

Sept. 11, 1962

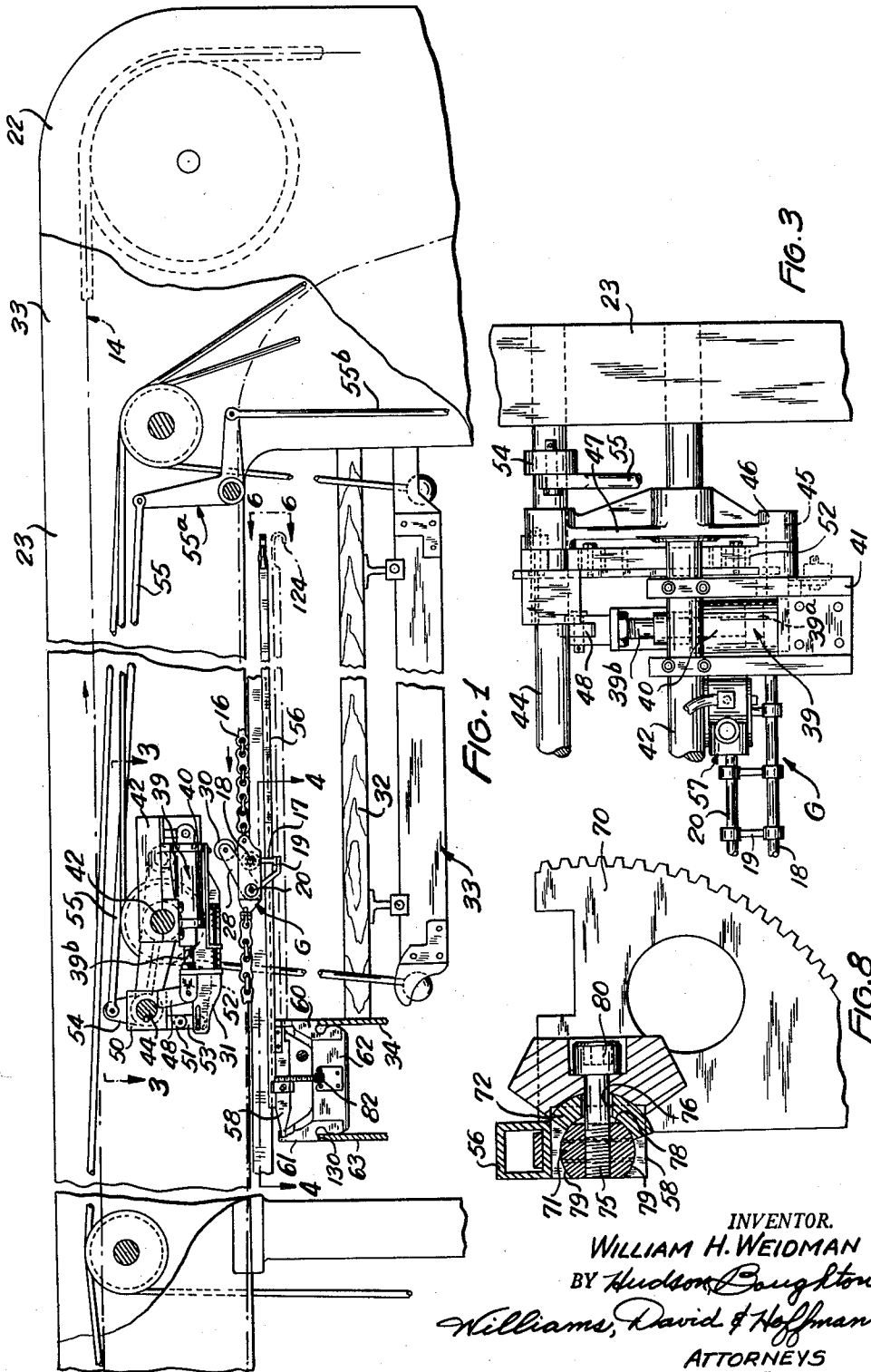
W. H. WEIDMAN

3,053,532

DELIVERY FOR PRINTING PRESS

Filed Nov. 9, 1959

3 Sheets-Sheet 1



Sept. 11, 1962

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3,053,532

DELIVERY FOR PRINTING PRESS

Filed Nov. 9, 1959

3 Sheets-Sheet 2

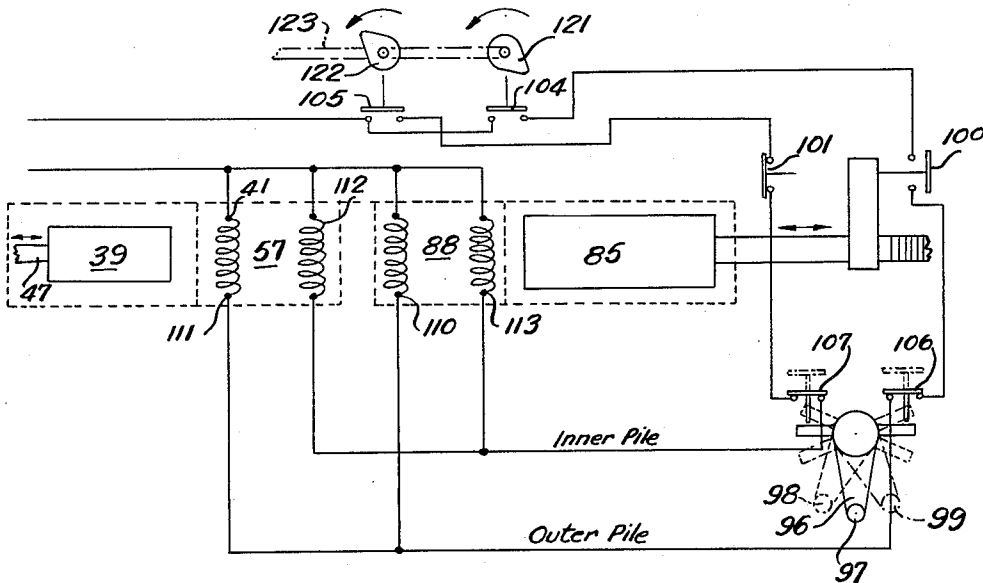


FIG. 9

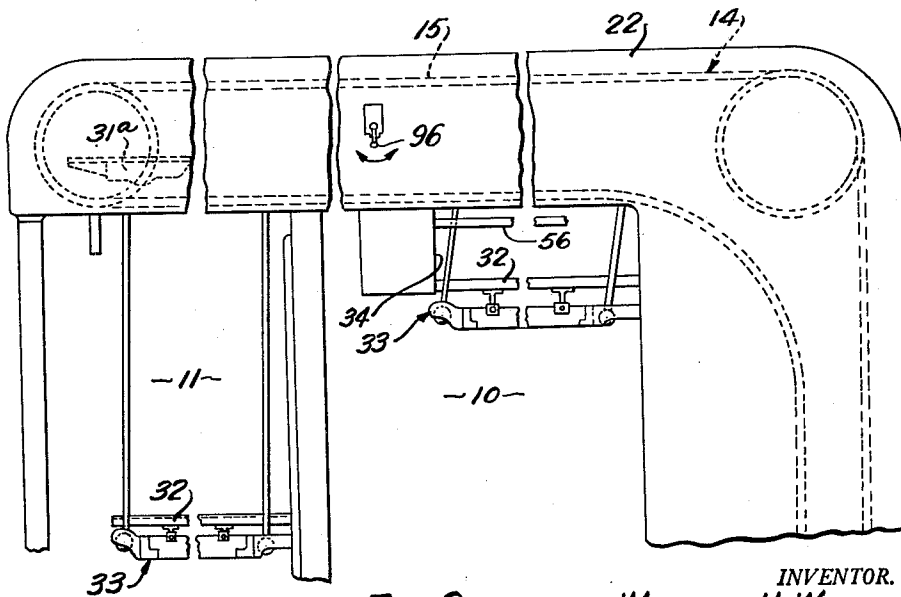


FIG. 2

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3 Sheets-Sheet 3

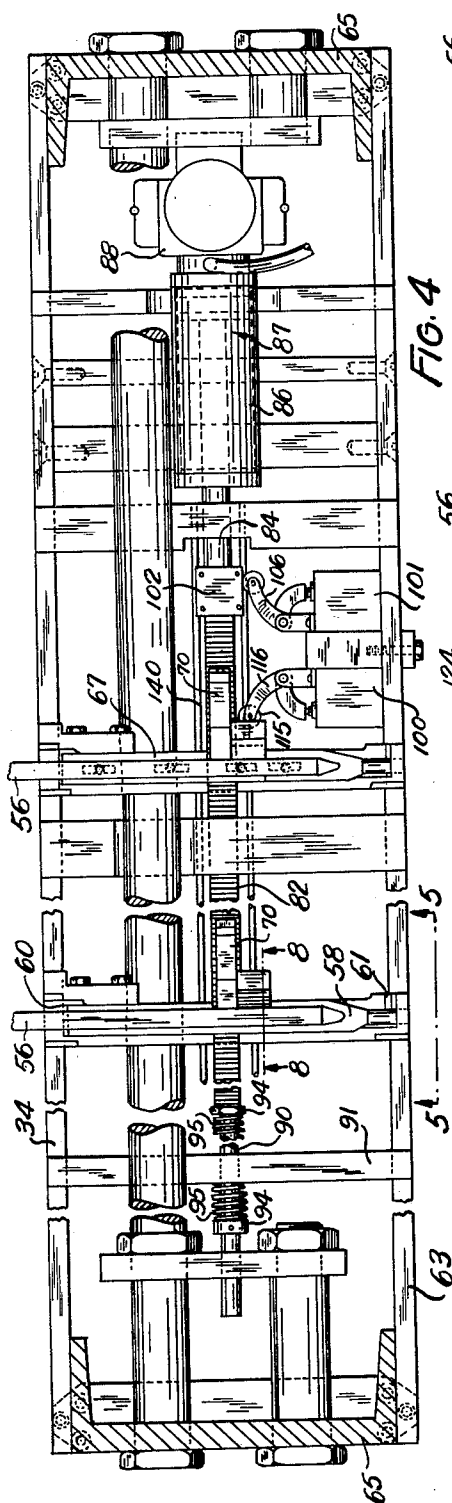


FIG. 4

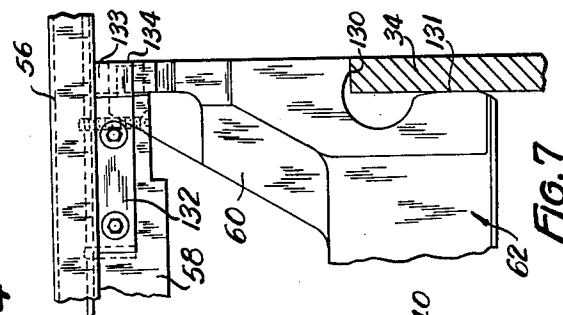


FIG. 7

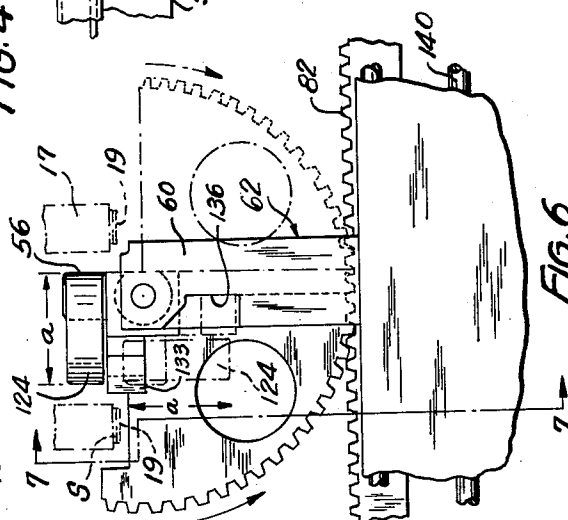


FIG. 6

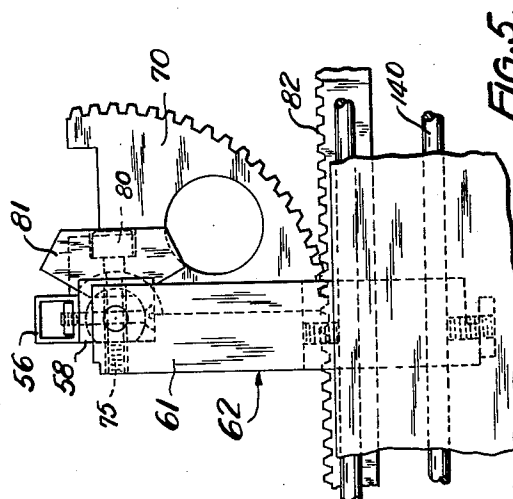


FIG. 5

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3,053,532

DELIVERY FOR PRINTING PRESS

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19 Claims. (Cl. 271-64)

The present invention relates to a delivery for a printing press and, more particularly, to a delivery of the dual type.

In a dual delivery, sheets being delivered from a printing press may be selectively deposited on either one of two piles, or may be deposited alternately on the individual ones of the piles. Such a dual delivery is disclosed and described in Niles et al. Patent No. 2,673,735 and the present invention may be said to be an improvement on the delivery of this patent. As disclosed in the aforesaid patent, the sheets being delivered to each pile position are deposited on a skid which is lowered as the sheets are deposited to prevent the sheets from piling up into the delivery mechanism which is disposed above the skid. As described in the aforesaid patent, the sheets being delivered are carried by a conventional sheet conveyor, including sheet gripping means for grasping the leading edge of the sheets and carrying them over the pile positions to which the sheet can be delivered, the sheet gripping means moving over a first or inner pile position and then over a second or outer pile position. If the sheet grasped by the gripping means is to be delivered to the inner pile position, the gripping means is actuated to drop the sheet when it is over the inner pile position and if the sheet is to be delivered to the outer pile position, the gripping means is not actuated as it passes the inner pile position but is actuated as it arrives over the outer pile position to drop the sheet at the latter. As a matter of practice, the gripping means is actuated each time at the outer pile position regardless of whether or not a sheet is present. If a sheet is carried by the gripping means, it is dropped and if no sheet is gripped, the releasing operation has no effect.

