

April 7, 1942.

A. J. JENNER

2,278,449

ARTICLE HANDLING

Filed Feb. 20, 1940

7 Sheets-Sheet 1

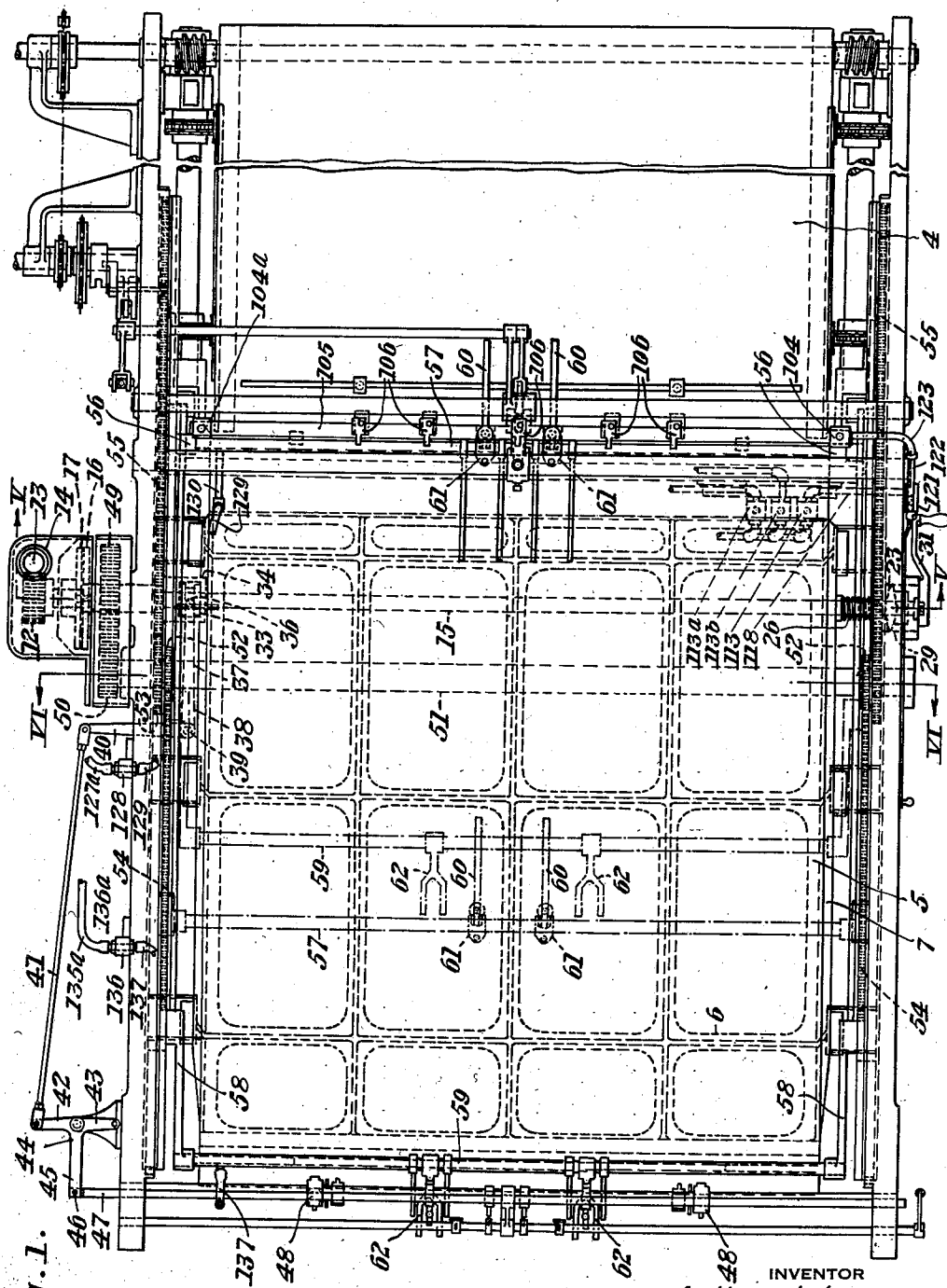


Fig. 1.

INVENTOR
Arthur J. Jenner

by *William Thomas Pender*
his attorney

April 7, 1942.

A. J. JENNER

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ARTICLE HANDLING

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7 Sheets-Sheet 3

Fig. 3.

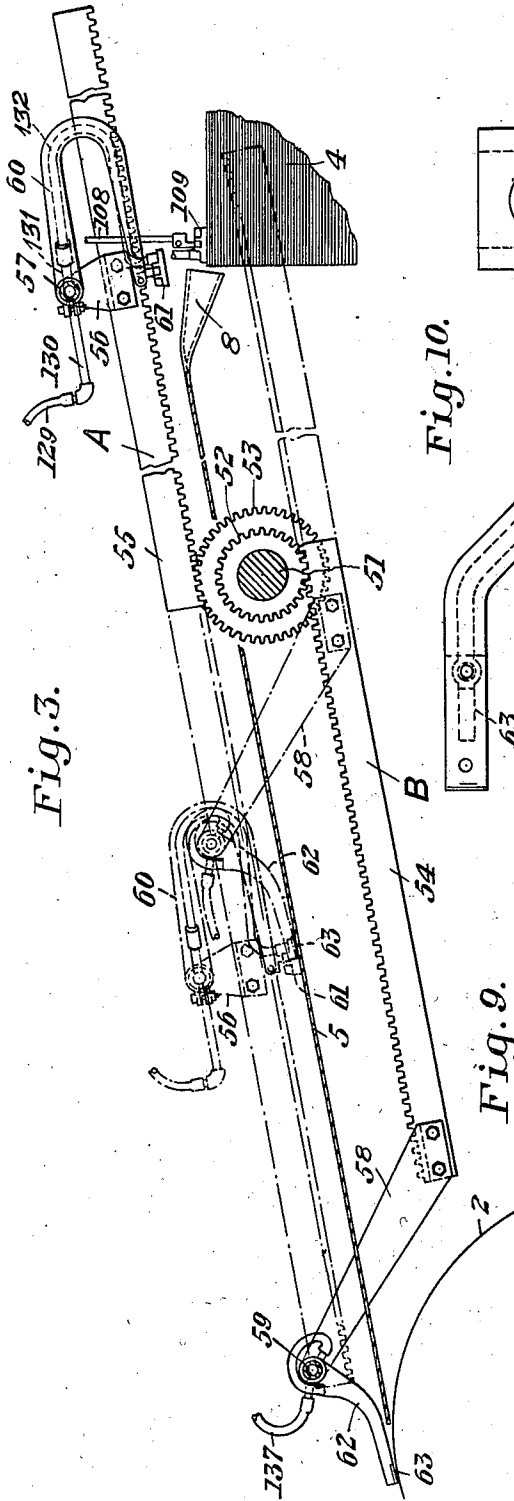


Fig. 10.

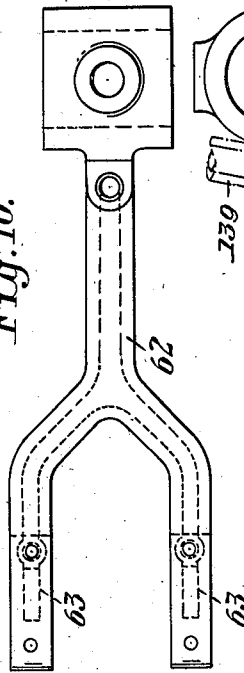


Fig. 11.

