United States Patent

[11] 3,595,560

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[45] Patented **July 27, 1971**

[73] Assignee **Warren W. Hannon, by said Charles N. Hannon**

[54] **MECHANISM FOR INSERTING A NEWSPAPER SECTION INTO OTHER FOLDED SECTIONS**
15 Claims, 17 Drawing Figs.

[52] U.S. Cl. **270/57**
[51] Int. Cl. **B65h 5/30**
[50] Field of Search 270/54, 55, 57

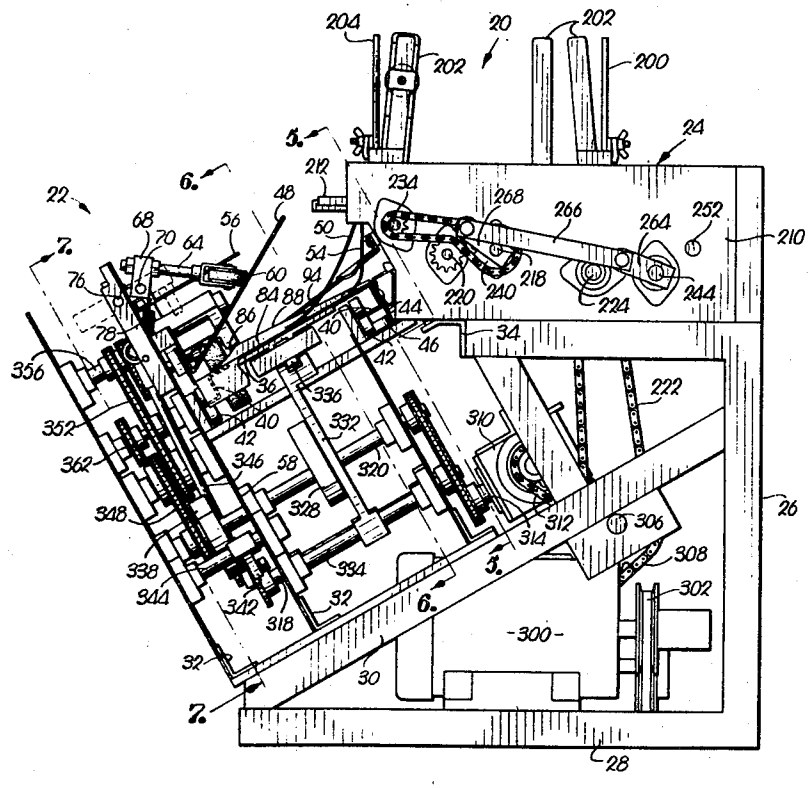
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ABSTRACT: An inserting machine for facilitating the assembly of multiple-section newspapers. The main newspapers, for example, are successively fed onto a reciprocating tray provided with a side guide against which the fold of the paper rests. Upon delivery of each main paper to the tray, the latter dwells momentarily, during which time a friction wheel is shifted into engagement with the top face of the paper along an arcuate path of movement extending downwardly and toward the side guide. This causes the uppermost leaf or leaves of the paper to be pulled toward the side guide relative to the remaining leaves of the section to, in turn, raise the forward, hard edge of the paper formed by such leaves. With the paper thus opened, the tray advances forwardly to place the raised edge on a stationary shelf, whereupon the paper is then fed from the tray and continues its advancement in the opened condition. The tray returns to its standby position and the action repeats as the next paper is fed into the tray. One or more feeders along the path of travel of the successively fed papers effect the delivery of additional sections beneath the shelf and into each advancing main paper.



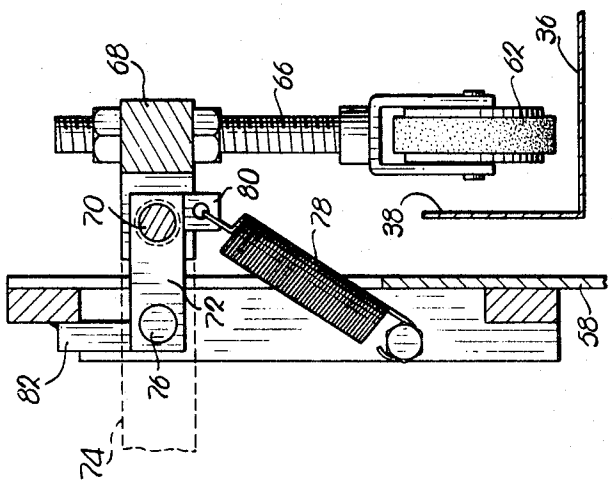


Fig. 8.

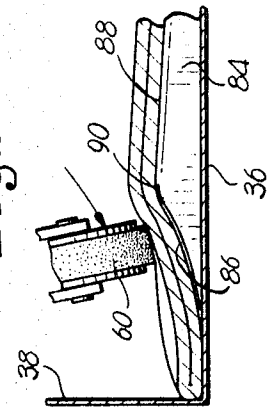


Fig. 9.

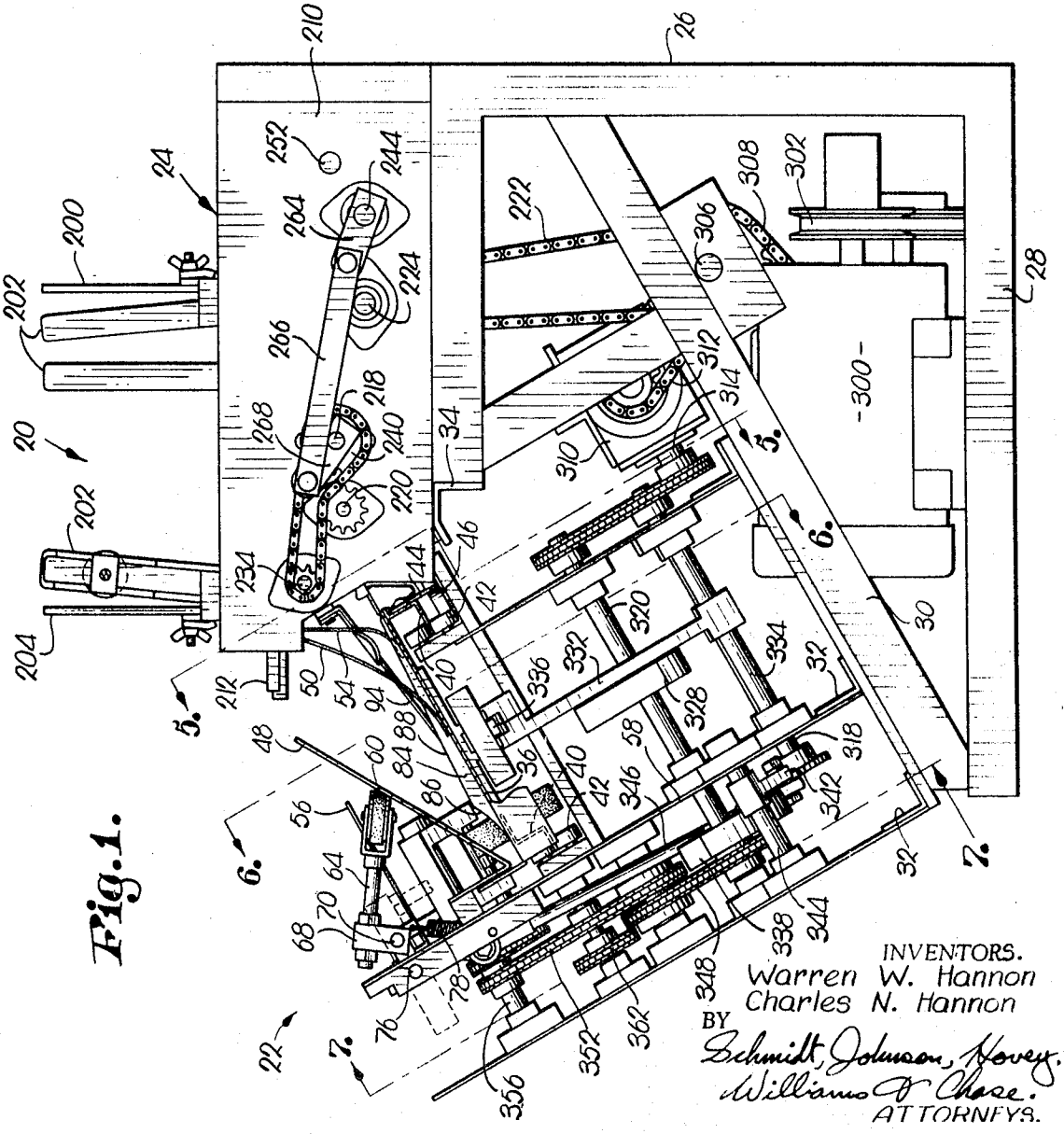


Fig. 1.

