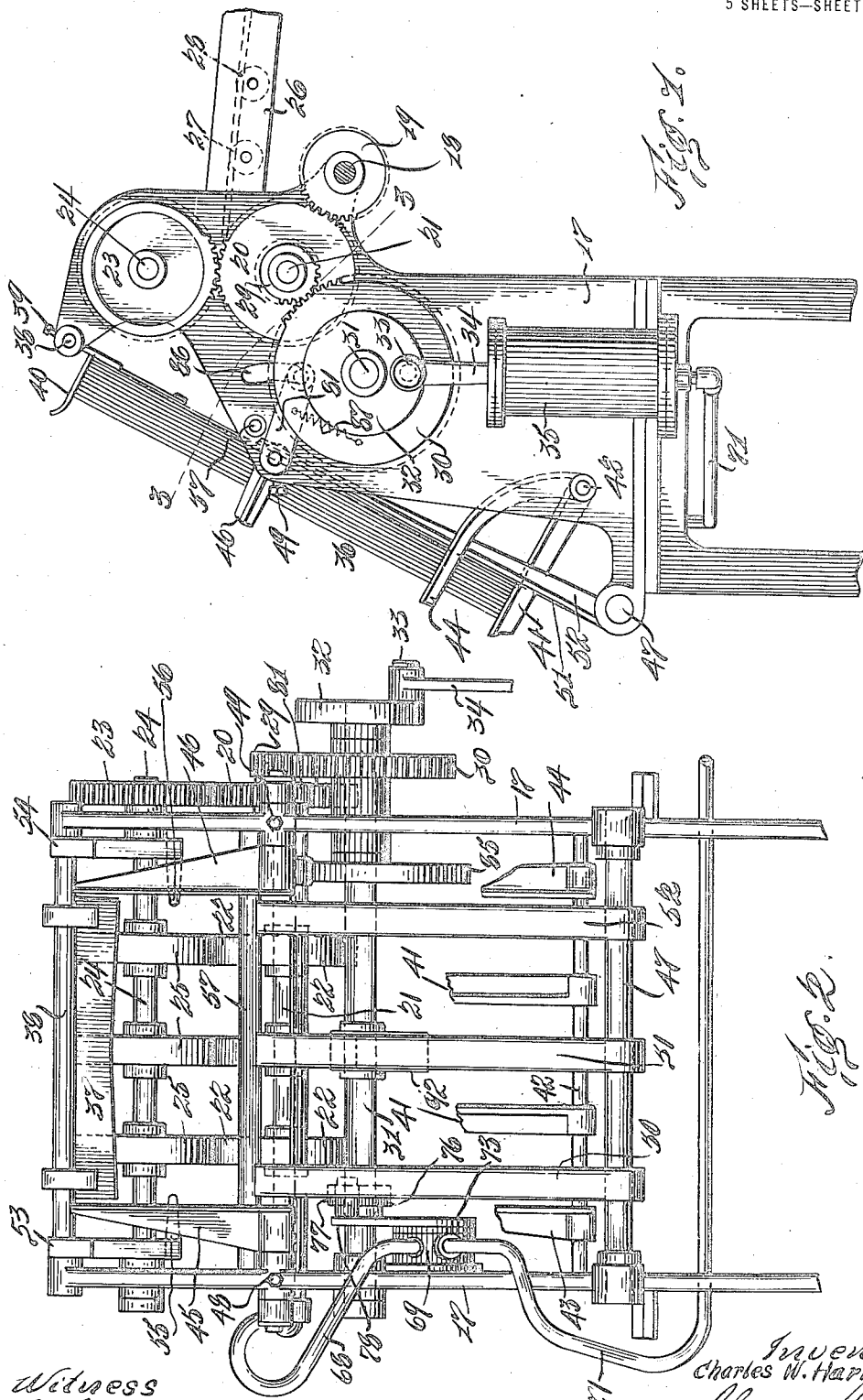


C. W. HARROLD,  
SHEET FEEDER,  
APPLICATION FILED FEB. 21, 1916.

1,312,539.

Patented Aug. 12, 1919.

5 SHEETS—SHEET 1.



Witness  
S. A. JAMES

Inventor  
Charles W. Harrold  
by Philip B. Keck  
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C. W. HARROLD.

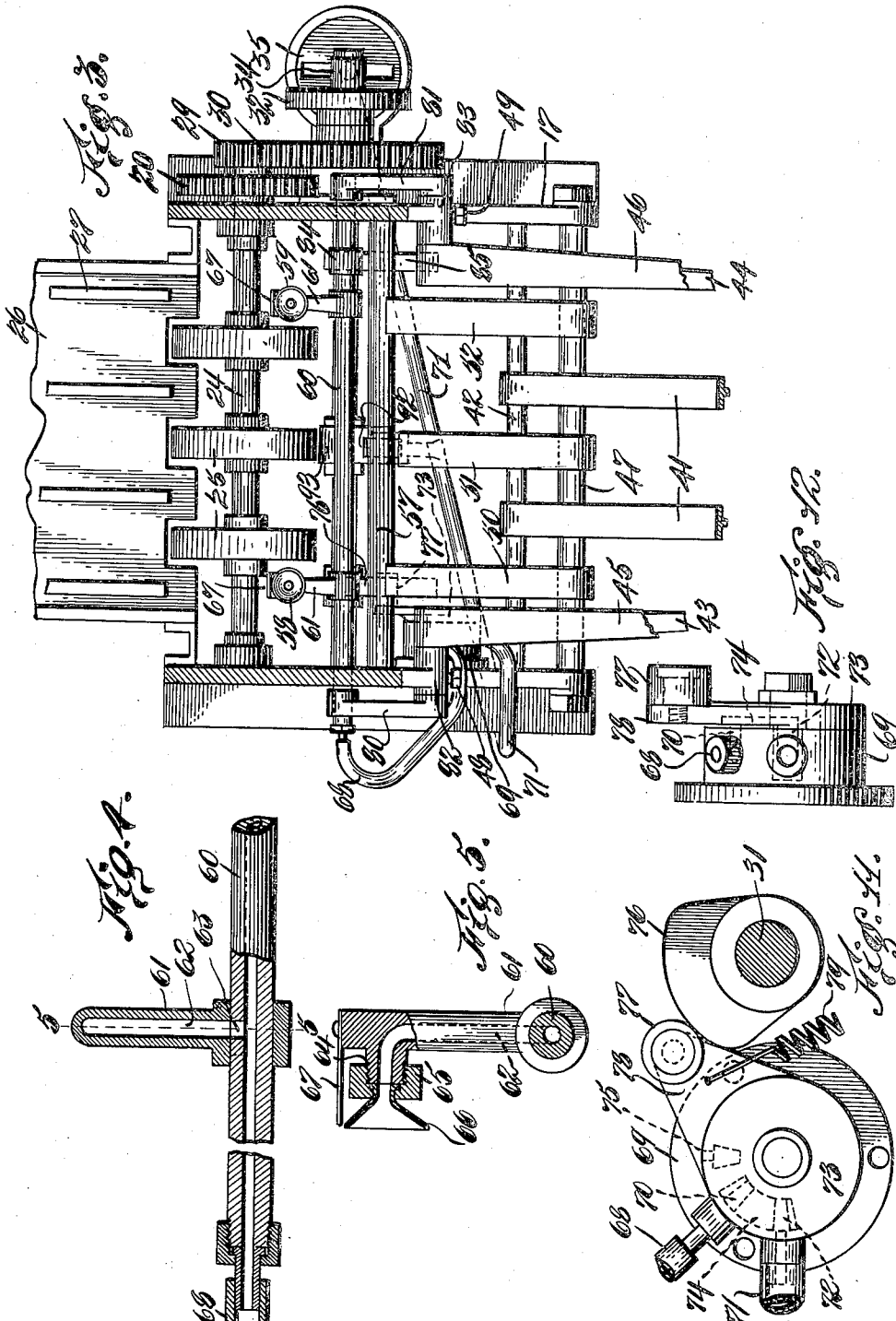
SHEET FEEDER.

