United States Patent [19]

Irwin

[11] **3,876,361**

[45] **Apr. 8, 1975**

[54] **AUTOMATIC PRESS**

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[21] Appl. No.: **498,030**

Related U.S. Application Data

[62] Division of Ser. No. 274,843, July 25, 1972, Pat. No. 3,830,611.

[52] **U.S. Cl.** **425/451.6;** 425/388; 425/395

[51] **Int. Cl.** **B30b 1/14;** B29c 17/00

[58] **Field of Search** ..... 425/388, 394, 395, 450 R

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Primary Examiner—J. Howard Flint, Jr.

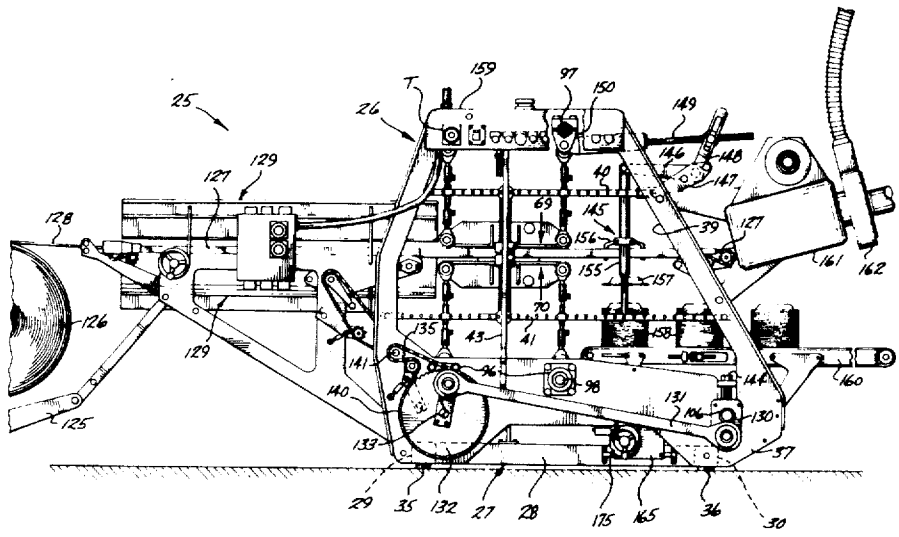
[57] **ABSTRACT**

The method provides matched molds in superimposed relation, cyclically reciprocating vertically each of said molds relative to the other, to first mold a product in a continuous web of heated thermo-plastic material fed cyclically between said molds, halting each cycle just short of its reaching the point of maximum proximity between said molds to allow the material adjacent the periphery of said product to cool prior to performing the trim step, starting the next following cycle with the trim step, the latter being accomplished by continuing the approach of said molds to the point of their maximum proximity, said product being left connected to the web by easily broken tabs and punching the product from the web at a stacking station during a succeeding cycle.

The apparatus embodies a double action automatic press including parallel vertical side frames rigidly united with each other and with a tripod supported base. A pair of massive vertical guide posts fixed at upper and lower ends to inner faces of said frames, vertically guide upper and lower tooling mounting platens, each platen being connected by four adjustable links to arms on one of two pair of rocker shafts, one such pair being above the upper platen, the other pair being below the lower platen. Outside one side frame, short arms are fixed on the upper pair of rocker shafts and double armed bell cranks are fixed on the lower pair of rocker shafts, each of the bell cranks having a long arm and a short arm. A pair of long links connect upper and lower outside short arms and a third link connects said long arms. A pitman connects one of said long bell crank arms to a crank arm fixed on one end of a transversely journaled crank shaft at the forward end of the press. A base mounted constant speed motor is connected through a variable speed transmission and an electro-air controlled clutch brake mechanism to a reduction gear box which is interposed in a gap in said crank shaft and directly drives the latter. Each revolution of the drive shaft accomplishes one production cycle of the press. A separate control device determines at what point in the production each cycle ends to provide a cooling "dwell" between cycles so that the trim step takes place at the beginning of each cycle, thereby improving the product.

A cyclic web feeder and heater is provided on and driven by the press. The tooling employed in the press leaves the product lightly connected with the scrap of the web following each trimming step by several oppositely disposed transfer tabs which may readily be broken by a punching operation when the product arrives at a stacking station. The press embodies and automatically drives a product punch for accomplishing this function. A product stack conveyor receives products thus punched from the web and automatically discharges product stacks of predetermined quantity. A scrap chopper disposes of the scrap left in the web. The press also includes separate means manually operable while the press is running to vary the time period of the cooling dwell and also to vary the distance, short of reaching the point of maximum proximity between the platens, at which each operating cycle concludes.

