May 15, 1945. J. T. HALE 2,375,989

SHEET FEEDING MECHANISM

Filed Aug. 16, 1943 4 Sheets-Sheet 1

Fig. 1.

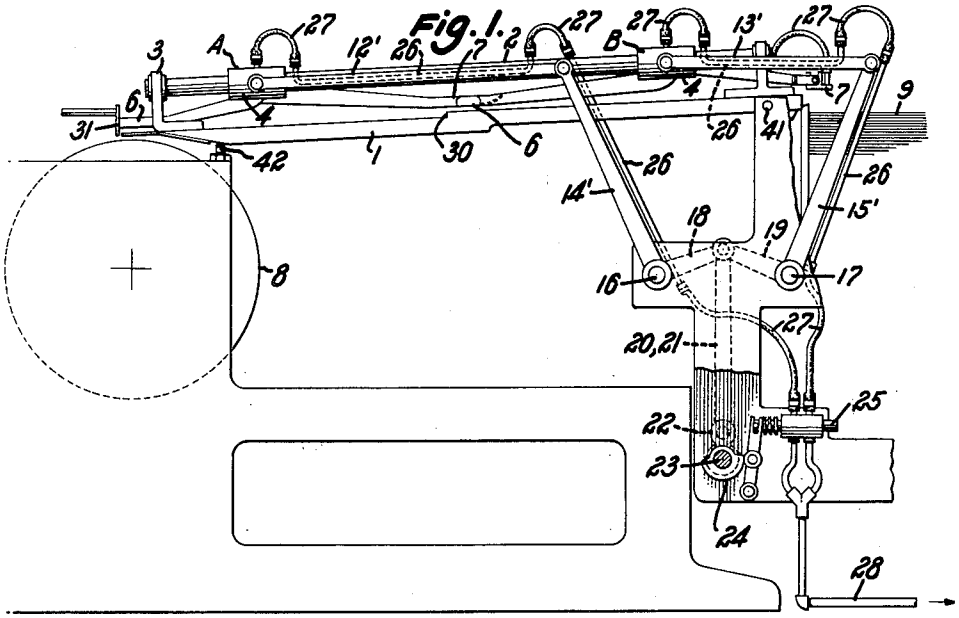


Fig. 3.

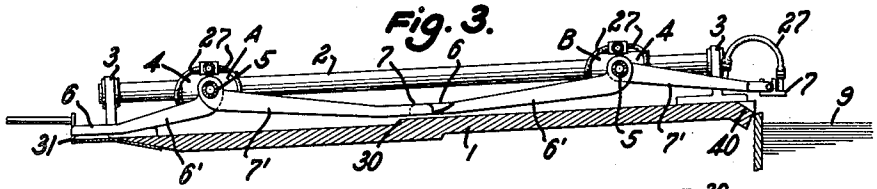
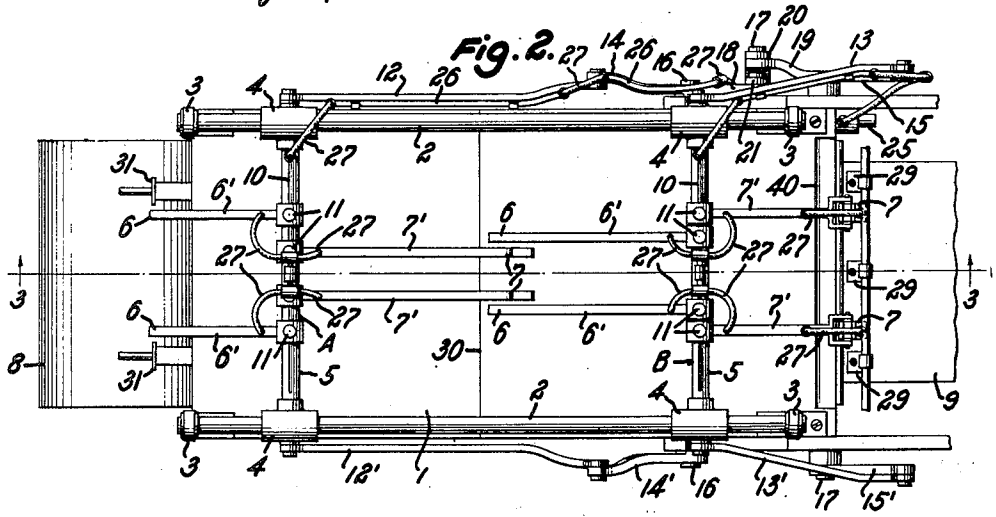


Fig. 2.



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SHEET FEEDING MECHANISM

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Fig. 4.

