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C. W. HARROLD ET AL

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SHEET DELIVERY MECHANISM

Filed June 15, 1938

4 Sheets-Sheet 1

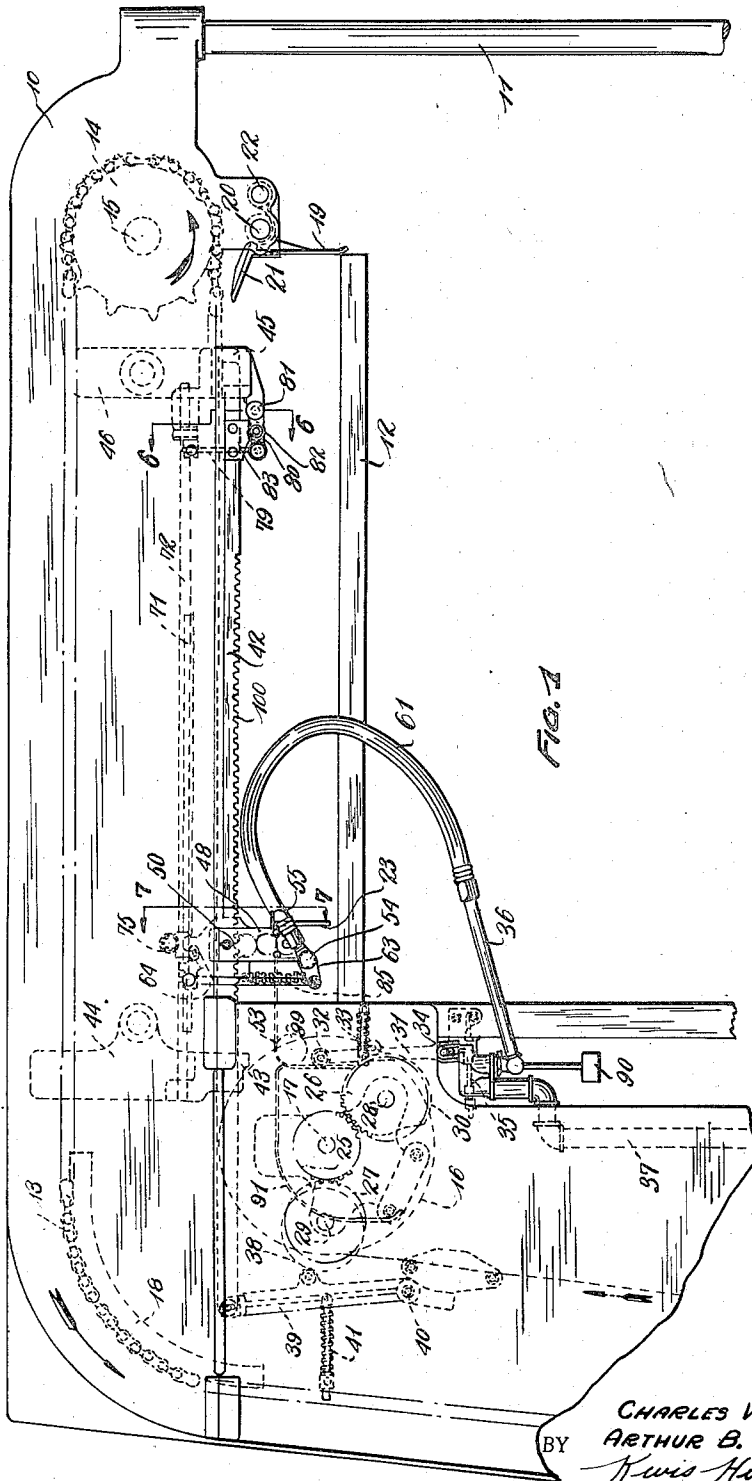


FIG. 1

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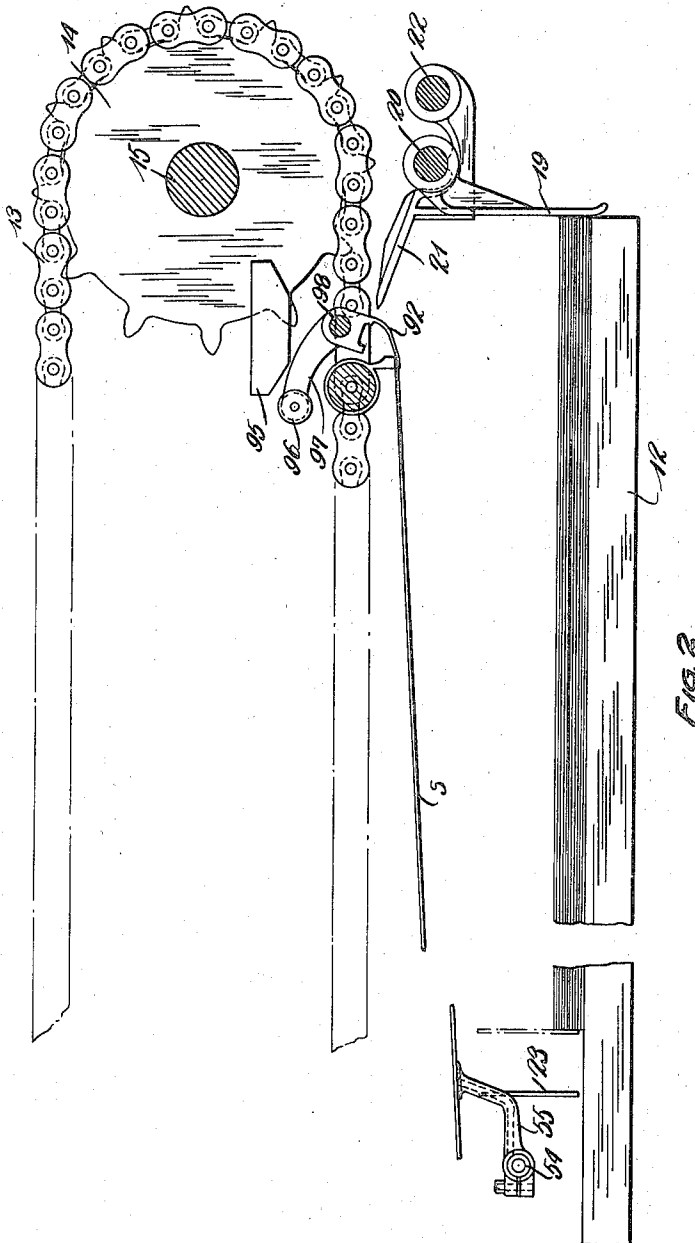
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4 Sheets-Sheet 2