As described in the aforesaid patent, a plurality of pile guide or sheet control fingers are mounted between the inner and outer pile positions and have free ends which are positioned above the inner pile position and which extend over the inner pile in a direction opposite but parallel to the direction of sheet movement. The fingers are movable between two positions, one above the path of sheet movement over the inner pile and one below the sheet path. When the sheet approaching the inner pile position is to be dropped at the inner pile position, the sheet control fingers are positioned above the path of sheet travel to function as a sheet stripping means; and when the sheet is to be carried past the inner pile position to the outer pile position, the fingers are positioned below the path of sheet travel and function as a support for the sheet as it is carried over the pile position. The fingers are located and maintained stationary in these positions when all sheets are being delivered to one pile only, and are reciprocated between the two locations when sheets are alternately delivered one to each pile to alternately act as stripping and supporting means.

The sheets are delivered to the pile positions by one of a plurality of conventional gripper or delivery assemblies each of which comprises a bar having a plurality of horizontally spaced gripper posts extending outwardly therefrom and against which a like plurality of cooperating fingers clamp the leading edge of the sheet being delivered. The bar is supported at each of its opposite ends by a chain adjacent the respective end, the chains being movable through endless paths to move the bar through a generally horizontal delivery run disposed over the pile

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positions and a return run disposed over the delivery run to effect movement of the bar to pick up a sheet, move it over the pile positions, and return it to pick up another sheet. The gripper fingers are supported on a second bar of each assembly and are mounted adjacent to the first-mentioned bar, the second bar being rockable to effect a releasing action of the gripper fingers. When the sheets are carried over the inner pile and below the aforementioned sheet control fingers, the fingers must pass between the aforementioned bars for supporting the grippers and the gripper fingers on the one hand and the sheets on the other hand. Additionally the fingers must be spaced laterally from each other so as to pass between the horizontally spaced sets of gripper fingers and posts. Clearance is therefore a problem.

While the sheet control fingers shown and described in the aforesaid patent have proved satisfactory in many respects, the fingers do tend to vibrate in an objectionable manner when the fingers are oscillated between their positions during delivery of alternate sheets to different piles. It will be realized that when the delivery is delivering sheets alternately to the two pile positions, the fingers are moved up and down at a rapid rate and this movement causes the free ends of the fingers to vibrate vertically and the vibratory movement of the free ends tends to build up in amplitude so that the vibrating ends will tend to engage and sometimes pierce the sheets being delivered. This problem is more pronounced when the fingers are vibrating while in their lower position since in this position a sheet travelling toward the outer pile tends to wrap itself around the free end of the finger as the sheet is drawn over the fingers by the gripper assemblies. Because of the clearances involved the vibration problem cannot be overcome by merely increasing the cross-section of the fingers and so the fingers have heretofore been kept shorter than their ideal length in an effort to minimize vibration. In the upper position the vibration of the fingers is also a problem because of their vibration carrying them into a jamming relationship with the bars of the gripper assemblies.

An important object of the present invention is to provide, in a delivery, which includes sheet control fingers that are selectively positionable above and below a sheet path when the sheet is to be selectively delivered to a certain position, a new and improved arrangement which minimizes the tendency of the fingers to vibrate or build up oscillations.

It is a further object of the present invention to provide a new and improved delivery having pile delivery sheet control fingers of the type described which are constructed so that the tendency of the fingers to pierce the sheet being delivered by the delivery is minimized.

Yet another object of the present invention is the provision of a new and improved delivery having simplified means for actuating and controlling the movement of a plurality of fingers extending parallel but opposite to the direction of sheet travel above a delivery pile from a position above the sheet path to a position below the sheet path, and for operating the fingers between the positions when the sheets are to be alternately deposited and carried past the delivery pile.

A still further object of the present invention is to provide a new and improved delivery of the type in which fingers extending parallel to the path of sheet travel over a pile position are reciprocated between a position above the path of sheet travel and below the path of sheet travel when the sheets are to be alternately deposited and carried past the pile position, and in which the mechanism for operating the fingers and for selectively releasing the sheet of the pile position is simple in construction and of a construction which will assure that the delivery will

cycle out on changes in the mode of operation of the delivery.

Another object of the invention is to provide in an alternating type of dual delivery, a method and means for operating sheet control fingers which enables the use of fingers of greater length than heretofore practical, where-
by a greater area of support may be provided by the fingers when the fingers are acting as a support.

A further object of the invention is to provide means for raising and lowering alternating sheet control fingers in a manner which enables the tips of the fingers to be provided with ramps of a dimension greater than the clearance between the gripper assemblies and sheets when the fingers are in their upper position.

In accordance with the present invention, the sheet control fingers of the delivery are supported for rocking movement about an axis parallel to the direction of the sheet movement to move the fingers to positions above and below the sheet path. In the preferred embodiment the fingers are rocked between their positions by the reciprocation of a rack engaging a gear on each finger, the rack preferably being reciprocated by an air actuator.

When the sheet control fingers are in their raised position, the fingers must be received between spaced gripper elements of the delivery which grasp the leading edge of the sheet being delivered and which are carried by bar means that passes over the fingers as the sheet is moved past the latter. The distance between adjacent gripper elements is greater than the distance between the bar means and the sheet path and the sides of the fingers that extend between adjacent gripper elements when the fingers are raised have a dimension which is greater than the distance from the bar means to the sheet gripped by the gripper elements thereon but less than the distance between the adjacent gripper elements which receive the fingers while the vertical dimension of the fingers in the raised position is less than the distance between the bar means and the sheet.

The actuator for reciprocating the fingers between their raised and lowered positions is also controlled, in the preferred embodiment, by first and second circuits which when energized effect operation of the actuators to move the fingers to a respective one of their positions if not already so positioned. The first circuit affects the raising of the fingers and includes a first switch which is momentarily closed as a sheet approaches the pile positions and a second switch which is closed if the fingers are not in their raised position and opened if the fingers are raised. The second switch therefore renders the circuit effective to raise the fingers if the fingers are not already so positioned. The second circuit is the same as the first circuit but effects operation of the fingers to their lower position if not already so positioned and includes first and second switch means which corresponds to the first and second switch means of the first circuit. In addition, each of the first and second circuits has a third switch means which is selectively operable to an open position to render the particular circuit ineffective to actuate the fingers regardless of their position. The third switch means of the first circuit is opened to render the first circuit ineffective to raise the fingers if the fingers are to be maintained in their lower position and the third switch means of the second circuit is opened to render the second circuit ineffective to lower the fingers if the fingers are to be maintained in their raised position. Further in accordance with the present invention, the first and second circuits are utilized to control a second actuator for raising and lowering a sheet release cam, the cam being raised to an inactive position when the fingers are in their lower position and moved to an active position when the fingers are in their raised position.

Further objects and advantages of the present invention will be apparent from the following detailed description of the preferred embodiment thereof made with refer-

ence to the accompanying drawings forming a part of the present specification in which

FIG. 1 is a side elevational view of a delivery embodying the present invention with parts thereof cut away;

FIG. 2 is a fragmentary front view of the delivery shown in FIG. 1 on a smaller scale without the parts cut away;

FIG. 3 is a view taken approximately along line 3—3 of FIG. 1;

FIG. 4 is a view taken approximately along line 4—4 of FIG. 1;

FIG. 5 is a view looking from approximately along line 5—5 of FIG. 4;

FIG. 6 is a fragmentary view looking approximately from along line 6—6 of FIG. 1;

FIG. 7 is a sectional view taken approximately along line 7—7 of FIG. 6;

FIG. 8 is a sectional view taken approximately along line 8—8 of FIG. 4; and

FIG. 9 is a diagrammatic circuit diagram of the control circuit for the illustrated mechanism.

