaft 76, the air blast nozzles 140 and the air blast nozzles 113, 114 are operated in the proper sequence.

While any desired mechanism may be employed to maintain the top of the paper stack 12 at the proper level, a preferred form of such mechanism will now be described.

The paper stack table 13 may be supported by a bracket 85 slidable vertically on guide bars 89. At each side of the machine a chain 90 (Fig. 6), connected to the supporting bracket 85, meshes with a sprocket 91 fast on a shaft 95. Each shaft 95 carries adjacent one end thereof a worm gear 96 (Fig. 3) which is in mesh with a worm 97. The two worms 97 at either side of the machine are keyed on a common shaft 98 having keyed thereto a ratchet-wheel 200 (Fig. 4). Rotatably mounted upon the shaft 98 and inwardly of the ratchet-wheel 200 is an eccentrically weighted pawl-carrying plate 201. A pawl 202 is pivotally mounted on the upper portion of the plate 201 so that gravity will act to cause the pawl 202 to engage the teeth of the ratchet-wheel 200. The center of gravity of the plate 201 is disposed toward the right of the shaft 98 as seen in Fig. 4. This disposition of the center of gravity causes the plate 201 to rotate about the shaft 98 in a clockwise direction as viewed in Fig. 4, keeping a pin 203 which is carried by plate 201 in engagement with the upper end of a slot 204 in a pitman 205. The lower end of the pitman is pivotally connected to an eccentric 205a on the previously mentioned shaft 78.

Uninhibited operation of the structure just described will result in stepped rotation of the shaft 98 since each rotation of the shaft 78 will cause the pawl 202 to engage a number of teeth and rotate the ratchet-wheel 200.

The operation of the plate 201 and the pawl 202 is controlled by the height of the paper stack 12 through the action of a paper stack height control feeler roller 15, (Fig. 3) carried by the upper end of a member 88 which is slidable vertically in a channel in guide 84. Roller 15 bears upon the topmost sheet 21 and changes in the height of the stack 12 are translated into vertical movement of member 88. Member 88 at the lower end thereof is pivotally connected to the inner arm of a double crank 206 (Fig. 3) of which the outer arm (Fig. 4) is pivotally connected to the lower end of a connecting rod 207. Rod 207 may have the effective length thereof adjusted by the use of clamping means 208. Thus, the means 208 adjustably clamps the lower end of the rod 207 to the outer arm of the crank 206 as well as pivotally interconnects these parts.

The upper end of the rod 207 is provided with a slotted head 209 which slidably engages a pin 210 on the right end of a lever 211 which is pivotally mounted intermediate the ends thereof upon a stud 212 projecting horizontally from the plate 24. The end of the lever 211 opposite to the pin 210 is adapted to detain a shoulder 201a which is integral with plate 201, thus preventing the plate from rotating counterclockwise as viewed in Figure 4. As the height of the top of the stack 12 decreases, the control feeler roller 15 and member 88 descend, the crank 206 rotates, the connecting rod 207 descends and the detent lever 211 disengages the shoulder 201a and allows the plate 201 to rotate counterclockwise as viewed in Figure 4, bringing the pawl 202 into position to engage a new tooth or teeth on the ratchet-wheel 200. Operation of the pitman 205 then results in actuating the ratchet-wheel to turn the ratchet-wheel 200, shaft 98, and shaft 95 and move the chain 90 to lift the table 13 and thereby raise the top of the stack to the desired position. A handwheel 98a may be provided on shaft 98 for lowering and adjusting the paper stack table.

This applicaton is in part a continuation of my applicaton Serial No. 490,556, filed June 12, 1943 (now abandoned).

While the drawings show the conveyor as having three open portions and three relatively closed portions, the conveyor may have a greater or lesser number of such portions depending upon the size and shape of the stack.