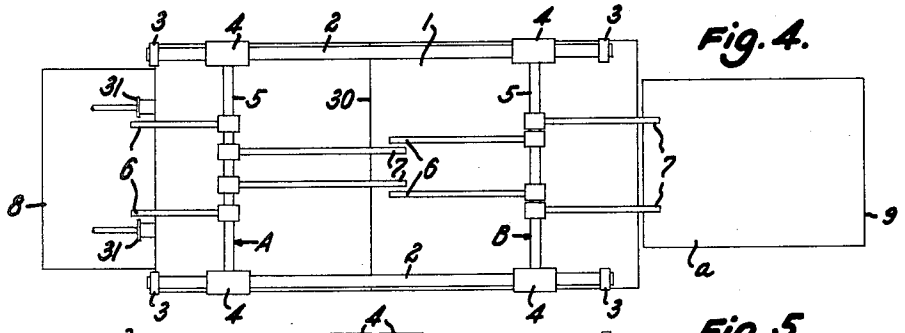


Fig. 5.

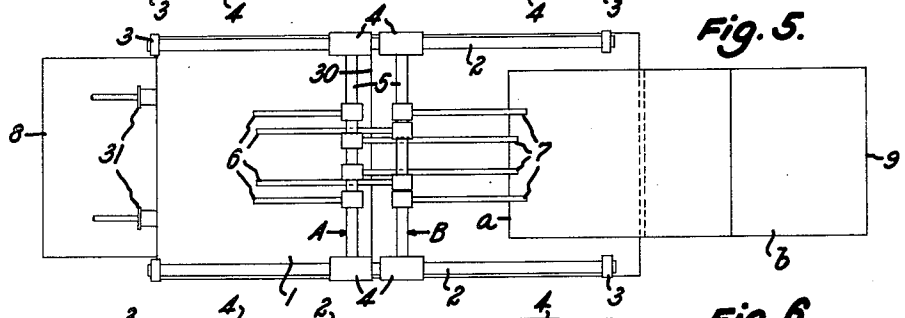


Fig. 6.

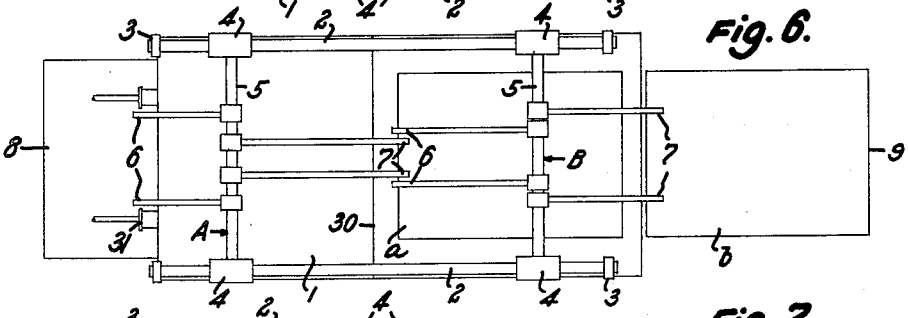


Fig. 7.

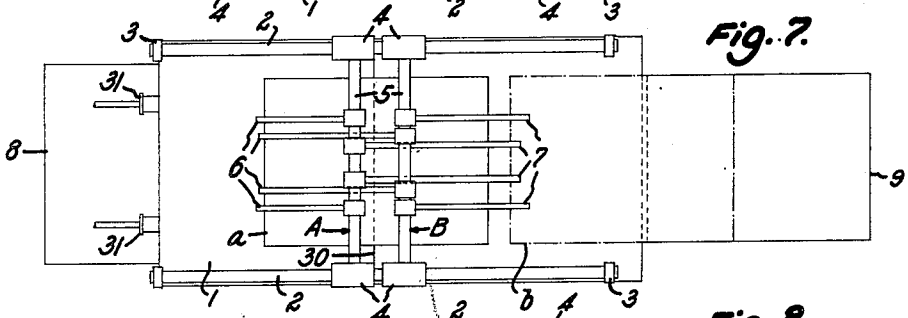
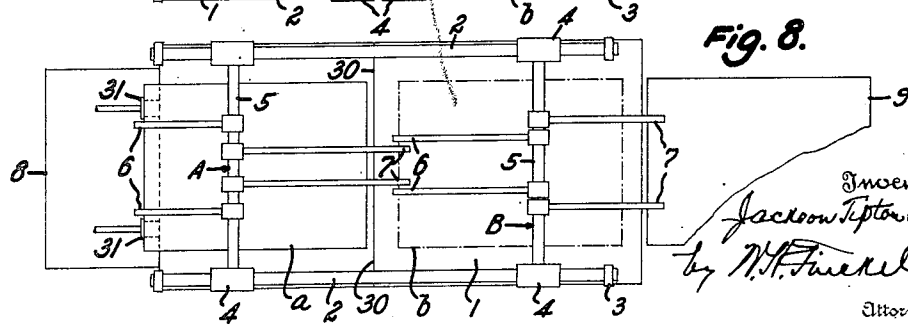


Fig. 8.