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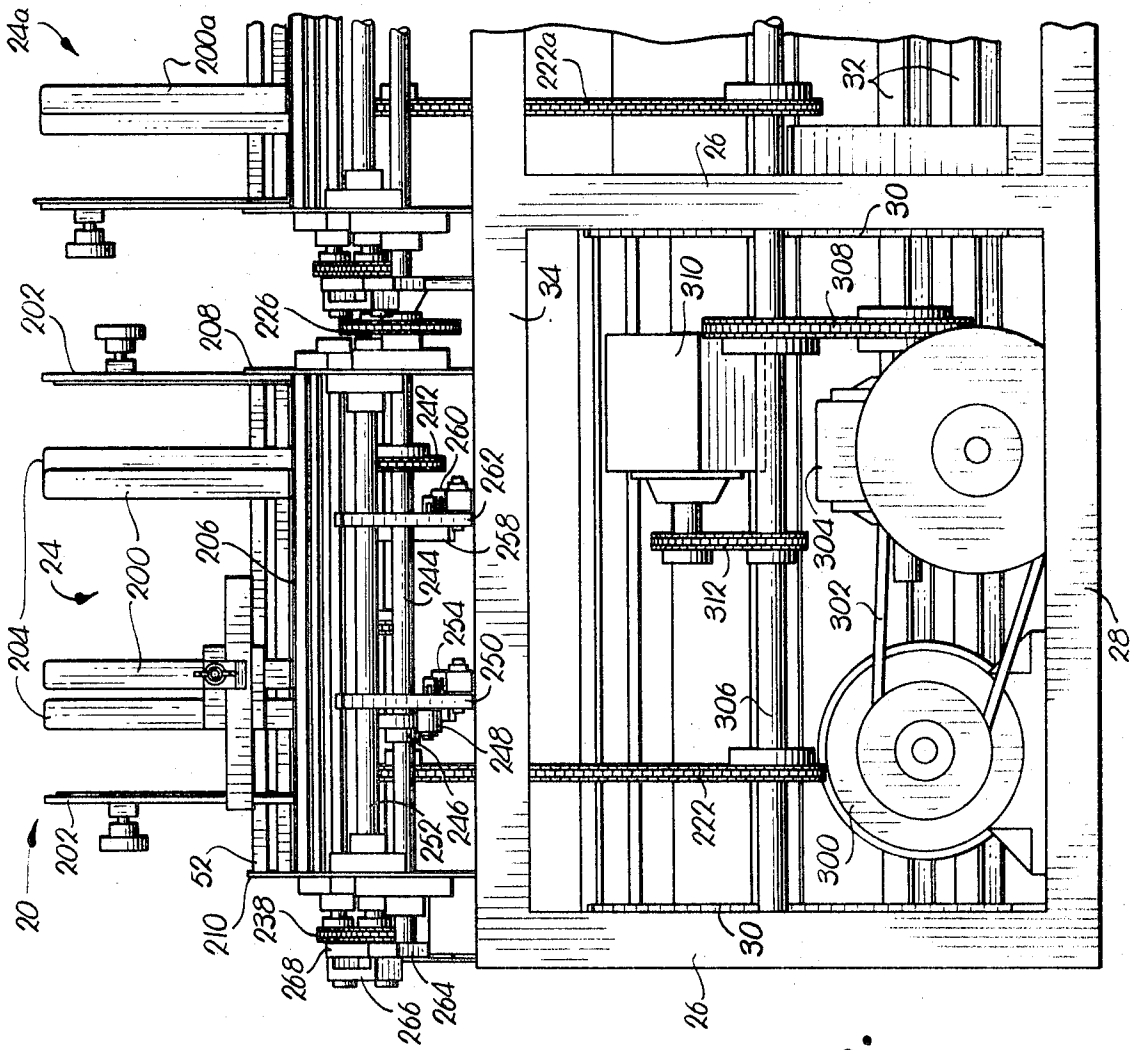


Fig. 2.

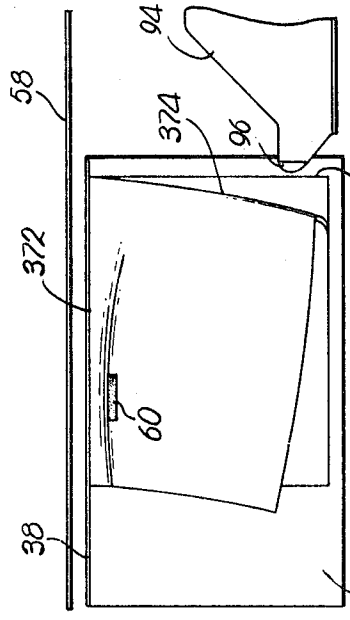


Fig. 16.

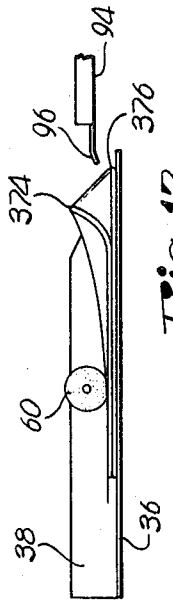


Fig. 17.

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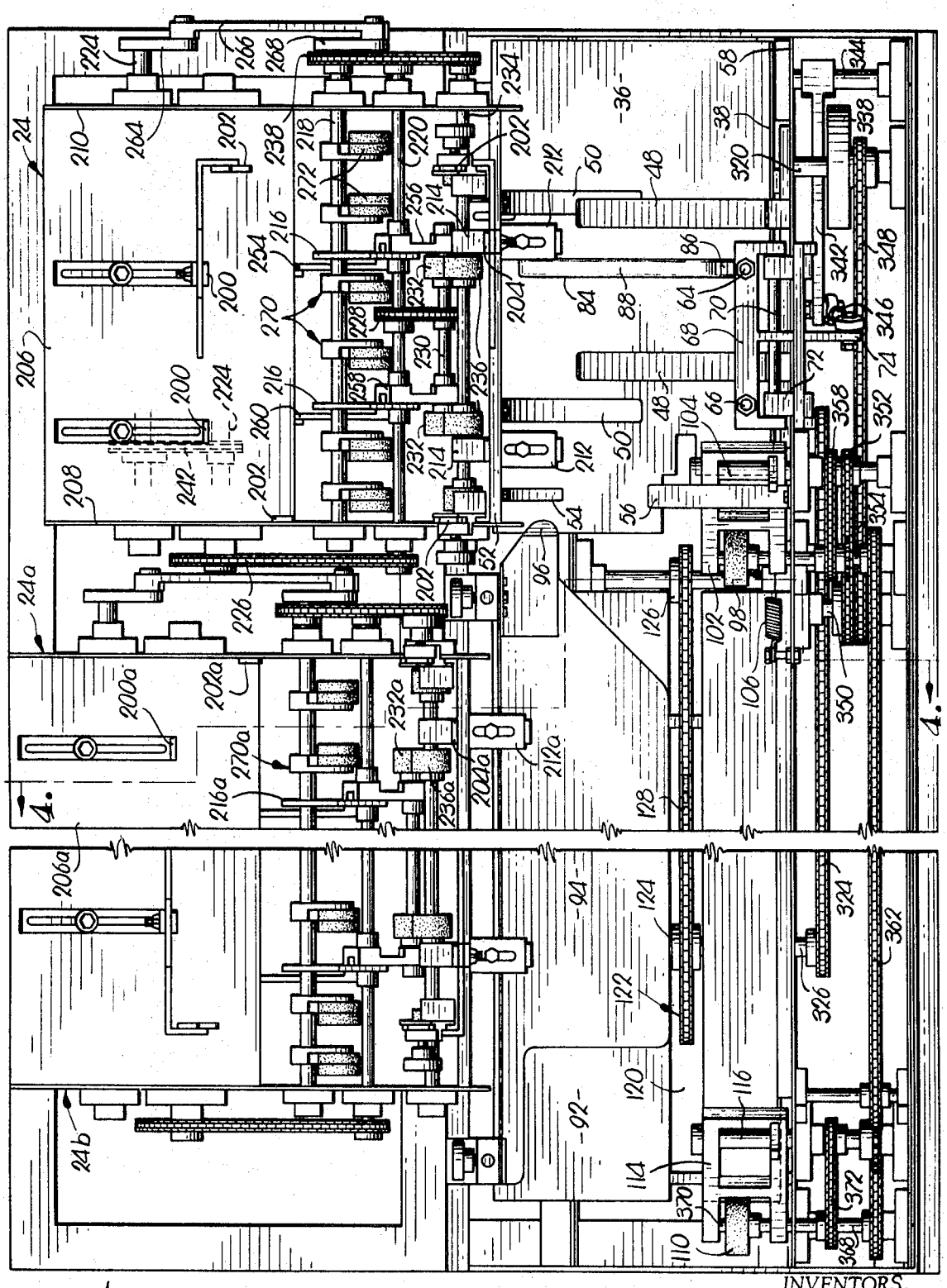


Fig. 3.

