May 16, 1944. T. J. KAUFFELD 2,348,821

SHEET DELIVERY MECHANISM FOR PRINTING PRESSES

Filed Sept. 4, 1941 2 Sheets-Sheet 1

FIG. 1.

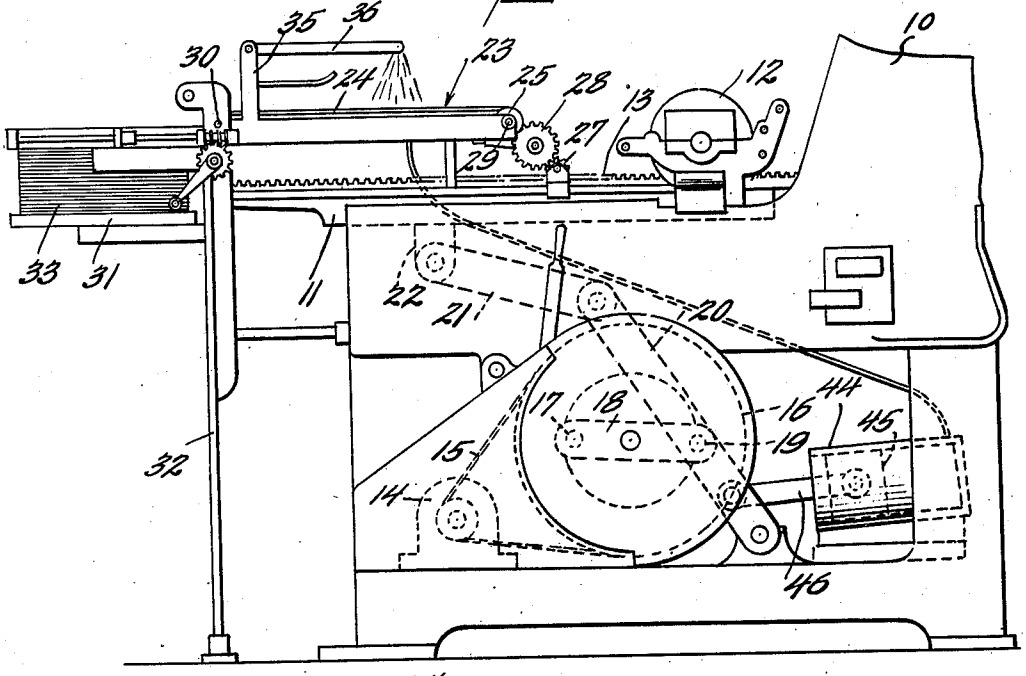


FIG. 2.

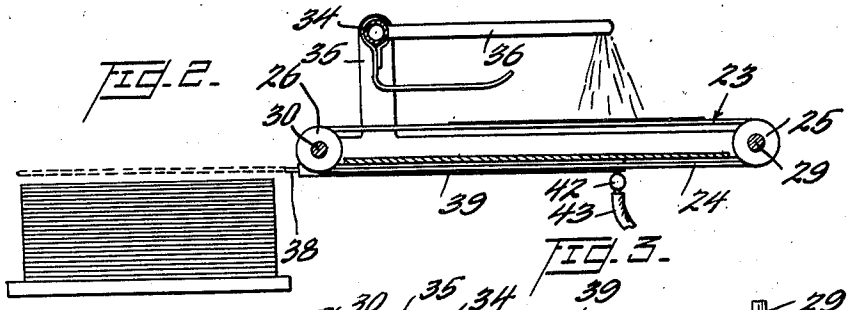
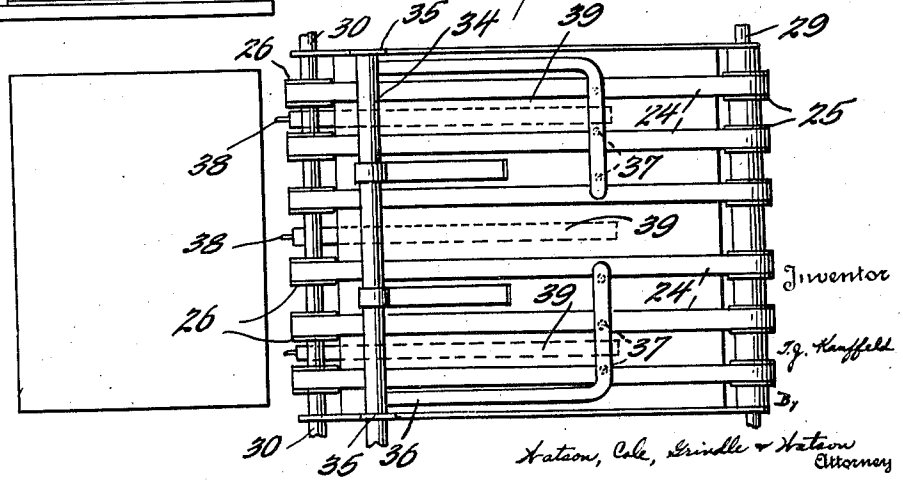