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SHEET FEEDING MECHANISM

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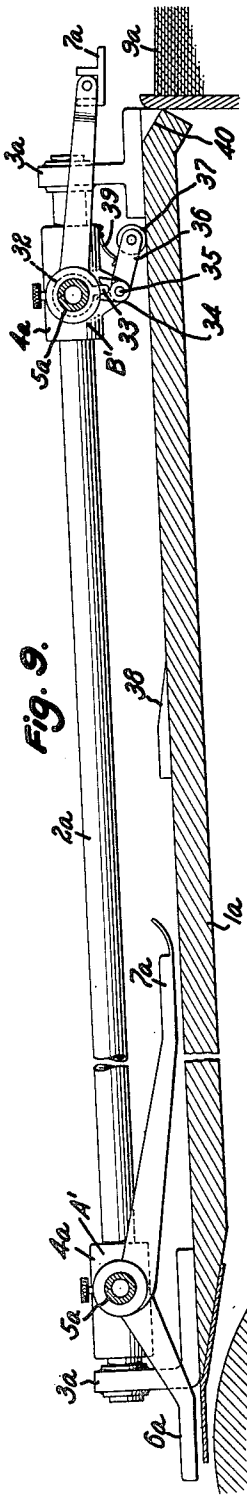


Fig. 9.

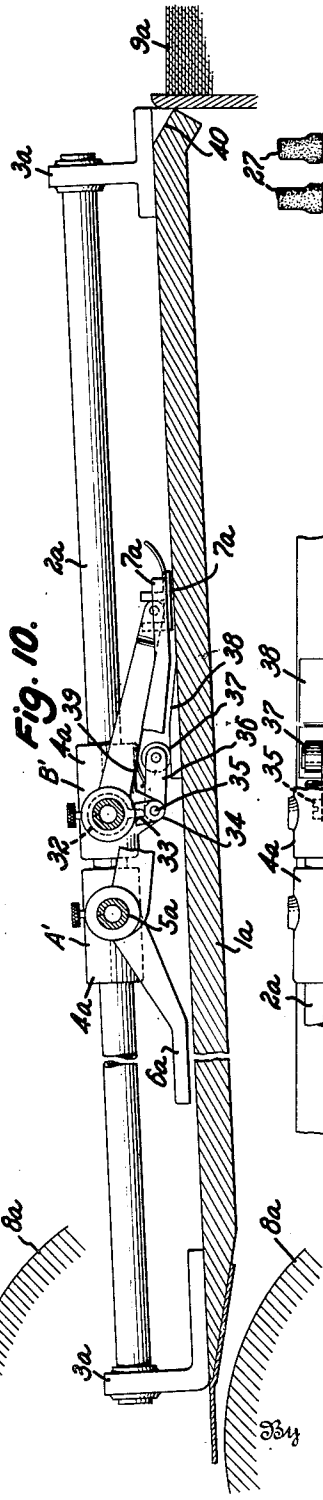


Fig. 10.

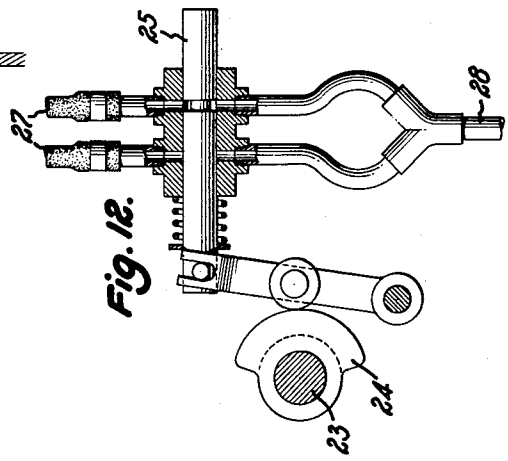


Fig. 12.

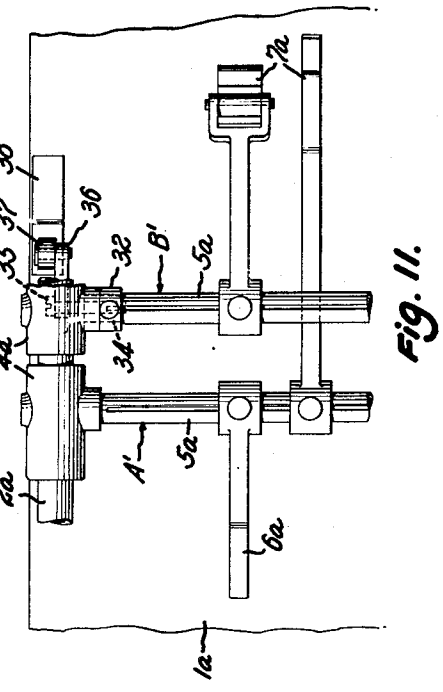


Fig. 11.