I claim:

1. In a sheet-feeding machine of the type including an endless conveyor having open and relatively closed portions, sheet picker mechanism movable in a cycle through an open portion

of the conveyor to pick up the trailing edge portion of the top sheet of a stack and hold said edge portion above the conveyor until after a closed portion of the conveyor has intervened between said sheet and the stack, the combination of a mounting for the picker mechanism adjustable lengthwise of the travel of the conveyor past the picker mechanism, permitting the picker mechanism to act on the trailing edge portions of sheets of various lengths stacked with their leading edges in a predetermined position driving mechanism for the picker mechanism arranged to cause the time of start of such cycle of movement of the picker mechanism to be dependent upon the position of lengthwise adjustment of the mounting for the picker mechanism, and means for causing the picker mechanism to release the sheet when the endless conveyor reaches a predetermined position regardless of the position of lengthwise adjustment of the mounting for the picker mechanism so that in feeding from stacks of different sheet lengths the picker mechanism is adapted to release the sheets to the conveyor with their leading edges in substantially the same position on the conveyor regardless of the length of the sheet.

2. In a sheet-feeding machine of the type including an endless conveyor having open and relatively closed portions, sheet picker mechanism movable in a cycle through an open portion of the conveyor to pick up the trailing edge portion of the top sheet of a stack and hold said edge portion above the conveyor until after a closed portion of the conveyor has intervened between said sheet and the stack, the combination of a stack guide for the leading edges of the sheets of the stack, a mounting for the picker mechanism adjustable lengthwise of the travel of the conveyor past the picker mechanism, permitting the picker mechanism to act on the trailing edge portions of sheets of various lengths stacked with their leading edges against said guide, driving mechanism for the picker mechanism arranged to cause the time of start of such cycle of movement of the picker mechanism to be dependent upon the position of lengthwise adjustment of the mounting for the picker mechanism, and means for causing the picker mechanism to release the sheet when the endless conveyor reaches a predetermined position regardless of the position of lengthwise adjustment of the mounting for the picker mechanism so that in feeding from stacks of different sheet lengths the picker mechanism is adapted to release the sheets to the conveyor with their leading edges in substantially the same position on the conveyor regardless of the length of the sheet.

3. In a sheet-feeding machine of the type including an endless conveyor having open and relatively closed portions, sheet picker mechanism having a cycle of movement through an open portion of the conveyor to pick up the trailing edge portion of the top sheet of a stack and hold said edge portion above the conveyor until a closed portion of the conveyor intervenes between said sheet and the stack, the combination of an adjustable mounting for the picker mechanism permitting the picker mechanism to be shifted lengthwise of the travel of the conveyor past the picker mechanism, and means for setting back the cycle of movement of the picker mechanism relative to the cycle of travel of the conveyor when the picker mechanism is shifted in the direction of travel of the conveyor and for setting forwardly the cycle of movement of the picker mechanism relatively to the cycle of travel of the conveyor when the picker mechanism is adjusted in a direction opposite to the direction of travel of the conveyor.

4. In a sheet-feeding machine of the type including an endless conveyor having open and relatively closed portions, sheet picker mechanism having a cycle of movement through an open portion of the conveyor to pick up the trailing edge portion of the top sheet of a stack and hold said edge portion above the conveyor until a closed portion of the conveyor intervenes between said sheet and the stack, the combination of an adjustable mounting for the picker mechanism permitting the picker mechanism to be shifted lengthwise of the travel of the conveyor past the picker mechanism, means for setting back the cycle of movement of the picker mechanism relative to the cycle of travel of the conveyor when the picker mechanism is shifted in the direction of travel of the conveyor and for setting forwardly the cycle of movement of the picker mechanism relatively to the cycle of travel of the conveyor when the picker mechanism is adjustable in a direction opposite to the direction of travel of the conveyor, and means for causing the picker mechanism to release the sheet at a substantially constant point in the cycle of travel of the conveyor.

