United States Patent [19]

Luffy et al.

[11] **3,827,688**

[45] **Aug. 6, 1974**

[54] **SHEET DELIVERY MECHANISM**

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[73] Assignee: **Miller Printing Machinery Co.**, Pittsburgh, Pa.

[22] Filed: **Feb. 23, 1973**

[21] Appl. No.: **335,253**

[52] **U.S. Cl.** **271/203**, 198/180, 271/204

[51] **Int. Cl.** **B65h 29/04**

[58] **Field of Search** 271/79, 68, 69, 82, 174, 271/182, 200, 202, 203, 204, 206; 198/180

[56] **References Cited**

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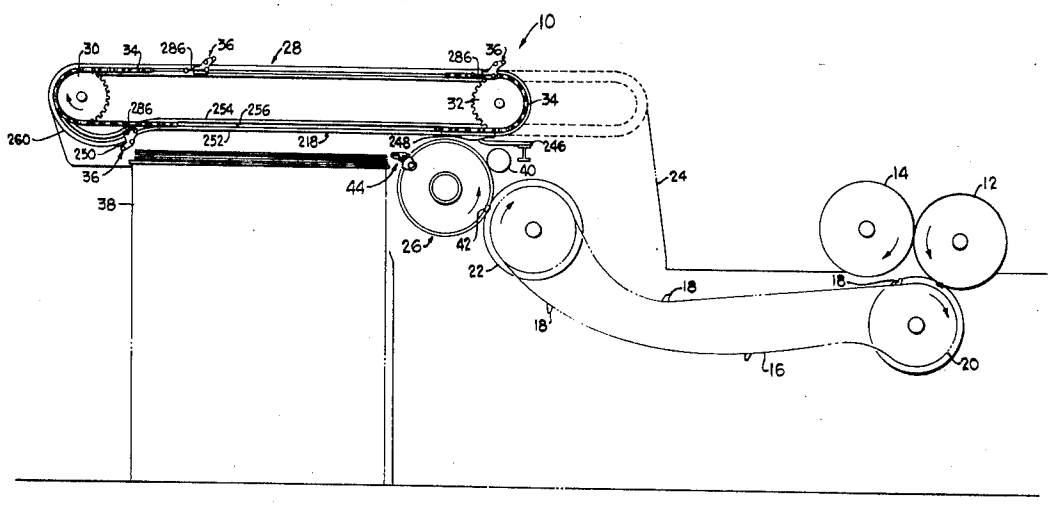
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Primary Examiner—Richard A. Schacher
Assistant Examiner—Bruce H. Stoner, Jr.
Attorney, Agent, or Firm—Stanley J. Price, Jr.

[57] **ABSTRACT**

A frame member having longitudinal side members and transverse connecting members is movably supported on the side frame members of the press so that the frame member can be moved longitudinally relative to the transfer cylinder positioned therebelow. A drive shaft is rotatably journaled in the frame side members and has a plurality of drive sprockets mounted thereon in spaced relation to each other. Idler sprockets are supported from the rear transverse frame member and endless chains are reeved about the sprockets. Endless gripper guides are positioned adjacent the respective chains and have an inner rail and an outer rail with a guide track therebetween. The gripper guide has an intermediate portion at substantially the same elevation as the lower horizontal portion of the endless chains and a downwardly, depending, arcuate front portion that extends below the path of the endless chain. The gripper device that includes a pair of plates positioned on opposite sides of the gripper device has a pair of roller members positioned in the gripper track and secure the plates to each other. One of the plates has a depending arm member with a sheet gripper connected to the lower end portion of the arm. The gripper is arranged to engage the front edge of the sheet. The gripper device is connected to the adjacent chain by means of rods so that the chains propel the gripper device in the gripper track. As the gripper device is moved into the downwardly, depending, arcuate portion of the gripper track the forward velocity of the gripper device is reduced below the forward velocity of the chain connected thereto. Further, the depending arm on the plate member pivots rearwardly as it traverses the downwardly, depending, arcuate portion of the gripper track to further reduce the forward velocity of the gripper device while the chain is driven at a relatively constant velocity.

7 Claims, 19 Drawing Figures



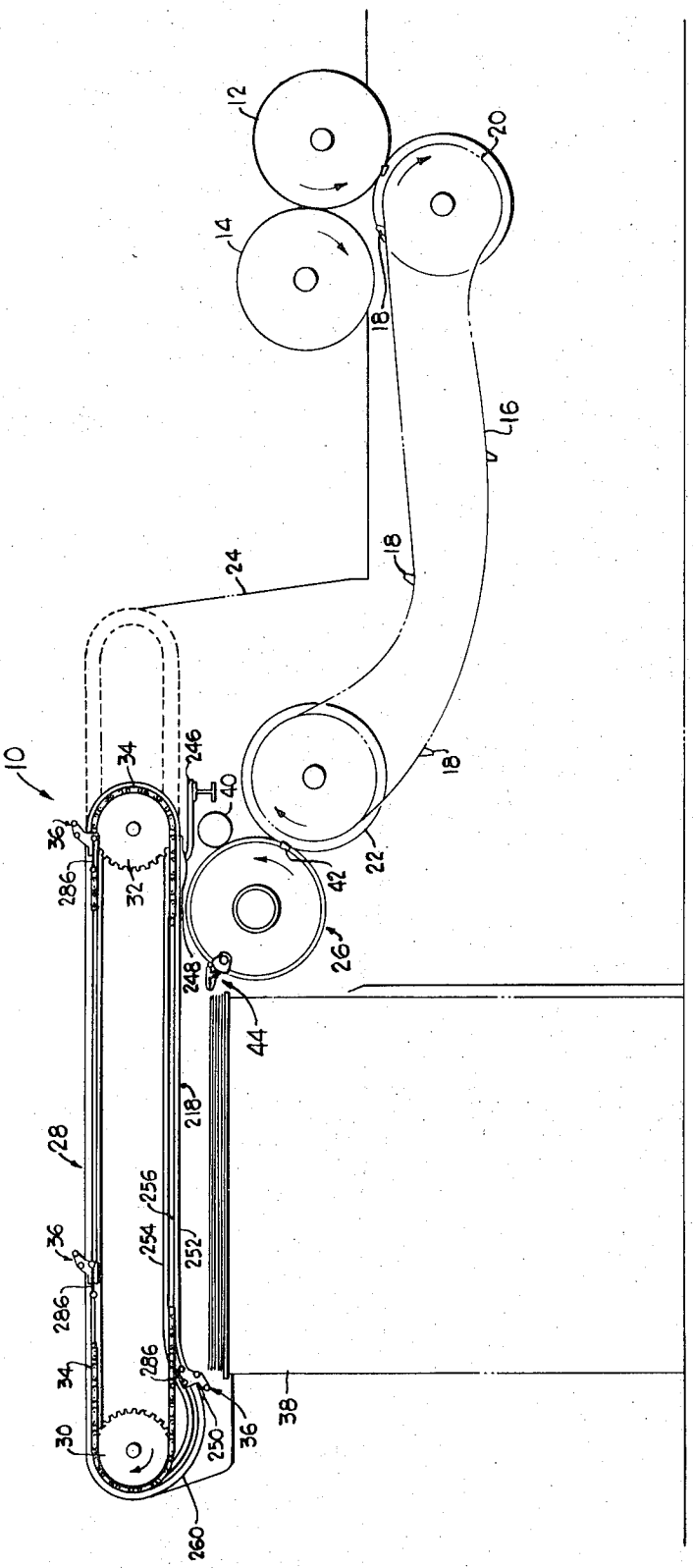

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Fig. 1.