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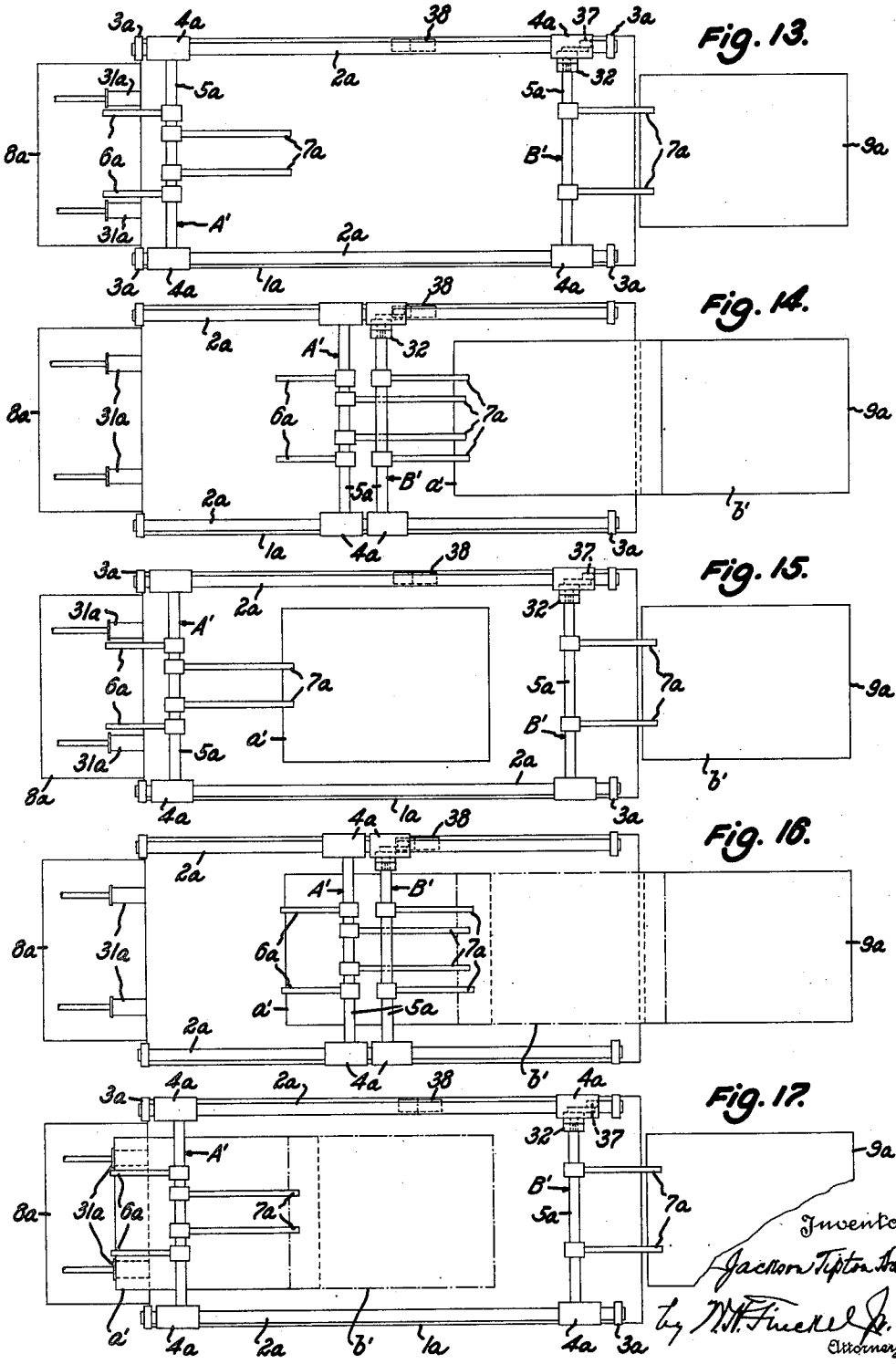
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May 15, 1945. J. T. HALE 2,375,989

SHEET FEEDING MECHANISM

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Patented May 15, 1945 2,375,989

UNITED STATES PATENT OFFICE

2,375,989

SHEET FEEDING MECHANISM

Jackson Tipton Hale, Atlanta, Ga., assignor of one-fifth to Augustine Sams, Atlanta, Ga.

Application August 16, 1943, Serial No. 498,837

10 Claims. (Cl. 271—14)

This invention relates to a sheet feeding mechanism, and particularly to such a mechanism for feeding sheets automatically by multiple sheet carriage means from a pile of sheets to the cylinder of a printing press or kindred machine, and particularly but not exclusively, to a flat bed cylinder press.

In view of the speed of present-day presses, it has become necessary to provide a feeding device which, although it can handle sheets during feeding slow enough to insure accuracy will, at the same time, present the sheets to the press at each impression cycle at a speed adequate to accommodate the speed of the press.

The primary object of the invention is to provide a sheet feeding mechanism having only two feed carriages cooperating during their movement to feed sheets from the pile thereof to the press guides, and distinguished from prior two-carriage feed devices in that instead of feeding the sheets by a two step method it increases the number of steps and hence reduces the extent of travel of successive sheets over the feed board. Thus, the likelihood of failure of or defects in feeding due to too rapid sheet transfer or to the attempt to transfer sheets through too great a distance at too high speed, and loss of operating time because of the resulting need for stopping the press, are avoided.

