April 16, 1968 J. R. ELLIS ETAL 3,378,256

SHEET DELIVERY SLOWDOWN

Filed March 22, 1966 4 Sheets-Sheet 1

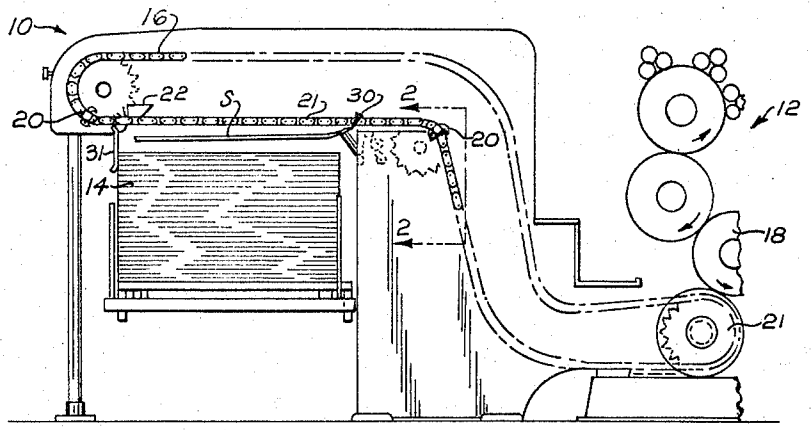


FIG. 1

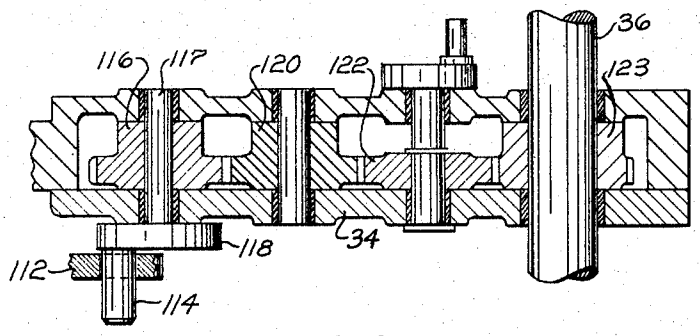


FIG. 6

INVENTORS
JARRETT R. ELLIS
HOWARD J. SEEL
BY Hoffmann and Yount
ATTORNEYS

April 16, 1968 J. R. ELLIS ETAL 3,378,256

SHEET DELIVERY SLOWDOWN

Filed March 22, 1966 4 Sheets-Sheet 2

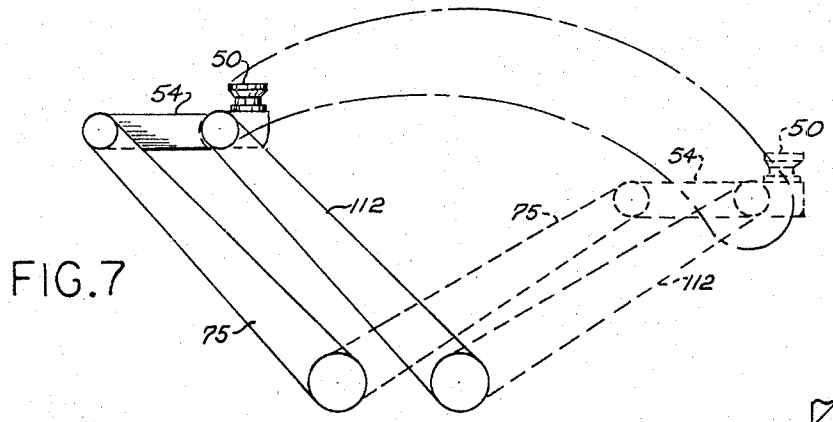


FIG.7

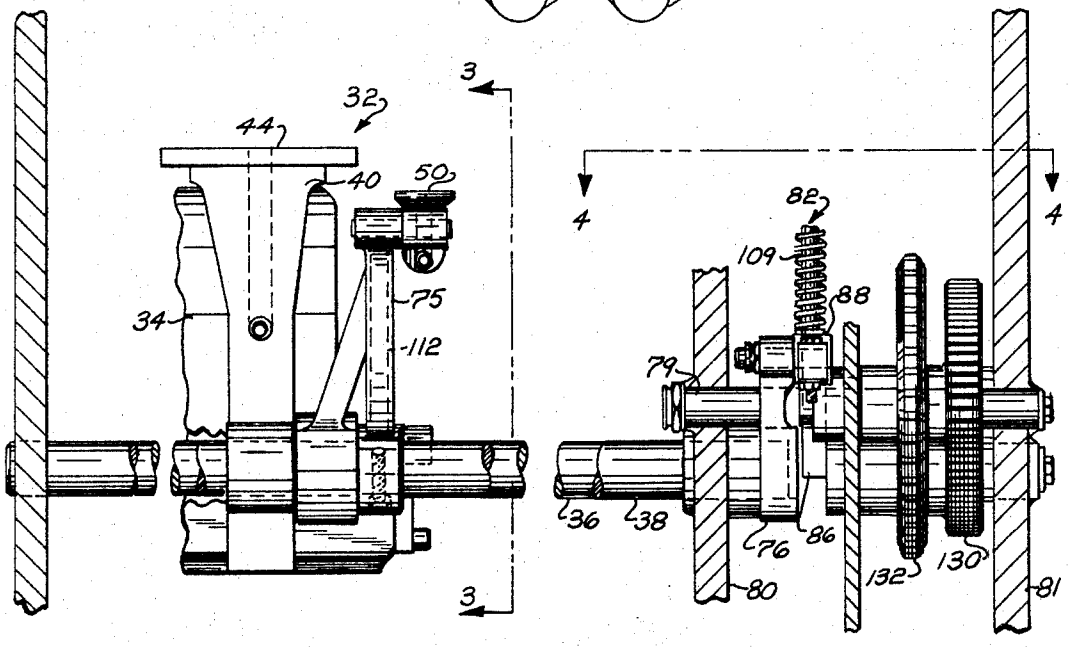


FIG.2

INVENTORS
JARRETT R. ELLIS
HOWARD J. SEEL

BY Hoffmann and Young
ATTORNEYS

April 16, 1968 J. R. ELLIS ETAL 3,378,256

SHEET DELIVERY SLOWDOWN

Filed March 22, 1966 4 Sheets-Sheet 3

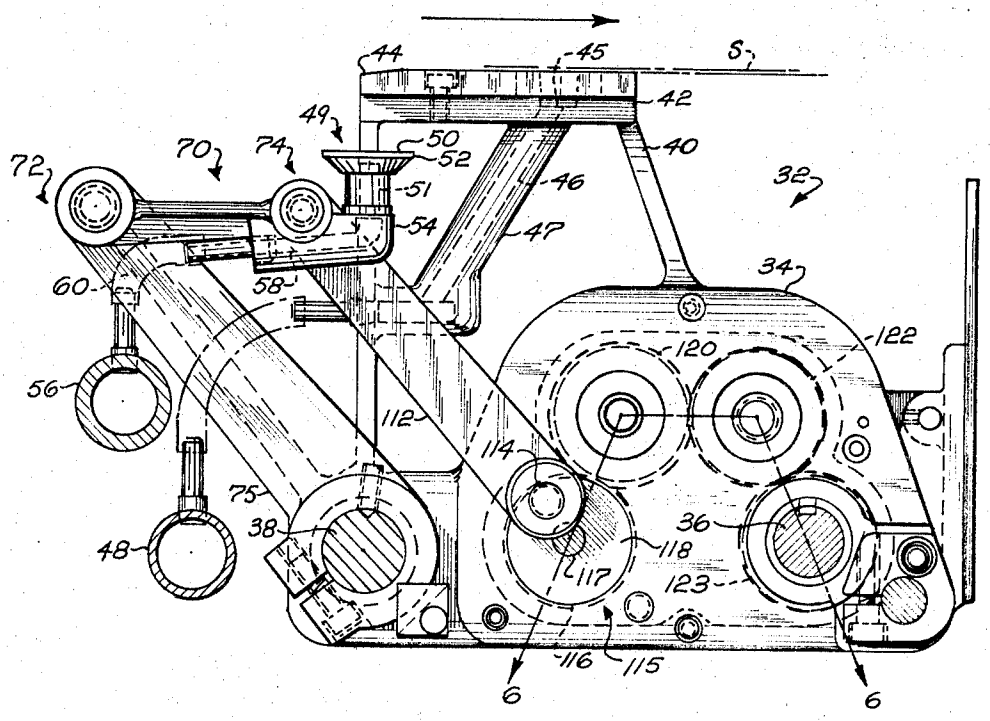


FIG. 3

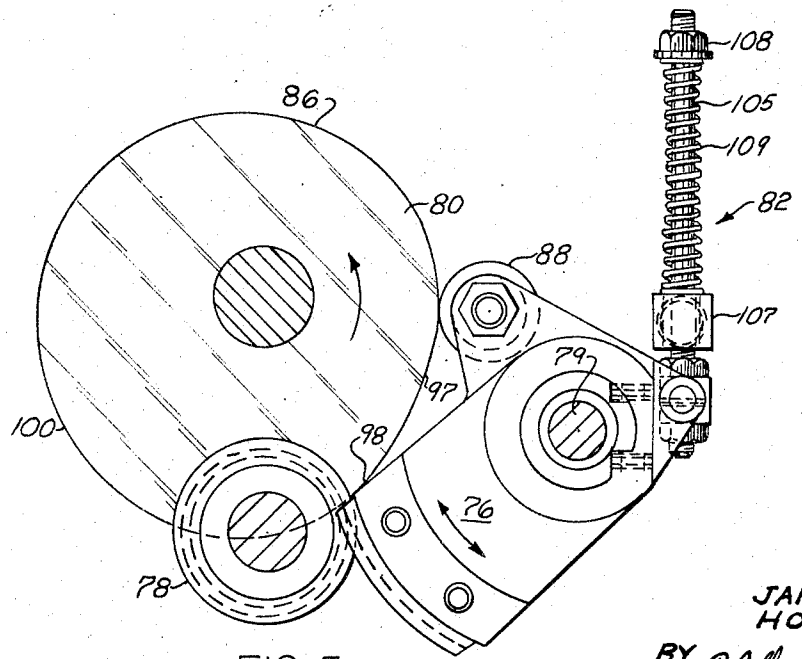


FIG. 5

INVENTORS
JARRETT R. ELLIS
HOWARD J. SEEL

BY Hoffmann and Yount
ATTORNEYS

April 16, 1968 J. R. ELLIS ETAL 3,378,256

SHEET DELIVERY SLOWDOWN

Filed March 22, 1966 4 Sheets-Sheet 4

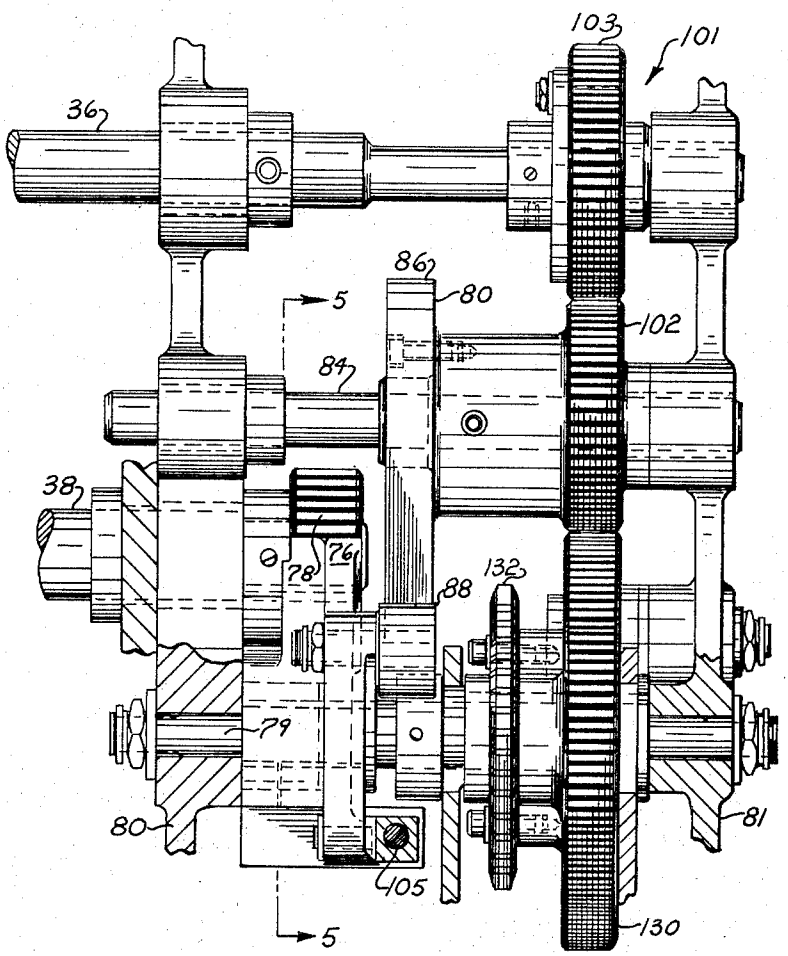


FIG. 4

INVENTORS
JARRETT R. ELLIS
HOWARD J. SEEL

BY Hoffmann and Young
ATTORNEYS

United States Patent Office 3,378,256 Patented Apr. 16, 1968

3,378,256

SHEET DELIVERY SLOWDOWN

Jarrett R. Ellis, Shaker Heights, and Howard J. Seel, Cleveland, Ohio, assignors to Harris-Intertype Corporation, Cleveland, Ohio, a corporation of Delaware

