Aug. 27, 1968 L. H. SAUCIER ETAL 3,398,657

BOX END FOLDING AND STAPLING MACHINE

Filed Sept. 22, 1966 9 Sheets-Sheet 1

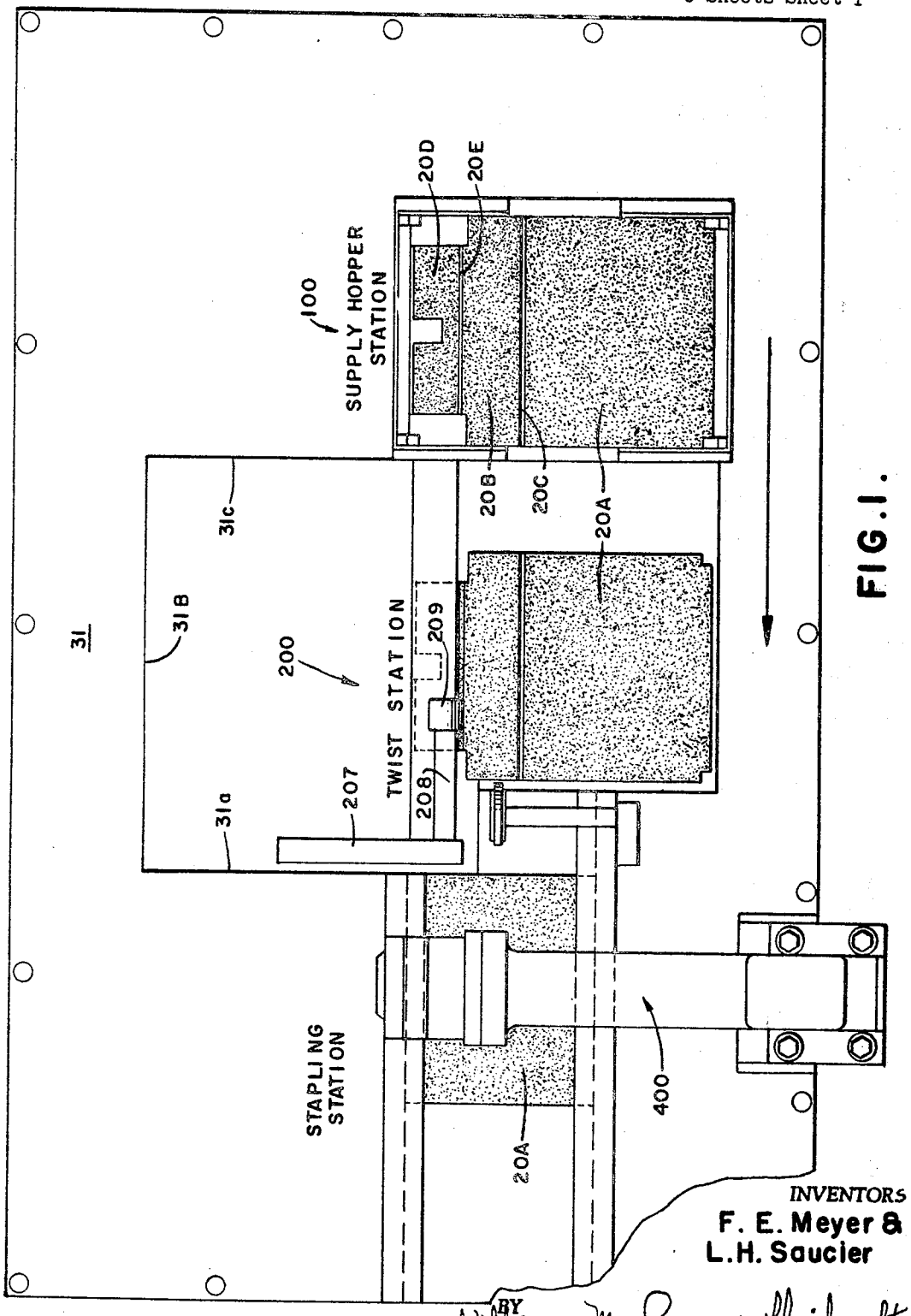


FIG. 1.

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BOX END FOLDING AND STAPLING MACHINE