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5 SHEETS—SHEET 2.



Witness  
E. A. Jarvis

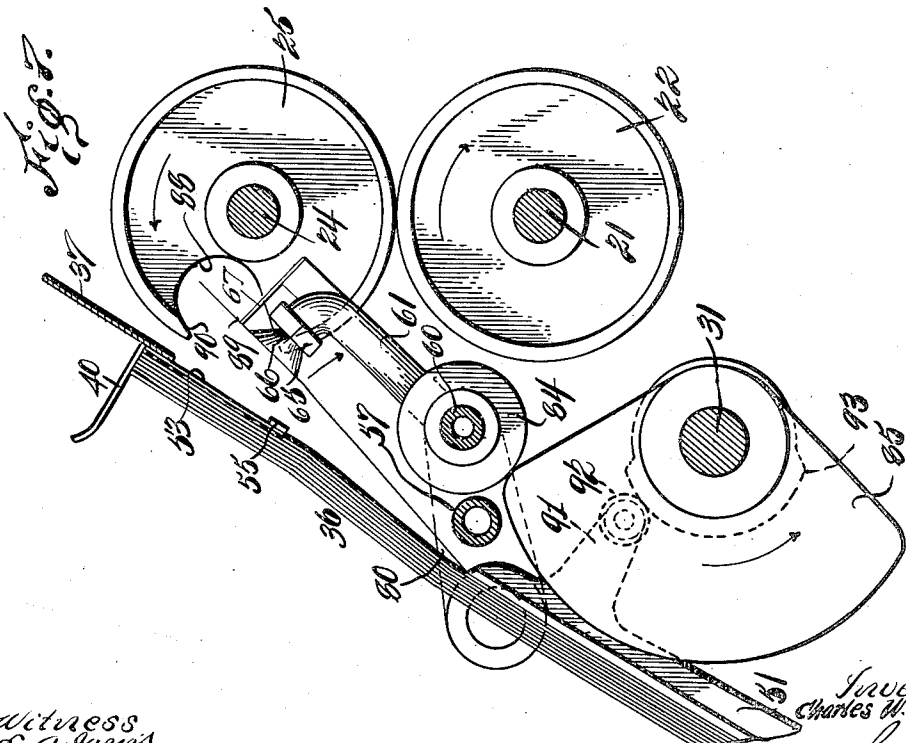
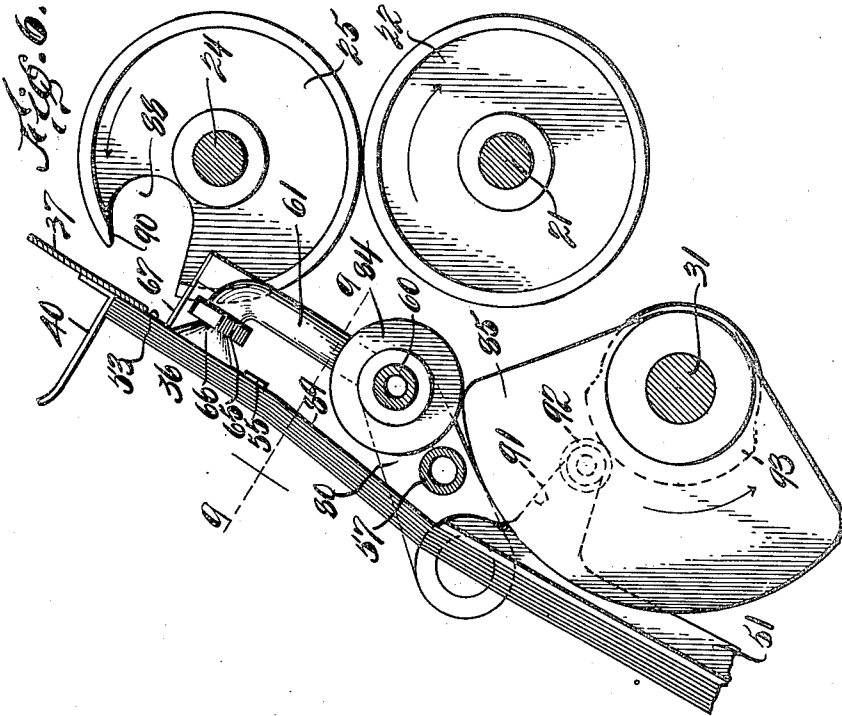
Inventor  
Charles W. Harrold  
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5 SHEETS—SHEET 3.



