Dec. 13, 1955 P. E. FISCHER ET AL 2,726,499

CARTON CLOSING MACHINE

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FIG. 1

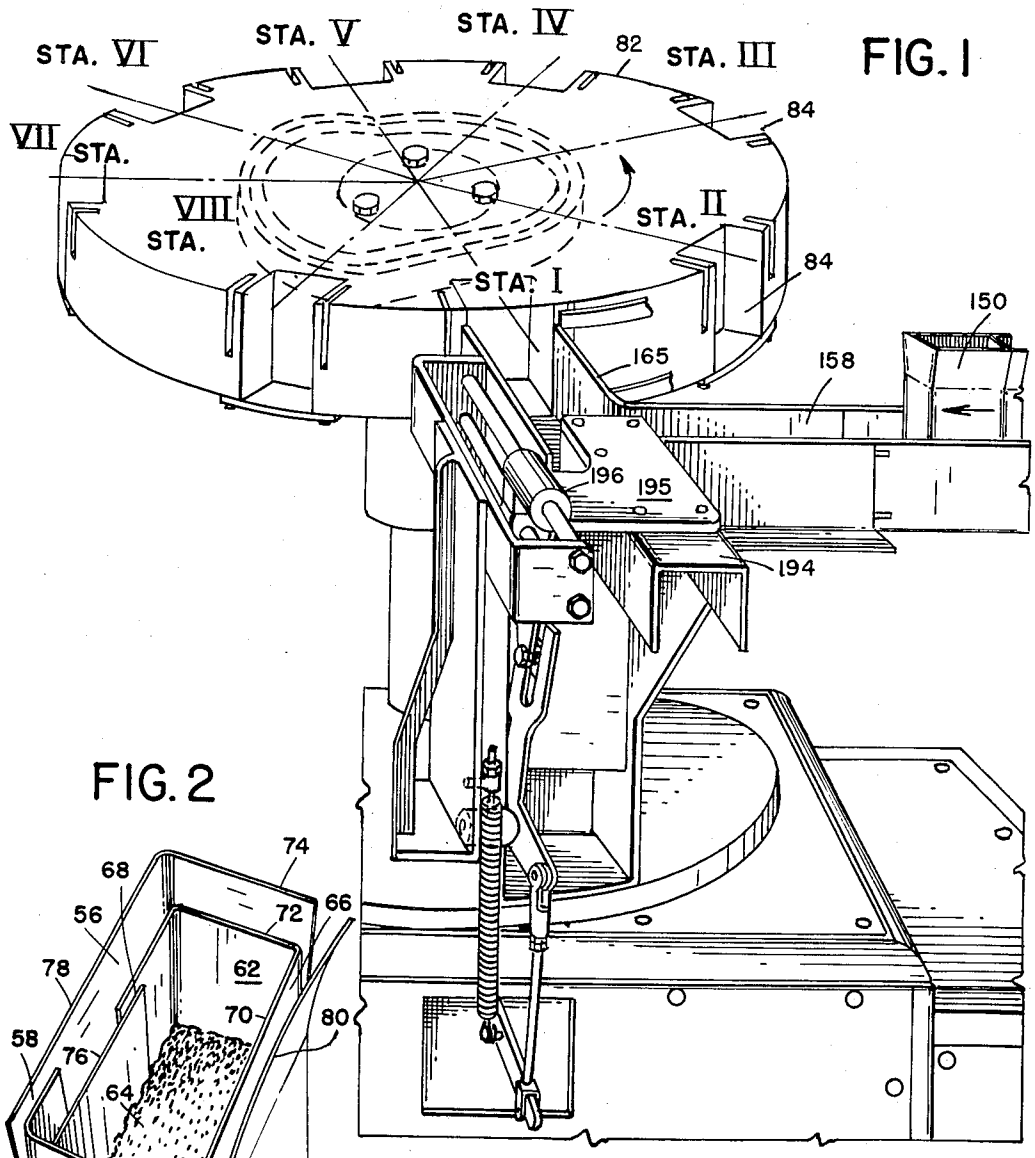
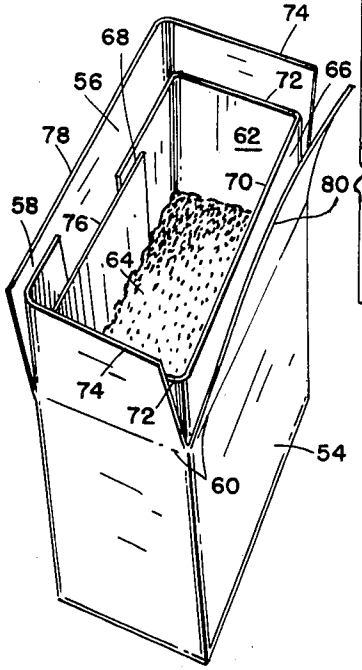


FIG. 2



INVENTORS:-

PAUL E. FISCHER
ROBERT S. HEDIN
CHARLES H. SWANSON
HENRY E. WISSMAN

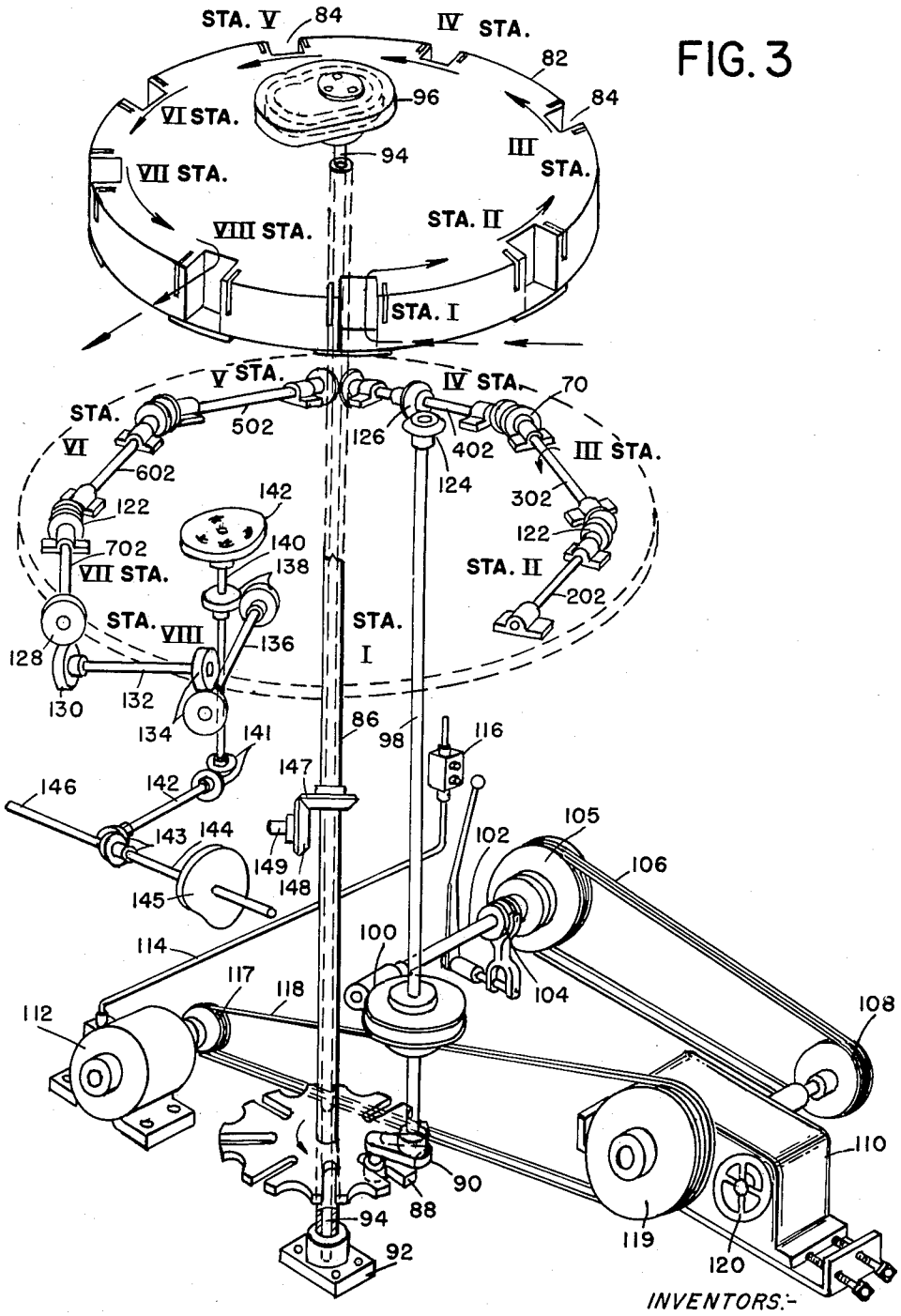
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CARTON CLOSING MACHINE

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FIG. 3



INVENTORS:-
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CARTON CLOSING MACHINE

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FIG. 4

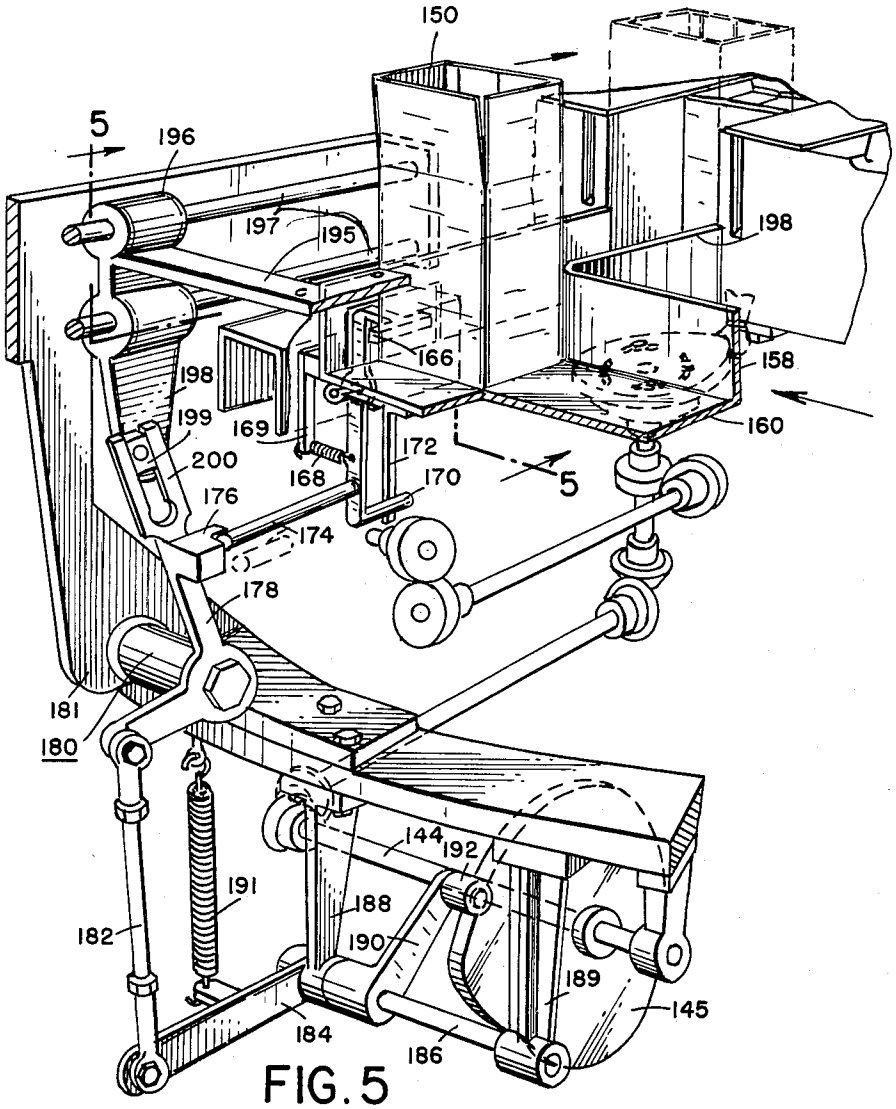
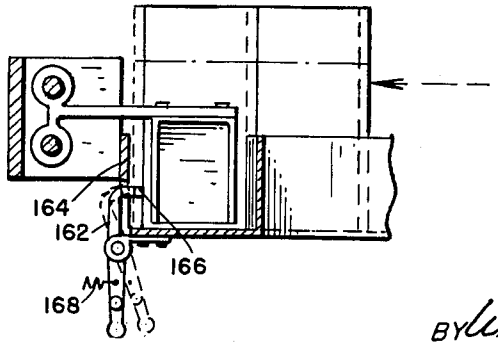


FIG. 5



INVENTORS:-

PAUL E. FISCHER
ROBERT S. HEDIN
CHARLES H. SWANSON
HENRY E. WISSMAN

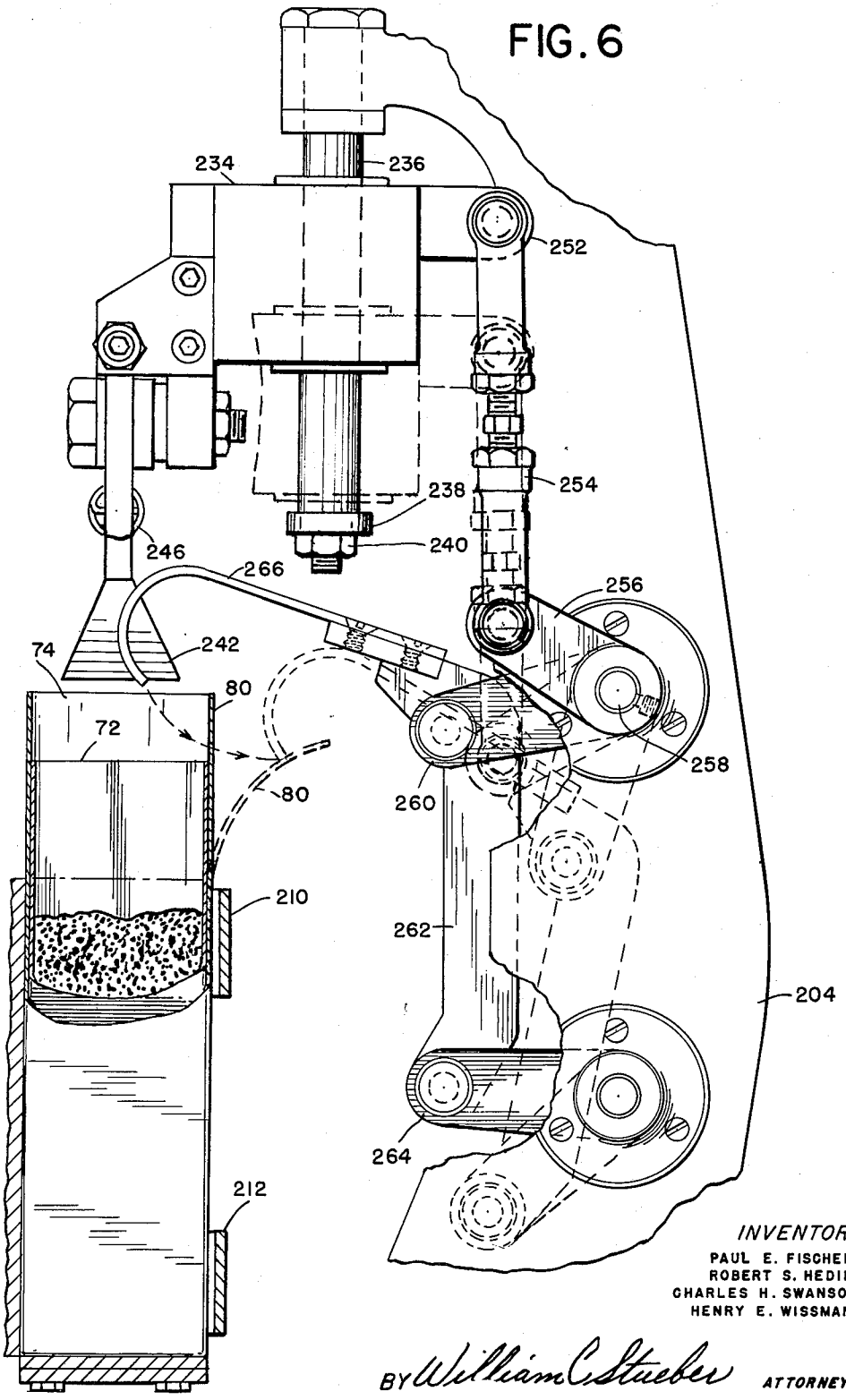
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FIG. 6



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CARTON CLOSING MACHINE

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FIG. 7

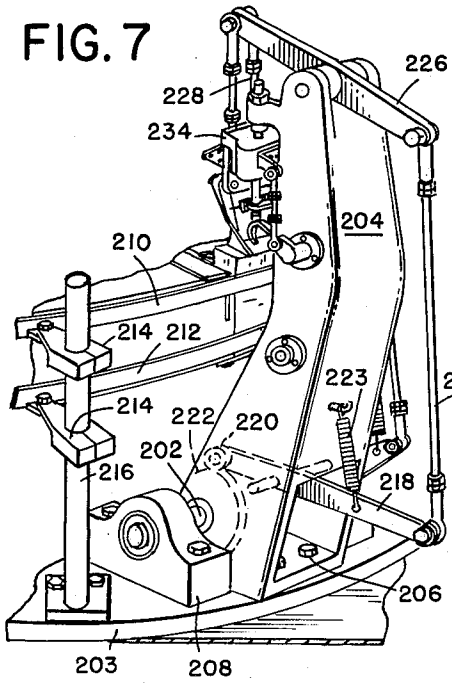


FIG. 8

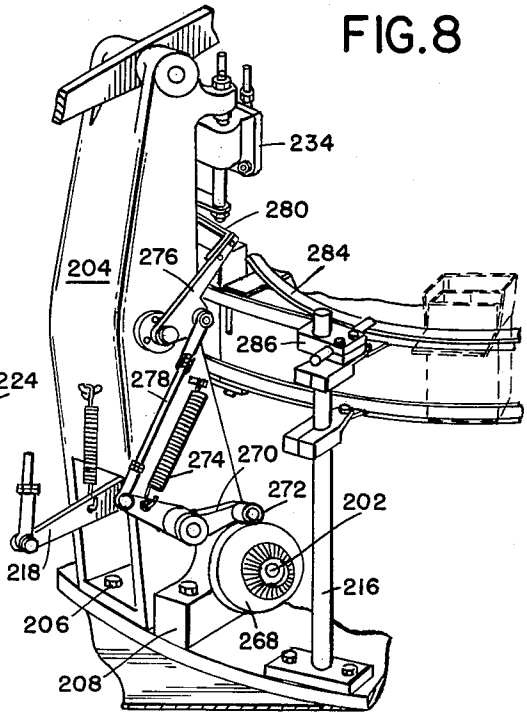


FIG. 9

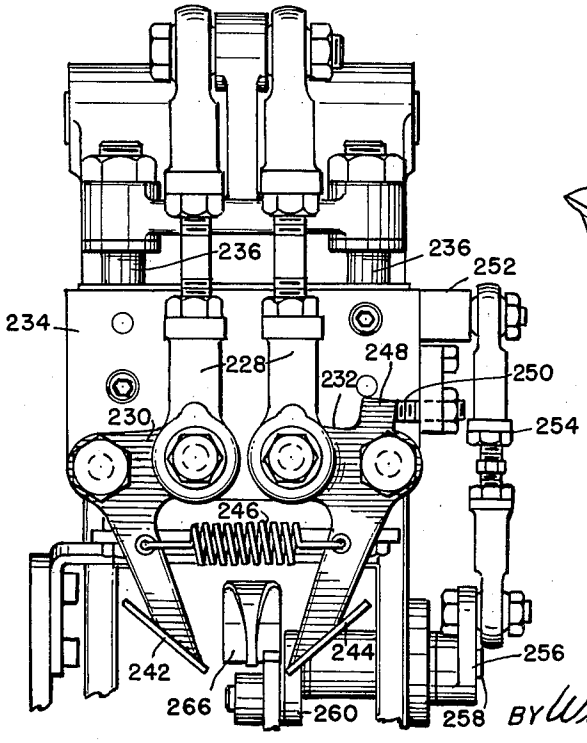
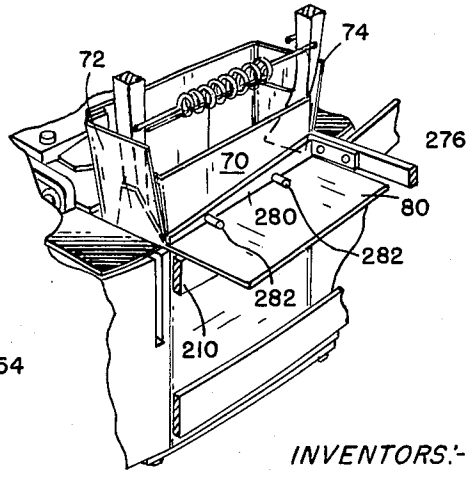