FIG. 3.



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SHEET DELIVERY MECHANISM FOR PRINTING PRESSES

Filed Sept. 4, 1941 2 Sheets-Sheet 2

FIG. 4.

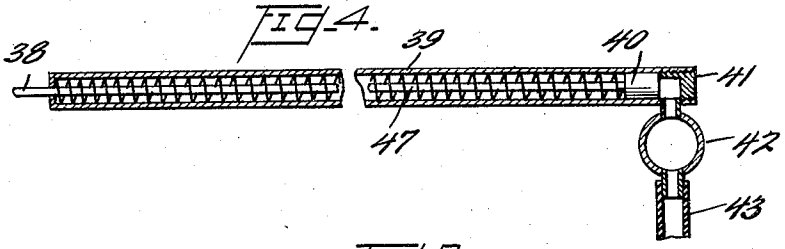


FIG. 5.

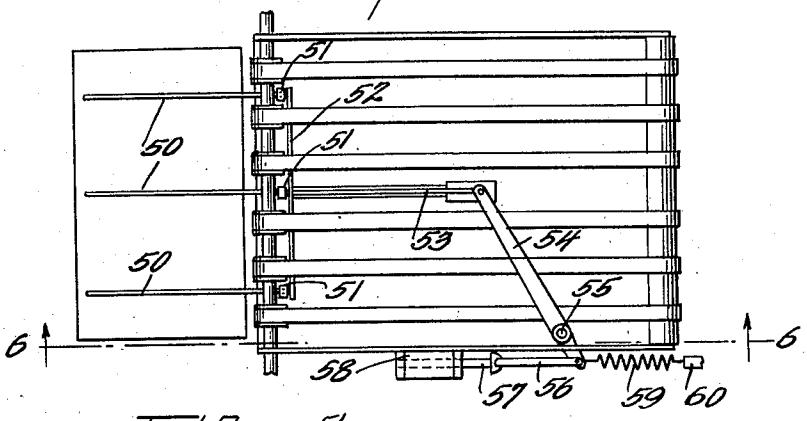


FIG. 6.

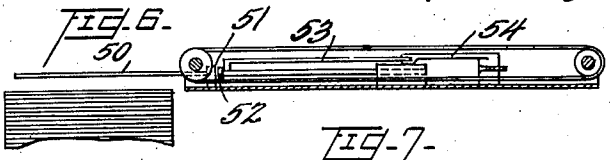


FIG. 7.

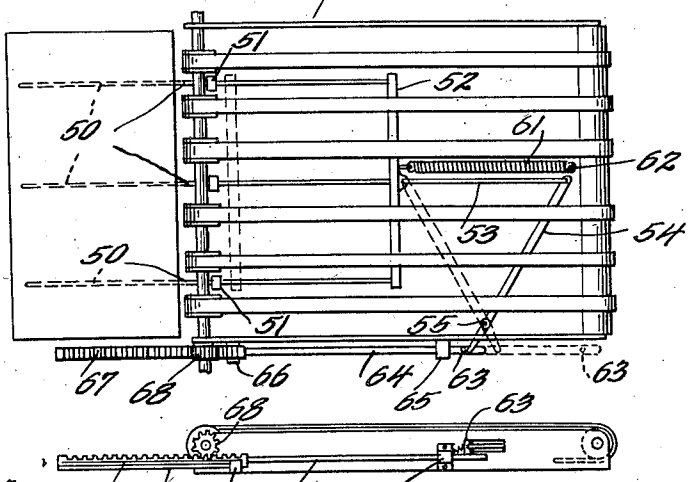


FIG. 9.

