Sept. 12, 1967 F. FARKAS Re. 26,265

PLASTIC MOLDING APPARATUS

Original Filed Jan. 25, 1963 8 Sheets-Sheet 1

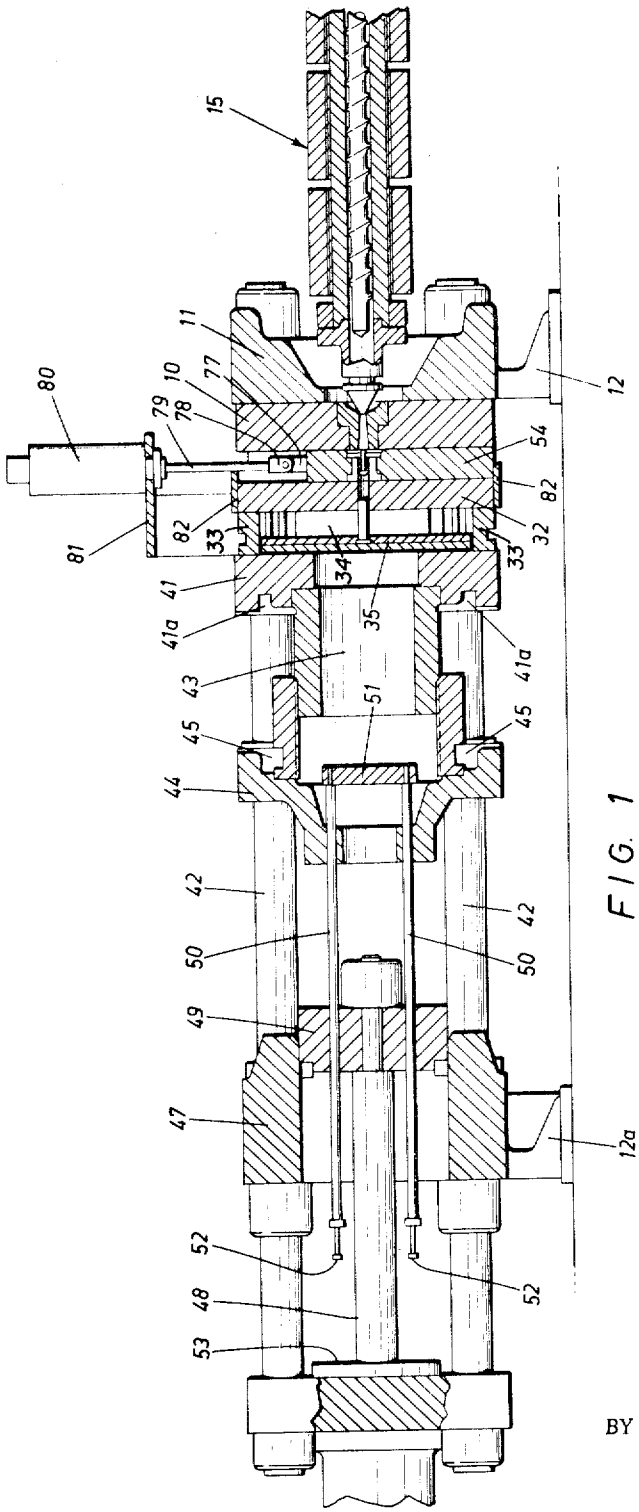


FIG. 1

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PLASTIC MOLDING APPARATUS

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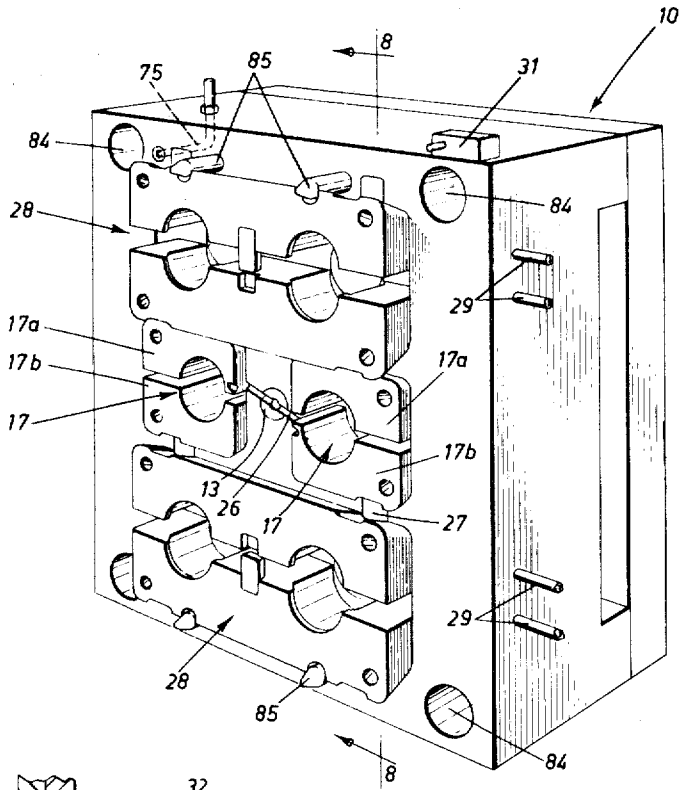