FIG. 10



INVENTORS:-
PAUL E. FISCHER
ROBERT S. HEDIN
CHARLES H. SWANSON
HENRY E. WISSMAN

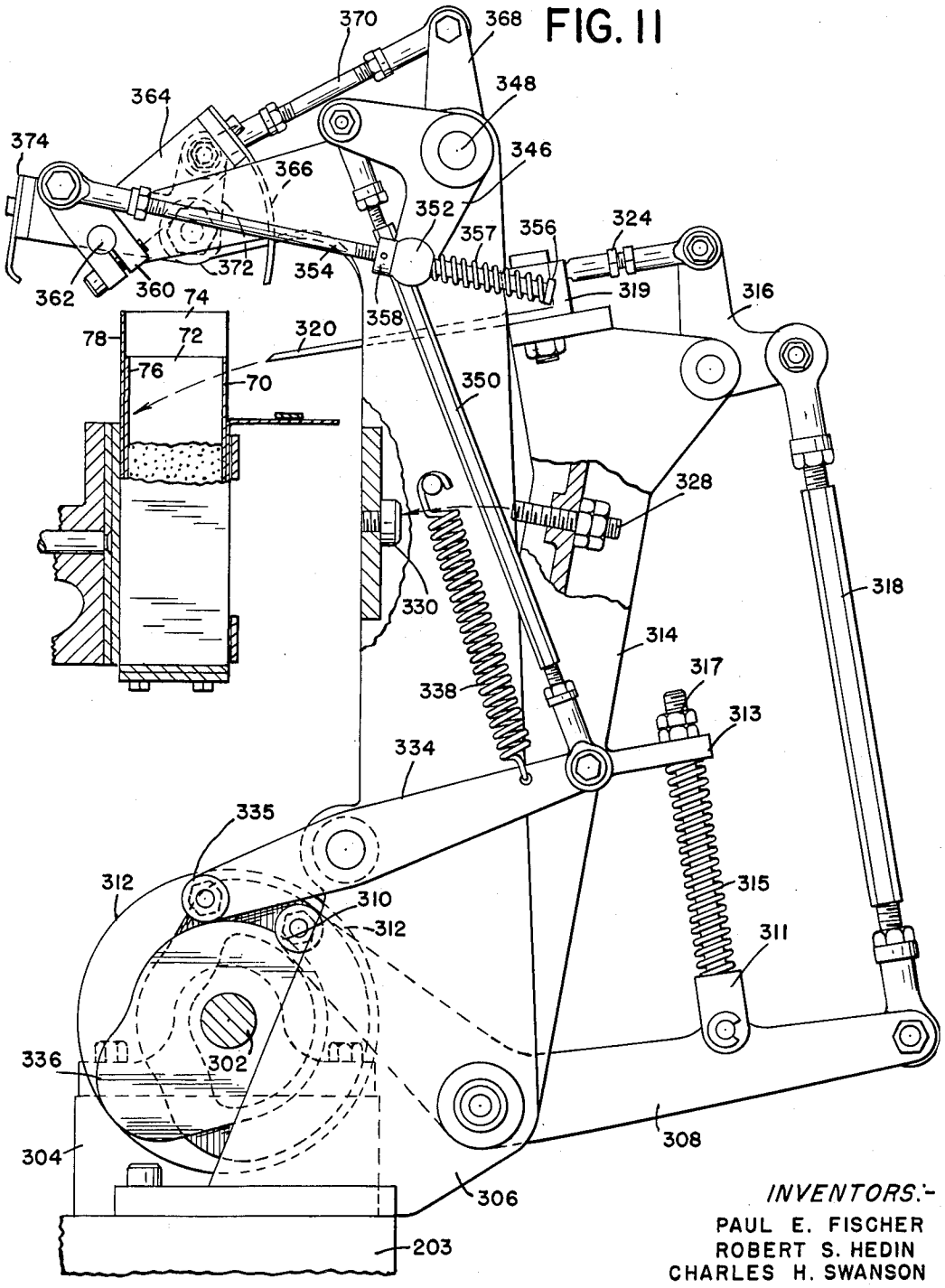
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FIG. 11



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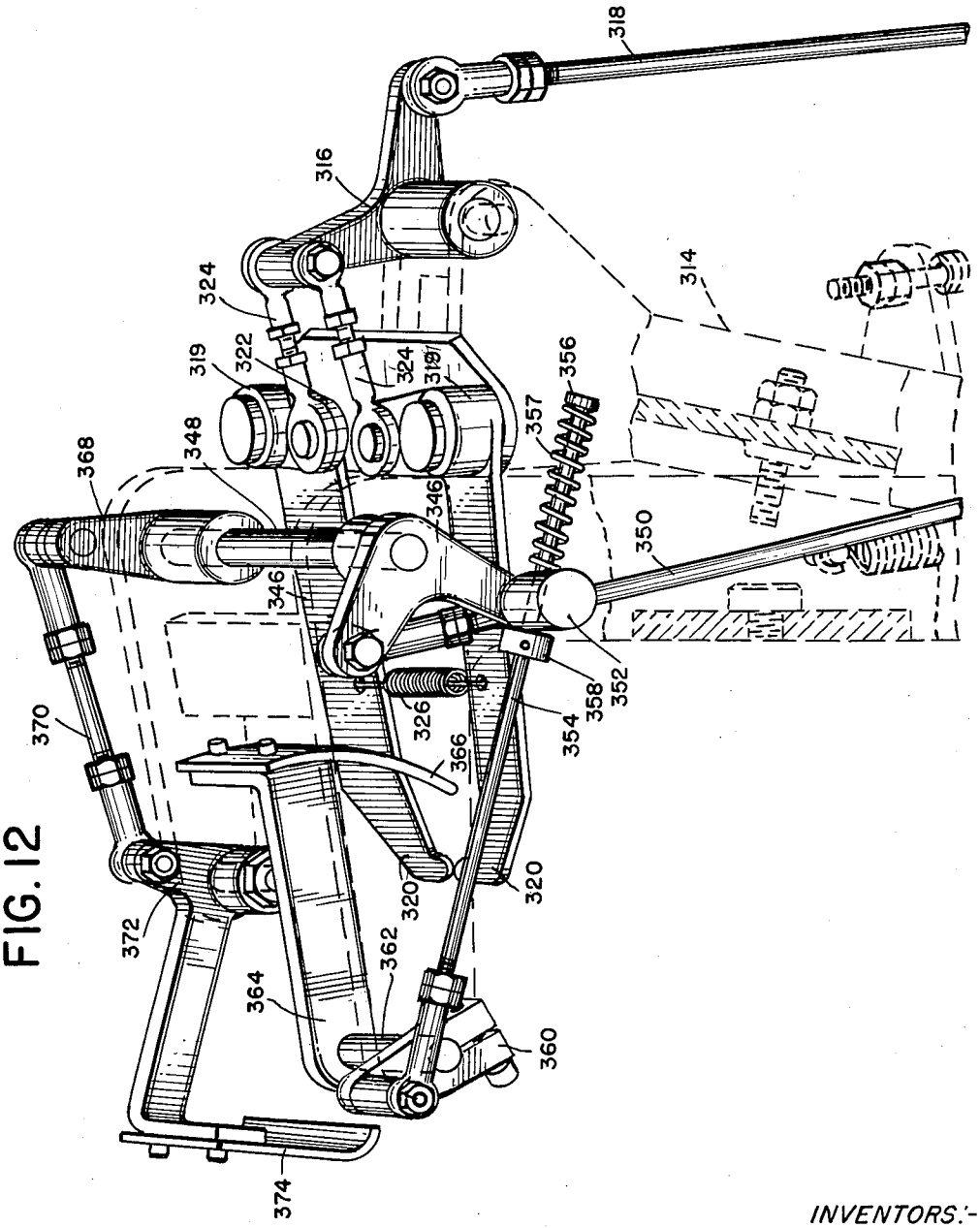


FIG. 12

INVENTORS:-

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HENRY E. WISSMAN

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FIG. 13

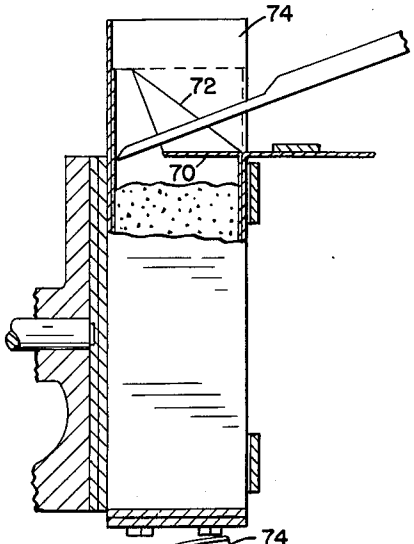


FIG. 14

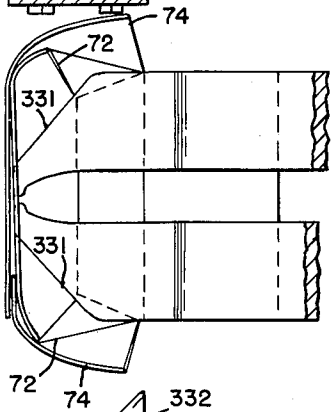
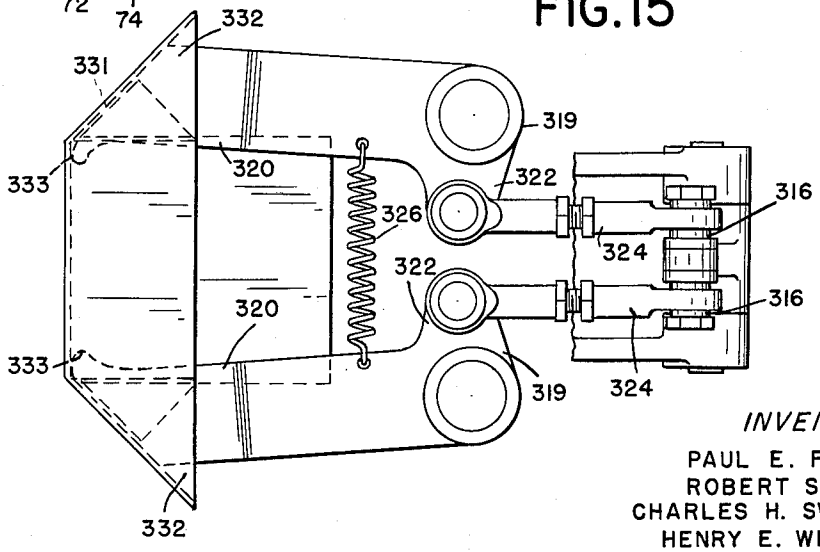


FIG. 15



INVENTORS:-

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FIG. 16

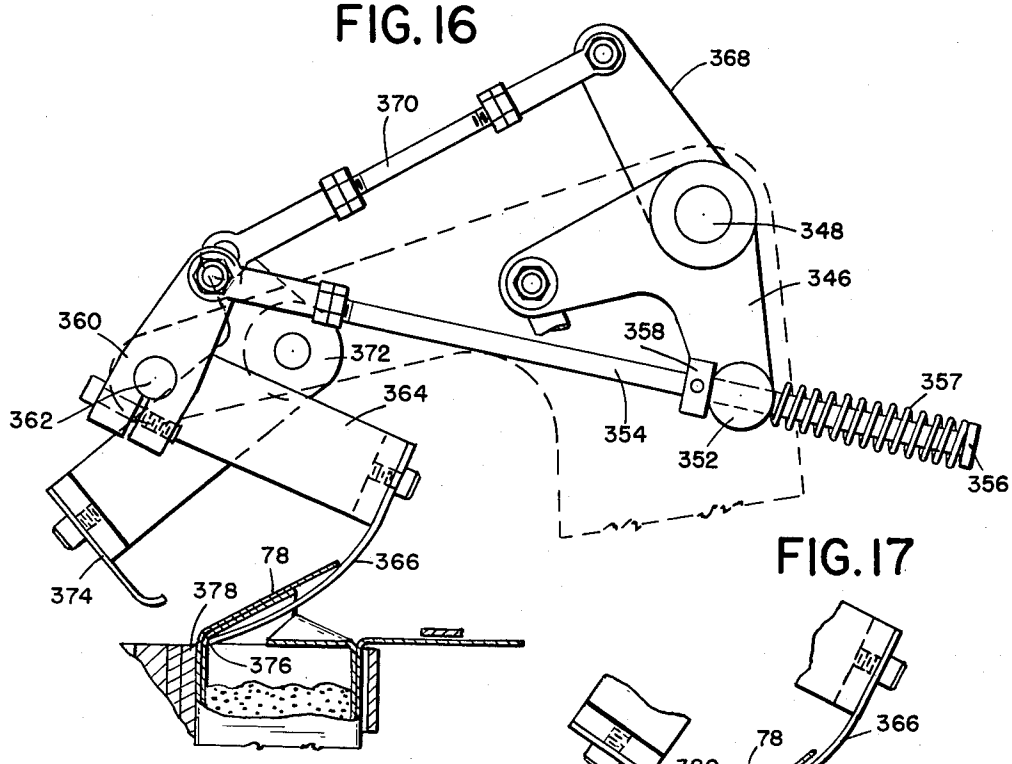


FIG. 17

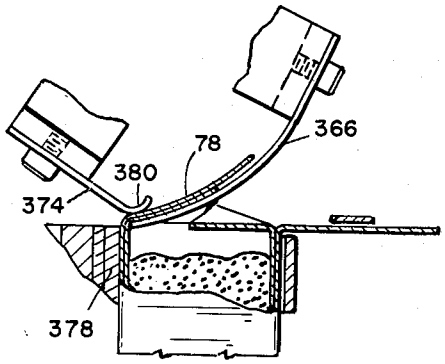
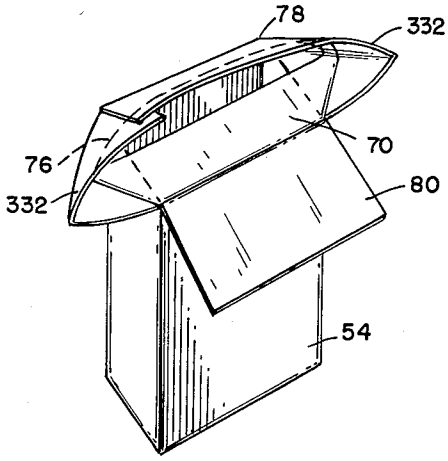


FIG. 18



INVENTORS:-

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FIG. 19

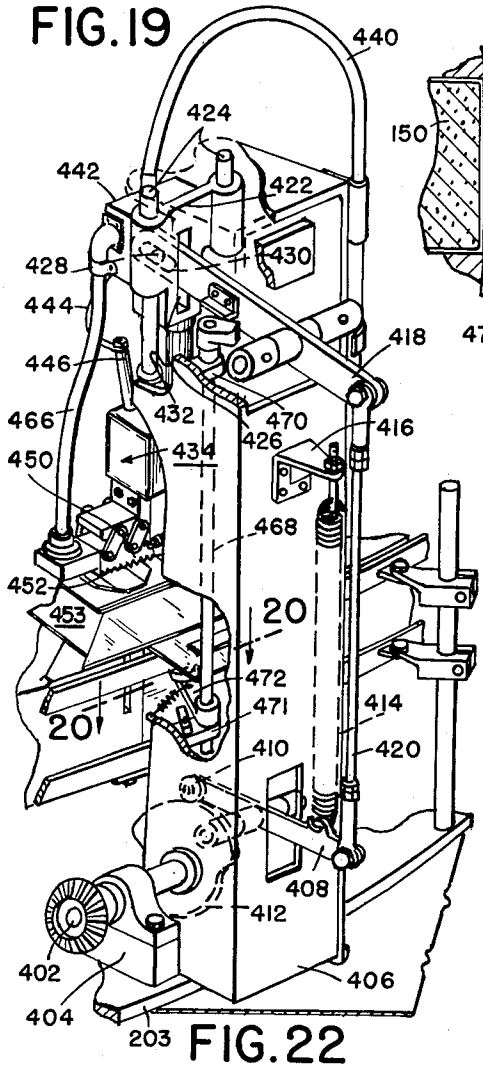


FIG. 20

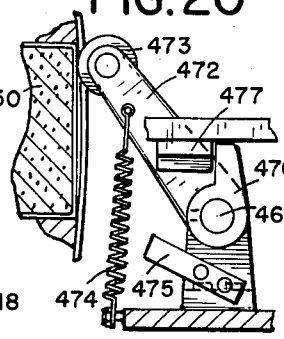


FIG. 21

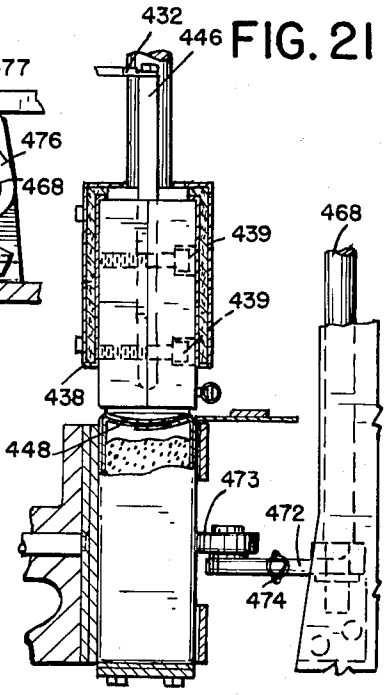


FIG. 22

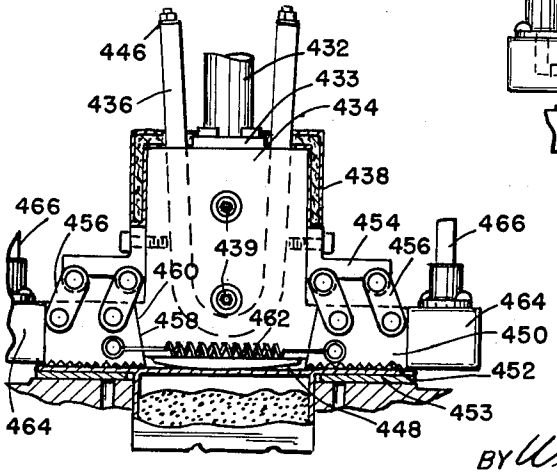
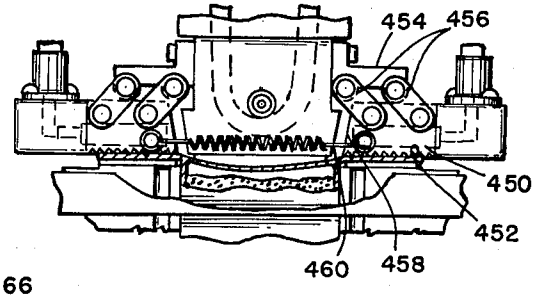