Filed Sept. 22, 1966 9 Sheets-Sheet 2

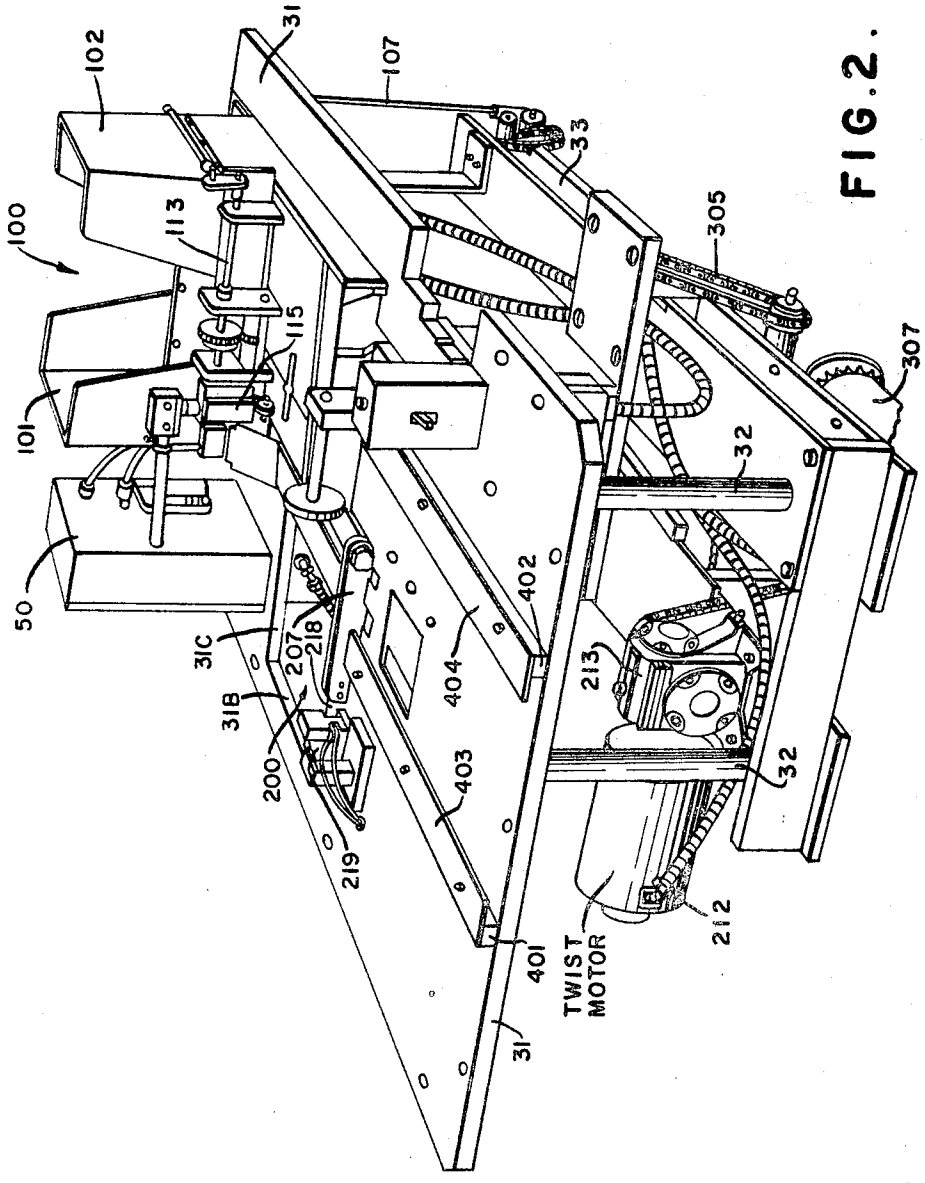


FIG. 2.

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BOX END FOLDING AND STAPLING MACHINE

Filed Sept. 22, 1966 9 Sheets-Sheet 3

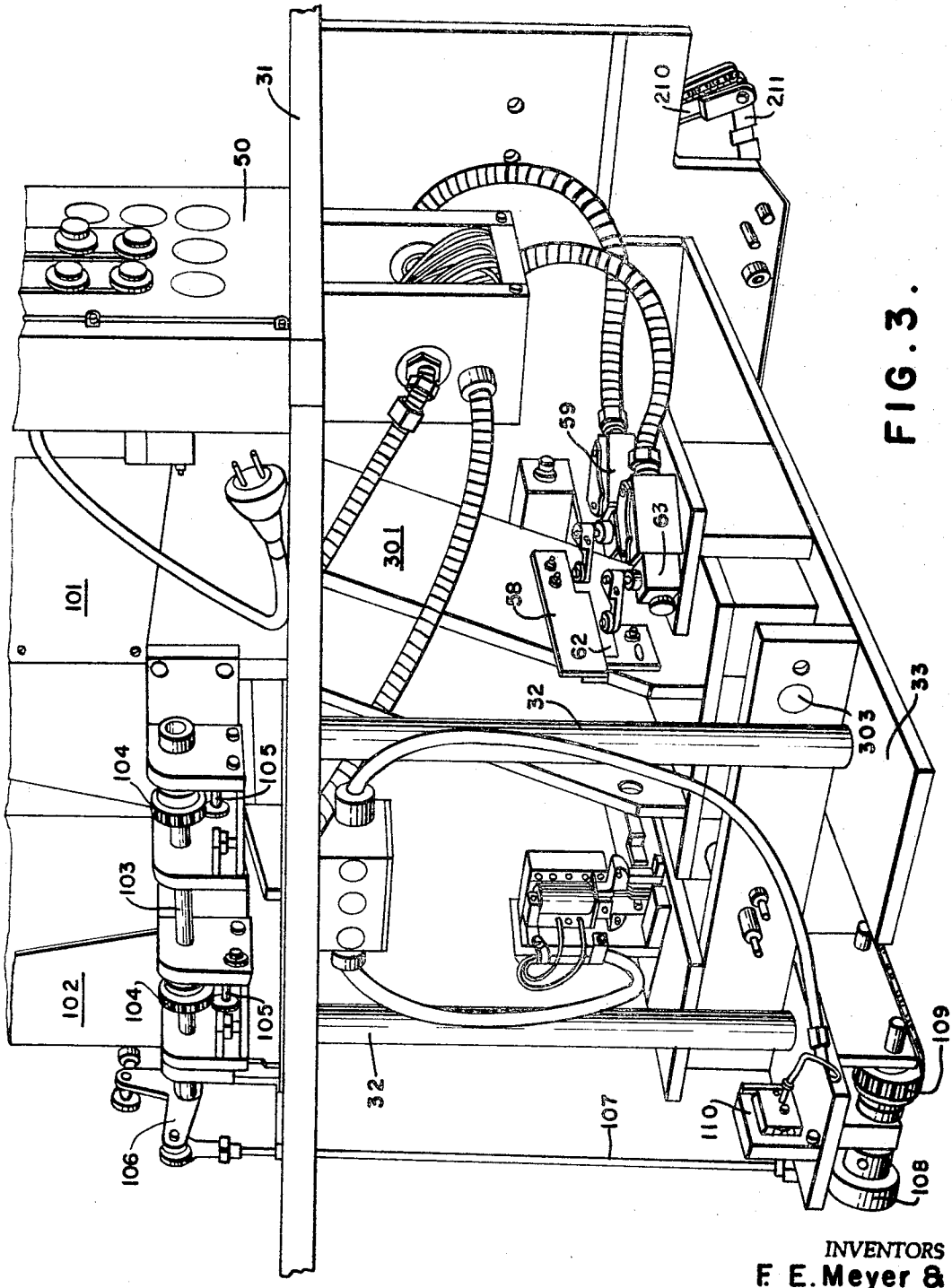


FIG. 3.

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BOX END FOLDING AND STAPLING MACHINE