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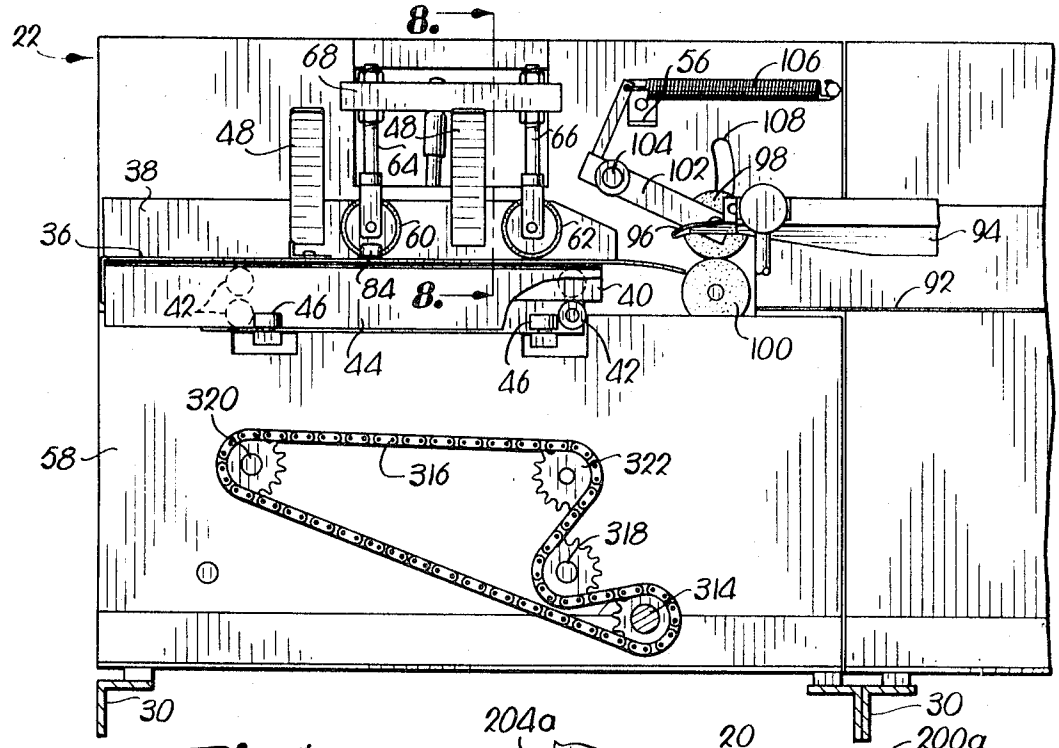


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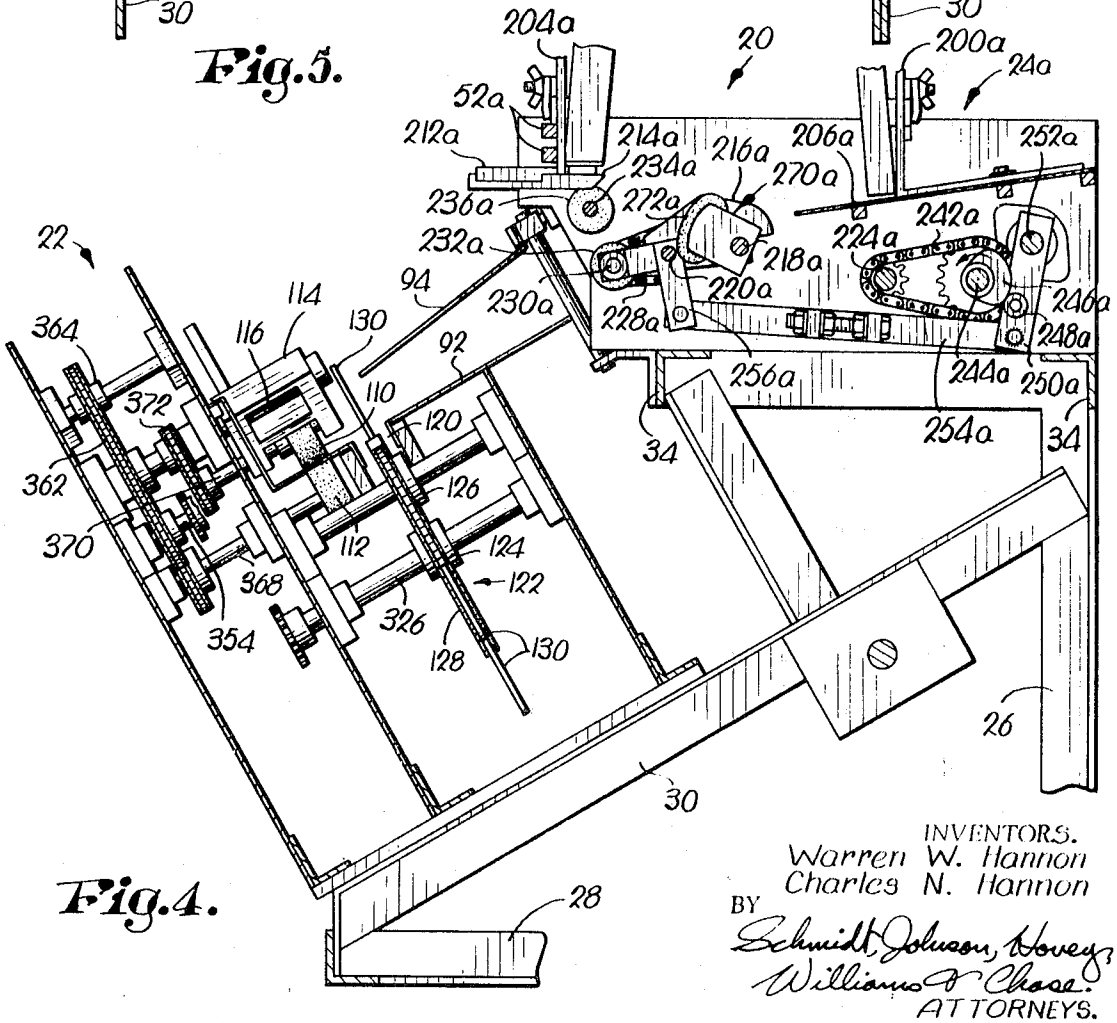


Fig. 4.