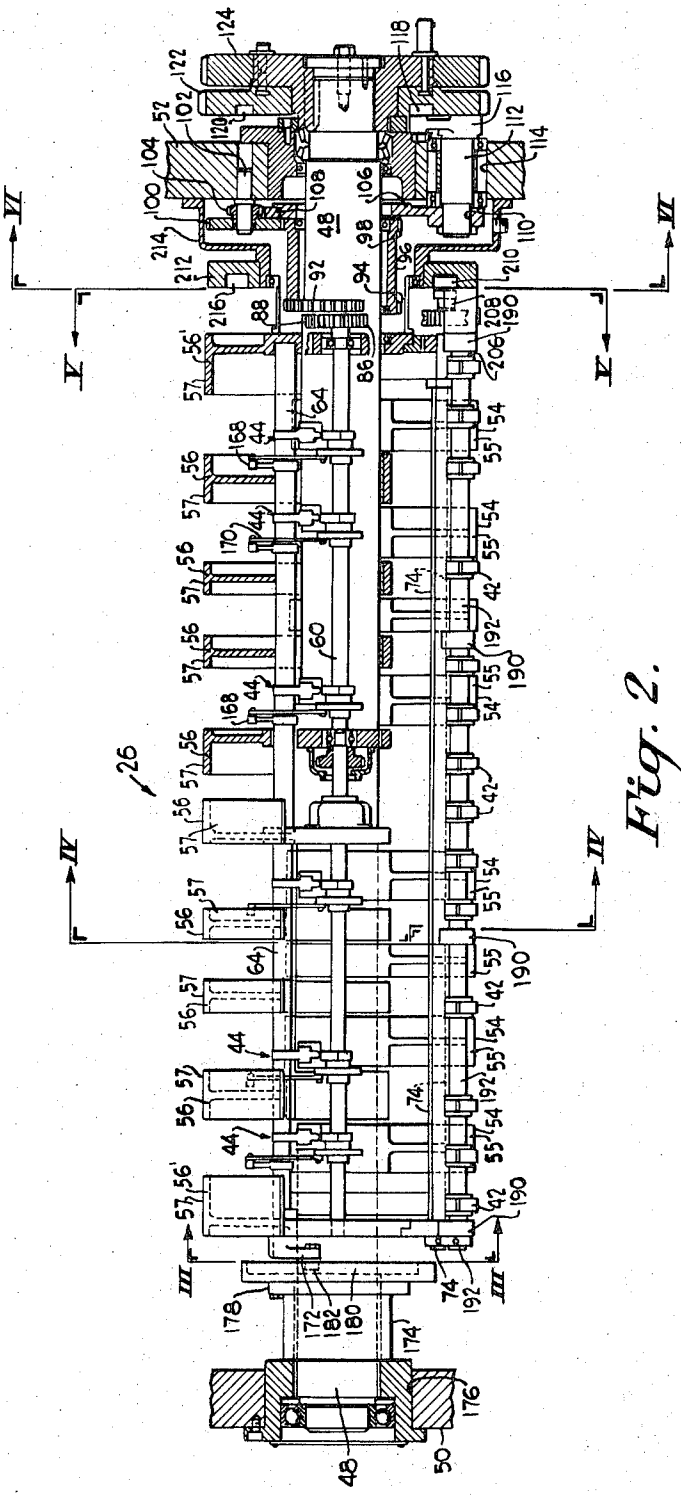


Fig. 2.

Fig. 3.

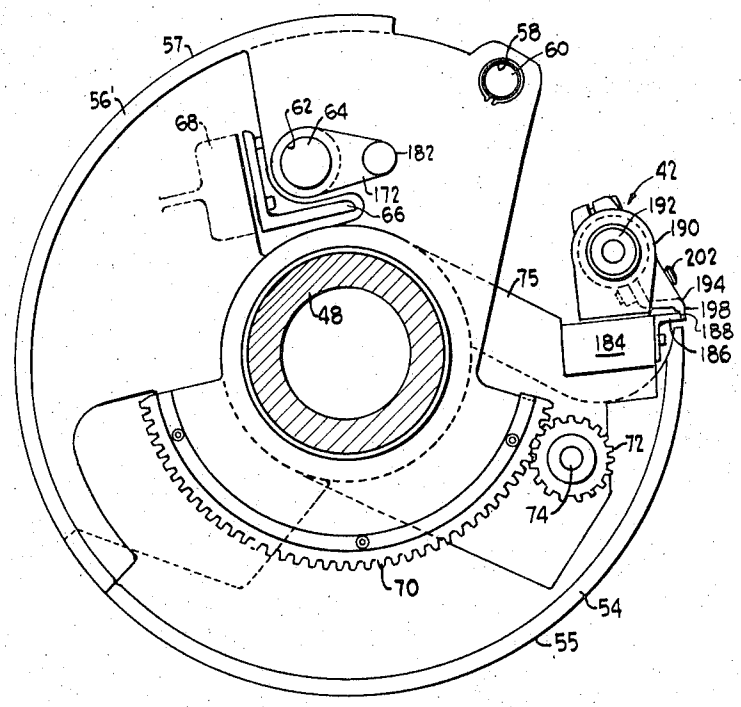
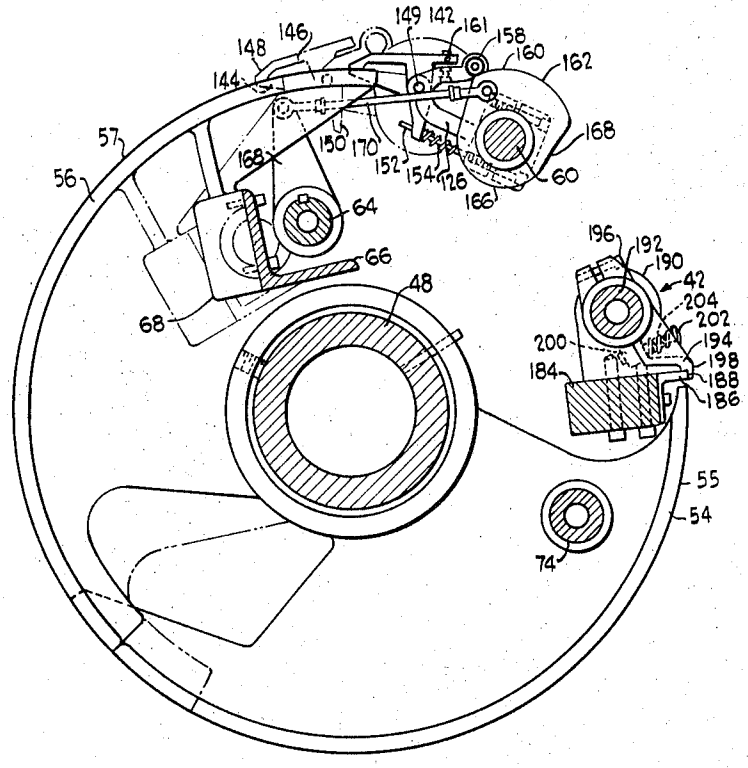

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Fig. 4.


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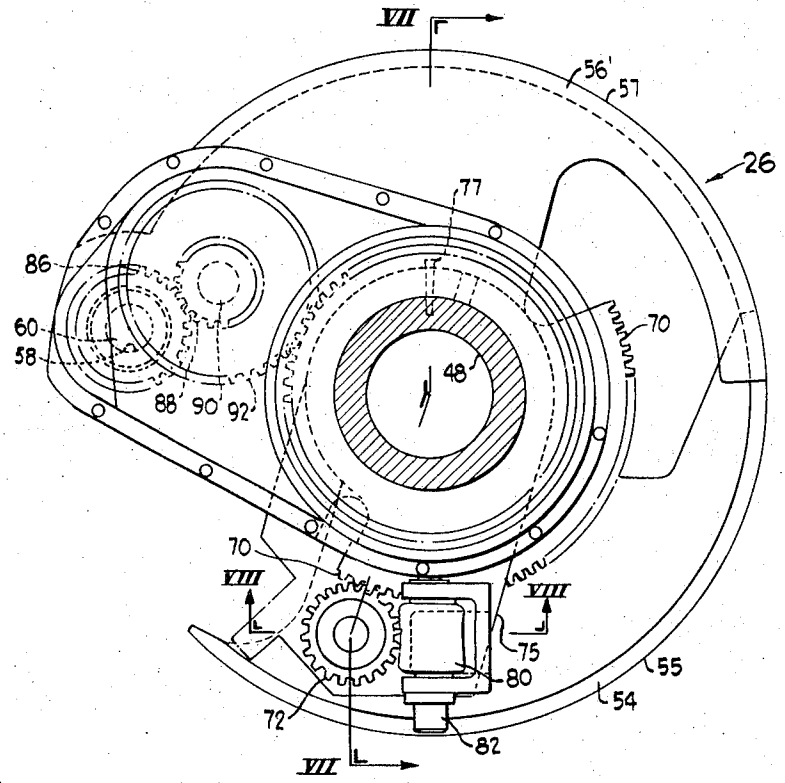


Fig. 5.