5. In a sheet-feeding machine of the type including an endless conveyor having open and relatively closed portions, sheet picker mechanism having a cycle of movement through an open portion of the conveyor to pick up the trailing edge portion of the top sheet of a stack and hold said edge portion above the conveyor until a closed portion of the conveyor intervenes between said sheet and the stack, the combination of an adjustable mounting for the picker mechanism permitting the picker mechanism to be shifted lengthwise of the travel of the conveyor past the picker mechanism, a chain movable in timed relation to the movement of the conveyor, a sprocket and driving connections from the sprocket to the picker mechanism, said sprocket and driving connections being shiftable with the picker mechanism, and said sprocket being in constant mesh with said chain, whereby shifting of the picker mechanism in the direction of travel of the conveyor turns said sprocket reversely to its normal movement and so sets back the cycle of movement of the picker mechanism relative to the cycle of travel of the conveyor.

6. In a sheet-feeding machine of the type including an endless conveyor having open and relatively closed portions and including a chain, sheet picker mechanism having a cycle of movement through an open portion of the conveyor to pick up the trailing edge portion of the top sheet of a stack and hold said edge portion above the conveyor until a closed portion of the conveyor intervenes between said sheet and the stack, the combination of an adjustable mounting for the picker mechanism permitting the picker mechanism to be shifted lengthwise of the travel of the conveyor past the picker mechanism, a sprocket and driving connections from the sprocket to the picker mechanism, said sprocket and driving connections being shiftable with the picker mechanism and said sprocket being in constant mesh with said chain, whereby shifting of the picker mechanism in the direction of travel of the conveyor turns said sprocket reversely to its normal movement and so sets back the cycle of movement

of the picker mechanism relative to the cycle of travel of the conveyor.

7. A sheet-feeding machine comprising, a sheet stack, an endless conveyor moving around said stack and adapted to carry away sheets successively lifted from the stack, said conveyor including spaced chains and means for engaging and driving said chains, picker means for lifting successive sheets from the stack to enable the same to be received on the conveyor, means for reciprocating said picker means including a driving element in constant mesh with and driven by at least one of the chains, and means by which the picker means is adjustable longitudinally of the stack without disturbing the engagement of the driving element with the conveyor chain.

8. In a sheet-feeding machine, a sheet stack, a continuous conveyor of endless form movable around the stack, said conveyor having open portions and relatively closed portions, sheet-elevating pickers entering through the open portions and raising a part of each sheet therethrough whereby it may be held for reception upon a closed portion of the conveyor, means for raising and lowering the pickers including a driving element, means for moving the conveyor, the driving element being in meshed engagement with the conveyor-moving means, and means for adjustably positioning the picker means lengthwise of the stack without disturbing the meshed relationship of the driving element and conveyor-moving means.

9. In a sheet-feeding machine, a sheet stack, a continuous conveyor including a pair of endless chains, means for imparting movement to said chains, sheet-carrying elements supported from the chains and carried thereby over the sheet stack, suction picker means for raising successive sheets from the stack to enable the sheet-carrying elements to move below them to support and carry away said successive sheets, means for raising and lowering said suction picker means including a driving element in mesh with at least one of the endless chains whereby it is driven thereby, and means by which the suction picker means may be shifted lengthwise of the stack and positioned at a selected location thereover without disengagement of the driving element from its meshed engagement with the chain.

10. In a sheet-feeding machine, a sheet stack, an endless chain conveyor for receiving successive sheets lifted from the stack, a suction picker for raising successive sheets from the stack whereby they may be received upon the conveyor, means for driving the conveyor, means for reciprocating the suction picker including a sprocket in constant engagement with an endless chain of the conveyor, means for adjustably positioning the picker relative to the length of the sheets in the stack, the arrangement of the picker-reciprocating means and conveyor-driving means being such that the relationship between the same is not disturbed by a shift in the position of the picker means relative to the stack.

11. A sheet-feeding machine including means for lifting an edge portion of the top sheet of a stack, a sheet picker mechanism adapted to engage said lifted edge portion and lift it further, a hold-down member normally located above the level of the top sheet of the stack, and means for raising the picker mechanism and lowering the hold-down member while each engages the said top sheet, so as to bend a portion of the sheet between the picker mechanism and the hold-down member and break the attraction between the top and next to the top sheets.