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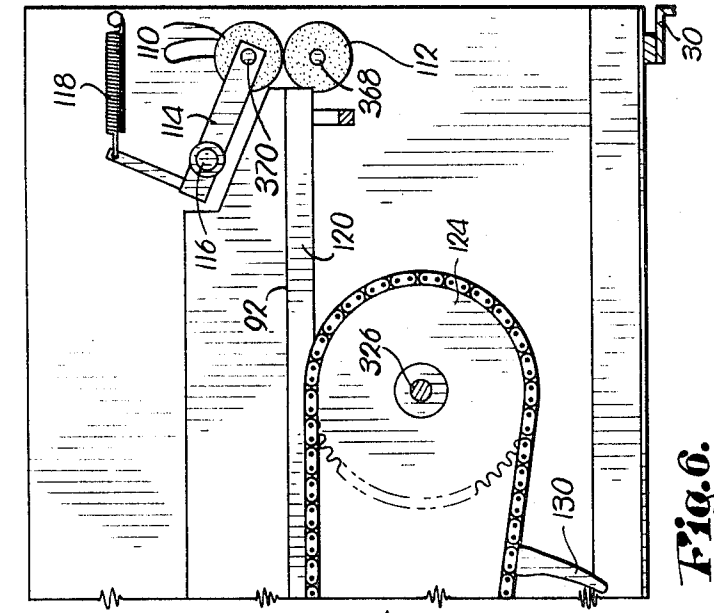
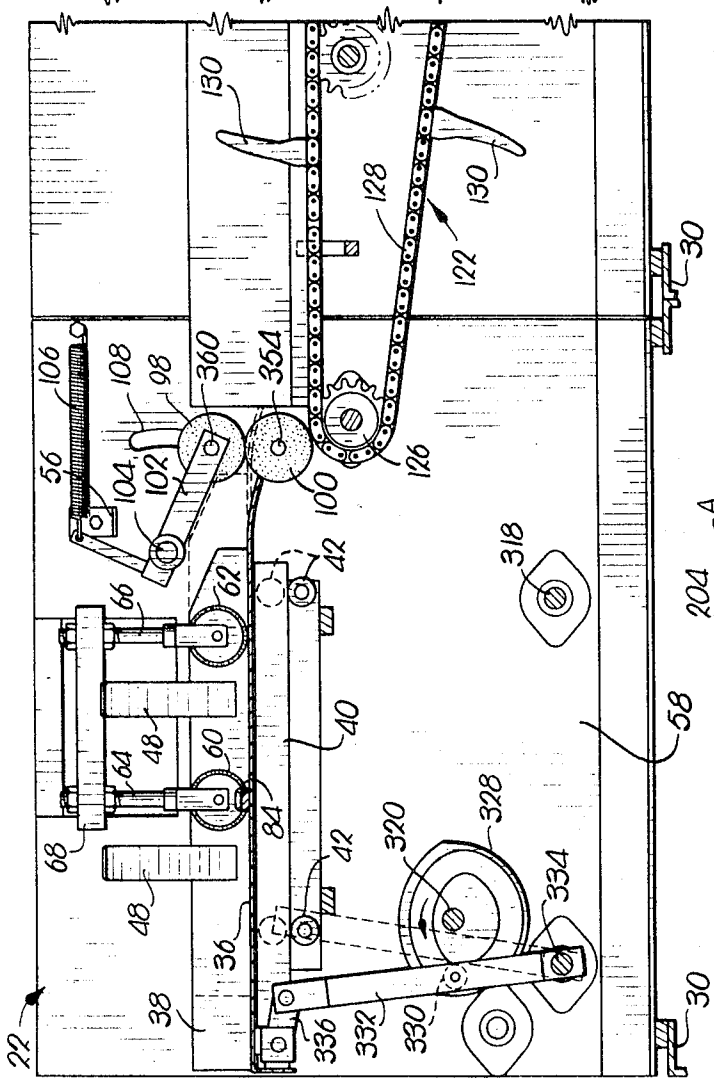


Fig.6.



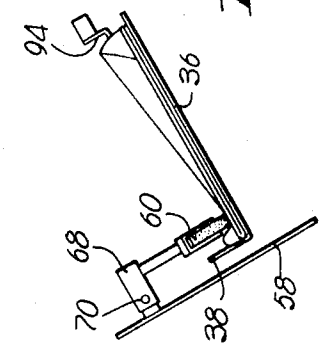


Fig.12.

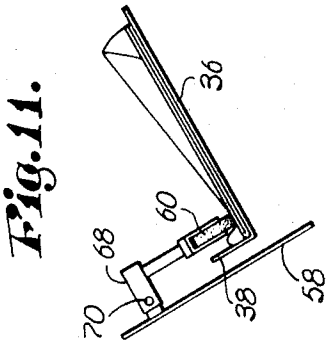


Fig.11.

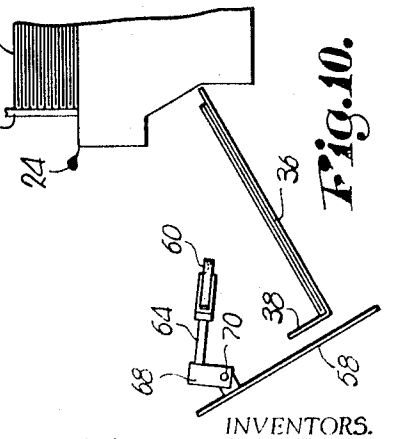


Fig.10.

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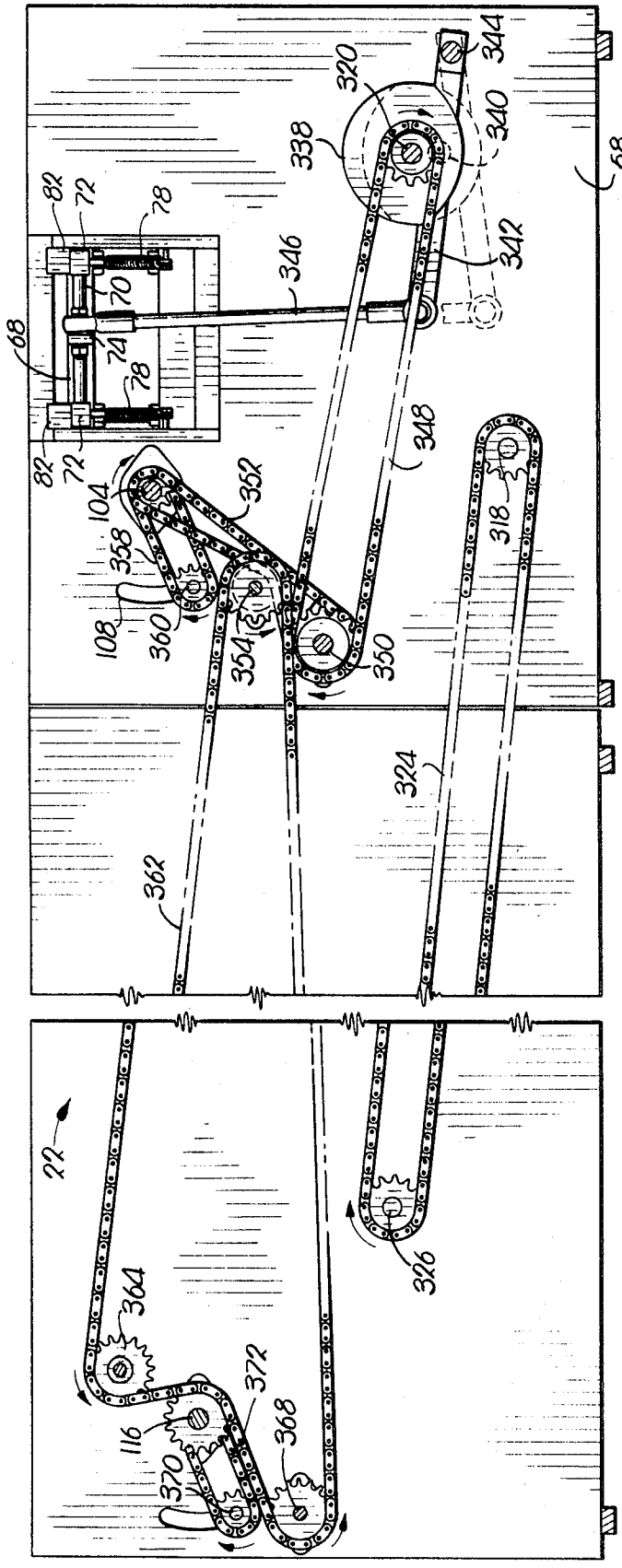


Fig. 7.

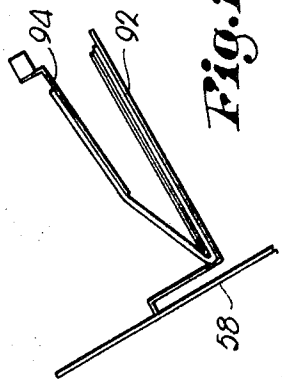


Fig. 15.

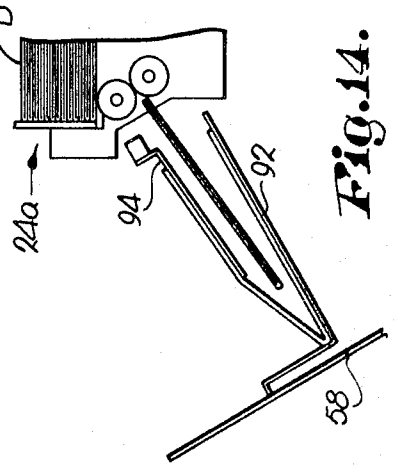


Fig. 14.