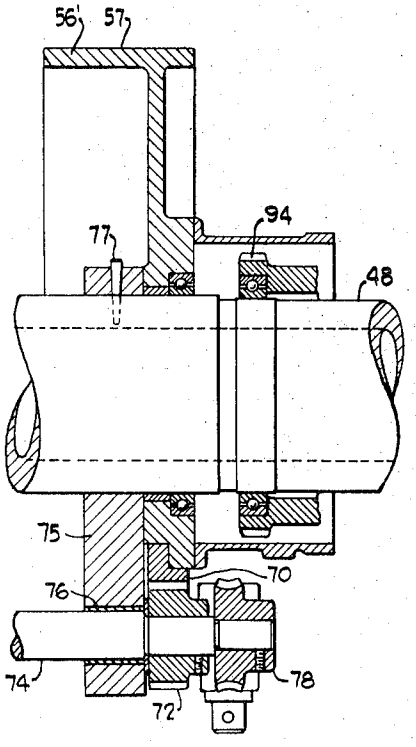


Fig. 7.

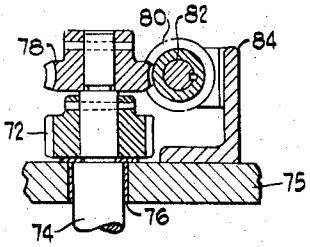


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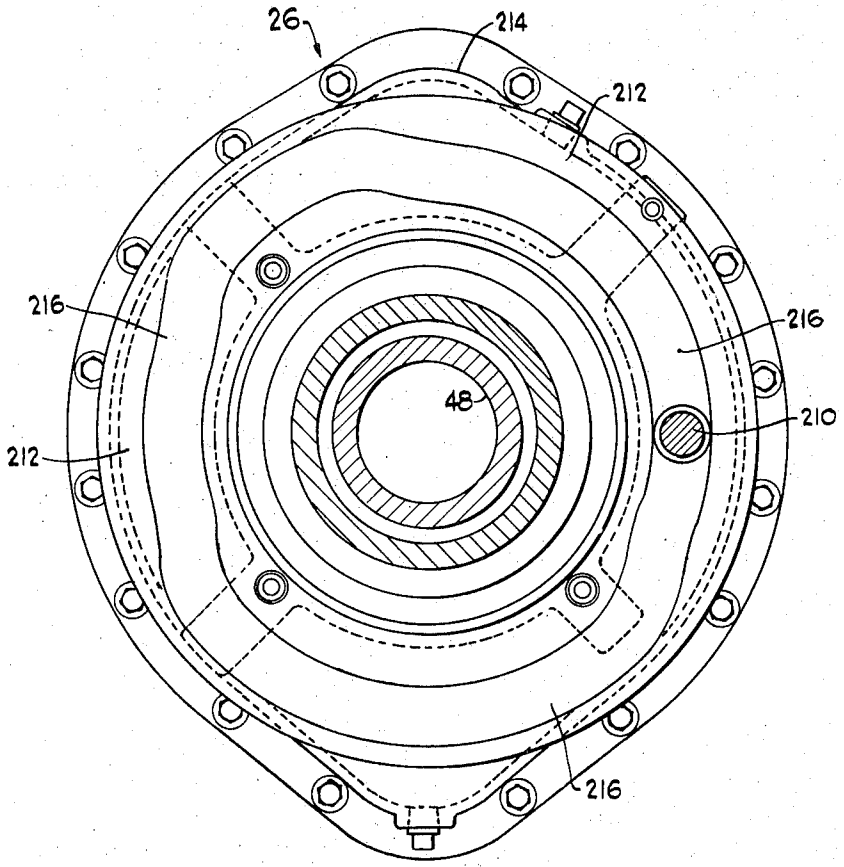


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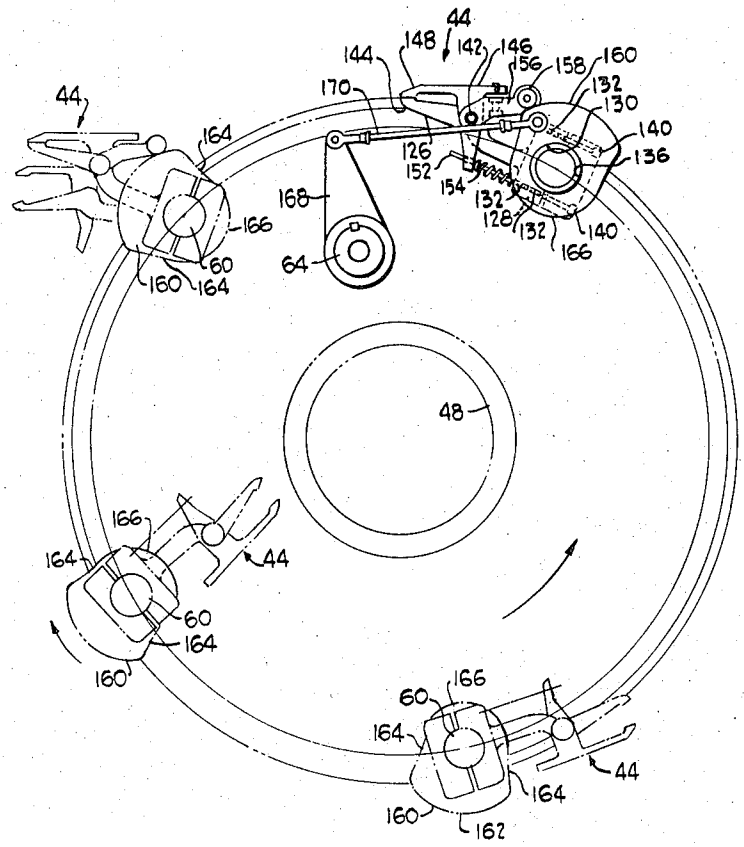


Fig. 9.

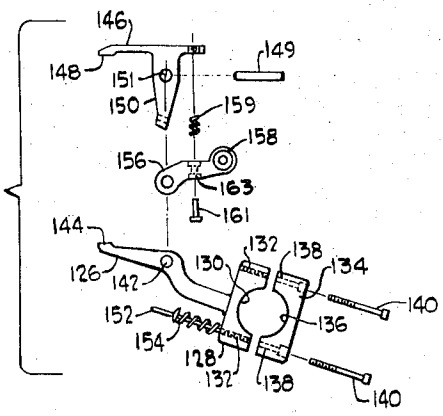


Fig. 9a.

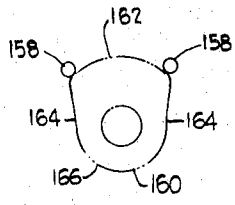


Fig. 9b.

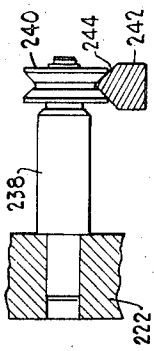


Fig. 11.