In a preferred embodiment of the invention, there is provided a four-step feeding mechanism including two reciprocating feed carriages arranged for actuation simultaneously in opposite directions. In other words, the carriages advance toward each other and then retreat from each other. Each of the two carriages, in order to accomplish the four-step movement in advancing the sheets from the pile thereof to the press guides, carries two sets of suction feet, one set on each carriage extending forward toward the press and one set on each carriage extending backward toward the pile. In movement, the arrangement of the four sets of suction feet is such that they, in effect, overlap each other laterally, as will be described hereinafter.

By means of this assembly and mode of operation the sheets are successively fed a short distance by each of the four sets of suction feet and thus move from pile to guides only half as fast as in the case of the known two-step sheet feeding devices. This slow sheet feeding speed permits either a greater speed for the press with the same degree of accuracy, or a lower relative speed for the sheets and a greater degree of accuracy. That is to say, each set of suction feet will move successive sheets through approximately one-fourth the distance from the pile to the press guides.

In another embodiment herein disclosed, an arrangement is provided whereby a three-step, rather than a four-step, feed is accomplished, the result being relatively satisfactory, and the mechanism somewhat simplified.

It will be understood that by the provision of two cooperating sheet carriages with their two sets of suction feet each, each reciprocation of the carriages toward the press guides will, assuming that full feeding operation obtains, result in the simultaneous forward feeding of two sheets over the feed board from pile to guides in such manner that one sheet is not overlapped by another until the forward sheet reaches the point from which it is carried into the press after alignment with the press guides. It will be noted, moreover, that the forward movement of the sheets is intermittently progressive with each forward (toward the guides) stroke or cycle of operation.

Furthermore, the mode of operation of the device prevents the deposit of a sheet on the feed board for any perceptible time, and, due to the timing of the feeder operation, two movements of a sheet take place upon each impression cycle of the press, thus producing slow sheet advancement and desired accurate register.

In the three-step feeding mechanism hereinbefore referred to one of the feed carriages has two sets of suction feet and the other carriage only one set, but, as stated, efficient operation is obtained while, at the same time, simplification of the mechanism is made possible.

In either the four-step or three-step sheet feeding mechanism, means are provided whereby two sheets will overlap without coming into actual contact with each other; one being registered at the press guides and being forwarded into the press from a position under, but not touching, the other which succeeds it and is just approaching the position for subsequent register with the press guides.

In the accompanying drawings illustrating the invention, in the several figures of which like parts are similarly designated,

Fig. 1 is a side elevation, with parts broken away, showing a press feeder of the four-step type in accordance with the invention,

Fig. 2 is a plan view of the feeder of Fig. 1.

Fig. 3 is a section taken on line 3—3 of Fig. 2 showing only the feed board and the reciprocating feed devices with their mountings,

Figs. 4 to 8 are diagrammatic plan views illustrating the several steps of the four-step feeding operation,

Figs. 9 and 10 are enlarged sectional views similar to Fig. 3, but illustrating the adaptation of the feeding device of the invention to three-step operation.

Fig. 11 is a partial plan view of the three-step adaptation as shown in Fig. 10,

Fig. 12 is a greatly enlarged sectional elevation

showing, in detail, the control valve means for the sets of suction feet of the feeding mechanism,

Figs. 13 to 17 are diagrammatic plan views illustrating the several steps of the three-step feeding operation.

Referring to Figs. 1, 2 and 3, it will be seen that a specially designed feed board 1 replaces the conventional feed board now used. At each side of this feed board, and extending longitudinally thereof, is a bar or rod 2 rigidly supported by end-adjacent brackets 3, and these bars or rods 2 carry pairs of slide members 4 between which are supported for reciprocation longitudinally of the feed board 1 hollow shafts 5 upon which are rigidly mounted the forwardly and rearwardly extending suction feet 6 and 7, respectively. Each of the pairs of slide members 4 with its shaft 5 and suction feet 6 and 7 constitutes a feed carriage, the carriage A nearest the press cylinder 8 being hereinafter referred to as the forward carriage, and the carriage B nearest the pile 9 of sheets to be fed being referred to as the rear carriage.

In order that appropriate fixed spacing may be given to the feet 6 and 7 a key-way 10 extends longitudinally of each of the shafts 5, and the supporting or bearing members 6' and 7' of the feet are provided with set screws 11 for engagement with this key-way. The shafts 5 are rigidly held against turning in the slide members 4, and although the suction feet are adjustable longitudinally of these shafts by means of the key-way and set screw means 10—11, they are rigidly held against any turning motion.

Reciprocation is imparted to the carriages A and B by means of appropriate sets of links 12, 12' and 13, 13', and levers 14, 14' and 15, 15' operatively connected upon opposite sides of the board 1 with the slide members 4 of the two carriages. The levers 14, 14' are rigidly mounted upon a cross-shaft 16, and a similar cross-shaft 17 carries the levers 15, 15'. These shafts 16 and 17 are oscillated by means of arms 18 and 19, respectively, fixed to the shafts and coupled by links 20 and 21 to a crank 22 turning with a shaft 23 which may be driven by any appropriate means (not shown) in timed relation to the operation of the press.