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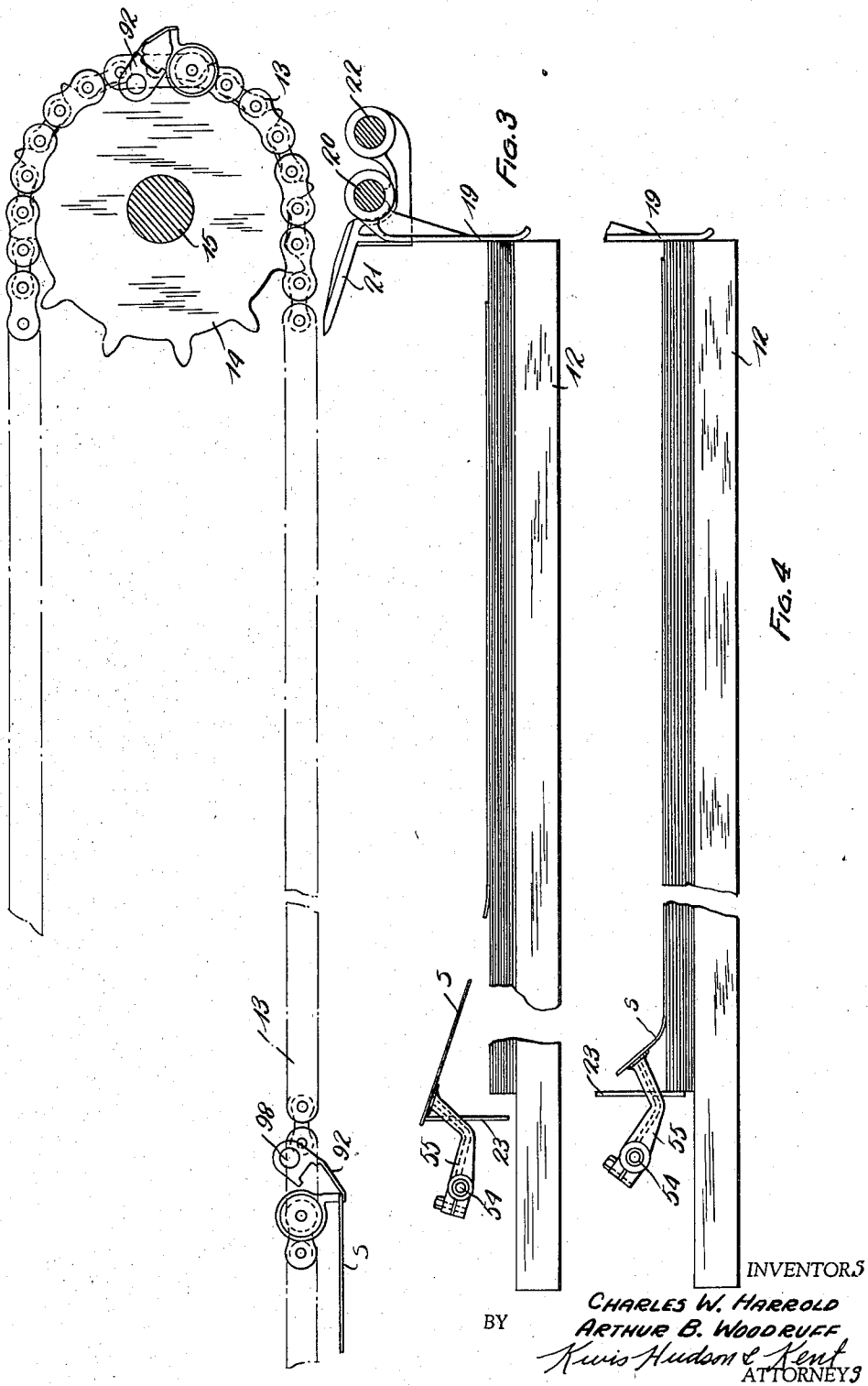
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4 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

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SHEET DELIVERY MECHANISM

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Application June 15, 1938, Serial No. 213,860

12 Claims. (Cl. 271—79)

This invention relates to improvements in sheet delivery mechanism, and has reference particularly to means for slowing down the rate of travel of the sheets after they reach the pile on the delivery board and before they strike the stops at the forward end of the delivery board in order to effect a smooth easy descent of the sheet onto the pile and elimination of damage and trouble such as result in the conventional delivery mechanism from the rebounding of stiff sheets and the crumpling of thin sheets when they strike the forward stops of the delivery board.

In printing machines it is common practice to provide a conveyor which takes the printed sheets from the press and transfers them to the top of a pile at some distance from the printing point. This conveyor usually consists of endless chains at either side of the machine, which chains support a series of gripper bars at appropriate intervals, which bars carry the sheets. In modern high-speed presses the delivery conveyor must necessarily be operated at high speed. As speeds increase the difficulty experienced in depositing a sheet upon the pile increases owing to the sudden deceleration of the sheet from full speed to a full stop on the pile. If a sheet traveling at high speed is simply released by the grippers and allowed to strike against stationary stops its forward edge may be damaged. Furthermore, the momentum of the sheet may be such as to cause it to bend or double over and occupy a position on the pile such that it cannot be later knocked into position by the joggers ordinarily provided.

One of the objects of the present invention therefore is to overcome the difficulties above mentioned.

Another object is the provision of sheet decelerating means acting upon the sheet near its tail end.

Another object is the provision of decelerating means which shall maintain control of the sheet from its tail end after the grippers at the forward end have released it.