FIG. 2

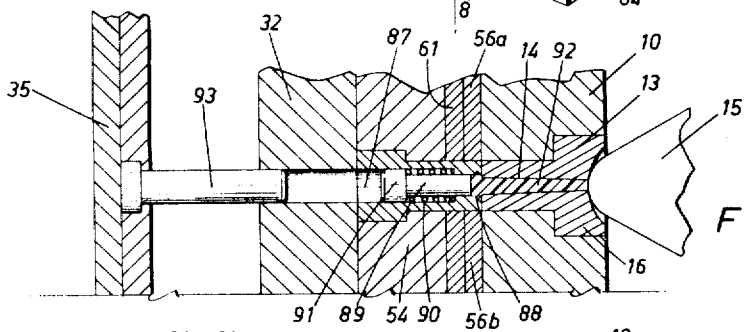


FIG. 3

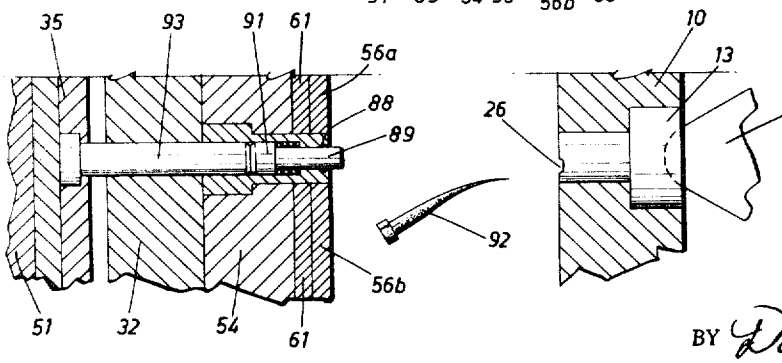


FIG. 4

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PLASTIC MOLDING APPARATUS

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