Also mounted upon the shaft 23, and turning therewith, is a cam 24 (Figs. 1 and 12) which appropriately actuates a suction control valve 25 in timed relation to the reciprocation of the carriages A and B so that suction will be imparted to the feet 6 and 7 upon the forward (toward the press) strokes of the carriages, and will be cut off from the feet upon the rearward (toward the pile) strokes of the carriages.

It will be understood that the hollow shafts 5 provide a means for communicating the air suction from the feet 6 and 7 through preferably rigid connections 26 and flexible connections 27 to the valve 25 and thence through a conduit 28 to a suitable source of suction such as a pump or the like, not shown. Also, it will be realized that the supporting or bearing members 6', 7' of the feet 6 and 7 are provided with ducts affording communication between the suction openings of the feet and the conduit means 26, 27 in a conventional manner.

The usual suction type sheet raising means 29 (Fig. 2) are provided for successively raising individual sheets from the pile 9 into the field of operation of the feet 7 of the rear carriage B.

It will be noted that the board 1 is provided with an offset 30 in order to provide for the overlapping, non-contacting arrangement of the fed sheets at the period of their introduction into the press, as hereinbefore pointed out.

The press guides 31 may be of any usual or approved form.

Referring now to Figs. 4 to 8 inclusive, the operation of the feeding mechanism of the invention in its four-step aspect will be understood to be substantially as follows: Assuming that starting of the press, and hence of the feeding mechanism, is made with the parts in the positions illustrated in Fig. 4, that is to say, with the carriages A and B at maximum separation, it will be apparent that, immediately upon the start of rotation of the shaft 23, movement of the carriages toward each other will begin to take place. Simultaneously, the sheet raising means 29, which have previously raised a sheet from the pile into the field of operation of the suction feet 7 of carriage B, will release this sheet and it will be grasped by the feet 7 of carriage B under the influence of suction communicated through valve 25, in the position shown in Fig. 12, and as the carriage B moves forward will carry with it the sheet *a* to the position shown in Fig. 5, where it momentarily comes to rest as separating movement of the carriages A and B is then immediately begun.

Obviously, as the carriages separate, the suction feet 7 of carriage A will be energized to grip the sheet *a* and move it to the position shown in Fig. 6, the carriage B meanwhile returning to the position in which its feet 7 are in sheet-receiving relation to the pile 9 and its feet 6 in gripping relation to the leading edge of the sheet *a*.

Now, as the carriages A and B again move toward each other, the suction feet 6 of carriage B will pick up and move the sheet *a* forward, by its leading edge, and the suction feet 7 of carriage B will grasp and move a succeeding sheet *b*, which has been lifted from the pile 9. forward from the pile, these relative positions of the sheets *a* and *b* being shown in Fig. 7.

As the carriages A and B again separate, the suction feet 6 and 7 of carriage A will move the sheets *a* and *b* forward a further step, the sheet *a* thus being given its final step into register with the guides 31 where it may be picked up by the cylinder 8, and the sheet *b* to a position where it may be further advanced by the feet 6 of carriage B and later by the feet 6 of carriage A, as shown in Fig. 8.

Obviously, inasmuch as the timing of the press cylinder is preferably such that a sheet will rest against the guides 31 momentarily, so that it may settle thereagainst in proper register after being released by the suction feet 6 of carriage A, and inasmuch, also, as the carriages A and B immediately begin their movement toward each other when a sheet (the sheet *a*) has been brought up against the guides, it will be apparent that the sheet *b* will overlap the following edge of the sheet *a* as the latter sheet is drawn into the press. But, due to the offset 30 in the feed board 1, this overlapping of the sheets will not cause them to come into actual surface contact, and hence the advance of the sheet *b* will not tend to disturb the register of sheet *a* against the guides 31. Also, the assumed momentary stationary condition of the sheet *a* will similarly have no tendency to misalign the following sheet *b* being fed.

It will be understood that the feeding of only two sheets (*a* and *b*) just described is in the interest of a clear understanding of the mode of op-

eration of the mechanism, it being apparent that at every reciprocation of the carriages in a forward direction a sheet will be fed from the pile 9 by the feet 7 of carriage B, and a sheet will be fed to the press guides 31 by the feet 6 of the carriage A.

The lateral overlapping of the feet 6, 6 and 7, 7 of the carriages A and B, respectively, when the carriages are at the limit of their movement toward each other, and the lateral overlapping of the feet 7 of carriage A with the feet 6 of carriage B makes possible the intermittent grasping of successive sheets during feed by the appropriate feet of the carriages without loss of time and without the need for exact register of the sheets at the termination of the successive steps of feeding prior to register with the press guides.

Referring to Figs. 9, 10, 11 and 13 to 17, wherein the mechanism is designed for a three-step rather than a four-step feed of the sheets, it will be seen that the feed board 1*a* has a flat surface of relatively conventional form, and at its sides are mounted in brackets 3*a* the rods or bars 2*a* upon which slide the members 4*a* carrying the hollow shafts 5*a* upon which are mounted the suction feet 6*a* and 7*a* of the carriage A', and suction feet 7*a*, only, of the carriage B', in a manner similar to that already described. However, although the shaft 5*a* of carriage A' is rigid in its slide bearings 4*a*, the shaft 5*a* of carriage B' is oscillatable about its longitudinal axis in its bearings 4*a* for a purpose later to be explained.