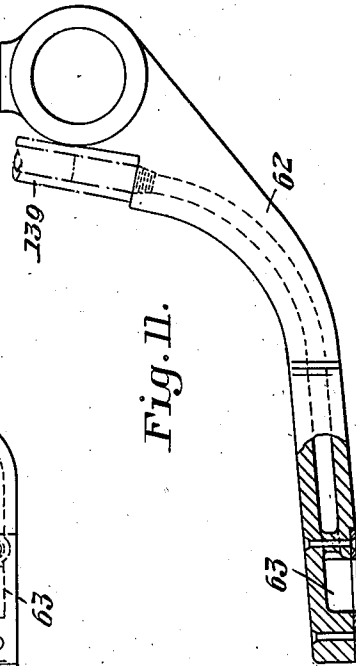
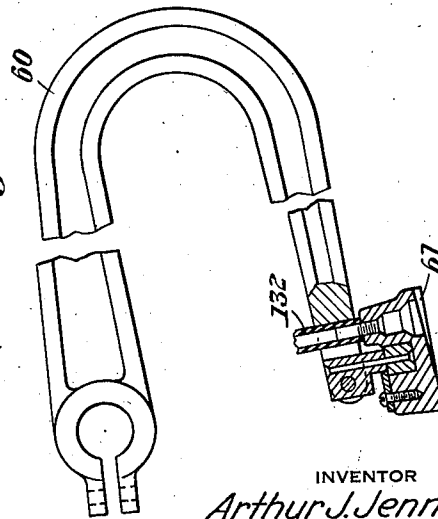


Fig. 9.



INVENTOR

Arthur J. Jenner

by *Edmund H. Parnell*
his attorney

April 7, 1942.

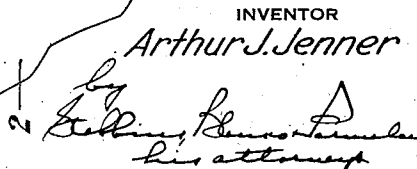
A. J. JENNER

2,278,449

ARTICLE HANDLING

Filed Feb. 20, 1940

7 Sheets-Sheet 4



April 7, 1942.

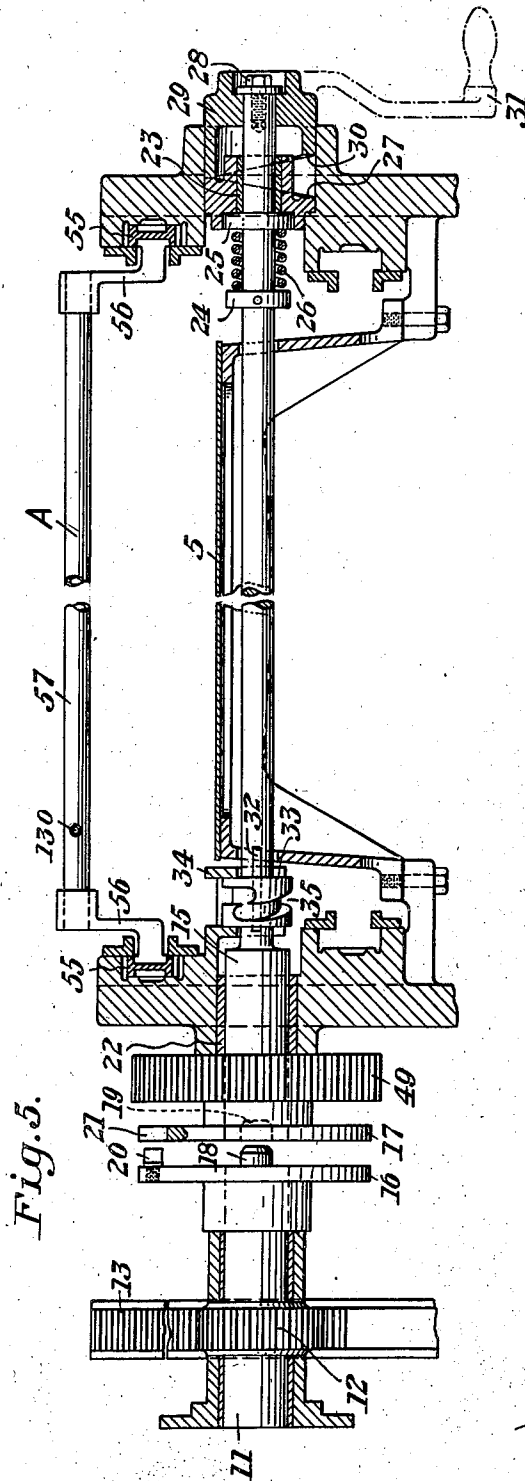
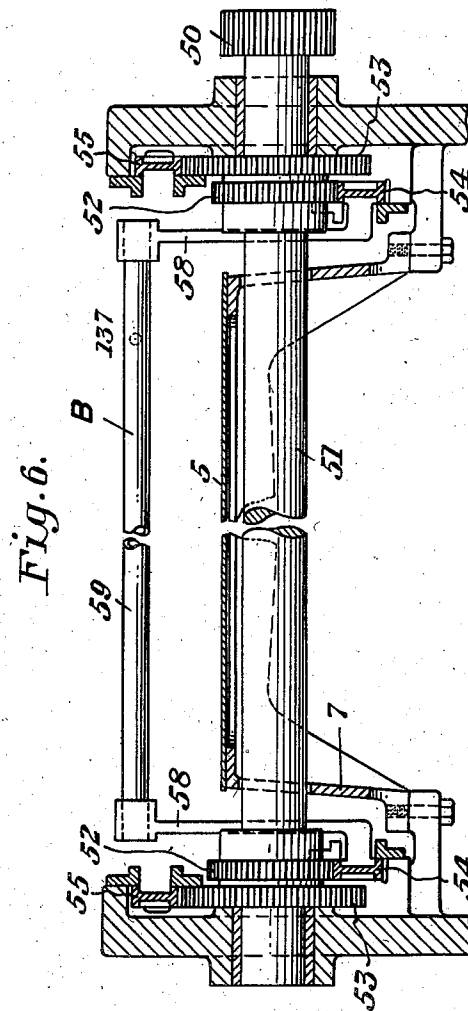
A. J. JENNER

2,278,449

ARTICLE HANDLING

Filed Feb. 20, 1940

7 Sheets-Sheet 5



INVENTOR

Arthur J. Jenner

by *William B. Jenner*
his attorney

April 7, 1942.