Filed Mar. 22, 1966, Ser. No. 536,437
17 Claims. (Cl. 271—68)

ABSTRACT OF THE DISCLOSURE

The present invention relates to a sheet slowdown mechanism for reducing the rate of speed of a moving sheet, and more particularly to a sheet slowdown mechanism for use in a sheet delivery for reducing the speed of the sheet prior to its being deposited onto a pile. The sheet slowdown mechanism includes a gripper which is moved in a substantially horizontal position along an elongated endless path.

A known sheet slowdown mechanism for reducing the speed of a sheet prior to its deposit onto a pile includes a sucker gripper member movable in an endless path. The gripper member moves from a position spaced from the plane or path of movement of the sheet toward the sheet path to a sheet gripping position at an accelerated rate of speed to bring the speed of the gripper member to substantially that of the moving sheet. The sucker grips or takes the sheet when it reaches its sheet gripping position. From the sheet gripping position, the sucker member moves to a sheet release position and decelerates to reduce the speed of the sheet to or approximately to zero prior to releasing the sheet and allowing the same to drop onto the pile. Such a slowdown mechanism is shown in United States Patent No. 2,942,878. These slowdown mechanisms which operate to accelerate the sucker member to initially engage and take the sheet while moving at sheet speed have been fairly complex. Moreover, the sucker member, after it takes the sheets, tilts relative to the horizontal causing some problems of sheets peeling off the sucker member.

An object of the present invention is to provide a new and improved sheet slowdown mechanism which includes a sucker member which initially engages and grips a sheet while moving at sheet speed and then decelerates to slow the speed of the sheet and which is of a simple and compact construction and operates to gradually slow down the moving sheets and minimizes peeling of sheets off the sucker member.

Another object of the present invention is to provide a new and improved sheet slowdown mechanism which includes a sucker member which initially engages and grips a sheet while moving at sheet speed and then decelerates to slow the speed of the sheet and which sucker member is maintained horizontally disposed substantially throughout the sheet deceleration portion of the path of movement of the sucker member.