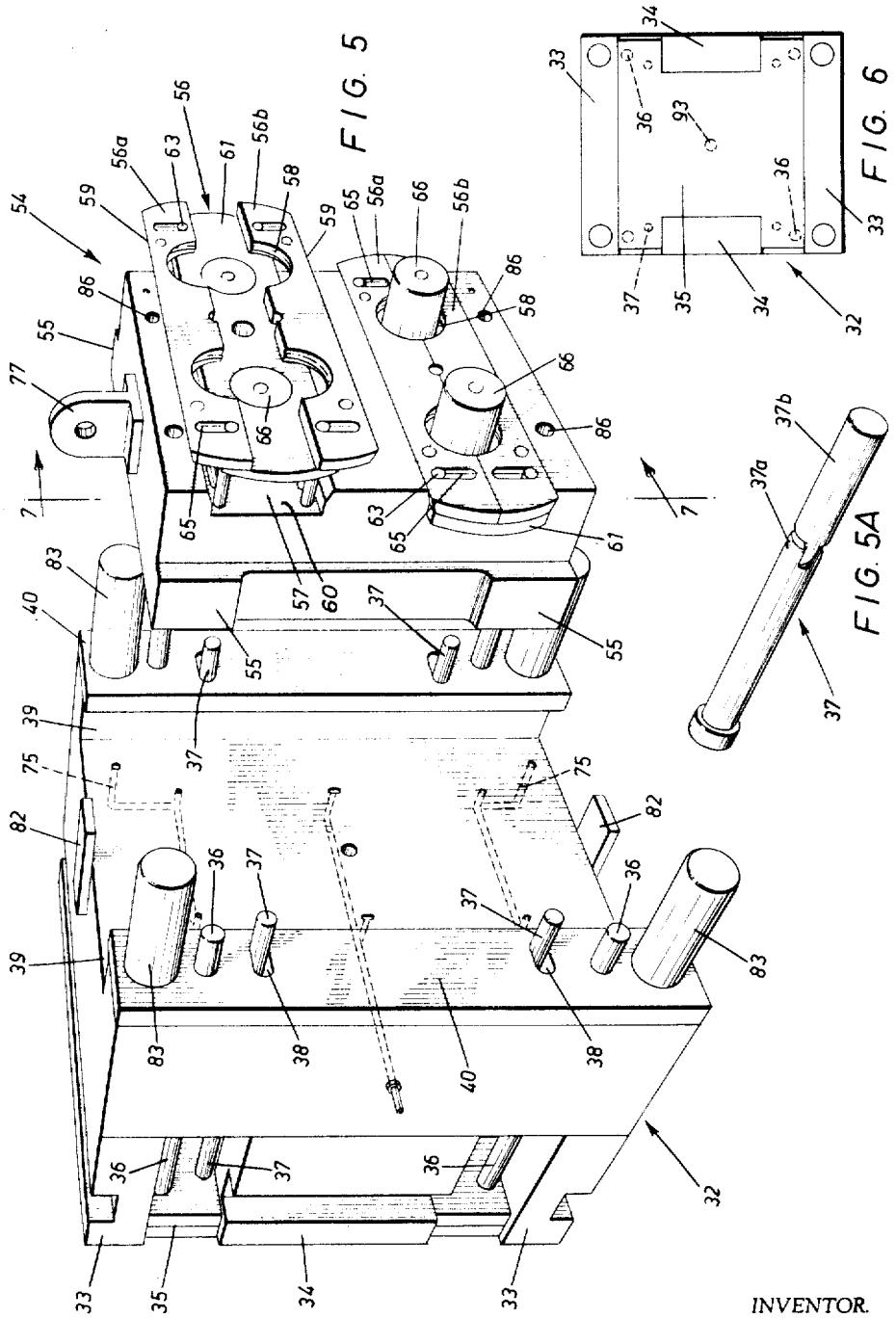


FIG. 5

FIG. 6

FIG. 5A

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PLASTIC MOLDING APPARATUS

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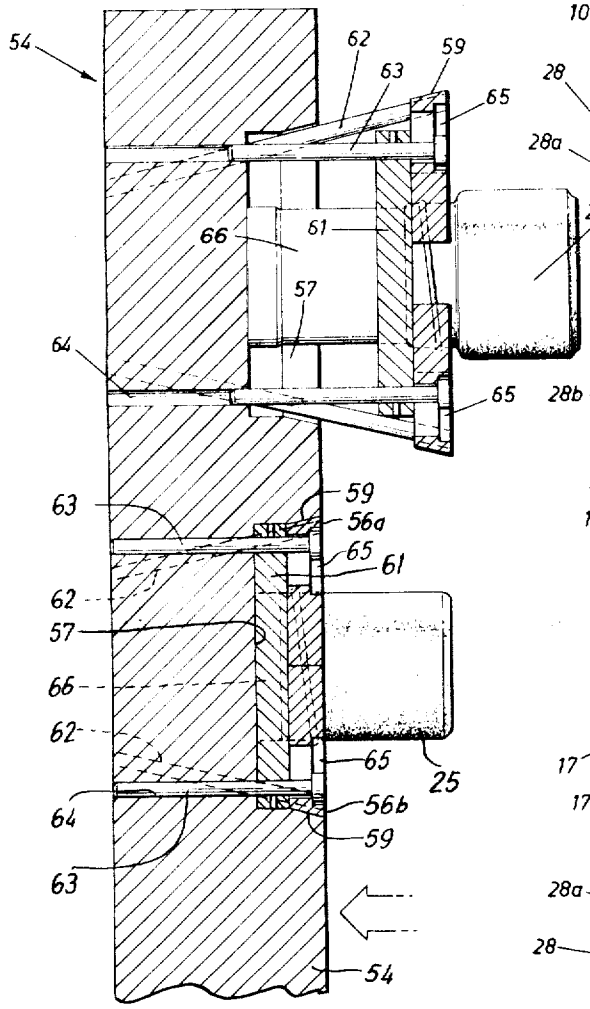