Filed Sept. 22, 1966 9 Sheets-Sheet 4

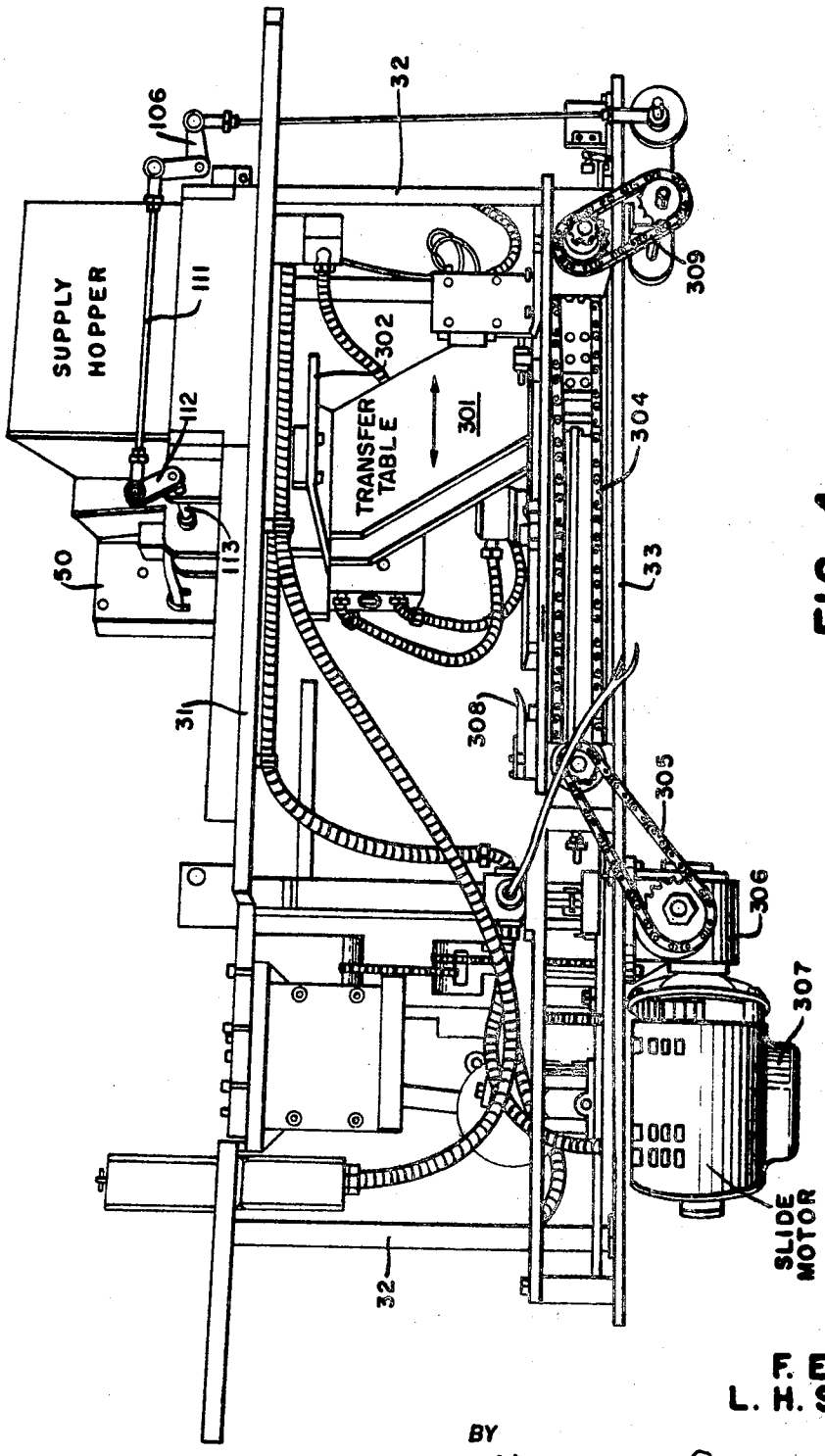


FIG. 4.

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BOX END FOLDING AND STAPLING MACHINE

Filed Sept. 22, 1966 9 Sheets-Sheet 5

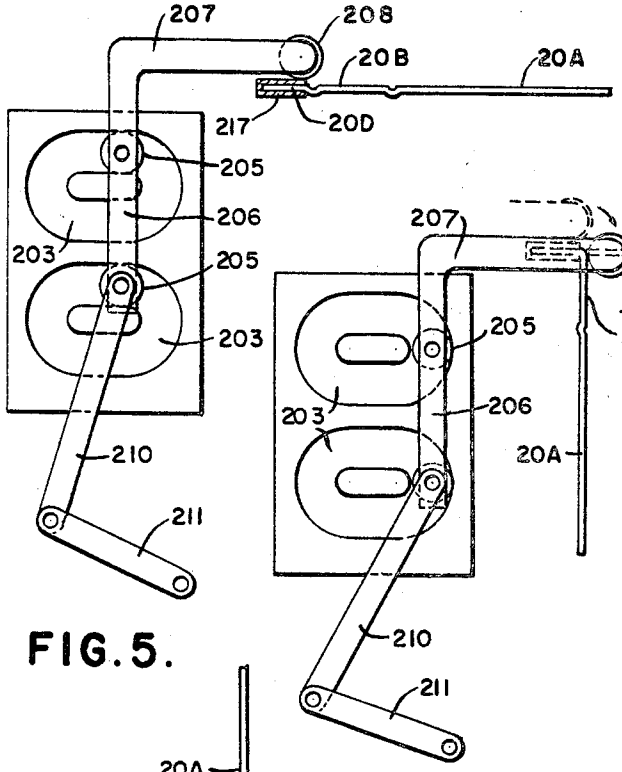


FIG. 5.

FIG. 6.

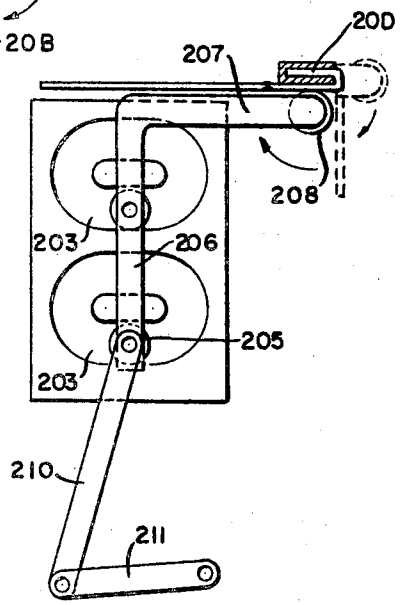


FIG. 7.

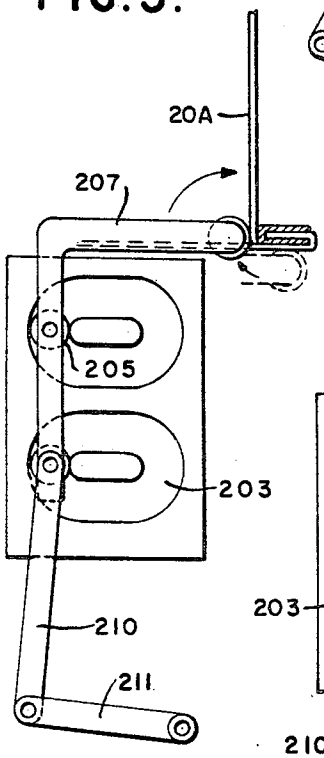


FIG. 8.