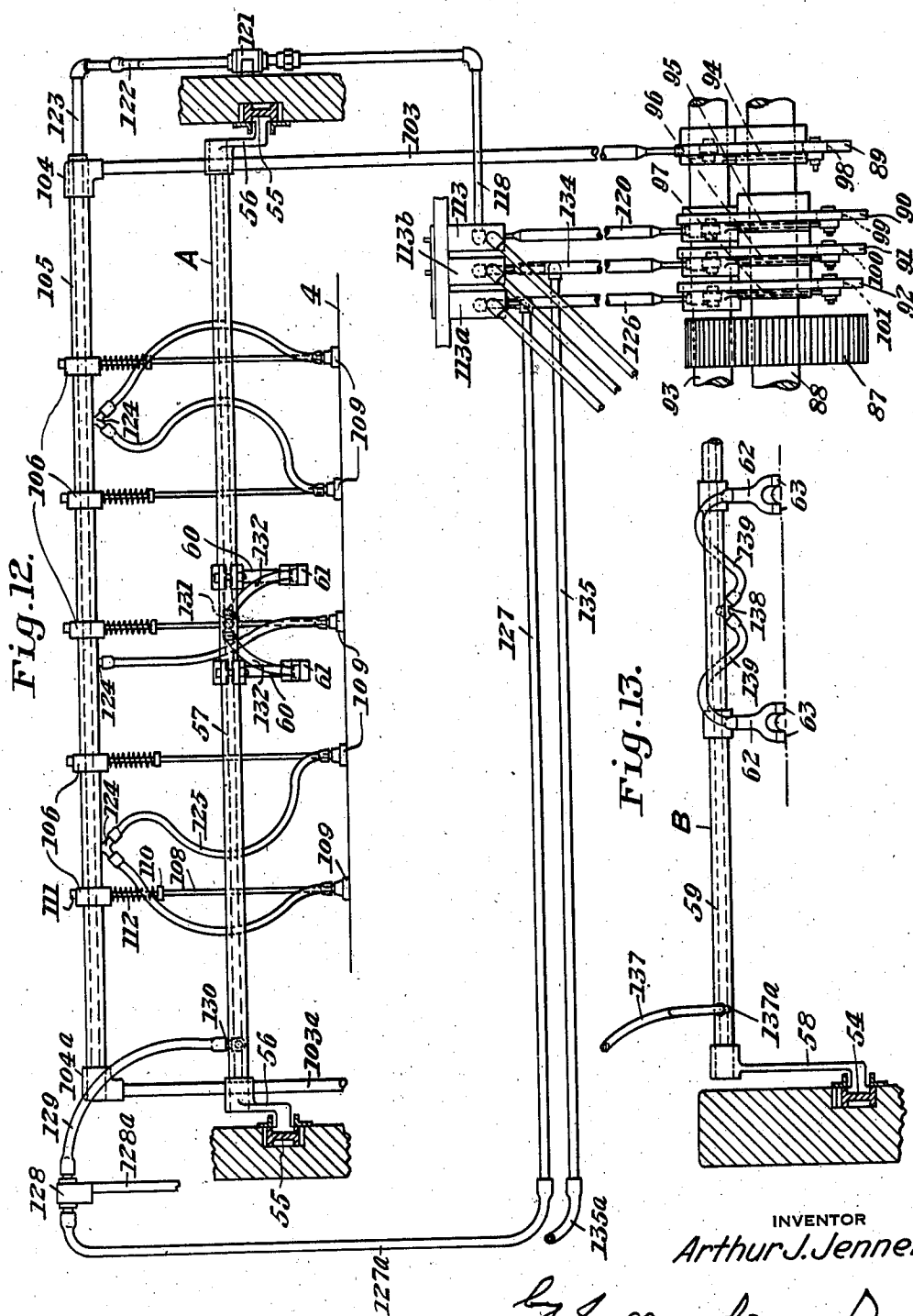
A. J. JENNER

2,278,449

ARTICLE HANDLING

Filed Feb. 20, 1940

7 Sheets-Sheet 6



INVENTOR

Arthur J. Jenner

By [Signature] Attorney

April 7, 1942.

A. J. JENNER
ARTICLE HANDLING

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Filed Feb. 20, 1940

7 Sheets-Sheet 7

Fig. 17.

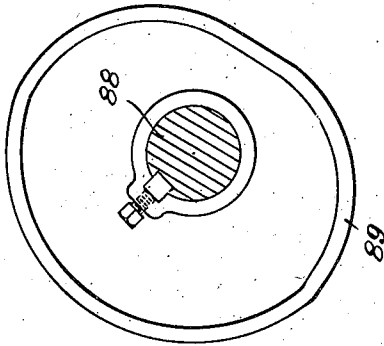


Fig. 16.

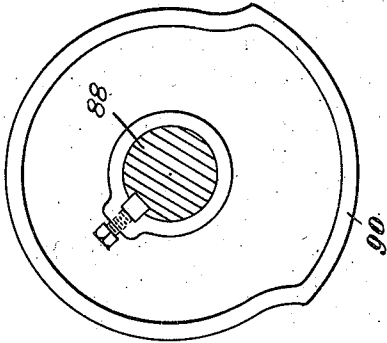


Fig. 15.

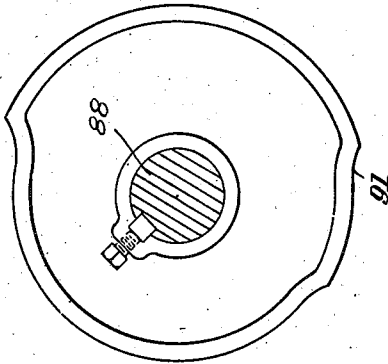


Fig. 14.

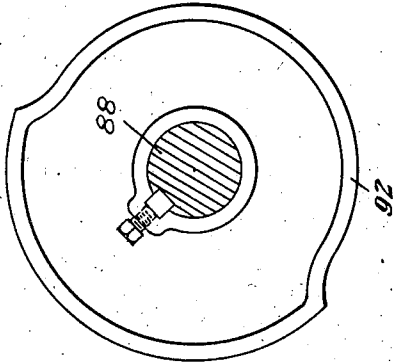
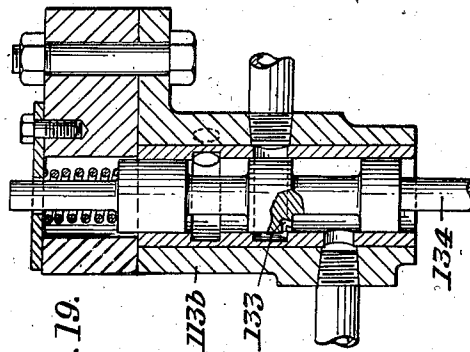


Fig. 19.

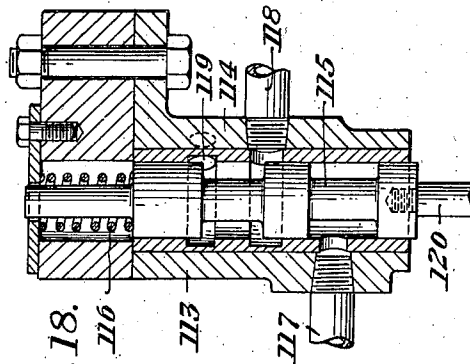


Fig. 18.

INVENTOR

Arthur J. Jenner

by *William H. Thomas*, *his attorney*

UNITED STATES PATENT OFFICE

2,278,449

ARTICLE HANDLING

Arthur J. Jenner, Chicago, Ill., assignor to Miller Printing Machinery Co., Pittsburgh, Pa., a corporation of Pennsylvania

Application February 20, 1940, Serial No. 319,862

46 Claims. (Cl. 271-14)

This invention relates to article handling. While it may be employed in many applications I have found it particularly useful in the handling of sheets and especially in the feeding of sheets to a press or the like.

For the sake of illustration I shall describe the invention as applied to a feeder for a flat bed and cylinder type printing press. The invention has particular advantages in such an application, although it is not restricted to use in connection with feeders or, indeed, in the handling of sheets, as in its broader aspects the invention is applicable generally to the handling of any articles adaptable for handling in the manner contemplated.

In describing the invention as embodied in a feeder for a flat bed and cylinder type printing press the general advantages of the invention and also specific advantages attendant upon the application thereof to the feeder art will be brought out. A feeder in order to most effectively serve its purpose should possess a number of qualities, among which some of the more important are speed, bringing the sheets successively into registry with the press at reduced velocity, shortness in the direction of feed and accurate and reliable handling of the sheets. At the present time speed is an important requisite of a satisfactory feeder as presses are being designed to operate at higher speeds than ever before. However, the higher the speed of operation of the feeder the more difficult becomes the problem of reducing the velocity of the sheet just prior to registry. The feeder should be short in the direction of feed so as not to consume unnecessary floor space. The mechanism should be such as to positively move and guide the sheets to eliminate to the greatest possible extent danger of miscarriage of sheets and consequent delays due to shut-downs.

One type of feeder which has been as satisfactory as any heretofore available and which has been in use over a period of years employs a reciprocable carriage which at one end of its strokes takes sheets from a pile and at the other end of its stroke registers the sheets to the drop guides of the press. The amplitude of reciprocation of the carriage is half the distance through which the sheets travel from the pile to the press. On one forward movement of the carriage a sheet is taken from the pile and advanced half way to the press. At this half-way point the sheet is retained on the feed board while the carriage moves rearwardly. Upon the succeeding forward movement of the carriage the sheet is

advanced from the half-way point to registered position and another sheet simultaneously is advanced from the pile to the half-way point. This feeder has the advantage that because the amplitude of reciprocation of the carriage is only half the distance from the pile to the press the stresses due to stopping and starting of the moving mass are less than if the carriage moved through a distance equal to the entire distance from the pile to the press.

The feeder just referred to, however, has certain disadvantages. The velocity at which the sheets move into registered position is at times undesirably high, particularly when the press is operating at high speed. By reason of the fact that each sheet in its movement into registered position of necessity moves through a distance which is greater than the dimension of the sheet in the direction of feed it must be advanced to registry at comparatively high speed, as otherwise the feeder would not maintain synchronism with the press. The rapid movement of the sheets into registered position sometimes results in miscarriage of a sheet, which may necessitate stopping of the press. Also as the distance between the pile and the press and, consequently, the length of the feeder must be at least somewhat greater than twice the dimension of the sheets being fed in the direction of feed this results in consumption of an undesirably great amount of floor space, particularly when relatively large sheets are being fed.