Yet another object of the present invention is to provide a new and improved sheet slowdown mechanism which includes a sucker member which is accelerated to initially engage and grip a sheet while moving at sheet speed and then decelerates to slow the speed of the sheet and wherein the sucker member is moved through an elongated horizontal path with the extent of its movement while decelerating being substantially greater than the extent of its movement while accelerating to provide for a substantial length of travel for the sheet while it is gripped so that a very gradual deceleration of the sheet with no abrupt change of speed is effected prior to its release.

A further object of the present invention is to provide

a new and improved sheet slowdown mechanism which includes a sucker member which initially engages and grips a sheet while moving at sheet speed and then decelerates to slow the speed of the sheet and where movement of the sucker member through its endless path is effected by an actuating means including a pair of rotatable drive elements connected with the sucker by a parallel linkage arrangement.

A still further object of the present invention is to provide a new and improved sheet slowdown mechanism for reducing the rate of speed of moving sheets and which includes an actuating means for moving a sucker member through an endless path and wherein the actuating means comprises separate actuating mechanisms for imparting a horizontal and vertical movement to the sucker member and wherein each of the actuating mechanisms includes a link member pivotally connected with the sucker member and driven by a rotatable drive element.

The invention further resides in certain novel constructions and arrangements of parts, and further objects and advantages will appear from the following description of the preferred embodiment described with reference to the accompanying drawings, which form a part of the specification, and in which like reference characters designate corresponding parts throughout the several views and wherein:

FIG. 1 is a fragmentary side elevational view of a sheet delivery apparatus for a printing press and embodying the present invention;

FIG. 2 is an enlarged fragmentary sectional view taken approximately along line 2—2 of FIG. 1;

FIG. 3 is a side elevational view of part of the apparatus shown in FIG. 2 with parts thereof shown in section, and looking in the direction of the arrows 3—3 of FIG. 2;

FIG. 4 is a fragmentary top plan view of part of the apparatus shown in FIG. 2 with parts thereof shown in section and looking in the direction of the arrows 4—4 of FIG. 2;

FIG. 5 is a fragmentary sectional view taken approximately along line 5—5 of FIG. 2;

FIG. 6 is a fragmentary sectional view taken approximately along line 6—6 of FIG. 3; and

FIG. 7 is a diagrammatic view illustrating the path of movement of a sheet gripper means comprising part of the slowdown mechanism of the present invention.

The present invention provides a novel sheet slowdown mechanism for reducing the rate of speed of a moving sheet. Although the novel sheet slowdown mechanism of the present invention could be used in various kinds of apparatuses in which it is desired to reduce the rate of speed of a moving sheet, it is especially adapted for use in a sheet delivery apparatus wherein moving sheets are to be slowed down prior to being deposited onto a pile. The sheet slowdown mechanism may be used for slowing cut and/or creased sheets prior to deposit onto a pile. However, for the purposes of illustration, the slow-down mechanism is herein shown as embodied in a sheet delivery apparatus 10 for a printing press.

The sheet delivery apparatus 10 delivers printed sheets S from the printing press, designated generally by reference numeral 12, to a delivery pile 14. The sheet delivery apparatus 10 includes an endless chain conveyor 16 for conveying the printed sheets S as they come off an impression cylinder 18 of the printing press 12 to a position above the pile 14. The conveyor 16 is operated in timed relationship with the printing press 12 so that as the sheets S come off the cylinder 18, they are gripped by grippers 20 mounted on gripper bars extending transversely of the conveyor 16 as the bars move over a skeleton cylinder 21. The conveyor 16 conveys the sheets S taken from the impression cylinder 18 along its lower run 21 until the grip-

pers 20 engage a stationary cam 22 which releases the grippers 20 to release the sheets being conveyed thereby. The gripper bars are spaced apart a distance somewhat greater than the maximum length of the sheet which the sheet delivery apparatus 10 is designed to handle.

As the conveyor 16 conveys the sheets S, the latter move past a sheet slowdown mechanism 30 disposed beneath the conveyor 16 and located adjacent the pile 14. The sheet slowdown mechanism 30 is operable to grip the rearward end of each sheet S immediately prior to or at the time its forward end is being released by the grippers 20 and to slow down or reduce the rate of speed of the moving sheet to zero speed or approximately zero speed and gently deposit the same on the pile 14. The sheet slowdown mechanism 30 is effective to prevent the moving sheets S from crashing into a stop plate 31 at the forward end of the pile 14 due to the forward momentum or inertia they possess upon being released by the grippers 20 and thus, prevents the forward edge of the sheets S from being damaged and/or crumpling of the sheets upon being released by the grippers 20.

The sheet slowdown mechanism 30 comprises a plurality of slowdown devices (only one of which is shown in the drawings and designated generally by reference numeral 32) located at spaced transverse locations between a pair of spaced side frames of the delivery apparatus 10. The slowdown device 32, in the preferred embodiment, comprises a housing 34 which is supported at its forward and rearward ends, as viewed in FIG. 3, by horizontally disposed shafts 36 and 38, respectively, extending therethrough and having their opposite ends rotatably supported by the delivery side frames. The shafts 36 and 38 are rotatable and suitable bearings are interposed between the shafts and the housing 34 to enable the shafts 36 and 38 to rotate relative to the housing 34. The housing 34 includes an upwardly extending bracket means 40, here shown as being formed integral therewith, having a horizontally disposed support portion 42. Bolted to the upper side of the support portion 42 is a suction plate 44 having a planar upper surface over which the sheets S move as they are being advanced by the chain conveyor 16.