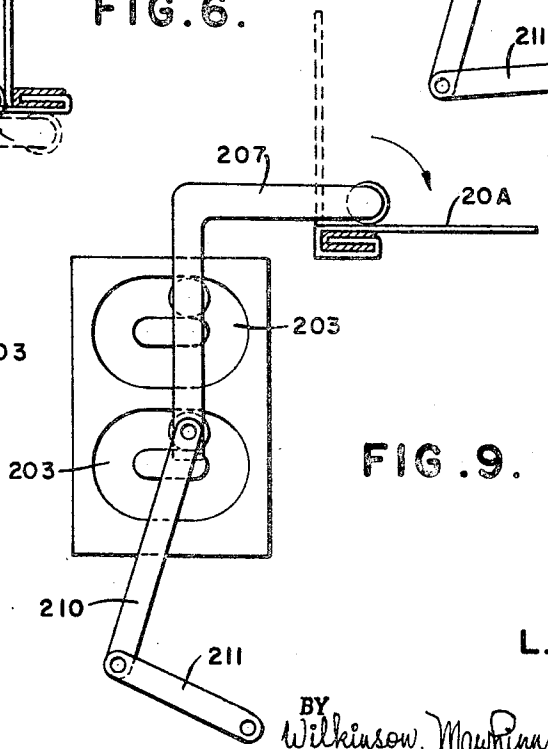


FIG. 9.

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Aug. 27, 1968 L. H. SAUCIER ET AL 3,398,657

BOX END FOLDING AND STAPLING MACHINE

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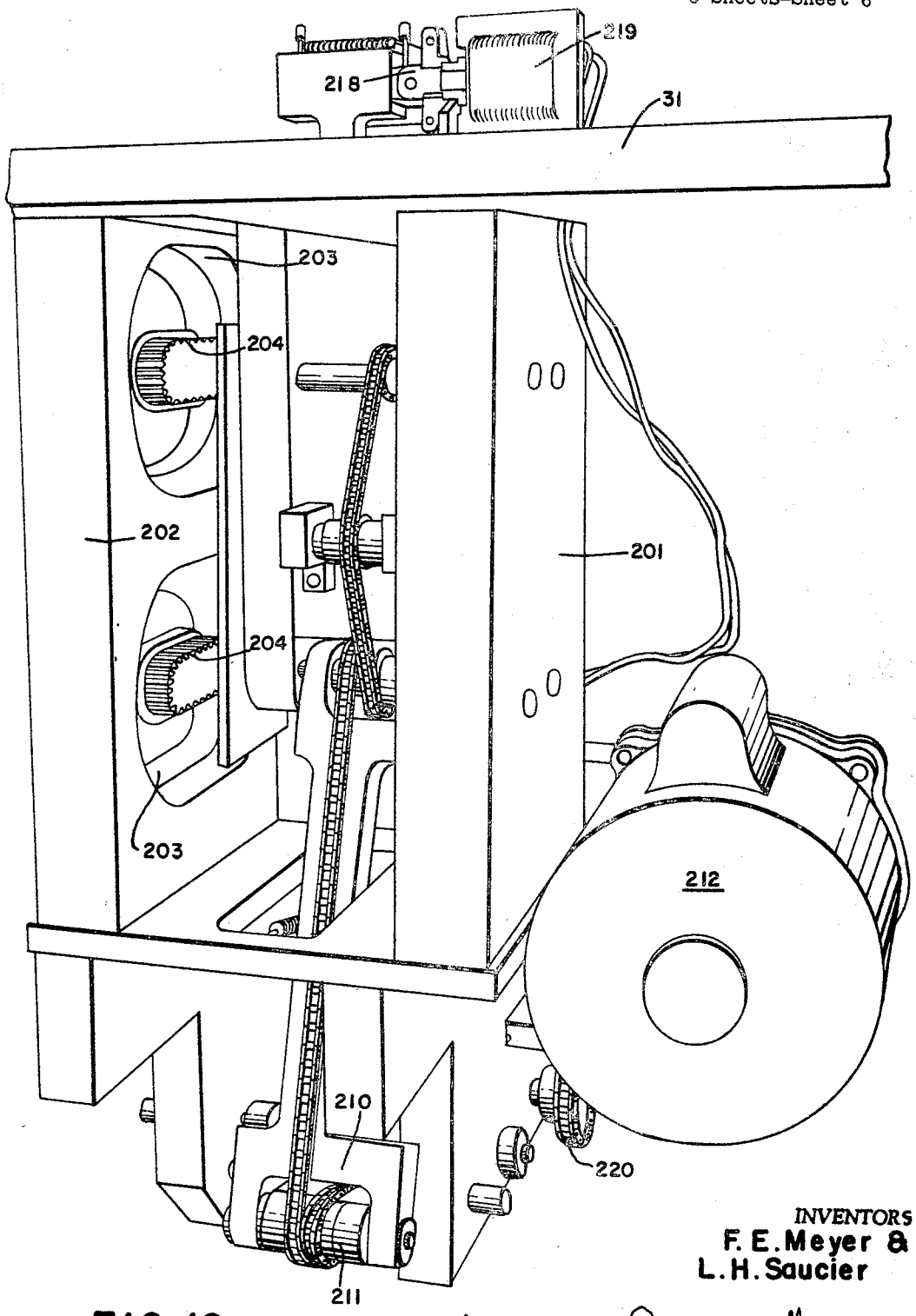


FIG. 10.

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BOX END FOLDING AND STAPLING MACHINE