FIG. 23



INVENTORS:-
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FIG.25

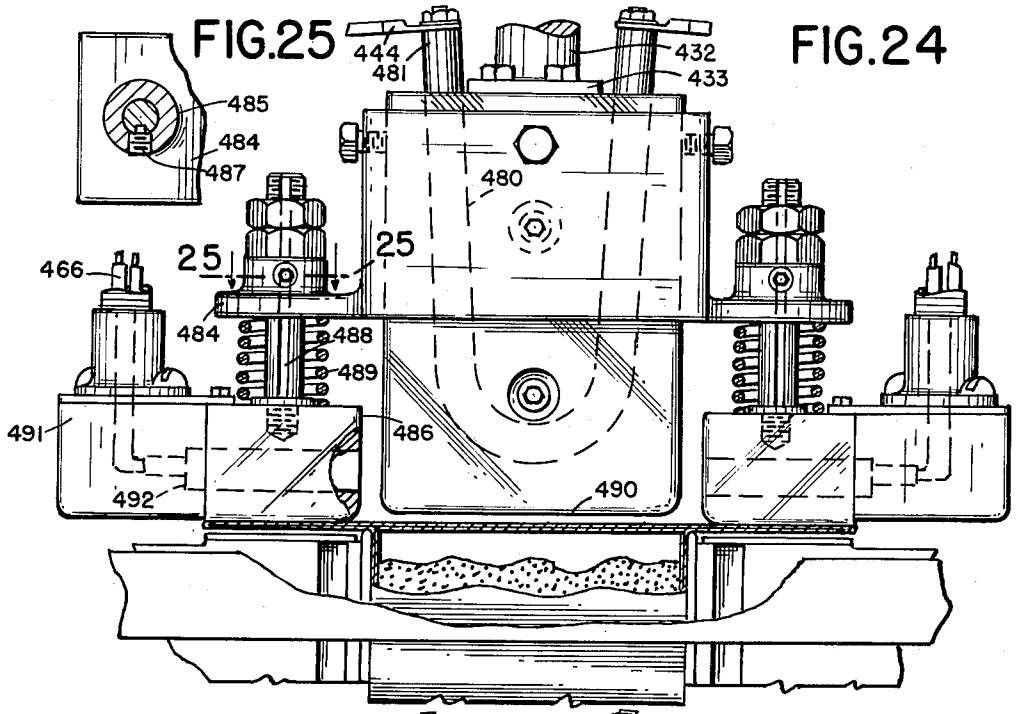
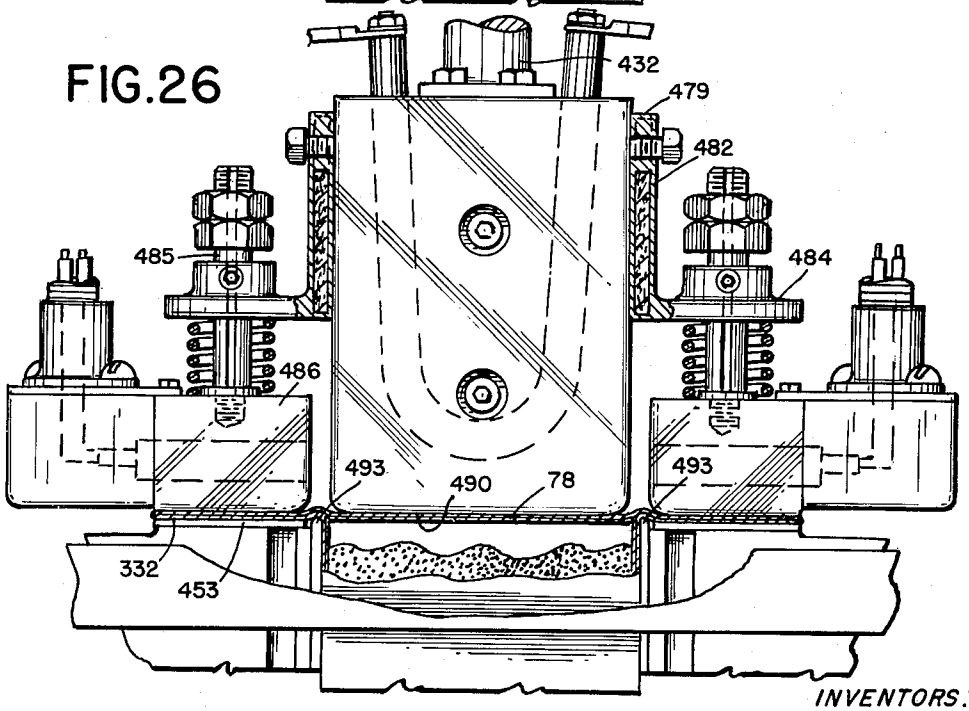


FIG.24

FIG.26



INVENTORS:-

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HENRY E. WISSMAN

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FIG. 27

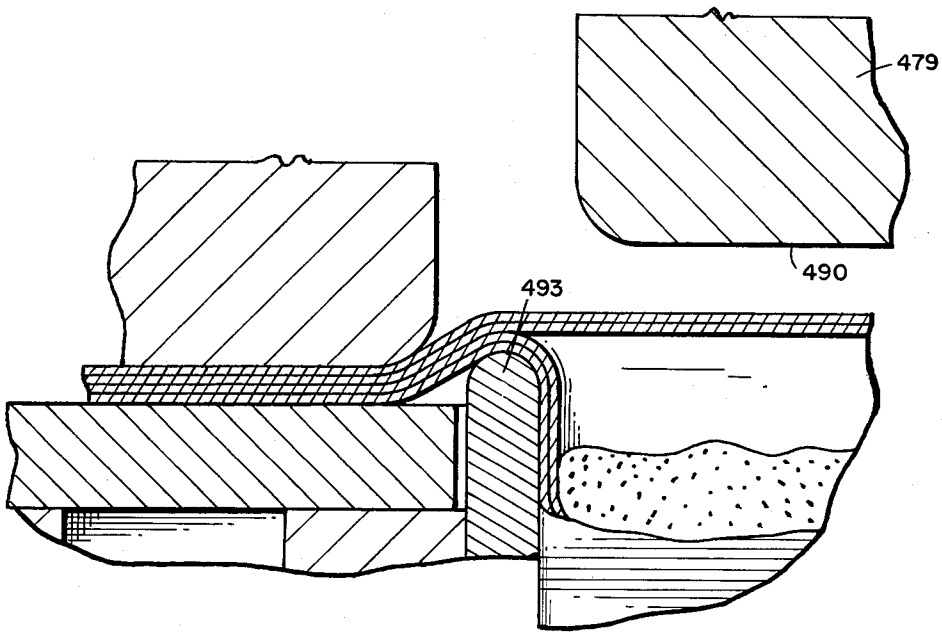
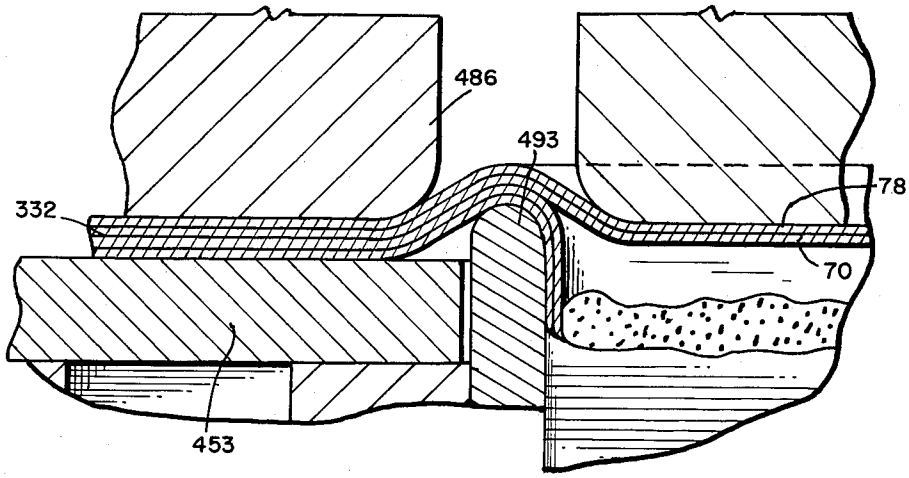


FIG. 28



INVENTORS:-
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ROBERT S. HEDIN
CHARLES H. SWANSON
HENRY E. WISSMAN

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FIG. 29

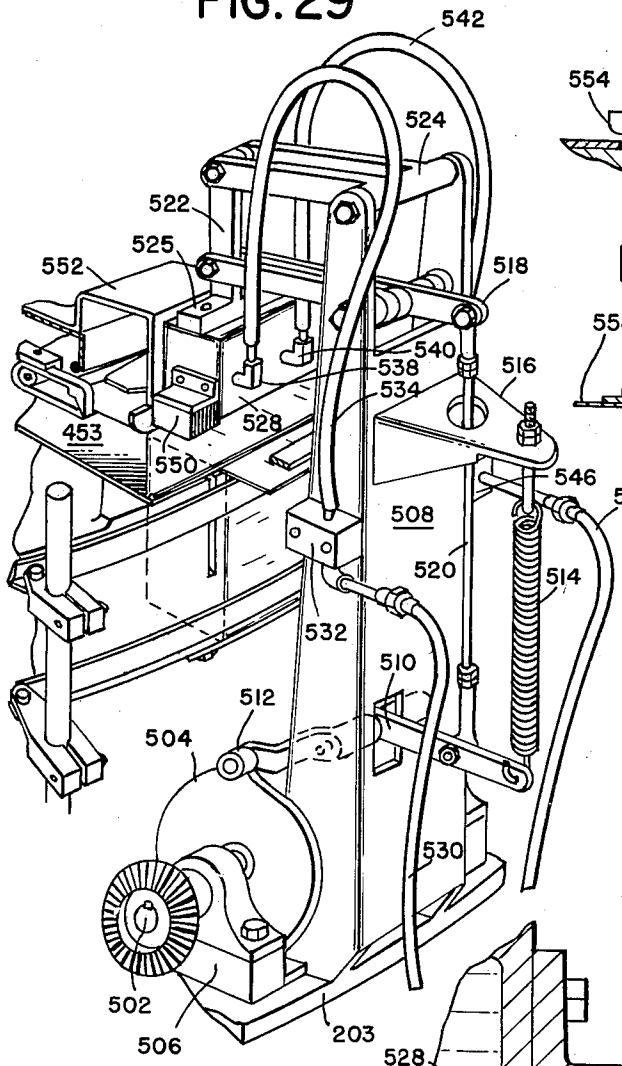


FIG. 30

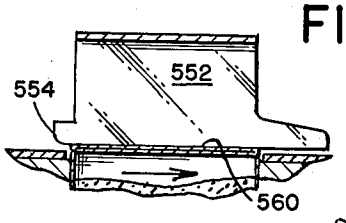


FIG. 31

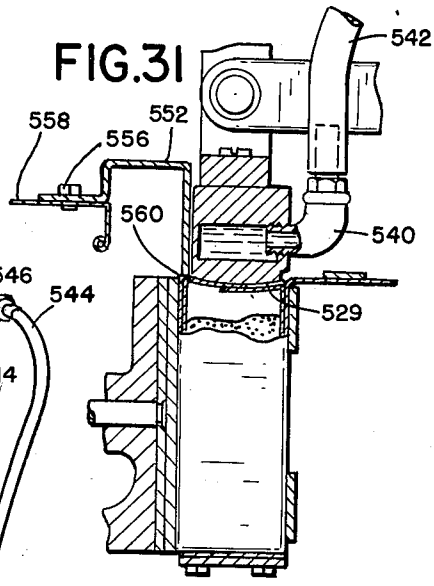


FIG. 32

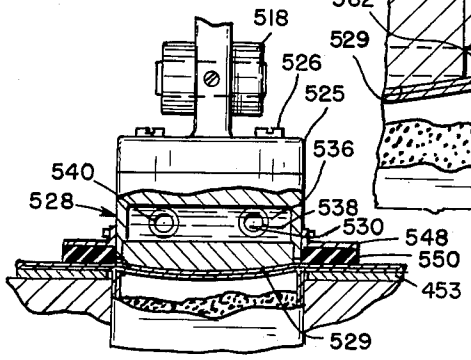
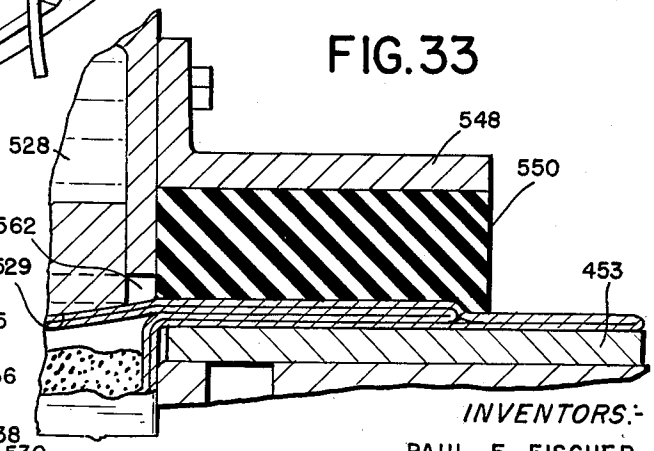


FIG. 33



INVENTORS:-

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FIG. 34

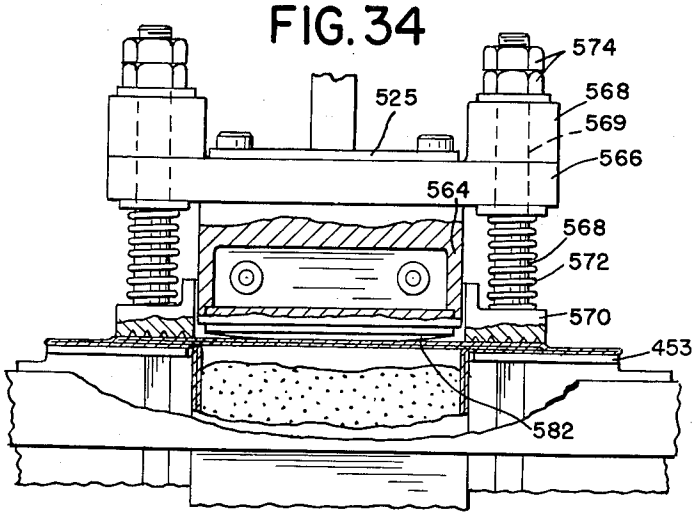


FIG. 35

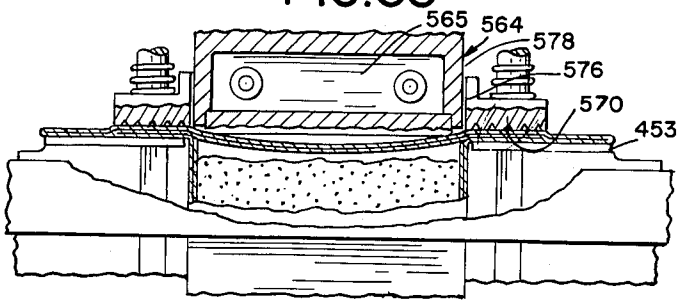


FIG. 36

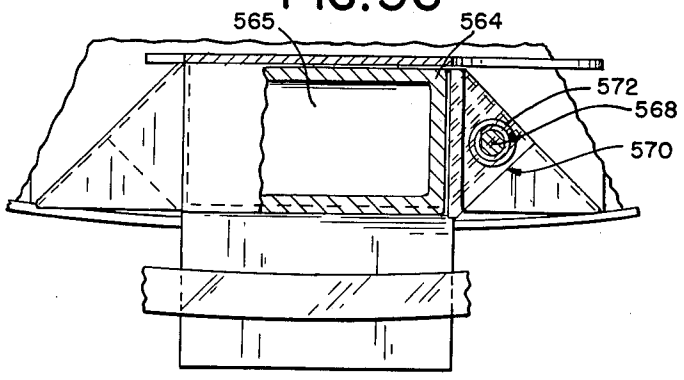


FIG. 37

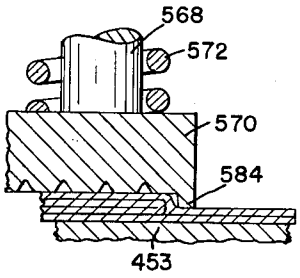
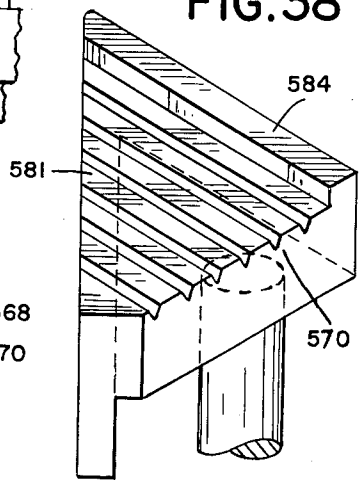