11 Claims, 18 Drawing Figures



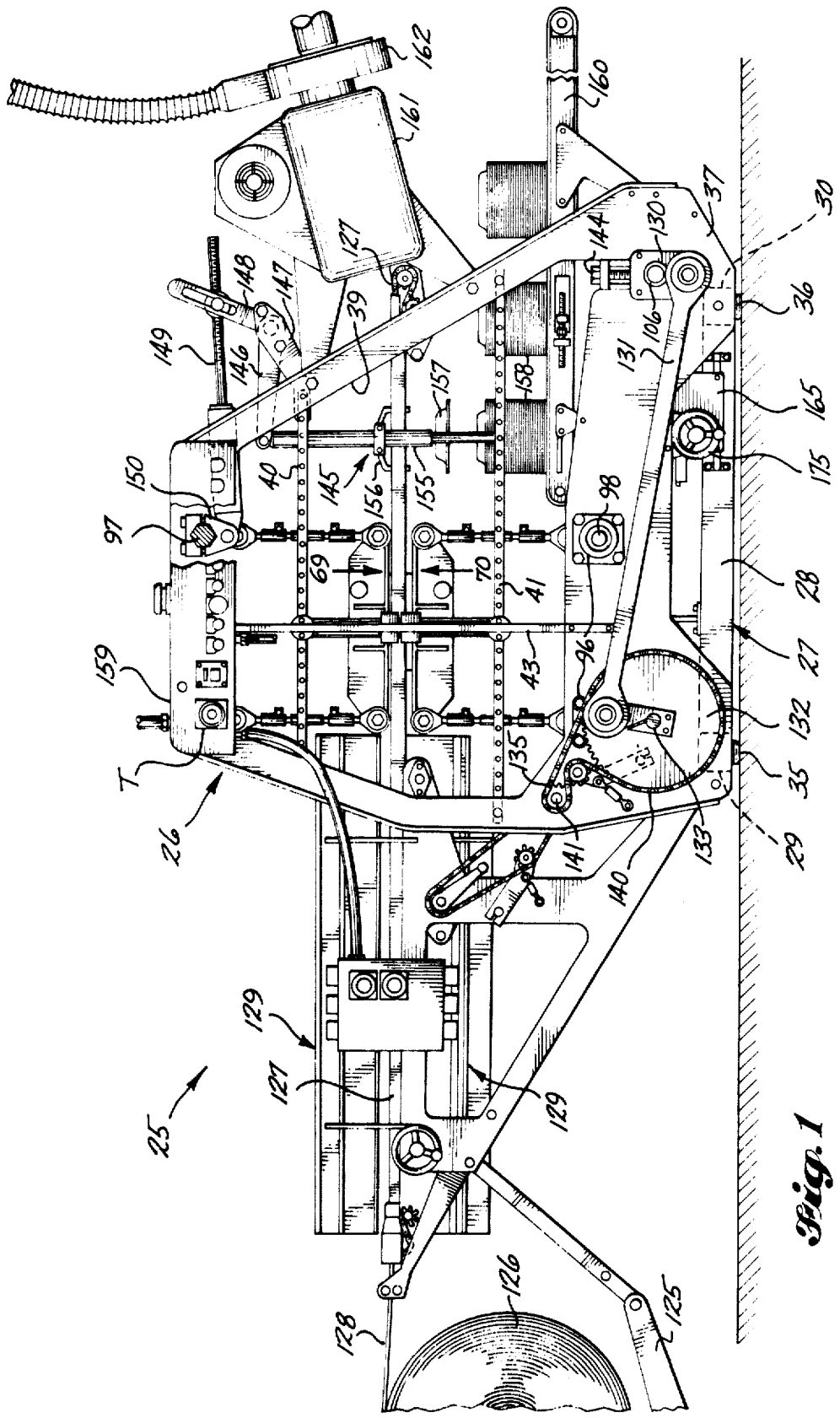

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Fig. 1

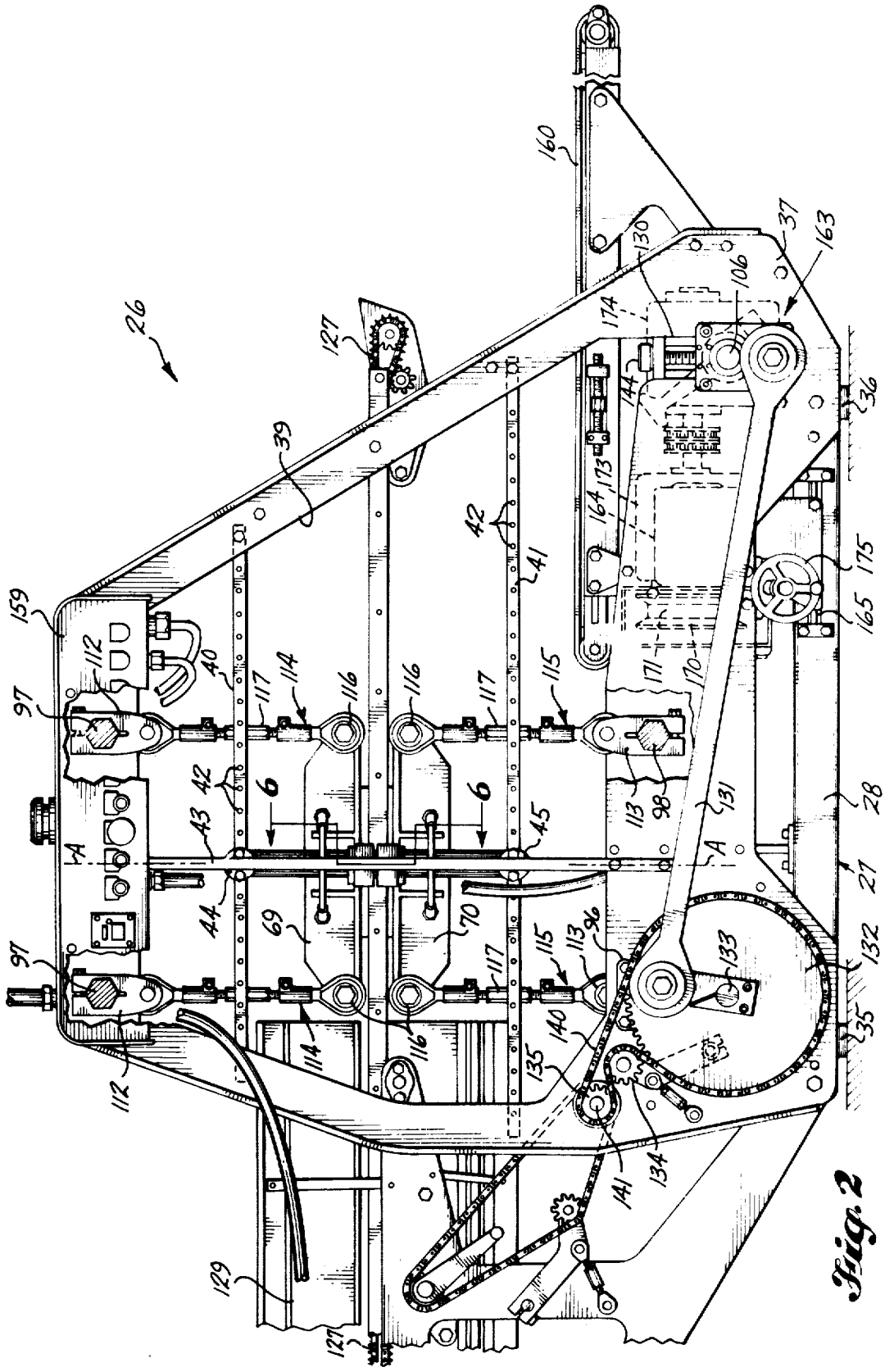

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Fig. 2

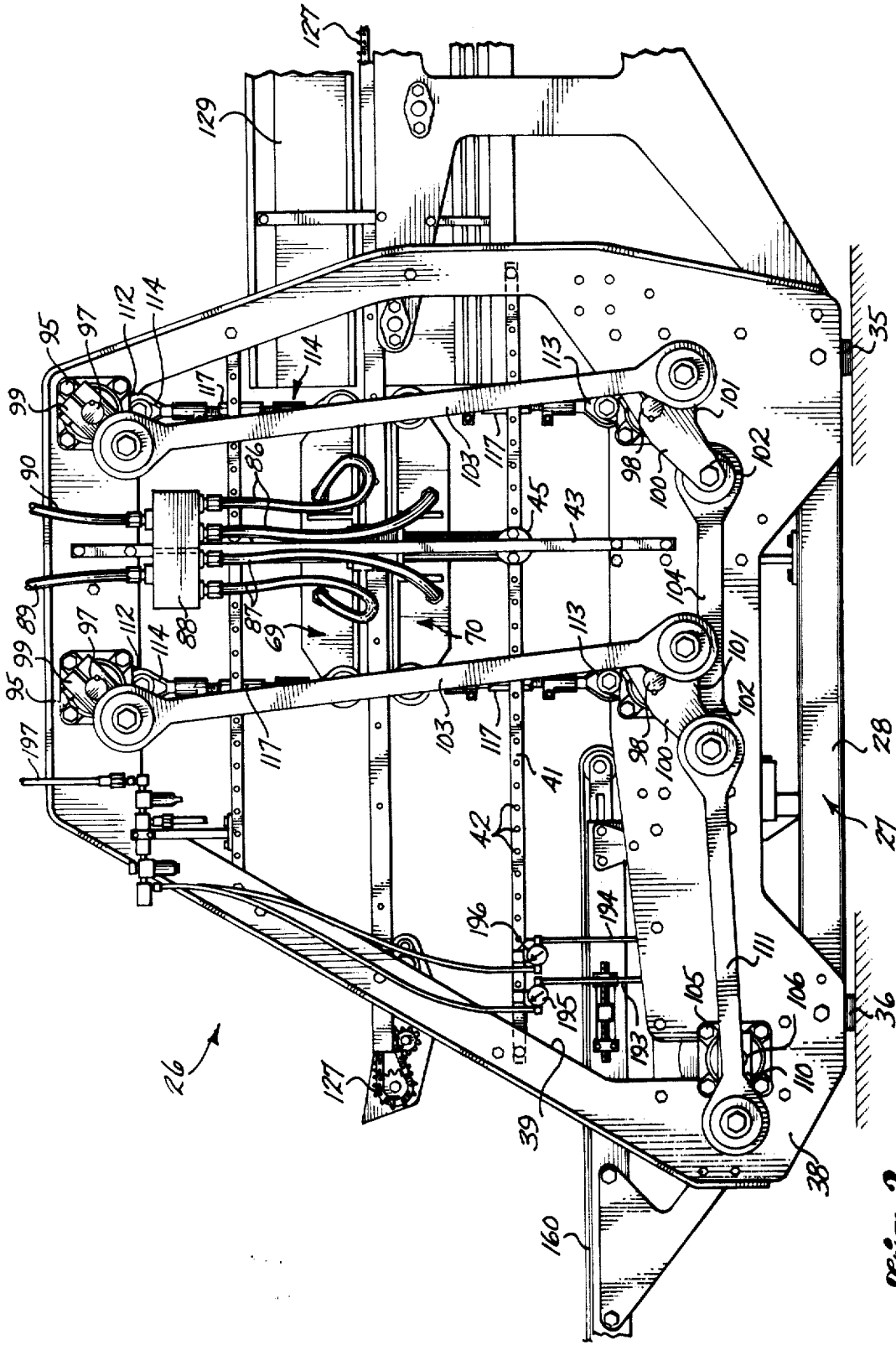

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Fig. 3

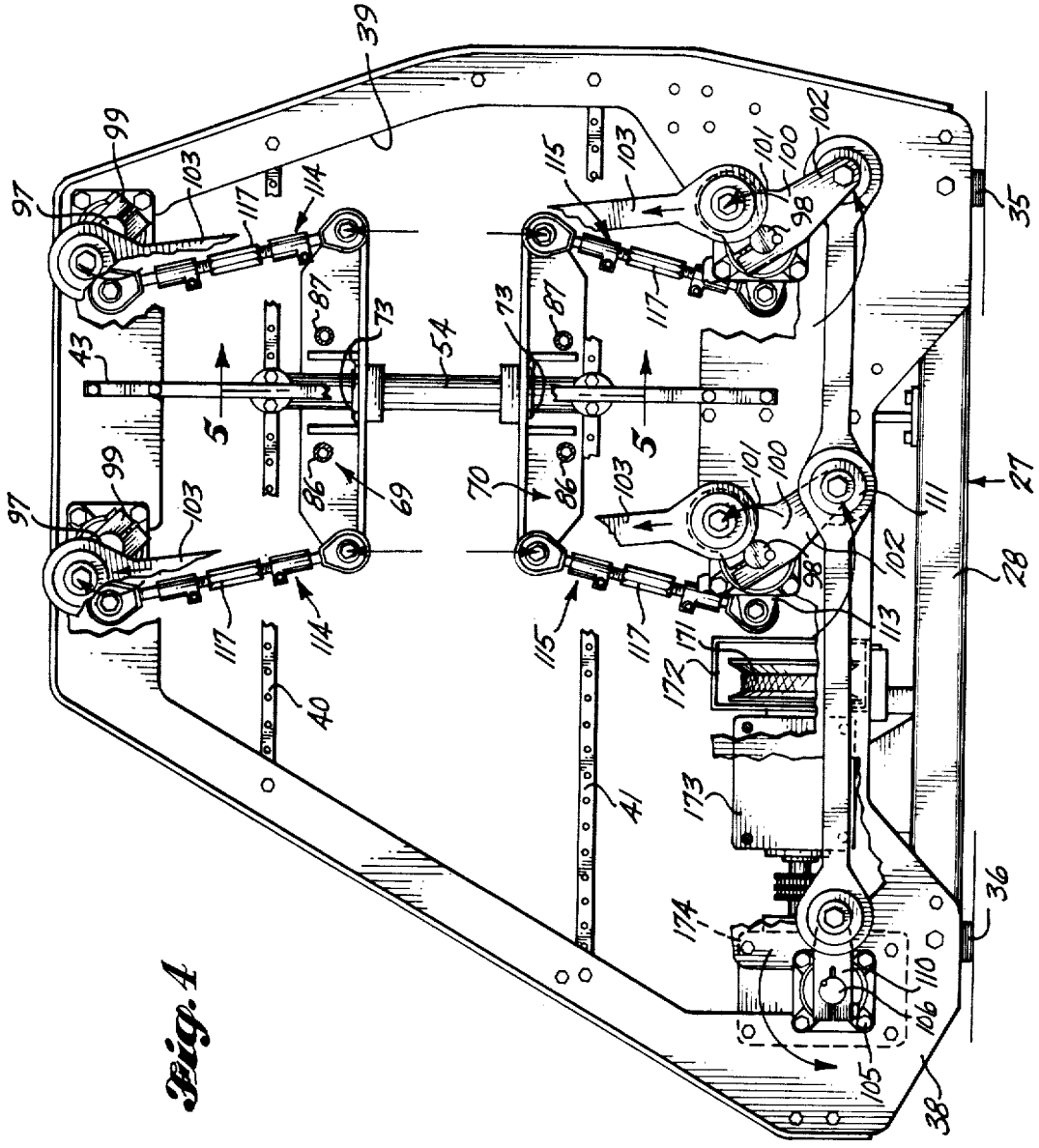

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Fig. 4