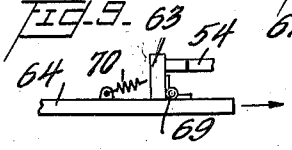
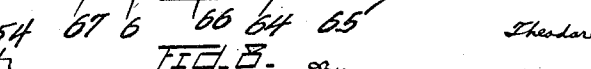


FIG. 8.



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SHEET DELIVERY MECHANISM FOR PRINTING PRESSES

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Application September 4, 1941, Serial No. 409,559

15 Claims. (Cl. 271—69)

The present invention relates to sheet delivery mechanism of the type usually associated with printing presses, and has for its general object the provision of improved means for delivering printed sheets onto a pile supported on a delivery table or the like, and more particularly for the satisfactory and expeditious handling of light, flimsy sheets. The improved mechanism of the present invention is especially suitable for use in connection with presses of the reciprocating bed type, but the invention is not limited to use with that type of press but may be employed in connection with any press having sheet delivery mechanism of the ejecting conveyor type.

It is well known in the art to which the present invention relates that in the use of sheet conveyors of the ejector type for the delivery of light and flimsy sheets, the resistance of the air to the forward movement of the successive sheets presents a problem because of the tendency of the sheets to curl at the leading edge as they are projected from the tape conveyor to the pile. That is, the leading edge of the sheet tends to drop from the plane of the conveyor tapes toward the delivery pile, which is usually maintained at a lower level than the tapes, and during the forward movement of the sheet there is a downward force exerted thereon by reason of the horizontal movement of the sheet and the downturned forward edge. This condition creates a tendency for the sheet to curl under, particularly at the sides, with resulting improper delivery, frequently causing shut-downs and thus lowering production.

In order to overcome the difficulties mentioned above, the present invention employs a reciprocating support for the sheet, which support is movable in a plane slightly below the plane of the conveyor tapes and is adapted to advance over the delivery table as the sheet is projected from the conveyor, the sheet being received on the support and maintained in a horizontal position thereon while it advances to a position directly over the pile on the delivery table. The support is then rapidly retracted from beneath the sheet, in such a manner that the entire area of the sheet becomes unsupported practically simultaneously, so that the sheet settles vertically onto the delivery pile in a flat, uncurled condition.

Certain types of delivery mechanism heretofore employed have made use of reciprocating rods or fingers for supporting the sheet as it is positioned over the delivery pile. However, in such cases, provision has not been made for rapidly retracting the support in such a way that the sheet remains practically stationary in space, and it has therefore been necessary to employ stripping fingers or equivalent means for preventing rearward movement of the sheet with the supporting fingers. According to the present invention, the support is retracted so rapidly that it is withdrawn practically instantaneously from beneath the supported sheet, and it is unnecessary to employ stripping fingers or other means to prevent rearward movement of the sheet.

Other and further objects, features and advantages of the present invention will be apparent to one skilled in the art from the following description taken in connection with the accompanying drawings in which:

Figure 1 is a side elevation of a printing press of the reciprocating bed type to which the mechanism of the present invention has been applied;

Figure 2 is a side elevation on an enlarged scale of a portion of the mechanism of Figure 1;

Figure 3 is a plan view of the mechanism of Figure 2;

Figure 4 is an enlarged vertical section through one of the pneumatic cylinders employed for operating the reciprocating support;

Figure 5 is a plan view of a modification, in which the reciprocating support is electrically actuated;

Figure 6 is a vertical section on line 6—6 of Figure 5;

Figure 7 is a plan view of a further modification according to which the reciprocating support is mechanically actuated;

Figure 8 is a side elevation of the mechanism of Figure 7; and

Figure 9 is an enlarged detail of a portion of the mechanism of Figures 7 and 8.