FIG. 38



INVENTORS:-

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HENRY E. WISSMAN

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FIG. 39

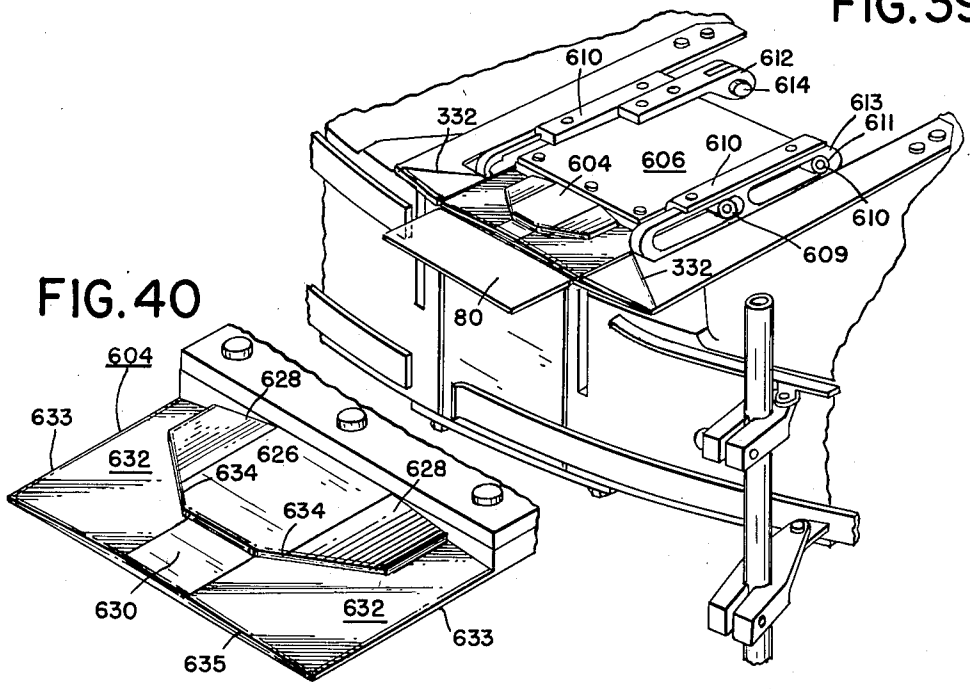
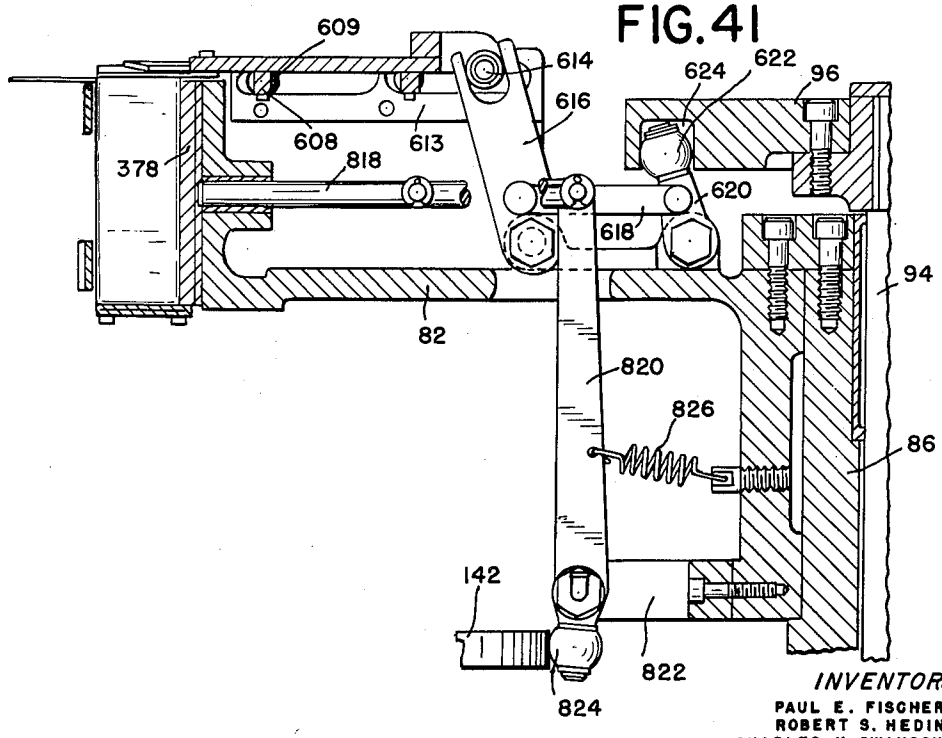


FIG. 40

FIG. 41



INVENTORS:-
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HENRY E. WISSMAN

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FIG. 42

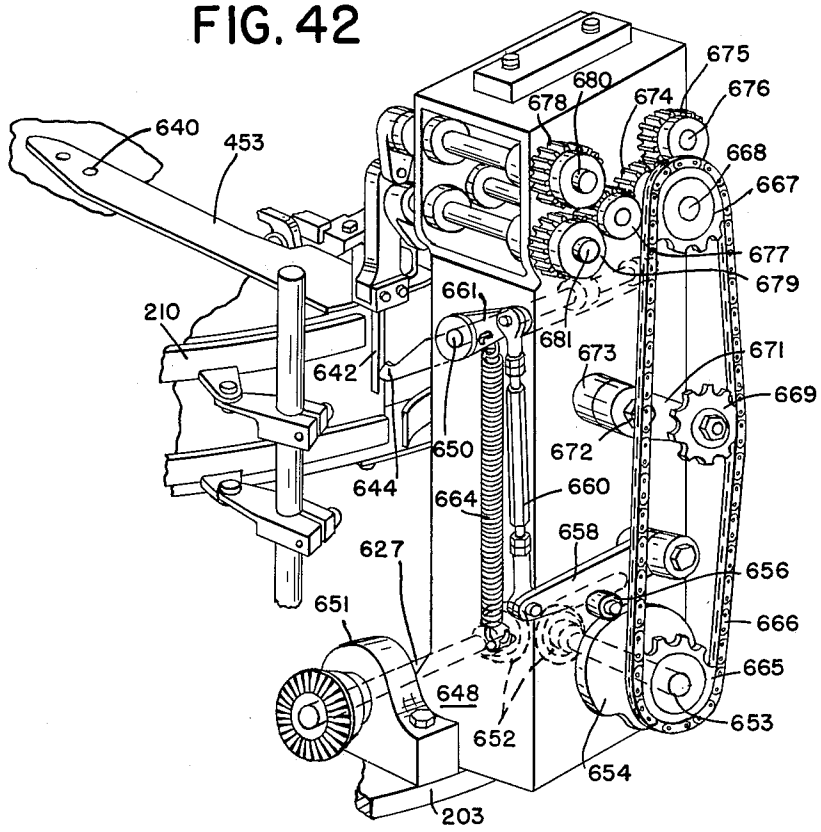
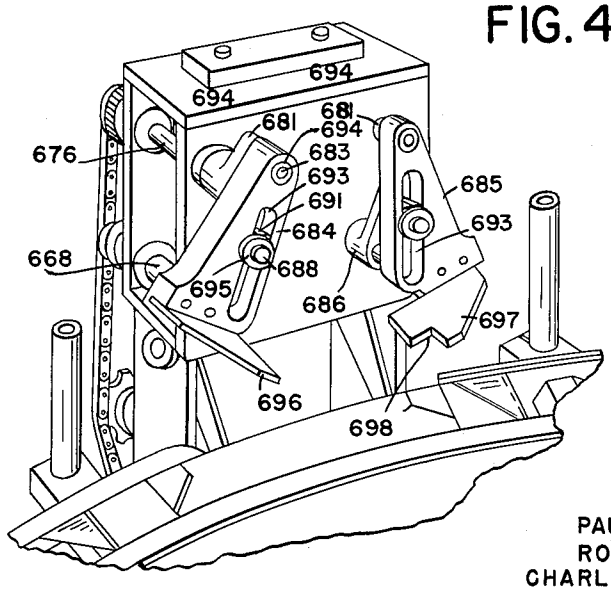


FIG. 43



INVENTORS.:-

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CHARLES H. SWANSON
HENRY E. WISSMAN

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FIG. 44

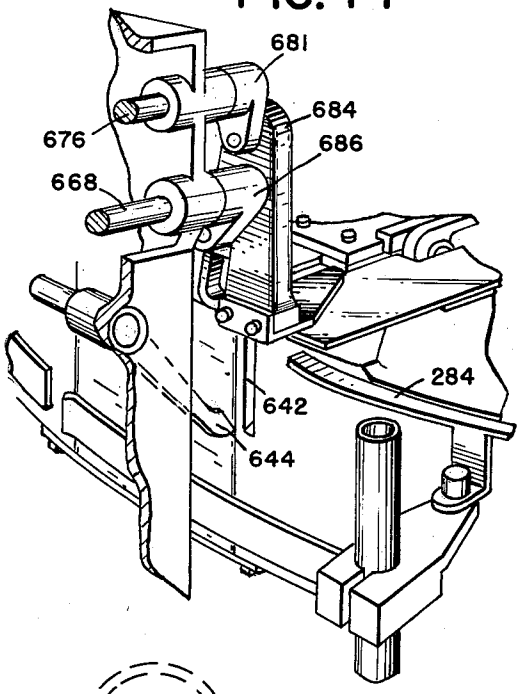


FIG. 45

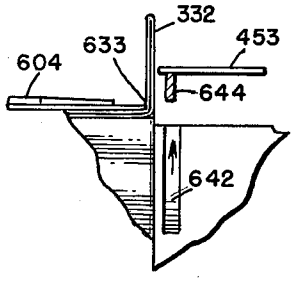


FIG. 46

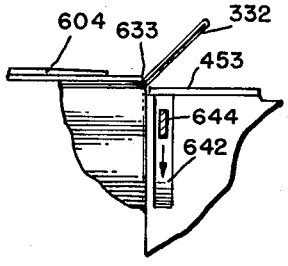
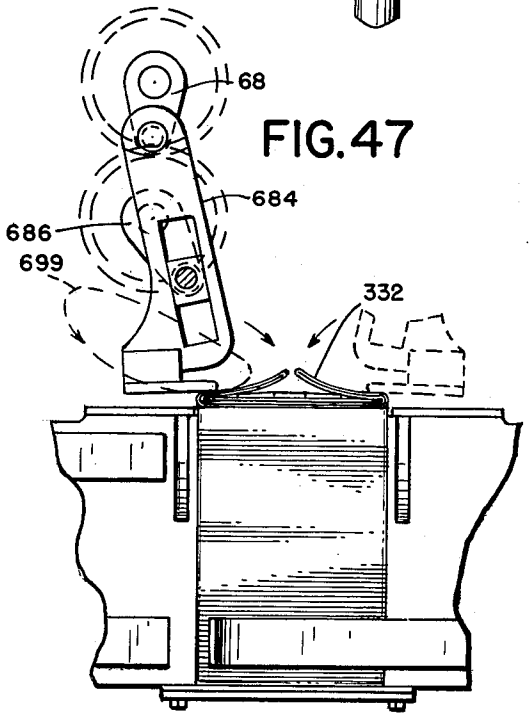


FIG. 47



INVENTORS:-

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CHARLES H. SWANSON
HENRY E. WISSMAN

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FIG. 48

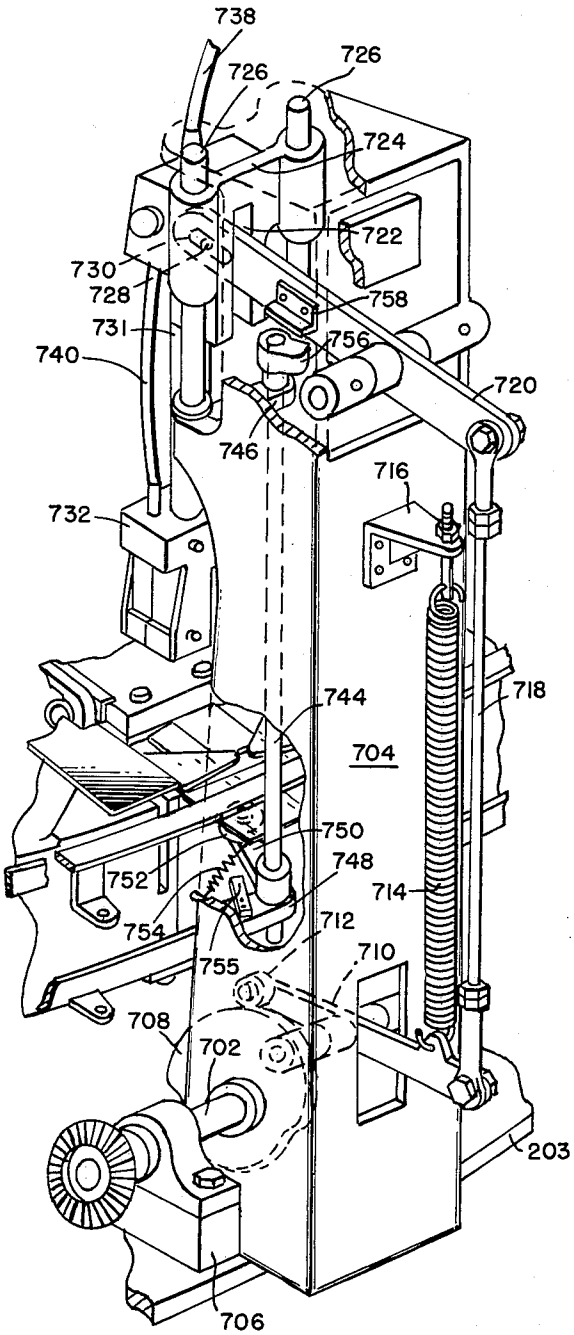


FIG. 49

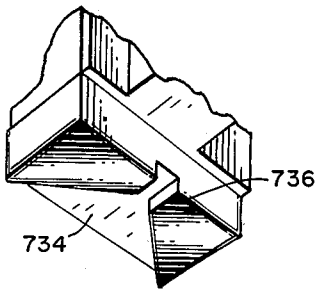
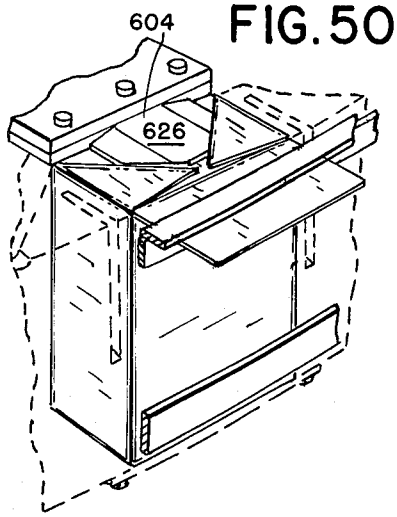


FIG. 50



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Dec. 13, 1955 P. E. FISCHER ET AL 2,726,499

CARTON CLOSING MACHINE

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FIG. 51

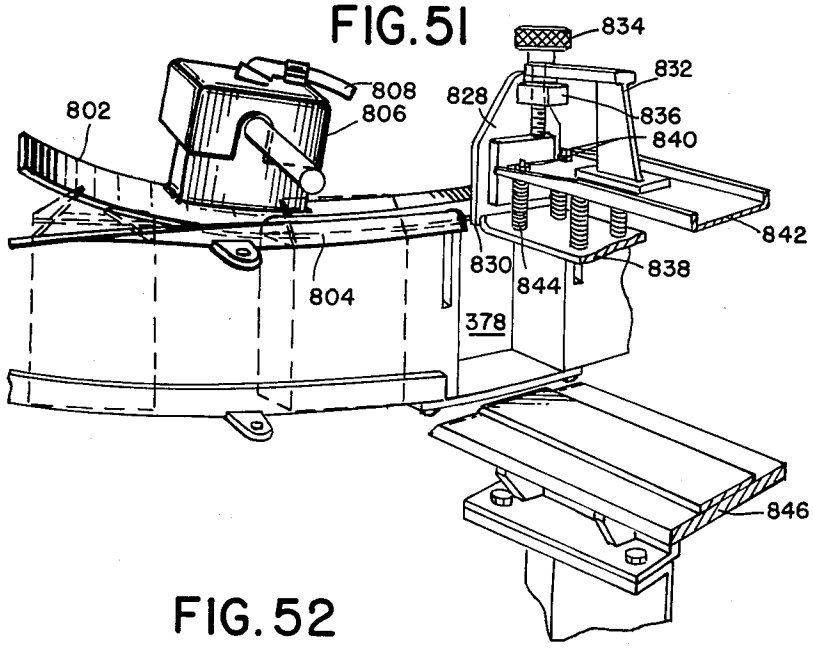
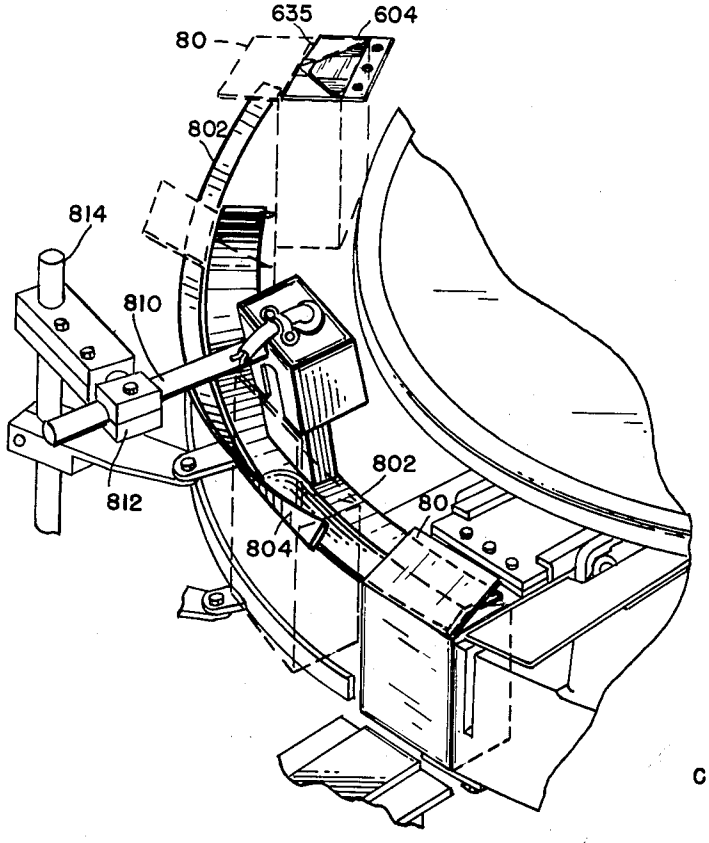


FIG. 52



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United States Patent Office 2,726,499 Patented Dec. 13, 1955

2,726,499

CARTON CLOSING MACHINE

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Application December 23, 1950, Serial No. 206,464

36 Claims. (Cl. 53—149)

The present invention realtes to improvements in automatic machinery which closes and seals the tops of filled containers.

More specifically the machine embodying the invention receives and closes cartons which have previously been formed either by hand or by other automatic machinery and then filled. The cartons are received, and through a series of specific folding operations performed upon the portion of the carton extending above the side walls, the tops are folded over the contents to close the carton. The carton material is provided with thermoplastic adhesive, and heat and cooling are applied at specific times during the folding operations to obtain an integral seal between the folding elements, and an air-tight package fully protecting the contents is achieved. The invention is especially adapted to folding a carton formed of laminations including metallic foil having a thermoplastic adhesive coating for sealing. The mechanism is unique in that the closure is formed by folding the opposing top closure panels into overlapping relationship over the carton end to form the closure rather than folding them to a face-to-face relationship as is the more usual custom with the type of carton where the contents give no support to the underside of the closure. A tight overlapping closure is not difficult in forming the bottom of the carton, as there, a support may be provided from inside the carton. In a carton such as one comprising laminations including metallic foil, the lower layer of the overlapping fold has little resistance when the upper layer is pressed over it, has a tendency to remain depressed and will not resiliently spring up against the upper layer to aid in obtaining a firm contact between materials. Also thermoplastic adhesive when softened does not have the characteristic of being as sticky as other adhesives. Therefore in order to achieve an integral seal between overlapped layers of carton material it has heretofore been necessary to apply pressure to both sides of the material until the thermoplastic adhesive sets or hardens. In the formation of an overlap type top closure on a carton filled with liquid, powdered, granulated, or other non-solid material, no resistance is offered beneath the overlapping closure, and since the inside of the carton is inaccessible without doing damage to the carton, it is impractical to apply a pressure to the underside of the closure. Also, while light gauge metallic foil affords the advantage of being impermeable to moisture, at an economical cost, it is relatively soft and easily wrinkled and torn making high speed automatic folding operations extremely difficult to practice.