The suction plate 44 has one or more ports 45 therethrough and extending transversely to its upper surface which are in communication with a vacuum source for constantly creating a suction effect at the ports 45. The ports 45 are in communication with a passageway 46 extending through a downwardly extending boss 47 of the bracket 40, the passageway 46 in turn being in communication with a vacuum pipe 48 via flexible conduit means 50. The pipe 48 is supported at its opposite ends by the side frames 33 and 34 of the delivery apparatus 10 and is in communication with a suitable vacuum source (not shown).

The suction plate 44 exerts a drag on the sheets S as they are individually passed or moved thereover by the conveyor 16. The drag exerted is effective to place the sheets S under a slight tension so that they will be straight and in a horizontally disposed position to enable them to be effectively gripped by a gripper means 49 carried by the slowdown device 32.

The gripper means 49 is operated in timed relationship with the conveyor 16 and is moved into the path of the sheet S to grip the rearward end thereof when the rear edge of the sheet is about to or begins to uncover the port 45. The gripper means 49 is also operable to grip the rearward end of the sheet S when or just prior to when the grippers 20 are actuated to their release position to release the forward end of the sheet S.

The gripper means 49, in the preferred embodiment, comprises a sucker member 50 which is movable in an endless path through forward and return runs beneath the sheet S, as shown diagrammatically in FIG. 7. The sucker member 50, as it moves through its endless path, moves from a first position at the start of its forward run and spaced beneath the plane or path of movement of the sheet S, as indicated by reference character A to a second or sheet gripping position, as indicated by reference character B, in which it grips the rearward end of the sheet S. The sucker member 50 then moves from the sheet gripping position to a third or sheet release position at the end or approximately the end of its forward run, as indicated by reference character C, in which it releases the sheet S with the sheet falling or dropping gently onto the pile 14. The sucker member 50 then moves from the sheet release position through its return run to the first position.

The movement of the sucker member 50 during its forward run between its first position and its sheet gripping position is at an accelerated rate of speed to bring the speed of the sucker member 50 up to or substantially up to the speed of the moving sheet S and between its sheet gripping and sheet release positions is at a decelerated rate of speed to decelerate or reduce the speed of the sheet to zero speed or substantially zero speed so that when the sheet is released it will fall vertically and be deposited gently onto the pile 14.

The sucker member 50 comprises a resilient suction cup, preferably made from a rubber material, having a mouth 51 and a substantially horizontally disposed gripping end or lip 52. The sucker member 50 is mounted on a carrier or link member 54 and its mouth 51 is placed in intermittent communication with suitable vacuum and air pressure sources (not shown). To this end, the mouth 51 of the sucker member 50 is in communication with a conduit or pipe 56 extending transversely between the side frames 33 and 34 of the delivery apparatus 10 via a passageway 58 in the carrier 54 and a flexible conduit 60 having one end connected to the passageway 58 in the carrier 54 and the other end connected to the pipe 56. The pipe 56 at one end is operatively connected to a suitable rotary valve means (not shown), which in turn intermittently places the pipe 56 in communication with suitable vacuum and air pressure sources (not shown). Since the valve means per se does not form a part of the present invention, it is not shown herein nor will it be described in detail. Suffice it to say that the valve means could be of the type shown and described in United States Patent No. 2,942,878 and suffice it further to say that it is operated in timed relationship with the movement of the sucker member 50 so that it places the mouth 51 of the sucker member 50 in communication with the vacuum source at the time the sucker member engages the rear end of the sheet and during its movement from its gripping position to its release position and in communication with the air pressure source when the sucker member 50 is in its sheet release position to insure that separation between the sheet and the sucker member is effected.

Movement of the sucker member 50 through its endless path is effected by a novel actuating means, indicated generally by reference character 70. As best shown in FIG. 7, the actuating means 70 is effective to move the sucker member 50 through an elliptical path which is horizontally elongated with the extent of its movement in a generally horizontal direction being substantially greater than the extent of its movement in a generally vertical direction and to maintain the gripping end 52 of the sucker member 50 in a generally horizontal disposition substantially throughout its path of movement, even though the sucker tilts somewhat at its release point.

The actuating means 70 comprises a first actuating mechanism 72 operatively connected with the sucker member 50 for moving the latter through the horizontal extent of its forward and return runs and a second actuating mechanism 74 which is operatively connected with the sucker member 50 independently of the actuating mechanism 72 for moving the same through the vertical extent of its endless path. The first actuating mechanism 72 comprises a lever or link member 75 having one end pivotally connected to the rearward end of the carrier 54, as shown in FIG. 3, and its other end fixed to the shaft 38. The shaft 38 is adapted to be rotated in op-

posite directions to cause the lever 75 to be oscillated about the axis of the shaft 38 between a first position, as shown by the solid lines in FIG. 7, in which the sucker member is located at the start of its forward run and a second position, as shown by the phantom lines in FIG. 7, in which the sucker member 50 is located at the end of its forward run by an oscillatable gear segment 76 which is in constant mesh with a gear 78 fixed to one end of the shaft 38. The gear segment 76 is rotatably journaled on a shaft 79 having its opposite ends fixed in a pair of laterally spaced side wall portions 80 and 81 of the side frame 34.