Reciprocation is imparted to the carriages A' and B' in substantially the same manner as that hereinbefore explained. Also, the same suction connections are employed and similarly controlled. But these parts have been omitted from the showing of Figs. 9 to 11 as not essential to a full understanding of the modification therein disclosed, when the foregoing description of Figs. 1 to 9 is kept in mind.

In view of the fact that the feed board 1*a* has a flat, unbroken surface, it will be obvious that means must be provided for moving the leading edge of a sheet advanced by the suction feet 7*a* of carriage B' under the suction feet 7*a* of carriage A'. This is preferably accomplished with the oscillatable mounting of shaft 5*a* of carriage B' by providing this shaft with a fixed collar 32 having a depending lug 33 operatively engaging a yoke 34 rigidly mounted upon a stud 35 to which is affixed an arm 36 provided with a roller 37 for engagement with a cam member 38, the arm 36 being biased to depressed position by a spring 39.

Thus, it will be seen that when the carriage B' is in its rearward position (Fig. 9) with the arm 36 depressed, the suction feet 7*a* associated with it will be in elevated position, and when the carriage B' is in its forward position (Fig. 10), engagement of the roller 37 with cam member 38 will cause arm 36 to be elevated a distance sufficient to depress the suction feet 7*a* of carriage B' to a level below that of the suction feet 7*a* of carriage A'.

Referring to the diagrammatic illustration (Figs. 13 to 17) of the operative steps of the modified feeding mechanism of Figs 9 to 11, and starting with the parts in the positions shown in Fig. 13, it will be apparent that upon the first reciprocation of the carriages A' and B' toward each other, a sheet *a'*, lifted from the pile 9*a*, and grasped by the suction feet 7*a* of carriage B', will be advanced longitudinally of the feed board 1*a* approximately one-third the distance between the pile and the press guides 31*a* of the cylinder 8*a* of the press (Fig. 14). Upon separation of the carriages A' and B' during their next reciprocative movement, the suction feet 7*a* of carriage A', which have grasped the sheet *a'*, will advance it through a further approximate one-third the distance toward the press guides (Fig. 15). As the carriages A' and B' now move toward each other again, a second sheet *b'* will be advanced from the pile by the suction feet 7*a* of carriage B', and the suction feet 6*a* of carriage A' will be brought into position to grasp the leading edge of sheet *a'* (Fig. 16).

It is during this feeding step of the carriages A' and B' that the mechanism for raising and lowering the suction feet 7*a* of carriage B' comes into play. Obviously, as hereinbefore described in connection with Figs. 1 to 3 and 12, suction is applied to the feet of carriages A' and B' only when the carriages are reciprocating in a direction toward the press guides, and then is cut off when they come to rest at the end of such movement. Hence, when the suction feet 7*a* of carriage A' have moved the sheet *a'* to the position shown in Fig. 15 they will release it there and permit it to rest flat upon the feed board 1*a*. While the sheet is thus at rest, the suction feet 7*a* of carriage B' will advance the leading edge of sheet *b'* beneath the suction feet 7*a* of carriage A' and in overlapping arrangement with the trailing edge of sheet *a'*.

Upon the next separating reciprocative movement of the carriages, the suction feet 6*a* of carriage A' will advance sheet *a'* to the press guides 31*a*, and the suction feet 7*a* of carriage A' will advance the sheet *b'*, as shown in Fig. 17.

As in the case of the description of the operation of the four-step feeding practice, Figs. 4 to 8, it will be understood that in the preceding description of the three-step feeding practice the feed of only two sheets is in the interest of clearness for, obviously, each reciprocative movement of the carriages A' and B' toward the press guides will result in the feeding of sheets from the pile 9*a* and to the press guides 31*a*, and there will thus be a continuous procession of sheets fed over the feed board 1*a*.

It will be noted that the feed boards 1 and 1*a* of both embodiments of the invention have the pile adjacent edges depressed at 40 to facilitate feed of sheets onto them from the pile 9*a*. Also, the feed boards are preferably pivotally mounted at 41 and provided with elevating screws 42, or the like means, for adjusting the slant from pile to press, as shown in Fig. 1.

Various changes and modifications are considered to be within the principle of the invention and the scope of the following claims.

What I claim is:

1. In a sheet feeding mechanism for feeding sheets from a supply thereof to a point of use, two sheet transfer devices arranged between said supply and point of use and relatively reciprocative toward and away from each other through a distance approximately half the distance between said supply and point of use, sheet engaging means carried by each of said transfer devices, and means for imparting reciprocation to said transfer devices, and means actuated in timed relation to such reciprocation for alternately energizing the sheet engaging means so that said two transfer devices will serve during reciprocation for progressively feeding sheets from said sheet supply to said point of use in a plurality of longitudinal feed steps greater than two.