An object of this present invention is, therefore, the accomplishment of the formation of an impervious integral seal of maximum tightness of the type wherein the opposing closure panels at the top of the carton are formed of a pliable, soft type of material such as metallic foil coated with a thermoplastic adhesive, and the closure panels are brought into overlapping relationship and sealed

in that position without the aid of means for supporting the underside of the overlapped closure.

Another object of the present invention is to provide an automatic closing machine which will capably handle and rapidly and successfully close a series of cartons made of metallic foil faced with an adhesive without in any way tearing, wrinkling, or damaging the soft pliable foil material while accomplishing tight, precise, uniform folds.

A further object of the invention is to provide a machine which will receive lined carbons having connected top closure panels extending from the side walls, having a single cover flap formed in the outer layer by vertical slits at the edges of one closure panel and having thermoplastic coating on the closure panels and which will seal the carton by adding heat to the thermoplastic adhesive to soften the adhesive, folding the liner closure panel against the cover flap over the carton top, spreading the adjoining closure panels laterally outward to form triangular flaps thereby drawing the closure panel opposite the cover flap over the carton, heat sealing the overlapping panels, folding the triangular flaps over the carton and folding and sealing the cover flap over the folded closure elements.

Other objects and advantages of the invention will appear in the specification taken in connection with the attached drawings in which:

Figure 1 is a schematic view of the carton closure machine showing the closing stations of the turret numbered I through VII;

Fig. 2 is a perspective view of a carton which is closed by the mechanism illustrated;

Fig. 3 is a schematic view of the driving mechanisms for indexing the turret through its folding station and for driving mechanism for operating the various elements for closing the container top;

Fig. 4 is a perspective view of the mechanism which inserts the filled unclosed carton into the turret pocket at Station I;

Fig. 5 is a sectional view taken along line 5—5 of Fig. 4;

Fig. 6 is a side elevation of mechanism of Station II;

Fig. 7 is a perspective view of the mechanism of Station II taken from the side from which the carton enters the station;

Fig. 8 is a perspective view of the mechanism of Station II taken from the side from which the carton moves away from the station;

Fig. 9 is a front elevation of a portion of the mechanism of Station II;

Fig. 10 is a detailed view of Fig. 7 having portions removed for clarity;

Fig. 11 is a side elevation of the top closing mechanism of Station III;

Fig. 12 is a perspective view of the top folding elements which are mounted at the top of the tower at Station III;

Fig. 13 is a fragmentary sectional view illustrating the relative position of the spreader fingers as they enter the mouth of the carton;

Fig. 14 is a fragmentary plan view showing the position of the spreader fingers in the mouth of the carton;

Fig. 15 is a fragmentary plan view illustrating the folding action of the fingers as they spread;

Fig. 16 is a side elevation of the mechanism for creasing the back closure panel and folding it over the carton top;

Fig. 17 is a fragmentary side elevation of the mechanism of Fig. 16, illustrating the creasing action;

Fig. 18 is a perspective view of the carton showing the condition of the closure panels after the operations of Station III have been completed;

Fig. 19 is a perspective view of the carton closing mechanism of Station IV having parts broken away for clarity;

Fig. 20 is a sectional view taken along line **20—20** of Fig. 19 illustrating the action of the no-carton, no-operation device;

Fig. 21 is a side elevation of the sealing block, the carton being sectioned to illustrate the action upon the closure panels;

Fig. 22 is a front elevation of the carton sealing block before it has fully descended, the carton being sectioned to illustrate the position of the closure panels;

Fig. 23 is a front elevation showing the mechanism of Fig. 22 after the block has fully descended;

Fig. 24 is a front elevation of an alternate mechanism for sealing the closure panels;

Fig. 25 is a sectional view taken along line **25—25** of Fig. 24;

Fig. 26 is a front elevation of the mechanism of Fig. **24** showing the sealing block fully descended upon the closure panels;

Fig. 27 is an enlarged fragmentary view showing the relative position of the elements of the mechanism of Figs. 24 and 25 before the sealing block has descended upon the closure panels;

Fig. 28 is a view of Fig. 27 with the sealing block fully descended, illustrating the stretching action upon the closure panels;

Fig. 29 is a perspective view of the carton closure mechanism of Station V;

Fig. 30 is a fragmentary sectional view illustrating the action of the retaining blade holding the carton in the turret pocket;

Fig. 31 is a sectional view taken through the turret pocket illustrating the action of the cooling block upon the carton closure panels;

Fig. 32 is a front elevation having portions broken away to illustrate the action of the cooling block upon the closure panels;

Fig. 33 is an enlarged fragmentary sectional view illustrating the action of the mechanism gripping the carton flap;

Fig. 34 is a front elevation of an alternate design for a cooling head having portions removed to show the action upon the closure flaps;

Fig. 35 is a view of the mechanism of Fig. 34, showing the cooling block fully depressing the closure eleemnts;

Fig. 36 is a plan view of the top of the carton showing the areas contacted by the cooling head;

Fig. 37 is a fragmentary view taken in section, showing the clamping action of the grooved feet on the carton flaps;

Fig. 38 is an enlarged perspective of the foot for clamping the ears;

Fig. 39 is a perspective view of a sector of the turret illustrating the protective plate which slides over the carton between Stations V and VI;

Fig. 40 is an enlarged detailed perspective view of the protection plate of Fig. 27;

Fig. 41 is a sectional view taken on a radial plane of the turret showing the mechanism operating the protective plate and the carton ejector;

Fig. 42 is a perspective view of the mechanism of Station VI as viewed from outside the turret;

Fig. 43 is a perspective view of the mechanism of Fig. 25 as viewed from the turret;

Fig. 44 is a perspective view of the mechanism of Station VI having parts removed for clarity;

Figs. 45 and 46 are fragmentary front elevational views of the flap lifting mechanism illustrating the successive position of the carton flap at Station VI;

Fig. 47 is a front elevation of the mechanism of Station VI having parts removed to illustrate the path of motion of the ear folding mechanism;

Fig. 48 is a perspective view of the mechanism of Station VII, having parts broken away for clarity;

Fig. 49 is a detailed perspective view of the shaped flap heating and pressing shoe;

Fig. 50 is a perspective view of the mechanism with portions removed to illustrate the condition of the carton at Station VII;

Fig. 51 is a perspective view of Stations VII and VIII; and,

Fig. 52 is a perspective view of Stations VII and VIII illustrating the action of the stationary guide rails on the carton flap.

The closing machine illustrated in the preferred embodiment of our invention is designed for receiving a continuous output of filled and unclosed cartons from a filling machine. The function of the machine embodying the present invention is to receive these cartons and subject them to a series of folding operations which fold the closing elements of the carton top and seal these elements in a closed position to form an integral and impervious seal to protect the contents of the carton. After being closed and sealed, the machine discharges the cartons, generally to be packed in shipping boxes.

The general layout of our closing machine is shown in Fig. 1, the turret being shown diagrammatically with the stations numbered in Roman Numerals I through VIII. A series of pockets are circumferentially arranged in the turret, facing outwardly to carry cartons therein. The turret is indexed, a station at a time, and at each station, while the carton is briefly halted, a successive folding operation is performed on the carton top until finally when the carton arrives at Station VIII and is discharged, the top will have been completely folded and sealed. For purposes of obtaining a clear description and for ease of understanding the exact functions performed upon the carton, the drawings and specification have been arranged in eight groups corresponding with the turret stations. The structure of each station and the operation performed upon the carton will be explained sequentially, and may be easily referred to by station number. For ease of location of elements, the folding and operational mechanism will be numbered, with a few exceptions, with the hundred digit corresponding to the number of the station at which the mechanism functions or is found. For example, all mechanism at Station III will be indicated by numbers between 300 and 400. The elements of the carton and of the driving mechanism are indicated by numerals up to 150.

The carton to which the machine is best adapted, shown in Fig. 2 as it is received by the machine before closing, has an outer covering layer **54** formed of laminations including metallic foil on the outer surface and a layer of thermoplastic adhesive either on the inner surface indicated at **56** or beneath a layer of porous material such as tissue paper through which the adhesive may penetrate when softened. The outer shell layer is formed of a single sheet joined by a seam **58**.

The inner liner **62** of the carton is formed of a material similar to outer covering material having the foil on the inside facing the carton contents **64** and the thermoplastic adhesive on the face **66** adjacent the covering material. The liner material is also joined by a seam **68**. The thermoplastic adhesive between the covering material and liner material in the side walls and bottom has been softened in the manufacture of the carton to cause the layers to adhere to form a rigid carton.

The carton side walls of the liner and covering material extend above the fold lines **60** to form rectangular closure panels which will be folded over the carton top and heat sealed in a unique manner to close the carton. The front liner closure panel is designated by the numeral **70**, the side inner and outer closure panels by **72** and **74** respectively, and the rear inner and outer closure panels by **76** and **78** respectively.

A cover flap **80** is formed from the front outer closure panel by vertical slits extending along the panel sides from the upper edge of the closure panels to lines **60**. These top fold lines **60** define the plane which will be the carton top when the closure panels have been folded.

It is to be understood that the invention will also operate to close cartons of other designs affording the same advantages, but the machine illustrated is best suited to closing the carton shown.

Referring now to Fig. 3 the operational drive mechanism for the machine is shown. Numeral **82** represents the turret having equally spaced carton holding pockets **84** arranged along the edge thereof. The turret is mounted on a rotatable vertical tubular shaft **86** which carries at its lower portion a Geneva drive sprocket **88** driven by a Geneva pinion **90**.

A support **92** has a thrust bearing which supports the tubular shaft and the support secures a stationary shaft **94** within the tubular shaft which carries cam **96** at its upper end.

The Geneva drive is designed to index one-eighth revolution for each step to move each of the eight turret pockets ahead one full station with each index, and eight indexes will rotate the turret and the cartons carried thereby through a full revolution. The driving Geneva pinion **90** is carried on the lower end of a drive shaft **98** driven by a worm gear assembly **100** which is rotated by cross shaft **102**. A suitable clutch **104** is provided on shaft **102** for manually starting and stopping the machine. Pulleys **105** on the cross shaft carry belts **106** which run over pulley **108** upon an output shaft on the speed ratio control **110**.

The main drive motor **112** is supplied with electricity through leads **114** from a suitable supply current controlled by switch **116**. Pulleys **117** on the motor carry belts **118** which mechanically connect the motor to the pulleys **119** on the input shaft of the variable speed ratio control **110**. Hand wheel **120** adjusts the ratio of the speed of power transmission through the speed control. The speed control has been found to be of great advantage, for at various speeds certain folding elements may have different effects upon the closure panel of the carton on which it is operating. For example, a flap of a certain thickness may fold over perfectly smooth at one speed whereas at higher or lower speeds it may acquire a whip or refuse to bend smoothly when it is folded, causing an undesirable crease or bulge in the finished fold. Different weights of carton material may also react differently at various speeds of operation.

A series of seven cam shafts are horizontally positioned in an octagonal pattern beneath the rotating turret at Stations II through VII. The shafts are so arranged that one is positioned at each station and as they are rotated in unison they drive cams and linkages which operate the folding elements at their respective stations. The shafts serving Stations II through VII are numbered with the first digit corresponding to the station served. Beginning with the shaft serving Station II, the numbers run counterclockwise as follows: **202, 302, 402, 502, 602, 702.** To rotate these cam shafts in unison, they are mechanically interconnected by bevel gearing between the shaft ends; the interconnecting gears being similar, they are indicated generally by the numeral **122.**

To drive the octagonally arranged cam shafts, vertical shaft **98** carries at its upper end a bevel gear **124** driving gear **126** which rotates the cam shaft **402** to rotate the remaining shafts.

At the end of the train of cam shafts, segment shaft **702** serving Station VII carries a gear **128** which drives mating gear **130** mounted on a shaft **132** which through gears **134** rotates shaft **136.** This shaft, through gears **138,** rotates the vertical cam shaft **140** upon which the carton ejecting cam **142** is mounted. The function of this cam will become apparent with the description of the carton ejecting mechanism later in the specification.

At the lower end of vertical shaft **140,** bevel gears **141** drive shaft **142** which through bevel gears **143** drives horizontal shaft **144** carrying the carton inserting cam **145.** The extension **146** of shaft **144** may be used to transmit power to associated carton folding mechanism

such as is shown in the co-pending application, Method and Apparatus for Sealing Cartons, Fischer, Serial No. 206,461, filed December 23, 1950, now Pat. No. 2,696,245. Mechanism of this type is used for auxiliary folding operations and is not part of the present invention. Intermittent motion may be transmitted to auxiliary folding mechanism by means of a gear **147** rotating a gear **148** carried on an extension drive shaft **149.**

Station I

Referring now to Figs. 1, 4, and 5, the mechanism for receiving the carton from the filling machine and inserting the cartons into the pockets of the turret will be described. The filled cartons **150** are carried by a conveyor belt not shown, into a channel **158.**

As the cartons are pushed to the left as shown in the drawings they operate a pivotal trip lever **162** (Fig. 5) which has the end bent at a right angle to the body to extend through the end guide wall **164** and carries a horizontal bar **166** against which the cartons abut. A tension spring **168** between an extension **169** of the frame and the lower end of the trip lever urges the bar against the carton. A pin **170** extending from the lower end of the trip lever strikes a stop rod **172** on the frame to limit pivotal movement caused by the spring.

A stop pin **174** extends from the lower end of the trip lever and abuts a trip block **176** to hold it in normal position to prevent a carton from being inserted into the machine. When in tripped or the dotted line position of Figs. 4 and 5 as caused by the pressure of a carton against the bar **166,** the trip block is permitted to move to allow the mechanism to insert a carton. This block **176** is mounted on the upper arm of a bell crank **178** pivoted on a trunnion **180** on the frame **181.** The lower arm of the bell crank connects by means of a push rod **182** to the end of rocker arm **184,** secured on a shaft **186** which is rotatably carried in brackets **188, 189** projecting from the frame. A second arm **190** carried on shaft **186** carries a cam follower **192** which rides on inserting cam **145.** The elements which rotate this cam are described above. A tension spring **191** between the frame and arm **184** pivots the rocker arms and bell crank when the cam follower rides to a low portion of the cam to operate the carton-inserting apparatus.

To push the cartons into the pockets in the turret, an inserting member **194** in the shape of an inverted channel iron, engages the side wall of the carton, pushes it along the channel **165** leading to the turret. The inserting member is of a length which permits it to extend across the first channel preventing cartons from being moved behind it while it pushes a carton into the turret pocket. The member is carried on arm **195** on a cross head **196** slidably mounted on parallel guide bars **197.** The cross head has a lower arm **198** having a trunnion rotatably carrying a sliding block **199** which slides between the fingers **200** of the bifurcated end of the upper arm of the crank **178.**

In operation, as the cartons gather in the conveyer channel **158,** the frictional pressure against the conveyer belt will force the cartons against the bar of the trip lever **162** causing it to pivot to move the pin **174** to the dotted line position to release block **176** When this occurs, the bell crank **178** is permitted to rock to move the cross head **196** to the right to push the carton into the turret pocket. It will be seen with a continuous long line of cartons in the channel the trip arm **162** is continually pivoted to the dotted line position, and the carton-inserting member **192** will insert cartons into the turret at Station I each time a pocket is opposite the inserting mechanism. If no cartons are present, the trip lever **162** will remain in normal position preventing the inserting mechanism from operating. It will be noticed that carton jams will not damage the mechanism as, if the inserting member is prevented from moving forward,

the rest of the mechanism will remain in retracted position and the cam **145** will rotate free of the follower.

Station II

Referring now to Figs. 6 through 10, the structure and functions of the mechanism of Station II are illustrated. It will be noticed that at each station an upright support or tower is mounted on the annular frame **203** which extends around the turret. Theh towers are provided to support the elements which perform the folding operations on the carton top. Tower **204** is mounted upon the frame **203** at Station II by bolts **206**, and serves as the carrier for the operating devices for that station. Cam shaft **202** is journaled in pillow blocks **208** secured to the frame at the base of the tower.

As the turret is indexed from Station I where the carton is inserted, the cartons are held in the pockets on the turret by upper and lower retainer rails **210** and **212** which extend completely around the turret except for several openings such as at Station I where the container is inserted and at Station VIII where the container is ejected. The rails are suitably carried on brackets **214** mounted on vertical posts **216** which are supported on the frame.

A rocker arm **218** is pivotally mounted in the base of the tower and carries a follower roller **220** which rides on a cam **222** mounted to rotate with the cam shaft **202**. A tension spring **223** between the arm and tower rocks the arm as the cam rotates. An adjustable connecting rod **224** is secured to the end of the rocker arm **218** and extends upwardly to connect to the end of a rocker arm **226** which is pivoted at the top of the tower. At the inner end of this pivotal arm, a pair of adjustable push rods **228** are pivotally connected. The lower ends of these push rods are each connected to an arm of bell cranks **230** and **232** (Fig. 9) which are pivotally mounted on a sliding block **234**, adapted to move vertically on guide rods **236** mounted on the tower. A collar **238** held on the lower end of the rods by a nut **240**, limits the downward slide of the block.

Flattened spreader shoes **242** and **244** on the lower arms of these bell cranks function to spread the carton closure panels when the bell cranks are pivoted. A tension spring **246** connects between the lower arms of the bell cranks and holds the spreader shoes together. A stop lug **248** on the bell crank **232** strikes an adjustable stop bolt **250** to limit the pivotal movement of the bell cranks.

A bracket **252** on the sliding block (Figs. 6 and 9) carries an adjustable push rod **254** which connects to a crank arm **256** mounted on a shaft **258** journaled in the wall of the tower. At the inner end of this shaft is a second crank arm **260** pivotally carrying the upper end of hook supporting member **262**, the lower end of which is journaled to a guide crank arm **264** mounted on the tower. The guide crank arm **264** is slightly longer than crank arm **260** to give the linkage a unique path of movement. A flap separating hook **266** is carried by the supporting member **262** to separate carton flap **80** from the mouth of the carton. The path of motion of the hooked finger in its action of grasping and separating the flap from the carton mouth may be traced by the dotted arrows in Fig. 6. The position of the hook after it has contacted and withdrawn the flap is shown by the dotted line position of the flap. The location of the hook in the normal raised position may be adjusted by altering the length of the adjustable rod **254** so that the hook will not interfere with the carton as it is carried into Station II from Station I by the turret.

Also carried upon the cam shaft **202** is a cam **268**, Fig. 8. A rocker arm **270** pivotally mounted at the base of the tower carries follower **272**, and tension spring **274** between the arm and tower rocks the arm as the cam rotates. A creasing arm **276** is pivoted on the side of the tower and an adjustable push rod **278** connects the creasing arm to the rocker arm. At right angles to the end of the creasing arm is a creasing blade **280** extending in a direction parallel to the line of the attachment of the carton cover flap to the carton. To crease the flap, the blade is brought down upon the flap pressing it against the upper surface of the retaining rail **210**. Since the upper rail **210** is curved, there is an open space between it and the midpoint of the carton side wall. To prevent this space from forming an uneven crease in the flap **80**, a pair of pins **282** projects from the creaser blade over the flap to hold it flat over the curved rail **210**. To keep the flap in the horizontal position to which it is creased, a curved rail **284** cams the flap down and holds it horizontal while the carton is being carried by the turret. This flap rail is supported by a bracket **286** clamped on the rail supporting posts **216**. The rail is broken at certain stations where it may interfere with folding operations and holds the flap out of the way at the remaining stations.