In order to facilitate an understanding of the invention, reference is made to the embodiment thereof shown in the accompanying drawings and detailed descriptive language is employed. It will nevertheless be understood that no limitation of the invention is thereby intended and that various changes and alterations are contemplated such as would ordinarily occur to one skilled in the art to which the invention relates.

Referring to Figure 1, the frame of a printing press is indicated generally by the numeral 10, the reciprocating bed slidably mounted on this frame in any suitable manner being indicated at 11, and the usual impression cylinder at 12. The impression cylinder is provided with a gear which meshes with a rack 13 which is rigid with the

bed 11, so that the movements of the bed and cylinder are synchronized in a manner well understood in the art. The bed may be reciprocated by any suitable means, and in the illustrated embodiment, this means comprises an electric motor 14 connected by a belt 15 to a pulley 16, which pulley is provided with an eccentric pin 17 upon which is pivotally mounted one end of a link 18. The opposite end of link 18 is connected by means of pin 19 to a rocker 20, the lower end of which is mounted to rock in a fixed bearing and the upper end of which is connected by means of a link 21 to a bracket 22 secured to the bed 11. It will be seen that energization of the motor 14 will result in reciprocation of the bed 11, the movement of the bed from left to right being effected by the driving mechanism when the cylinder 12 is on impression and paper sheet is secured thereto, so that this left to right movement of the bed is its printing movement. Movement from right to left is the return movement, during which time the impression cylinder is raised.

It will be understood that sheets to be printed are successively fed from a magazine to the impression cylinder at proper intervals, are then gripped to the impression cylinder by suitable means, and are released therefrom after being printed and thereupon engaged by sheet delivery gripping devices for removal from the cylinder to a conveyor. The mechanism for effecting these operations forms no part of the present invention, and will not be described in detail.

After release from the impression cylinder, the successive sheets are deposited upon the reversible conveyor indicated generally by the numeral 23, which conveyor preferably comprises a plurality of endless tapes 24 (Figure 3) disposed in parallel vertically spaced horizontal planes and passing around spaced horizontally disposed rollers 25 and 26. Movement is transmitted to the rollers 25 by means of a gear train comprising a pinion 27 meshing with the rack 13 of the press bed, a gear 28 meshing with the pinion 27 and a gear (not shown) meshing with the gear 28 and secured on the shaft 29 which carries the rollers 25. The rollers 26 and their supporting shaft 30 are driven by the tapes 24.

A delivery table 31 is supported from the standards 32 adjacent the delivery end of the conveyor 23, the table 31 being adapted through automatic means to descend slowly as the pile 33 of sheets thereon grows in height. In order to insure good frictional contact between the light, flimsy sheets and the tapes 24 of the conveyor 23, means are provided above the conveyor for directing a downward flow of air against the sheets. To this end, the hollow support 34 is supported above the conveyor on brackets 35 secured to the frame of the conveyor, and a pair of L-shaped conduits 36 are tapped into the hollow support 34 and project rearwardly therefrom, as best seen in Figures 2 and 3. A series of spaced apertures 37 are provided in the lower side of the transversely extending portions of the conduits 36, and it will be apparent that if the hollow support 34 is supplied with air under super-atmospheric pressure, a downward flow of air will be directed against the successive sheets passing over the conveyor 23, as indicated in Figures 1 and 2, pressing the sheets firmly against the tapes 24, and will prevent curling of the sheets as they are advanced.