12. A sheet-feeding machine including an endless conveyor having open and relatively closed portions, means for holding a stack of sheets inside the path of said endless conveyor, means for lifting the edge portion of the top sheet of the stack, sheet picker mechanism movable from above the path of the conveyor through an open portion thereof to engage said lifted edge portion and raise it above the path of the conveyor, a hold-down member below the path of the conveyor and normally above the level of the top sheet of the stack, and means for lowering the hold-down member against the lifted edge portion of the top sheet during engagement of said picker mechanism with the said top sheet, so as to bend a portion of the said top sheet between the picker mechanism and the hold-down member and break the attraction between the top and next to the top sheets.

13. A sheet-feeding machine including means for lifting an edge portion of the top sheet of a stack, a normally open suction hold-down nozzle normally located above the level of the top sheet of the stack in position for its opening to be obstructed by said lifted edge portion of the top sheet, a suction picker nozzle movable into position for its opening to be obstructed by said lifted edge portion, suction connections to both said suction nozzles adapted to reduce the internal pressure in said suction hold-down nozzle when the openings of both of said suction nozzles are thus obstructed, and a mounting for said suction hold-down nozzle permitting the latter to be moved downwardly by atmospheric pressure upon such reduction of internal pressure.

14. A sheet-feeding machine including an air blast nozzle adapted to lift an edge portion of the top sheet of a stack, a normally open suction hold-down nozzle normally located above the level of the top sheet of the stack in position for its opening to be obstructed by said lifted edge portion of the top sheet, a suction picker nozzle movable into position for its opening to be obstructed by said lifted edge portion, suction connections to both said suction nozzles adapted to reduce the internal pressure in said suction hold-down nozzle when the openings of both of said suction nozzles are thus obstructed, and a mounting for said suction hold-down nozzle permitting the latter to be moved downwardly by atmospheric pressure upon such reduction of internal pressure.

15. A sheet-feeding machine including an endless conveyor having open and relatively closed portions, means for holding a stack of sheets inside the path of said endless conveyor, a normally open downwardly directed suction nozzle, normally located above an edge portion of the top sheet of the stack, means for raising the top sheet into contact with said nozzle and then past said nozzle to a position above the path of the conveyor, and means for lowering said nozzle to apply its suction to an edge portion of the next to the top sheet during raising of said top sheet.

16. A sheet-feeding machine including means for lifting an edge portion of the top sheet of a stack, a suction picker nozzle engageable with the lifted portion of the top sheet, a normally open suction hold-down nozzle normally located above the level of the top sheet of the stack in position for its opening to be obstructed by said lifted edge portion of the top sheet, the suction picker

nozzle and the hold-down nozzle being open when not engaging a sheet, a connection between the suction picker nozzle and the hold-down nozzle such that when both nozzles are obstructed by a sheet, pressure drops in the interior of the hold-down nozzle, and means normally holding the hold-down nozzle elevated above the top of the stack and permitting the hold-down nozzle to be drawn downwardly by said drop in pressure.

17. A sheet-feeding machine including means for holding a stack of sheets, means, including an air blast nozzle, for lifting an edge portion of the top sheet of the stack, a conveyor arranged to enter in between the said top sheet and the stack and adapted to convey sheets successively away from the stack, an air blast nozzle disposed to blow downwardly against sheets thus conveyed on said conveyor, and means for directing air under pressure alternately to said nozzles.

18. A sheet-feeding machine including means for lifting an edge portion of the top sheet of a stack, a normally open suction hold-down nozzle normally located above the level of the top sheet of the stack in position for its opening to be obstructed by said lifted edge portion of the top sheet, means for reducing the internal pressure in said suction hold-down nozzle, and a mounting for said suction hold-down nozzle permitting the latter to be moved downwardly by atmospheric pressure upon such reduction of internal pressure.

19. A sheet-feeding machine including an air

blast nozzle adapted to lift an edge portion of the top sheet of a stack, a normally open suction hold-down nozzle normally located above the level of the top sheet of the stack in position for its opening to be obstructed by said lifted edge portion of the top sheet, means for reducing the internal pressure in said suction hold-down nozzle, and a mounting for said suction hold-down nozzle permitting the latter to be moved downwardly by atmospheric pressure upon such reduction of internal pressure.

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