Witness  
C. A. Jarvis

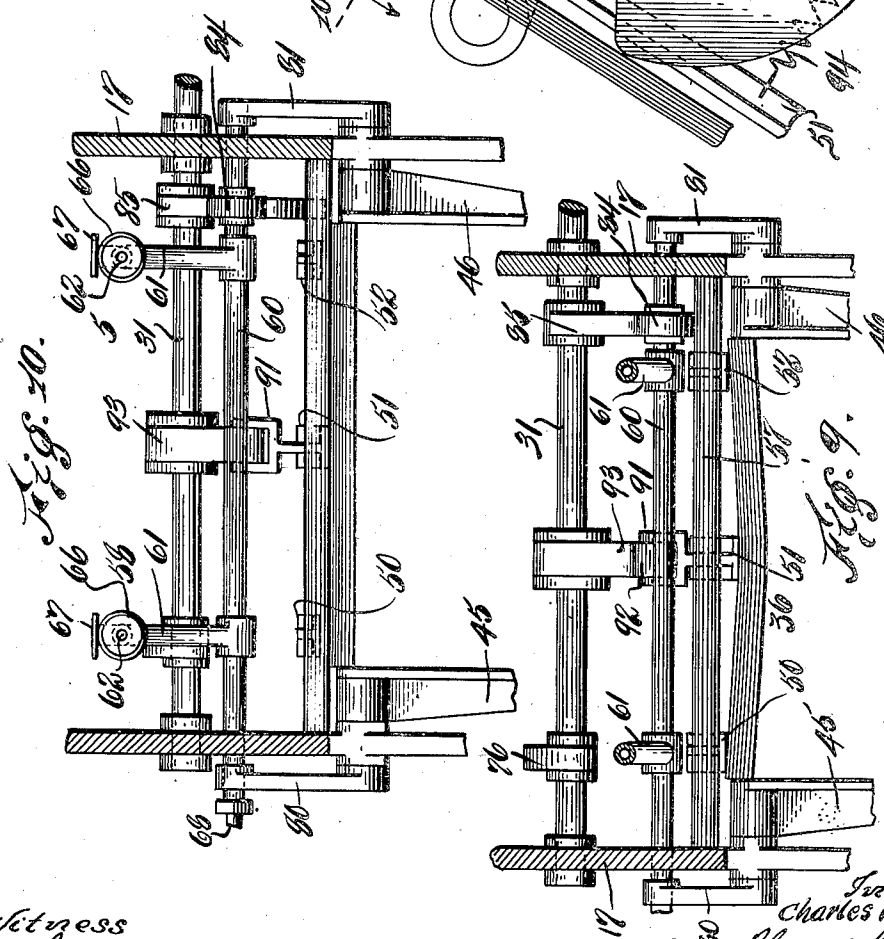
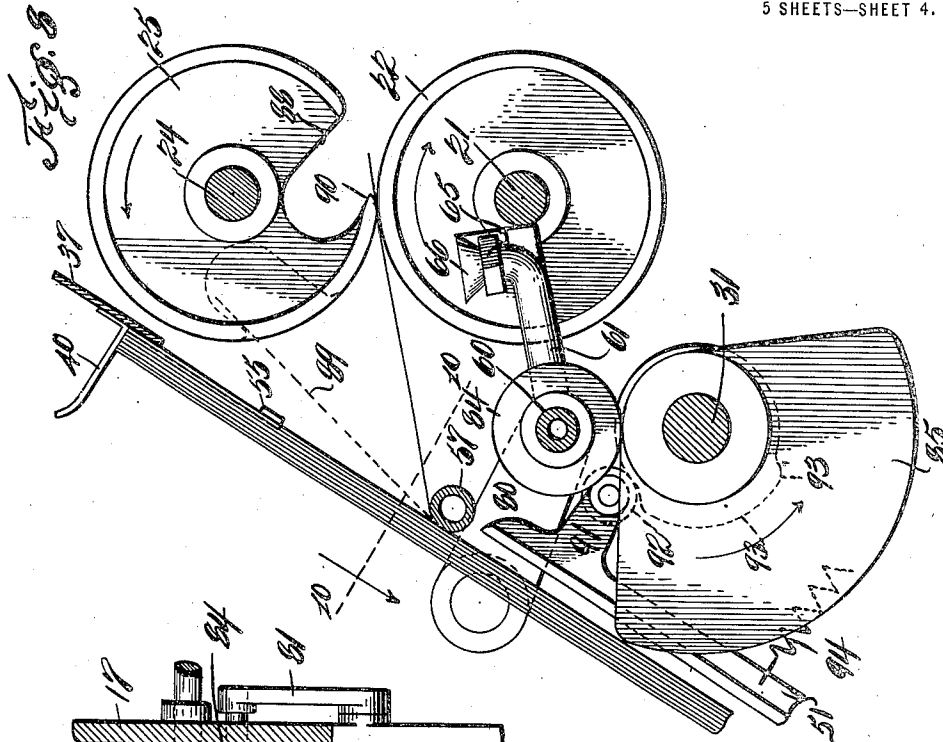
Inventor  
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C. W. HARROLD,  
SHEET FEEDER.  
APPLICATION FILED FEB. 21, 1916.

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5 SHEETS—SHEET 4.



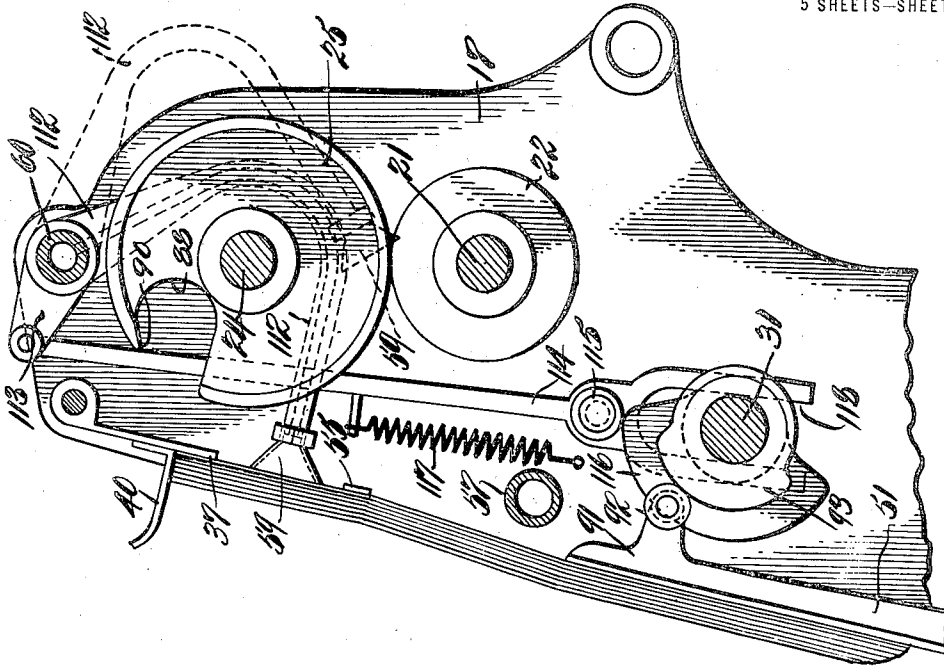
Witness  
C. A. Jarvis

Inventor  
Charles W. Harrold  
Philip Beck  
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C. W. HARROLD.  
SHEET FEEDER.  
APPLICATION FILED FEB. 21, 1916.