The present invention is shown as embodied in a delivery of the type shown and described in the aforementioned United States Patent No. 2,673,735. The delivery is adapted to take a succession of sheets from a printing press and to deliver them to either one of two inner and outer pile positions 10, 11 or alternately to one pile position and then the other. The printing press is not shown and the complete delivery is not shown in detail since it is not believed to be necessary for an understanding of the present invention. Suffice it to say that the delivery comprises a sheet conveyor 14 of the endless-chain type which passes around the delivery drum of a printing press to take a sheet from the printing press and to deliver it to one or the other of the piles 10, 11. The endless chain conveyor 14 is of a conventional type and is similar to that shown in the aforesaid patent. The chain conveyor 14 comprises endless chains 15, 16 which pass around sprockets on the opposite ends of the delivery drum of the press and which support gripper means or assemblies G for gripping the leading edge of a sheet and conveying the sheet to one of the piles 10, 11. The gripper means is of a conventional type and comprises a plurality of laterally spaced gripper posts 17 supported to extend outwardly from a bar 18 having its opposite ends connected to corresponding runs of the chains 15, 16 and moved thereby through an endless delivery and return path. Each of the gripper posts 17 has a cooperating finger 19 associated therewith and supported by a shaft 20 extending between the chains 15, 16 adjacent to the lead side of the bar 18. The shaft 20 is rockable about its length to move the fingers 19 toward and from engagement with the contact surfaces of the gripper posts 17 to grip and release the leading edge of a sheet to be conveyed by the sheet conveyor. It will be understood that a number of gripper means G are conventionally provided, the gripper means being spaced from each other along the chains 15, 16 so that one is always in position to receive the sheet exiting from the press.

The endless conveyor 14 is supported by the frame of the delivery including front and rear frame members 22, 23 for movement along an endless path which will carry the gripper assemblies over the pile positions 10 and 11. Each of the chains 15, 16 in moving from and returning to the delivery of the press defines an endless path in a vertical plane and the gripper means G moves along the lower run of the endless path when carrying a sheet over the pile positions 10, 11. The mechanism for supporting and guiding the endless conveyor 14 has not been shown or described in detail since it is conventional and per se does not form a part of the present invention.

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The gripper means G has associated therewith an arm 28 which is fixed to the shaft 20 so as to be capable of effecting rocking of the latter. The arm 28 extends upwardly from the shaft 20 when the assembly is traversing the lower run of the conveyor path and has a roller 30 fixed to the outer end thereof which is adapted to engage a cam disposed above the path of the roller to effect a releasing of the gripper fingers 19. In the illustrated embodiment, a cam 31 is disposed above the path of the roller 30 as the gripper assembly passes the left-hand side of inner pile position 10 as the latter is viewed in FIGS. 1 and 2 and a similar cam 31^a (FIG. 2) is disposed in an adjustable position above the left hand side of the outer pile 11. When the roller 30 engages the cam 31 or cam 31^a, the shaft 20 will be rocked to release a sheet, if one is gripped by the gripper means, to allow the latter to drop onto a skid 32 at the pile position which is supported in position to receive the sheet by a corresponding delivery elevator 33. The skids 32 are elevated adjacent the lower run of the sheet conveyor 14 to minimize the drop of the sheet, and the left-hand edge of the skid in pile position 10, as it is viewed in FIG. 1, i.e., the edge of the skid remote from the edge first approached by the gripper assembly, is positioned adjacent a vertical plate 34 which acts as a stop and guide for the front edge of the sheet being deposited at the inner pile position 10. The sheet when released will float against the plate 34 and will fall onto the skid 32 and be jogged into proper position by conventional joggers (not shown). The plate 34 extends transversely of the sheet path, as is evident from FIG. 4. The skid 32 at pile position 11 is engageable with a similar functioning stop and guide plate. As sheets are deposited upon the skids 32, the elevators 33 are lowered to prevent the pile from building up into the chain assembly. The structure for lowering the elevators 33 is fully described in the aforementioned patent and only those parts thereof which differ from the parts disclosed in the aforementioned patent will be described.

The cam 31^a is, during operation, maintained in a fixed active position to effect an opening of the gripper means G each time it passes the cam. The cam 31, however, can be raised or lowered to selectively effect a dropping of a sheet at the inner pile position 10. In the illustrated embodiment, the cam is raised and lowered to inactive and active positions by the operation of an air actuator 39 comprising a cylinder element 40 pivoted to a bracket 41 supported from a bar 42. The bar 42 is disposed over the inner pile position 10 and extends across the sheet conveyor 14 between the upper and lower runs and is supported by the front and rear frames 22, 23. A rockshaft 44 extends between frames 22, 23 parallel to the bar 42 to the left of the latter as it is viewed in FIG. 1, i.e., in the direction of movement of the sheet along the lower run of the conveyor path. The bracket 41 is clamped to the bar 42 at one end and extends therefrom in the direction opposite to sheet travel and has the other end thereof supported by a pivot pin 45 which extends from the bracket 41 horizontally to be received in a boss 46 at one end of a bracket 47 supported on the bars 42, 44 (FIG. 3).

A piston element 39^a cooperates with the cylinder element 40 of cam actuator 39 and a piston rod 39^b is connected to the piston and extends outwardly from the cylinder. The rod 39^b is connected at its outer end to an arm 48 of a rocker member 50 fixed to the shaft 44 for rotation therewith. The rocker member 50 has a second depending arm 51 to which one end of a cam support member 52 is pivotally connected by a link 53, the cam support member having its other end pivoted on the pin 45 for rocking movement thereabout. Together, arm 51 and link 53 form a toggle mechanism for locking the cam when in its down position. When the piston rod 39^b is moved outwardly of the cylinder 40 the rocker member 50 and shaft 44 are rocked clockwise as viewed

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in FIG. 1 to lift the cam 31 out of the path of the roller 30, and when the piston is moved inwardly into the cylinder 40, the rocker member 50 is moved to the position shown in FIG. 1 where the cam 31 is in a position to operate the roller 30 and arm 28 to rock shaft 20 and effect a releasing of a sheet S gripped by the fingers 19. When the rockshaft 44 is in the position shown in FIG. 1, the delivery drops each sheet on the skid 32 at pile position 10, a sheet being delivered each cycle of the machine and the skid 32 is preferably lowered once for each sheet. To effect a lowering of the skid 32 at position 10 for each machine cycle, the rockshaft 44 also has an arm 54 fixed thereto and pivotally connected to a rod 55 which is in turn pivotally connected to a bell crank lever 55^a supported by the frame of the delivery and having an arm connected to operate a rod 55^b. The link 55, the bell crank lever 55^a and the rod 55^b correspond to the elements 159, 150 and 162, of the aforementioned patent which effect a lowering of the elevator 33 at pile position 10 once for each cycle when the cam for effecting a release of sheets at the inner pile position is in its active position and operate mechanism substantially the same as in the aforesaid patent for lowering elevator 33. If, however, the shaft 44 is rocked to raise the cam 31 so that the sheet is carried by the inner pile position 10 to the outer pile position 11, the elevator control mechanism is operated through the elements 55, 55^a, 55^b to lower the corresponding elevator 33 at the outer pile position 11. If the actuator 39 is operated once during each machine cycle so that alternate sheets are delivered to different pile positions, the elements 55, 55^a, 55^b will be reciprocated to alternately effect an incremental lowering of the proper elevator, all as described in the aforesaid patent.