The operation of the mechanism at Station II is as follows:

As the turret rotates, the carton is moved beneath the spreader shoes at Station II and comes to a stop opposite the tower **204**. A cam shaft **202** rotates, and the spring **223** through the operating linkage rocks the upper rocker arm **226** to slide block **234** downwardly on its guide rods **236** against the stop collars **140**. As the block descends from the solid line to the dotted line position of Fig. 6, the parallelogram linkage carrying the flap separating hook **266** has moved to the dotted line position drawing the flap away from the carton mouth.

At this point the creaser blade **280** is swung down striking the flap to crease it against the retainer rail **210** as shown in Fig. 10.

The descending block **234** has inserted the spreader shoes **242** and **244** into the mouth of the carton. As the block strikes the stop collars **238**, the rods **228** pushing downwardly overcome the tension of the spring **246**. The rods pivot bell cranks **230** and **232** moving the spreader shoes outwardly to stretch the carton mouth as shown in Fig. 10. The tightness of the stretch may be regulated by adjustment of the length of the rods **228**. The shoes draw the mouth of the carton into an elongated shape, removing any wrinkles and deflections which may have been present in the metallic foil material and which might cause an imperfect closure to result in the subsequent folding operations. The stretching also creases the side closure panels **72** and **74** along their line of attachment to the side walls and draws the front closure panel **70** inwardly over the carton. The shoes **242** and **244** are flared outwardly at the base from a narrower top to elongate the mouth of the carton and to crease the closure panel along its entire width. Since the carton is of metallic foil, the closure panels will tend to remain in the position where the spreader shoes have forced them.

As the cam shaft **202** completes its cycle, cam **222** forces the linkage to return position. The rods **228** move upwardly and the spring **246** pivots the bell cranks **230** and **232** moving the spreader shoes together. When the lug **248** strikes stop **250**, the rods raise the block and connected linkage back to the elevated position, withdrawing the spreader shoes from the carton mouth.

It will be noticed that the present stations and many of the succeeding folding stations are provided with linkage whereby a spring actuates the folding elements from normal position to fold the closure panels and a cam positively returns them to normal position. This positive return insures that the folding elements will always be drawn out of the way of the turret when it is indexed.

The turret then indexes the carton to Station III. The turned back carton cover flap **80** strikes and is cammed under the curved rail **284** which holds it in a horizontal position through Station III. While the present carton moves to Station III, the carton formerly at Station I is, of course, moved into Station II where the mechanism of Station II will operate on it.

Station III

At Station III, the front closure panel **70** of the carton is folded over the contents and the liner and outer covering side closure panels **72** and **74** are given a diagonal crease and folded outwardly, doubled upon themselves to form triangular lateral flaps. The liner and outer covering rear closure panels **76** and **78** are creased along their line of attachment to the side wall and brought over the carton into overlapping relationship with the front closure panel **70**.

To accomplish these functions, the mechanism shown in Figs. 11 through 18 includes a cam shaft **302** carried in pillow blocks **304** mounted on the frame **203**. A tower **306** is carried on the frame at Station II to support the top folding mechanism. A rocker arm **308** is pivotally mounted at the base of the tower and carries at one end a roller follower **310** which rides in the groove of cam **312** carried on the cam shaft. A sliding pin **311** is connected between the rocker arm **308** and a bracket **313** on the tower. To take up the play of the cam **310** in the cam track, a compression spring **315** is carried on the bolt to act between the pivotal arm and bracket. Nuts **317** prevent the bolt from sliding out of the bracket. A pivotal carrier member **314** is also mounted at the pivotal point of the rocker arm **308** and extends upwardly to pivot between the side walls of the tower. At the upper end of the arm is a pivotal bell crank **316** connected to the rocker arm **308** by a push rod **318**. A pair of bell cranks **319**, one arm of which forms spreader fingers **320**, are pivotally mounted at the top of the carrier member **314**. The other arms **322** of the bell cranks are connected to the bell crank **316** by means of short connecting rods **324** (Fig. 15). A tension spring **326** between the spreader fingers holds them together.

As the rocker arm **308** is pivoted counter-clockwise, as shown in Fig. 11, the carrier member **314** also pivots counter-clockwise until the adjustable stop bolt **328** strikes the stop **330** on the tower. By this movement, the spreader fingers will have been inserted into the mouth of the package, engaging the front closure panel **70** as they enter, folding it inwardly over the carton contents. The action of the spreader fingers is shown in detail in Figs. 13 through 15. Continued movement of the rocker arm overcomes the tension of the spring **326** and the bell crank **316** will begin to pivot, pushing against the crank arms **322** to pivot cranks **319** and spread the spreader fingers **320** in the manner shown in Fig. 15. It will be noted, as viewed in Fig. 13, that the spreader fingers are inserted into the carton mouth at an angle with the plane of the carton top. As the spreader fingers begin to move apart, the beveled outer edges **331** engage the side closure panels **72** and **74** upon a diagonal line, forcing them laterally outward and creasing them along this diagonal line to form lateral ears or flaps **332**.

It will be noted that since the front closure panel **70** was inclined inwardly by the action of the spreader shoes at Station II, it readily folds inwardly over the carton contents when engaged by the tips of the spreader fingers. The side closure panels which have been pressed outwardly, causing them to crease along their line of attachment to the carton, permit the front closure panel to pass between them without wrinkling at its corners. The receding beveled shape of the edge **331** of the spreader fingers is inclined with respect to the package at the same angle as the diagonal edge of the folded triangular carton ears **332**, forming a sharp crease along this diagonal edge. The tip **333** of the spreader fingers **320**, which curves in from the edge, forces the rear corners of the package outwardly to prevent a collapsed corner.

Continued rotation of the cam shaft **302** brings the spreader fingers back together and withdraws them from the carton mouth, whereupon the elements for folding the rear closure panels go into action.

A rocker arm **334** is mounted on the tower and carries the roller follower **335** which rides on a second cam **336**, also carried on the cam shaft **302**. A tension spring **338** between the rocker arm and tower causes the arm to pivot as the cam rotates. A bell crank **346** is carried on a rotatable pin **348** at the top of the tower (Figs. 11, 12, and 16). A push rod **350** connects between one arm of the bell crank and the rocker arm **334**. On the other arm of the bell crank **346** is carried a pivotal boss **352** having a hole at right angles to the axis thereof through which slidably extends a rod **354**. A shoulder **356** at the end of the rod holds a spring **357** against the boss and a collar **358** pinned to the rod limits the movement of the rod through the boss. The other end of the rod is pivotally connected to a crank arm **360** secured on a tower-supported pivotal shaft **362** which carries on its other end an arm **364** to which is attached a curved creasing blade **366**.

Returning to the cross pin **348**, a crank arm **368** is mounted thereon and connects by means of a push rod **370** to the arm of a bell crank **372** pivotally mounted on the tower. At the end of the remaining arm of this bell crank is carried a panel-folding shoe **374**.

With the rotation of the cam **336** the rocker arm **334** pivots clockwise, as shown in Fig. 11, pivoting the bell crank **346** mounted at the top of the tower in a counter-clockwise direction. This action pivots the crank arm **360** clockwise, bringing the creasing blade **366** down into the mouth of the carton, shown in detail in Fig. 16. The forward edge **376** of the blade **366** presses against the inside of the carton wall along the line of attachment between the back closure panels and carton, the rear wall **378** of the turret pocket providing a stop which prevents the blade from moving farther. Thus the pivotal movement of the creasing blade **366** terminates, but the movement of the other mechanism continues. Bell crank **346** continues to pivot causing the boss **352** to slide along the rod **354** and compress the spring **357**. This continued pivotal movement pivots crank **368** and bell crank **372** counter-clockwise, bringing the panel folding shoe **374** down upon the rear closure panel **78**, as shown in detail in Fig. 17. Forward curved edge **380** of the folding shoe creases the rear closure panels along their line of attachment to the carton, forcing them against the upper surface of the curved creasing blade.

As the cam shaft continues its rotation, the folding blade and creasing shoe will be removed from the carton top and returned to their normal positions. The carton, having the folding operations of Station III completed, now appears as shown in Fig. 18, with the adhesive coated side of the front closure panel **70** facing upwardly and the adhesive coated face of the outer rear closure panel **78** facing downwardly. The rear inner closure liner **76** will overlap the front liner closure panel **70** by a small margin. Thus when the facing surfaces of the panels are forced together and sealed, a double seam will be formed.

Station IV

At Station IV the semi-folded top closure formed in Station III is completed. The doubled triangular flaps are given a firm crease and pressed down flat into the plane of the carton top. Heat is added to the closure panels to soften the thermoplastic adhesive on the surfaces which are in face-to-face relationship.

A lateral tension is placed on the overlapping front and back closure panels and pressure and heat applied to the back closure panels to seal them to the underlying front closure panel. The lateral tension placed on the panels tends to hold the front closure panel in the plane of the carton top and, when vertical pressure is applied to the overlying back closure panel, it is pressed tightly against the underlying panel, forcing the softened thermoplastic adhesive into the pores of the material forming a tight integral seal.

The mechanism of Station III for performing these functions is shown in Figs. 19 through 28. The cam

shaft 402 is rotatably carried in pillow blocks 404 (Fig. 19) mounted on the annular frame 203 at Station III. The vertical tower 406 is secured to the frame between the blocks. Pivotally mounted in the base of the tower is a rocker arm 408 having a follower roller 410 on its inner end which bears against a cam 412 on the cam shaft. A spiral tension spring 414 connected between the rocker arm and a bracket 416 on the tower pivots the rocker arm as the cam rotates. Pivotally mounted at the top of the tower is a second rocker arm 418 connected at its outer end to the lower rocker arm by a push rod 420. A cross head 422 reciprocates vertically on guide bars 424 and has a channel 426 cut in the rear face across which extends a pin 428. The inner end of the rocker arm 418 extends into this channel and has an elongated slot 430 in which the pin slides as the cross head is reciprocated by the pivotal movement of the rocker arm. On the underside of the cross head is a rod 432 having a flanged lower end 433 (Fig. 22) through which bolts extend to secure the heater block or head 434 to the rod. A heating element 436 is mounted in the block and insulation 438 is provided on the outer box surface. The block is constructed in two sections held together by bolts 439 for ease in installing the heating element. Electrical leads 440 lead from a suitable source of electricity to a junction box 442 on the cross head and leads 444 connect between the junction box and terminals 446 on the heater block.

The block has a lower crowned face 448 (Figs. 21, 22 and 23) the edges of which are rabbeted to give dimensions slightly less than the area of the top of the carton to prevent pinching the carton top against the top edges of the turret pocket. The function of this uniquely shaped carton-contacting face will become clear later in the discussion of the operation of the device. At the side of the crowned face of the heater block are carried clamping blocks or shoes 450 having roughened or knurled lower faces 452. Brackets 454 carried on each side of the heater block carry a pair of pivotal parallel links 456 which are also pivotally connected to the clamping shoes. The clamping shoes have inclined side faces 458 which are engaged by inclined side faces 460 on the heater block in such a manner that when the heater block is lowered with respect to the clamping shoes they are forced laterally outwardly from the heater block (see Fig. 22). A tension spring 462 is connected between the clamping shoes and urges them inwardly to engage the inclined side faces 460 of the heater block. Heating elements 464 are connected on the outer side face of each clamping shoe and leads 466 connect between the elements and the junction box 442.

The station is provided with a no-carton, no-operation device which prevents the mechanism from operating if a carton is absent from the pocket of the turret. If the heated clamping shoes were lowered to the turret when a carton was not present, the roughened face 452 of the blocks 450 would damage the upper surface of the leaf springs 453 which support the laterally extending carton ears and which lie in the plane of the carton top. Also, heat would be transmitted to these surfaces which would cause softening of the thermoplastic adhesive on the wall of a carton which is later inserted into the turret pocket.

A vertical rod 468 is journaled in upper and lower brackets 470 and 471 secured to the turret and a crank arm 472 secured to the lower end of the vertical shaft carries a roller 473 which rides on the peripheral edge of the turret and against the wall of the carton 150 as it passes (see Fig. 20). A tension spring 474 biases the arm toward the turret and a stop 475 limits the pivotal movement of the arm. At the top of the shaft 468 is a stop lug 476 which is moved beneath a stop bracket 477 mounted on the pivotal arm 418 when a carton is not present in the pockets.

It will be seen that normally the arm 472 will be held outwardly by virtue of its contacting the carton in the pocket and will hold the stop lug 476 out of the way of the stop bracket 477. If, however, a carton is not present in the turret pocket, the arm 472 will snap into the empty pocket moving the stop lug beneath the stop bracket. With this situation, when the pivotal arm 418 attempts to lower the heater blocks on the empty carton pocket, its movement will be prevented. It is to be noted that the lowering action is accomplished by means of the tension spring 414 and no damage will be done to the machine if action is prevented. The mechanism returns to its normal position with the heater blocks lifted away from the turret by positive action of the cam 412, insuring that the blocks will be withdrawn when the turret is indexed.

In operation, as the turret is indexed into Station IV beneath the heater block and clamping shoes, pivotal arm 418 is rocked counterclockwise, lowering the assembly down on the carton top. The carton is first contacted by the roughened surfaces 452 of the clamping shoes engaging the triangular carton flaps. With further descent of the heater block, the inclined faces 460, engaging the side faces 458, forces the shoes outwardly. The roughened surfaces of the clamping shoes grasp the triangular carton ears and force them outwardly, sliding them against the surface 452 and creating a tension on the overlapping closure panels which lie over the top of the carton. This action is shown in detail in Fig. 22. Continued downward movement of the heater block forces the crowned surface into contact with these overlapping closure panels and the parallel links 456 continue to force the clamping shoes outwardly maintaining a tension across the carton top. The clamping shoes continually move outwardly to cause a constant tension on the front and rear closure panels, compensating for any slippage between the lower surfaces of the shoes and the triangular carton flaps. As the heater block pushes downwardly, the crowned heated face 448 of the block forces the overlying rear closure panels downward below the plane of the carton top. The front closure panel, which is the underlying panel, is under a tension and exerts a reactive vertical component of force against the overlying panels. The softened thermoplastic adhesive which is between the panels is forced into the pores of the material and a tight seal is formed. This action is shown in detail in Figs. 21 and 23. It will be noticed in Fig. 21 that the contacting surface of the heater block being convex in side profile depresses the closure panels the greatest distance below the plane of the carton top at the point where the center seam is formed and where the greatest pressure is required.

Referring now to Figs. 24 through 28, an alternate form of the invention is shown which accomplishes the forming of a tight overlapping seal on a carton top where the contents of the carton offers no support to the underlying closure panel. The heated alternate sealing head 479 may be attached by removing and replacing the bolts which secure the head to the flange 433 on the lower end of the rod 432 carried on the reciprocating cross head.

The alternating sealing head 479 is heated by elements 480 having terminals 481 to which are connected the leads 444. Insulating material 482 covers the head. Brackets 484 extend laterally from either side of the head and have vertical holes through which slidably extend pins 485, carrying at their lower ends clamping blocks 486. A set screw 487 (Fig. 25) is set in each bracket 484 to extend into keyway 488 on the pins 485 to prevent the clamping blocks from twisting with respect to the head. Coil compression springs 489 are positioned on the pin between the block 486 and bracket 484 to normally hold the lower clamping surface of the block at a lower level than the carton-contacting surface 490 of the heater head. Connector blocks 491, having heater elements 492 which extend into the clamping block, are secured to the side of the block and connect to the electrical leads 466. In this manner the clamping blocks are kept at a temperature sufficient to heat the thermoplastic adhesive between

the layers forming the side flaps. When the clamping blocks engage and press down upon the side flaps of the carton, the layers of the flaps are laminated by the heat and pressure.

Positioned on either side of the carton adjacent the carton walls and extending above the plane of the carton top are ridge elements **493**. The elements extend the depth of the carton and support the carton ears at their base. The function of these ridge elements, as is shown in detail in Figs. 27 and 28, will become apparent from the description of the operation of the apparatus.

As the heater head is lowered upon the carton, the clamping blocks first engage the carton ears **332**, flattening them and clamping them to the upper surface of the flat blade **453** on the turret. This forces the ears against the raised ridge **493** to the plane of the carton top in the manner shown in Fig. 27 drawing the closure panels tight across the top of the carton. Further descent of the heated sealing head **479** compresses the springs **489** and will cause the sealing surface **490** of the sealing head to engage the overlying rear carton closure panel **78**, forcing the closure panels downwardly against the ridge **493**. Since the overlapping closure elements were drawn tight across the carton top by the clamping action of the clamping block, the closure elements, when forced below the level of the ridge down to the plane of the carton top, become extremely taut and are forced tightly together. The heat of the head softens the thermoplastic adhesive and the vertical reactant force of the underlying closure panel **70** forces up against the overlying closure panels **76** and **78** to force the adhesive into the pores of the material, thereby forming an integral contact between the layers and a tight seal.

By the provision of the ridges **493** which extend above the plane of the carbon top and the operations of the successive clamping action of the blocks **486** and the forcing action of the sealing head **479**, the closure flaps have been forced together with considerable pressure. In drawing the closure panels tightly across the top of the carton by creating a lateral tension on the attached side flaps, the overlapping panels have been forced tightly together without the necessity of providing an upward pressure on the lower underlying flap. Thus the formation of a seal of the overlapping type has been made possible where the carton contains contents which form no base of reactance against which the flaps may be pressed.

Station V

Referring to Figures 29 through 38 the mechanism of Station V is shown which functions to press the overlapping seam together and cool the thermoplastic which has been softened at Station IV. Cam shaft **502** carrying cam **504** is mounted on pillow blocks **506** carried on the frame **203**. A tower **508** suitably mounted on the frame carries a rocker arm **510** having a follower **512** which contacts the cam. A spring **514** connected between a bracket **516** on the tower and the end of the rocker arm holds the follower in contact with the cam causing the rocker arm to pivot as the cam revolves. An upper rocker arm **518** is pivotally mounted on the top of the tower and a connecting rod **520** connects the outer ends of the two rocker arms. Rocker arm **518** is bifurcated at its inner end which is connected to the midpoint of an inverted T shaped member **522**, the upper end of which is connected between the bifurcated ends of an arm **524** pivotally mounted at the top of the tower. Members **518** and **524** carrying the T member form a parallelogram linkage which keeps the T member in constant vertical position. To the lower cross bar **525** of the T-shaped member, a uniquely shaped cooling block **528** is secured by means of bolts **526**. The underside of the block **529** is substantially the size of carton top and is crown shaped similar to the heated sealing head to force the overlying closure panels of the carton together. The cooling block **528** is cooled by means of a constantly circulating water supply fed from a suitable source through supply pipe **530** which is connected to the block by means of a connector block **532** mounted on the tower and a flexible tube **534** which feeds to the hollow chamber **536** of the cooling block through the connecting elbow **538**. The water leaves the cooling block through elbow **540** and the flexible return tube **542**, which connects to the return pipe **544** through a connector block **546** secured on the side of the tower.