Filed Sept. 22, 1966 9 Sheets-Sheet 7

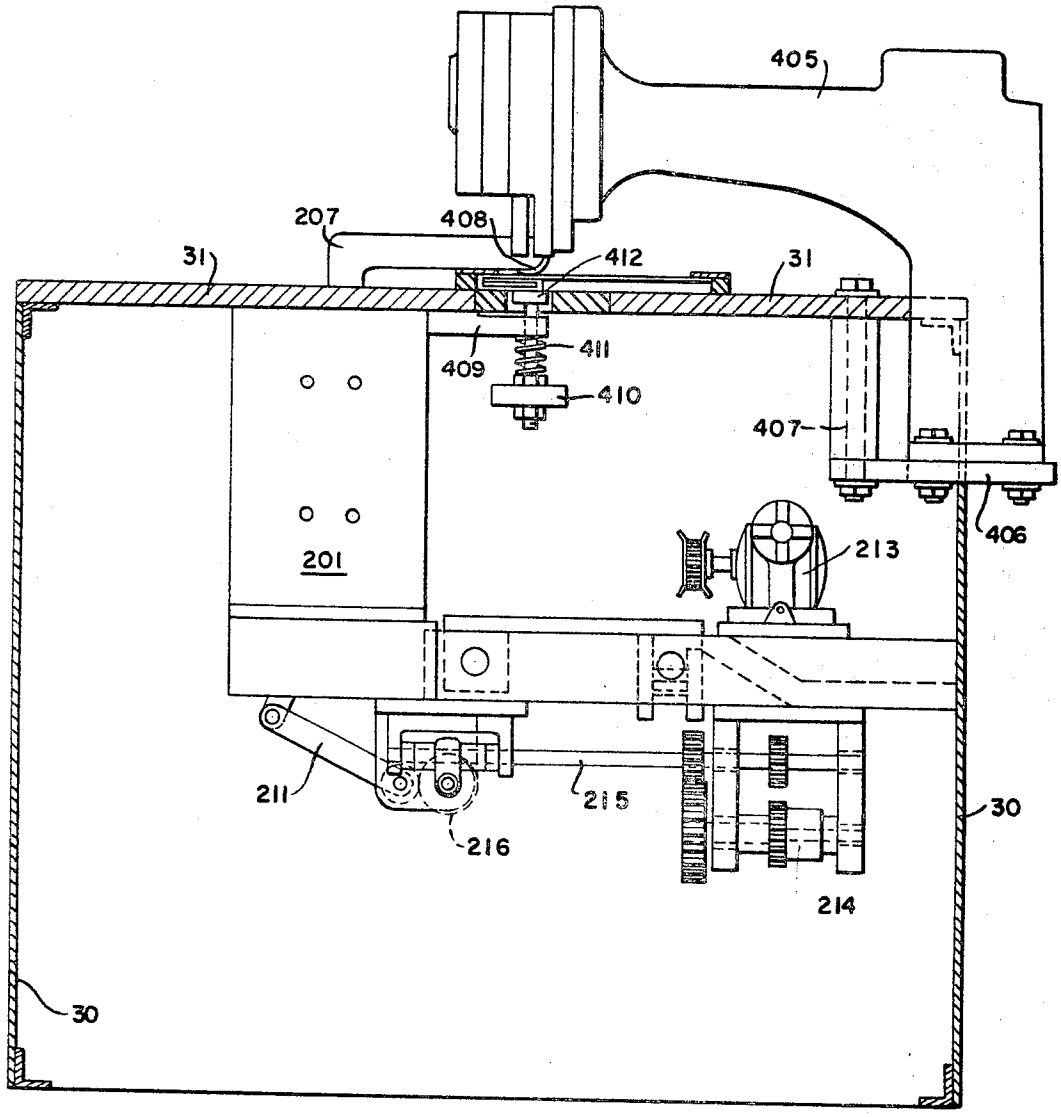


FIG. 11.

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BOX END FOLDING AND STAPLING MACHINE

Filed Sept. 22, 1966 9 Sheets-Sheet 8

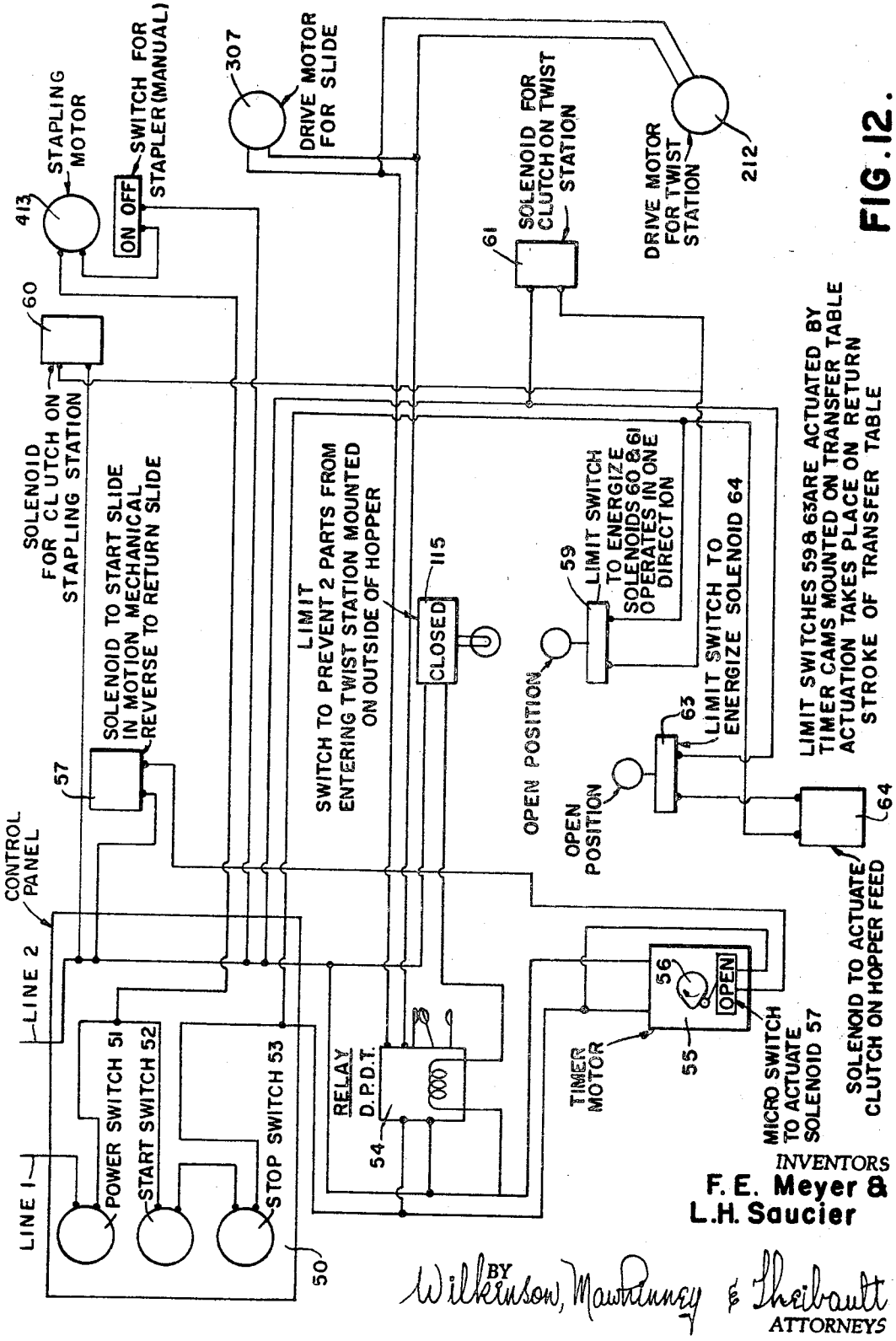


FIG. 12.