I have devised an article handling method and apparatus which, when embodied in a feeder, bring about all of the advantages to be desired above referred to and obviate the disadvantages of the prior feeder. Instead of employing a single reciprocable carriage as in the prior feeder I preferably employ a pair of oscillatable or reciprocable carriers which successively advance the sheets in their feeding movement. The two oscillatable carriers are preferably so constructed and arranged that one of them on a forward movement takes a sheet from the pile and advances it part way toward the press, the other carrier simultaneously moving away from the press to meet the sheet in intermediate position. The two carriers preferably come to rest simultaneously and the sheet is transferred from the first carrier to the second, whereupon the carriers move in the reverse direction, the first returning to the pile and the second advancing to register the sheet to the press.

The intermediate position or transfer point may, unlike the prior feeder above referred to,

be disposed elsewhere than half-way between the pile and the press. It may be disposed relatively near the pile or relatively near the press as desired. I prefer to dispose the transfer point nearer the press than the pile, as this reduces the amplitude of movement of the sheets as they move into registered position relatively to the press. In other words, each sheet may advance throughout the greater portion of the distance between the pile and press on the first carrier and then advance throughout a relatively short distance on the second carrier. As the carriers preferably reciprocate or oscillate in synchronism the first carrier moves rapidly while the second carrier moves quite slowly relatively thereto and the sheets move into registered position at desirably low speed.

Also it is necessary with my new feeder for the distance between the pile and the press to be greater than twice the dimension of the sheets in the direction of feed. As only one sheet can ever be at a position intermediate the pile and the press at a given time this distance may be reduced so that it is only enough greater than the dimension of the sheets in the direction of feed to allow for removal of a registered sheet upon the press cylinder prior to advance of the succeeding sheet to within a distance from the press equal to the dimension of the sheets being fed in the direction of feed. As a practical matter the distance between the pile and the press can be reduced to about one and one-fourth times the dimension of the sheets in the direction of feed or even less. This results in a substantial saving in space which was not possible with the prior feeder and at the same time the sheets can be moved into registry at much lower speed than before. There are fewer miscarriages of sheets as they move into registered position and, consequently, fewer stoppages of the press due to miscarriages.

Other details, objects and advantages of the invention will become apparent as the following description of a present preferred embodiment of the invention and a present preferred method of practicing the same proceeds.

In the accompanying drawings I have shown a present preferred embodiment of the invention and have illustrated a present preferred method of practicing the same, the invention being therein illustrated is embodied in a feeder for a flat bed and cylinder printing press. In the drawings

Figure 1 is a plan view of a feeder with a portion cut away;

Figure 2 is a side elevational view, partly in vertical longitudinal cross section, of the feeder shown in Figure 1;

Figure 3 is a diagrammatic elevational view similar to Figure 2 but to enlarged scale with a portion cut away and with portions of the mechanism removed whereby more clearly to show portions with which the invention in certain of its aspects is primarily concerned;

Figure 4 is a view similar to Figure 3 showing more particularly the vacuum applying and control means which have for the most part been omitted from Figures 1, 2 and 3 to avoid obscuring other parts;

Figure 5 is a vertical transverse cross-sectional view to enlarged scale taken on the line V—V of Figure 1;

Figure 6 is a vertical transverse cross-sectional view to enlarged scale taken on the line VI—VI of Figure 1;

Figure 7 is a fragmentary plan view partly in horizontal cross section of a portion of the operating mechanism;

Figure 8 is a fragmentary vertical longitudinal cross-sectional view through a portion of the operating mechanism including the portion shown in Figure 7 and also additional operating elements, the parts being shown in one extreme operative position;

Figure 8a is a view similar to Figure 8 in which the parts are shown in solid lines in the opposite extreme operative position, the operating characteristics of the mechanism being indicated in this figure;

Figure 9 is a side elevational view with portions broken away and partly in vertical longitudinal cross section of a portion of the sheet handling mechanism;

Figure 10 is a plan view of another portion of the sheet handling mechanism;

Figure 11 is an elevational view partly in vertical longitudinal cross section of the portion of the sheet handling mechanism shown in Figure 10;

Figure 12 is a vertical transverse cross-sectional view taken on the line XII—XII of Figure 4;

Figure 13 is a fragmentary vertical transverse cross-sectional view taken on the line XIII—XIII of Figure 4;

Figures 14, 15, 16 and 17 are, respectively, end views of cams forming portions of the operating mechanism; and

Figures 18 and 19 are, respectively, vertical cross-sectional views through vacuum control valves also forming portions of the operating mechanism.

Referring now more particularly to the drawings, there is shown purely diagrammatically at 2 the cylinder of a flat bed and cylinder type printing press to which sheets are to be fed, the usual drop guides being indicated at 3. The cylinder 2 might also be the cylinder of a rotary type printing press or a cutting and creasing press or other operating mechanism, it being here described as the cylinder of a flat bed and cylinder type press because I have found the invention to be ideally applicable to the feeding of sheets to such a press.

I show feeding mechanism for feeding sheets individually and successively to the cylinder 2. The cylinder ordinarily makes two revolutions per printing cycle, taking a sheet from the feeder at each alternate revolution. The sheet is registered to the cylinder in proper position for printing by the guides 3 and remains on the periphery of the cylinder during the printing stroke of the bed in which it is printed upon after which it is removed from the cylinder and conveyed away by suitable delivery mechanism. The present invention has to do only with the mechanism for handling the sheets up to the time they are registered to the printing press. The printing press per se may be entirely of a structure previously known.

The sheets to be fed to the printing press are supplied in a pile 4. The sheets are removed from the pile individually and successively. Each sheet is partially raised from the pile and engaged by an oscillatable carrier which advances it the greater portion of the distance toward the press. At the end of the forward stroke of said carrier the sheet is transferred to a second oscillatable carrier operating in synchronism with the first carrier but in opposite direction. Thus the two

carriers in effect meet at a point intermediate the pile and the press for enabling transfer of the sheet from the first carrier to the second carrier. Thence the second carrier advances the sheet to the press and into registry with the guides 3.

There is provided a feed table 5 carried by supports 6 mounted upon a frame 7, such feed table being, except at its upper end, substantially planar and leading from a point adjacent the pile 4 somewhat downwardly to a point adjacent the guides 3 of the press. At its upper end the table 5 is flared outwardly and downwardly as shown at 8 to facilitate the movement of sheets from the pile to a position over the table without danger that the forward edges of the sheets as they move forwardly will strike the edge of the table. A two-sheet detector is shown at 9 and may be of well known construction. The feed table is perforated to receive the head 10 of the detector 9.

There is provided a stub shaft 11 mounted at one side of the feeder and whose axis extends transversely thereof, such shaft having fixed thereon a pinion 12 meshing with a rack 13. The rack 13, whose upper portion extends within a cover 14, oscillates generally vertically and imparts oscillatory motion to the stub shaft 11. The means for oscillating the rack 13 will be described hereinafter.

Mounted coaxially with the stub shaft 11 and extending transversely of the feeder is a driving shaft 15. The shafts 11 and 15 are provided, respectively, with cooperating clutch parts 16 and 17. The clutch part 16 has a central projection 18 adapted when the clutch parts are engaged to enter a central recess 19 in the clutch part 17. The clutch part 16 also has adjacent its periphery a projection 20 adapted when the clutch parts are engaged to enter a recess 21 in the clutch part 17. This insures proper synchronization of the moving parts as the total rotative movement of the stub shaft 11 during oscillation is less than 360°, so that shafts 11 and 15 can only rotate together in one predetermined angular position relatively to each other.

The driving shaft 15 is slidable axially in bearings 22 and 23. Fixed to the shaft 15 is a collar 24. Bearing between the collar 24 and a stationary thrust member 25 connected with the bearing 23 is a coil spring 26 tending to move the shaft 15 toward the left viewing Figure 5—that is, tending to engage the clutch parts 16 and 17 so that the driving shaft 15 will be driven from the stub shaft 11. The bearing 23 has an annular surface 27 facing toward the right-hand end of the driving shaft 15 viewing Figure 5, which surface is in the form of a cam, projecting farther toward the right at its upper portion as shown than at its lower portion. Fastened to the right-hand end of the shaft 15 by a bolt 28 is an operating head 29 which has an annular surface 30 facing toward the left viewing Figure 5 and of a form complementary to that of the surface 27 of the bearing 23. The head 29 is provided with an operating handle 31.