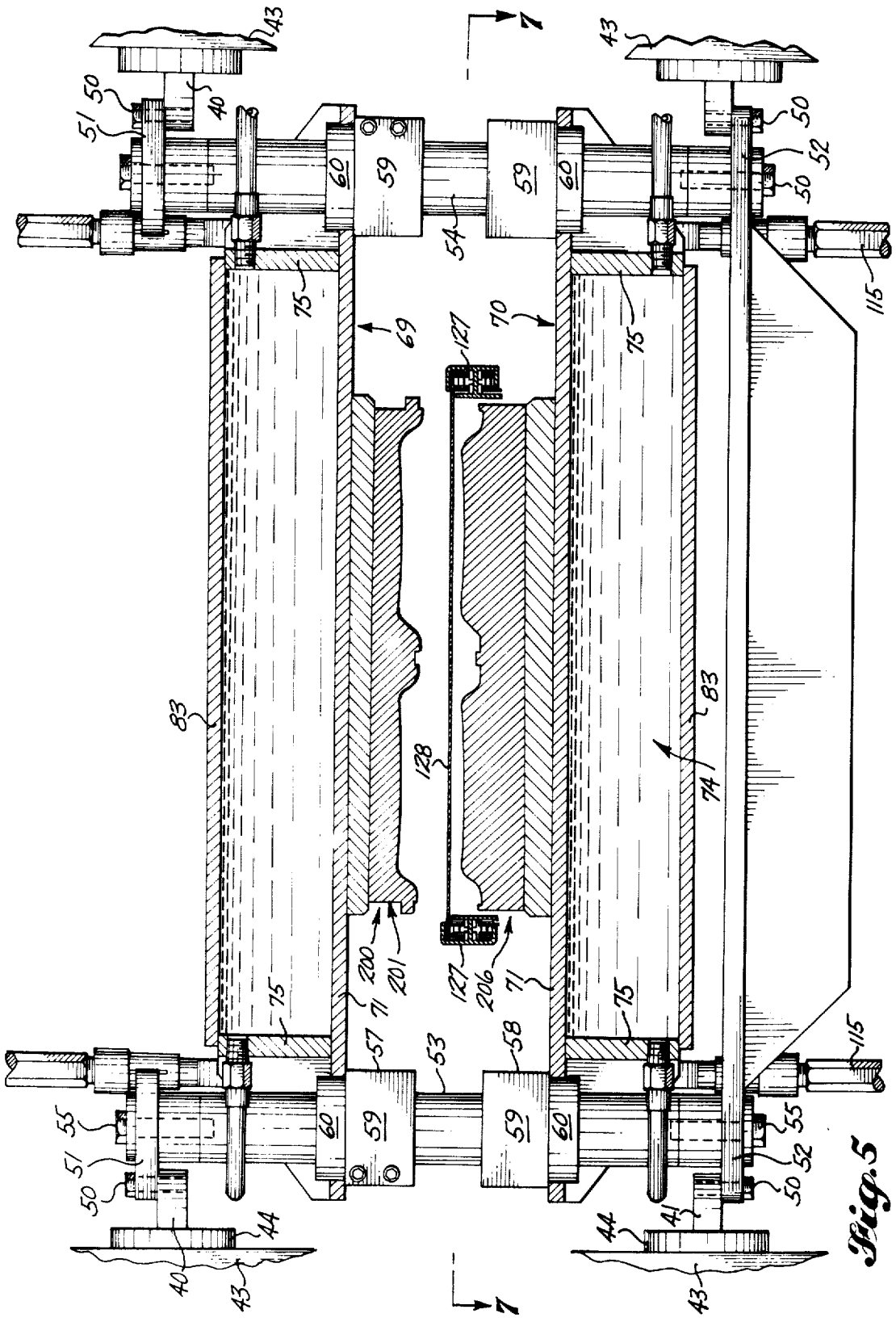

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Fig. 5

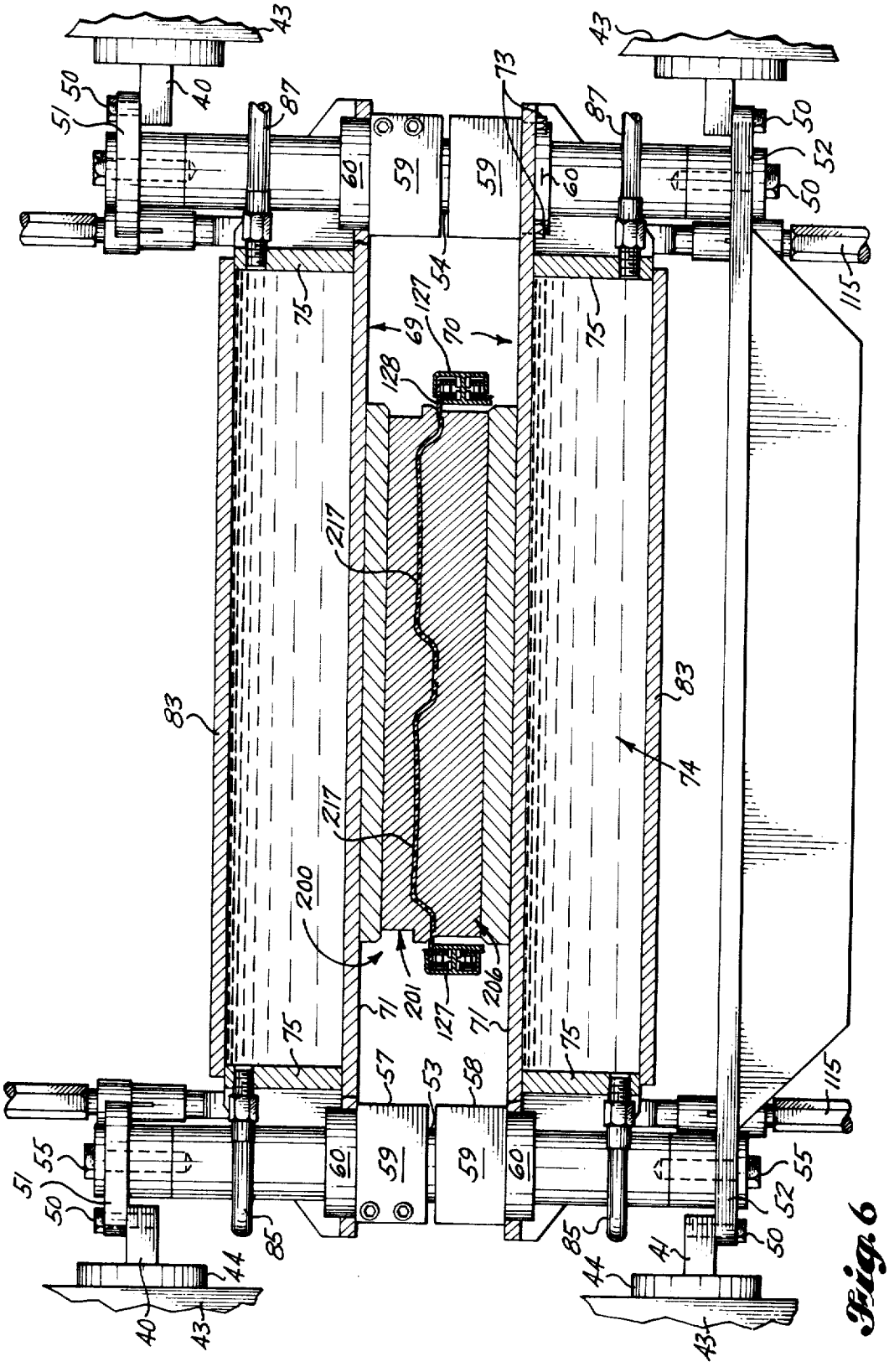

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Fig. 6

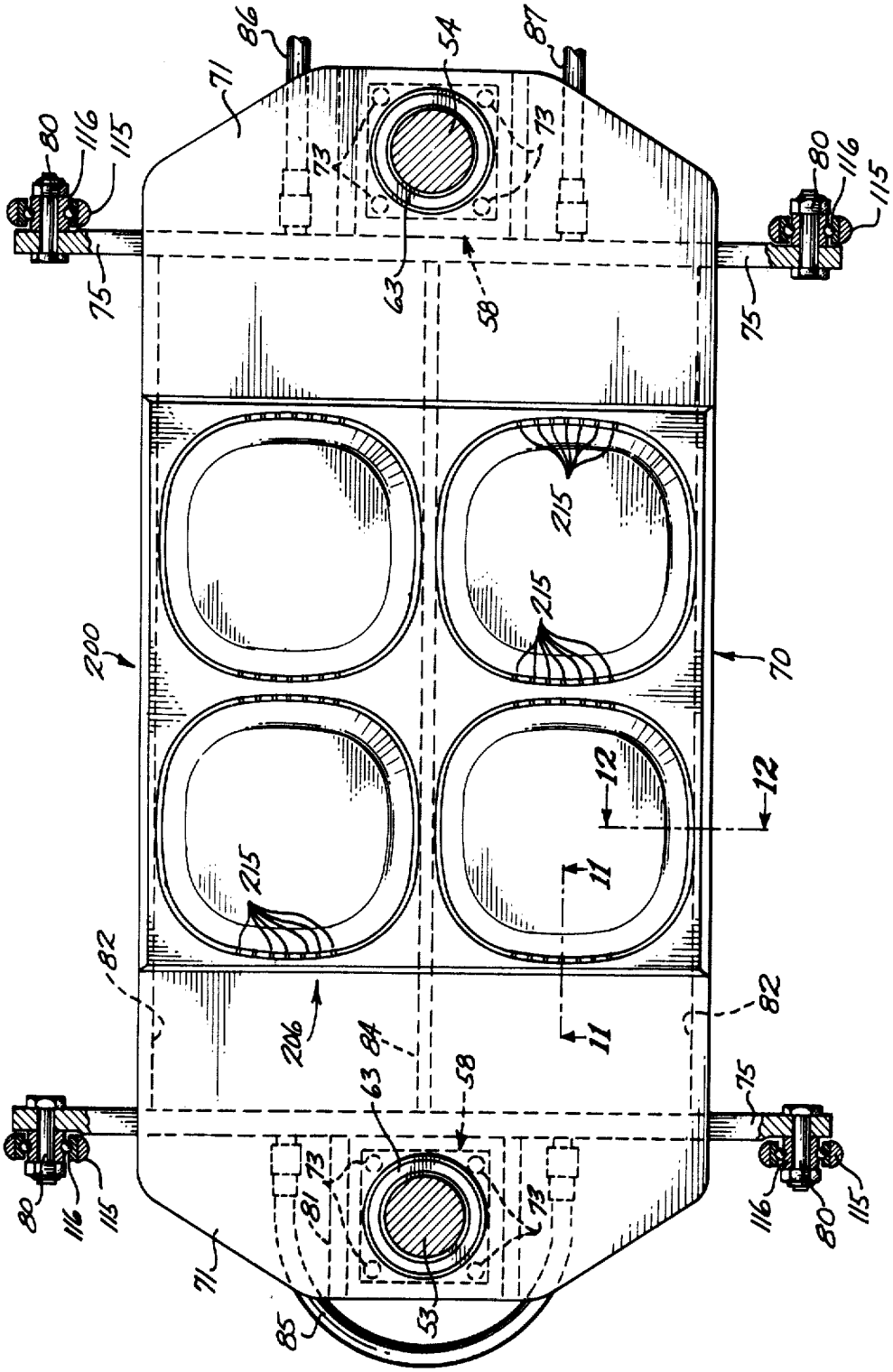


Fig. 7

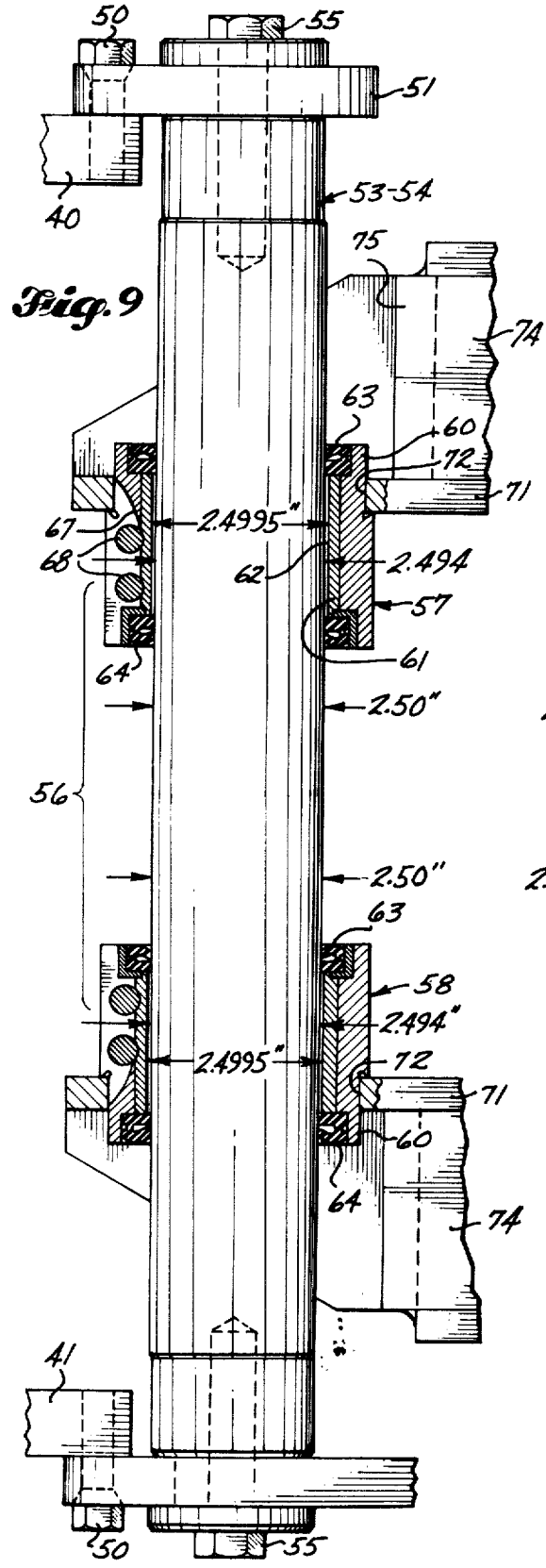

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2.4995"
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Fig. 9