FIG. 7

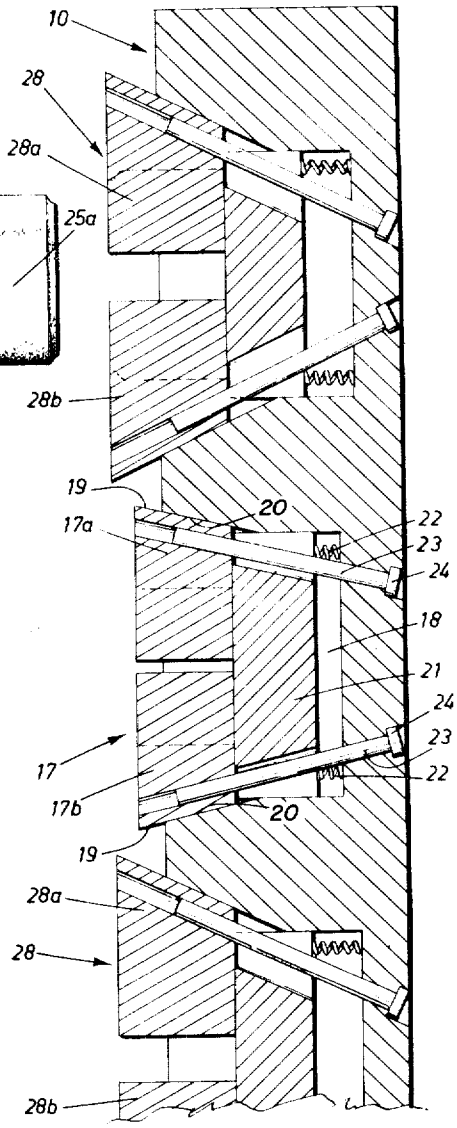


FIG. 8

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PLASTIC MOLDING APPARATUS

Original Filed Jan. 25, 1963 8 Sheets-Sheet 5

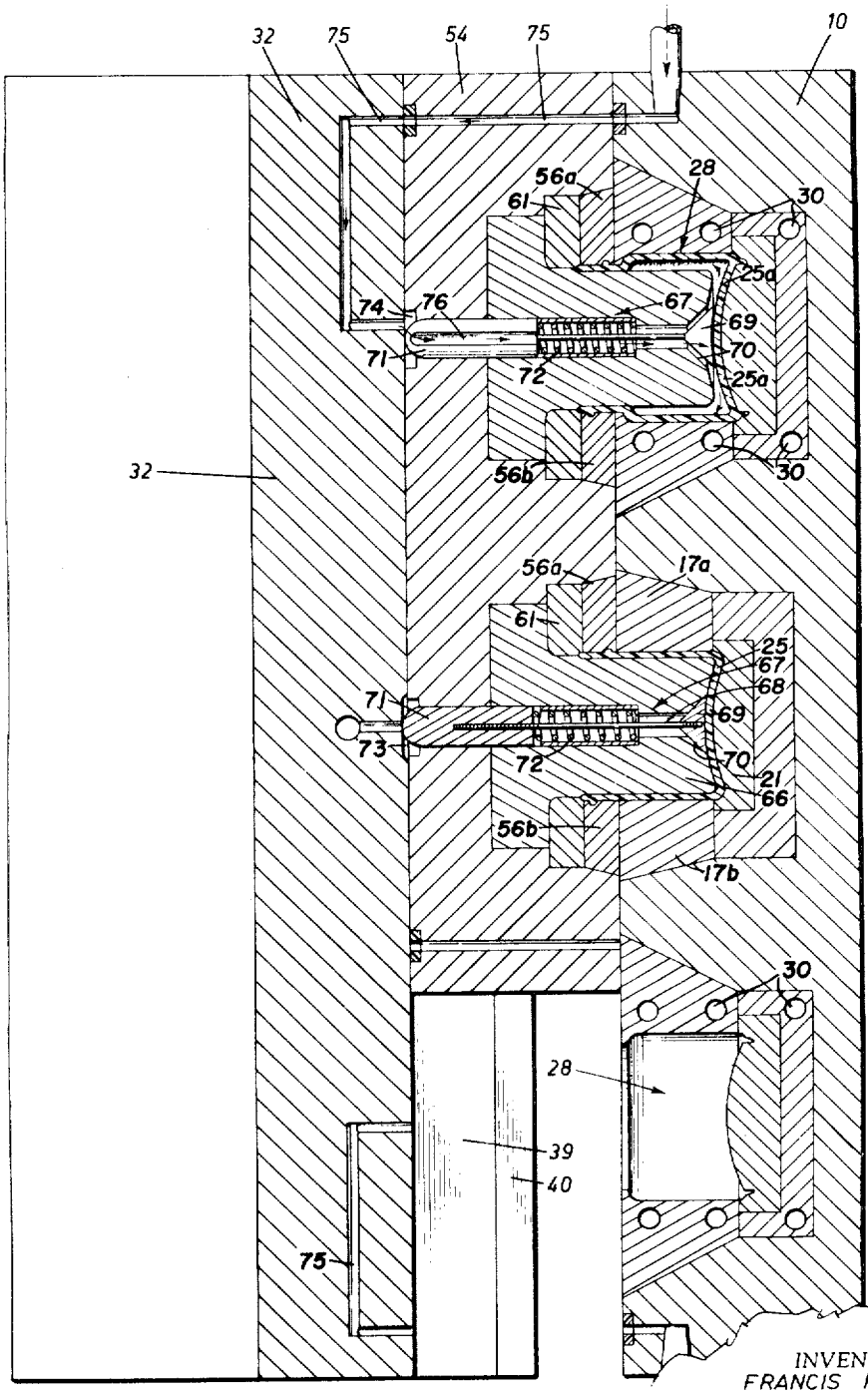


FIG. 9

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Sept. 12, 1967 F. FARKAS Re. 26,265

PLASTIC MOLDING APPARATUS

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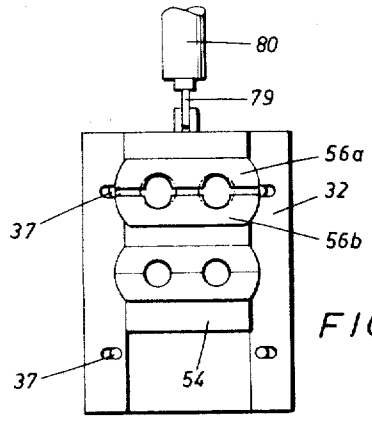