2. In a sheet feeding mechanism for feeding sheets from a supply thereof to a point of use, two sheet transfer devices arranged between said supply and point of use and relatively reciprocative toward and away from each other through a distance approximately half the distance between said supply and point of use, sheet engaging means carried by each of said transfer devices, means for imparting reciprocation to said transfer devices, and means actuated in timed relation to such reciprocation for alternately energizing the sheet engaging means so that said two transfer devices will serve during reciprocation for progressively feeding sheets from said sheet supply to said point of use in a plurality of successive longitudinal feed steps greater than two.

3. In a sheet feeding mechanism for feeding sheets from a source of supply to a point of use, two sheet transfer devices relatively reciprocative toward and away from each other longitudinally of the direction of feed, sheet engaging means carried by each of said transfer devices, at least one of said transfer devices carrying two sheet engaging means extending respectively forwardly and rearwardly thereof with respect to the direction of feed and capable of being energized to provide transferring engagement with successive sheets, and means for energizing the said engaging means of the two transfer devices alternately so that they will be capable of transferring engagement with the sheets only when travelling toward said point of use.

4. In a sheet feeding mechanism, two sheet transfer devices relatively reciprocative toward and away from each other, sheet engaging means carried by each of said transfer devices, and means for actuating said transfer devices and the sheet engaging means carried thereby so that said two transfer devices will serve during reciprocation for progressively feeding sheets from a sheet supply to a point of use in a plurality of longitudinal feed steps greater than two, the sheet engaging means of the respective transfer devices being so relatively arranged as to overlap each other laterally of sheets being fed, whereby when feed of a sheet by the sheet engaging means of one transfer device is terminated the sheet engaging means of the other transfer device may be in position for feeding engagement with it.

5. In a sheet feeding mechanism for feeding sheets from a supply thereof to a point of use by a multiple successive-step feeding movement, two feed carriages relatively reciprocative toward and away from each other, sheet engaging means extending from each of said carriages forwardly and rearwardly thereof with respect to the direction of feed, means for reciprocating said carriages, and means for energizing the sheet engaging means of the respective carriages only when said carriages are travelling toward said point of use, whereby the two carriages as they alternately travel toward said point will serve to progressively feed sheets in a plurality of longitudinal feed steps greater than two.

6. In a sheet feeding mechanism for feeding sheets from a supply thereof to a point of use by a multiple successive-step feeding movement, two feed carriages relatively reciprocative toward and away from each other, sheet engaging means extending from each of said carriages forwardly and rearwardly thereof with respect to the direction of feed, means for reciprocating said carriages, and means for energizing the sheet engaging means of the respective carriages only when said carriages are travelling toward said point of use, whereby as the two carriages alternately travel toward said point sheets will move forward with them engaged first by their rearwardly extending sheet engaging means and second by their forwardly extending sheet engaging means.

7. In a sheet feeding mechanism for feeding sheets from a supply thereof to a point of use, two feed carriages relatively reciprocative toward and away from each other, sheet engaging means extending from each of said carriages forwardly and rearwardly thereof with respect to the direction of feed, means for reciprocating said carriages, and means for energizing said sheet engaging means of the respective carriages only when said carriages are travelling toward said point of use, whereby as the two carriages alternately travel toward said point sheets will move forward with them engaged first by their rearwardly extending sheet engaging means and second by their forwardly extending sheet engaging means to impart a four-step successive feed of the sheets.

8. In a sheet feeding mechanism for feeding sheets from a supply thereof to a point of use, two feed carriages relatively reciprocative toward and away from each other, sheet engaging means movable with said carriages, means for energizing said sheet engaging means for feeding contact with sheets only during movement of the respective carriages toward said point of use, whereby the sheets are fed by successive steps from the supply to the point of use, the last two steps of such feeding movement causing successive sheets to partially overlap adjacent to the point of use, and means for preventing contact between such sheets at their overlapping portions.

9. In a sheet feeding mechanism for feeding sheets from a supply thereof to a point of use, a feed board, two feed carriages relatively reciprocative toward and away from each other, sheet engaging means movable with said carriages, means for energizing said sheet engaging means for feeding contact with sheets only during movement of the respective carriages toward said point of use, whereby the sheets are fed by successive steps from the supply to the point of use, the last two steps of such feeding movement causing successive sheets to partially overlap adjacent to the point of use, and means including a vertical offset in said feed board for preventing contact between such sheets at their overlapping portions.

10. In a sheet feeding mechanism for feeding sheets from a supply thereof to a point of use, two feed carriages relatively reciprocative toward and away from each other in the line of feed of the sheets, one of said carriages being forward and the other rearward of a median point in such line, sheet engaging means carried by and extending forwardly and rearwardly of said forward carriage, sheet engaging means extending rearwardly of said rearward carriage, means for reciprocating said carriages, and means for energizing the sheet engaging means of the respective carriages only during movement in a direction toward said point of use, whereby the sheet engaging means of the two carriages will advance sheets from said supply to said point of use successively in three steps of longitudinal feed movement.

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