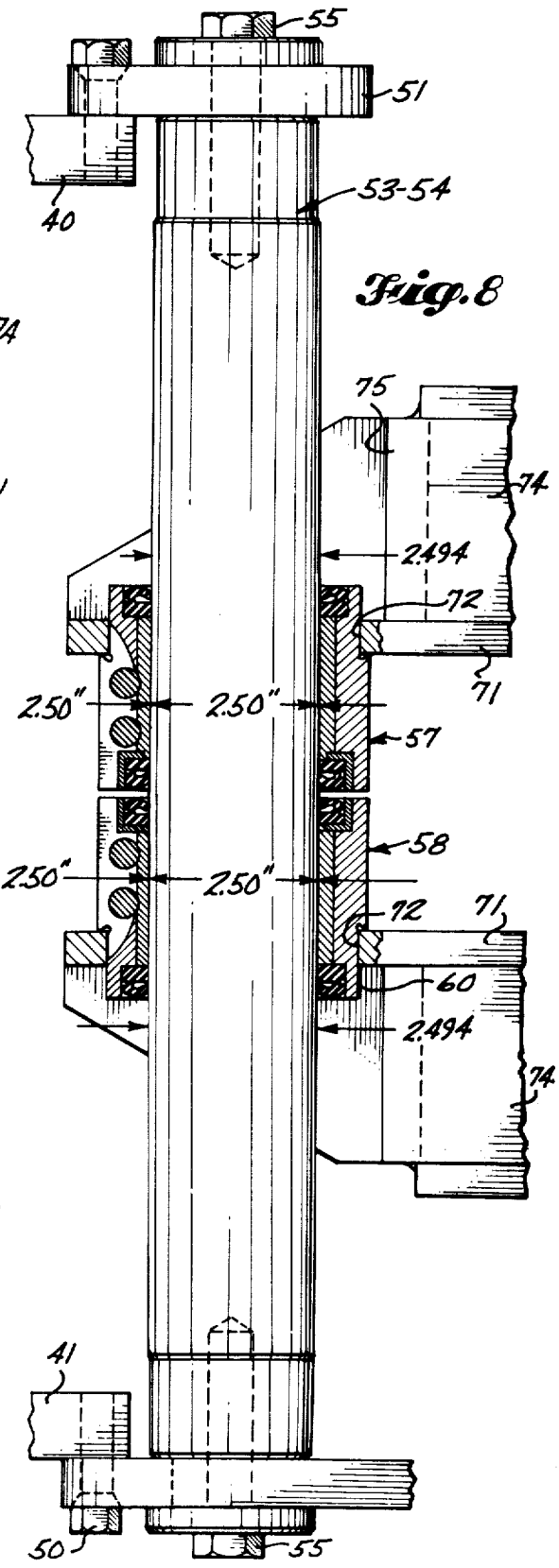

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2.494
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Fig. 8

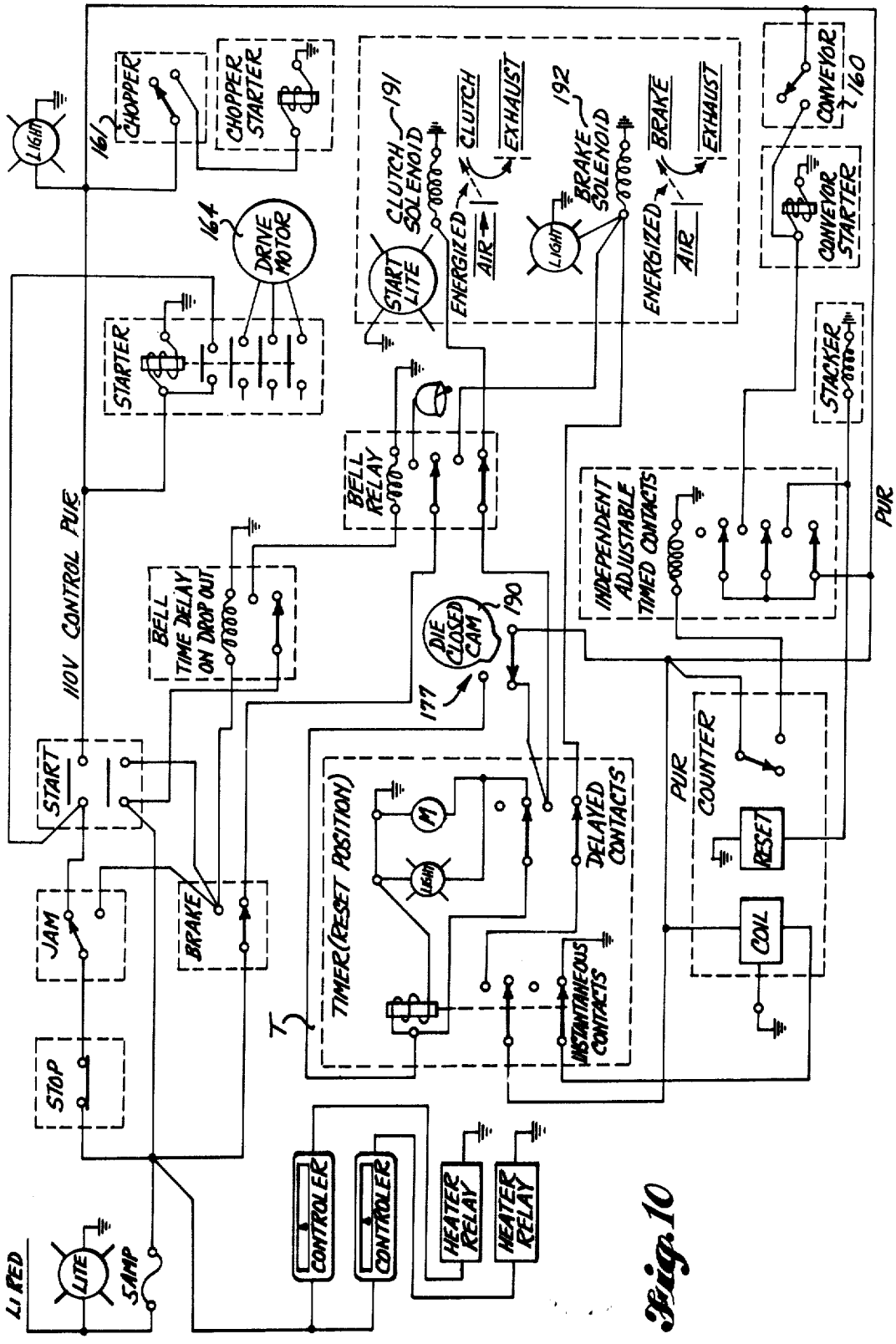

LIGHT
CHOPPER
CHOPPER STARTER
DRIVE MOTOR
STARTER
CLUTCH SOLENOID
START LITE
ENERGIZED
AIR
CLUTCH
EXHAUST
BRAKE SOLENOID
LIGHT
BRAKE
EXHAUST
CONVEYOR
CONVEYOR STARTER
STACKER
BELL RELAY
BELL TIME DELAY ON DROP OUT
110V CONTROL PUR
INDEPENDENT ADJUSTABLE TIMED CONTACTS
DIE CLOSED CAM
START
JAM
BRAKE
STOP
TIMER (RESET POSITION)
DELAYED CONTACTS
INSTANTANEOUS CONTACTS
PUR COUNTER
RESET
COIL
CONTROLER
CONTROLER
HEATER RELAY
HEATER RELAY
LITE
SAMP
LI RED
PUR
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Fig. 10

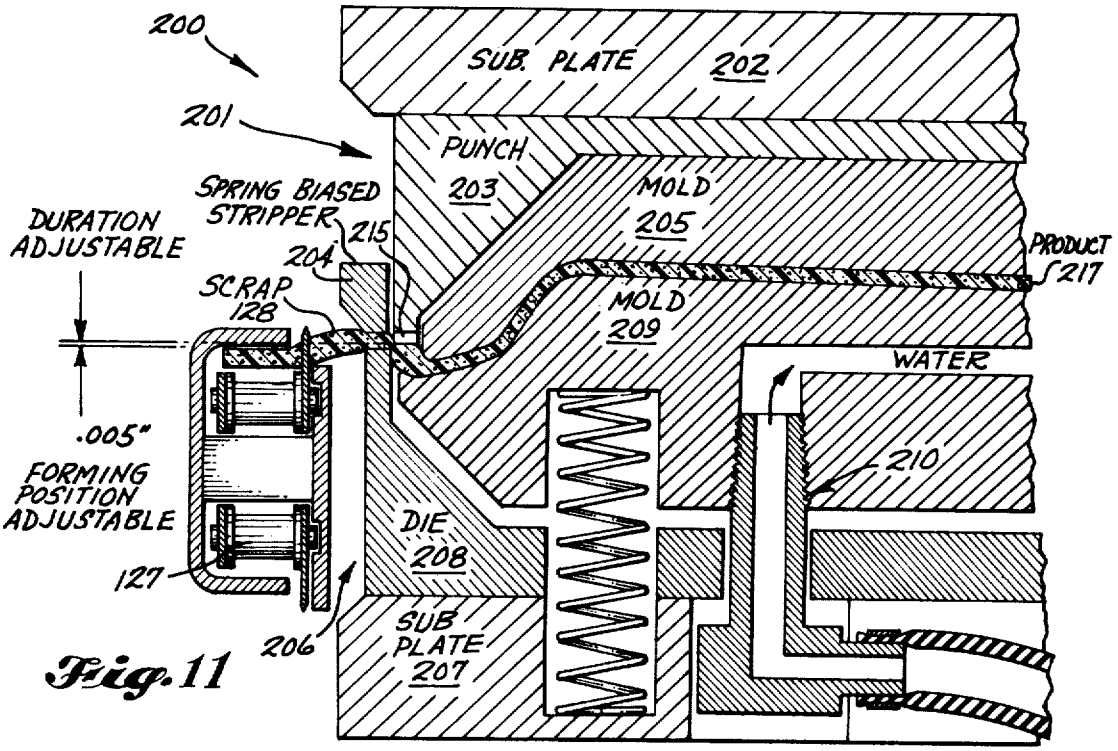

200
SUB. PLATE 202
201
PUNCH 203
SPRING BIASED STRIPPER 215
MOLD 205
DURATION ADJUSTABLE
204
PRODUCT 217
SCRAP 128
MOLD 209
WATER
.005"
FORMING POSITION ADJUSTABLE
210
DIE 208
127
206
SUB PLATE 207