In order to support the sheets as they are projected from the conveyor 23 to position over the pile 33, and to prevent curling of the sheets during this movement, a reciprocating support is provided which will now be described. In its preferred form, this reciprocating support comprises a plurality of fingers 38 (Figures 2, 3, and 4) each supported for sliding movement in a cylinder 39 which is in turn supported in any suitable manner on the frame of the conveyor 23, the fingers 38 being adapted to reciprocate in a plane slightly below the upper reach of the conveyor tapes 24. Each finger 38 is provided at its rearward end with a piston 40 which makes a close fit in the cylinder 39, the rearward end of which is closed by a plug 41. The forward end of each cylinder 39 is apertured to admit the finger 38 with slight clearance, and a coil spring 47 is interposed between the forward end of the cylinder 39 and the piston 40, tending to urge the latter to its rearmost position.

The respective cylinders 39 are connected to a transverse header 42 which is in turn connected through a conduit 43 to a pump cylinder 44. A piston 45 adapted to reciprocate within the cylinder 44, is connected by means of a piston rod 46 with the rocker 20 of the press bed actuating mechanism, and the piston 45 is thus caused to reciprocate in timed relation to the movements of the printing press.

From the foregoing description it will be apparent that as the piston 45 reciprocates in the cylinder 44, the pneumatic cylinders will be alternately supercharged and evacuated. When the piston 45 moves to the right, supercharging the cylinders 39, the fingers 38 will be projected, against the pressure of the springs 47, to a position over the delivery pile 33. As the fingers 38 move to this position, they receive a sheet which is projected from the forward or delivery end of the conveyor 23 and support such sheet in a horizontal, flat condition as it moves to a position directly over the delivery pile. At this point, the piston 45 moves to the left in the cylinder 44 relieving the pressure in the cylinders 39 and partially evacuating them, and the pistons 40 and fingers 38 move rapidly to the right under the pressure of the springs 47 and the atmospheric pressure to the left of pistons 40, thus instantaneously removing the support from beneath the sheet and permitting the latter to settle vertically and without curling, onto the delivery pile. The mechanism for securing this result is extremely simple and inexpensive, and has been found to operate in a satisfactory manner and with advantageous results. Obviously, for some purposes, the assisting spring 47 could be eliminated and the suction caused by the piston 45 relied upon to retract the support.

In the modification illustrated in Figures 5 and 6, which is in all other respects the same as the embodiment first described the fingers 50 are supported in bearings 51 and are secured to a common cross-head 52. The latter is connected by means of a link 53 to a rock lever 54 pivoted at 55. The opposite end of the lever 54 is connected to a link 56 which is in turn connected to the movable core 57 of a solenoid 58. The linkage thus constituted is normally urged to the position illustrated in Figure 5 by means of a tension spring 59 secured to the lever 54 and to any suitable fixed member 60. Provision is made for energizing the solenoid 58 intermittently and in timed relation with the movements of the press so that the solenoid will be energized each time the fingers 50 reach the position illustrated and are supporting a sheet directly

over the delivery pile. It will be apparent that when the solenoid 58 is energized, the core 57 will be instantly drawn to the left, rocking the lever 54 and retracting the fingers 50 very rapidly. When the solenoid is de-energized the spring 59 will move the fingers 50 again to the position illustrated. Any suitable contact making apparatus may be employed for intermittently connecting the solenoid 58 to a source of electric energy in timed relation to the movements of the printing press.

In the modification of the sheet laying means illustrated in Figures 7, 8, and 9, the fingers 50 are supported in bearings 51 and are secured to a cross-head 52, as in the case of the modification just described. The cross-head 52 is secured by means of a link 53 to the rock lever 54 which is pivoted at 55. A spring 61 secured to the cross-head 52 and to any suitable fixed member 62 urges the fingers 50 toward their rearward or retracted position.

The end of the rock lever 54 opposite the link 53 projects into the path of an upstanding lug 63 hingedly supported on the rearwardly extending portion of a rack 64. The latter is supported in slide bearings 65 and 66 secured to the frame of the conveyor 23 and the toothed portion 67 of the rack meshes with a pinion 68 secured on the shaft 30 of the conveyor. As the conveyor moves in a direction to advance a sheet toward the delivery pile, the rack 64 is moved rearwardly and, as the lug 63 engages the lever 54, the latter is rocked counterclockwise to project the fingers 50 into position to receive the advancing sheet from the conveyor and position it over the delivery pile. At this point the lug 63 passes the engaged end of the lever 54, permitting the fingers 50 to be rapidly retracted by the spring 61. In the reverse movement of the rack 64, as the lug 63 engages the lever 54, the lug swings downwardly on its hinge 69, against the tension of the spring 70, and passes under the end of the lever 54, after which the lug 63 springs upright into position to engage the lever 54 upon the next rearward movement of the rack.