1,312,539.

Patented Aug. 12, 1919.  
5 SHEETS—SHEET 3.



Witness  
S. A. Jarvis

Inventor:  
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By his Attorney  
Philip S. Koch

# UNITED STATES PATENT OFFICE.

CHARLES W. HARROLD, OF WARREN, OHIO, ASSIGNOR TO THE HARRIS AUTOMATIC PRESS COMPANY, OF NILES, OHIO, A CORPORATION OF OHIO.

## SHEET-FEEDER.

1,312,539.

Specification of Letters Patent.

Patented Aug. 12, 1919.

Application filed February 21, 1916. Serial No. 79,631.

*To all whom it may concern:*

Be it known that I, CHARLES W. HARROLD, a citizen of the United States, and a resident of Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Sheet-Feeders, of which the following is a specification.

My invention relates to mechanism for successively separating and feeding sheets of paper or similar material, and relates more particularly to a mechanically operated feeding mechanism wherein a suction device is combined with certain novel adjuncts to produce the requisite action to separate and feed forward the individual sheets.

The objects of my invention are, among other things, to provide mechanism whereby the individual sheets may be separated and fed from a pile rapidly and with great precision without any break or intermission in the forward succession of sheets, and without disturbing or disarranging the balance of the pile; also to provide means for intermittently releasing the pressure of the pile against the sheet which is about to be separated and fed forward. A further object is to provide a sheet-feeder of this general character of simple and efficient construction and operation, with parts that are durable and not apt to get out of order.

My improved construction also presents other features of novelty and usefulness whereby the sheet-feeding mechanism is constructed and operated so as to give satisfactory and reliable results, all of which will be hereinafter set forth and claimed.

The accompanying drawings illustrate one embodiment of my invention, and serve, in connection with the description herein, to fully explain the principles of my invention and the best mode in which I have contemplated applying those principles in actual practice.

Figure 1 is a side elevation view of my improved sheet-feeder;

Fig. 2 is an end view, looking from the left in Fig. 1, the pile of sheets being omitted;

Fig. 3 is a sectional plan view taken on the line 3—3 in Fig. 1;

Fig. 4 is an enlarged fragmentary sectional view of the tubular sucker shaft;

Fig. 5 is a sectional view of one of the

suckers taken on the line 5—5 shown in Fig. 4;

Fig. 6 is a diagrammatic view of one of the suckers about to separate a sheet from the pile;

Fig. 7 is a view similar to that shown in Fig. 6, the sucker separating and withdrawing the outer sheet from the pile;

Fig. 8 is another view similar to Figs. 6 and 7, the separated sheet being engaged by upper pull-out roll;

Fig. 9 is a sectional plan view illustrating the pile in a buckled condition, the section being taken on the line 9—9 shown in Fig. 6;

Fig. 10 is a sectional plan view illustrating the middle pile support finger and drawn backward, the section being taken on the line 10—10 shown in Fig. 8;

Fig. 11 is a side view of one form of valve for controlling the vacuum in the suckers;

Fig. 12 is an end view of the valve shown in Fig. 11;

Fig. 13 is a sectional diagrammatic view illustrating another alternate arrangement of the suckers.

Similar numerals refer to similar parts throughout the several figures.

Referring to the drawings, 17 designates the end parts or standards of the frame, composed of any suitable material, and formed in any desired shape to accommodate the structural parts of my sheet-feeder. These standards 17 may be properly connected by cross-bars or other ties to provide a sufficiently strong and rigid structure. A main driving shaft 18 is suitably journaled in the standards 17 and secured thereto is a driving pulley (not shown) for receiving power to drive the feeder. Secured to the shaft 18 is the driving gear 19 enmeshed with the gear 20 secured to the shaft 21, to which is affixed the lower pull-out rolls 22. The gear 20 engages with the gear 23 mounted on the shaft 24, to which are affixed the upper pull-out rolls 25. I prefer to construct the cooperating pull-out rolls 22 and 25 as shown in Figs. 2 and 3; these pull-out rolls are three in number and are in the form of disks each mounted on their respective shafts, so as to cooperate with one another, and have suitable spaces therebetween. The respective upper and lower rolls rotate in unison and at the same speed, through their respective gears 23 and 20.

Affixed to the frame 17, as shown in Fig. 3, is the feed-table 26 having journaled therein the forwarding rollers 27 and 28, or any other suitable devices to carry forward the individual sheets to a printing-press or other machine. This feed-table 26 is so arranged as to lie in proximity to the plane of junction between the upper and lower pull-out rolls 22 and 25, as shown in Fig. 1. This feed-table 26, with forwarding devices adapted to carry the individual sheets forwardly to a printing-press or like machine, is well-known and common in this art, and constitutes, in itself, no part of my present invention.

Mounted on the shaft 21 is the gear 29 which engages with the gear 30 secured to the shaft 31. The size of the gears 29 and 30 is such that the shaft 21 will make substantially three revolutions while the shaft 31 makes a single revolution. Mounted on the end of the shaft 31 is the disk 32, which carries the pin 33, upon which is pivoted the piston rod 34 projecting from the cylinder 35 affixed to the lower part of the frame 17, as shown in Fig. 1. The cylinder 35, with the piston therein may be of any suitable construction to produce a vacuum of sufficient degree to operate the suckers, which will be hereinafter described.

36 indicates the stack or pile of superimposed sheets of paper or other material which are to be separated one by one and withdrawn and fed forward from my feeder. Preferably the pile of sheets 36 is arranged with their edges in alinement and resting on edge in a slightly inclined position in a suitable rack or hopper formed in the frame 17, as shown in Fig. 1. It must be understood that my feeder will operate equally as well when the pile 36 is arranged vertically or at an intermediate angle; the inclination shown in Fig. 1 I have found very desirable in separating and feeding the sheets. As shown in this figure, the upper margins of the pile 36 rest against the transverse plate 37 adjustably secured to the cross-bar 38 mounted in the frame 17 by the set-screw 39. Secured at right angles to the plate 37 is the guide-plate 40 adapted to engage the upper edges of the pile, as shown in Fig. 1. The lower edges of the pile 36 rest upon the arms 41 (one of which is shown in Fig. 1), adjustably secured in the frame 17 upon the bar 42. The lateral edges of the pile 36 are engaged by a series of projecting arms 43, 44, 45 and 46, the lower arms 43 and 44 (Fig. 2) being mounted on the cross-bar 42, while the upper arms 45 and 46 are mounted upon studs adjustably secured in the frame 17 by set-screws 48 and 49 respectively. The lower part of the pile 36 rests upon a series of pile supports 50, 51 and 52, all pivotally mounted on the cross-bar 47 (Fig. 2), and depending from, and mounted on, the cross-

bar 38, are two brackets 53 and 54, having secured to their ends the spring separator blades 55 and 56 respectively, the ends of which project slightly outside the pile 36 along the upper lateral margins of the pile 36, as shown in Figs. 1 and 2. Journaled in the frame 17 is the transverse pile-support roller 57, over which the individual sheets are drawn through the action of the pull-out rolls 22 and 25, as shown in Fig. 8. The upper ends of the pile-supports 50, 51 and 52 are arranged to be in proximity to this pile-support roller 57, as shown.