At the sides of the cooling block are mounted brackets **548** which carry on their lower side compressible rubber clamping pads **550** extending below crowned surface **529** of the block.

The rubber pads engage the triangular carton flaps before the underside of the cooling shoe contacts the carton top and press and anchor the flaps tightly against the surface on the turret top.

It will be apparent that small amounts of thermoplastic adhesive may at times be squeezed from the seams to the outside of the container when the heat is applied at Station IV. If this is the case, then when the cooling block contacts the carton and solidifies the adhesive, the carton will be caused to adhere to the block, and when the block is raised the carton may be lifted from the turret pocket. To prevent this undesirable situation from occurring, a uniquely shaped hold-down plate **552** is provided (Fig. 30). The plate has a rounded lead corner **554** to cause it to ride over the carton without damaging the soft foil material as the turret indexes the carton beneath the plate. The plate is secured by a bolt **556** (Fig. 31) to a resilient spring leaf **558** which is suitably secured on the turret, the point of securement not being shown. The lower horizontal edge **560** of the plate bears on the top of the carton holding it down in the pocket. If any thermoplastic causes the carton to stick when the cooling head is raised, the plate will cause the carton to break away from the head and remain in the pocket. As the turret is indexed to Station VI, the carton slides out from under the plate **552** without difficulty.

Briefly summarizing the operation of Station V, as the cam **504** rotates, the cam operated arms **510** and **518** are caused to pivot by the action of tension spring **514**. The cooling head **528** descends upon the top of the carton, the thick rubber holders **550** striking the carton ears first, pinning them to the upper surface of the leaves **453** which are fixed on the upper surface of the turret. The crowned face **529** of the head pushes against the overlying rear closure panel. The panels anchored at the side become taut across the carton top and are forced tightly together in the manner illustrated in Figs. 31 and 32. The edges **562** of the crowned face are rabbeted to prevent pinching the carton material against the sides of the turret pocket as illustrated in Fig. 33. It will also be noticed in this figure that the resilient face of the clamping block **550** accommodates for differences in thickness in certain areas of the flaps.

The cold head quickly solidifies the thermoplastic adhesive causing the overlapping top closure panels to be sealed together. The action of the cam then raises the cooling head, the plate **552** preventing the carton from being lifted. The turret then indexes the carton to Station VI.

Figs. 34 through 38 show an alternate form of the cooling head. The heads are interchangeable by removing the bolts securing the head to the cross bar **525** of the T bar and replacing the alternate cooling head **564**. The flexible water supply and return tubes **534** and **542** may be easily connected to the alternate cooling head **564** in a manner similar to that shown in the first described form. The head functions similarly to that described above except that a different form of a clamping shoe was used. Cooling head **564** has a hollow chamber **565** through which a constant supply of cold water circulates. A bar **566** is secured to the top of the cooling head and extends beyond the sides of the head and bosses **568**

extend from the top of the ends of the bar. Vertical holes are drilled in each boss and in each hole is slidably mounted a pin **569** which carries at its lower end a clamping shoe **570**. A coil compression spring **572** is positioned between the bar and shoe urging the shoe downwardly. Stop nuts **574** on the upper end of the pin prevent it from being withdrawn from the bracket. A flat vertical shoulder **576** on the side of the shoe rides against the flat side face **578** of the cooling head preventing the shoe from having rotational movement. The lower surface **581** (Fig. 38) of the shoe **570** is corrugated to achieve a secure clamping effect and this surface normally extends below the lower face **582** of the cooling head. This cooling head face is crowned similarly to that of the previous cooling head. The clamping shoe is provided with a ridge **584** extending along a diagonal edge. As the cooling head is lowered and the clamping shoe engages the triangular flap, this ridge is positioned at the point on the flap where the flap tapers from a four-layer lamination to a two-layer lamination and compensates for the difference in total thickness (see Fig. 37). After the clamping shoes engage the triangular carton flaps and pin them to the upper surfaces of the leaves on the turret, the cooling head continues its downward travel compressing the springs **572**. The crowned face **582** of the cooling head begins pushing the overlapping closure flaps at the top of the carton down below the plane of the carton top. Since the lateral ears of the carton are anchored, the closure flaps become taut as they are pushed downwardly and are forced tightly together. While in this integral relationship, softened thermoplastic becomes solidified by the cooled head, thus sealing the carton. The pattern formed on the carton top by the contact of the clamping block **580** and the crowned face **582** of the cooling head is shown in Fig. 36. The cooling head is then lifted from the carton top to normal position and the carton indexed, by movement of the turret, to Station VI.

Station VI

The carbon top has received an impervious closure by sealing the overlapping closure panels. To complete the closure to form a neat package, the triangular lateral ears must be folded inwardly over the top of the carton and also the cover flap must be folded and sealed over the ears. This is accomplished by the mechanisms of Stations VI through VIII. Co-pending applications entitled Method and Mechanism for Folding Carton Flaps, Serial No. 202,518, filed December 23, 1950, now Patent No. 2,677,220, and Mechanism for Folding Carton Flaps, Serial No. 206,463, filed December 23, 1950, also disclose apparatus included in these stations which is shown in this application. It is obvious that further mechanical operation and addition of heat may disturb the perfect seal which has been formed by the overlapping closure panels. To protect the seal by preventing both heat and pressure from contacting the sealed panels, a protective plate **604** moves over the closed carton top between Stations V and VI as the turret is indexing. The plate has, until this time, been held in a recessed position on the turret inward from the carton top, as may be seen from the preceding drawings. This plate, shown in Figs. 39 through 41, is suitably secured on a supporting member **606** which has cross bars **608** secured to the lower surface with rollers **609** mounted on trunnion **610** extending from the ends of the bars. The rollers ride in slots **611** in guide members **613** secured on the turret. A bracket **612** extends from the rear of member **606** and contains a cross pin **614** which is cradled in the upper bifurcated end of a lever arm **616** pivotally carried on the turret. A short connecting link **618** connects the lever arm to a short pivotally mounted arm **620**, the upper end of which has a follower **622** and resides in a cam track **624** of stationary cam **96** which is carried on the stationary vertical shaft **94**. The cam and shaft are shown in Figs. 3 and 41. As the follower **622** rides outwardly in cam track **624**, plate **604** is moved outwardly over the top of the carton. The plate is held in this position through Stations VI, VII and VIII, when it is withdrawn to its original position.

The shape of the plate is chosen for purposes of giving it added strength. The plate has a flat center elevated portion **626** which has tapered flat surfaces **628** on either side of it. The main body of the plate also has a flat central portion **630** in front of the elevated portion and surfaces **632** on each side taper to thin side edges **633**. These surfaces **632** support the carton ears which are folded over the top of the plate. To accommodate the triangular shape of the ears, the surfaces **628** are cut diagonally back to form shoulders **634**. The edges of all surfaces are rounded to prevent damaging the carton foil material. The plate **604** is substantially the same size as the top of the carton so that the side edges **633** lie along the line of attachment of the ears **332** to the carton, and the front edge **635** lies along the line of attachment of the cover flap **80** to the carton. The edges **633** and **635** insure that the side flaps and cover flap will be creased along an even straight line when folded.

Referring now to Figs. 42 through 47, the ear folding mechanism of Station VI will be observed. The spring leaves **453** which lie on each side of the turret pocket have upper flat surfaces which support the ears of the carton. These leaves are suitably secured at their inner ends to the central portion of the turret at **640**. As illustrated in Figs. 45 and 46, slots **642** in the turret form passageways to the bottom of the leaf springs through which the pivotal fingers **644** pass to strike the springs. Tower **648** is mounted on the frame at Station VI and supports the rotatably mounted pin **650** upon which the fingers are mounted. Cam shaft **602** is rotatably mounted at the base of the tower in pillow blocks **651** and through a pair of bevel gears **652**, rotates a cam shaft **653**. A cam **654** is mounted on the shaft and contacts a follower **656** which is carried upon a lever arm **658** pivotally mounted on the tower. An adjustable rod **660** connects between the end of the lever arm **658** and a pivotal arm **661** secured on the rotatable pin **650**. Spring **664** between the tower and the arm **660** operates the fingers as the cam rotates.

In operation as the cam rotates, the follower drops to a low portion of the cam and the spring **664** causes the finger **644** to move up into slot **642** to strike spring leaf **453** moving it upwardly, thereby kicking the carton ears upwardly into a vertical position as shown in Fig. 45. The carton retaining rail **210** and cover flap rail **284** are interrupted at this station to allow the finger to pivot into the turret.

It will be noticed that as the spring leaf lies directly beneath the leaf and its inner edge is adjacent the side wall of the carton, the ear will pivot about its line of attachment to the carton without being deformed. The edge **633** of the protector plate lies along the top of the line of attachment of the ear to the carton and a straight fold line at the base of the ear will result. When the finger returns, the resilient spring leaf flattens on the turret top and the carton ear drops partially back to the position shown in Fig. 46 which is sufficiently elevated for the folding shoe to move beneath it.

Cam shaft **653** also carries at its outer end sprocket **665** over which runs chain **666**. The upper end of the chain runs over sprocket **667** mounted on a shaft **668** running through the top of the turret. A tightener sprocket **669** engaging the chain is carried on an arm **671** adjustably mounted on the tower. A stud **672** threaded into a boss **673** on the tower tightens the arm in the adjusted chain tightening position. Sprocket shaft **668** also carries gear **674** which meshes with gear **675** on shaft **676** and idler gear **677**. The idler gear in turn meshes with gears **678** and **679** which are mounted on shafts **680**, **681**, respectively, which with shafts **676** and **668** rotatably extend through to the front face of the upper tower.

In Figs. 43 and 44 the mechanism operated by these

shafts on the inner face of the tower may be observed. The upper shafts **676** and **680** carry similar drive cranks numbered **681**, which have crank pins **683** extending through holes in the shoe carrying arms **684** and **685**. Lower shafts **668** and **681** carry on their inner ends guide cranks **686** each of which has a crank pin **688** extending through a small bearing block **691** slidably carried in a slot **693** in each of the arms **685**. Collars **694** on the ends of the upper crank pins and **695** on the lower pins hold the arms **684** and **685** on the crank. The folding shoes **696** and **697** are mounted at the lower ends of arms **684** and **685**. The shoe **697** is longer and will strike its flap first in the folding operation. The shoe is notched at **698** to prevent the longer end from striking the raised portion **626** of the protective plate.

In operation, rotation of shaft **652** drives chain **666** causing the gears on the rear of the tower to rotate, causing simultaneous rotation of the cranks on the front of the tower.

The lower cranks **686**, as illustrated in Figs. 44 and 47, lead the upper cranks **681** by a few degrees and are slightly longer thereby giving motion to the ear-folding shoes in a unique path. This path forms an elliptical arc in the downward stroke to catch under the flaps and gently push them over the top of the plate. When the flaps are flattened over the top of the carton, the shoes are returned along a substantially straight path. The path of movement is shown by the dotted lines **699** of Fig. 47. It will be noted that the ears should be folded over the top of the carton as gently as possible, preventing undue cracking of the solidified thermoplastic adhesive at the base of the flap and between the laminations and preventing wrinkling of the foil which forms the flap. The unique path of movement returns the shoes directly to the starting point out of the way of the carton when it is indexed into the station. The folding shoes, by having no waste movements, may be kept in constant operation and yet have time, in the short while the carton is at the station, to fold the ears gently in the downward stroke.

The ears are pressed down on the top of the carton to form a crease at the base of the flap, but the folding pressure does not disturb the sealed front and rear closure panels because the protector plate prevents any downward pressure from being applied to the seam. When the shoes have folded the flaps and are starting to return to their top position, the turret indexes the carton to Station VII.

Station VII

At Station V the thermoplastic adhesive between the laminations of material which form the top of the carton was cooled and solidified with the lateral side flaps lying in plane of the carton top. When the flaps are folded through 180° over the top of the carton at Station VI, this solidified adhesive is stressed and crumbled in certain areas. The material forming the outer layer of the carton material is bent about a larger radius than the material forming the inner layer, thus stressing both inner and outer layers as they attempt to shift with respect to each other. To relieve this stress and restore the broken adhesive to sealed condition, the flaps are subjected to heat to soften the thermoplastic between the laminations, permitting slippage therebetween to relieve the stress. The ruptured adhesive at the base of the flap is remelted and permitted to reharden with the flaps in the folded position.

Referring to Fig. 48, the tower **704** is shown mounted on the annular frame **203** and pillow blocks **706** are also mounted on the frame and carries cam shaft **702** which carries cam **708**. A rocker arm **710** is pivotally mounted in the tower and a follower **712** on its inner end bears against the cam. A tension spring **714** connected between a bracket **716** on the tower and the outer end of the rocker arm pivots the arm as the cam rotates. An adjustable connecting rod **718** connects between rocker arm **710** and a second rocker arm **720** pivoted at the upper end of the tower. The inner end of the rocker arm extends into a channel **722** in a sliding cross head **724** which may be vertically reciprocated on guide rods **726**. To connect the block to the end of the rocker arm, a pin **728** is mounted across the channel and extends through an elongated slot **730** in the arm and slides in the slot as the rocker arm pivots. On a rod **731** which extends downwardly from the cross head is carried a heated head **732**. The lower face of this heating head **734** may be seen in Fig. 49 and has raised portions **736** shaped to fit the carton ears. A lead wire **738** connects from a suitable source of electricity to the connector lead **740** which is connected to heating elements within the head.

As the carton is indexed into Station VII beneath the heated head **732**, the pivotal movement of the upper rocker arm **720** causes the head to descend upon the carton ears. The heat penetrates the flaps softening the adhesive between the laminated carton ears, thus relieving the stress placed upon the foil by folding the ears over the carton at Station VI. The raised areas of the head **736** are the only surfaces which make contact with the carton ears, the relieved portion between said areas being positioned above the raised central portion **626** of the protector plate. The plate allows vertical pressure to be applied to the flaps and supports them, preventing any pressure on the seam beneath the plate.

The plate has an important function at this point, acting as an insulator preventing the seam from being separated by heat. The plate being of metal absorbs the excess heat and a certain amount is conducted away through the supporting plate **604**. The plate, being subject to the heat for a short period of time, will raise only slightly in temperature and will not soften the adhesive forming the overlapped seal beneath it. This insulation protection is of critical importance as if the adhesive between the seams becomes softened, the closure panels will separate, causing leakage of the container. The plate continues to rotate with the turret through the other stations after the carton has been removed at Station VIII and has adequate time to cool and lose the small degree of heat which it may have acquired before it is again moved over the carton top between Stations V and VI.

The heated head **732** dwells on the ear flaps for a short period of time which is sufficient to fuse the thermoplastic out to the base of the flaps. The head is then lifted from the carton, and the carton is indexed from Station VII to Station VIII.

Station VII is provided with a no-carton device similar to that of Station IV. The vertical shaft **744** rotatably carried in the tower on brackets **746** and **748** carries at its lower end arm **750** having a roller **752** at its outer end to roll against the turret. If no carton is present, the spring **754** pivots the arm into the empty turret pocket against stop **755** to pivot the stop finger **756** beneath the bracket **758** on the upper pivotal arm, preventing movement thereof. This prevents the undesirable action of the heated head descending directly on the uncovered areas of the protector plate and overheating the plate.

Station VIII

The adhesive in the flaps is still softened when the carton leaves Station VII. The flaps must be held down to permit the adhesive to harden with the flaps in folded position. The cover flap must also be folded over the flaps to complete the folded closure.

The folding of the final overlying flap of the carton is accomplished between Stations VII and VIII by the stationary curved folding rails numbered **802** and **804** illustrated in Figs. 51 and 52. The rail **802** first cams the flaps downwardly flat on the carton top, holding them in that position while the cover flap is folded over them. This rail is heated by an attached block **806** containing heating elements supplied with electricity by leads **808** which connect to a suitable source of electricity. The

block has a supporting arm 810 clamped in a holder 812 supported on the vertical post 814. The heat applied to this rail prevents wax from collecting on the metal and provides smooth sliding of the carton as the carton moves from Station VII to Station VIII.

As the carton moves, the cover flap 80 begins climbing up on the gradually inwardly curved folding rail 804 until it is folded up over the carton flaps at Station VIII when the carton is ejected from the turret pocket.

The ejector plate 378 forms the inner wall of the turret pocket and is mounted (Fig. 41) upon a sliding rod 818 which connects to a pivotal arm 820, mounted on a bracket 822 on the turret 86. The lower portion of this arm has a cam follower 824 contacting cam 142. The driving train operating this cam is shown in detail in Fig. 3. At the appropriate moment after the carton has reached Station VIII, the cam causes pivotal movement of arm 820 and the consequent outward movement of the ejector plate 378 pushes the carton out of the turret pocket. Spring 826 connected between the arm 820 and the turret 86 returns the plate into the pocket.

The ejectment of the cartons (Fig. 51) passes it beneath the flap pressing mechanism which consists of the plate 828 having a horizontal lower creaser edge 830. This plate is adjustably hung on a frame piece 832 by means of the thumb screw 834 threaded to a lug 836 fixed to the back of the plate. This plate functions to iron or smooth the flap down upon the top of the carton as the carton passes therebeneath. The plate firmly presses the flap against the folded flaps and carton top. Following this pressing, a pressure plate 838, which is suspended by means of pins 840 extending through holes in the frame piece 842, holds the closure flap on the top of the carton. Spiral compression springs 844 surrounding the pins 840 between the plate 838 and frame 842 resiliently hold the plate down upon the top of the carton. The cartons move away from the turret sliding over the platform 846.

To complete the closure the flap is sealed over the entire top of the package by the application of heat and pressure. This may be accomplished by other packaging machinery, preferably of the type such as is shown in the co-pending application entitled Method and Apparatus for Sealing Cartons, Fischer, Serial No. 206,461, filed December 23, 1950, now Patent No. 2,696,245.

Thus our invention has provided a machine which closes the top of a filled container and forms a seal which is impervious to air. The machine performs a specific series of folding operations during which the thermoplastic adhesive is alternately heated and cooled to achieve the optimum in a tight seal and an attractive closure. The mechanism forms an overlapping type seal on a carton which may be made of pliable, soft material and accomplishes this without the aid of supporting means on the under side of the overlapping closure. Though the apparatus shown is adapted to closing the top of a carton, it will be apparent that the mechanism could be altered to close either end of a carton employing the teachings of our invention.

While the invention is susceptible of various modifications and alternative constructions, we have shown in the drawings and have described in detail the preferred embodiments. However, it is to be understood that we do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

We claim as our invention:

1. A device of the class described including a device for folding a flap outwardly from the carton mouth, an anvil member positioned outside of the carton with an upper surface substantially at the plane of the carton top and adjacent the side wall to which the flap is connected, a creasing bar extending parallel to the plane of the carton top, and means moving said bar rapidly between the folding device and the mouth of the carton substantially parallel to the plane of said carton side wall to strike the carton flap closely adjacent its line of attachment to the side wall while said folding device is engaging the flap and holding it outwardly and press the flap against said anvil.