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Aug. 27, 1968 L. H. SAUCIER ET AL. 3,398,657

BOX END FOLDING AND STAPLING MACHINE

Filed Sept. 22, 1966 9 Sheets-Sheet 9

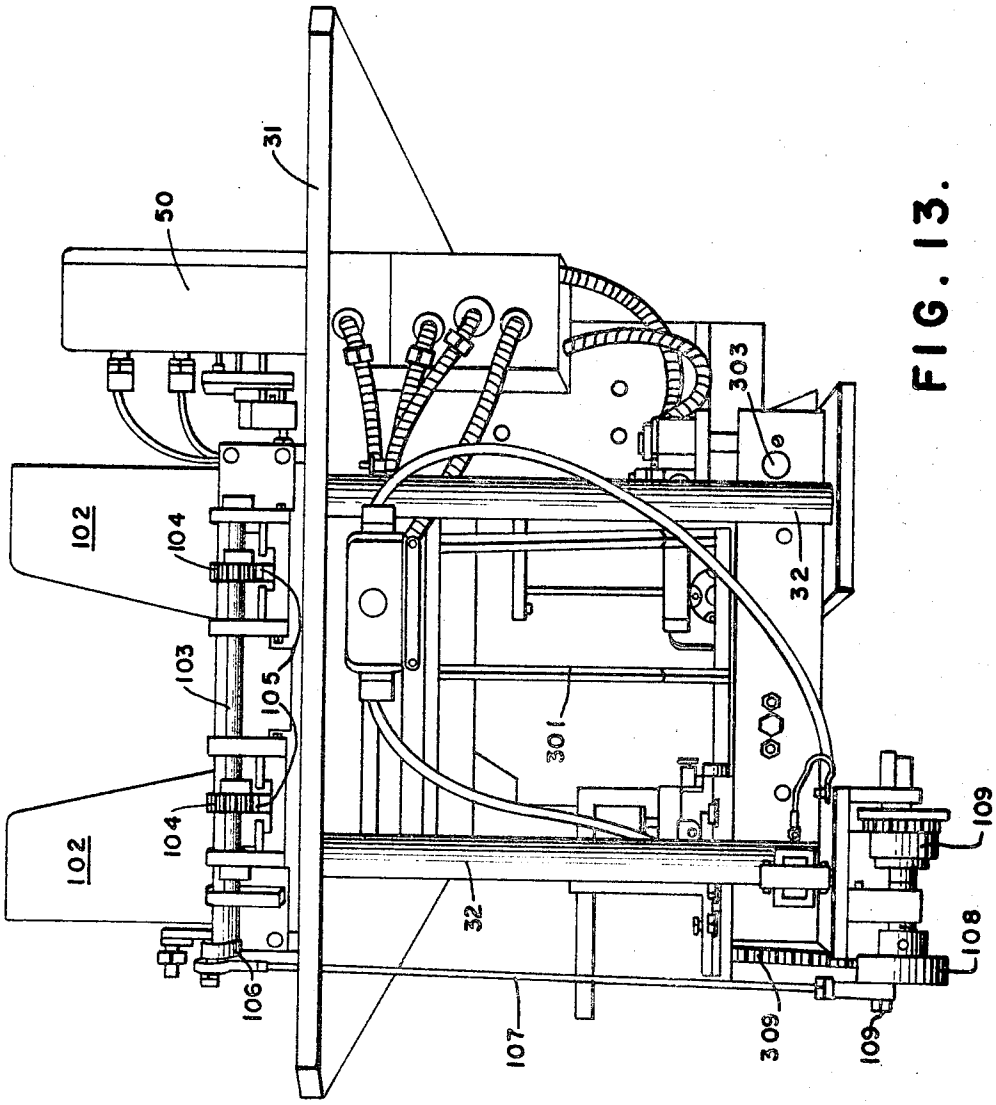


FIG. 13.

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United States Patent Office 3,398,657 Patented Aug. 27, 1968

3,398,657

BOX END FOLDING AND STAPLING MACHINE

Lionel H. Saucier and Frank Emmett Meyer, New Orleans, La., assignors, by direct and mesne assignments, to Owens-Illinois, Inc., Toledo, Ohio, a corporation of Ohio

Filed Sept. 22, 1966, Ser. No. 581,314
8 Claims. (Cl. 93—36)

The present invention relates to a box end folding and stapling machine for folding and stapling previously scored box end blanks in large quantities automatically requiring only a charge of the supply hopper with a supply of box end blanks. After the box ends have been stapled, they are dropped off the machine onto a conveyor line for distribution. Heretofore the state of the art was such that each box end blank was required to be manually folded and formed and subsequently stapled. This reduced output production of box end blanks and the present invention provides a machine for overcoming the drawbacks requiring the human labor as well as the retarded rate of production and then producing a standardized uniform part.

With the present invention a machine is provided having a supply hopper for receiving a vertical stack of box end blanks and for feeding these box end blanks from the supply hopper one at a time from the bottom of the stack to a twist station where one end of the box blank is retained and the remainder of the box end at the twist station was wrapped about the folded end to provide an exceptionally strong end at one end of the box blank. A horizontal transfer means is provided for engaging the box blank at the bottom of the supply hopper which transfers the box blank to the twist station and thereafter the thus twisted and formed blank is advanced to a stapling position where the wrapped and folded end of the box blank is stapled.

A further object of the present invention is the provision of a machine of the type described in which each of the transfer stations, twist stations and stapling stations are under the actuation of the solenoid control clutch which clutch may have its torque loading regulated so as to supply adequate power to do the job so that upon overload the mechanical train of the machine is not broken because the clutch will simply override and slip.

A further object of the present invention is to provide a machine having a horizontal transfer means which will transfer only one box blank at a time from the supply hopper vertical stack to the twist station. A limit switch is provided to stop the machine should more than one box blank be supplied from the supply hopper at any one time.

A further object of the present invention is the provision in a machine of the type described of a twist station having a folding horn which is positioned to overlie a box end blank and which is positively driven to make an elliptical orbit of 360° so as to fold the box end blank upon itself.

A still further object of the present invention is the provision of a box end folding and stapling machine wherein the horizontal transfer for moving the box blank from the supply hopper to the twisting station is a reciprocating table which table is driven in both directions of reciprocation by a unidirectional endless drive chain, the upper run of which causes the transfer table to move a box blank from the supply hopper to the twist station and the lower run of said endless chain causes the transfer table to return to its origin position beneath the supply hopper.

A further object of the present invention is the provision of a box end folding and stapling machine as set

forth hereinabove wherein the solenoid actuated clutches are arranged to interlock the system so that the box blanks are fed from the supply hopper only one at a time and the twist station could not be energized unless the transfer table is back to the origin position beneath the supply hopper and the folding member is in an origin position.