As the parts are shown in Figure 5 the clutch members 16 and 17 are disengaged so that the driving shaft 15 is not being driven even though the stub shaft 11 is being driven in oscillatory movement by the rack 13. To engage the clutch parts 16 and 17 the handle 31 is turned through 180°, thus turning the operating head 29. In the position shown the portions of the surfaces 27 and 30 which project farthest axially of the shaft

15 are opposite each other. When the handle 31 is turned through 180° the portion of the surface 30 projecting farthest to the left will come opposite the portion of the surface 27 which projects the least toward the right which will allow the spring 26 to move the shaft 15 toward the left so that the clutch parts 16 and 17 will engage. Such engagement may be effected while the stub shaft 11 is being oscillated. If the projection 20 on the clutch parts 16 is not opposite the recess 21 in the clutch part 17 when the clutch parts first come together the projection 20 will slide over the surface of the clutch part 17 until it reaches the recess 21, at which time it will drop into such recess and the clutch parts will be maintained in engagement by the action of the spring 26. To disengage the clutch the handle 31 is simply turned again through 180°, the camming action of the surfaces 27 and 30 resulting in drawing of the shaft 15 toward the right as shown in Figure 5 against the action of the spring 26. Thus simply by a half turn of the handle 31 the feeder may be rendered operative or inoperative at will and if the feeder has been stopped it may be started again and its parts will operate in proper synchronization without any manual synchronizing adjustment.

The shaft 15 has a spline 32 and mounted upon the shaft and maintained against rotation relatively to the shaft by means of the spline 32 but movable axially relatively to the shaft is a cam 33. The cam 33 is maintained in fixed position transversely of the feeder by a guide 34 connected with the feeder frame. Consequently the cam 33 is rotated upon rotation of the shaft 15 but axial movement of the shaft 15 as above described has no effect on the cam. The cam 33 has an inclined cam groove 35 in which rides a cam follower 36 (Figure 1). The cam follower 36 is in the form of a pin connected with one arm 37 of a bell crank lever 38 pivoted to the frame at 39. The arm 37 extends generally longitudinally of the feeder so that rotary oscillation of the cam 33 causes oscillation of the bell crank lever. The second arm 40 of the bell crank lever 38 projects laterally of the feeder and is connected through a link 41 with either of two oppositely projecting arms 42 and 43 (as desired) of a compound bell crank lever 44 having a third arm 45 to which is pivoted at 46 a guide rod 47 carrying a side guide 48 for effecting side registry of the sheets as they are advanced along the table 5 into engagement with the guides 3 of the press. The sheets may be side registered toward either side as desired, the compound bell crank lever 44 being provided for this purpose. When it is desired to change the side registry from one side to the other the left-hand end of the link 41 viewing Figure 1 can be disconnected from the arm 42 and connected to the arm 43.

The driving shaft 15 carries a driving gear 49 which meshes with a gear 50 fixed to a shaft 51 arranged parallel to the shaft 15 extending transversely of the press and having bearing in the press frame. The shaft 51 extends just beneath the feed table 5. Fixed to the shaft 51 adjacent each end thereof and laterally offset from the feed table 5 is an inner relatively small pinion 52 and an outer relatively large pinion 53. Meshing with the respective pinions 52 and disposed therebelow and guided by suitable guide means carried by the frame are opposed racks 54 forming portions of one carrier, while meshing with the respective pinions 53 and disposed thereabove and guided by suitable guide means carried by the

frame are opposed racks 55 forming portions of another carrier, as will presently appear.

Carried by each of the racks 55 is a bracket 56, the respective brackets 56 being opposed to each other and carrying between them a transversely extending hollow rod 57. The carrier comprising the racks 55, the hollow rod 57 and the appurtenant mechanism hereafter to be described will be referred to as carrier A. Carried by each of the racks 54 is a bracket 58, the respective brackets 58 being opposed to each other and carrying between them a transversely extending hollow rod 59. The carrier comprising the racks 54, the hollow rod 59 and the appurtenant mechanism hereafter to be described will be referred to as carrier B.

The movements of carriers A and B can readily be seen in Figure 3 of the drawings from which a considerable portion of the mechanism not directly connected with the movement of the carriers has been omitted. The carrier A is driven by the relatively large pinions 53 while the carrier B is driven by the relatively small pinions 52. As all of the pinions 52 and 53 are fixed to the same shaft 51, both carriers move at the same time—that is, when either of the carriers is moving so is the other and when either of the carriers is stationary so is the other. Moreover, because the racks 55 of the carrier A are disposed above the shaft 51 and the racks 54 of the carrier B are disposed below such shaft the carriers move in opposite directions at the same time—that is, whenever the carrier A is moving toward the left the carrier B is moving toward the right and whenever the carrier A is moving toward the right the carrier B is moving toward the left. Also because the pinions 53 are larger than the pinions 52 the carrier A has an oscillatory movement upon oscillation of the shaft 51 of greater amplitude than the oscillatory movement of the carrier B. Still further, the carrier A moves at greater speed than the carrier B. As will presently appear, the carrier A is employed to move sheets from the pile 4 to a position intermediate the pile and the press and the carrier B is employed to receive the sheets at such intermediate position and advance them forward to the press. Such intermediate position or transfer point is closer to the press than to the pile because of the characteristics of movement of the carriers as just explained. Also because of such characteristics the sheets are moved relatively rapidly on the carrier A and relatively slowly on the carrier B.

Carried by the rod 57 is a pair of arms 60, each being of generally U shape as shown in Figures 2, 3, 4, and 9 and whose lower portions extend down to a point just above the feed table 5. At the lower end of each arm 60 it is provided with a sucker 61. Carried by the rod 59 is a pair of downwardly and forwardly extending arms 62 (Figures 2, 3, 4, 10 and 11) whose lower portions extend to a point just above the feed table 5. The lower end of each arm 62 is bifurcated, each bifurcation being provided with a sucker 63. The suckers 61 and 63 are all disposed slightly above the feed table and move generally parallel thereto. The arms 60 carrying the suckers 61 and the arms 62 carrying the suckers 63 are offset relatively to each other transversely of the feeder so that they will not strike each other upon oscillation of the carriers A and B.

The carrier A oscillates between a receiving position at which a sheet from the pile 4 is de-

livered to its suckers 61 and a transfer position at which such sheet is transferred from the suckers 61 to the suckers 63 of the carrier B. The carrier B oscillates between such transfer position and a delivery position where it delivers the sheet to the press. The respective receiving, transfer and delivery positions just referred to define the limits of movement of the carriers. In Figure 3 the carrier A is shown in full lines at the receiving position and the carrier B is shown in full lines at the delivery position. Both of carriers A and B are shown in chain lines at the transfer position. As will be seen from this figure, when the carriers are at the transfer position which coincides with the lower extremity of oscillation of the carrier A and the upper extremity of oscillation of the carrier B the suckers 61 and 63 are approximately in transverse alignment. The reason for making the arms 60 of U shape will also be seen in Figure 3. This is to allow the hollow rod 59 to pass the hollow rod 57 when the carriers move to transfer position so as to bring the suckers 61 and 62 into transverse alignment. The arms 62 extend downwardly and forwardly from the hollow rod 59 so that as the carriers move into transfer position such arms will not strike the forward edge of a sheet being carried by the suckers 61 in such a way as to tear such sheet or tend to dislodge it from the suckers 61.