Fig. 11

Fig. 12

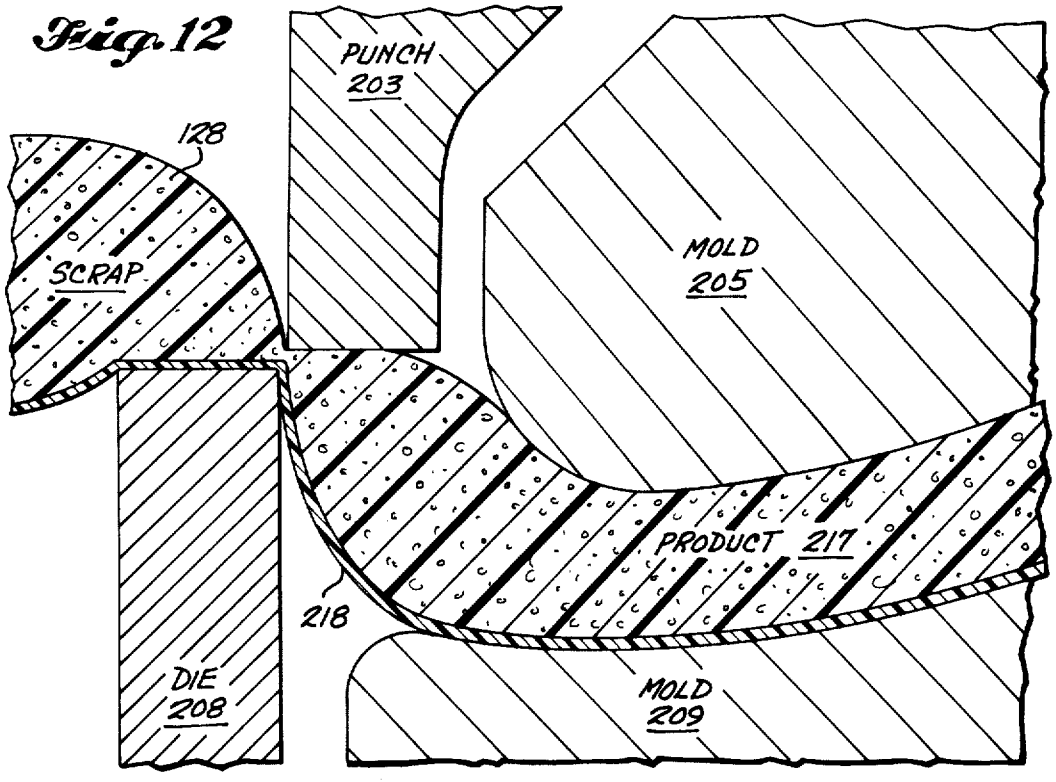

PUNCH 203
128
SCRAP
MOLD 205
PRODUCT 217
218
DIE 208
MOLD 209

Fig. 13

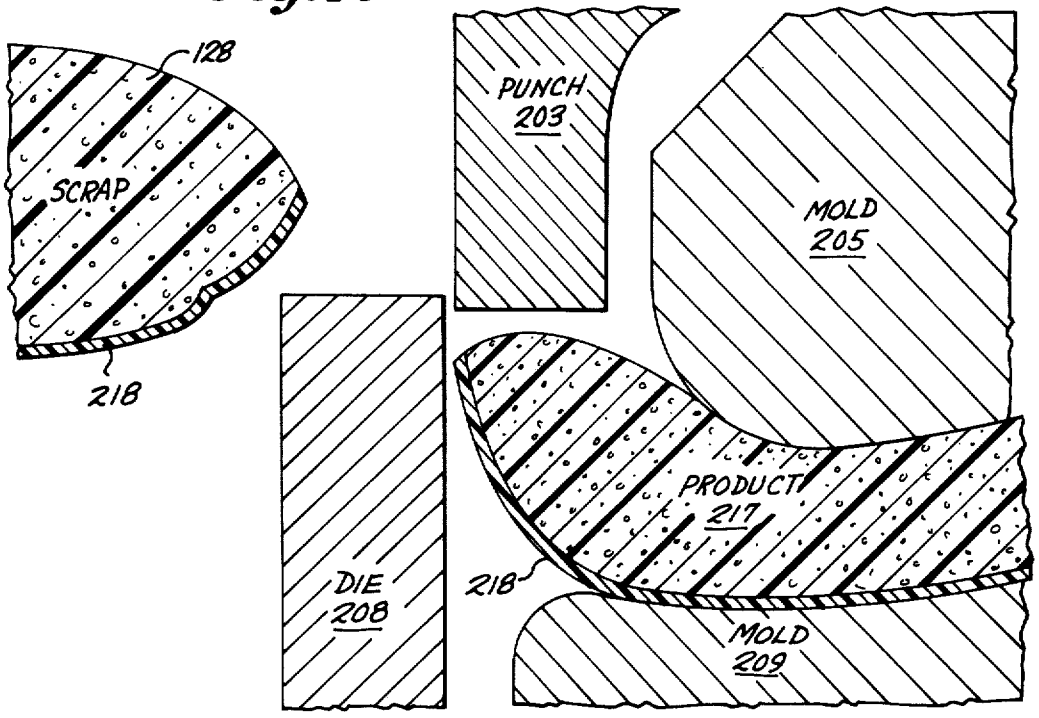


Fig. 14

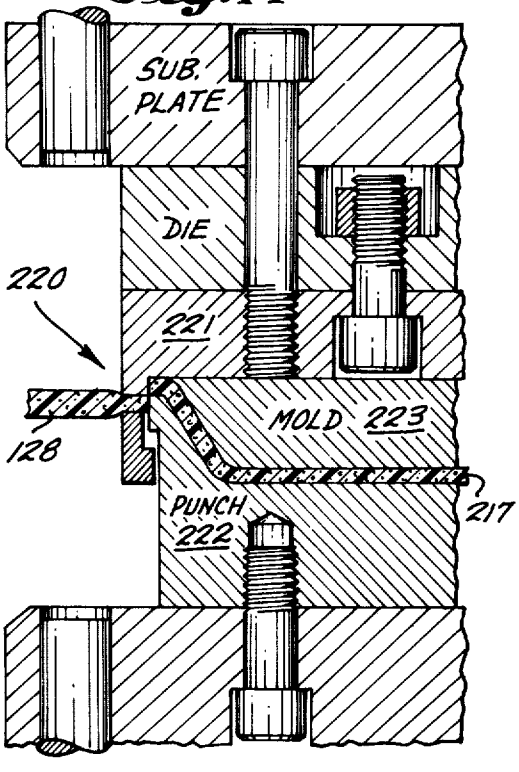


Fig. 15

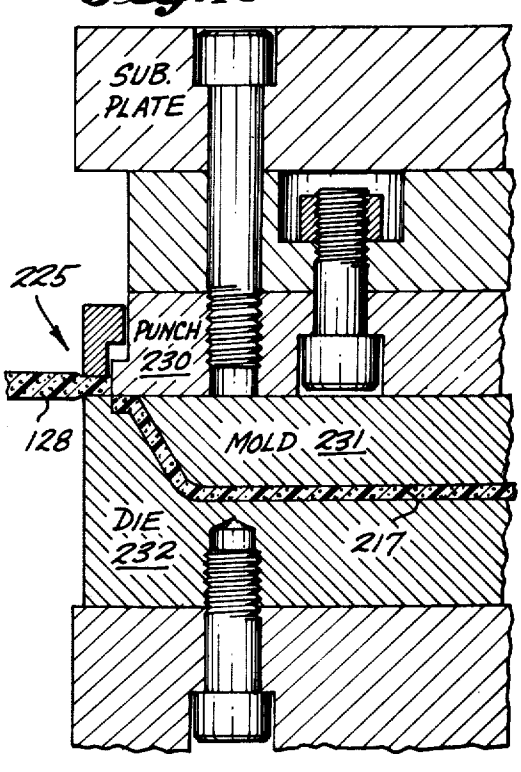
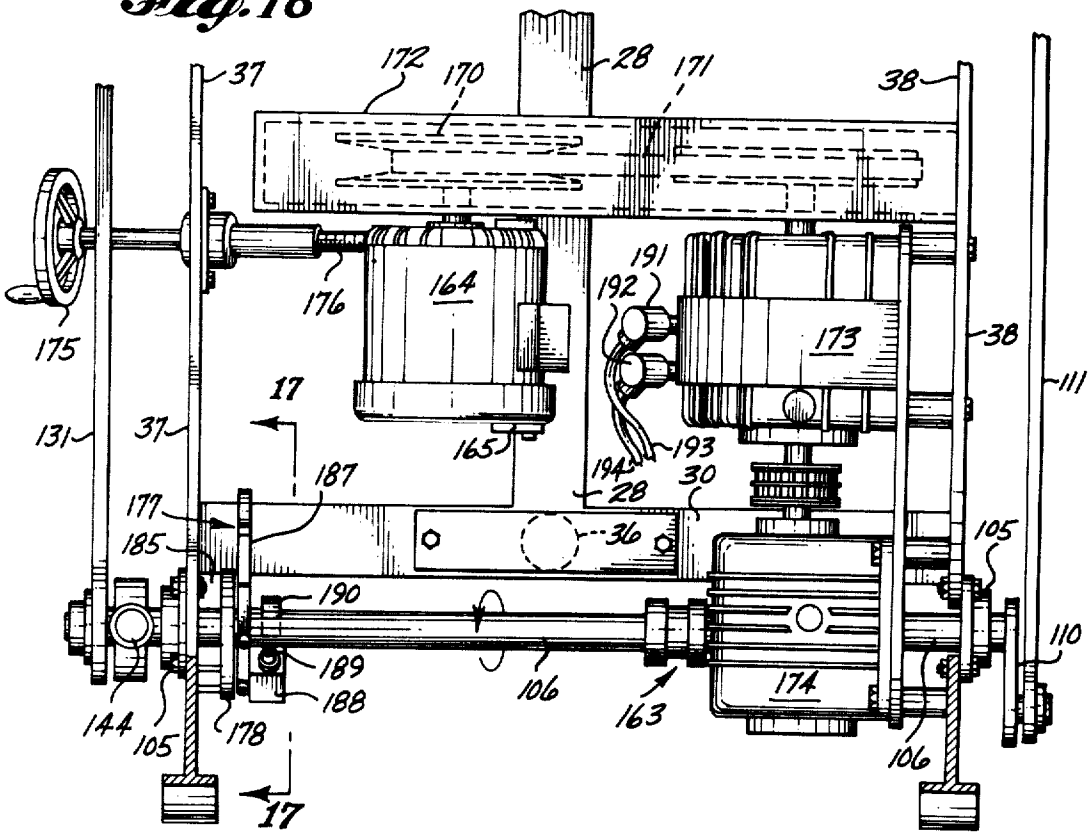