2. A mechanism of the class described having a carton flap folding device, comprising means to draw the flap outwardly from the carton mouth, an anvil positioned adjacent the side wall and having an upper surface lying substantially in the plane of the carton top, and a hammer movable between said flap drawing means and the carton mouth, means for moving said hammer rapidly against the inside of the flap closely adjacent the line of attachment of the flap to the container side wall to force it against said anvil surface to bend the flap outwardly.

3. A mechanism of the class described having a carton flap folding device comprising a carton carrier supporting the carton having an opening exposing a carton side wall, a retaining rail positioned across said opening to hold the carton in the open carrier with the upper edge of the rail at the carton top, means to draw the carton flap over the rail away from the mouth, and a creasing hammer movable between said flap drawing means and the carton mouth while the drawing means is engaging and holding down the flap, said hammer moving at substantially right angles to the held flap against the inside of the flap to force it against the rail thereby creasing the flap outwardly.

4. A mechanism for closing a carton comprising a pair of spreader fingers movable into the mouth of the carton against the rear edge of the carton top, means for spreading the fingers to fold opposing carton closure panels laterally into triangularly shaped ears, means for withdrawing the fingers from the mouth, a creasing member moved into the mouth after withdrawal of the fingers and having a straight edge engageable with the inside of the wall of the carton, and a folding shoe engageable with the base of the rear closure panel of the carton to bring it over the carton mouth and crease it at its base.

5. A mechanism for folding a carton comprising spreader fingers movable into the carton mouth over a first carton closure panel against the rear top edge of the carton, means to spread the fingers folding the opposing panels adjoining said first panel outwardly, means to withdraw the fingers from the carton, a creasing blade movable into the mouth vacated by the fingers against the carton rear wall supporting the remaining closure panel, and a folding shoe movable to engage the panel and passing in close proximity to said blade to crease said remaining panel and fold it over the carton.

6. A mechanism for sealing a carton comprising means for folding opposing closure panels having adhesive therebetween into overlapping relationship over the carton top forming attached ears extending laterally over the sides of the carton, means for anchoring the ears with respect to the carton preventing lateral movement and holding the closure panels taut across the carton top, and means for forcing the overlying closure panel down upon the underlying panel into adhering contact while the ears are anchored.

7. A mechanism for sealing a carton comprising means for folding opposing closure panels having adhesive therebetween into overlapping relationship over the carton top forming attached ears extending laterally over the sides of the carton, means for anchoring the ears with respect to the carton preventing lateral movement and holding the closure panels taut across the carton top, a sealing member with a lower crowned surface having an area no larger than the carton top, and means to force the surface of the sealing member into engagement with the unsupported taut closure panels while the ears are anchored forcing the panels below the plane of the carton top.

8. A mechanism for sealing a carton comprising means for folding opposing closure panels having adhesive therebetween into overlapping relationship over the carton top forming attached ears extending laterally over the sides of the carton, a rigid carton support positioned beneath the carton ears, clamping means forcing the ears tightly against said support and preventing lateral movement thereof and holding the closure panels taut over the carton top; and means engaging the overlapping closure panels while the ears are held against lateral displacement by said clamping means and depressing the taut panels below the plane of the carton top to force them into integral adherence.

9. A mechanism for sealing a carton comprising means for folding opposing closure panels having thermoplastic adhesive therebetween into overlapping relationship over the carton top forming attached ears extending laterally over the sides of the carton, a carton support having a surface beneath the ears, elements engaging the ears clamping them tightly against said surface, a heated sealing block having a convex lower surface, means for moving the block into engagement with the overlapping closure panels depressing them below the plane of the top of the carton to force the juxtaposed panels into integral sealing contact.

10. A mechanism for sealing a carton comprising means for folding opposing closure panels having adhesive therebetween into overlapping relationship over the carton top forming attached ears extending laterally over the sides of the carton, supporting means beneath the carton ears, a sealing block having a crowned surface with dimensions no greater than the top of the carton, a clamping element resiliently carried by the sealing block and extending below the block as to engage the carton before the block, and means for moving the sealing block to engagement with the overlapping carton closure panels, the clamping elements first engaging the ears and clamping them against the support to hold the overlapped elements taut across the carton top.

11. A mechanism for sealing a carton comprising means for folding opposing closure panels having adhesive therebetween into overlapping relationship over the carton top forming attached ears extending laterally over the sides of the carton, a carton support having surfaces beneath the ears, a sealing body having a carton top engaging surface, a pair of stretcher clamp blocks having ear engaging surfaces and carried adjacent said sealing member surface, said blocks connected to the sealing body in such a manner that pressure normal to their engaging surfaces will cause movement away from the sealing body, and means for moving the sealing body into engagement with the overlying panels to force the closure panels together, the clamp blocks first contacting the ears and moving outwardly from the reactant pressure of the carton support to draw the closure elements taut across the carton top.

12. A mechanism for sealing a carton comprising means for folding opposing closure panels having adhesive therebetween into overlapping relationship over the carton top forming attached ears extending laterally over the sidewalls of the carton, means creating a lateral tension upon the ears drawing the closure elements taut across the carton top, and sealing means for engaging the overlying closure element and forcing it against the underlying closure element to create a seal therebetween.

13. A mechanism for sealing a carton comprising means for folding opposing closure panels having adhesive therebetween into overlapping relationship over the carton top forming attached ears extending laterally over the sidewalls of the carton, means for supporting the carton having surfaces beneath the carton ears, a sealing element having a crowned lower carton engaging surface with dimensions no larger than the carton top, a pair of clamping blocks having roughened ear engaging surfaces, said blocks dependent at the side of the sealing element on links pivotally connected to the sealing element with the ear engaging surfaces normally below said carton engaging surface, and means for moving the sealing element to engagement with the carton top, the clamping blocks first engaging the ears and being swung on the supporting linkage to force the ears laterally outward stretching the overlapping closure elements tightly across the carton top for engagement by the sealing element.

14. A mechanism for sealing a carton comprising means for folding opposing closure panels having thermoplastic adhesive therebetween into overlapping relationship over the carton top forming attached ears extending laterally over the sidewalls of the carton, means for supporting the carton having surfaces beneath the carton ears, a heated sealing element having a crowned lower carton engaging surface with dimensions no larger than the carton top, a pair of heated clamping blocks having ear engaging surfaces, linkage pivotally connected to the sealing element and connected to the clamping blocks, said links depending downwardly to support the clamping blocks; with the ear engaging surfaces normally below said carton engaging surface, means for moving the sealing element to engagement with the carton top, the clamping blocks first engaging the ears and moving outwardly on the supporting linkage to force the ears laterally outward stretching the overlapping closure elements tightly across the carton top for engagement by the sealing element, and biasing means urging the clamping blocks to normal position.

15. A mechanism for sealing a carton comprising means for folding opposing closure panels having adhesive therebetween into overlapping relationship over the carton top forming attached ears extending laterally over the sidewalls of the carton, a sealing member having a surface engageable with the carton top, ear supporting means positioned beneath the carton ears and extending above the plane of the carton top, means clamping the ears to prevent lateral movement when the sealing member engages the carton top, and means actuating the sealing member to engagement with the overlapped closure members forcing them to the plane of the carton top.

16. A mechanism for sealing a carton comprising means for folding opposing closure panels having adhesive therebetween into overlapping relationship over the carton top forming attached ears extending laterally beyond the sidewalls of the carton, a sealing block having a surface engageable with the carton top, a ridge parallel to the sidewalls lying beneath each carton ear and extending above the plane of the carton top, means rigidly securing the ears, and means for moving the sealing block surface into engagement with the overlapping closure elements stretching them down to the plane of the carton top.

17. A mechanism for sealing a carton comprising means for folding opposing closure panels having adhesive therebetween into overlapping relationship over the carton top forming attached ears extending laterally over the sidewalls of the carton, a sealing block having a lower carton closure engaging surface, narrow ridges extending along the sides of the carton beneath the ears above the plane of the carton top, ear supporting surfaces positioned outwardly from the ridge and at a lower level than said ridges, clamping blocks engaging the ears to clamp them against said surface, and means for lowering the sealing block upon the overlapping closure panels forcing them downward to the plane of the carton top to form an integral seal.

18. A mechanism for sealing a carton comprising means for folding opposing closure panels having thermoplastic adhesive therebetween into overlapping relationship over the carton top forming attached ears extending laterally over the sides of the carton, supporting surfaces beneath the ears; ridges above said surfaces extending beneath the ears adjacent the line of attachment of ears to sidewalls, a heated sealing block having a closure panel

engaging surface and adapted to pass between the ridges, a pair of clamping blocks resiliently carried on the sealing block to pass outside of said ridge and having an ear engaging surface normally beneath said closure panel engaging surface, and means for actuating the sealing block moving the clamping blocks to holding engagement with the ears and subsequently moving the panel engaging surface to force the closure elements to the plane of the ear supporting shoulders.

19. A carton closing machine comprising means for folding opposed thermoplastic coated carton closure panels into overlapping engagement having attached ears extending laterally outwardly, means for applying heat to the overlapping panels to soften the thermoplastic therebetween, means for laterally anchoring the carton ears in the plane of the carton top, and cooling means for forcing the overlapping closure panel against the underlying panel forcing them tightly together to form an impervious seal.

20. A carton closing machine comprising means for folding opposed thermoplastic coated carton closure panels into overlapping engagement forming attached ears extending laterally outwardly, means for applying heat to the overlapping panels to soften the thermoplastic therebetween, means for supporting the carton including surfaces beneath the ears, means for clamping the ears to the surfaces, a cooling block, and means for forcing said block against the overlapping closure elements forcing them together to a position below the plane of said surfaces.

21. A carton closing machine comprising means for folding opposed thermoplastic coated carton closure panels into overlapping engagement having attached ears extending laterally outwardly, means for applying heat to the overlapping panels to soften the thermoplastic therebetween, fixed surfaces beneath the carton ears, blocks engageable with the ears clamping them against the surfaces, a cooling block for solidifying the wax having a crowned carton engaging surface, and means to actuate the block to move the surface against the closure elements stretching said elements downwardly below the level of the fixed surfaces.

22. A carton closing machine comprising means for folding opposed thermoplastic coated carton closure panels into overlapping engagement having attached ears extending laterally outwardly, means for applying heat to the overlapping panels to soften the thermoplastic therebetween, a support for the carton having surfaces beneath the ears, a cooling block having a surface for engaging the carton closure elements, a pair of clamping elements mounted on each side of the block, resilient rubber facing pieces on said elements extending beneath said engaging surface, and actuating means forcing the block down upon the carton closure elements to cool the adhesive and seal the carton, the facing pieces first clamping the ears to said support surfaces.

23. A carton closing machine comprising means for folding opposed thermoplastic coated carton closure panels into overlapping engagement forming attached ears extending laterally outwardly, means for applying heat to the overlapping panels to soften the thermoplastic therebetween, a carton support having surfaces facing the underside of the ears, a cooling block having a crowned carton engaging surface, means to remove heat from the block, a pair of ear clamping members resiliently mounted on each side of the block and having a knurled ear engaging face normally at a lower level than said crowned surface, and actuating means moving the clamping members and cooling block to engagement with the carton top to solidify the softened thermoplastic and seal the carton.

24. A carton closing machine comprising means for folding opposed thermoplastic coated carton closure panels into overlapping engagement forming attached ears extending laterally outwardly, means for applying heat to the overlapping panels to soften the thermoplastic therebetween, a carton supporting means moving the carton along a path, a restraining member mounted beside the path and engaged by the carton top as the carton is moved therebeneath, a cooling member for solidifying the adhesive and sealing the carton, actuating means moving the cooling member to engagement position against the closure panels and to non-engagement position, said restraining member preventing the carton from being withdrawn from the supporting means by adhesive adhering the carton to the block when the block is moved to non-engaging position.

25. A carton closing machine comprising means for folding opposed coated carton closure panels into overlapping engagement forming attached ears extending laterally outwardly, a carton supporting mechanism adapted to carry the carton along a path, a restraining blade mounted along said path to ride over the carton top edgewise as the carton is moved therebeneath by the supporting mechanism, a closing block adapted to engage the carton top to seal the closure panels, and means to withdraw the block from the carton, the blade preventing the carton from being withdrawn from the supporting mechanism with the block.

26. A carton closing machine comprising means for folding opposed thermoplastic coated carton closure panels into overlapping engagement forming attached ears extending laterally outwardly, means for applying heat to the overlapping panels to soften the thermoplastic therebetween, a rotatable turret having carton supporting pockets therein open at the top and surfaces underlying the carton ears, a stationary blade chordally positioned with respect to the turret to ride over the carton top as it is moved therebeneath, a cooled closing block having a crowned carton engaging surface to solidify the thermoplastic adhesive between the closure elements, means for causing the block to engage and for removing the block from the carton top, means for clamping the ears against said underlying surfaces, and actuating means to move the block from non-engagement to engagement position against the carton top and for moving the block to non-engagement position, the stationary blade preventing the block from withdrawing the carton from the supporting means when moving to non-engagement position.

27. A mechanism for closing cartons having closure panels having a thermoplastic coating and extending above the carton sidewalls comprising means for folding a closure panel over the carton top, means for forcing the two adjacent closure panels laterally outwardly to form outwardly extending triangular flaps drawing the remaining closure panel over the first closure panel in overlying relationship, means for heating the thermoplastic adhesive and sealing the overlying panels together, means for anchoring the triangular flaps while heating and sealing the overlying panels to hold said first closure panel taut preventing it from separating from said overlying remaining closure panel as the thermoplastic coating becomes softened, and means for folding the triangular flaps inward over the top of the overlying flaps.

28. A mechanism for closing cartons having closure panels having a thermoplastic coating and extending above the carton sidewalls comprising means for folding a closure panel over the carton top, means for forcing the two adjacent closure panels laterally outwardly to form double thickness outwardly extending triangular flaps, drawing the remaining closure panel over the first closure panel in overlying relationship, and means for heating the thermoplastic adhesive and sealing the overlying panels together, means for cooling the thermoplastic adhesive between the overlying flaps, means for folding the triangular flaps inward over the top of the overlying flaps, and means for heating the folded triangular flaps to soften the adhesive between the layers composing the triangular flaps to relieve the stress formed by folding said flaps inward.

29. A mechanism for closing a carton having closure

panels with a thermoplastic adhesive coating extending above the carton sidewalls comprising means for folding a first closure panel over the carton top, means for folding adjacent closure panels laterally outward to form triangular extension flaps and to draw the remaining closure panel to overlap said first panel, means for adding heat to the overlying and first closure panels to soften the thermoplastic and seal the panels together, means for cooling the thermoplastic adhesive, means for folding the triangular flaps over the overlying panel, means for adding heat to the top of the flap to soften the thermoplastic at the juncture of the triangular flaps and cover panel to relieve the folding stress and fix the flaps in place.

30. A mechanism for closing a carton having closure panels with a thermoplastic adhesive coating extending above the carton sidewalls comprising means for folding a first closure panel over the carton top, means for folding adjacent closure panels laterally outward to form triangular extensions and to draw the remaining closure panel to overlap the first element, means for simultaneously heating the thermoplastic adhesive on the overlying and first closure panels and applying lateral tension to the flaps in the plane of the carton top to seal the panels together, means for cooling the thermoplastic adhesive, and means for folding the flaps over the top of the sealed panels.

31. A mechanism for closing a carton having closure panels with a thermoplastic adhesive coating extending above the carton sidewalls comprising means for folding a first closure panel over the carton top, means for folding adjacent closure panels laterally outward to form triangular extensions and to draw the remaining closure panel to overlap the first element, means for simultaneously heating the thermoplastic adhesive on the overlying and first closure panels and applying lateral tension to the flaps in the plane of the carton top to seal the panels together, means for holding the ears while pressing the overlying panel to the first closure panel while cooling the thermoplastic adhesive, means for folding the flaps over the sealed panels, and means for heating the thermoplastic adhesive between the laminations of the triangular flaps while pressing them over the carton top.

32. A mechanism for closing a carton having an inner liner and outer covering layer each having closure panels extending above the carton sidewalls and with vertical slits at the sides of a covering layer closure element to form a cover flap, the liner having an outer coating of thermoplastic adhesive and the covering layer having an inner coating of the thermoplastic adhesive, the mechanism comprising means to fold the liner closure panel lying against the cover flap over the carton top, means for folding the side closure panels of the liner and covering layer laterally outward into triangularly shaped flaps thereby drawing the liner and covering closure panels opposite the cover flap over the carton, means to apply heat and pressure to the overlying panels to soften the thermoplastic and form a seal, means to cool the thermoplastic, means for folding the triangular flaps over the carton top, and means for folding the cover flap over the triangular flaps and top of the carton.

33. A mechanism for closing a carton having an inner liner and outer covering layer each having closure elements extending above the carton sidewalls and with vertical slits at the sides of a covering layer closure element to form a cover flap, the liner having an outer coating of thermoplastic adhesive and the covering layer having an inner coating of thermoplastic adhesive, the mechanism comprising means to fold the liner closure panel which lies against the cover flap over the carton top, means for folding the side closure panels of the liner and covering layer laterally outward into triangularly shaped flaps thereby drawing the liner and covering closure panels opposite the cover flap over the carton, means to apply heat and pressure to the overlying panels to soften the thermoplastic and form a seal, means to cool the thermoplastic, means for folding the triangular flaps over the carton and applying heat thereto to soften the thermoplastic between the layers, and means for folding the cover flaps over the carton top.

34. A carton closing mechanism comprising a rotating turret having a series of cartons holding pockets therein operating outwardly, a guide rail extending annularly around the turret with a top face in the plane of the carton top, means to fold a carton flap outwardly and force the flap against the top face of the rail to crease the flap in the plane of the carton top, and folding means positioned around the turret to close the top of the carton within the pockets.

35. A carton closing machine comprising means for folding opposed thermoplastic coated carton closure panels into overlapping engagement, the panels having attached lateral flaps extending outwardly beyond the carton sidewall, means for supporting the carton with flat surfaces beneath the lateral flaps, means for applying heat to the overlapping panels to soften the thermoplastic adhesive therebetween, clamping means engageable with the ears holding them against said surfaces, and a cooling block for engaging the overlapping closure panels to solidify the adhesive, said block having relieved edges to prevent pinching the carton closure panels against the supporting surfaces.

36. In a device of the class described, an element for folding a carton cover flap outwardly from the carton liner comprising means for supporting a tubular container having an open end with the liner and cover flap extending beyond the end, a parallelogram linkage having a supporting link positioned parallel to the axis of the container, a pair of carrier links pivotally attached to the supporting link, and a fourth link rotatably carried by said carrier links, and a separating finger carried by said fourth link with movement of said carrier links from a position outside the side wall of the container to which the cover flap is connected, over the container end to engage the inner face of the flap, and again outside of said side wall to carry the flap outwardly away from the liner.

References Cited in the file of this patent

UNITED STATES PATENTS

1,818,497	Milmoe	Aug. 11, 1931
1,868,686	Belcher	July 26, 1932
1,989,471	Belcher	Jan. 29, 1935
2,095,938	Schmitt	Oct. 12, 1937
2,114,622	Bergstein	Apr. 19, 1938
2,196,666	Moore	Apr. 9, 1940
2,551,527	Cartwright	May 1, 1951

FOREIGN PATENTS

201,559	Great Britain	Apr. 10, 1935
580,273	Germany	July 11, 1935