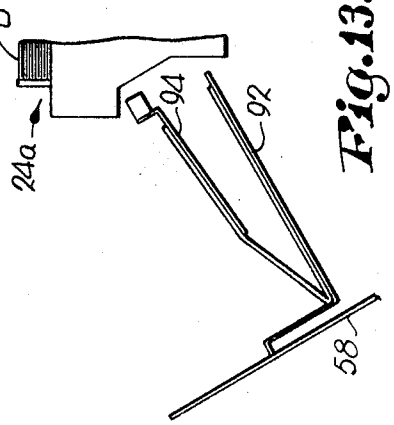


Fig. 13.

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MECHANISM FOR INSERTING A NEWSPAPER SECTION INTO OTHER FOLDED SECTIONS

This invention relates to improvements in inserting machines for newspapers and similar multiple leaf sheet articles and, more particularly, to an improved means of opening the initial section of the paper into which one or more additional sections are to be inserted.

In the newspaper industry, preprinted, multicolor advertising supplements and other preprinted sections are becoming increasingly popular and must be handled by the larger daily papers across the country as a matter of business necessity. Preprinted sections include a variety of supplements, comics, and television guides as well as advertising. The problem of assembling the composite newspaper is particularly acute in the case of large weekday or Sunday editions where the main newspaper itself has either a large number of pages or comprises multiple sections even without the addition of the supplemental sections.

Inserting machines in present use normally employ feeders that utilize a vacuum system to effect the sequential delivery of the paper sections to the assembly apparatus of the inserting machine. This necessarily limits the capability of the machine since vacuum feeders become ineffective when the section to be fed is of substantial thickness. This is often the case with large weekday or Sunday editions, thereby requiring that hand insertion ultimately be employed to assemble the composite newspaper.

The problem outlined above can be overcome, however, through the utilization of mechanical feeders that will handle thick sections, such as a feeder of the bottom delivery type as disclosed in our copending application, Ser. No. 751,011, filed Aug. 7, 1968. This also results in a material cost saving since the high-capacity vacuum system necessary with vacuum feeders is not required. However, to fully benefit from the cost economy realized by the omission of vacuum equipment, the inserting machine desirably should then not require a vacuum system to effect the opening of the main paper or other section into which the supplemental sections are to be inserted.

It is, therefore, the primary object of the present invention to provide an inserting machine which is capable of opening multipage newspapers or similar multiple leaf sheet articles without utilizing a vacuum system for the opening operation.

Another important object of the invention is to provide an inserting machine as aforesaid in which opening is effected by pulling one or more leaves adjacent one face of the paper in directions generally in their planes and oriented to cause a hard edge formed by such leaves to separate from adjacent portions of the paper.

Furthermore, it is an important object of this invention to provide an inserting machine as aforesaid wherein, once one hard edge is separated or lifted, the apparatus maintains the paper or other sheet article in an open condition while advancing the same along a predetermined path of travel, thereby permitting other sheet sections to be fed into the open paper as it advances.

Additionally, it is an important object of the invention to provide such an inserting machine which, in the newspaper industry, may be utilized either at a press location or at carrier substations as desired, but with the capability of handling the main newspaper as received from the folder of the press and assembling the same with additional preprinted sections for direct delivery of the assembled papers into a folding and wrapping machine which prepares the papers for residential delivery.

In the drawings:

FIG. 1 is an end elevation of the inserting machine with certain parts broken away for clarity, the paper-gripping friction wheels being shown in their raised positions;

FIG. 2 is a rear elevation of the feed end of the machine seen in FIG. 1, the friction wheels in FIGS. 2—8 being in their lowermost positions at the time just prior to commencement of forward movement of the floating tray;

FIG. 3 is a fragmentary, top view showing the feeder section and the receiver line of the inserting apparatus as they would both appear in plan;

FIG. 4 is a vertical sectional view taken along line 4–4 of FIG. 3;

FIG. 5 is a cross-sectional view of the feed end of the machine taken along line 5–5 of FIG. 1;

FIG. 6 is a fragmentary, cross-sectional view of the machine taken along line 6–6 of FIG. 1;

FIG. 7 is a fragmentary, cross-sectional view taken along line 7–7 of FIG. 1;

FIG. 8 is an enlarged, fragmentary, cross-sectional view taken along line 8–8 of FIG. 5;

FIG. 9 is a detail view illustrating the action of the friction wheels;

FIGS. 10—15 are diagrammatic views illustrating the operational sequence of the machine;

FIG. 16 is a diagrammatic, top plan view of the feed end of the machine illustrating the pulling action of a friction wheel; and

FIG. 17 is an elevational view corresponding to FIG. 16.

Referring particularly to FIGS. 1—8, it may be seen that the inserting apparatus of the present invention is an elongated structure having a feeder section 20 disposed at the top rear of the machine and extending longitudinally thereof, and a receiver line 22 at the front of the machine which also extends the length thereof. The function of the receiver line 22 is to receive newspaper sections fed thereinto, effecting opening of the first newspaper section and subsequent insertion of other sections into the open section as the latter is advanced toward the delivery end of the machine. The feeder section 20 is illustrated herein as comprising a series of three feeders 24, 24*a*, and 24*b*, but additional feeders may be provided depending upon the number of individual sections to be combined to form each composite newspaper. Furthermore, it should be understood that, although the description and operational discussion to follow will make reference to the utilization of the apparatus in the assembly of newspapers, the machine is equally well adapted to other similar applications requiring the handling of single and multiple leaf sheet articles.

The machine has a frame comprising a plurality of upstanding, rear frame members 26, a base framework 28, a plurality of inclined crossmembers 30, three longitudinal angle members 32 spanning the crossmembers 30, and longitudinal top members 34 carried by the upright frame members 26. The receiver line 22 is supported by the inclined crossmembers 30 and associated longitudinal members 32, the feeders 24, 24*a* and 24*b* of the feeder section 20 being supported atop the upright frame members 26 and longitudinal top members 34.

At the feed end of the receiver line 22, a support in the nature of a floating tray 36 is mounted for reciprocal movement through a limited distance longitudinally of the machine. The tray 36 is inclined transversely of its path of travel, the lower edge thereof having an upstanding flange 38 which serves as a side guide for newspapers fed onto the tray 36, as will be explained hereinafter. A pair of right-angle plates 40 depend from tray 36 adjacent respective sides thereof, each plate 40 being received between two pairs of opposed rollers 42, thereby mounting the tray 36 for movement longitudinally of the machine (to the right from the standby position of the tray 36 as viewed in FIG. 5). To prevent lateral displacement of the tray 36, an elongated plate element 44 is attached to the right hand angle plate 40 (as viewed in FIG. 1) and extends downwardly therefrom, the plate element 44 being received between two pairs of opposed rollers 46 arranged for rotation about axes orthogonal to the axes of rotation of the guide rollers 42.

A pair of stationary, elongated fingers 48 are mounted just above the side guide 38 of the tray 36 and project downwardly toward the bottom of the side guide 38 and then outwardly over the tray at an angle with respect to the upper surface thereof, as is clear in FIG. 1. The fingers 48 serve as guides for the papers fed onto the tray 36 from the adjacent feeder 24,

directing each paper toward the corner formed by the tray **36** and its side guide **38**. Additionally, a pair of flexible guide fingers **50** have their upper ends secured to a pair of crossbars **52** forming a part of the frame of the feeder **24**, the flexible fingers **50** extending downwardly into contact with the upper surface of the tray **36**. A third, smaller flexible finger **54** also extends downwardly into contact with the tray **36** adjacent its leading edge. A deflector **56** is vertically spaced from the tray **36** and extends parallel to the plane thereof, the deflector **56** being located above the leading edge of the tray **36** and secured to a panel **58** which is supported by the center longitudinal frame member **32**.