The gear segment 76 is adapted to be oscillated or rotated about the axis of a shaft 79 in a clockwise direction, as viewed in FIG. 5, and at accelerated and decelerated speeds during different portions of its clockwise movement by a rotatable cam member 80 and in a counterclockwise direction by a spring biasing means 82 connected with the end of the gear segment 76 remote from its gear teeth. The cam member 80 is fixed to a shaft 84 having its opposite ends rotatably supported by the spaced side wall portions 80, 81 of the side frame 34 and has an outer peripheral cam surface 86 which is in engagement with the peripheral surface of a cam follower roller 88 rotatably supported by the gear segment 78. The cam follower roller 88 is biased or held in engagement with the peripheral surface 86 of the cam 80 by the biasing means 82. The cam member 80 is adapted to be rotated in a counterclockwise direction, as viewed in FIG. 5, and includes first and second rise portions 97 and 98 for moving the gear segment 76 in a clockwise direction at accelerated and decelerated rates of speed, respectively, and a fall portion 100 to permit the spring biasing means 82 to move the gear segment 76 in a counterclockwise direction.

From the foregoing, it should be apparent that when the cam 80 is rotated in a counterclockwise direction, as viewed in FIG. 5, and the first rise portion 97 engages the cam follower roller 88, the gear segment 76 is rotated about the axis of the shaft 79 in a clockwise direction, as viewed in FIG. 5, and at an accelerated rate of speed in opposition to the bias imposed by the biasing means 82. Movement of the gear segment 76 in a clockwise direction causes the gear 78 and the shaft 38 to be rotated in a counterclockwise direction which in turn causes the lever 75 to be rotated in the direction of sheet travel, as viewed in FIGS. 3 and 7, and the sucker member 50 to be moved from its first position toward its sheet gripping position. Due to the fact that the movement of the gear segment 76 is at an accelerated rate of speed, the movement imparted to the shaft 38, lever 75 and sucker member 50 will also be at an accelerated rate of speed to bring the speed of the sucker member 50 to that or substantially that of the speed of the moving sheet S. When the second rise portion 98 of the cam 80 engages the cam follower roller 88, the gear segment 76 continues to be rotated in a clockwise direction but at a decelerated rate of speed, which in turn causes the speed of the sucker member 50 to be slowed down or reduced as it moves from its gripping position toward its sheet release position. The second rise portion 98 of the cam 85 effects a gradual deceleration of the sucker member 50 to zero speed at the end of its forward run.

When the drop portion 100 of the cam 80 engages the follower roller 88, the gear segment 76 is rotated in a counterclockwise direction about the axis of the shaft 79, as viewed in FIG. 5, by the spring biasing means 82. Rotation of the gear segment 76 in a counterclockwise direction causes the gear 78 and the shaft 38 to be rotated in a clockwise direction which in turn causes the lever 75 to be moved in the direction opposite to the direction of sheet travel and the sucker member 50 to be moved through its return run.

The cam member 80 is rotated at a constant speed by a drive means 101. The drive means 101 comprises a gear 102 fixed to the shaft 84 and which is in constant mesh with an input gear 103 fixed to one end of the shaft 36. The input gear 103 can be driven by any suitable power driven means, such as an electric motor (not shown).

The spring biasing means 82 for biasing the cam follower roller 88 into engagement with the cam member 85 and for moving the gear segment 76 in a counterclockwise direction, as viewed in FIG. 5, may be of any suitable constructiton. The biasing means 82 is here shown as comprising a rod 105 having one end fixed to the gear segment 76 at its end opposite that of its gear teeth and which is slidably received within an oversized through opening in a stationary abutment block 107 which is suitably secured to a frame portion. The rod 105 carries an adjustably positionable nut 108 at its other end and extends through a compression spring 109 having one end in abutting engagement with the nut 108 and the other end in abutting engagement with the stationary block 107. From the above, it should be apparent that when the gear segment 76 is rotated in a clockwise direction, as viewed in FIG. 5, the rod 105 is moved downwardly which causes the spring 109 to be compressed and that when the cam follower roller 88 engages the drop portion 100 of the cam 80, the spring 109, which tends to return to its normal position, causes the gear segment 76 to be rotated in a counterclockwise direction.

The actuating means 74 is actuated in timed relationship with the actuating means 72 and cooperates with the actuating means 72 to cause the sucker member 50 to be moved into and out of the path of movement of the sheet S while its gripping end 52 is maintained in a generally horizontal disposition. The actuating means 74 comprises a link member or crank arm 112 having one end pivotally connected to the carrier 54 at its forward end, as viewed in FIG. 3, and its other end pivotally connected to an eccentric pin 114 of a rotary eccentric means 115. The eccentric means 115 comprises a gear 116 fixed to a shaft 117 having its opposite end rotatably journaled in the side walls of the housing 34. The shaft 117 projects outwardly of one side of the housing 34 and has an annular member 118 fixed thereto. The eccentric pin 114 is fixed to the member 118 and projects outwardly of its side in a direction parallel to its axis of rotation and at a location radially spaced from the axis of the shaft 117. The gear 116 is in constant mesh with an idler gear 120 which in turn is in constant mesh with an idler gear 122. The idler gears 120 and 122 are fixed to shafts having their opposite ends rotatably journaled in the side walls of the housing 34. The idler gear 122 is in constant mesh with a gear 123 fixed to the shaft 36 which is rotated by the input gear 103 of the drive means 101.