The operation of the actuator 39 is controlled by a two position solenoid valve 57 which is actuatable to a first position by the energization of a coil 111 to connect the actuator 39 to a supply of air and exhaust to supply air to the right-hand side of the piston thereof, as viewed in FIG. 1 to raise the cam 31, and to a second position by the energization of a coil 113 to supply air to the left-hand side of the piston and effect the lowering of the cam. Preferably, the valve is of the type which utilizes a pilot valve that is actuated by the coils 111, 113 so that only a momentary energization of the coils is required to position the valve.

It is desirable in deliveries of the type shown to provide a plurality of sheet control fingers 56 which extend over the pile position 10 parallel to the direction of sheet movement and which are supported between the pile positions 10 and 11 so that the unsupported ends only of the fingers 56 extend over the skid 32 and the elevator 33 of the inner pile position. The fingers 56 are movable between a position above the sheet path, as is shown in FIG. 1 in solid lines, where they are disposed between the path of bar 18 and the sheet path, and also between the paths of the gripper posts 17, as is shown in FIG. 6, and a position below the sheet path, as shown in FIG. 1 in dot-dash lines. When a sheet is to be dropped at the inner pile position 10, the fingers 56 are positioned above the sheet line to act as stripper fingers, and when the sheets are to be carried past the pile position 10, the fingers 56 are disposed below the sheet line to act as supporting fingers.

In accordance with one feature of the present invention, the sheet control fingers 56 are supported for movement between their described positions about an axis which is parallel to the direction of sheet movement. As is shown in FIGS. 1 and 4, the fingers 56 are fixed to a flat side 67 of a support or rocker member 58 extending parallel to the direction of movement and having opposite ends pivotally supported in upstanding arms 60, 61 of respective brackets 62. The brackets 62 each rest on the plate 34 at one of their ends and on a plate 63 at their other ends, the plate 63 extending parallel to the plate

34 at a distance from the plate 34 in the direction of sheet movement. The plates 34, 63 are fastened at their opposite ends to end plate 65 which are supported from the frame members 22, 23.

The ends of the sheet control fingers 56 are clamped to the flat sides 67 of the corresponding rocker members 58 and each rocker member is rockable about a horizontal axis to swing the flat side 67 thereof from a position where it constitutes the upwardly facing surface of the rocker member to a position where it is the side surface to rock the corresponding finger from a position above to a position below the sheet path.

To effect a rocking of each of the fingers 56, a gear segment 70 is clamped to a recessed portion 71 (FIG 8) of the corresponding support member 58 for the finger. Each gear segment is provided with an axially extending hub portion 72 which is received by the recessed portion 71 of the corresponding support member, the hub members each being clamped to the respective support member thereon by a bolt 75 which passes through an opening 76 in the hub 72 and threads into the corresponding recessed portion 71. Each of the recessed portions has a flat side 78 facing the center of the hub and curved or arcuate side portions 79 engaged by the hub and along which the hub may be adjusted to adjust the angularity of the gear segment 70 with respect to the sheet control fingers 56. The bolt 75 has a head 80 and an oversized clamp member or washer 81 is disposed between the head 80 and the hub and the bolt passes therethrough. The clamp member is counterbored to receive the head and the head acts through the washer to clamp the hub and gear to the corresponding support member 58. If the bolt 75 is loosened, the enlarged opening 76 will permit angular adjustment of the hub 72.

A rack 82 extends transversely of the sheet movement below the fingers 56 and the support members 58 and is adapted to mesh with each of the gear segments 70. Reciprocation of the rack will effect a reciprocation of the gear segments 70 to move the fingers 56 about 90° between their positions above and below the sheet path. The right-hand end of the rack, as the latter is viewed in FIG. 4, is connected to a piston rod 84 of a double-acting piston cylinder actuator 85 having a cylinder element 86 supported by cross brackets mounted between the plates 34, 63. When the piston rod moves outwardly of the cylinder element, the sheet control fingers 56 move to their lower positions and when it moves inwardly the fingers move to their upper positions. The right-hand end of the cylinder actuator includes a two position solenoid control valve 88, similar to valve 57 and which can be selectively energized to supply fluid pressure, such as air, to one side or the other of the piston element of the actuator and to connect the other side to draw an exhaust. The valve 88 is of a conventional type and includes coils 110, 112 respectively energizable to effect operation of the valve to connect the actuator 85 to a source of air and exhaust to respectively effect the extension and retraction of the actuator 85 to operate the rack 82 to one of its limit positions.

The end of the rack 82, remote from the air cylinder 85, carries a rod 90 which forms an extension of the rack and which passes through a frame member 91 supported between the plates 34, 63. On each side of the frame member 91, a collar 94 is mounted on the rod 90 and a pair of cushioning springs 95 are disposed on the rod 90 immediately adjacent the side of each collar 94 facing the frame member 91. One of springs 95 engages the frame member 91 as the actuator 85 reaches the end of each of its strokes to cushion the stopping of the rack, one of the springs engaging the frame member 91 when the rack is moved in one direction and the other engaging the frame member when the rack is moved in the opposite direction.

The reciprocation of the rack 82 and the raising and lowering of the cam 31 is controllable by the operation

of a control lever 96 (FIGS. 2 and 9) having three positions, a center position 97, an outer pile position 98 and an inner pile position 99. When the control lever 96 is in the center position, the actuator 85 and the actuator 39 are operated once during each cycle of the delivery so that successive sheets are delivered to alternate pile positions. When the lever is moved to its outer pile position 98, the delivery is to the outer pile position 11 only and when moved to its inner pile position 99, the delivery is to its inner pile position 10 only.

The supply of air to reciprocate the actuators 39, 85 is under the control of normally closed limit switches 100, 101, cam operated switches 104, 105, and the switches 106, 107 operated by the lever 96 (see FIG. 9). The switches 100, 101 are disposed adjacent the rack 82 and are operated by a block 103 on the rack when the latter is reciprocated. The switches 104, 105 are operated by cams 121, 122, rotated in timed relation to the movement of sheets as described in more detail hereinafter. When the switches 100, 104, 106 are closed they complete a circuit to effect energization of coils 111, 110 of the solenoid valves 57, 88 respectively to operate the actuators 39, 85 to move cam 31 to its inactive, raised position and to lower the fingers 56. When the switches 105, 101, 107 are closed they complete a circuit for energizing coils 113, 112 of the solenoid valves 57, 88 respectively to effect operation of the actuators 39, 85 to lower the cam 31 to its operative position and raise the fingers 56. Since the valves are two position valves, the air pressure remains on the actuators after they are operated.

The limit switches 100, 101 are operated by the block 102 on the rack 82 and when the actuators 39, 85 are operated to their outer pile positions, i.e., when the rack 82 moves to its left-hand position, shown in FIG. 4, the block 102 actuates switch 100 and holds it open to break the circuit for energizing coils 111, 110 as long as the actuators are positioned to effect delivery to the outer pile. When the rack 82 is operated to its position for effecting the delivery to the inner pile, i.e., its right-hand position in FIG. 4, the switch 101 is actuated by the block 102 to open the circuit for energizing coils 112, 113 and hold it open as long as the rack is in its right-hand position. The one of the limit switches 100, 101 which is held open by the block 102 when the rack is in a limit position is closed when the rack 82 starts its movement to the other limit position. The limit switches 100, 101, therefore, operate to break the circuits for effecting reciprocation of the rack and cam 31 to their inner and outer pile positions respectively when the rack reaches the corresponding position and to condition the circuits for energization when the rack is not in the corresponding position.