A pair of friction wheels **60** and **62** are rotatably mounted on the lower ends of a pair of threaded support rods **64** and **66**, respectively, the rods **64** and **66** being carried by a U-shaped mounting bar **68** whose ends are journaled on a shaft **70** supported by a pair of mounting projections **72**. The shaft **70** is horizontally disposed with its axis extending longitudinally of the machine and parallel to the side guide **38** of the tray **36**. An arm **74** connected at one end to the center of the mounting bar **68**, the opposite end of the arm **74** being coupled with a drive (to be subsequently described) which swings the friction wheels **60** and **62** about the axis of the shaft **70** between the positions best illustrated by a comparison of FIGS. **1** and **8**. Each projection **72** supporting shaft **70** is free to pivot in a counterclockwise direction (as viewed in FIG. **8**) about a pivot pin **76** against the bias of a safety spring **78** connected to a lug **80** on the projection **72** (see FIG. **8**). The projections **72** are held against clockwise movement by stops **82**.

A rib **84** on the upper surface of the tray **36** extends transversely thereof below and in vertical alignment with the path of travel of the friction wheel **60**. As best seen in FIG. **9**, the rib **84** has a concave upper surface **86** faced with a frictional material, the concave surface **86** merging with a straight upper surface **88** at a peak **90**. The length of the concave surface **86** is short relative to the length of the straight surface **88**, the peak **90** being adjacent the left and of the rib **84** as viewed in FIGS. **1** and **9**. The radius of curvature of the concave surface **86** is the same as the radius of the arc traversed by the friction wheels **60** and **62** during movement thereof between standby and operative positions.

An elongated, stationary table **92** is spaced forwardly of the tray **36** and extends longitudinally of the machine in substantial alignment with tray **36**, as best seen in FIG. **3**. Referring to FIGS. **4** and **5**, note that the table **92** is transversely inclined in the same manner as the tray **36**, the plane of the table **92** actually being spaced slightly below the plane of the tray **36**. An elongated shelf **94** is nearly coextensive with the table **92** and is mounted thereabove in spaced relationship to table **92** and at a slightly greater transverse inclination. The rearward edge of the shelf **94** is provided with a rearwardly projecting extension which presents a lip **96** that overlies the upper portion of the forward edge of the tray **36**. Both the table **92** and the shelf **94** extend in front of the two feeders **24***a* and **24***b*, paper sections delivered from these two feeders being directed onto the table **92** beneath the shelf **94**.

A pair of upper and lower pinch rollers **98** and **100** are disposed between the front edge of the tray **36** and the rear edge of the table **92** as is clear in FIG. **5**. The upper roller **98** is carried by a bracket **102** swingable on a rotatable shaft **104**, the bracket **102** being biased in a clockwise direction (as viewed in FIG. **5**) about shaft **104** by a spring **106**. The upper roller **98** is thus yieldably held in engagement with the lower roller **100**, both rollers being driven via drive connections illustrated in FIG. **7** and discussed hereinbelow. As is clear in FIG. **3**, the rollers **98**, **100** are located just behind the panel **58**, the latter having a clearance slot **108** therein to permit the drive connection to be made to the roller **98** and also permit pivotal movement thereof about shaft **104**.

Similarly, at the delivery end of the receiver line **22**, a pair of upper and lower pinch rollers **110** and **112** are disposed in substantial longitudinal alignment with the rollers **98** and **100**, the upper roller **110** being carried by a bracket **114** pivotal on a shaft **116**. A spring **118** is connected to the bracket **114** and biases the latter in a clockwise direction (as viewed in FIG. **6**) about the shaft **116**, the nip of the engaging rollers **110** and **112** being in horizontal alignment with the proximal leading edge portion of the table **92**. Both of the rollers **110** and **112** are driven via drive connections illustrated in FIG. **7** and discussed hereinafter.

The table **92** has a longitudinal opening **120** therein which splits the table into two longitudinal sections as is clear in FIGS. **3** and **4**. An endless conveyor **122** is disposed beneath the table **92** and is aligned with the longitudinal opening **120**, the conveyor **122** including a drive sprocket **124**, an idler sprocket **126**, an endless chain **128** trained around the sprockets **124** and **126**, and a plurality of spaced pusher fingers **130** attached to the chain **128**. The upper stretch of the chain **128** moves parallel to the plane of the table **92** beneath the latter, the pusher fingers **130** of the upper stretch projecting upwardly through the opening **120** and hence above the plane of the table **92**.

The feeders **24**, **24***a*, and **24***b* are of the bottom delivery type as disclosed in our copending application, Ser. No. 751,011, filed Aug. 7, 1968. Being of identical construction, the same reference numerals are used in the drawings to designate like components of the three feeders **24**, **24***a*, and **24***b*, with the addition of the "*a*" or "*b*" notation. Referring to feeder **24**, a hopper is defined by a pair of upright, rear guides **200**, two pairs of side guides **202**, and a pair of front guides **204**. The bottom of the hopper is defined by an inclined table **206** from which the rear guides **200** extend in an upward direction. The front guides **204** are rigid with the pair of crossbars **52** extending between side plates **208** and **210**. A slotted plate **212** extends forwardly from each guide **204** and carries a support finger **214** which cooperates with table **206** to support a stack of newspaper sections A in the hopper, as illustrated diagrammatically in FIG. **10**. The two front guides **204**, therefore, are fixed, a bolt through the slot in each plate **212** rendering each finger **214** adjustable toward and away from the table **206**. Several of the other guides **200** and **202** are adjustable as is clear in FIGS. **1**—**3**.

The newspapers sections are also supported by two irregularly shaped plate elements **216** carried by a rocker shaft **218** and a cross-shaft **220** spaced therefrom, both of the shafts **218** and **220** extending horizontally between the two sideplates **208** and **210**. The lowermost paper of the stack A overlies the upper edges presented by the elements **216** and extends between the front guides **204** and the rear guides **200**, support for the opposed, front and rear edge portions of the paper being provided by the projecting fingers **214** and the portion of table **206** which extends toward elements **216** from rear guides **200**. It should be noted that the table **206** is inclined downwardly toward the elements **216**, and that the upper edges of elements **216** are substantially rectilinear and are inclined downwardly toward the front edge of the table **206** (see the element **216***a* and table **206***a* shown in FIG. **4**).

A drive chain **222** is trained around a sprocket rigid with a rotatable shaft **224**, and a chain and sprocket assembly **226** transmits power from the shaft **224** to the cross-shaft **220**. A chain and sprocket assembly **228** forms a driving connection between cross-shaft **220** and a shiftable roller shaft **230**, the latter having a pair of friction rollers **232** rotatable therewith. A second roller shaft **234** spans the distance between sideplates **208** and **210** and is journaled thereon, the shaft **234** having a pair of friction rollers **236** rotatable therewith and aligned with rollers **232**. The shaft **234** is driven by a chain **238** trained over a sprocket rigid with the end (FIG. **1**) of shaft **234**. The chain **238** is also in mesh with a sprocket rigid with cross-shaft **220**, and is trained around an idler sprocket **240** rotatable on rocker shaft **218**.

A chain and sprocket assembly **242** couples shaft **224** to a rear shaft **244** spanning sideplates **208** and **210** and journaled thereon. The rear shaft **244** (see rear shaft **244***a* of feeder **24***a* in FIG. **4**) has a cam **246** keyed thereon which, during a portion of each revolution, is in engagement with a follower **248**

carried by the rocker arm **250** which oscillates about the axis of a pivot shaft **252**. The rocker arm **250** is pivotally coupled with a link **254** which, in turn, is connected to an L-shaped crank **256** that is freely rotatable on cross-shaft **220** and carries the adjacent end of roller shaft **230**. The L-crank **256** is biased in a clockwise direction, viewing crank **256***a* in FIG. **4**, by a spring (not shown). In FIG. **3**, it may be seen that the opposite end of roller shaft **230** is also carried by a crank **258** swingable on shaft **220**, the crank **258** being pivotally connected to a link **260** which is, in turn, pivotally joined to an idler arm **262** swingable about the axis of pivot shaft **252**.

The rocker shaft **218** is operated by a crank arm **264** (FIG. **1**) rigid with shaft **244** and pivotally connected to a link **266** which is, in turn, pivotally joined to a crank arm **268** rigid with the rocker shaft **218**. During one complete revolution of crank arm **264**, the crank arm **268** is oscillated through a displacement of less than 180°.

Six paper grippers **270** are rigid with shaft **218** and are spaced therealong, each gripper having a pair of side-by-side, continuous bands **272** of rubber or similar material radially spaced from shaft **218** and presenting a serrated, outer surface constituting a continuous, generally oval-shaped tread. The oval configuration is particularly clear in FIG. **4** where one of the grippers **270***a* of feeder **24***a* is shown viewed axially of shaft **218***a*.