From the foregoing description it will be understood that in each of the three modifications, namely, the pneumatically operated, electrically operated, and mechanically operated forms of the present invention, substantially similar results are obtained in that, in each case, a support consisting of a plurality of spaced fingers is moved outwardly over the delivery pile as a sheet is projected from the delivery end of the conveyor. The sheet is received on the support and is maintained thereon, momentarily, in a horizontal, flat condition, directly over the delivery pile. The support is then rapidly retracted in such a way as to remove the support from beneath all parts of the sheet practically simultaneously, so that the latter settles downwardly onto the pile without losing its horizontally disposed position and without curling at the edges.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. For use in connection with a printing press or the like, apparatus for handling thin sheets, comprising a sheet delivery conveyor, a delivery table adjacent the delivery end of said conveyor, means for assisting the deposit of a sheet from said conveyor onto said table, said means comprising a movable support adapted to receive a sheet from said conveyor and to support said sheet in a horizontal position while said sheet moves to a position over said table, and means operable in timed relation to the movements of said press for advancing said support to a position over said table whereupon said support comprises the sole supporting and holding means for the sheet, and means for suddenly retracting said support from beneath the sheet, whereby said sheet due to its inertia alone remains substantially in its position longitudinally of the apparatus and is permitted to settle onto a pile supported on said table.

2. For use in connection with a printing press or the like, apparatus for handling thin sheets, comprising a sheet delivery conveyor, air jet means disposed above said conveyor for maintaining a sheet in frictional contact with said conveyor, a delivery table adjacent the delivery end of said conveyor, means for assisting the deposit of a sheet from said conveyor onto said table, said means comprising a movable support adapted to receive a sheet from said conveyor and to support said sheet in a horizontal position while said sheet moves to a position over said table, and means operable in timed relation to the movements of said press for advancing said support to a position over said table whereupon said support comprises the sole supporting and holding means for the sheet, and means for suddenly snatching said support from beneath a sheet, whereby said sheet due to its inertia alone remains substantially in its position longitudinally of the apparatus and is permitted to settle onto a pile supported on said table.

3. For use in connection with a printing press or the like, apparatus for handling thin sheets, comprising a sheet delivery conveyor, a delivery table adjacent the delivery end of said conveyor, means for assisting the deposit of a sheet from said conveyor onto said table, said means comprising a movable support adapted to receive a sheet from said conveyor and to support said sheet in a horizontal position while said sheet moves to a position over said table, and pneumatic means operable in timed relation to the movements of said press for advancing said support to a position over said table and for suddenly retracting said support, whereby said sheet is permitted to settle onto a pile supported on said table.

4. For use in connection with a printing press or the like, apparatus for handling thin sheets, comprising a sheet delivery conveyor, a delivery table adjacent the delivery end of said conveyor, means for assisting the deposit of a sheet from said conveyor onto said table, said means comprising a movable support adapted to receive a sheet from said conveyor and to support said sheet in a horizontal position while said sheet moves to a position over said table, and means operable in timed relation to the movements of said press for advancing said support to a position over said table and for rapidly retracting said support, whereby said sheet is permitted to settle onto a pile supported on said table, said last means comprising air-pressure means for advancing said support, spring means for quickly retracting said support upon release of the air pressure, and means actuated in timed relation to the movements of said press for intermittently producing a super-atmospheric pressure for operating said air-pressure means.