Referring to Fig. 3, 58 and 59 designate two suckers mounted on the transverse tubular shaft 60. The construction of these suckers is shown more particularly in Figs. 4 and 5, and consists of a hollow L-shaped arm 61 mounted at right angles to the tubular shaft 60 with its hollow bore 62 engaging with the port 63 in the shaft 60, as shown in Fig. 4; the outer end of the arm 61 is screw-threaded at 64, and secured thereto is the bracket 65 carrying the flaring, conically-shaped lips 66, composed of rubber or other suitable material, to engage the surface of the outermost sheet. Secured to the end of the arm 61 is the transverse plate 67, the outer end of which lies in the same plane as the contacting edge of the rubber lips 66. This plate 67 presses against the surface of the pile 36, and enables the lips 66 to secure a firm hold upon the outermost sheet, and it also protects the more or less delicate rubber lips from injury.

Secured to one end of the tubular shaft 60 is the pipe 68 which leads to the sucker control valve mechanism shown in detail in Figs. 11 and 12. Any suitable form of valve mechanism may be used so as to regulate the proper action of the suckers. The device I have shown is constructed as follows: Mounted on the frame 17 is the cylindrical valve box 69 connected to the shaft 60 by the pipe 68 through the port 70; the pipe 71 connects the box 69 through the port 72, with the vacuum cylinder 35, as shown in Fig. 3. Journaled upon the box 69 is the oscillating valve 73 having cut therein a segmental opening 74 arranged to connect, in one position, the ports 70 and 72, as shown in Figs. 11 and 12, thereby creating a vacuum within the rubber lips 66, and in another position to connect the port 70 with the vent 75, which causes the suckers 58 and 59 to release their hold on the sheet. The oscillating movement of the valve 73 is secured and controlled by the cam 76 mounted on the shaft 31, the cam 76 engaging with a cam-roller 77 pivoted to the arm 78 secured to the valve 73, as shown in Figs. 11 and 12. The coil-spring 79 holds the cam-roller 77 always in contact with the cam 76, and Fig. 11 shows that when the roller 77 contacts with the high part of the cam 76, the suckers 58 and

59 are in direct communication with the vacuum cylinder 35, through the shaft 60, pipe 68, port 70, opening 74, port 72, and pipe 71.

The two suckers 58 and 59 are preferably mounted on the shaft 60 slightly beyond the vertical planes of the two outer pull-out rolls, as shown in Fig. 3, so as to engage the outermost sheet of the pile 36 near the upper corners thereof, as shown in Fig. 6. The tubular shaft 60 carrying the suckers 58 and 59, extends transversely across the feeder, and is pivotally mounted upon the links 80 and 81 secured to the studs 82 and 83 respectively, in the frame 17, as shown in Fig. 3. Mounted on the tubular shaft 60 is the cam-roller 84 which is engaged by a suitably-shaped cam 85 mounted on the shaft 31, as shown in Figs. 6, 7 and 8. The rotation of this cam 85 in the direction shown by the arrow causes the suckers 58 and 59 to be successively lifted and lowered, as shown in these figures, to separate and bend down the upper portion of the outermost sheet to be engaged by the pull-out rolls 22 and 25, to be thereafter withdrawn from the pile and fed forwardly to the feed-table 26. The orbit through which the tubular shaft 60 passes in its upward and downward path is shown in Fig. 1 by the circular slot 86; the coil-spring 87 connecting the link 81 to the frame 17 always holds the cam-roller 84 in contact with the sucker-operating cam 85.

Referring particularly to Figs. 6, 7 and 8, the upper pull-out rolls 25 are so constructed as to have within their peripheries curved cut-out portions or openings 88, which are adapted to contain, within themselves, the upper edge portion of the outermost sheet 89, after it has been pulled back and separated from the pile 36, as shown in Fig. 7. The continued rotation of the pull-out rolls 25 bends the upper portion of the sheet through the peripheral hook-ends 90 of the roll 25, as shown in Fig. 8, the hook-ends 90 first engaging the sheet 89, as shown in dotted lines, and then bending and carrying the sheet downwardly so that its upper margin is engaged between the hook-ends 90 of the upper pull-out rolls 25 and the periphery of the lower pull-out rolls 22, as shown in full lines in 8. The suckers 58 and 59 release the sheet 89 as soon as the hook-end 90 engages the upper portion of the sheet.

Referring to Figs. 9 and 10, I prefer to hold the lower half of the pile 36 in a slightly curved or buckled position by having the middle pile support 51 held slightly advanced from the transverse plane of the other pile-supports 50 and 52, as shown in Fig. 9. This enables me to withdraw the lower portion of the outermost sheet from the pile more easily than if the dead weight of the pile 36 bore against the sheet which is being withdrawn. To the upper end of