A further object is the provision of means of this character which shall be readily adjustable to accommodate sheets of different lengths.

Another object is the provision of decelerating means engaging the lower or unprinted side of the sheet, and more particularly the provision of sucker means thus arranged so that while the sheet is engaged both by the grippers and the decelerating means there may be slippage to accommodate any difference in speed of travel between the grippers and the decelerating means.

Still another object is to provide a mechanism

which may be made to seize the sheet while traveling at the same speed as the sheet, and to thereafter decelerate it and deposit it in a desired location.

Other objects and features of novelty will appear as we proceed with the description of that embodiment of the invention which, for the purposes of the present application, we have illustrated in the accompanying drawings, in which,

Fig. 1 is an elevational fragmentary view of a sheet delivery mechanism embodying the invention.

Fig. 2 is a fragmentary elevational view showing a sheet gripped by decelerating suckers and about to be released by the grippers on the endless conveyor.

Fig. 3 is a similar view showing the sheet after it has been released by the grippers and is moving forward at a decelerating rate of speed under control of the decelerating suckers, the suckers being lowered somewhat below their original level.

Fig. 4 is a further similar view of a sheet at substantially the end of its forward travel, the suckers being then swung down to their lowest level to bring the tail end of the sheet close to the pile, and the suction being about to be broken.

Fig. 5 is a plan view on a larger scale showing the decelerating suckers and the rear pile joggers.

Fig. 6 is a vertical sectional detail view on a larger scale taken substantially on the line 6—6 of Fig. 1.

Fig. 7 is a vertical sectional view on the same scale as Fig. 6, the view being taken substantially on the line 7—7 of Fig. 1.

Fig. 8 is a cross section taken substantially on the line 8—8 of Fig. 5.

Fig. 9 is a vertical, transverse, sectional view showing adjustment means located at the opposite side of the machine from Fig. 7.

In the drawings 10 indicates a side frame member of which there are two in the machine spaced apart approximately the width of the printing press with which they are employed. These frame members may be tied together by the usual cross braces. At the end of the frame remote from the printing press columns or posts 11 take the weight of the machine and transmit it to the floor of the press room.

A delivery board or platform 12 is provided for receiving the sheets as they come from the press. This board is mounted and operated in the usual manner by mechanism including means for lowering it step by step as the pile of sheets sup-

ported by the board increases in depth, all of which being well known is omitted from the drawings.

A chain conveyor comprising two endless chains 13 runs over sprockets 14, one at each side of the machine and both keyed or otherwise fastened to a transverse shaft 15. One run of each chain also engages a sprocket wheel 16, the two sprockets 16 being carried by a shaft 17 journaled in the frame members or brackets attached thereto. The other run extends over a suitably curved track 18. The press end of the conveyor is not herein illustrated, but it is to be understood that it is connected in the usual way to the press to receive sheets from the impression cylinder thereof, and is driven at a speed synchronized with that of the press.

At the outer end of the delivery board 12 there are provided a series of sheet stops 19 supported upon a cross shaft 20 in the usual manner, and a series of stripper fingers 21 which are supported upon a cross shaft 22 and operated periodically in the usual manner to deflect downwardly the forward edge of each sheet when it has been released by the conveyor grippers.

Near the inner end of the delivery board 12 and occupying an adjustable position depending upon the length of the sheet being handled is a jogger plate or plates 23 operated in a manner to be later described, which plate or plates serve to shift the sheets slightly upon the pile to bring them into uniform position against the stops 19. The usual side joggers may be provided also, but since they do not form a part of the present invention they are not herein illustrated.

Shaft 17 which carries sprockets 16 also has keyed thereto a gear 25 which drives two other gears 26 and 27 supported on studs 28 and 29, respectively, carried by the frame members. Secured to gear 26 is a cam 30 which controls the operation of a lever 31 pivoted at 32 in the frame of the press and held against the cam by a spring 33. Lever 31 engages a pin 34 of a sliding valve 35. The valve 35 controls the making and breaking of suction in line 36, which is connected through the valve to the suction supply line 37. Sprocket 16 and gears 25 and 26 are so proportioned in relation to the speed of the conveyor that cam 30 operates the valve 35 to make and break suction in the line 36 once for each sheet carried by the conveyor over the delivery board 12.