5. For use in connection with a printing press or the like, apparatus for handling thin sheets, comprising a sheet delivery conveyor, a delivery

table adjacent the delivery end of said conveyor, means for assisting the deposit of a sheet from said conveyor onto said table, said means comprising a plurality of spaced movable fingers adapted to receive a sheet from said conveyor and to support said sheet in a horizontal position while said sheet moves to a position over said table, a cylinder for each said finger, a piston attached to each said finger and slidable in the associated cylinder, spring means for urging each said piston rearwardly in its cylinder, and means actuated in timed relation to the movements of said press for intermittently producing a super-atmospheric pressure in said cylinders for advancing said fingers.

6. For use in connection with a printing press or the like, apparatus for handling thin sheets, comprising a sheet delivery conveyor, a delivery table adjacent the delivery end of said conveyor, means for assisting the deposit of a sheet from said conveyor onto said table, said means comprising a movable support adapted to receive a sheet from said conveyor and to support said sheet in a horizontal position while said sheet moves to a position over said table, and electrical means operable in timed relation to the movements of said press for advancing said support to a position over said table and for suddenly retracting said support, whereby said sheet is permitted to settle onto a pile supported on said table.

7. For use in connection with a printing press or the like, apparatus for handling thin sheets, comprising a sheet delivery conveyor, a delivery table adjacent the delivery end of said conveyor, means for assisting the deposit of a sheet from said conveyor onto said table, said means comprising a movable support adapted to receive a sheet from said conveyor and to support said sheet in a horizontal position while said sheet moves to a position over said table, and solenoid-operated means operable in timed relation to the movements of said press for advancing said support to a position over said table and for suddenly retracting said support, whereby said sheet is permitted to settle onto a pile supported on said table.

8. For use in connection with a printing press or the like, apparatus for handling thin sheets, comprising a reversing sheet delivery conveyor, a delivery table adjacent the delivery end of said conveyor, means for assisting the deposit of a sheet from said conveyor onto said table, said means comprising a movable support adapted to receive a sheet from said conveyor and to support said sheet in a horizontal position while said sheet moves to a position over said table, and means operable in timed relation to the movements of said press for advancing said support to a position over said table and for rapidly retracting said support, whereby said sheet is permitted to settle onto a pile supported on said table, said last means comprising a toothed rack geared to a shaft of said conveyor, a lever pivoted adjacent said rack and adapted to be rocked by said rack upon movement of the latter in one direction, means connecting said lever and said support, and spring means for quickly retracting said lever and support.

9. In the process of delivering thin sheets from a printing press or the like, the successive steps of supporting each sheet substantially equally throughout its area in a horizontal position and moving it while so supported in a delivery direction substantially in its own plane; transferring the sheet to a second support by further movement substantially in the same plane, whereby it is again supported substantially equally throughout its area; then suddenly snatching said support from beneath the sheet, whereby due to its inertia only the sheet remains momentarily suspended in the same position, and thereupon settles evenly to the delivery point under the influence of gravity without danger of drooping or folding.

10. For use in connection with a printing press or the like, apparatus for handling thin sheets, comprising a sheet delivery conveyor, a delivery table adjacent the delivery end of said conveyor, means for assisting the deposit of a sheet from said conveyor onto said table, said means comprising a movable support adapted to receive a sheet from said conveyor and to support said sheet in a horizontal position while said sheet moves to a position over said table, and means operable in timed relation to the movements of said press for advancing said support to a position over said table and for rapidly retracting said support, whereby said sheet is permitted to settle onto a pile supported on said table, said last means comprising air-pressure means for advancing said support, spring means for quickly retracting said support upon release of the air-pressure, and a double acting pump actuated in timed relation to the movements of said press for intermittently and alternately producing and releasing a super-atmospheric pressure for operating said air-pressure means.

11. For use in connection with a printing press or the like, apparatus for handling thin sheets, comprising a sheet delivery conveyor, a delivery table adjacent the delivery end of said conveyor, means for assisting the deposit of a sheet from said conveyor onto said table, said means comprising a movable support adapted to receive a sheet from said conveyor and to support said sheet in a horizontal position while said sheet moves to a position over said table, and means operable in timed relation to the movements of said press for advancing said support to a position over said table and for rapidly retracting said support, whereby said sheet is permitted to settle onto a pile supported on said table, said last means comprising fluid pressure means for advancing said support, spring means for quickly retracting said support upon release of the fluid pressure, and a double acting pump actuated in timed relation to the movements of said press for intermittently and alternately producing and releasing the fluid pressure for operating said fluid pressure means.