From the foregoing, it should be apparent that when the input gear 103 is rotated the shaft 36 and gear 123 are caused to be rotated which in turn causes the idler gears 122 and 120 to be rotated. Rotation of the idler gear 120 causes the gear 116 of the eccentric means 115 to be rotated which in turn causes the crank arm or link member 112 to move the carrier and the sucker member 50 in a vertical direction.

As best shown in FIG. 3, the crank arm 112 and the lever 75 extend substantially parallel to one another and provide a parallel linkage arrangement which effects a closed path of movement for the sucker member 50 with the extent of the horizontal movement of the sucker member being substantially greater than the extent of the vertical movement. Moreover, as shown in FIG. 7, the deceleration portion of the path of sucker movement is substantially greater than the acceleration portion thereof. By providing such a path of movement, the gripping end 52 of the sucker member 50 can be maintained in a substantially horizontal disposition substantially throughout its path of endless movement and by providing a long deceleration movement a gradual deceleration of the sucker member 50 after it has gripped

the sheet can be effected because of the distance between the sheet gripping and sheet release positions. Therefore, there will be little or no tendency for the sheet to peel off the sucker member and/or slippage between the sucker member and the sheet. Moreover, the novel construction of the actuating means 70 provides for a compact and simplified construction.

As previously mentioned, the conveyor 16 is driven in timed relationship with the actuating means 70 of the slowdown device 32. To this end, the gear 102 is in constant mesh with a gear 130 rotatably journaled on the shaft 79. The gear 130 is drivingly connected to a sprocket wheel 132 which is driven in timed relation to the conveyor 16. The slowdown mechanism is adjustable relative to the main frame of the delivery along the sheet path and the drive for the slowdown and specifically to the sprocket wheel 132 permits this adjustment while maintaining the predetermined timed driving relationship with the conveyor 16. This drive is not shown on the drawings but may be a conventional walking beam drive between the sprocket 132 and a drive sprocket driven in timed relation to the chain 16.

From the foregoing, it can be seen that a novel sheet slowdown mechanism of a compact and simple construction for reducing the speed of moving sheets has been provided. It can also be seen that a novel sheet slowdown mechanism in which the gripper or sucker means is maintained in a generally horizontal disposition substantially throughout its endless path of movement has been provided. Furthermore, it can be seen that a novel sheet slowdown mechanism in which the gripper or sucker means is moved through a horizontally elongated path with the horizontal extent of its movement being substantially greater than its movement vertically has been provided. Additionally, it can be seen that a novel sheet slowdown mechanism in which the actuating means for moving the gripper or sucker means in an endless path includes a parallel linkage arrangement has been provided.

Although the sheet slowdown mechanism of this invention has been illustrated and described herein to a somewhat detailed extent, it will be understood, of course, that the invention is not to be regarded as being limited correspondingly in scope but includes all changes and modifications coming within the terms of the claims hereof.

Having described our invention, we claim:

1. A sheet slowdown mechanism for reducing the rate of speed of a moving generally horizontally disposed sheet comprising a sucker member movable through an endless path in forward and return runs, said sucker member during its forward run moving in a first path portion from a retracted position spaced from the plane of sheet movement toward the plane of movement of the sheet and to a sheet gripping position in which it grips the sheet and in a second path portion from said sheet gripping position to a sheet release position in which it releases the sheet, and actuating means operatively connected with said sucker member for moving said sucker member in said endless path and maintaining its gripping end in a substantially horizontal disposition substantially throughout said second path portion, said actuating means including means for accelerating said sucker member during its movement in said first path portion from said retracted position to its sheet gripping position to bring the speed of the sucker member to approximately the speed of the moving sheet when it reaches its sheet gripping position and for decelerating the sucker member and the sheet gripped thereby during movement of the sucker member in said second path portion from said sheet gripping position to its sheet release position while maintaining said horizontal disposition.

2. A sheet slowdown mechanism, as defined in claim 1, wherein said actuating means is operatively connected to said sucker member to maintain its gripping end in a substantially horizontal disposition substantially throughout said endless path of movement.

3. A sheet slowdown mechanism, as defined in claim 1, wherein said actuating means comprises a pair of parallel links pivotally connected to said sucker member, means for oscillating one of said links about an axis spaced from said sucker member, and means for moving the other of said links vertically while said oscillating means operates to effect movement of said sucker member in said endless path.

4. A sheet slowdown mechanism, as defined in claim 3, wherein said oscillating means comprises a rotatable shaft carrying said one link, a gear carried by said shaft, a gear segment meshing with said gear, cam means for moving said gear segment in one direction to effect movement of said sucker member in its forward run, and spring means for moving said gear segment in a direction to effect movement of said sucker member in its return run.

5. A sheet slowdown mechanism, as defined in claim 1, wherein said actuating means comprises a first actuating mechanism for moving said sucker member in a substantially horizontal direction and a second actuating mechanism for moving said sucker member in a substantially vertical direction, said first and second actuating mechanisms including first and second link members respectively, said link members having one end pivotally connected with the sucker member and the other end operatively connected to separate rotatable drive elements.

6. A sheet slowdown mechanism, as defined in claim 5, wherein said first actuating mechanism includes means for oscillating said first link in opposite directions to cause the sucker member to be moved in opposite horizontal directions and wherein said second link member extends generally parallel to said first link member, and said first actuating mechanism includes a rotatable eccentric means connected to said second link to cause the sucker member to be moved in opposite vertical directions.