Secured to gear 27, which is similar in size to gear 26 and therefore rotates once for each sheet carried to the delivery board, is another cam 38 which controls the movement of a lever 39 pivoted at 40 in the frame and pressed against the cam by spring 41. The lever 39 has a pivot and slot connection with the upper end of a long rectangular bar 42 which is supported in and guided by a slot 43 in a bracket 44 that is bolted to the inner side of one of the frame members 10, the bar 42 being supported and guided at its outer end by a slot 45 in a bracket 46 also secured to the frame member. The cam 38 imparts a forward and backward movement to the bar 42 each time a sheet is carried over the board 12 by the conveyor, and preferably the cam 38 is so formed as to cause the forward movement of the bar 42 to approximate, for a portion of its travel, the speed of a sheet carried by the conveyor. At the remote side of the machine there is a bar 42' corresponding in all respects with bar 42, and in order to mount and operate both bars it will be understood that

brackets 44 and 46, cam lever 39, cam 38, and gears 27 and 25 are duplicated on each side of the machine.

Near the inner end of delivery board 12 and slidably supported to move with the bars 42 and 42' are a pair of depending brackets 48 and 48' shown in detail in Figs. 7 and 9. These brackets are held in place on the bars 42 and 42' by cover plates 49 and 49', and may be held in any desired position lengthwise of the bars 42 and 42' by means of the thumb screws 50 and 50'. The lower ends of the brackets 48 and 48' are provided with extensions 51 and 51' to which are fastened the ends of a crosswise support 52 consisting, in the present embodiment of the invention, of an angle bar which serves to join the brackets 48 and 48' together rigidly, to carry jogger plates 23 and to support the forward ends of tapes 53. The jogger plates 23 are preferably made vertically adjustable on the bar 52. For this purpose they may be provided with undercut vertical guides 56 which are engaged by a T-bar 57 that is clamped to the angle bar 52 by screws 58 or the like, see Fig. 5.

The tapes 53 extend rearwardly from angle bar 52 and run over an idler 59 and downward to a weight or weights 60 by which the horizontal portion of each tape is maintained taut. To the rear of the horizontal portion of tapes 53 there is a metal guard 61, the forward portion of which is flush with the tapes. This guard 61, together with the tapes 53, serves to support and guide the rear portions of each sheet as it moves upwardly and forwardly toward the delivery board. The tapes 53 provide a sheet support varying in length to compensate for different adjustments of the delivery mechanism to suit sheets of different lengths.

The lower extremities of brackets 48 also rotatably support the ends of a hollow shaft 54. This shaft carries at intervals along its length a series of suckers 55 which are clamped to the shaft in the required position by means of a split collar and a screw 56. These suckers have at their outer ends sucker mouths 57 which are connected by passages 58 and holes 59 in the shaft 54 to the central passage of that shaft. The shaft is plugged at one end, as indicated at 59, and at the other end is joined by a fitting 60 to the flexible hose 61 which connects with the intermediate suction line 36.

Adjacent to one of the brackets 48 and clamped by a screw 62 to the hollow shaft 54 is an arm 63, the outer end of which is pivoted to a rod 64. At its upper end this rod is connected by nuts 65 to a noddle pin 66 carried in the outer end of an arm 67 which is pivotally mounted at its opposite end on a stud 68 carried by the bracket 48. The arm 67 carries a spindle 69 upon which is rotatably mounted a rounded roller 70 that bears upon the under side of a long flat plate 71 set into and secured to a shaft 72 which is rotatably supported at its ends in the brackets 44 and 46. The upper end of bracket 48 is provided with a boss 73 in which is mounted a stud 74. On the latter there is rotatably mounted a concave roller 75 which bears against the upper side of the shaft 72 to steady the latter and prevent undesirable deflection which might tend to arise because of the roller 70 bearing against the plate 71 midway between the supports for shaft 72. Rotation of shaft 72 in the anti-clockwise direction, as viewed in Figs. 6 and 7, tends to depress rod 64 against the action of a tension spring 85 that is secured at its upper end to a 75