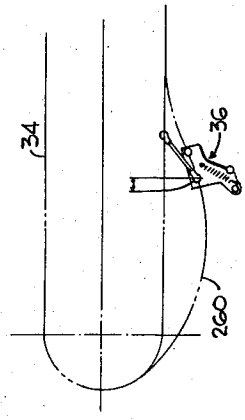


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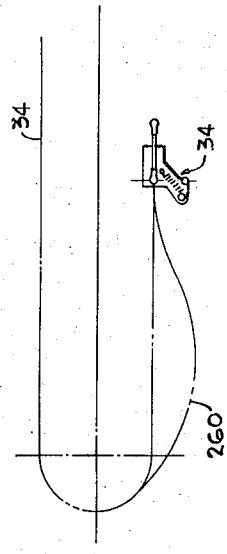


Fig. 16.

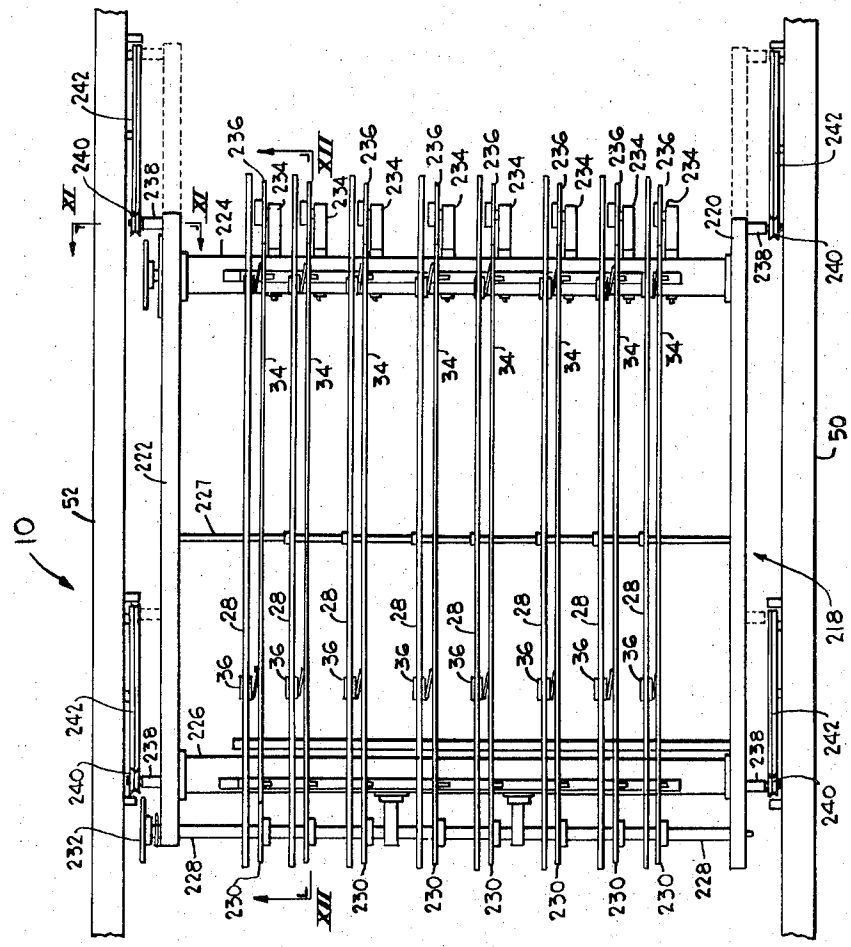


Fig. 10.

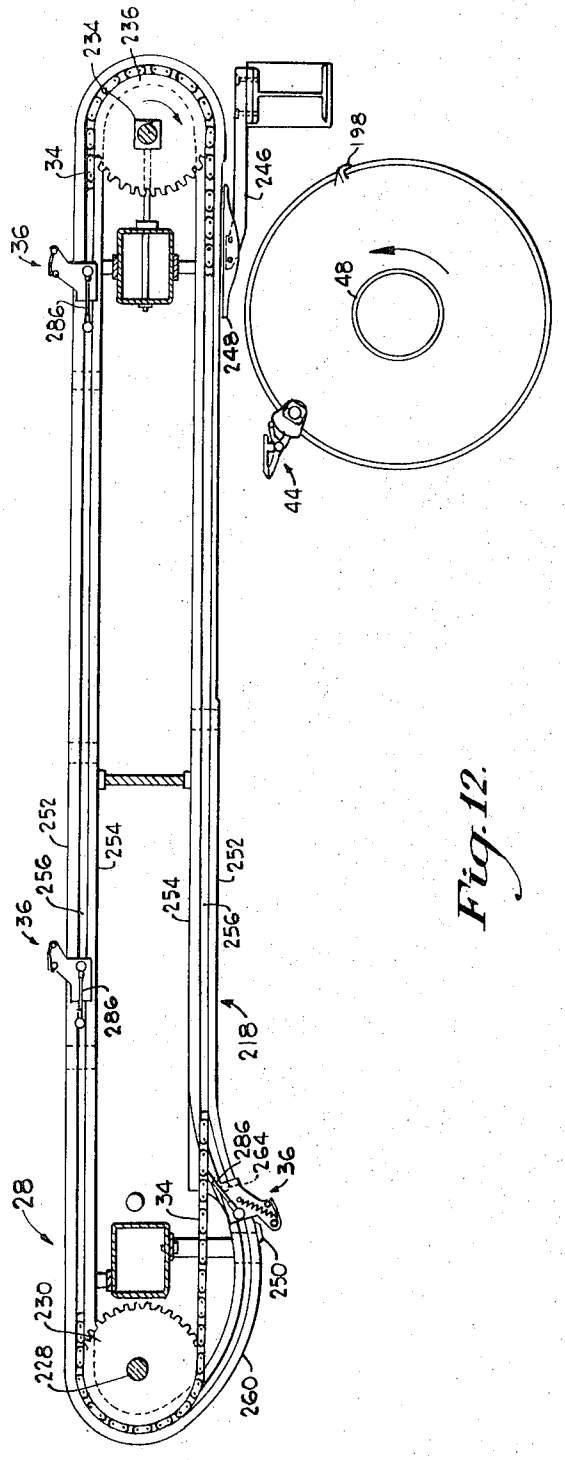


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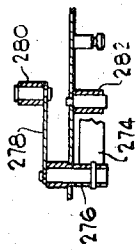


Fig. 15.

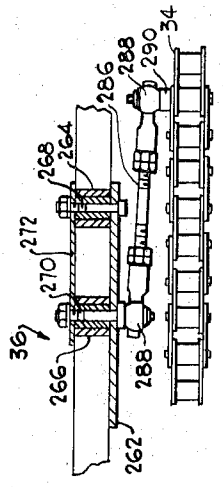


Fig. 14

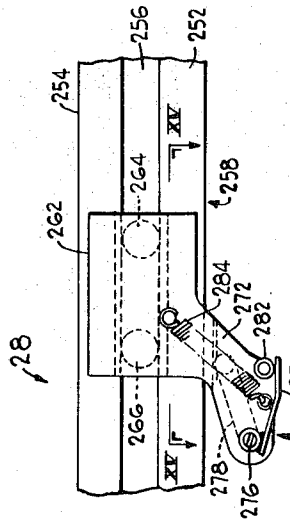


Fig. 13

SHEET DELIVERY MECHANISM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a sheet delivery mechanism and more particularly to a sheet slowdown mechanism.

2. Description of the Prior Art

In delivering freshly printed sheets it is essential that the rate of travel of the sheet being deposited on a delivery pile be slowed down to reduce the forward inertia of the sheet. Apparatus has been provided in the past to slowdown the rate of travel of the sheet. For example, U.S. Pat. No. 3,378,256 discloses suction devices that engage the rear edge of the sheet to reduce the forward rate of travel of a sheet. U.S. Pat. No. 2,093,228 also discloses a similar device.

With large sheets it is desirable to slowdown the front edge of the sheet as the sheet is deposited on the pile. West German Pat. No. 1,119,300 illustrates an auxiliary gripper device that engages the front edge of the sheet adjacent the front edge of the pile and reduces the forward velocity of the sheet and deposits the sheet on the delivery pile.