the pile-support 51 is secured the bracket 91 carrying the cam-roller 92 adapted to engage a suitably-shaped cam 93 mounted on the cam-shaft 31, as shown in Fig. 8. The coil-spring 94, connecting the pile-support 51 with the frame 17, always holds the cam-roller 92 in contact with the cam 93. As shown in Fig. 8, just as the sheet 89 is engaged by the pull-out rollers 22 and 25, the pile-support 51 falls away from the pile 36 by the roller 92 entering the drop in the cam 93, the suckers 58 and 59 being in their lowered position, as shown in Figs. 8 and 10. This backward movement of the pile-support 51, as shown in Fig. 10, suddenly relieves the weight or pressure of the pile 36 against the lower portion of the outermost sheet 89, thereby enabling the pull-out rolls to readily disengage, through diminished friction, this sheet 89 from the next sheet in the pile, without tearing and, furthermore, without disturbing or distorting the balance of the pile, such dropping away of the pile supports taking place simultaneously with the bite of the pull-out rolls, enabling me to take advantage of the inertia of the pile in extracting the lower portion of the outermost sheet. The retraction of the pile-support 51 is so abrupt and rapid that the momentary relieving of the pressure of the pile itself prevents the inherent weight of the associated sheets constituting the balance of the pile from immediately or closely following the retracted pile-support 51 when the roller 92 enters the drop of the cam 93 as shown in Fig. 8; it is during this instant of relieved pressure, or inherent weight, that the outermost sheet 89 theretofore seized by the suckers 58 and 59 begins to withdraw from the pile 36. The inherent weight of the pile on the pile-support 51 may have returned to normal before the sheet is fully withdrawn, yet the quick retraction of this support has served its purpose in relieving the inherent weight of the pile itself at the very instant of the starting of the outermost sheet 89 so that this detached sheet is under headway, and its bearing surface with attending friction is constantly and rapidly being reduced in area as the sheet is withdrawn from the pile. In lieu of the three pile-supports 50, 51 and 52, I may employ a curved plate projecting convexly into the body of the pile, the purpose in each case being to stiffen the sheets in the pile 36 as well as to reduce the friction surface as much as possible. However, my preferred construction is to give a slight reciprocating movement to the pile-support 51, as hereinbefore shown and described.

Referring to the alternate construction shown in Fig. 13, I have here illustrated a variation in the location and shape of the suckers, and in their mode of operation. The sucker 59 (only one being shown) is



mounted in the tubular shaft 60 which is journaled in the frame 17 and has only an oscillating movement in the frame. The hollow arm 112 carrying the sucker 59 is U-shaped, and is rigidly secured to the shaft 60. To the outer end of the shaft 60 is an arm 113 to which is pivoted the link 114 carrying the cam-roller 115 adapted to engage the cam 116 mounted on the cam-shaft 31. The coil-spring 117 holds the cam-roller 115 in contact with the cam 116, and the link 114 has its outer end slotted at 118, through which the shaft 31 passes in the reciprocating movement in the link. In the construction shown the sucker 59 is pressed against the pile 36 through the cam-roller 115 riding along the high part of the cam 116; the roller 115 is about to descend, which will rock the shaft 60 through the link 114 and arm 113 in a contra-clockwise direction, which will cause the sucker 59 to swing away from the pile, as shown in dotted lines, and carry the outermost sheet within the bite of the pull-out rolls 22 and 25.

It is obvious that the pivot point of the suckers is capable of various locations, the essential requirement being that the suckers be arranged and located on the feeder so that they pull off the outer sheet and bend same sufficiently to cause it to enter between the pull-out rolls, and then pass out of the forward path of the sheet which is being fed forward.

The operation of my sheet-feeder is substantially as follows: The stack or pile of sheets or blanks 36 is placed within the rack or hopper formed as hereinbefore described, with the pile-support 51, or the curved plate to be used in lieu of the pile-support, causing the pile of sheets to slightly buckle forwardly, as shown in Figs. 6, 7 and 9. The respective cams 76, 85 and 93, having the shapes as illustrated in the figures, are mounted and secured to the cam-shaft 31, as to first cause the suckers to be lifted in contact with the outermost sheet of the pile, as shown in Fig. 6. The two suckers 58 and 59 are preferably arranged on their hollow shaft 60, so as to engage the upper corners of the pile 36, so as to first disengage the extreme corners of the sheet and admit air between the outermost sheet and the second sheet, so as to prevent the second sheet from following the first. The suction control valve 73 is opened by the cam 76, thereby connecting the two suckers with the vacuum cylinder 35, the parts constituting the valve mechanism being substantially in the position as shown in Figs. 11 and 12. As soon as the suckers 58 and 59 have fastened themselves to the outermost sheet, they are quickly swung away or withdrawn from the plane of the pile of the sheets, carrying with them this separated sheet 89 so that its edges have snapped by

the plate 37 and the spring fingers 55 and 56; meanwhile the upper pull-out rolls are rotated contra-clockwise so that the upper margin of the sheet 89 passes within the cut-out openings 88 in the rolls 25, all as shown in Fig. 7. As soon as the hook-ends 90 of the rolls 25 have engaged the sheet, as shown in dotted lines in Fig. 8, the cam-roller 77 drops off the high part of the cam 76 and the spring 79 causes the valve 73 to rotate in a clockwise direction, thereby shutting off the vacuum from the suckers, and simultaneously connecting the latter with the atmosphere through the vent 75. This causes the suckers 58 and 59 to release their hold on the sheet 89, and the suckers are rapidly lowered out of the path of the bent-over sheet through the cam-roller 84 riding down the sharp drop of the cam 85, as shown in Fig. 8. As the sheet 89 is bent over within the cut-out openings 88 in the upper pull-out rolls 25, the upper margin of the sheet is caught in the bite between the hook-ends 90 and the periphery of the lower pull-out rolls 22, and simultaneously therewith the cam-roller 92 rides off the high part of cam 93, as shown in Fig. 8, which causes the retraction of the pile-support 51 through the force of the coil-spring 94, which momentarily straightens the pile 36, as shown in Figs. 8 and 10, from the buckled position shown in Figs. 6 and 9, thereby enabling the outermost sheet 89, now caught between the rolls 22 and 25, to be rapidly drawn out over the roller 57, free from the weight or pressure of the remainder of the pile, and without disturbing the position of the next sheet in the pile. The sheet 89 is then passed forwardly to the feed-table 26 to be advanced to the printing-press or other like machine. Inasmuch as the pull-out rolls 22 and 25 make three revolutions while the cam-shaft 31 makes a single revolution, it will be obvious that separation and feeding forward of the sheet proceeds while the suckers are rising to perform their initial function in pulling out the upper portion of the next sheet in the second cycle of movement. The peripheral length of the pull-out rolls, with their triple revolutions for each cycle of operations, is amply sufficient to deliver the sheet from the pile and advance same to the feeding-off rollers or other devices on the feed-table proper.

My improved sheet-feeder, therefore, combines first the action of the suckers in preliminarily separating and drawing down the upper edge or margin of the separated sheet within the path of the cut-out openings in the upper pull-out rolls; then the sucker action is terminated, and the upper portion of the sheet is further bent down by the upper pull-out roll into the opening between the two sets of pull-out rolls formed by the cut-out openings and the peripheries of the

lower rolls, and thereafter the sheet is grasped slightly back of its front edge when withdrawal from the pile proper begins; simultaneously with such withdrawal the pressure of the pile against the sheet is momentarily released just as the sheet starts to feed, which release of the pile has distinct advantages in securing the proper separation and advancement of the individual sheets.