There is provided a power shaft 64 (Figures 8 and 8a) adapted to be driven at substantially constant speed by any suitable source of power, as, for example, an electric motor and reduction gearing. Fastened to the shaft 64 is a crank arm 65 to which is pivoted at 66 a link 67, the opposite end of which is pivoted at 68 to a projection 69 integral with an arm 70 pivoted for oscillation about a stub shaft 71. Pivoted at 72 to the arm 70 and at 73 to a connector 74 fastened to the bottom of the rack 13 is a link 75. Rotation of the power shaft 64 transmits through the crank arm 65 and the link 67 to the arm 70 oscillatory motion which in turn is transmitted from the arm 70 to the rack 13 through the link 75. In this way the feeder is driven.

The parts are shown in Figure 8 in the position they occupy when the rack 13 is at the upper end of its stroke. At such time the carrier A is at the right-hand end of its stroke and the carrier B is at the left-hand end of its stroke. In such position the crank arm 65 and the link 67 are inclined at an angle of approximately 27° to the vertical as shown in Figure 8. The parts are shown in solid lines in Figure 8a in the position they occupy when the rack is at the lower end of its stroke. At such time the carrier A is at the left-hand end of its stroke and the carrier B is at the right-hand end of its stroke. In such position the link and the crank arm are generally inverted relatively to the position in which they are shown in Figure 8 and the link and the crank arm extend substantially vertically. Thus the constant speed shaft 64 turns through an angle of approximately 207° when the carrier B is moving toward the press and through an angle of only about 153° when the carrier B is moving away from the press. The result of this is that the movement of the carrier B toward the press is slower than its movement away from the press. This is desirable to insure relatively slow movement of the sheets as they are registered to the drop guides of the press. Not only is the speed of travel of the carrier B slower than that of the carrier A but the speed of travel of the carrier B

in its movement toward the press is slower than the speed of travel of such carrier in its movement away from the press.

The power shaft 64 also carries an eccentric cam 76 which bears against a follower 77 at the extremity of one arm 78 of a bell crank lever 79 pivoted to the frame at 80. The bell crank lever 79 is shown in Figure 8 but is omitted from Figure 7 to avoid obscuring the showing of other parts. The second arm 81 of the bell crank lever 79 extends generally upwardly and has at its extremity a follower 82 which bears against the upper end of an arm 83 rigidly carried by a shaft 84. Also rigidly carried by the shaft 84 is a generally horizontal arm 85. The cam 76 oscillates the bell crank lever 79 upon rotation of the shaft 64 and such oscillatory motion is transmitted through the arm 83 and the shaft 84 to the generally horizontal arm 85.

The arm 85 operates the usual pile support elevating mechanism shown more or less diagrammatically and designated generally by reference numeral P in Figure 2. This mechanism is of standard construction and is for the purpose of raising the pile support S to compensate for removal of sheets from the top of the pile, which removal tends to lower the top of the pile. When the top of the pile has been lowered a predetermined amount the pile support elevating mechanism actuated by the oscillating arm 85 raises the pile support slightly so that the top of the pile is always maintained at approximately the same level as shown in the drawings. Inasmuch as the pile support elevating mechanism is of standard construction and per se forms no part of the present invention it will not be described in detail.

Driven from the power shaft 64 through a suitable train of gears including a gear 86 is a gear 87 fixed to a cam shaft 88 mounted in the frame. The cam shaft 88 has fixed thereon four cams 89, 90, 91 and 92, respectively. A fixed shaft 93 has mounted thereon for rotary movement four bell crank levers 94, 95, 96 and 97 which carry cam followers 98, 99, 100 and 101, respectively. The follower 98 engages the cam 89, the follower 99 engages the cam 90, the follower 100 engages the cam 91 and the follower 101 engages the cam 92. Thus upon rotation of the cam shaft 88 the bell crank levers 94, 95, 96 and 97 are moved by the respective cams 89, 90, 91 and 92.

The bell crank lever 94 has pivoted to its outer end at 102 a rod 103 which extends generally vertically and is suitably guided in the feeder frame. Such rod partially supports through a connection 104 a hollow rod 105 extending transversely of the feeder. At the side of the feeder opposite the side at which the rod 103 is disposed there is a similar rod 103a which through a connection 104a assists in supporting the hollow rod 105. The lower end of the rod 103a is connected with a bell crank lever identical with the bell crank lever 94 and which cooperates with a cam identical with the cam 89 and operating synchronously therewith so that the rods 103 and 103a are both raised and lowered in synchronism. The motion could be obtained through a single such operating mechanism, but I find it desirable to duplicate the same on both sides of the feeder to insure that the structure will be sufficiently strong and operate in a positive manner.

Carried by the hollow rod 105 are five stationary but adjustably positionable heads 106 each having therethrough a vertical bore 107. Pass-

ing through the vertical bore 107 of each of the heads 106 is a sucker rod 108 carrying at its bottom a sucker 109. Each of the sucker rods 108 carries a fixed collar 110 and has an enlargement 111 connected with its upper extremity. A coil spring 112 bears between the upper surface of the collar 110 of each sucker rod and the under surface of the head 106 through which the sucker rod passes. Thus each sucker rod is carried through one of the heads 106 by the hollow rod 105 and is resiliently movable upwardly against the action of its spring 112, its downward movement being limited by the enlargement 111.

The function of the suckers 109 is to lift the forward edge of the top sheet from the pile 4 to such a position that the sheet may be moved downwardly and toward the left above the feed table 5 and so that the forward edge of the sheet may be engaged and carried by the suckers 61. As will be seen in Figures 4 and 12, the top sheet on the pile 4 is spaced somewhat below the suckers 61 and also somewhat below the upper end of the feed table 5. At each cycle of the feeder the cam 89 and the corresponding cam at the opposite side of the machine functioning through the mechanism above described raise the hollow rod 105 to move the suckers 109 upwardly to approximately the same elevation as the suckers 61. After the sheet has been taken from the suckers 109 by the suckers 61 the hollow rod 105 again moves downwardly, such downward movement being preferably always to such an extent that the suckers 109 may rest upon the next sheet on the pile to enable proper lifting of the same from the pile. The hollow rod 105 moves downwardly somewhat farther than is necessary to bring the suckers barely into engagement with the sheet so as to bring about sufficient pressure of the suckers on the sheet at each cycle of the machine to insure proper lifting of the sheet and also to compensate for slight variations in the elevation of the top of the pile 4.

Vacuum or suction to the suckers 109 is controlled by a valve 113 (Figure 18) comprising a casing 114 and a vertically movable valve element 115 urged downwardly by a coil spring 116. The connection to the vacuum pump is shown at 117 and the connection which leads to the suckers is shown at 118. When the valve element 115 is in the position shown in Figure 18 no vacuum is admitted to the suckers. When the valve element is raised to uncover the passage 118 vacuum is admitted to the suckers. A relief port 119 to the atmosphere is provided to quickly release the vacuum when the element 115 moves downwardly to cut off communication between the passages 117 and 118. The valve element 115 is operated by the cam 90 through the bell crank lever 95 and the operating rod 120.

The conduit 118 leads to a connection 121 with a flexible conduit 122 which communicates with a pipe 123 which in turn communicates with the bore of the hollow rod 105. Connections 124 lead from the bore of the hollow rod 105 to flexible conduits 125 which in turn lead to the suckers 109 as shown in Figure 12.

Vacuum to the suckers 61 is controlled by a valve 113a identical with the valve 113, such valve being operated by the cam 92 through the bell crank lever 97 and the operating rod 126. Suction passes from the valve 113a through a conduit 127, a flexible conduit 127a and a connection 128 supported by an arm 128a and thence through a flexible conduit 129 to a connection

130 communicating with the interior of the hollow rod 57. A connection 131 leads from the bore of the hollow rod 57 to flexible conduits 132 which in turn lead to the suckers 61 as shown in Figure 12.

Vacuum to the suckers 63 is controlled by a valve 113b (Figure 19) identical with the valve 113 except for a bleeder passage 133 in the movable valve element which upon movement of the valve downwardly, or toward closed position, prevents immediate shutting off of the entire vacuum but provides for a continued partial vacuum to the suckers 63 until the bleeder passage 133 is closed upon continued downward movement of the movable valve element. The valve 113b is operated by the cam 91 through the bell crank lever 96 and the operating rod 134. Suction passes from the valve 113b through a conduit 135, a flexible conduit 135a and a connection 136 supported by an arm 136a and thence through a flexible conduit 137 to a connection 137a communicating with the interior of the hollow rod 59. A connection 138 leads from the bore of the hollow rod 59 to flexible conduits 139, which in turn lead to the suckers 63 as shown in Figure 13.