pin mounted in bracket 48, and at its lower end to the free extremity of arm 63. At the same time hollow shaft 54 is swung through a predetermined angle anti-clockwise, as viewed in Fig. 1. When force tending to rotate shaft 72 in the anti-clockwise direction is removed, however, spring 85 raises arm 63, causing roller 70 to revolve plate 71 and shaft 72 in the clockwise direction and at the same time swinging shaft 54 clockwise in Fig. 1 to carry the suckers down toward the pile.

Near that end of shaft 72 which is mounted in bracket 46 there is an arm 76, shown in detail in Fig. 6, which carries a noddle pin 77 adjustably secured by nuts 78 to the upper end of a rod 79, the lower end of which is connected to a lever 80 pivotally mounted on a stud 81 secured in the depending portion of bracket 46. The lever 80 carries a cam roller 82 which bears against the under surface of a cam 83 secured by screws or the like 84 to the reciprocating bar 42. If desired this connection may be made variable to provide for adjustment of the cam lengthwise of the bar.

In order to facilitate the adjustment of the two brackets 48 and 48' with the mechanism carried thereby lengthwise of the bars 42 and 42', we form those bars for a portion of their length with rack teeth 100 and 100' on their lower surfaces. These teeth mesh with pinions 101 and 101' mounted within the brackets 48 and 48' respectively, which pinions mesh with other pinions 102 and 102', while the latter pinions mesh with pinions 103 and 103' which are keyed to a shaft 104 that is journaled in the extensions 51 and 51' of the brackets. At the remote side of the machine shaft 104 projects beyond bracket 48' and has keyed thereto a knurled wheel or knob 105 by means of which it may be rotated. When it is desired to adjust the brackets 48 and 48' so as to suit the machine to sheets of different lengths, the operator merely loosens the two thumb screws 50 and 50', after which he turns knob 105 to cause pinions 101 and 101' to run upon the rack teeth of the two bars 42 and 42', thereby shifting the brackets along the bars to whatever extent may be necessary. When the desired adjustment has been accomplished the screws 50 and 50' are again tightened.

Operation.—Somewhat prior to the time when a given set of grippers 92 have carried a sheet nearly to the position which it is desired to have the sheet occupy upon the board 12, the suckers 55 are brought to their raised position, shown in Fig. 8, when they are slightly higher than the cross bar 52, so that a sheet of paper indicated at S is dragged by the grippers across the surface of the sucker mouths. As the tail end of the sheet nears the sucker mouths, suction is applied by the valve 35 and the suckers grip the under surface of the sheet. This condition is illustrated in Fig. 2. The suckers then travel forward with the sheet so that the latter is gripped both by the suckers and by the grippers 92 for a short interval. Forward travel of the suckers and of the jogger plates 23 is effected by the bars 42, which are reciprocated by the cam 38 and the lever 39. The cam 83 at the forward end of one of the bars 42, as that bar moves forward, runs off the roller 82, relieving the crank arm 76 of the down pull previously exerted by rod 79 and removing the pressure exerted by plate 71 against roller 70. Spring 85 thereupon swings arm 63 upward, raising rod 64, which swings shaft 72 clockwise. At the same time hollow shaft 54

is revolved clockwise, as viewed in Figs. 2, 3 and 4, or anti-clockwise, as viewed in Fig. 8. The suckers thereupon move forward with the jogger plates for a short distance, when the grippers 92 are opened by a stationary cam 95 acting upon a roller 96 at the end of an arm 97 attached to a shaft 98 upon which the gripper fingers 92 are mounted. The control of the sheet is then transferred to the suckers 55. The forward movement of the latter is then decelerated and at the same time the sucker mouths are lowered about shaft 54 as a center, so that the tail end of the sheet is carried forwardly and downwardly onto the pile.