I claim as my invention:—

1. In a sheet-feeder, the combination with a support for a pile of sheets standing on edge, of means for detaching one end of the outer sheet from the pile by bending the sheet edge at the beginning of the separation, means for engaging the detached end and drawing the sheet from the pile, and means for relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

2. In a sheet-feeder, the combination with an inclined support for a pile of sheets on edge, of means for detaching one end of the outer sheet from the pile, means for engaging the detached end and drawing the sheet from the pile, and means for relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

3. In a sheet-feeder, the combination with a support for a pile of sheets standing on edge, of means for detaching one end of the outer sheet from the pile by bending the sheet edge at the beginning of the separation, rotary means for engaging the detached end and drawing the sheet from the pile, and means for relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

4. In a sheet-feeder, the combination with an inclined support for a pile of sheets on edge, of means for detaching one end of the outer sheet from the pile, rotary means for engaging the detached end and drawing the sheet from the pile, and means for relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

5. In a sheet-feeder, the combination with a support for a pile of sheets standing on edge, of means for detaching one end of the outer sheet from the pile by bending the sheet edge at the beginning of the separation, means for engaging the detached end and drawing the sheet from the pile, and means for simultaneously relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

6. In a sheet-feeder, the combination with an inclined support for a pile of sheets on edge, of means for detaching one end of the outer sheet from the pile, means for engaging the detached end and drawing the sheet from the pile, and means for simul-

taneously relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

7. In a sheet-feeder, the combination with a support for a pile of sheets standing on edge, of means for detaching one end of the outer sheet from the pile by bending the sheet edge at the beginning of the separation, rotary means for engaging the detached end and drawing the sheet from the pile, and means for simultaneously relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

8. In a sheet-feeder, the combination with an inclined support for a pile of sheets on edge, of means for detaching one end of the outer sheet from the pile, rotary means for engaging the detached end and drawing the sheet from the pile, and means for simultaneously relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

9. In a sheet-feeder, the combination with a support for a pile of sheets standing on edge, of means for detaching one end of the outer sheet from the pile by bending the sheet edge at the beginning of the separation, means for engaging the detached end and drawing the sheet from the pile, and means for momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

10. In a sheet-feeder, the combination with an inclined support for a pile of sheets on edge, of means for detaching one end of the outer sheet from the pile, means for engaging the detached end and drawing the sheet from the pile, and means for momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

11. In a sheet-feeder, the combination with a support for a pile of sheets standing on edge, of means for detaching one end of the outer sheet from the pile by bending the sheet edge at the beginning of the separation, rotary means for engaging the detached end and drawing the sheet from the pile, and means for momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

12. In a sheet-feeder, the combination with an inclined support for a pile of sheets on edge, of means for detaching one end of the outer sheet from the pile, rotary means for engaging the detached end and drawing the sheet from the pile, and means for momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

13. In a sheet-feeder, the combination with a support for a pile of sheets, of means for detaching one end of the outer sheet

from the pile, means for engaging the detached end and drawing the sheet from the pile, and means for simultaneously and momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

14. In a sheet-feeder, the combination with an inclined support for a pile of sheets on edge, of means for detaching one end of the outer sheet from the pile, means for engaging the detached end and drawing the sheet from the pile, and means for simultaneously and momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

15. In a sheet-feeder, the combination with a support for a pile of sheets, of means for detaching one end of the outer sheet from the pile, rotary means for engaging the detached end and drawing the sheet from the pile, and means for simultaneously and momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

16. In a sheet-feeder, the combination with an inclined support for a pile of sheets on edge, of means for detaching one end of the outer sheet from the pile, rotary means for engaging the detached end and drawing the sheet from the pile, and means for simultaneously and momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

17. In a sheet-feeder, the combination with a support for a pile of sheets, of means for successively detaching and withdrawing the undermost sheet, and means for relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

18. In a sheet-feeder, the combination with a support for a pile of sheets, of means for successively detaching and withdrawing the undermost sheet, and means for simultaneously relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

19. In a sheet-feeder, the combination with a support for a pile of sheets, of means for successively detaching and withdrawing the undermost sheet, and means for simultaneously and momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

20. In a sheet-feeder, the combination with an inclined support for a pile of sheets on edge, of means for successively detaching and withdrawing the undermost sheet, and means for relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

21. In a sheet-feeder, the combination with an inclined support for a pile of sheets on edge, of means for successively detach-

ing and withdrawing the undermost sheet, and means for simultaneously relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

22. In a sheet-feeder, the combination with an inclined support for a pile of sheets on edge, of means for successively detaching and withdrawing the undermost sheet, and means for simultaneously and momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

23. In a sheet-feeder, the combination with a support for a pile of sheets, of means for detaching one end of the outer sheet from the pile, means comprising a rotatable pull-out roll having a cut-out portion extending across the entire periphery of said roll for directly engaging the detached end from said detaching means, a cooperating rotatable pull-out roll to contact with the periphery of the first-mentioned pull-out roll, means for rotating the rolls to withdraw the detached sheet from the pile, and means for relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

24. In a sheet-feeder, the combination with a support for a pile of sheets, of means for detaching one end of the outer sheet from the pile, means comprising a rotatable pull-out roll having a cut-out portion extending across the entire periphery of said roll for directly engaging the detached end from said detaching means, a cooperating rotatable pull-out roll to contact with the periphery of the first-mentioned pull-out roll, means for rotating the rolls to withdraw the detached sheet from the pile, and means for simultaneously relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

25. In a sheet-feeder, the combination with a support for a pile of sheets, of means for detaching one end of the outer sheet from the pile, means comprising a rotatable pull-out roll having a cut-out portion extending across the entire periphery of said roll for directly engaging the detached end from said detaching means, a cooperating rotatable pull-out roll to contact with the periphery of the first-mentioned pull-out roll, means for rotating the rolls to withdraw the detached sheet from the pile, and means for momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

26. In a sheet-feeder, the combination with a support for a pile of sheets, of means for detaching one end of the outer sheet from the pile, means comprising a rotatable pull-out roll having a cut-out portion extending across the entire periphery of said roll for directly engaging the detached end

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from said detaching means, a cooperating rotatable pull-out roll to contact with the periphery of the first-mentioned pull-out roll, means for rotating the rolls to withdraw the detached sheet from the pile, and means for simultaneously and momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