A motor **300** is coupled by a belt and pulley drive **302** to a speed reducer **304**, the output thereof being coupled to a common feeder drive shaft **306** by a chain and sprocket assembly **308**. As is clear in FIG. **2**, the drive chains **222** and **222***a* of the respective feeders **24** and **24***a* are trained around sprockets on the common drive shaft **306**. The feeder **24***b* is likewise driven, the drive connection thereto from shaft **306** not being visible in the drawings.

Beneath the feeder **24**, a right-angle gearbox **310** is located and is driven by a chain and sprocket assembly **312** coupled with the drive shaft **306**. The gearbox **310** has an output shaft **314** visible in cross section in FIG. **5**, a chain **316** being trained around sprockets keyed to the shaft **318**, a shaft **320**, plus an idler sprocket **322**. Referring to FIG. **7**, it may be seen that a drive chain **324** is trained around a sprocket on the opposite end of the shaft **318** and is also trained around a sprocket on a shaft **326** to transfer drive to the latter. This shaft **326** is also visible in FIG. **6** and has the drive sprocket **124** of the endless conveyor **122** mounted thereon. In this manner, the conveyor **122** is continuously driven.

A cyclic drive for the tray **36** is best illustrated in FIGS. **1** and **6**. A cam **328** is rigid with shaft **320** and has an internal cam track which receives a follower **330** carried by an upright rocker arm **332**, the lower end thereof being secured to a rocker shaft **334**. The upper end of the rocker arm **332** is joined to the trailing edge portion of the tray **36** by a link **336**. As is clear in FIG. **6**, the cam **328** has a generally oval-shaped track in which the follower **330** rides, half of the track being concentric with the axis of the shaft **320** while the other half of the track describes an arc having a center spaced below the shaft **320**. The direction of rotation of the cam **328** is counterclockwise in FIG. **6** as indicated by the arrow, thus the relationship of the parts is shown at the end of the half revolution dwell period, during which time the follower **330** was traversing the concentric portion of the cam track.

In FIG. **7** an analogous arrangement is illustrated for driving the friction wheels **60** and **62**. A cam **338** of the same configuration as cam **328** rotates with shaft **320** in the direction indicated by the arrow, the cam **338** being 180° out of phase with respect to the cam **328**. The cam **338** engages a follower **340** carried by a rocker arm **342**, one end of the rocker arm **342** being mounted on a rocker shaft **344**. The opposite end of the rocker arm **342** is pivotally joined to the lower end of an upwardly extending connecting rod **346**, the upper end of the rod **346** being pivotally joined to the end of the arm **74**, the latter extending from the mounting bar **68** that carries the friction wheels **60** and **62** as described above. It should be noted that the cam follower **340** is displaced 90° relative to the follower **330** associated with the tray drive, thus (together with the 180° out-of-phase relationship between cams **328** and **338**) the connecting rod **346** is at its maximum raised position at the time of termination of the dwell of the tray drive. This results in the friction wheels **60** and **62** being disposed in their lowermost operative positions at this time.

A drive chain **348** is trained around a sprocket on the shaft **320** (FIG. **7**) and is also trained around a sprocket on the shaft shaft **350** to transmit power thereto. Power is then taken from a second sprocket rotatable with shaft **350** via a chain **352** which is in mesh with the teeth of a sprocket on a shaft **354** and is also trained around a sprocket on the shaft **104**. Another chain **358** then transmits the drive to a shaft **360**, the latter having the upper pinch roller **98** mounted thereon for rotation therewith (FIG. **6**). The shaft **354** carries the lower pinch roller **100** for rotation therewith, the directions of rotation of the various shafts and sprockets of the drive configuration being indicated by the arrows in FIG. **7**.

The drive is transmitted onto the pinch rollers **110** and **112** by a drive chain **362** trained around a sprocket keyed to the shaft **354**. The chain **362** engages an idler sprocket **364** and is then trained around sprockets on the shaft **116** and a shaft **368**, the latter shaft **368** having the lower pinch roller **112** mounted thereon for rotation therewith. The upper pinch roller **110** is on a shaft **370**, drive thereto being effected by a chain **372** and associated sprockets on shafts **370** and **116**.

OPERATION

As an aid in understanding the operation of the machine of the present invention, particular reference is made to the diagrammatic views of FIGS. **10—15**, together with the FIG. **9** detail and the diagrammatic illustrations of FIGS. **16** and **17**. As one of example of use of the machine, the papers of stack A in the hopper of the first feeder **24** is assumed to be the main newspaper sections into which other sections, such as preprinted supplements, are to be inserted. The other sections or supplements are loaded into the hoppers of the feeders **24***a* and **24***b*, a stack B thereof in feeder **24***a* being diagrammatically illustrated in FIGS. **13** and **14**.

An understanding of the basic manner of operation of each of the feeders **24**, **24***a*, and **24***b* may be obtained with reference to FIGS. **1** and **4**. Although two different feeders **24** and **24***a* are illustrated, their parts are in the same relative positions. As the shaft **224** is driven in a counterclockwise direction (as viewed in FIGS. **1** and **4**) by the drive chain **222**, the cam **244** (or **244***a*) rotates as indicated by the arrow in FIG. **4**. When the cam **244** engages the follower **248**, the rollers **232**, **236** are open. Movement of the lower rollers **232** upwardly toward the upper rollers **236** to engage a paper fed therebetween is effected by spring action during the time that the lobe of the cam **246** is out of engagement with the follower **248**. In synchronism with this operation, the feeder grippers **270** are oscillated about the axis of shaft **218** by the crank mechanism **264**, **266**, **268**. Rearward movement of the feeder grippers **270** toward table **206** causes the treads **272** to engage the lowermost paper of the stack to effect buckling of the paper between the feeder grippers and the table **206**, causing the leading edge of such paper to be withdrawn from between the fingers **214** and the remaining papers of the stack thereabove. As the feeder grippers **270** are then rocked forwardly away from the table **206**, the withdrawn leading edge of the paper is introduced between the rollers **232** and **236** to deliver the paper from the feeder, the trailing edge portion of the paper being withdrawn from between the remaining papers thereabove and the table **206** by the frictional engagement of the rollers **232**, **236** therewith. Additional details concerning the operation of bottom delivery feeders of this type may be obtained from our aforesaid copending application.

In FIG. **10** a paper from the stack A is shown received by the tray **36** and resting against the side guide **38**. The friction wheels **60** and **62** have not as yet commenced downward movement. FIG. **9** shows the friction wheel **60** after downward

movement commences under the action of the cam **338**, follower **340**, rocker arm **342**, and connecting rod **346** shown in FIG. **7**. FIG. **9** clearly reveals that the paper in the tray **36** is a typical newspaper section having a fold **372** along its bottom (in relation to the copy on the upper half of the front page). This fold **372** divides the newspaper section into two segments and constitutes a side edge of the newspaper section for purposes of discussion herein, the fold **372** being flush against the side guide **38**. Note that the friction wheel **60** begins to grip the upper face of the top segment of the newspaper section as it passes over the hump in the section formed by the peak **90** presented by the upper surface configuration of the rib **84**.

The wheel **60** is shown in its lowermost, fully operative position in FIGS. **16** and **17**. A comparison of FIG. **9** with FIGS. **16** and **17** illustrates the pulling action of the wheel **60** as it grips the upper page of the top segment of the newspaper section as it completes its arcuate downward path of movement. The typical newspaper section has a pair of hard edges **374** and **376** which will be considered herein as the forward edges of the paper, the hard edges **374** and **376** being formed by the fold that constitutes the left hand edge of the newspaper section when it is opened at the bottom fold **372** and held in the usual orientation for reading the copy. As the wheel **60** moves from the position thereof shown in FIG. **9** to the position shown in FIGS. **16** and **17**, the uppermost page or pages of the top segment of the paper are pulled toward the fold **372** in directions generally in their planes relative to the remaining sheets of the top and bottom segments, thereby causing the upper, hard edge **374** to separate from the lower, hard edge **376**. As is clear from a comparison of FIGS. **16** and **17**, the hard edge **374** is pulled back and raised to a position which will place the edge **374** over the lip **96** of the shelf **94** upon forward advancement of the tray **36** (to the right as viewed in FIGS. **16** and **17**).