7. A sheet slowdown mechanism, as defined in claim 6, wherein said means for accelerating and decelerating the rate of speed of the sucker member comprises a gear segment rotatable in opposite directions and operatively connected with said first link member and a rotatable cam engageable with the gear segment for causing the gear segment to be rotated in one direction at varying rates of speed during a portion of each revolution of the cam.

8. A sheet slowdown mechanism, as defined in claim 1, and further including a suction plate having a sheet engaging surface located adjacent the plane of sheet movement and positioned relative to said sucker path at the sheet gripping position of said sucker member, said surface having ports therein connected with a vacuum source to cause the sheets to be drawn against the surface and to provide a tensioning effect on the sheet as it is pulled across said surface and to position said sheet for gripping by said sucker member.

9. A sheet slowdown mechanism for reducing the rate of speed of a moving generally horizontally disposed sheet comprising a gripper means movable through forward and return runs in an endless path, said path being horizontally elongated with the extent of the movement of the gripper means in a horizontal direction being substantially greater than the extent of its movement in a vertical direction, said gripper means during its path of movement moving from a retracted position spaced from the plane of sheet movement toward the plane of movement of the sheet to a sheet gripping position at which it grips the sheet and from said sheet gripping position to a sheet release position at which it releases the sheet, and an actuating means operatively connected with said gripper means for moving the same in said endless

path and for accelerating said gripper means during its movement from said retracted position to its sheet gripping position to bring the speed of the gripper means to substantially the speed of the moving sheet and for decelerating said gripper means and the sheet gripped thereby during its movement from said sheet gripping position to said sheet release position, said actuating means including a pair of link members pivotally connected at one end to said gripper means for pivotal movement relative thereto about spaced axes and one of said links connected at its other end to means for oscillating said link and the other of said link members connected at its other end to eccentric means for moving said link vertically.

10. A sheet slowdown mechanism, as defined in claim **9**, and wherein said gripper means comprises a sucker member having a sheet gripping end, and wherein said actuating means maintains the gripping end of said sucker member in a substantially horizontal disposition throughout its endless path of movement.

11. A sheet slowdown mechanism for reducing the rate of speed of a moving sheet comprising a sucker member movable through forward and return runs in an endless path, said sucker member during its path of movement moving from a retracted position spaced from the plane of sheet movement toward the plane of movement of the sheet to a sheet gripping position at which it grips the sheet and from said sheet gripping position to a sheet release position at which it releases the sheet, and an actuating means operatively connected with said sucker member for moving said sucker member in said endless path, said actuating means comprising a first actuating mechanism for moving said sucker member in a horizontal direction and a second actuating mechanism for moving said sucker member in a vertical direction with the operation of said first and second actuating mechanisms resulting in said sucker member moving in said endless path, said first and second actuating mechanisms including first and second link members, respectively, having one end pivotally connected with the sucker member at spaced locations and the other end operatively connected with separate rotatable drive elements.

12. A sheet slowdown mechanism, as defined in claim **11**, wherein said sucker member is mounted on a carrier and wherein said link members of said first and said second actuating mechanisms extend generally parallel to one another and are pivotally connected with the carrier at spaced locations thereon.

13. A sheet slowdown mechanism, as defined in claim **11**, wherein said first link member is oscillated in opposite directions to cause said sucker member to be moved back and forth through the horizontal extent of its movement in the endless path and wherein said second link member is pivotally connected with a rotatable eccentric means to cause the sucker member to be moved through the vertical extent of its movement in the endless path.

14. A sheet slowdown mechanism, as defined in claim **13**, further including means for oscillating said first link member comprising a shaft member carrying said link member; a gear fixed on said shaft, and a gear segment meshing with said gear to effect rotation of said shaft upon rotation of said gear segment.

15. A sheet slowdown mechanism, as defined in claim **13**, further including cam means for moving said gear segment to effect movement of said first link to move said sucker member in its forward run, and spring means acting on said gear segment to effect movement of said first link and said sucker member in its reverse run.

16. A sheet slowdown mechanism, as defined in claim **15**, wherein said rotatable eccentric means comprises a crank, and means for rotating said crank comprising a gear train driven in timed relation with the rotation of said cam means.

17. A sheet slowdown mechanism for reducing the rate of speed of a moving generally horizontally disposed sheet comprising a gripper means movable through forward and return runs in a horizontally elongated endless path, said gripper means moving in a first path portion from a retracted position spaced from the plane of sheet movement toward the plane of movement of the sheet to a sheet gripping position at which it grips the sheet and in a second path portion from said sheet gripping position to a sheet release position at which it releases the sheet, said second path portion being substantially greater than said first path portion, an actuating means operatively connected with said gripper means for moving the same in said endless path in a substantially horizontally position, said actuating means including means for accelerating said gripper means during its movement from said retracted position to its sheet gripping position to bring the speed of the gripper means to substantially the speed of the moving sheet for decelerating said gripper means and the sheet gripped thereby during its movement from said sheet gripping position to said sheet release position whereby the deceleration of the gripper means occurs over a greater path than the acceleration thereof.

References Cited

UNITED STATES PATENTS

2,942,878 6/1960 Yingling ---------- 271—79

RICHARD E. AEGERTER, *Primary Examiner.*