In order to reduce the forward rate of travel of the sheet it has been proposed in the past to have the endless chain follow an arcuate path adjacent the front edge of the delivery pile so that the forward rate of travel of the gripper device is reduced as it follows the arcuate path of the chain. The amount of slowdown that the arcuate chain arrangement may accomplish is limited and with large sized sheets and high speed presses additional slowdown is essential to prevent disturbances and fluttering of the sheets. There is a need for a slowdown apparatus that permits the press to operate at high speeds and the sheets to be efficiently deposited on a delivery pile.

SUMMARY OF THE INVENTION

This invention relates to a sheet delivery mechanism that has a frame member supported in overlying relation with a pile of sheets. A plurality of endless chains are positioned in spaced relation to each other and are reeved about drive sprockets and idler sprockets. Means are provided to drive the endless chains at a preselected substantially constant velocity. Endless guide means are positioned adjacent to the endless chains and have an intermediate portion at substantially the same elevation as the lower horizontal portion of the endless chains. The guide means has a front arcuate, downwardly depending portion adapted to be positioned adjacent the front edge of the pile. Gripper means are movably positioned in the guide means and are connected to the endless chains by articulated means so that the endless chains propel the gripper means in the endless guide means. The gripper means are arranged to engage the front edge of a sheet and to convey the sheet at a velocity substantially the same as the velocity of the endless chains to a position adjacent the front arcuate, downwardly depending portion of the guide means and the gripper means are further operable while traversing the front arcuate, downwardly depending portion of the guide means to reduce the forward velocity of the gripper means below the velocity of the endless chains.

The gripper means includes a first plate member positioned on one side of the guide means and a second plate member positioned on the opposite side of the guide means. Connecting means extend through the guide means and connect the plates to each other. One of the plates has a downwardly extending arm member with a gripper device connected to the lower portion thereof. The downwardly depending arm member is arranged to be displaced rearwardly as the gripper means traverses the front arcuate, downwardly depending portion of the guide means to further reduce the forward velocity of the gripper device. With this arrangement the gripper device deviates downwardly from the path of the chain to reduce the forward travel of the gripper device and further the gripper device is displaced rearwardly during travel in the downwardly depending portion of the guide track to further reduce the forward velocity of the gripper means.

Accordingly, the principal object of this invention is to provide a sheet slowdown device where the gripper means deviates from the path of the endless drive chain.

Another object of this invention is to displace the gripper means rearwardly to reduce the forward travel of the gripper means.

These and other objects of this invention will be more completely disclosed and described in the following specification, the accompanying drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram of the delivery apparatus and the relative position of the delivery apparatus to the impression and blanket cylinders of the last printing unit.

FIG. **2** is a view in section of the transfer cylinder that engages the front edge and trailing edge of the sheet and transfers the front edge of the sheet to grippers on a delivery conveyor.

FIG. **3** is a view in section taken along the line III—III of FIG. **2**, illustrating the manner in which the segments of the transfer cylinder can be rotated relative to each other to adjust the peripheral distance between the sheet front edge gripper and the sheet tail edge gripper.

FIG. **4** is a view in section taken along the line IV—IV of FIG. **2**, illustrating the relative position of the front edge gripper and tail edge gripper and in phantom lines an adjusted position of the tail edge gripper to reduce the peripheral distance between the respective grippers around the transfer cylinder.

FIG. **5** is a view in section taken along the line V—V of FIG. **2**, illustrating the apparatus to rotate the shaft having the tail edge grippers mounted thereon.

FIG. **6** is a view in section taken along the line VI—VI of FIG. **2**, illustrating the endless cam track for the cam follower connected through a lever to a shaft that is arranged to open and close the front edge grippers.

FIG. **7** is a view in section taken along the line VII—VII of FIG. **5**, illustrating another portion of the apparatus for adjusting the peripheral distance between the front edge and tail edge grippers.

FIG. **8** is a view in section taken along the line VIII—VIII of FIG. **5**.

FIG. 9 is a schematic view, illustrating the path of the tail edge grippers during a single revolution of the transfer cylinder.

FIG. 9*a* is an exploded view of the elements of the tail edge gripper.

FIG. 9*b* is an enlarged view in elevation of tail edge cam illustrating in phantom the position of the cam follower where the gripper closes on the sheet and opens to release the sheet.

FIG. 10 is a top plan view of the frame having the chains and gripper guides or tracks for delivering the sheet from the transfer cylinder to the pile.

FIG. 11 is a view in section taken along the line XI—XI of FIG. 10, illustrating the manner in which the frame is adjustable longitudinally for different sized sheets.

FIG. 12 is a fragmentary view in side elevation, illustrating one of the gripper guide tracks and the relative position of the frame to the transfer cylinder.

FIG. 13 is a fragmentary view in section of a gripper positioned in the gripper guide.

FIG. 14 is a fragmentary top plan view, illustrating the manner in which the grippers are connected to the chain.

FIG. 15 is a fragmentary view in section taken along the line XV—XV of FIG. 13, illustrating in detail the actuator for opening the individual grippers.

FIG. 16 is a schematic illustration of a gripper as the gripper enters the arcuate portion of the gripper guides before the gripper beings to slow down.

FIG. 17 is a view similar to FIG. 16, illustrating the gripper in the slowed down position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, there is schematically illustrated a sheet delivery mechanism generally designated by the numeral 10 that is positioned adjacent to the delivery end of a printing press having an impression cylinder 12 and a blanket cylinder 14. An endless chain 16 has a plurality of gripper bars 18 connected thereto and is reeved about a drive sprocket 20 and an idler sprocket 22. The drive sprocket 20 is positioned adjacent to the impression cylinder 12 and the grippers on gripper bars 18 are arranged to engage the front edge of the sheet as the sheet is positioned on the impression cylinder and being printed on the outer surface by blanket cylinder 14.

The gripper bars 18 have a velocity substantially the same as the peripheral velocity of the impression cylinder 12 as the grippers on gripper bar 18 engage the front edge of the sheet and convey the sheet along the path indicated by the chain 16 and up to the sprocket 22. The sprocket 22 is mounted on a shaft that is, in turn, supported in a delivery frame 24 that has a transfer cylinder 26 rotatably mounted adjacent thereto. A plurality of delivery chains 34 are mounted above the transfer cylinder 26 and have a chain sprockets 30 and 32 with the endless chains 34 reeved therearound. Adjacent to the chains 34 are a plurality of gripper tracks 28 with grippers 36 mounted therein. Grippers 36 are connected to the delivery chains 34 by a push rod as later explained.

The grippers 36 in the gripper tracks 28 are arranged to engage the front edge of the sheet while the sheet is on the transfer cylinder 26 and convey the sheet forwardly and deposit the sheet on the pile 38. A slitter mechanism 40 is positioned adjacent the transfer cylinder 26 and is arranged to slit the sheets longitudinally before the sheets are deposited on the pile 38. As illustrated in FIG. 1, the chains 34 and gripper tracks 28 are movable longitudinally relative to the transfer cylinder 26 to accommodate sheets of different length.

The sheet transported by the grippers on gripper bar 18 on the first chain 16 is arranged to be transferred to front edge grippers 42 of transfer cylinder 26, as schematically illustrated in FIG. 1 and illustrated in greater detail in FIGS. 3, 4 and 12. Further rotation of transfer cylinder 26 transfers the front edge of the sheet from the front edge grippers 42 on transfer cylinder 26 to the front edge grippers 36 in gripper tracks 28 associated with the second endless chains 34. The front edge of the sheet is then conveyed forwardly toward the pile 38 by the grippers 36 in gripper track 28 and the front edge grippers 36 in gripper track 28 release the sheet as it is deposited on the pile. As the tail edge of the sheet approaches the point of tangency between the transfer cylinder 26 and the first chains 16, the tail edge of the sheet is engaged by the tail edge grippers 44. The tail edge grippers 44, as illustrated in FIG. 9, move outwardly beyond the periphery of the transfer cylinder 26 while engaged to the tail edge of the sheet to slow down the sheet and release the sheet as it is deposited on the pile.