A still further object of the present invention is the provision of a gear rack and pinion positive drive, for driving the twist or box end folding member, which defines an endless track having teeth thereabout which mesh with the pinion for positively driving and actuating the linkage compelling the twist or folding member to follow its predetermined orbit of motion.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views:

FIGURE 1 is a top plan view of a machine constructed in accordance with the present invention showing the supply hopper charged with the box end blank and the twist station with the box end blank advanced to the position where it is to be folded upon itself.

FIGURE 2 is a perspective view of the machine of the present invention removed from its cabinet enclosure and with the stapling device removed.

FIGURE 3 is a perspective view of the machine of the present invention removed from the cabinet showing the transfer supply table and hopper feed arrangement.

FIGURE 4 is a rear elevational view of the machine of the present invention removed from its cabinet and having the stapler removed.

FIGURES 5 through 9 inclusive are schematic sequential views of the mode of operation of the twist station operating upon a box blank.

FIGURE 10 is a perspective view of the drive mechanism for the twist station.

FIGURE 11 is a vertical section taken through the machine at the stapling station.

FIGURE 12 is an electrical schematic of the control and drive system of the machine of the present invention.

FIGURE 13 is an end elevational view taken from the supply hopper station end of the machine.

The box end blank

As best seen in FIGURE 1, the article worked upon by the machine of the present invention is a flat box blank having a major portion **20A**, a fold portion **20B** defined from **20A** by a score line **20C**, the width of **20B** is the same as that of **20A**. A lead or retaining flap **20D** is provided to retain the blank while it is being twisted or folded upon itself. The fold portion **20B** is defined from the flap **20D** by a score line **20E**.

General description of the machine

Referring now for the moment to FIGURES 1 and 4, **30** designates a metal cabinet which contains a top support plate **31**, having spacers **32** from which is suspended a base plate **33**.

The supply hopper station

A supply hopper station **100** is shown and for the moment with respect to FIGURES 2 and 4, a box blank confining shields **101** and **102** are mounted on the top support plate **31** and are spaced apart to receive, as best seen in FIGURE 1, a supply of the box end blanks. At one end of the box blank retainer is rotatably journalled, a shaft **103** having gears **104** secured thereon for actuating a dispensing finger **105** which permits only a single box blank to be dropped down beneath the fingers **105** in the hopper.

The feed rate is controlled by a bell crank arm **106** secured to rock shaft **103** which bell crank receives its oscillatory motion from a shaft **107** eccentrically connected to a drive member **108** at **109**, which drive member is actuated when engaged by a clutch **109** under a solenoid **110** when the transfer slide table is in the origin poistion as will be more fully described hereinafter. Extending forwardly is a rod **111** which actuates a crank arm **112** which causes shaft **113** to rock and in the manner described, and as the shaft **103** and its gears **104** cooperate with fingers **105**, box blanks are dropped at the opposite end of the supply hopper by the rocking motion. This rocking motion is in synchronism to permit the fingers **105** to come back into place, and to block descent of more than one box blank, the shaft **113** at the other end also controls the descent so that only one such blank is permitted to drop beneath the supply hopper at a time.

The twist station

As shown in FIGURE 1, the box blanks are advanced in the direction of the arrow from the supply hopper station to the twist station and thence to the stapling station. The twist station will now be described.

As shown in FIGURES 1 and 2, the top support plate **31** has a cutout bounded by the areas **31a**, **31b** and **31c** to permit operation of the twisting mechanism. The twisting station structure will bear the reference numerals of series **200**.

Secured beneath the plate **31** are a pair of plates **201**, **202** having cutout endless trackways **203**, the inner runs of which are provided with gear teeth **204** which gear teeth are meshed with a drive pinion **205** for compelling positive driving motion in an elliptical path in the endless guide slots **203**. The pinion **205** is secured to arm **206** but may rotate relative thereto. The upper end of the arm **206** at its portion **207** has a folding horn **208**. A roller **209** is journalled at the free end of the horn **208**. Pivotally connected to and compelling motion of the arm **206** are linkages **210**, **211**. The linkage **211** is driven from a twist motor **212**, through a reducer **213**, through a solenoid clutch assembly **214**, over shaft **215**, through gear train **216**. As shown in FIGURES 5 through 9 inclusive, the mode of operation of the twist station is shown. A box blank having its portion **20D** is confined in a U-shaped guide **217**. Upon driving the twist motor **212**, the arm **207** will advance to the right as shown in FIGURE 6 causing the horn **208** to pass over the end of the U-shaped member **217**, and the descent causing the portion of the box blank **20B** and its connected end **20A** to be directed downwardly. When this motion has been completed, the link **210** will then travel as shown in FIGURE 7 to the left causing the horn **208** to compel the portion **20B** and **20A** of the box blanks to be twisted to the left in FIGURE 7 upon completion of which motion the link **210** then compels arms **206** and **207** to rise upwardly folding the portion **20A** at right angles to the portion **20B** upon scored line **20C** to the position of FIGURE 8 and thence further driving movement of the link **210** causes the horn **208** to fold the portion **20A** over the entire previously held and folded portions as shown in FIGURE 9 to form a completely folded box end.

As best seen in FIGURES 1 and 2, the box blank is then advanced to the stapling station.

As best seen in FIGURE 2, the arm **207** has a member **218** which engages and actuates a solenoid **219** for engaging a drive clutch **220** to permit the twist motor **212** to drive the mechanism. If the member **218** has not engaged the solenoid control **219**, no power will be supplied to the motor **212** and hence the twist station cannot be activated.

The transfer slide table

As best seen in FIGURES 3 and 4, a box blank transfer table mechanism will be described as being in series bearing the numbers **300**.

A transfer slide **301** having a top transfer table **302** is reciprocatably carried on rods **303** secured to plate **33** and spacers **32**. This transfer table is adapted to be reciprocated in the direction of the arrows shown in FIGURE 4. The transfer table is reciprocated back and forth on the rods **303** by an endless chain drive **304** which receives its power through chain **305**, driven through a gear reducer **306**, powered by a transfer table slide motor **307**. The endless chain **304** travels in the direction of the arrow, that is so driven that the upper run moves from right to left in FIGURE 4. The transfer table carriage **301** engages the top run of endless chain **304** and is advanced to the left in FIGURE 4 from its starting position beneath the supply hopper **100** where it engages the box blank which has been released by the supply hopper feed mechanism and the transfer table moves the box blank horizontally to the left in FIGURE 4 over to the twist station **200** shown in FIGURE 1, at which time the transfer table mechanism engages a reverse contactor **308** which causes the lower run of the chain to engage the transfer table and return it to the origin position beneath the supply hopper. After each box blank has been formed at the twist station, the subsequent transfer of an unfolded box blank from the supply hopper **100** by the transfer table **300** will cause abutting transfer displacement of the folded formed box blank to advance same exactly beneath the stapling station. It will be noted that the actuation of dispensing box blanks from the supply hopper **100** is mechanically interlocked with the actuation of the transfer table through chain **309**.