The limit switches 100, 101 are preferably actuated just before the rack 82 reaches its outer and inner pile positions respectively, i.e., just before the actuator 85 and rack 82 reach the limit of their corresponding stroke. The rack 82 and cam 31, however, will complete their movement to their proper positions since the valves 57, 88 remain in their actuated positions. It is further noted that the solenoid valves and air actuators respond quickly and energization of the coils of the valves need only be for very short time periods. The switches 104, 105 which are closed to initiate positioning are, as described hereinafter, closed for only very short intervals. It should be further noted that switches 106, 107 prevent energization of both coils of the valves 57, 88 when rack 82 is in a limit position. In the illustrated embodiment, each of the limit switches 100, 101 is operated to an open position when the block 102 engages a corresponding roller 115 supported on the end of an arm of a rocker lever 116, the lever 116 having a second arm 117 which is adapted to depress a switch actuator for the switch.

To effect delivery to either the inner pile or outer pile only, one of the switches 106, 107 is opened by

moving the control handle 96 from its center position, the switch 106 being opened when the handle is moved to its inner position to break the circuit for operating the actuators to their outer pile positions and the switch 107 being opened to break the circuit for operating the actuators to their inner pile position when the handle is moved to its outer pile position. If the handle is in its center position both switches 106, 107 are closed.

In the illustrated embodiment the switches 104, 105 are closed alternately to effect alternate movement of the actuators to their outer and inner pile positions respectively in timed relation to the approach of sheets to the pile positions 10, 11 by cams 121, 122 respectively as long as the handle 96 is in its center position. The cams are adjustably mounted 180° apart on a shaft 123 rotated one revolution for each two cycles of the associated printing press, i.e., once for every two sheets delivered. The cams 121, 122 are positioned so that switch 104 is closed as the first, third, etc., sheets approach the pile positions and the switch 105 closed as the second, fourth, etc., sheets approach the pile positions. It can be seen that as long as the switches 106, 107 are closed the alternate closing of the switches 104, 105 will effect reciprocation of the actuators 39, 85 to effect delivery of successive sheets to alternate piles.

It will be appreciated, however, that when the control handle is operated to open one of the normally closed switches 106, 107 the actuators will then remain in one position. If the switch 106 is open, the closing of the switch 104 can have no effect since the circuit is broken at the switch 106. The closing of the inner pile switch 105 will, however, effect energization of coils 112, 113 to raise the fingers if the fingers 56 are not in their raised position where switch 101 is open. If the fingers 56 are raised (and the cam 31 lowered) when switch 105 is operated, nothing will happen on the closing of switch 105, since the block 102 will be in a position opening limit switch 101. It can be seen therefore that opening the switch 106 will cause the fingers 56 to be raised if not already elevated and cam 31 lowered, if not so positioned, to effect delivery to the inner pile only and the actuators will remain in their positions for effecting delivery to the inner pile as long as switch 106 remains open. Similarly, when the switch 107 is opened, switch 100 being closed, the actuators 39, 85 will be operated by energizing coils 110, 111 to their positions for effecting delivery to the outer pile on the next closing of switch 104, if not so positioned at the time the switch 107 is opened, and will remain in this position as long as the switch 107 remains open.

The cams 121, 122 are timed so that the switches 104, 105 are actuated at a particular point in the machine cycle. The cam 122 closes the switch 105 for raising the fingers if not already so positioned every other time a gripper bar assembly has just cleared the supported ends of fingers 56 while the cam 121 actuates switch 104, when the other gripper assemblies have just been opened by the cam 31. It will be noted that once one of switches 104, 105, during alternate operation, properly positions the fingers 56 and cam 31, if not already so positioned to deliver a sheet approaching the piles to a certain pile, the subsequent operation of the inner control handle will have no effect upon the delivery until the sheet then being delivered has been deposited on its proper pile. This is true because the fingers 56 will not be operated in response to the movement of the control handle until the corresponding one of the switches 104, 105 is next actuated and the switches 104, 105 are not actuated until a point in the cycle where the grippers for any given sheet in the process of delivery to one of the piles have just cleared the fingers 56 or been released to the inner pile. This assures that the delivery will cycle out even though the handle is switched to set up delivery to one

position while a sheet is in the process of being delivered to the other position.

In accordance with one feature of the present invention, the outer ends of the fingers 56 are shaped to provide a depending guide portion 124. The depending guide portion is preferably curved and reversibly bent on the finger to form a smooth surface against which the sheet may drape itself as it rides over the sheet control fingers to the outer pile without danger of piercing the sheet. It will be noted that the vertical dimension "a" (FIG. 6) of the portion 124 when the fingers are in their lower position is greater than the distance between the bar supporting the gripper post and the sheet path. The dimension, however, is less than that between adjacent gripper posts supported on the bar 18 and when the finger is rotated to its upper position where it must pass between the bar and the sheet path, the height of the portion is such as to be received in the space between the bar and the sheet path. As is apparent from FIG. 4, the finger 56 may be square in cross section and is preferably hollow and is formed at its outer end with the portion 124 by cutting away a part of the finger and reversibly bending one side thereof. The square cross section is particularly advantageous because it has been found to cut down the amplitude of the vibration of the fingers 56. The amplitude of vibration is further minimized by the fact that the fingers 56 are rocked 90° about horizontal axes so that the reciprocation of the fingers also changes the planes of vibration of the fingers between horizontal and vertical planes and vice versa. This change of the plane of vibration tends to dampen the vibration and minimize the effect. Furthermore, when the finger is in its upper position, the vibration is taking place in a horizontal plane where it is not detrimental or likely to effect a piercing of the sheet and where more room is usually available for horizontal vibration than vertical. When the fingers are in their lower position, the fingers vibrate in a vertical plane but the enlarged curved guide portion at the end of the finger operates to minimize the danger that the sheet will be pierced by the finger. It is also noted that when the fingers are in their upper position the curved ends will act as cam surface to prevent jamming if the vibrations were such as to cause the ends of the fingers to hit the gripper posts. Inasmuch as the vibration problem of the fingers is minimized, the fingers can be made longer than heretofore possible.

Operation

From the foregoing the operation of the described delivery will be readily understood. If the control handle 96 is in its center position, the sheets being delivered over the piles 10 and 11 are deposited on the piles 10 and 11 alternately. If the fingers 56 are in their lower position, the actuator 85 is extended as shown in the diagrammatic control diagram of FIG. 8 and the limit switch 100 is open. The sheet then being delivered over the piles 10, 11 will be carried past the inner pile 10 to the outer pile 11 and as the next sheet approaches the fingers 56 and the pile positions 10, 11, the switch 105 will be actuated to complete a circuit through the limit switch 101 to energize the coils to effect operation of the actuators 39, 85 to lower the cam 31 and raise the fingers 56 to effect delivery of the sheet at the inner position 10. The operation of the actuator 85 to raise the fingers and lower the cam will open limit switch 101 to de-energize the circuit for effecting operation of the actuators 39, 85 to raise the fingers and lower the cam 31 and also actuate the limit switch 100 to condition the circuit for lowering the fingers 56 and raising the cam 31 the next time that the limit switch 104 is closed. It can be seen therefore that with the handle in the center position sheets are delivered to piles 10, 11 alternately.