Fig. 16



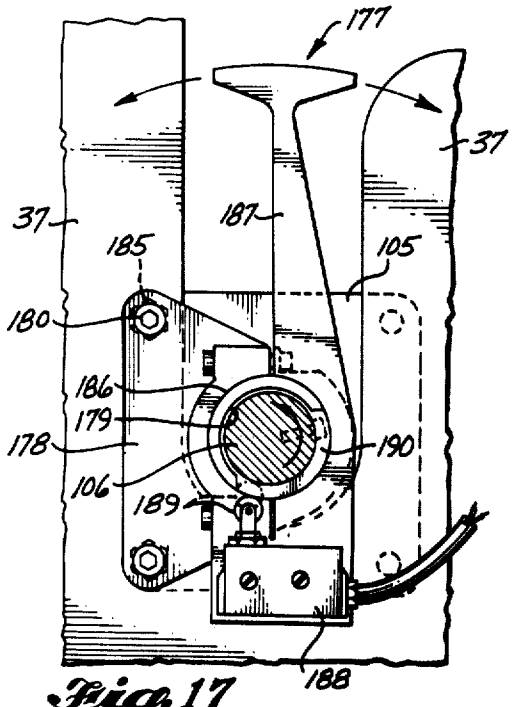
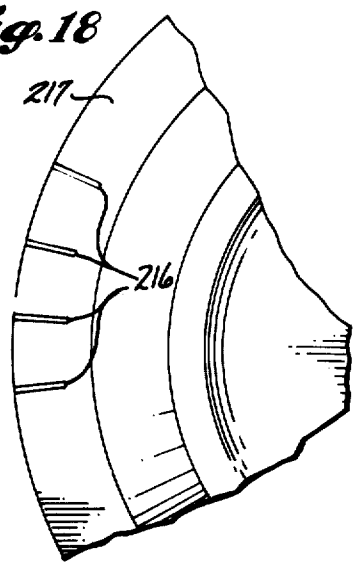


Fig. 17

Fig. 18



AUTOMATIC PRESS

This is a division of application Ser. No. 274,843, filed July 25, 1972, now U.S. pat. No. 3,830,611.

SUMMARY OF THE INVENTION

In developing the present invention, one of the outstanding objects kept in view was to provide an automatic press adapted for matched mold thermoforming which is simple, quick, smooth, dependable, quiet, versatile and easy to operate.

Another object was to produce such an automatic press which can efficiently produce a variety of products at a relatively low cost.

Another object was to produce such an automatic press by which thermoplastic products of a higher quality than hitherto available could be produced in large volume at low cost.

Another object of the invention is to provide an apparatus for producing in large volume thermo-plastic products at a low cost in which the periphery of the individual product has a smooth pleasingly rounded contour.

Still another object of the invention is to provide such an apparatus by which such a product might be produced in which the upper surface of the product is coated with a very thin lamination of solid styrene which extends around the rounded edge of the product to the extreme periphery thereof and is cleanly trimmed to provide a continuously smooth edge to the product.

A yet further object of the invention is to provide such an automatic press in which the length of the time dwell in each cyclic operation and the distance short of maximum proximity between the platens at the moment each operation of the cycle is halted are manually variable while the press is running, whereby product quality control may be exercised in accordance with observations made of the character of the product coming from the press and without stopping the operation of the press.

Still another object of the invention is to provide an automatic press in which the form trim step may be accomplished for each product in a single cycle of operation and in which transport tabs are simultaneously provided connecting the product with the web whereby the punching of the product from the web and the stacking of the same is reserved for a subsequent cycle thereby simplifying the production of the product and greatly decreasing the force required and tooling needed for the punching step and permitting all three steps to be performed in a single press.

Another very important object of the present invention is to provide an automatic press for matched mold thermo-forming which is capable of operation at relatively slow speeds and at relatively high speeds and at any in-between speed and which provides vertically juxtaposed flat platens which are guided vertically relative to each other particularly as they approach the point of their maximum proximity and which is the most critical point in each operational cycle, with a very high degree of precision and at the same time maintaining said platens in practically perfect horizontal parallelism with each other and spaced apart at said point of maximum proximity, a precisely predetermined distance under which conditions the tooling attached to said platens is designed to function with almost absolute precision in the formation of the product.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagrammatic side elevational view of a preferred embodiment of the automatic press of the invention taken from one side thereof on which is mounted the control panel at the top of the machine and the automatic web feeding mechanism at the bottom of the machine. This view also shows diagrammatically the webb heating elements and the web advancing chains and the atuomatic product punching device, and the automatic product stack receiving conveyor which functions only in response to stacks of apredetermined size being deposited thereon by the punch mechanism, and the scrap chopper which disposes of the scrap left in the web as it leaves the press.

FIG. **2** is a fragmentary enlarged elevational view of the automatic press of the invention, portions of which are broken away to better illustrate certain parts otherwise hidden, and illustrating in broken lines the power plant of the press.

FIG. **3** is a view with the same scale as FIG. **2** taken from the opposite side of the press and illustrating the linkage employed in connecting the power plant to the vertically reciprocating platens on which the tooling is carried. In each of FIGS. **1, 2** and **3**, the press of the invention is illustrated with the said platens disposed at the point of their maximum proximity.

FIG. **4** is a view similar to FIG. **3** and with the adjacent side frame partly broken away to reveal otherwise hidden elements of the operating mechanism of the machine with all the various operating elements shown as these are positioned with the platens of the machine disposed in horizontal parallelism at the point of their maximum separation.

FIG. **5** is an enlarged fragmentary transverse sectional view taken on the line **5—5** of FIG. **4** and showing the upper and lower platens of the press of the invention equipped with male and female tooling, the latter being shown diagrammatically by broken lines in outline only and with said platens as they are positioned when approaching each other during a production cycle to bring said tooling simultaneously into contact with a heated thermo-plastic web shown in this view as suspended between said upper and lower tooling.

FIG. **6** is a view similar to FIG. **5** and illustrates said upper and lower platens and the tooling mounted thereon at the conclusion of the trim step at the beginning of a cycle of production in which said platens are located at the point of their maximum proximity.

FIG. **7** is a fragmentary horizontal sectional view taken on the line **7—7** of FIG. **5** and illustrating the four cavity character of the tooling illustrated diagrammatically in FIGS. **5** and **6.**

FIG. **8** is an enlarged diagrammatic vertical sectional view taken on the line **6—6** of FIG. **2** and particularly illustrating the squeeze fit of the vertical guide bearings provided on the superimposed platens of the press when said platnes are located at the point of maximum proximity between said platens.

FIG. **9** is a view similar to FIG. **8** and may be said to be taken on the line **5—5** of FIG. **4** and illustrates the relatively sloppy fit of said slide bearings on the vertical guide posts provided therefor when the platens are at their point of maximum separation as shown in FIG. **4.**

FIG. 10 is a schematic wiring diagram of the electrical elements of the press of the invention.

FIG. 11 is a fragmentary diagrammatic enlarged sectional view taken on the line 11—11 of FIG. 7 and illustrating the details of the tooling shown diagrammatically in FIGS. 5, 6 and 7 with the platens carrying such tooling halted at the end of a given production cycle with said platens short of arrival at the point of their maximum proximity, in other words, with said platens spaced apart a distance in excess by 0.005 of an inch above the spacing between said platens which exists at their point of maximum proximity and which will occur at the beginning of the next succeeding production cycle in the accomplishing of the trimming step which will separate the entire periphery of the product from the web with the exception of the relatively fragile transfer tabs, means for forming which are illustrated in FIG. 11.

FIG. 12 is a greatly enlarged fragmentary operational cross sectional view taken on the line 12—12 of FIG. 7 and a portion of the tooling illustrated in the latter view which is not provided with means for forming transport tabs as is the case in the portion of the tooling illustrated in FIG. 11. FIG. 12 however is taken at the same instant in an operational production cycle as FIG. 11 is taken, to wit: as the tooling supporting platens are located approximately 0.005 of an inch short of the point of their maximum proximity, this halting of the platens in the press of the invention continuing throughout a time dwell period (and which is adjustable in length) for the purpose of permitting cooling of the thermo-plastic material of the web being fed between the platens and being formed by the tooling in the production of a product.

FIG. 13 is a view similar to FIG. 12 and is taken at the instant in the initial portion of the next following cycle that the trim step is accomplished by the overlapping of the die and punch mounted respectively on the upper and lower platens of the press when the latter reach the point of their maximum proximity. As shown in this view, the scrap portion of the web snaps away from the product portion to effect this trimming operation which separates the product from the web entirely excepting for those portions of the periphery of the product which comprise the transporting tabs aforementioned.

FIG. 14 is a fragmentary diagrammatic vertical sectional view of a modified form of tooling which is adapted for use in the press of the invention for the manufacture of a meat tray, the tooling being here shown at the point of maximum proximity between the upper and lower platens of the press which accomplishes the trim step separating the product completely from the web excepting for those restricted areas in which transporting tabs are formed.

FIG. 15 is a view similar to FIG. 14, illustrating a second modified form of tooling adapted for use in the press of the invention in the formation of said meat tray. This FIGURE also shows said modified form of tooling just as it reaches the point of their maximum proximity where the trim step is accomplished and the platens and the tooling attached thereto start to withdraw from that point in pursuance of the next succeeding production cycle.

FIG. 16 is a fragmentary horizontal sectional view taken on the line 16—16 of FIG. 2 and illustrating the power plant of the press of the invention. This view also illustrates the manual control for actuating the chain speed transmission of said power plant as well as the manually operable adjustment means for modifying the point in the rotation of the drive crank shaft at which a production cycle stops and starts.

FIG. 17 is an enlarged view taken on the line 17—17 of FIG. 16 and illustrates the switch and adjustment means therefor which is operable during the running of the press to modify the point in each rotation of the drive crank shaft at which each of the successive production cycles starts and stops.

FIG. 18 is a fragmentary bottom plan of a product showing the transporting tabs formed thereon.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention includes an apparatus 25 which is required for practicing said method commercially. A detailed description of the apparatus will therefore precede the description of the method.

The apparatus 25 includes an automatic press 26 having an H-shaped base 27 formed by welding a longitudinal square tubular member 28 to similar cross members 29 and 30, the cross member 29 having a pair of widely spaced cylindrical foot plates 35 and the cross member 30 having a single centrally located foot plate 36, thus furnishing a tripod support for the press 26.

Rigidly fixed to opposite ends of cross members 29 and 30 of base 27 are vertical, parallel side frames 37 and 38, these frames being substantially reverse duplicates of each other and being shaped as shown in FIGS. 1, 2, 3 and 4. The frames 37 and 38 have corresponding large openings 30 through which access may be had to the interior of the press. Bars 40 and 41 are secured at their opposite ends to inner faces of marginal portions of the frames 37 and 38, each of these bars being furnished with a series of horizontal holes 42 for securing other elements of the press or accessories to the side frames 37 and 38. Secured at their upper and lower ends to side frames 37 and 38 at points above and below the openings 39 so as to be centered upon the same transverse vertical plane A—A is a pair of supplemental frame reinforcing bars 43. Bars 43 are connected respectively to the horizontal mounting bars 40 and 41 by discs 44 and 45. Secured to upper and lower faces of horizontal mounting bars 40 and 41 by screws 50 are plates 51 and 52, between which a pair of massive cylindrical guide posts 53 and 54 are mounted by axial screws 55. The posts 53 and 54 are thus held in vertical parallel relation with their axes disposed in the aforesaid vertical transverse plane A—A. These posts are preferably made of cylindrical tool steel shafting with a net diameter of 2 ½ inches in a central portion 56 thereof (approximately six inches long), the diameter of said posts decreasing upwardly and downwardly from said area 56 to a diameter of 2.494 inches, for reasons to be made clear hereinafter. (See FIGS. 8 and 9).