With this arrangement the sheet is first engaged by the transverse gripper bar 18 while the sheet is on the impression cylinder of the last printing unit. The sheet is conveyed by the transverse gripper bars 18 to the transfer cylinder 26. The front edge of the sheet is transferred from the gripper bars 18 to the lead edge grippers 42 in transfer cylinder 26 and the lead edge grippers 42 in transfer cylinder 26 thereafter transfer the front edge of the sheet to the front edge grippers 36 mounted in the gripper track 28, and the sheet is thereafter conveyed to the pile 38.

The tail edge of the sheet is engaged by the tail edge grippers 44 on transfer cylinder 26 and the tail edge of the sheet remains engaged by the tail edge grippers 44 until the sheet is in substantially overlying relation with the pile 38. The grippers 36 first release the sheet to deposit it on the pile and thereafter the tail edge of the sheet is released by the tail edge grippers 44 to permit the sheet to be deposited on the pile without disturbances or flutter.

The transfer cylinder generally designated by the numeral 26 is illustrated in detail in FIGS. 2 — 9 and includes a cylinder shaft 48 rotatably journaled in side frames 50 and 52. The side of the delivery mechanism 10, including the side frame 50, will also be referred to as the operator's side of the press and the delivery mechanism and the opposite side having the side frame 52 will also be referred to as the drive side of the press.

Nonrotatably mounted on the shaft 48 are a plurality of spaced cylindrical segments 54 illustrated in FIGS. 3, 4 and 5. The spaced cylindrical segments 54 have cylindrical sheet supporting surfaces 55 and the segments 54 will also be referred to as segments or discs associated with the front edge grippers. Positioned between the cylindrical segments 54 are other cylindrical segments 56 associated with the tail edge grippers and will also be referred to as segments or discs associated with the tail edge grippers. The discs 56 also have cylindrical sheet supporting surfaces 57 and are adjustably

mounted on the shaft **48.** The discs **56** are arranged to rotate about the shaft **48** to increase or decrease the peripheral distance around the cylinder between the front edge grippers **42** and tail edge grippers **44.**

The end discs **56'** adjacent to the frames **50** and **52** are illustrated in FIGS. **3** and **5.** The end discs **56'** have bores **58** therethrough for receiving the tail edge gripper support shaft **60** and bores **62** to receive the tail edge gripper actuator shaft **64.** The intermediate discs **56,** as illustrated in FIG. **4,** are connected to the end discs **56'** by the angle **66** extending longitudinally in the cylinder **26** and secured to pads **68** on each of the discs **56** and **56'.** With this arrangement rotation of the ends discs **56'** about the shaft **48** rotate all of the discs **56** and **56'** the same amount, so that all of the tail edge grippers **44** remain aligned linearly in various positions of adjustment of the tail edge grippers **44** to the front edge grippers **42.**

The discs **56** and **56'** are rotated about the shaft by an adjustment mechanism illustrated in FIGS. **3, 5, 7** and **8.** The end discs **56'** include a gear segment **70** that meshes with a pair of gears **72** mounted on shaft **74.** The shaft **74** is, in turn, journaled in aperture **76** in fixed shaft support **75** located adjacent the end discs **56'** and nonrotatably secured to the shaft **48** by means of pin **77,** as illustrated in dotted line in FIG. **5.** With this arrangement the rotation of gear **72,** because of its meshing relation with the gear segment **70,** rotates the end discs **56'** about the shaft **48** to change the peripheral distance between the tail edge grippers **44** and the front edge grippers **42.** The manner in which the tail edge grippers **44** are rotated about the shaft **48** to reduce the distance between the tail edge grippers **44** and the front edge grippers **42** is illustrated in phantom lines in FIG. **4.**

The shaft **74** has an adjusting gear **78** (FIGS. **7** and **8**) secured to an end portion thereof adjacent the drive side of the press. The gear **78** meshes with a worm gear **80** mounted on a shaft **82.** The shaft **82** is, in turn, supported on a shaft support **84** secured to the adjusting shaft support **75.** The shaft **82** has an end portion arranged to be engaged by a crank to rotate the gear **80** which, in turn, through gear **78** rotates adjusting shaft **74.** The rotation of shaft **74** rotates the gears **72** to thus rotate the end discs **56'** and the intermediate discs **56** connected thereto to change the peripheral distance between the front edge grippers **42** and the tail edge grippers **44.**

As illustrated in FIG. **9,** the tail edge gripper support shaft **60** is arranged to rotate or revolve relative to the main shaft **48,** so that the tail edge grippers revolve with the shaft **60** and make one complete revolution per revolution of the shaft **48.** The tail edge gripper support shaft **60** and the tail edge grippers **44** revolve at a variable angular velocity during the revolution of the transfer cylinder main shaft **48** to extend the tail edge grippers beyond the periphery of the transfer cylinder **26,** as later described. The rotation of the tail edge gripper support shaft **60** is controlled by a cam and gear mechanism illustrated in FIGS. **2** and **5.**

Referring to FIG. **5,** the tail edge gripper support shaft **60** adjacent the drive side has a spur gear **86** nonrotatably secured thereto. The spur gear **86** meshes with a spur gear of reduced diameter **88** rotatably mounted on a suitable shaft **90** positioned radially inwardly of the tail edge gripper support shaft **60.** Nonrotatably secured to gear **88** is a large spur gear **92** which meshes with a ring gear **94** that extends around the transfer cylinder shaft **48.** The ring gear **94** is, in turn, connected to the end of a cylindrical member **96** that has a second ring gear **98** on the outboard end adjacent the frame **52.** The cylindrical member **96** is supported by bearings on shaft **48.**

A spur gear **100** is nonrotatably mounted to a smaller diameter gear **104.** Gear **104** is rotatably mounted to shaft **102** journaled in the side frame **52.** An arm **106** extends around the transfer cylinder shaft **48** and has a gear segment **108** meshing with the spur gear **104.** The arm **106** has a bore **110** through which shaft **112** extends. The shaft **112** is nonrotatably secured to the arm **106** and is rotatably journaled in bore **114** of side frame **52.** A lever arm **116** is nonrotatably secured to the other end of shaft **112** and has a cam follower **118** secured thereto. The cam follower **118** is, in turn, positioned in the endless cam track **120** on gear **122.** The gear **122** is secured to drive gear **124** which rotates therewith. The gear **122** is adjustable radially on gear **124** for different size sheets. The gear **124** is secured to the transfer cylinder shaft **48** and transmits rotation to shaft **48** at a constant angular velocity. The cam follower **118,** by means of cam track **120,** pivots the arm **116** to oscillate the shaft **112** and through the arm **106** with gear segment **108** and gear train **104, 100, 98, 94, 92, 88** and **86** revolves the tail edge gripper support shaft **60** at a non-uniform angular velocity to position the tail edge gripper shaft as illustrated in FIG. **9.**

The tail edge grippers generally designated by the numeral **44** are illustrated in detail in FIGS. **4, 9, 9**a and **9**b and include a first arm **126** that has an end portion **128** with a semi-circular recess **130** having substantially the same diameter as the tail edge gripper support shaft **60** and longitudinally threaded bores **132** therethrough. A clamp end portion **134** has a similar circular recessed portion **136** and longitudinal bores **138** therethrough. The clamp end portion **134** is positioned in overlying relation to the arm end portion **128** and bolts **140** extend through the respective apertures to nonrotatably clamp the arm **126** to the tail edge gripper support shaft **60.** The arm **126** has an aperture **142** intermediate the end portions and a gripper pad end portion **144** on which the tail edge of the sheet is arranged to be positioned.