The tray **36** dwells in its standby position during the pulling action of the gripping wheel **60** just described, by virtue of the configuration of the lower half of the track of the cam **328** as viewed in FIG. **6**. Being concentric with the cam shaft **320**, the dwell period of the tray **36** is approximately one-half of a revolution of the shaft **320**. Following the dwell period, the tray **36** commences advancement toward the table **92** and shelf **94**, at which time the gripper wheel **60** begins return movement. However, the raised forward edge **374** of the newspaper section remains under the pulling action of the gripper wheel **60** for a sufficient period of time to assure that the lip **96** of the shelf **94** is effectively inserted into the section beneath the edge **374**, thereby supporting the raised edge **374** in vertically spaced relationship to the edge **376** therebeneath. This is depicted in FIGS. **11** and **12** and, finally, the section is completely removed from the tray **36** with the lower half thereof now resting on the table **92** as illustrated in FIG. **13**. Feeding of the section from the tray **36** is effected by the pinch rollers **98** and **100**, the leading edges **374** and **376** of the section adjacent the fold **372** being introduced into the nip of the rollers **98** and **100** as the tray **36** advances to place the raised edge **374** on the lip **96**. The small guide finger **54** (FIG. **3**) is advantageously utilized at this time to hold down the loose corner formed by the lower edge **376** and, additionally, slips under the raised edge **374** to prevent the latter from closing against the lower edge **376** before it can be supported by the lip **96**. Normally, the second friction wheel **62** would be adjusted to a somewhat greater height than the pulling wheel **60** and serves primarily to hold the fold **372** against the side guide **38**.

It may be appreciated from FIG. **9** that the frictional facing of the concave upper surface **86** of the rib **84** assists the gripper wheel **60** in separating the hard edges **374** and **376** of the newspaper section. Being of the same curvature as the arcuate path of movement of the wheel **60**, the concave surface **86** opposes the wheel **60** continuously as it advances into engagement with the upper face of the newspaper section and continues downward movement to its fully operative position.

In FIGS. **14** and **15**, the second feeder **24***a* is shown delivering a newspaper section from the bottom of stack B, the delivery path extending beneath the shelf **94** and directly into the now opened main section which is supported on both table **92** and shelf **94**. Continued advancement of the open main section along the table **92** is effected by the pusher fingers **130** of the conveyor **122**, resulting in the main section and an inserted section or sections being advanced in front of the row of feeders along the table **92**. Manifestly, the number of feeders utilized in practice of the invention will depend upon the number of sections to be inserted into the main or first newspaper section. Synchronism of the various feeders for successive delivery of respective sections into the open sections advancing along table **92** may be effected by any suitable means, such as by an adjustment (not shown) for each feeder which effectively shortens or lengthens one stretch of the respective drive chain **222**, **222***a*, or **222***b*, etc.

As long as the hoppers of the various feeders remain loaded, the operation described above is continuous with open sections from the feeder **24** being successively delivered to the table **92** as the tray **36** reciprocates between its forward and standby positions, shown by a comparison of the broken and solid line illustrations in FIG. **6**. At the delivery end of the table **92**, the fully assembled newspapers are received in the nip of the pinch rollers **110** and **112** for delivery from the table **92**. The assembled papers may simply be collected in stacks as they are discharged from the rollers **110** and **112** or, if desired, the apparatus may directly feed a newspaper folding and wrapping machine of the type disclosed in U.S. Pat. Nos. 3,161,000 and 3,255,569.

Having thus described the invention, what we claim as new and desire to be secured by Letters Patent is:

1. Apparatus for inserting a first sheet section into a second, folded multiple leaf sheet section, the fold dividing the section into two segments and constituting a side edge of said second section with the segments thereof having hard, forward edges extending transversely of the fold, said apparatus comprising:

a support for receiving said second section and holding said fold thereof against lateral movement;

a shiftable gripper disposed to frictionally engage only the face of the outermost leaf of one of the segments of said second section when the latter is received by said support;

means coupled with said gripper for shifting the latter into engagement with said face to pull the outermost leaf or leaves of said one segment adjacent said gripper in directions generally in their planes relative to the remaining leaves of said segments to cause the hard forward edge formed by said one segment to separate and move away from the hard forward edge of the other segment of said second section to thereby open the latter;

means for advancing said second section forwardly along a predetermined path of travel upon operation of said gripper shifting means and attendant opening of said second section;

structure along said path of travel in disposition to support said second section and maintain the latter open as it advances; and

means along said path of travel for feeding said first section into the open second section as the latter advances.

2. Apparatus as claimed in claim **1**,

there being means along said path of travel for feeding at least one additional sheet section into the open second section as the latter continues to advance, whereby said apparatus inserts a plurality of sheet sections into said second section.

3. Apparatus as claimed in claim **1**,

said gripper shifting means effecting movement of said gripper generally toward said fold, whereby the outermost leaf or leaves of said one segment adjacent said face are pulled toward said fold to open said second section.

4. Apparatus as claimed in claim **1**,

said support having means disposed to underlie said second section in supporting relationship to the opposite face

thereof, said one face thereby constituting the upper face of said second section,

said gripper-shifting means effecting movement of said gripper downwardly into and at an angle to said upper face and generally toward said fold, thereby raising the hard forward edge of said one segment to open said second section.

5. Apparatus as claimed in claim 4,

said structure having means disposed to underlie the raised forward edge and hold the latter in spaced relationship to the forward edge therebeneath, as said second section advances along said path of travel.

6. Apparatus as claimed in claim 4,

there being means mounting said support for movement a predetermined distance along said path of travel,

said advancing means including drive means coupled with said support for shifting the latter said distance to effect initial forward advancement of said second section,

said structure having means for receiving the raised forward edge of said second section as said support is shifted, said receiving means being disposed to underlie said raised forward edge and hold the latter in spaced relationship to the forward edge therebeneath as said second section continues to advance along said path of travel.

7. Apparatus as claimed in claim 6,

said gripper including a friction wheel rotatable about an axis extending transversely of said path of travel.

8. Apparatus as claimed in claim 7,

said support shifting relative to said wheel as the support moves said distance,

said gripper shifting means maintaining said wheel in engagement with said upper face of the second section during initial movement of the support, whereby the wheel rotates as the support commences movement to hold the second section open.

9. Apparatus as claimed in claim 6,

said advancing means further including means engageable with said second section upon said initial forward advancement thereof for shifting the second section from said support and effecting continued advancement thereof along said path of travel.

10. Apparatus as claimed in claim 6,

said drive means effecting said shifting of the support following operation of said gripper-shifting means to open said second section.

11. Apparatus as claimed in claim 4,

said support including a tray presenting said means disposed to underlie said second section and provided with an upstanding side guide,

said tray having a rib thereon generally aligned with said gripper and extending transversely of said path of travel,

there being means for feeding said second section into said tray over said rib with said fold against said guide, whereby a hump is formed in said second section by said rib to augment the pulling action of said gripper.

12. Apparatus as claimed in claim 11,

said rib having a concave, frictional upper surface opposing said gripper as the latter moves into engagement with said upper face of the second section.

13. Apparatus as claimed in claim 12,

said movement of said gripper being arcuate and directed downwardly over said tray and toward said guide,

said concave surface of the rib having a curvature substantially conforming to the arcuate path of movement of said gripper.

14. Apparatus as claimed in claim 4,

said support including a tray presenting said means disposed to underlie said second section and provided with an upstanding side guide,

there being means for feeding said second section into said tray with said fold against said guide,

said movement of said gripper being arcuate and directed downwardly over said tray and toward said guide.

15. Apparatus as claimed in claim 4,

said support including a tray presenting said means disposed to underlie said second section and provided with an upstanding side guide,

there being means for feeding said second section into said tray with said fold against said guide; and

means mounting said tray for forward and return movement a predetermined distance along said path of travel,

said advancing means including cyclic drive means coupled with said tray for shifting the latter forwardly said distance to effect initial forward advancement of said second section, and then returning said tray to a standby position thereof for a predetermined dwell period before again shifting the tray forwardly,

said gripper-shifting means being synchronized with said drive means and operable to effect downward movement of said gripper into said upper face during said dwell period,

said structure having means for receiving the raised forward edge of said second section upon forward movement of said tray following said dwell period, said receiving means being disposed to underlie said raised forward edge and hold the latter in spaced relationship to the forward edge therebeneath as said second section continues to advance along said path of travel.