Vertically slideable on each of the posts 53 and 54 is a pair of upper and lower square slide blocks 57 and 58 all of which are identical in construction and each of which includes a square body 59 having a turned down neck 60. Each block is provided with a bore 61 for receiving a bronze sleeve 62, opposite ends of bore 61 being counter bored to provide recesses for mounting resilient oil retaining seals 63 and 64 in opposite ends of the block. One side of each body 59 is partially severed by a deep kerf 67 and is provided with a pair of

screws 68 by which the body 59 may be contracted to compress sleeve 66 so as to actually reduce the internal diameter of the latter to closely control the fit of said sleeve when it is slid over one of the guide posts 53 or 54 onto the central area 56 thereof. In practice, the screws 68 are tightened so as to produce a normal inside diameter in the bronze sleeve 66 of 2.4995 inches, which is to say, one-half one-thousandth of an inch smaller in diameter than the external diameter of the central six inch section 56 of the guide posts 53 and 54. This means that a considerable amount of force is required to press each of the slide blocks 57 and 58 onto the central areas 56 of maximum diameter of the guide posts 53 and 54 as shown in FIG. 8 of the drawings.

The press 26 also includes a pair of platens; 69 and 70, each of which includes a flat plate 71 having holes 72 in its opposite ends which are formed of the proper size and center spacing to snugly receive the necks 60 of slide blocks 57 and 58, these side blocks then being held in assembled relation with the plates 71 of the respective latens 69 and 70 by corner screws 73. The platens 69 and 70 include coolant boxes 74 embodied with the respective plates 71 of said platens and extending respectively upwardly and downwardly therefrom, each of said boxes including a pair of end plates 75 which are located just inwardly from and close to holes 72 in plates 71 and are secured to said plates so as to extend short distances forward and rearward from the corners of plates 71 as shown in FIG. 7, where end portions of end plates 75 are apertured to receive bolts 80. End plates 75 are reinforced outwardly by triangular gusset plates 81 and are connected lengthwise along front and rear edges of plates 71 by coolant box walls 82. Each coolant box 74 is completed by a cover plate 83 which is secured at its edges to end plates 75 and coolant box walls 82. Each coolant box 74 has a central medial dividing wall 84. At one end of each coolant box 74 the spaces on opposite sides of the medial wall 84 thereof are connected by a hose 85 while at the opposite end of said box the spaces on opposite sides of said medial wall are connected to separate hoses 86 and 87, opposite ends of which connect to a water circulating manifold box 88 which is centrally divided into two chambers which individually connect with water circulating hoses 89 and 90 which lead to and from a cooling water source, not shown.

Mounted in upper and lower portions of side frames 37 and 38 are heavy ball bearings 95 and 96, the axes of which are horizontal, parallel and lie in the vertical planes of the bolts 80 shown in FIG. 7. Journalled in these bearings are upper and lower pairs of rocker shafts 97 and 98. the major portions of these shafts being hexagonal in cross section and being turned down at their end portions to cylindrical cross section where they extend through said bearings. Certain end portions of said rocker shafts extend outwardly beyond side frame 38 where upper rocker shafts 97 receive short arms 99 and lower rocker shafts 98 receive bell cranks 100, each of which includes a short arm 101 and a long arm 102. The short arms 99 and 101 connect pivotally at their outer ends to the opposite ends of two parallel links 103. The outer ends of bell cranks long arms 102 are pivotally connected to opposite ends of a link 104.

Journalling in heavy ball bearings 105 mounted at one end of the press 26 on side frames 37 and 38 is a drive crank shaft 106 carrying a crank arm 110 and the outer end of this crank arm and the outer end of the adjacent bell crank long arm 102 are pivotally connected to opposite ends of a pitman 111, so that for each rotation of the drive crank shaft 106, each of the rocker shafts 97 and 98 is rocked through an angle of 90°.

Mounted on the hexagonal middle portions of rocker shafts 97 and 98 are short arms 112 and 113 which are slidable lengthwise on said rocker shafts and are in the form of clamps which permits them to be set in any adjusted position lengthwise of said shafts. Pivotally connected at their ends to bolts 80 of upper platen 69 and to the ends of upper rocker arms 112 are longitudinally adjustable links 114. In a like manner, opposite ends of four links 115 are pivotally connected to bolts 80 of lower platen 70 and to the ends of lower rocker arms 113. The rocker arms 112 and 113 are so set on rocker shafts 97 and 98 that at one extreme in each cyclic revolution of drive crank shaft 106, as shown in FIG. 3, rocker arms 112 are extending directly downwardly from upper rocker shafts 97, and lower rocker arms 113 are extending directly upwardly from lower rocker shafts 98. At the opposite extreme in each cyclic revolution of drive crank shaft 106, shown in FIG. 4, short arms 112 and 113 extend exactly horizontally in the same direction from the respective rocker shafts 97 and 98 on which said short arms are mounted. As before noted, the position of the operating parts just discussed and shown in FIG. 3 results in upper and lower platens 69 and 70 being located at the point of their maximum proximity whereas the opposite point in each cyclic revolution of drive crank shaft 106, shown in FIG. 4, results in said platens being located at the point of their maximum separation.

It is to be noted that the links 114 and 115 above described are uniformly comprised of self-aligning bearings 116 at each of the opposite ends thereof, and a turnbuckle 117 connecting said bearings. Each of these turnbuckles preferably employs at each of its ends, threads pitched in the same direction but slightly differing as to the number of threads per inch so as to render each of these trunbuckles capable of making a very fine adjustment in the length of the link in which it is embodied. This is a vitally important feature of the present invention inasmuch as only with such a precise adjustment available in determining the exact length of these links would it be possible to set up the press 26 so as to obtain the high degree of precision and quality in the product of which it is capable.

Referring again to FIG. 1, the press 26 is here shown as equipped with a support 125 for a roll 126 of sheet thermo-plastic material and a pair of feeder chains 127 for withdrawing a web 128 from said roll and feeding it through a heater unit 129 along a horizontal path extending practically midway between platens 69 and 70 and terminating at the opposite end of the press 26.

The web feeder chains 127 are driven by an adjustable radius crank arm 130 on the opposite end of drive crank shaft 106 from the crank arm 110. The tip of crank arm 130 is pivotally connected to one end of a pitman 131, the opposite end of which pivotally connects to a large diameter sprocket 132 which is mounted on an idle shaft 133 mounted in suitable bearings on side frames 37 and 38. Trained around the sprocket 132, an idler sprocket 134 and a sprocket toothed unidirectional clutch 135 is an endless chain 140. The clutch 135 turns freely in one direction on a shaft 141 but when turned in the opposite direction by

chain **140**, it rotates the shaft **141** to drive s shaft **142** through a chain **143** so as to drive web feeder chains **127** to carry web **128** an adjustable distance towards and through the press **26**. This distance is adjustably determined by manual rotation of a screw **144** on the adjustable radius crank arm **130**. This can be done while the press is running at all normal production speeds.

The press **26** is also equipped with a mechanism **145** for punching the product from said web after it has been formed and trimmed between platens **69** and **70** and during a cycle subsequent to that in which the product was molded. This mechanism includes a bell crank **146** rockably mounted on brackets **147** mounted on the side frames **37** and **38** and including an upwardly extending arm **148** which is connected pivotally and adjustably to a link **149** which connects to a short arm **150** which is clamped onto an adjacent one of the rocker shafts **97** so that with each production cycle of the press **26** the bell crank **146** is rocked so as to impart a vertical reciprocation from the bell crank **146** to a telescopic member **155** carrying a tool **156** designed for lightly engaging and punching from the web **128** one or more products previously formed and trimmed in a preceding operation cycle of the press. Individual products **157** thus punched from siad web gravitate downwardly as shown in FIG. **1** to form stacks **158** until such a stack contains a predetermined number of individual products whereupon a relay provided in a control panel **159** mounted on the upper end of side frame **37** energizes a conveyor **160** causing this to remove the stack **158** just formed beneath the product punch **145** so as to leave room on the conveyor to start another stack.

Just beyond the point at which the feeder chains **127** terminate, a scrap chopper **161** is mounted which automatically responds to the delivery thereto of scrap remaining in the web **128** as the latter is discharged from the press **26** to reduce this to small chips which can be readily carried away by an airblower **162** to a place of storage.

The drive crank shaft **106** is driven by a power plant **163** which is clearly illustrated in FIGS. **1-4** and **16**. Included in this are an electric motor **164** which is pivotally mounted at **165** so that a drive pulley **170** provided thereon extends into and is connected by a belt **171** of a variable speed transmission **172** to the input end of an electro-air controlled "posidyne" clutch/brake drive unit **173**. Unit **173** is the product of Force Control Industries, 3660 Dixie Highway, Hamilton, Ohio 45014. The output shaft of this unit connects in turn to a reduction gear unit **174** which is mounted in a gap in drive crank shaft **106** and thus forms a connecting link in said shaft and directly drives the latter at a reduced speed of **1** to **15**. The variable speed transmission **172** preferably has the capacity to vary the speed ratio between the motor **164** and the clutch/brake unit **173** from 1-1 to 3-1. Modification of the latter speed ratio is effected by a manual crank wheel **175** mounted on the outer end of a threaded control shaft **176** which effects said control by rocking the motor **164** about its pivot mount **165**.

The drive crank shaft **106** is equipped with a manual cycle control mechanism **177** which includes a triangular plate **178** having a bore **179** which receives drive crank shaft **106**, the plate **178** being mounted by screws **180** and spacer tubes **185** on the inner face of side frame **37**. Formed on plate **178** and extending inwardly therefrom and bordering the bore **179** is an annularly recessed sleeve **186** on which a flat control handle **187** is clamped so as to rotate on sleeve **186**, a lip on said control arm fitting the recess in sleeve **186** to retain said arm in assembled relationship with plate **178**.

Mounted on a lower portion of control arm **187** is a switch **188** having a spring biased roller **189** which is spring propelled into a position close to shaft **106** except when said roller is depressed by a cam **190** provided on said shaft for the express purpose of depressing said roller and actuating switch **188** immediately upon the cam passing out of contact with said roller.