A gripper arm **146** has a gripper finger end portion **148** and a dependent intermediate arm **150.** The dependent intermediate arm **150** has a pivot aperture **151** therethrough arranged in overlying relation with the pivot aperture **142** in arm **126.** A pin **149** extends through the apertures and pivotally connects the arm **126** to the arm **146,** so that the gripper finger end portion **148** is arranged to move toward and away from the gripper pad **144.** A pin **152** extends through the lower portion of arm **150** and is secured at the other end to the enlarged end portion **128** of arm **126.** A spring **154** is positioned between the arm **150** and the other end portion **128** of arm **126** is arranged as viewed in FIG. **4** to pivot the arm **146** in a clockwise direction to move the gripper finger **148** away from the gripper pad **144** to thus open the tail edge grippers **44.** With this arrangement, the spring **154** continually urges the gripper finger **148** away from the gripper pad **144.**

A plate member **156** is secured to the arm **146** and is arranged to pivot therewith about the pivot pin **149** and has a cam follower **158** thereon. A spring **159** is positioned on pin **161** and the pin **161** is positioned in re-

cess **163** in plate **156.** The pin **161** is secured to arm **146** and is operable to adjust the gripper **44** for different sheet thickness. The cam follower **158** is arranged to abut a surface of a cam **160** rotatably positioned on the tail edge gripper support shaft **60.** With this arrangement, the spring **154** urges the gripper finger **148** toward an open position and further urges the cam follower **158** into abutting relation with the surface of the cam **160.**

The cam **160,** as illustrated in FIGS. **3, 9** and **9***b*, has a first arcuate surface **162** which is spaced a sufficient distance from the axis of shaft **60** to maintain the tail edge grippers **44** in a closed position where the gripper finger **148** abuts the gripper pad **144.** The cam **160** has other cam surfaces **164,** which permit the gripper finger **148** to move from a full open position to a full closed position, and a surface **166** that permits the gripper finger **148** to move into a full open position under the tension exerted by the spring **154.** With this arrangement the tail edge grippers **44** are opened and closed by the relative position of the cam discs **160** associated with each tail edge gripper **44.** The discs **160** are rotatably positioned on the tail edge gripper support shaft **60** so that the cams **160** can rotate about the shaft **60.**

The relative position of the cams **160** on the tail edge gripper support shaft **60** is controlled by shaft **64** illustrated in FIGS. **3, 4, 9** and **9***b*. The tail edge gripper actuator shaft **64** has a plurality of levers **168** nonrotatably secured thereto. The levers **168** are connected at their end portion by means of rods **170** to the respective cams **160.** With this arrangement rotation of shaft **64** relative to shaft **60** rotates the cam **160** to open and close the tail edge grippers **44.** The shaft **64** is suitably journaled in the tail edge gripper end discs **56'** and has a lever member **172** (FIGS. **2** and **3**) connected to the end portion adjacent the frame **50** on the operator's side of the delivery mechanism. A cylindrical member **174** is journaled in an aperture **176** in side frame **50** and has an axial passageway to rotatably support the transfer cylinder main shaft **48.** The cylindrical member **174** has an enlarged circular end portion **178** with an endless cam track **180** therein. A cam follower **182** is positioned in the cam track **180** and is rotatably connected to lever **172** that is, in turn, connected to the end portion of shaft **64.** With this arrangement, the cam follower **182** follows the endless cam track **180** in the fixed member **174** and pivots the arm **172** to thus rotate the shaft **64** with a preselected angular velocity to open the tail edge grippers **44** as the pad **144** of tail edge grippers **44** moves into underlying relation with the tail edge of the sheet and to thereafter close the tail edge grippers **44** to engage the sheet. Cam track **180** holds lever **168** stationary, as tail end gripper **44** rotates outward from transfer cylinder **26** as previously described, and cam follower **158** moves across surface **162** of cam **160.** When the sheet has been conveyed to a position in substantially overlying relationship with the pile, cam follower **158** leaves cam surface **162** and tail end gripper **44** opens to release the sheet.

The sheet front edge grippers **42** are secured to a block **184** that is in turn, secured to the nonrotatable member **75** which is pinned to shaft **48** (FIG. **7**) by means of bolts. The front edge grippers include an angular member **186** having a radially extending edge portion **188** that serves as a gripper pad. Upstanding shaft supports **190** are secured to the pad **184** and have a front edge gripper pad actuator shaft **192** rotatably supported therein. The front grippers include a gripper arm **194** rotatably positioned on the shaft **192,** as illustrated in FIGS. **3** and **4.** The gripper arm **194** has a gripper finger **198** that is arranged to abut the gripper pad **188** to engage the front edge of a sheet therebetween. Member **200** is clampingly engaged on shaft **192** by bolts **196** and has a pin **202** connected thereto. A spring **204** is positioned between the head of the pin **202** and the surface of the gripper arm **194** for adjustment purposes.

Rotation of shaft **192** opens and closes the front edge grippers **42.** The shaft **192** is journaled in the supports **190** and has an end portion **206** extending beyond the end disc **56'** adjacent the frame **52** on the delivery side of the delivery mechanism. The shaft end portion **206** is nonrotatably connected to a lever mechanism **208** that has a cam follower **210** rotatably secured thereto. A cam member **212** (FIGS. **2** and **6**) is nonrotatably secured to a housing **214** which is, in turn, nonrotatably secured to the frame **52.** The cam member **212** has an endless cam track **216** in which the cam follower **210** connected through lever **208** to shaft **192** is positioned.

Rotation of the transfer cylinder main shaft **48** moves the cam follower **210** in the cam track **216.** The configuration of cam track **216** opens the front edge grippers **42** as the front edge grippers approach the point of tangency between the sprocket **22** and transfer cylinder **26** and close the front edge grippers **42** on the front edge of the sheet as the sheet is transferred thereto from the transverse gripper bars **18** on chain **16.** Thereafter, the cam track **216** maintains the grippers closed and in engagement with the sheet front edge portion until the transfer cylinder has revolved to a position where the grippers **36** are tangent to the transfer cylinder **26.** At that location the cam track **216** opens the front edge grippers **42,** so that the front edge of the sheet may be transferred to the grippers **36.**

Referring to FIGS. **10** and **12** there is illustrated in top plan and side elevation a frame member generally designated by the numeral **218** that includes a side member **220** adjacent the press operator's side frame **50** and a side member **222** adjacent the drive side frame **52.** The frame **218** has transverse members **224** and **226** secured to the respective side members **220** and **222** in spaced relation to each other. An intermediate support member **227** is also positioned between side members **220** and **222.** A sprocket drive shaft **228** is suitably journaled in the side frame members **220** and **222** in spaced relation to each other. A plurality of sprockets **230** are mounted on the sprocket drive shaft **228** for rotation therewith. Sprocket **232** connected to the end portion of shaft **228** is suitably connected to a drive mechanism and is arranged to rotate at a preselected linear speed.

Extending rearwardly from the transverse member **224** are a plurality of sprocket supports **234** on which are rotatably mounted idler sprockets **236.** A plurality of endless chains **34,** previously described, are reeved about drive sprockets **230** and idler sprockets **236.** The endless chains **34** are arranged to be driven at a preselected speed that is coordinated with the press speed. Positioned adjacent to the respective chains **34** are a plurality of endless gripper tracks or guides **28** in which the grippers generally designated by the numeral **36** are positioned. As later described, the grippers **36** are con-

nected to the adjacent endless chains, so that the endless chains **34** propel the grippers **36** in the gripper tracks **28.**

The frame **218,** which supports the endless chains **34** and gripper trackes **28,** is movable longitudinally relative to the transfer cylinder **26,** as illustrated in FIG. **12.** The frame **218** has laterally extending shafts **238** with rollers **240** rotatably mounted thereon. The rollers **240** have annular V shaped recessed portions therein. As illustrated in FIG. **11,** the rollers **240** are supported on members **242** that have an upstanding pointed portions **244** extending into the annular V shaped recessed portions of rollers **240.** The members **242** are, in turn, supported by the side frames **50** and **52.** With this arrangement the frame **218** is movable longitudinally relative to the side frames **50** and **52** and the transfer cylinder **26** mounted thereon. The longitudinal adjustment of the frame **218** with the sheet delivery mechanism positioned thereon permits adjustment for delivery of different sized sheets without relative movement of the transfer cylinder **26.**