27. In a sheet-feeder, the combination with a support for a pile of sheets, of means comprising a pneumatic sucker for detaching one end of the outer sheet from the pile, means for moving said sucker toward and from the pile, an air-exhausting means to produce a partial vacuum in the sucker, a valve for relieving said vacuum, means comprising a rotatable pull-out roll having a cut-out portion across its entire periphery for directly engaging the detached end and drawing the sheet from the pile, means for opening said valve when said last-mentioned means has engaged the detached end of the sheet, and means for relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

28. In a sheet-feeder, the combination with a support for a pile of sheets, of means comprising a pneumatic sucker for detaching one end of the outer sheet from the pile, means for moving said sucker toward and from the pile, an air-exhausting means to produce a partial vacuum in the sucker, a valve for relieving said vacuum, means comprising a rotatable pull-out roll having a cut-out portion across its entire periphery for directly engaging the detached end and drawing the sheet from the pile, means for opening said valve when said last-mentioned means has engaged the detached end of the sheet, and means for simultaneously relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

29. In a sheet-feeder, the combination with a support for a pile of sheets, of means comprising a pneumatic sucker for detaching one end of the outer sheet from the pile, means for moving said sucker toward and from the pile, an air-exhausting means to produce a partial vacuum in the sucker, a valve for relieving said vacuum, means comprising a rotatable pull-out roll having a cut-out portion across its entire periphery for directly engaging the detached end and drawing the sheet from the pile, means for opening said valve when said last-mentioned means has engaged the detached end of the sheet, and means for momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

30. In a sheet-feeder, the combination with a support for a pile of sheets, of means comprising a pneumatic sucker for detaching

one end of the outer sheet from the pile, means for moving said sucker toward and from the pile, an air-exhausting means to produce a partial vacuum in the sucker, a valve for relieving said vacuum, means comprising a rotatable pull-out roll having a cut-out portion across its entire periphery for directly engaging the detached end and drawing the sheet from the pile, means for opening said valve when said last-mentioned means has engaged the detached end of the sheet, and means for simultaneously and momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

31. In a sheet-feeder, the combination with a support for a pile of sheets, of a pair of rotatable pull-out rolls, one of said rolls having a cut-out portion extending across its periphery to make and close an opening between the rolls, means to detach one end of the outer sheet from the pile and bend same directly into said cut-out portion, means for rotating said pull-out rolls to draw the sheet from the pile, and means for relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

32. In a sheet-feeder, the combination with a support for a pile of sheets, of a pair of rotatable pull-out rolls, one of said rolls having a cut-out portion extending across its periphery to make and close an opening between the rolls, means to detach one end of the outer sheet from the pile and bend same directly into said cut-out portion, means for rotating said pull-out rolls to draw the sheet from the pile, and means for simultaneously relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

33. In a sheet-feeder, the combination with a support for a pile of sheets, of a pair of rotatable pull-out rolls, one of said rolls having a cut-out portion extending across its periphery to make and close an opening between the rolls, means to detach one end of the outer sheet from the pile and bend same directly into said cut-out portion, means for rotating said pull-out rolls to draw the sheet from the pile, and means for momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

34. In a sheet-feeder, the combination with a support for a pile of sheets, of a pair of rotatable pull-out rolls, one of said rolls having a cut-out portion extending across its periphery to make and close an opening between the rolls, means to detach one end of the outer sheet from the pile and bend same directly into said cut-out portion, means for rotating said pull-out rolls to draw the sheet from the pile, and means for simultaneously and momentarily relieving the inherent

weight of the pile upon the detached sheet during its withdrawal from the pile.

35. In a sheet-feeder, the combination with a support for a pile of sheets, of a pair of rotatable pull-out rolls, one of said rolls having a cut-out portion extending across its periphery to make and close an opening between the rolls, a pneumatic sucker, means for moving said sucker toward and from the pile to detach one end of the outer sheet and bend same directly into said cut-out portion, an air-exhausting means to produce a partial vacuum in the sucker, a valve for relieving said vacuum, means for opening said valve when said cut-out portion has engaged said detached sheet end, means for rotating said pull-out rolls to draw the sheet from the pile, and means for relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

36. In a sheet-feeder, the combination with a support for a pile of sheets, of a pair of rotatable pull-out rolls, one of said rolls having a cut-out portion extending across its periphery to make and close an opening between the rolls, a pneumatic sucker, means for moving said sucker toward and from the pile to detach one end of the outer sheet and bend same directly into said cut-out portion, an air-exhausting means to produce a partial vacuum in the sucker, a valve for relieving said vacuum, means for opening said valve when said cut-out portion has engaged said detached sheet end, means for rotating said pull-out rolls to draw the sheet from the pile, and means for simultaneously relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

37. In a sheet-feeder, the combination with a support for a pile of sheets, of a pair of rotatable pull-out rolls, one of said rolls having a cut-out portion extending across its periphery to make and close an opening between the rolls, a pneumatic sucker, means for moving said sucker toward and from the pile to detach one end of the outer sheet and bend same directly into said cut-out portion, an air-exhausting means to produce a partial vacuum in the sucker, a valve for relieving said vacuum, means for opening said valve when said cut-out portion has engaged said detached sheet end, means for rotating said pull-out rolls to draw the sheet from the pile, and means for momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

38. In a sheet-feeder, the combination with a support for a pile of sheets, of a pair of rotatable pull-out rolls, one of said rolls having a cut-out portion extending across its periphery to make and close an opening between the rolls, a pneumatic sucker, means for moving said sucker toward and from the pile to detach one end of the outer sheet and bend same directly into said cut-out portion, an air-exhausting means to produce a partial vacuum in the sucker, a valve for relieving said vacuum, means for opening said valve when said cut-out portion has engaged said detached sheet end, means for rotating said pull-out rolls to draw the sheet from the pile, and means for simultaneously and momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

39. In a sheet-feeder, the combination with means for supporting a pile of sheets standing on edge and means for detaching the outer sheet by preliminarily bending the sheet edge from the pile, of means for relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

40. In a sheet-feeder, the combination with means for supporting a pile of sheets standing on edge and means for detaching the outer sheet by preliminarily bending the sheet edge from the pile, of means for simultaneously relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

41. In a sheet-feeder, the combination with means for supporting a pile of sheets standing on edge and means for detaching the outer sheet by preliminarily bending the sheet edge from the pile, of means for momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

42. In a sheet-feeder, the combination with means for supporting a pile of sheets standing on edge and means for detaching the outer sheet by preliminarily bending the sheet edge from the pile, of means for simultaneously and momentarily relieving the inherent weight of the pile upon the detached sheet during its withdrawal from the pile.

CHARLES W. HARROLD.

Witnesses:

C. E. PRITCHARD,  
A. D. LOOP.