If, however, the control handle 96 is moved to either its inner pile or outer pile positions, one of the switches 106, 107 is opened to effect delivery to the corresponding

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pile. If the switch 106 is opened, and the actuator 85 is in the position shown in FIG. 8, that is, with the fingers in their lower position and the cam 31 raised, the next time that the switch 105 is closed the actuator 85 will operate to move the fingers to their up position because of the circuit completed through the switches 105, 107. Movement to raise the fingers, however, will open the limit switch 101 to break that circuit and since the circuit normally closed by operating the switch 104 is broken by the open switch 106, the actuator and fingers will remain in this condition. If the actuator 85 and fingers had been in their inner pile position where limit switch 101 is open when the handle 96 was moved to open the limit switch 106, nothing would have happened, since the closing of switch 104 which would normally effect movement of the fingers to their lower position is now ineffective because of the open switch 106. Conversely, if the switch 107 is opened by movement of the handle 96 to its outer pile position, the actuators 85, 39 and the fingers 56 and the cam 31 will operate to their positions for effecting delivery to the outer pile, if not already so positioned.

It is desirable that the fingers 56 be adjustable since the clearances between the fingers and the gripper means G and the sheet gripped thereby are small. As explained hereinbefore, the relative angular position of the fingers 56 and their support member 58 with respect to the rack 82 may be adjusted by loosening a bolt 80 and shifting the gear 70 on the recessed portion 71 of the support member 58. In addition to this angular adjustment, the brackets 62 may be adjusted to adjust the tilt of the fingers 56. Since the sheet path over the pile portion 10 and 11 is horizontal, the fingers 56 are preferably horizontal fingers and to adjust the plane of the fingers, the brackets 62 are formed so that either end thereof may be shimmed to make the fingers 56 horizontal. To this end the brackets 62 are cut away adjacent the bottom of each of the upstanding arms 60, 61 to provide a shoulder 130 which rests on the top of the adjacent one of the plates 34, 63. Below the shoulders 130, the ends of each bracket are provided with convex curvatures thereon and are adapted to fit against the inner sides of the plates 34, 63. Between the convexly curved portions 131, and the shoulders 130, the brackets 62 have a cutout which provides a clearance space for the upper inner edges of the plates 34, 63. It can be seen that the described structure will permit the placing of shims under the shoulders 130 to shim one or the other of the brackets 62 to adjust the angularity of the fingers supported thereby. The brackets 62 may be held in place by a plurality of tie rods 140 which have ends fixed to the end plates 65 and which may be loosened to permit the shimming of the brackets.

By reference to FIGS. 6 and 7, it will be noted that when a finger 56 is raised there is a space between the top of the arm 60 of the corresponding bracket 62 and the underside of the support member 58 for the finger. During operation, the leading edge of the sheet might be caught in this space when the sheet is being delivered to the inner pile. To prevent this, each of the support members 58 has secured thereto a block 132 which has an end portion 133 providing an outer end 134 that lies in the plane of the outer side of the corresponding arm 60 and of the outer side of the plate 34. The block 132 is secured to the left-hand side of the support member 58 when the latter is viewed as in FIG. 6 with the finger 56 raised. When the finger 56 is lowered, the end portion 133 of the block is received in a cutout 136 in the arm 60 to allow the finger 56 to rotate approximately 90° to its position below the sheet path.

It can now be seen that the present invention provides a new and improved delivery in which the pile guide fingers are reciprocated and constructed in such a manner that the fingers can be made longer than heretofore possible and with the danger of piercing sheets therewith eliminated or materially reduced and in which the con-

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trol circuit is arranged in a simplified manner, and in such a manner that it will cycle out if the delivery pile control handle is moved to a position to effect delivery to one of the piles while the mechanism is set to deliver a sheet to the other of the piles. In practice, it has been found practical to provide fingers as long as 30" which is about 2½ times as long as has heretofore proved practical. This means that in a delivery having gripper assemblies spaced five feet apart, the fingers will extend over half the distance between assemblies and will support over one-half of the maximum size sheet handled by the delivery as the sheet moves over the inner pile position to the outer pile position.

While a preferred embodiment of the present invention has been described in considerable detail, it will be understood that the scope of the present invention is such that further modifications and arrangements which fall within the ability of those skilled in the art can be made.

Having described my invention, what I claim is:

20 1. In a sheet delivery mechanism for receiving a sheet from a printing press and moving it along a path extending over a pile position and wherein the sheet being delivered along the sheet path is to be selectively dropped at the pile position or carried past the pile position, means for guiding the sheet comprising a sheet control finger adjacent to said path and disposed over said pile position and extending parallel to the direction of sheet movement, said finger having a first position above and a second position below said sheet path, support means disposed on the side of said pile position remote from the side from which the sheet approaches and supporting one end of said finger, the finger extending from said support means over said pile position and terminating in a free end whereby movement of said finger in a plane of the finger to move the finger between two positions tends to set up vibrations of the finger in the plane, said support means including means mounting said finger for movement about an axis parallel to the line of sheet movement to move the finger between said first and second positions and minimize vibration of said finger due to movement between its positions above and below the sheet path and actuator means operatively connected to said finger for rocking said finger about said axis to move said finger between its said first and second positions.

45 2. In a sheet delivery mechanism, the structure as defined in claim 1 wherein said finger has a square cross section.

3. In a sheet delivery mechanism for receiving a sheet from a printing press and moving it along a path extending over a pile position and wherein the sheet being delivered along the sheet path is to be selectively dropped at the pile position or carried past the pile position, means for guiding the sheet comprising a sheet control finger disposed adjacent said path and extending parallel to the direction of sheet movement, said finger having a first position above and a second position below said sheet path, support means disposed on the side of said pile position remote from the side from which the sheet approaches and supporting one end of said finger, the finger extending from said support means over said pile position and terminating in a free end whereby movement of said finger in a plane of the finger to move the finger between two positions tends to set up finger vibration in the plane, said support means including means supporting said finger for movement about an axis parallel to the line of sheet movement to move the finger between its said first and second positions, control means operable between a first condition to effect a dropping of the sheet at said pile position and an inactive position wherein said sheet is carried past said pile position, and means for oscillating said finger about said axis to move said finger between its said first and second positions upon operation of said control means between its said positions to thereby position said finger above the sheet path when the sheet is to be

dropped at said pile position and below the sheet path when the sheet is to be carried past the pile position.

4. In a sheet delivery mechanism for receiving a sheet from a printing press and moving it along a path extending over a pile position and wherein the sheet being delivered along the sheet path is to be selectively dropped at the pile position or carried past the pile position, means for guiding the sheet comprising a sheet control finger disposed over said pile position and extending parallel to the direction of sheet movement, said finger having a first position above and a second position below said sheet path, means disposed on the side of said pile position remote from the side from which the sheet approaches supporting said finger for movement about an axis parallel to the line of sheet movement to move the fingers between said positions, reciprocable actuator means operatively connected to said finger for actuating said finger between its said positions, control means for said actuator means comprising first and second circuits corresponding to said first and second positions and respectively energizable to effect operation of said actuator means to operate said finger to its said first and second positions respectively, each of said circuits including a first switch means periodically closed in timed relation to the delivery of sheets along said path and second switch means opened when said finger is in the position to which it is actuated by energization of the circuit and closed when said finger is in the other one of its positions, means responsive to the operation of said actuator means for operating said second switch means, and means for momentarily closing said first switch means of said first and second circuits alternately as successive sheets approach said pile positions whereby said finger is operated from its immediate position to its other position for each sheet approaching the pile position.