As best seen in FIGURES 2 and 12, a limit switch **115** is provided and positioned with its wand at the point of entrance of the box blank into the U-shaped guide **217**. A flared mouth is provided at the introduction end of the U-shaped member **217** to permit insertion of the box blank **20** for advancing to the twist station and thence to the stapling station. The limit switch **115** will shut the machine down should it detect the presence of more than one box blank at a time.

Stapling station

Referring now to the stapling station, the parts described will bear reference numerals in the series 400.

Referring for the moment to FIGURES 1, 2 and 11, the top plate **31** has a pair of spaced apart guides **401**, **402** to which are secured confining plates **403**, **404** for exactly receiving, confining and guiding the box end blanks which have been formed in the twist station in the manner shown in FIGURES 5 through 9 inclusive. As the abutting box end blanks are advanced incident to reciprocation of the transfer table **301**, the box end blanks will come exactly beneath a commercial stapling machine **405** which is secured to a plate **406**, carried by spacers **407**, from the top plate **31**. The stapling end of the stapler **408** is positioned to exactly overlie spring loaded mandrel **409** which comprises a stop **410**, a compression spring **411**, and a mandrel head **412**. The mandrel head **412** is fitted to fall beneath the portion of the stapling machine overlying the stapling head **408** so that in the event there is a jam-up, the resiliently loaded mandrel will protect the machine against breakage. At the stapling station, two staples are driven through the previously folded end of the box blank advanced to the stapling station from the twist station. As shown in the schematic of FIGURE 12, the stapling drive motor **413** is interlocked with a solenoid clutch for actuation so that it cannot be actuated unless the other systems of the apparatus have functioned in their proper order.

Circuitry

As best seen in FIGURES 2, 3, and 12, an electrical system for the sequential operation of this apparatus has been provided which comprises a control panel **50** which is mounted on the top plate **31** and contains a main line switch **51**, a start switch **52** and a stop switch **53**. A main line switch **51** is connected across a suitable supply of 110–125 A.C. 60 cycle. In the control panel **50** is a relay

54 which will energize and start a timing motor 55. A cam 56 on the time rmotor 55 will actuate a micro-switch on the timer motor housing thus energizing the solenoid 57 to start the transfer table 301 moving in its forward direction to the left in FIGURE 4 by supplying current to the slide motor 307 which drives the horizontal transfer endless chain 304. At the far end of the slide, a mechanical finger 308 will push the roller on the slide trigger down thereby causing the slide table 301 to engage the lower run of endless chain 304 to return its origin position beneath the supply station 100. A top cam 58 is carried by the slide 301, as best seen in FIGURE 3, will actuate a limit switch 59 which will energize solenoid 60 to operate a single acting clutch on the twist station only when the arm 207 is in origin position. These solenoids operate together. While the slide 301 moves in a backward direction or to the right, as best seen in FIGURE 4, a lower cam 62 on slide 301 will activate limit switch 63 which will energize solenoid 64 which operates the single acting clutch 109 on the supply hopper station 100 to feed another box blank from the supply hopper to cause another complete cycle of the machine to take place.

The limit switch 115, as best seen in FIGURES 2 and 12, prevents two box blanks from entering the twist station and is mounted on the outside of the hopper so that when a double thickness of parts move under the roller of the limit switch, the switch will cause the circuit to be opened, letting the relay in the control panel to fall out, thereby causing both motors 212 and 307 to stop.

Although we have disclosed herein the best forms of the invention known to us at this time, we reserve the right to all such modifications and changes as may come within the scope of the following claims.

What we claim is:

1. A box end folding and stapling machine for folding and stapling previously scored box end blanks having two score lines proximate one end of the blank comprising

(a) a supply hopper for receiving a vertical stack of box end blanks and ejecting a single blank at a time from the bottom of the stack,

(b) a twist station positioned to receive a box end blank and retain one end thereof while permitting the remainder of the blank to be twisted beneath, under, over and about the retained end,

(c) horizontal transfer means positioned to engage and transfer the single box blank from the bottom of the supply hopper and to transfer the box blank to said twist station in position to be retained at one end and twisted 360° about the retained end, and

(d) stapling means positioned to staple the folded box end.

2. A box end folding and stapling machine as claimed in claim 1 wherein the ejecting of a single blank is electrically interlocked with the horizontal transfer means and the twist station to avoid arrival of more than one box end at a time at the twist station.

3. A box end folding and stapling machine as claimed in claim 1 wherein said twist station comprises a folding horn positioned to overlie a U-shaped guide which retains one end of the box end blank to be folded, said horn being positively driven to make an elliptical orbit to fold the box end blank upon itself.

4. A box end folding and stapling machine as claimed in claim 1 wherein said horizontal transfer means is a reciprocating table driven by a unidirectional endless drive chain whereby the upper run of said endless drive chain causes the table to transfer a box blank from the supply hopper to the twist station and the lower run of said endless chain returns the table to the supply hopper.

5. A box end folding and stapling machine as claimed in claim 1 wherein said supply hopper has a positive feed means positioned to engage and permit only one box blank to drop onto the horizontal transfer means upon engagement of a solenoid actuated clutch the solenoid of which is actuated by the horizontal transfer means when it has returned to its origin position beneath the supply hopper.

6. A box end folding and stapling machine as claimed in claim 1 further comprising a solenoid interlock at the twist station to render the twist station active only when the horizontal transfer means has returned to its origin position beneath the supply hopper.

7. A box end folding and stapling machine as claimed in claim 1 wherein said twist station comprises a pair of spaced apart support members, endless track means carried by each support means, a box end twist engaging member, twist drive means positively engageable with said track means, linkage connecting said drive means with said twist member, and drive means having a solenoid actuated clutch to engage and drive said twist member only when the twist member is in a home origin position.

8. A box end folding and stapling machine as claimed in claim 1 wherein said stapling means comprises a stapler positioned to overlie the folded end of the box end after the folded end has been displaced by a newly folded box end, and a spring loaded mandrel beneath said stapler.

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BERNARD STICKNEY, *Primary Examiner.*