In Fig. 3 the suckers are midway of their forward movement and the grippers 92 have released the forward edge of the sheet which therefore drops onto the pile. In Fig. 4 the suckers have completed their forward and downward movement and are about to release their suction grip on the sheet. When released by the suckers the sheet may not be in its desired exact location, that is with its forward edge against the stops 19, but the next movement of the jogger plates 23 will jog the sheet forward into position while the next succeeding sheet is being decelerated and laid upon the pile in the position formerly occupied by the preceding one.

By the mechanism described it is possible to completely avoid contact of the forward edge of the sheet with the stops 19 and with the surface of the stripper fingers 21 when the sheet is deposited upon the pile, thus avoiding any possibility of marring this edge of the sheet. Furthermore, by gradually decelerating the sheet and laying it upon the pile by its rear edge the momentum of the sheet is overcome and its tendency to fold or roll up is avoided. In addition to this, the action of the suckers in positively lowering the tail end of the sheet is very advantageous, since it avoids any possibility of the tail end of the sheet interfering with the conveyor or with the leading edge of the next sheet. Furthermore, by mounting the suckers and jogging mechanism to move together a simplified construction is attained. Also, adjustments for various sizes of sheets are very simply and quickly made and no adjustments for timing the mechanism or suction are necessary.

Having thus described our invention, we claim:

1. In a sheet delivery mechanism for printing machines and the like, an endless conveyor, a delivery board above which the conveyor runs, sheet grippers carried by the conveyor for engagement with the forward edge of each sheet, a pile jogger at the rear edge of the delivery board, means for reciprocating said pile jogger, sheet decelerating means attached to and mounted to move with said jogger, said decelerating means being adapted to engage each sheet near the tail end thereof, said jogger operating means being driven to decelerate as the jogger approaches the forward end of its travel, means for releasing the grippers after the decelerating means engages the sheet, and means for releasing the sheet from said decelerating means substantially at the end of the forward travel of the sheet.

2. In a sheet delivery mechanism for printing machines and the like, an endless conveyor, a delivery board over which the conveyor runs, sheet grippers carried by the conveyor for engagement with the forward edge of each sheet, means for engaging the tail end of each sheet and arranged to move forward at a gradually decelerating rate, said means being adjustable toward and away from the forward end of the delivery board in

order to maintain a desired relation to the tail edge of sheets of different lengths, driving means effective in all positions of adjustment for actuating said decelerating means in a given time relation to the cycle of said machine, and means for releasing the grippers after the tail end of the sheet has been thus engaged.

3. In sheet delivery mechanism for printing machines and the like, an endless conveyor, sheet grippers carried thereby for engagement with the forward edge of each sheet, sheet decelerating means comprising a transverse shaft and suckers carried thereby for engagement with the tail end of each sheet, a longitudinally extending reciprocating bar by which said sheet decelerating means is moved forward, and means actuated by the forward travel of the bar for oscillating said shaft, whereby the suckers are caused to swing downwardly as they move forwardly.

4. In sheet delivery mechanism for printing machines and the like, an endless conveyor, sheet grippers carried thereby for engagement with the forward edge of each sheet, sheet decelerating means comprising a transverse shaft and suckers carried thereby for engagement with the tail end of each sheet, a longitudinally extending reciprocating bar by which said sheet decelerating means is moved forward, and means for adjusting said sheet decelerating means longitudinally of said bar.

5. In sheet delivery mechanism for printing machines and the like, an endless conveyor, sheet grippers carried thereby for engagement with the forward edge of each sheet, sheet decelerating means comprising a transverse shaft and suckers carried thereby for engagement with the tail end of each sheet, a longitudinally extending reciprocating bar by which said sheet decelerating means is moved forward, means for adjusting said sheet decelerating means longitudinally of said bar, and means actuated by the forward travel of the bar for oscillating said shaft, whereby the suckers are caused to swing downwardly as they move forwardly.

6. In sheet delivery mechanism for printing machines and the like, an endless conveyor, sheet grippers carried thereby for engagement with the forward edge of each sheet, sheet decelerating means comprising a transverse shaft and suckers carried thereby for engagement with the tail end of each sheet, a longitudinally extending reciprocating bar by which said sheet decelerating means is moved forward, a rock shaft arranged parallel with said bar, means actuated by the forward travel of the bar for oscillating said rock shaft, and means actuated by said rock shaft for turning said transverse shaft through a predetermined angle to swing said suckers downwardly as they move forwardly.