Clutch/brake **173** is preferably operated through electric solonoid valves **191** and **192**, the first being for the brake and the other for the clutch. The switch **188** is connected electrically to the solonoids **191** and **192** whereby, as soon as the roller **189** rides off the cam **190** as the latter moves past said roller, the unit **173** is immediately actuated to disengage the clutch and set the brake thereof. Also connected electrically in the circuits of the solonoid valves **191** and **192** is a "series GP" plug-in automatic reset delay/interval (timer) model number GP-6S which is manufactured by Singer Industrial Timer Division, U.S. Highway 287, Parsippany, N.J. 070754. This timer is located in control panel **159** and is designated therein by the letter T. The Singer timer is energized by the actuation of the switch **188** (which stops rotation of the drive crank shaft **106**) to start a timer motor embodied therein to advance a timer hand to alignment with the position of a manual setting hand from which it then returns automatically in short jumps at one-tenth second intervals, step-by-step, to the zero position, thereby consuming the time period of the delay for which the timer is manually set. At the conclusion of this time period, the timer closes the clutch/brake air valve circuit which starts another cyclic revolution of the drive crank shaft **106**.

Referring now to FIG. **3**, hoses **193** and **194** are there shown as leading upwardly from solonoid valves **191** and **192** and being connected through pressure regulators **195** and **196** to a hose **197** leading to an air compressor (not shown). By manipulation of the pressure regulators **195** and **196**, the pressure delivered through hoses **193** and **194** to the solonoid valves **191** and **192** can be varied thereby softening or hardening the force with which the clutch and brake of the unit **173** are shifted from open to set positions and visa versa.

The distance between opposed flat faces of upper and lower platens **69** and **70** when these are at the point of maximum proximity is preferably 5.125 inches. Matched tooling including various combinations of punches and dies, male and female molds and spring biased strippers and jig plates are assembled on and united with the flat plates **71** of the upper and lower platens, this tooling embracing upper and lower tooling elements which are spaced apart during most of each production cycle and then cooperate with each other to mold a product, or a group of products, from web **128** as the platens **69** and **70** approach the point of their maximum proximity. Of the wide variety of various types of tooling suitable for use in the press **26** of the invention, the tooling **200** shown in FIG. **11** has been associated with some of the finest results obtained in high quality production realized in the operation of the press **26**. This tooling includes an upper element **201** which is mounted on upper platen **69** and this ele-

ment includes a sub plate **202**, a punch **203**, a spring biased stripper **204**, and a female mold **205**, said sub plate, punch and female mold being rigidly secured together.

Tooling **200** also includes a lower element **206** which is mounted on lower platen **70** and includes a sub plate **207** and a die **208**, which are united with each other and with the lower platen, and a male mold **209** which is normally spring biased upwardly above the upper edge of the die **208** so as to come into molding relation with the female mold **205** and mold a product substantially in its final form between said two molds before die **208** advances upwardly relative to male mold **209** as shown in FIG. **11**. AS shown in this view, means **210** are provided for circulating cold water through the internal passages formed in male mold **209** so as to enhance the capacity of this mold to cool the peripheral portion of a product being formed between the female mold **205** and the male mold **209**. The section illustrated in FIG. **11** was taken at a point where the lower end of punch **203** which is its cutting edge, has formed therein a series of narrow grooves **215** which permits at each of the places occupied by these grooves the escape of a small amount of material from the web upwardly in these grooves, at the time the trim step is accomplished, to form tabs **216**. These tabs continue to connect the web with a product **217** and serve to transport the product **217** with the web from the product molding and trimming station located between the platens **69** and **70**, to the product punching and stacking station which is located at the punch **145**.

FIG. **11** illustrates the relationship of the upper element **201** and the lower element **206** of the tooling **200** as these two tooling elements are precisely related at the instant rotation of drive crank shaft **106** is halted by the opening of the switch **188**. As bbefore pointed out, the normal operation of the press **26** requires an adjustment of the control arm **187** so that when switch **188** closes, the reciprocative relative movement between the platens **69** and **70** instantly stops with said platens short of reaching the point of their maximum proximity. FIG. **11** illustrates the distance short of maximum proximity at which the press is halted with the upper tooling element **201** and the lower tooling element **206** yet to travel 0.005 inches in order to accomplish the trim step which will sever the product **217** from the web **128** at all points about the periphery of the product excepting where the tabs **216** are located.

One of the finest products tried out for production on the invention to date is made of expanded styrene coated on the upper surface with a clear film of pure styrene. The method of the invention exhibits tremendous merit in the production of this commodity and it is for this reason that FIG. **12** is shown to illustrate in enlarged detail what is taking place in the tooling **200** illustrated in FIG. **11** at the same instant as illustrated in the latter view, but with a section taken elsewhere than opposite one of the tab forming grooves **215**. FIG. **12** shows the molding of the rounded peripheral lip of the product with this being covered neatly by the shaping of a coating **218** of a pure styrene with which the web was laminated prior to the web being fed between the tooling elements.

It is to be noted that a substantial portion of the rounded lower and outer edge portions of the upper surface and lower surface of the periphery of product **217** shown in FIG. **12** is not dependent on its being molded but is produced by the material being stretched between tangential points of contact with the upper and lower molds and pinching action of the cutting edges of the die and punch. The coincidental interruption of the operation of the press for a short interval to permit relative cooling of the material as thus shaped has the effect, when the trim step occurs, of preserving the form thus imparted to the edge portion of the product.

At the conclusion of the dwell time period which can vary between one-fifth of a second and 6 seconds, the next cycle commences with the consummation of the interrupted movement of the two platens toward their relative maximum proximity which causes the die **208** and the punch **203** to overlap as shown in FIG. **13**. While the action of the die and punch at the instant of their accomplishing the trim step is hidden from view, ample evidence obtained from studying the product indicates that the trim step does not function as a true shearing action but rather by a cracking of the web along the edge of the die as this starts to overlap the corresponding cutting edge of the punch. The wide separation of the edge of the product from the edge of the scrap shown in FIG. **13**, of course, cannot take place at the points where the scrap and the product are still held integrally joined by tabs **216**. The retention of the smoothly rounded surfaces produced on the peripheral portions of the product **217** at the conclusion of the trim step is clearly shown in FIG. **13**.

In a similar manner plates, saucers and dishes of various kinds made by the press **26** by the method of this invention without the web being coated as shown in FIGS. **12** and **13**, present a remarkably smooth rounded edge throughout the periphery of the product excepting where the tabs **216** appear and which are too small to be objectionable.

FIG. **14** illustrates a modified form of tooling **220**, the upper element of which includes a die **221** and the lower element a punch **222** which itself forms a female mold that cooperates with a male mold **223** embodied with the die **221**.

FIG. **15** illustrates another modified form of tooling **225** in which the upper tooling element carried by the upper platen embraces a punch **230** and has a male mold **231** associated therewith, while the lower tooling element embraces a die **232** which embodies in itself a female mold cavity which cooperates with the mold **231** in the formation of the product.

One of the significant differences between the modified forms of tooling **220** and **225** over the tooling **200** shown in FIG. **11** is that a further compression of the product takes place incidental to the performance of the trim step because of the fact that the latter requires a relative movement between the two tooling elements which form the product in order to bring the cutting edges of the die and punch into shearing relation with the web. The forms of tooling **220** and **225** therefore are suitable in more rapid production where a relatively short cooling period between cycles is both practical and desireable.

I claim:

1. An automatic press for use in forming a product from a continuous web of material, said press comprising:

a pair of parallel, spaced, rigidly-united, vertical side frames;

a plurality of vertical guide posts mounted at their upper and lower ends just inside of and on said side frames;

slide bearings slidable on said posts;

a pair of vertically superimposed horizontal tool mounting platens mounted on said slide bearings;

two pairs of rocker shafts journalling in bearings provided on said side frames, one of said pairs being above the upper platen and having short arms connected by links to said upper platen, the other of said pairs of shafts being below the lower platen and having short arms connected by links to said lower platen, said shafts extending laterally outside of one side frame;

short arms on said extensions of said upper shafts;

bell cranks including short arms and long arms on said extensions of said lower shafts;

links connecting pivotally at their opposite ends to said outside short arms;

a link connecting pivotally at its ends to said bell crank long arms;

a drive shaft journalling transversely on said side frames at one end of said press and having a drive crank on one end thereof extending outside said one side frame;

a pitman pivotally connected at its ends to said drive crank and to one of said bell crank long arms;

power means for rotating said drive shaft automatically through successive single revolution cycles and halting rotation of said shaft between cycles, each such shaft revolution causing performance of one of a series of cyclic reciprocative relative movements between said platens.

2. A press as recited in claim **1** including

means for adjustably varying the point in the rotation of said drive shaft at which said single revolution cycles start and end,

said last recited means being adjustable while the press is running.

3. A press as recited in claim **1** including

means for adjustably varying the time period dwell between successive single revolution cycles of said drive shaft.

4. A press as recited in claim **3** wherein

said last recited means is adjustable while the press is running.

5. An automatic press for use in forming a product from a continuous web of material, said press comprising:

a base structure including a pair of rigidly spaced parallel vertical side frames;

plural spaced vertical guide post means mounted on said side frames;

upper and lower slide bearings slidable on said guide post means;

upper and lower approximately rectangular flat platens mounted at their ends respectively on said upper and lower slide bearings whereby said platens are maintained accurately superimposed in vertically reciprocable relation with each other;

upper and lower horizontal rocker shaft means disposed respectively above and below said upper and lower platens and in vertical alignment with each other and having short arms and adjustably extensible links pivotally connected at their ends to said short arms and to said respective platens; and

precision power means mechanically connecting said upper and lower rocker shaft means to automatically rock the same coordinately through a series of successive reciprocating cycles causing relative reciprocation of said platens in each cycle between positions of maximum proximity and maximum separation, the pivotal axes of said links being vertically on dead center with the axes of said rocker shaft means at the point of maximum proximity of said platens.

6. An automatic press as recited in claim **5** wherein each of said rocker shaft means includes a pair of rocker shafts, said shafts overlying and underlying respective side edge portions of said platens, each shaft having short arms and links said links pivotally connecting with corner portions of said platens.

7. An automatic press as recited in claim **6** wherein said individual rocker shafts are polygonal in cross section and said short arms are shaped to form clamps apertured to slidably fit said shafts and thus are adjustable on said shafts to accommodate platens varying in length.

8. An automatic press as recited in claim **7** wherein said guide post means includes a plurality of approximately cylindrical posts, middle portions of which snugly fit said slide bearings to produce a high degree of precision in the vertical alignment of said platens (and between any tooling mounted thereon) with said platens at the point of their maximum proximity;

end portions of said posts fitting said slide bearings relatively loosely to facilitate lubrication.

9. An automatic press as recited in claim **6** wherein said guide post means comprises a pair of relatively massive approximately cylindrical posts located in a vertical transverse plane equidistant from the vertical axial planes of said rocker shafts.

10. An automatic press as recited in claim **9** wherein middle portions of said guide posts snugly fit said slide bearings to produce a high degree of precision in the vertical alignment of said upper and lower platens (and between any upper and lower tooling mounted thereon) with said platens at the point of their maximum proximity;

end portions of said posts fitting said slide bearings relatively loosely to facilitate lubrication.

11. An automatic press as recited in claim **3** wherein said upper and lower rocker shaft means are provided with link connected short arms and wherein said power means includes

a unidirectional power driven crank shaft having a crank arm; and

a pitman connecting said crank arm to said lower rocker shaft means whereby unidirectional rotation of said crank shaft produces a succession of precisely coordinate rocking cycles in said upper and lower rocker shaft means.

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