The cams 90, 91 and 92 are especially designed to control the suction to the suckers 109, 63 and 61 in relation to the movement of the rod 105 and the carriers A and B so that the feeder operates as follows. As the carrier A moves toward the right the suckers 109 with suction applied thereto carrying with them the forward edge of the topmost sheet on the pile 4 move upwardly. When such suckers reach their uppermost position the suckers 61 come into substantial transverse alignment therewith. When the suckers 109 and 61 are in alignment vacuum is admitted to the suckers 61 and released from the suckers 109. This effects a transfer of the forward edge of the sheet from the suckers 109 to the suckers 61. The transfer is effected in a very brief interval of time when the carrier A is at the end of its stroke, after which the carrier A with the sheet carried by the suckers 61 moves to the left, the suckers 61 advancing from the position shown in full lines to the position shown in chain lines in Figure 3. The sheet moves rapidly along with the carrier A above the feed board 5 and the trailing portion of the sheet may rest upon the upper edge of the feed board as the sheet advances. When the carrier A reaches the position shown in chain lines in Figure 3 the carrier B likewise reaches the position shown in chain lines in such figure. The carriers in the positions shown in chain lines in Figure 3 are in the transfer position at the ends of their respective strokes intermediate the pile and the press. At such time suction is released from the suckers 61 and admitted to the suckers 63, thus transferring the sheet from the carrier A to the carrier B. The carrier B moves toward the left with the sheet being carried by the suckers 63 until the sheet is registered to the press guides. During registry the vacuum or suction on the sheet is reduced by reason of the bleeder passage 133 in the valve 113b. This insures urging of the sheet against the drop guides of the press without positively necessitating movement of the sheet with the suckers 63. The partial suction insures that the sheet is urged forward against the guides but allows for slippage between the suckers 63 and the sheet when the sheet is registered to the guides.

The sheets being fed to the press move relative-

ly rapidly on the carrier A and relatively slowly on the carrier B. They are transferred directly from one carrier to the other without any intermediate handling. The apparatus is highly efficient and foolproof and adaptable for very high speed operation.

While I have shown and described a present preferred embodiment of the invention and a present preferred method of practicing the same it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

I claim:

1. Article handling mechanism comprising a first suction carrier movable to a transfer point, a second suction carrier movable from said transfer point and means controlling the suction to said carriers so that suction is supplied to the first carrier in its movement to the transfer point and to the second carrier in its movement from the transfer point, the carriers being so related as to transfer an article carried by the first to the second at the transfer point.
2. Article handling mechanism comprising a pair of oscillatable carriers whose movements are so related as to enable transfer of an article from one to the other of said carriers when both carriers are at or near one extremity of oscillation and rack and pinion means for oscillating said carriers.
3. Article handling mechanism comprising a pair of oscillatable carriers whose movements are so related as to enable transfer of an article from one to the other of said carriers when both carriers are at or near one extremity of oscillation and means for oscillating said carriers, said means being so constructed and arranged as to move one of said carriers faster than the other during oscillation.
4. Article handling mechanism comprising a pair of oscillatable carriers whose movements are so related as to enable transfer of an article from one to the other of said carriers when both carriers are at or near one extremity of oscillation and means for oscillating said carriers, said means being so constructed and arranged that the amplitude of oscillation of one of said carriers is greater than the amplitude of oscillation of the other.
5. Article handling mechanism comprising a pair of oscillatable carriers whose movements are so related as to enable transfer of an article from one to the other of said carriers when both carriers are at or near one extremity of oscillation and means for oscillating said carriers, said means being so constructed and arranged as to move said first mentioned carrier faster and farther than said second mentioned carrier during oscillation.
6. Article handling mechanism comprising a pair of oscillatable carriers whose movements are so related as to enable the advance of an article in generally the same direction and, during said advance, the transfer of the article from one to the other of said carriers when both carriers are at or near one extremity of oscillation, rack means on the carriers and pinion means meshing with the rack means for oscillating the carriers.
7. Article handling mechanism comprising a pair of oscillatable carriers whose movements are so related as to enable transfer of an article from one to the other of said carriers when both carriers are at or near one extremity of oscillation, an oscillatable shaft for oscillating said carriers

and driving connections between said shaft and the respective carriers whereby the carriers are moved toward transfer position simultaneously and away from transfer position simultaneously.

8. Article handling mechanism comprising a pair of oscillatable carriers whose movements are so related as to enable transfer of an article from one to the other of said carriers when both carriers are at or near one extremity of oscillation, an oscillatable shaft for oscillating said carriers, pinion means on said shaft and rack means on the respective carriers meshing with said pinion means.

9. Article handling mechanism comprising a pair of oscillatable carriers whose movements are so related as to enable transfer of an article from one to the other of said carriers when both carriers are at or near one extremity of oscillation, an oscillatable shaft for oscillating said carriers, pinions of different diameters on said shaft and a rack on one of the carriers meshing with one of said pinions and a rack on the other carrier meshing with the other of said pinions.

10. Article handling mechanism comprising a pair of oscillatable carriers movable generally in parallel planes and means carried by said carriers for advancing an article thereby sequentially in a generally straight path.

11. Article handling mechanism comprising a pair of oscillatable carriers movable generally in parallel planes and means carried by said carriers for advancing an article thereby sequentially in a generally straight path intermediate said planes.

12. Article handling mechanism comprising a pair of oscillatable carriers movable generally in parallel planes and article holding means carried by each of the carriers and extending toward the other carrier so that upon oscillation of the carriers the holding means move generally in the same plane.

13. Article handling mechanism comprising a pair of oscillatable carriers movable generally in parallel planes and article holding means carried by the respective carriers and positioned to move in substantially the same plane upon oscillation of the carriers.

14. Article handling mechanism comprising means for separating an article from an article supply, a reciprocable carrier for moving the separated article to an intermediate position and a second reciprocable carrier for moving the article from the intermediate position to final position.

15. Article handling mechanism comprising a pair of oscillatable carriers for sequentially advancing an article, pneumatic means for holding the article on each of the respective carriers and separate control means for individually controlling the pneumatic means on the respective carriers.

16. Article handling mechanism comprising a pair of oscillatable carriers for sequentially advancing an article, pneumatic means for holding the article on each of the respective carriers, means for rendering the pneumatic means on one of the carriers operative during advancing of an article thereon and inoperative to permit transfer of the article to the other carrier and means for rendering the pneumatic means on the second mentioned carrier operative to take the article from the first mentioned carrier and further advance the same.

17. Article handling mechanism comprising an oscillatable shaft, a pair of carriers oscillatable in

generally parallel planes on opposite sides of said shaft and connections between said shaft and said carriers to oscillate the carriers upon oscillation of said shaft.

18. Article handling mechanism comprising an oscillatable shaft, a pair of carriers oscillatable in generally parallel planes on opposite sides of said shaft, means carried by said carriers for advancing an article therebetween and past said shaft and connections between said shaft and said carriers to oscillate the carriers upon oscillation of said shaft.

19. Article handling mechanism comprising an oscillatable shaft, a pair of carriers oscillatable in generally parallel planes on opposite sides of said shaft, one of said carriers having means for advancing an article past said shaft and the other carrier having means for receiving said article after having been advanced past said shaft and further advancing the same and connections between said shaft and said carriers to oscillate the carriers upon oscillation of said shaft.

20. Article handling mechanism comprising an oscillatable shaft, a pair of carriers oscillatable in generally parallel planes on opposite sides of said shaft, one of said carriers having means for holding an article whereby upon oscillation of the carrier to advance the article past said shaft on the same side of said shaft as said carrier, the other carrier having means extending toward the first mentioned carrier and lying substantially in the same plane parallel to the planes of oscillation of the carriers as the holding means on the first mentioned carrier for receiving an article from the first mentioned carrier and further advancing the same upon oscillation of the second mentioned carrier and connections between said shaft and said carriers to oscillate the carriers upon oscillation of said shaft.