7. In sheet delivery mechanism for printing machines and the like, an endless conveyor, sheet grippers carried thereby for engagement with the forward edge of each sheet, two longitudinally extending bars on opposite sides of the machine, means for reciprocating said bars together, a cross frame carried by said bars, sheet decelerating means carried in said cross frame, sheet gripping means carried by said cross frame for engagement with the tail end of each sheet, and means for simultaneously adjusting both ends of said cross frame on said bars to compensate for sheets of different lengths.

8. In sheet delivery mechanism for printing machines and the like, an endless conveyor, sheet grippers carried thereby for engagement with the

forward edge of each sheet, two longitudinally extending bars on opposite sides of the machine, slide bearings for the ends of said bars, means for reciprocating said bars together, a cross frame carried by said bars, sheet decelerating means comprising sheet gripping means carried by said cross frame for engagement with the tail end of each sheet, said bars having rack teeth along a middle portion of the length thereof, pinions carried by the cross frame for engagement with said racks, and means for rotating said pinions simultaneously for adjusting both ends of said cross frame on said bars to compensate for sheets of different lengths.

9. In sheet delivery mechanism for printing machines and the like, an endless conveyor, sheet grippers carried thereby for engagement with the forward edge of each sheet, a longitudinally reciprocating bar, a transverse shaft, suckers carried thereby for engagement with the tail end of each sheet, said shaft being mechanically connected with said bar for movement therewith, the forward movement of said bar during reciprocation being at a gradually decelerating rate after the suckers have gripped a sheet, and means for adjusting the said shaft lengthwise of the bar to accommodate sheets of different lengths.

10. In sheet delivery mechanism for printing machines and the like, an endless conveyor, sheet grippers carried thereby for engagement with the forward edge of each sheet, a longitudinally reciprocating bar, a transverse shaft, suckers carried thereby for engagement with the tail end of each sheet, a pile jogger for engagement with the rear end of the pile, said shaft and said pile jogger being mechanically connected with said bar for reciprocation therewith, the movement of said bar on its forward stroke being at a gradually decelerating rate after the suckers have gripped a sheet, and means for adjusting the said shaft and jogger simultaneously lengthwise of the bar to accommodate sheets of different lengths.

11. In sheet delivery mechanism for a printing or like machine, the combination with a sheet conveyor having grippers engaging the front end of a sheet, a delivery board for receiving sheets from the conveyor, and means operating in a given relation to the cycle of the machine to release a sheet from the grippers to the delivery board, of a guide for the rear end of the sheets, sheet decelerating means arranged to move in the direction of sheet travel, grasp the rear end of a sheet while still held by the front end grippers, decelerate the sheet after the same is released by the front end grippers, and release the sheet while substantially stationary, said sheet guide and sheet decelerating means being adjustable lengthwise of the conveyor to permit cooperation thereof with the rear ends of sheets of different lengths, and means arranged to operate said sheet decelerating means in all positions of adjustment thereof in a given relation to the cycle of the machine.

12. In sheet delivery mechanism for a printing or other machine, the combination with a sheet conveyor having grippers engaging the front end of successive sheets, a delivery board for receiving sheets from the conveyor, and means operating in a given relation to the cycle of the machine to release successive sheets from the grippers to the delivery board to form a stack thereon, of a pile jogger for the rear end of the sheets, sheet decelerating means arranged to move in the direction of sheet travel, grasp the rear end of a sheet while still held by the front end grippers, de-

5 celerate the sheet after the same is released by the front end grippers, and release the sheet while substantially stationary, said pile jogger and sheet decelerating means being adjustable lengthwise of the conveyor to permit cooperation thereof with the rear ends of sheets of different lengths,

and means arranged to operate said pile jogger and said sheet decelerating means in all positions of adjustment thereof in a given relation to the cycle of the machine.

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