5. In a delivery, the structure as defined in claim 4 wherein said first and second circuits each includes third switch means for selectively opening the circuit.

6. In a delivery, the structure as defined in claim 4 wherein said actuator means comprises a double acting pneumatic piston and cylinder actuator including a reciprocable element movable in one direction to operate said finger to one of its positions and in the other direction to operate said finger to the other of its positions, and said control means comprises a solenoid actuated valve for controlling the connections of said actuator to a source of fluid pressure and exhaust or drain and energizable to effect operation of said actuator in said one direction by said second circuit and to effect operation of said actuator in the opposite direction by energization of said first circuit.

7. In a sheet delivery mechanism for receiving a sheet from a printing press and moving it along a path extending over a pile position and wherein the sheet being delivered along the sheet path is to be selectively dropped at the pile position or carried past the pile position, means for guiding the sheet comprising a plurality of sheet control fingers displaced from each other across said path over said pile position and extending parallel to the direction of sheet movement adjacent said path, said fingers each having a first position above and a second position below said sheet path, support means disposed on the side of said pile position remote from the side from which the sheet approaches and supporting said fingers, the fingers extending from said support means over said pile position and terminating in free ends whereby movement of said fingers in respective planes of the fingers to move the fingers between two positions tends to set up finger vibrations in the respective planes, said support means including means mounting each of said fingers for movement about a respective axis parallel to the line of sheet movement to move the fingers between their said positions upon rocking movement of the fingers about their respective axes whereby oscillations of said fingers due to movement between positions above and below

said path are minimized and means for rocking said fingers between said positions comprising a rack extending across said sheet path and parallel to the plane thereof adjacent said fingers and a respective gear connected to each of said fingers to effect rotation thereof and meshing with said rack, and means for reciprocating said rack.

8. In a sheet delivery mechanism the structure as defined in claim 7 wherein the last said means comprises a fluid pressure actuator for reciprocating said rack.

9. In a sheet delivery mechanism the structure as defined in claim 8 wherein control means for said actuator comprises first and second control circuits for effecting energization of said actuator to operate the latter in opposite directions to opposite limit positions respectively, and means responsive to the operation of said actuator for opening the circuit energized to effect operation of the actuator to one position in response to the positioning of the actuator and conditioning the other circuit for effecting operation to the other position.

10. In a sheet delivery for delivering a succession of sheets along a sheet path to an outer pile position disposed along said path beyond an inner pile position whereby a sheet delivered to said outer pile position is moved over said inner pile position, said delivery including first means having first and second positions wherein said sheet moving over said inner pile is respectively carried past, and deposited at, said inner pile position, means supporting said first means for movement between said positions, reciprocable actuator means operatively connected to said first means for actuating said first means between its said positions, control means for said actuator means comprising first and second circuits corresponding to said first and second positions and respectively energizable to effect operation of said actuator means to operate said first means to its said first and second positions respectively, each of said circuits including a first switch means periodically closed in timed relation to the delivery of sheets along said path and second switch means opened when said first means is in the position to which it is actuated by energization of the circuit and closed when said first means is in the other one of its positions, means responsive to the operation of said actuator means for operating said second switch means, and means for momentarily closing said first switch means of said first and second circuits alternately as successive sheets approach said pile positions whereby said first means is operated from its immediate position to its other position for each sheet approaching the pile positions.

11. In a delivery, the structure as defined in claim 10 wherein said first and second circuits each includes third switch means for selectively opening the circuit.

12. In a delivery, the structure as defined in claim 10 wherein said actuator means comprises a double acting pneumatic piston and cylinder actuator including a reciprocable element movable in one direction to operate said first means to one of its positions and in the other direction to operate said first means to the other of its positions, and said control means comprises a solenoid actuated valve for controlling the connections of said actuator to a source of fluid pressure and exhaust or drain and actuable to effect operation of said element in one direction by energizing said first circuit and to effect operation of said actuator in the opposite direction by energization of said second circuit.

13. In a sheet delivery as defined in claim 10 wherein said first means comprises a sheet release cam at said inner pile position and operable between active and inactive positions and sheet control fingers disposed over said inner pile position and movable between positions disposed on opposite sides of the sheet path and wherein said actuator means comprises double acting fluid pressure cylinder means for actuating said cam and fingers between their said positions.

14. In a sheet delivery for delivering a sheet along a sheet path to move the sheet over a pile position at which

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it is to be selectively delivered, bar means extending across the sheet path and movable therealong, a plurality of spaced gripper elements extending from the bar means for gripping the leading edge of a sheet to move the latter along said path with said bar means, said bar means being spaced from said sheet path, a plurality of fingers disposed adjacent said sheet path and spaced therefrom and extending in a direction parallel to the direction of sheet movement, said fingers having first positions on one side of the sheet path wherein the fingers are received in the spaces between said gripper elements and between the bar means and the sheet and second positions on the other side of the sheet path, and means supporting said fingers for rocking movement between said positions about individual axes parallel to the direction of sheet movement and actuated between said positions by said rocking movement parallel to the direction of sheet movement.

15. In a delivery, a structure as defined in claim 14 wherein the space between said gripper elements is greater than the space between said bar means and the said path and the end portions of said fingers which are first approached by the sheets have a cross section such that the dimension of each finger end portion extending between the gripper elements which receive the fingers when said fingers are in their said first position is greater than the distance between the bar means and the said path and the dimension of each finger extending between the bar means and sheet path when the fingers are raised is such as to be received in the space between the bar means and the sheet path.

16. In a delivery, the structure as defined in claim 14 wherein said end portions are rounded.

17. In a sheet delivery mechanism, the structure as defined in claim 14 wherein said finger has a square cross section.

18. In a sheet delivery for delivering a sheet along a sheet path to move the sheet over a pile position at which it is to be selectively delivered, bar means extending across the sheet path and movable therealong, a plurality of spaced gripper elements extending from the bar means for gripping the leading edge of a sheet to move the lat-

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ter along said path with said bar means, said bar means being spaced from said sheet path, a plurality of fingers disposed adjacent said sheet path and spaced therefrom and extending in a direction parallel to the direction of sheet movement, said fingers having first positions on one side of the sheet path wherein the fingers are received in the spaces between said gripper elements and between the bar means and the sheet and second positions on the other side of the sheet path, and means supporting each of said fingers for rocking movement between its sheet positions about an individual axis parallel to the direction of said movement, said fingers each being in a plane containing its axis of rocking movement and said planes being vertical and horizontal when said fingers are in their first and second positions respectively and said rocking movement of each finger being 90° to move the finger between its said positions.

19. In a sheet handling mechanism for moving a sheet along a sheet path, a sheet guide finger disposed along said path and extending in the direction of sheet movement, means at the end of said finger remote from the end thereof first approached by a sheet moving along said path supporting said finger for rocking movement about an axis parallel to the direction of sheet movement between a position above and a position below the approaching sheet to guide said sheet above and below said finger as it moves by the latter, said finger extending from said means and terminating in said end first approached by a sheet moving along said path with the latter end being a free end whereby movement of said finger in a plane of the finger between two positions tends to set up vibrations of the finger in the plane, said finger being rocked about said axis to move between positions above and below the sheet path to minimize vibration of said finger.

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