21. Article handling mechanism comprising an oscillatable shaft having gear means fixed thereon and a pair of carriers oscillatable in generally parallel planes on opposite sides of said shaft and each having rack means meshing with said gear means.

22. Article handling mechanism comprising an oscillatable shaft having fixed thereon gears of different diameter and a pair of carriers oscillatable in generally parallel planes on opposite sides of said shaft and each having a rack meshing with one of said gears.

23. Article handling mechanism comprising a table, a pair of oscillatable carriers disposed at the same side of the general plane of the table but at different distances from the table and adapted to oscillate along substantially parallel lines and to overlap during at least a portion of their oscillation.

24. Article handling mechanism comprising a pair of carriers oscillatable in overlapping generally parallel paths and means for oscillating the carriers, said means being so constructed and arranged as to move each carrier in the direction opposite the direction of concurrent movement of the other carrier.

25. Article handling mechanism comprising a pair of carriers oscillatable in overlapping generally parallel paths and means for oscillating the carriers, said means being so constructed and arranged that at any time either both carriers are moving or both carriers are stationary, and means for transferring an article from the control of one carrier to the control of the other carrier while both carriers are stationary.

26. Article handling mechanism comprising a pair of carriers oscillatable in overlapping generally parallel paths and means for oscillating the carriers, said means being so constructed and arranged that at any time either the carriers are moving in opposite directions or they are both stationary, means for delivering an article to one of the carriers when it is remote from the other carrier, and means for transferring such article from the first mentioned carrier to the second mentioned carrier when the carriers are relatively close together.

27. Article handling mechanism comprising a pair of oscillatable carriers and means including a reciprocable rack, pinion means meshing therewith and connections between said pinion means and said carriers for oscillating the carriers.

28. Article handling mechanism comprising means for removing an article from the top of a pile and advancing it to an intermediate position in which it is clear of the pile and means for further advancing the article from said intermediate position to a final position through a distance unequal to the distance through which the article advanced in moving from the pile to said intermediate position.

29. Article handling mechanism comprising means for advancing an article from an initial position to an intermediate position and means for further advancing the article from said intermediate position to a final position through a distance less than the distance through which the article advanced in moving from the initial position to the intermediate position.

30. Article handling mechanism comprising a pair of oscillatable carriers whose movements are so related as to enable transfer of an article from one to the other of said carriers when both carriers are at or near one extremity of oscillation, the speed of movement of the carrier to which the article is transferred being greater in the movement of said carrier toward said extremity of oscillation than in the movement of said carrier away from said extremity of oscillation.

31. Article handling mechanism comprising a pair of oscillatable carriers whose movements are so related as to enable transfer of an article from one to the other of said carriers when both carriers are at or near one extremity of oscillation, the speed of movement of the second mentioned carrier being slower than the speed of movement of the first mentioned carrier and being greater in the movement of said second mentioned carrier toward said extremity of oscillation than in the movement of said second mentioned carrier away from said extremity of oscillation.

32. Article handling mechanism comprising a first oscillatable carrier, a second oscillatable carrier adapted to receive an article from said first oscillatable carrier and advance the same therefrom, and means for moving said second oscillatable carrier slower in its oscillatory movement in the direction of advance of the article than in its oscillatory movement in the opposite direction.

33. A sheet feeder comprising a pair of oscillatable carriers, a sheet supply, means for delivering sheets singly from said sheet supply to one of said carriers, means for operating said carrier to advance the sheets on said carrier at relatively high speed to a transfer point closer to the press or the like being fed than to the sheet supply, means for transferring the sheets

to the other carrier at said transfer point and means for operating the second mentioned carrier to move the sheets relatively slowly into registry with a press or the like.

34. In a handling of articles, advancing an article from an initial position to an intermediate position and thereafter further advancing the article from said intermediate position to a final position through a distance less than the distance through which the article advanced in moving from the initial position to the intermediate position.

35. In the handling of articles, oscillating a pair of carriers to and from a transfer point, one between a supply point and the transfer point and the other between the transfer point and a delivery point, delivering an article to the first mentioned carrier from the supply point when the carrier is remote from the transfer point, moving such carrier in an oscillatory movement to the transfer point carrying said article, transferring the article from said carrier to the other carrier at the transfer point and moving the second mentioned carrier in an oscillatory movement away from the transfer point carrying said article to deliver the article to the delivery point.

36. In the handling of articles, oscillating a pair of carriers whose movements are so related as to enable transfer of an article from one to the other of said carriers when both carriers are at or near one extremity of oscillation, carrying an article on one of the carriers on an oscillatory movement thereof toward the transfer point, transferring the article to the other carrier at the transfer point, carrying the article from the transfer point on the second mentioned carrier and moving the first mentioned carrier faster than the second mentioned carrier during oscillation.

37. In the handling of articles, oscillating a pair of carriers whose movements are so related as to enable transfer of an article from one to the other of said carriers when both carriers are at or near one extremity of oscillation, carrying an article on one of the carriers on an oscillatory movement thereof toward the transfer point, transferring the article to the other carrier at the transfer point, carrying the article from the transfer point on the second mentioned carrier and moving the first mentioned carrier farther than the second mentioned carrier during oscillation.

38. In the handling of articles, oscillating a pair of carriers in generally parallel paths and during such oscillation advancing an article by the action of said carriers sequentially along a path intermediate the paths of the carriers.

39. In the handling of articles, sequentially advancing an article on a pair of oscillatable carriers, holding the article on the first carrier pneumatically during advance thereof, releasing the article from said carrier to permit transfer thereof to the second carrier, holding the article on the second carrier pneumatically during advance thereof and releasing the article from the second carrier to permit delivery of the same therefrom.

40. In the handling of articles, removing an article from the top of a pile and advancing it to an intermediate position in which it is clear of the pile and then further advancing the article from said intermediate position to a final position through a distance unequal to the distance

through which the article advanced in moving from the pile to said intermediate position.

41. In the handling of articles, oscillating a pair of carriers to and from a transfer point, carrying an article on one of the carriers on an oscillatory movement thereof toward the transfer point, transferring the article to the other carrier at the transfer point and carrying the article from the transfer point on the second mentioned carrier on an oscillatory movement thereof at a speed less than the speed of movement of the second mentioned carrier in moving toward the transfer point on its return oscillatory movement.

42. In the handling of sheets, oscillating a pair of suction holding means to and from a transfer point, holding a sheet on one of the holding means by suction, moving such holding means in an oscillatory movement toward the transfer point with such sheet so held thereon, transferring the sheet from said holding means to the other holding means at the transfer point, holding the sheet on the second mentioned holding means by suction and moving the second mentioned holding means in an oscillatory movement away from the transfer point with the sheet so held thereon.

43. In the feeding of sheets, moving the sheets singly at relatively high speed from a sheet supply to a transfer point closer to the press or the like being fed than to the sheet supply, at the transfer point transferring the sheets to a registering carrier and advancing the sheets into registry with the press or the like on said registering carrier and at relatively low speed.

44. In the feeding of sheets, moving the sheets on a carrier at relatively high speed to a transfer point, there transferring the sheets from said first mentioned carrier to a second carrier retracting the first mentioned carrier and advancing the sheets into registry with a press or the like on said second mentioned carrier and at relatively low speed.

45. In the feeding of sheets from a pile to a press or the like, removing a sheet from the pile and advancing it to an intermediate position in which it is clear of the pile and thereafter advancing the sheet from said intermediate position to registered position relative to the press or the like, the distance of advance of the sheet from the pile to the intermediate position being substantially greater than the distance of advance of the sheet from the intermediate position to the registered position.

46. In the feeding of sheets from a pile to a press or the like, removing a sheet from the pile and advancing it on a carrier to an intermediate position in which it is clear of the pile, at said intermediate position transferring the sheet from said carrier to another carrier and thereafter advancing the sheet on said second mentioned carrier from said intermediate position to registered position relative to the press or the like, the distance and speed of advance of the sheet from the pile to the intermediate position both being substantially greater than the distance and speed of advance of the sheet from the intermediate position to the registered position.

ARTHUR J. JENNER.