As illustrated in FIG. **12,** a beam member secured to the frames **50** and **52** has a forwardly extending arm **246** on which cam members **248** are positioned. The cam members **248** are arranged to open and close the grippers generally designated by the numeral **36** so that the grippers **36** engage the leading edge of the sheet as it is transferred by the transfer cylinder **26.** It should be noted that the cam member **248** remains fixed relative to the transfer cylinder **26** and longitudinal movement of frame **218** does not change the location at which the grippers **36** open to engage the sheet. Secured to the frame transverse member **226** are cam members **250** which are arranged to open the grippers **36** and release the front edge of the sheet as the sheet is deposited on the pile. It should be noted that the cam actuator **250** for opening the grippers **36** moves longitudinally with the frame **218.**

One of the gripper tracks **28** is illustrated in detail in FIG. **12** and includes an outer rail **252** and a parallel inner rail **254** with a space **256** therebetween. The endless gripper track **28** has an intermediate lower portion **258** along which the gripper **36** is conveyed to a front portion generally designated by the numeral **260.** The intermediate lower portion **258** is at substantially the same elevation as the lower strand of endless chain **34** and the gripper track front portion **260** deviates downwardly along an arcuate path from the path followed by the chain **34.** The gripper **36** positioned in the gripper track thus follows the downwardly extending arcuate track front end portion **260** and, as later explained, slows down the forward velocity of the sheet as it is released.

The gripper **36** is illustrated in detail in FIGS. **13 – 17** and includes a first plate member **262** with a pair of rollers **264** and **266** positioned in the track opening **256.** The rollers have shafts **268** and **270** that are secured to a second plate **272** on the opposite side of the gripper track **28.** With this arrangement the plate **262** follows the path of the gripper track **256.** The plate **262** has a depending arm portion **272** with a gripper finger **274** pivotally secured thereto about pivot pin **276.** A lever **278** is connected through pivot pin **276** to gripper finger **274** and has a cam follower **280** secured to the end portion thereof. A gripper pad **282** is secured to the plate depending arm portion **272** and the gripper finger **274** is arranged to abut the pad **282** and hold the front edge of the sheet therebetween. A spring **284** is connected to the gripper **274** and plate **262** to urge the gripper finger **274** into abutting relation with the gripper pad **282.** With this arrangement the lever **278** through cam follower **280** is arranged to move the gripper finger **274** away from the gripper pad **282** in response to cam surfaces **248** and **250.**

The grippers **36** are connected to the respective adjacent chains **34** by an adjustable push rod **286** connected through ball type joints **288** to respective shafts **290** on chain **34** and shaft **270** on grippers **36.** With this arrangement the grippers **36** are propelled by the respective adjacent chains **34** and open adjacent the transfer cylinder **26** to engage the front edge of the sheet and propel the sheet toward the front edge of the frame **218** where the cam **250** opens the grippers **36** and releases the sheet.

The grippers **36** by following the arcuate portion **260** of the cam track are arranged to slowdown the forward movement of the sheet as the chains **34** continue to move at the same velocity. As the gripper **36** is pushed into the arcuate portion **260** of track **256** one end of the rod **286** follows the chain path while the other end of the rod follows the arcuate portion **260** of the cam track. The counterclockwise motion of the push rod, as illustrated in FIGS. **16** and **17,** slows down the entire gripper assembly relative to chain speed because the gripper assembly traverses a greater linear distance than the propelling chain reeved about sprockets **230** and **236.**

In addition, the two rollers **264** and **266** in the gripper assembly **36** follow th arcuate downwardly extending portion of the gripper track **260** and pivot the entire gripper **36** in a counterclockwise direction about the end of the push rod **286** that follows the cam or arcuate portion **260** of the cam track. The slowdown of the gripper **36** is accomplished by a combination of the push rod **286** pivoting counterclockwise and the gripper assembly **36** also pivoting counterclockwise. This slowdown of the grippers is arranged to match the slowdown of the tail grippers **44;** thus maintaining the sheet straight as it is brought over the pile. The conveyor grippers **36** release the sheet first and then the tail end grippers **44** release the tail of the sheet thereafter. This permits the sheet to be deposited on the pile without flutter and the like.

According to the provisions of the patent statutes, we have explained the principal, preferred construction and mode of operation of our invention and have illustrated and described what we now consider to represent its best embodiments. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. In a sheet delivery mechanism the combination comprising,

a frame member,

frame support means, said frame member positioned on and supported by said frame support means in overlying relation with a pile of sheets,

a plurality of endless chains positioned in parallel spaced relation to each other, said endless chains reeved about drive sprockets and idler sprockets rotatably mounted on said frame member,

means to drive said endless chains at a preselected substantially constant velocity,

endless guide means positioned adjacent to said endless chains, said endless guide means having an intermediate lower portion at substantially the same elevation as the lower horizontal portion of said endless chains,

said guide means having a front arcuate, downwardly depending portion adapted to be positioned adjacent the front edge of the pile,

gripper means movably positioned in said guide means,

means to actuate said gripper means to engage the front edge of a sheet,

other means to actuate said gripper means while said gripper means is traversing said front arcuate, depending portion of said guide means to release the front edge of a sheet,

articulated means connecting said gripper means to said endless chains so that said endless chains propel said gripper means in said endless guide means,

said gripper means arranged to engage the front edge of a sheet and convey the sheet at a velocity substantially the same as the preselected velocity of said endless chains to a position adjacent the front arcuate portion of said guide means,

said front portion of said guide means operable while the gripper means is traversing said front arcuate downwardly depending portion of said guide means to articulate said gripper means relative to said endless chains and displace said gripper means downwardly to reduce the forward velocity of said gripper means below said preselected velocity of said endless chains while said endless chains are driven at said preselected velocity,

means to move said frame member longitudinally on said frame support means so that said gripper means engages and transports sheets of different length, and

means to move said other means to actuate said gripper means to thereby release the front edge of sheets of different sizes while said gripper means is traversing said front arcuate, downwardly depending portion of said guide means.

2. A sheet delivery mechanism as set forth in claim 1 in which said guide means includes,

an outer endless rail and an inner endless rail, said inner endless rail positioned in spaced relation to said outer endless rail and forming a guide track therebetween,

said gripper means positioned in said guide track between said outer endless rail and said inner endless rail.

3. A sheet delivery mechanism as set forth in claim 1 in which said gripper means includes,

a first plate member positioned on one side of said guide means,

a second plate member positioned on the opposite side of said guide means,

connecting means extending through said guide means and connecting said plates to each other,

one of said plates having a downwardly extending arm member,

a gripper device connected to said downwardly extending arm member,

said downwardly depending arm member arranged to be displaced downwardly as said gripper means traverses said front arcuate, downwardly depending portion of said guide means to further reduce the forward velocity of said gripper means as said gripper means traverses said arcuate, downwardly depending portion of said guide means.

4. A sheet delivery mechanism as set forth in claim 3 in which said gripper means includes,

a gripper finger pivotally secured to said articulated means and having an end portion abutting a gripper pad,

resilient means to maintain said gripper finger end portion in abutting relation with said gripper pad, and

means to move said gripper finger away from said gripper pad.

5. A sheet delivery mechanism as set forth in claim 1 in which said articulated means includes,

a rod member connected at one end to said endless chain and at the other end to said gripper means.

6. A sheet delivery mechanism as set forth in claim 5 which includes,

ball joint means connecting an end of said rod member to said chain and other ball joint means connecting said rod member to said gripper means.

7. A sheet delivery mechanism as set forth in claim 1 which includes separate guide means positioned adjacent to each endless chain,

a plurality of gripper means aligned transversely across said sheet delivery mechanism and separately driven by said endless chains.

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