12. For use in connection with a printing press or the like, apparatus for handling thin sheets, comprising a sheet delivery conveyor, a delivery table adjacent the delivery end of said conveyor, means for assisting the deposit of a sheet from said conveyor onto said table, said means comprising a movable support adapted to receive a sheet from said conveyor and to support said sheet in a horizontal position while said sheet moves to a position over said table, and means operable in timed relation to the movements of said press for advancing said support to a position over said table and means for suddenly retracting said support from beneath the sheet, whereby said sheet due to its inertia remains substantially in its position longitudinally of the apparatus and is permitted to settle onto a pile supported on said table; said advancing means comprising a fluid pressure motor having a moving part operatively connected with said support,

and means actuated in timed relation to the movements of said press for intermittently and alternately applying pressure and suction to said fluid pressure motor to cause it to advance and retract the support.

13. For use in connection with a printing press or the like, apparatus for handling thin sheets, comprising a sheet delivery conveyor, a delivery table adjacent the delivery end of said conveyor, means for assisting the deposit of a sheet from said conveyor onto said table, said means comprising a movable support adapted to receive a sheet from said conveyor and to support said sheet in a horizontal position while said sheet moves to a position over said table, and means operable in timed relation to the movements of said press for advancing said support to a position over said table, and means for suddenly retracting said support from beneath the sheet, whereby said sheet due to its inertia remains substantially in its position longitudinally of the apparatus and is permitted to settle onto a pile supported on said table; said advancing means comprising a reciprocating, pneumatic piston and cylinder motor, and means for operatively connecting the piston of said motor to said support, means actuated in timed relation to the movements of said press for intermittently and alternately applying super-atmospheric pressure and suction to said pneumatic motor to cause it to advance and retract the support, and spring means operatively connected with said support to urge it toward retracted position to assist the motor in effecting the quick retracting movement.

14. For use in connection with a printing press or the like, apparatus for handling thin sheets, comprising a sheet delivery conveyor, air jet means disposed above said conveyor for maintaining a sheet in frictional contact with said conveyor, means for assisting the deposit of a sheet from said conveyor onto said table, said means comprising a movable support adapted to receive a sheet from said conveyor and to support said sheet in a horizontal position while said sheet moves to a position over said table, and means operable in timed relation to the movements of said press for advancing said support to a position over said table and means for suddenly snatching said support from beneath a sheet, whereby said sheet due to its inertia remains substantially in its position longitudinally of the apparatus and is permitted to settle onto a pile supported on said table; said advancing means comprising a reciprocating, pneumatic piston and cylinder motor, means operatively connecting said piston with said support, and a double acting, pneumatic, piston and cylinder pump actuated in timed relation to the movements of said press for intermittently and alternately applying super-atmospheric pressure and suction to said pneumatic motor to cause it to advance and retract the support.

15. For use in connection with a printing press or the like, apparatus for handling thin sheets, comprising a reversing sheet delivery conveyor, a delivery table adjacent the delivery end of said conveyor, means for assisting the deposit of a sheet from said conveyor onto said table, said means comprising a movable support adapted to receive a sheet from said conveyor and to support said sheet in a horizontal position while said sheet moves to a position over said table, and means operable in timed relation to the movements of said press for advancing said support to a position over said table and for suddenly retracting said support, whereby said sheet is permitted to settle onto a pile supported on said table, said last named means comprising a toothed rack geared to said sheet delivery conveyor, a lever pivoted adjacent said rack, means connecting said lever and said support, spring means for quickly retracting said lever and said support, and a one-way releasable connection between said rack and said lever whereby the lever may be rocked during movement of said rack in one direction up to the point of release of said one-way connection, whereupon said connection will be suddenly broken and said spring will act to suddenly retract said support.

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