FIG. 10

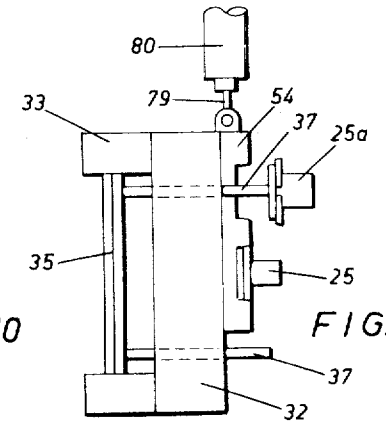


FIG. 10A

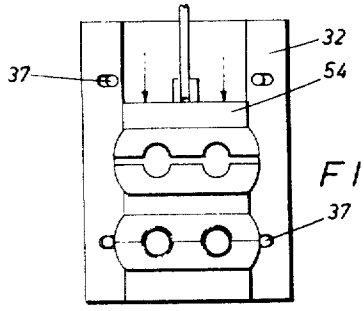


FIG. 11

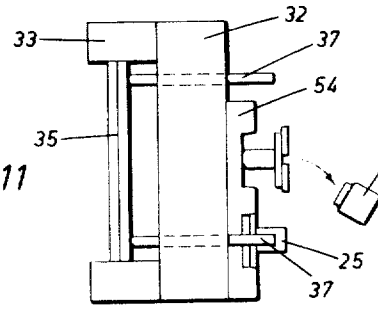


FIG. 11A

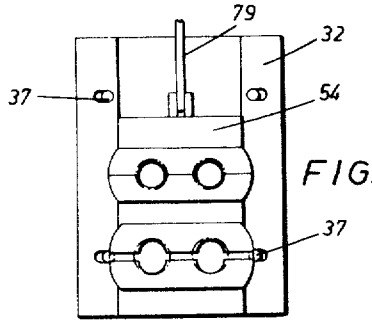


FIG. 12

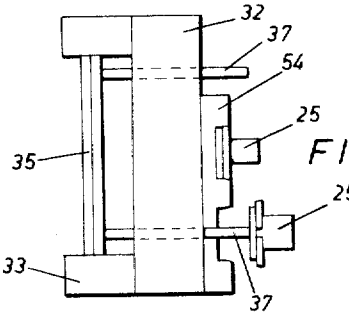


FIG. 12A

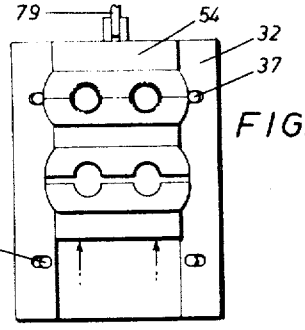


FIG. 13

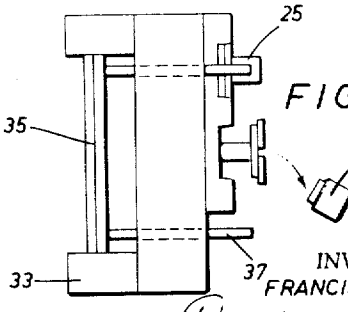


FIG. 13A

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PLASTIC MOLDING APPARATUS

Original Filed Jan. 25, 1963 8 Sheets-Sheet 7

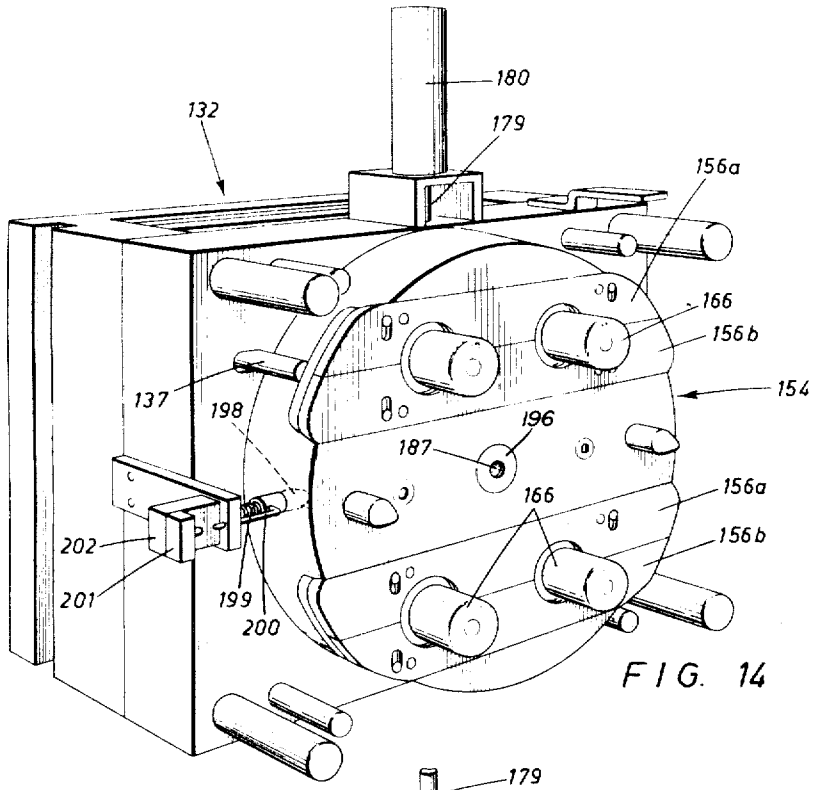


FIG. 14

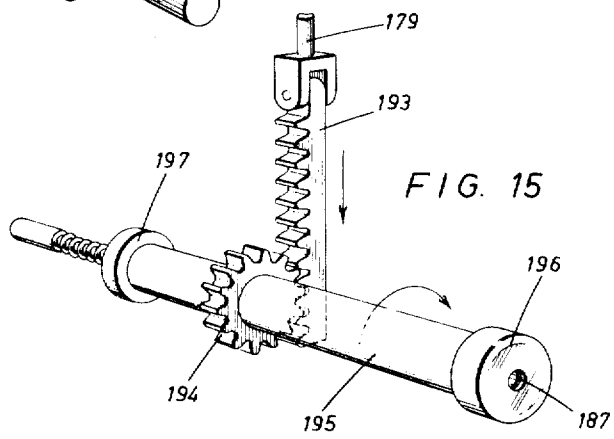


FIG. 15

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PLASTIC MOLDING APPARATUS

Original Filed Jan. 25, 1963 8 Sheets-Sheet 8

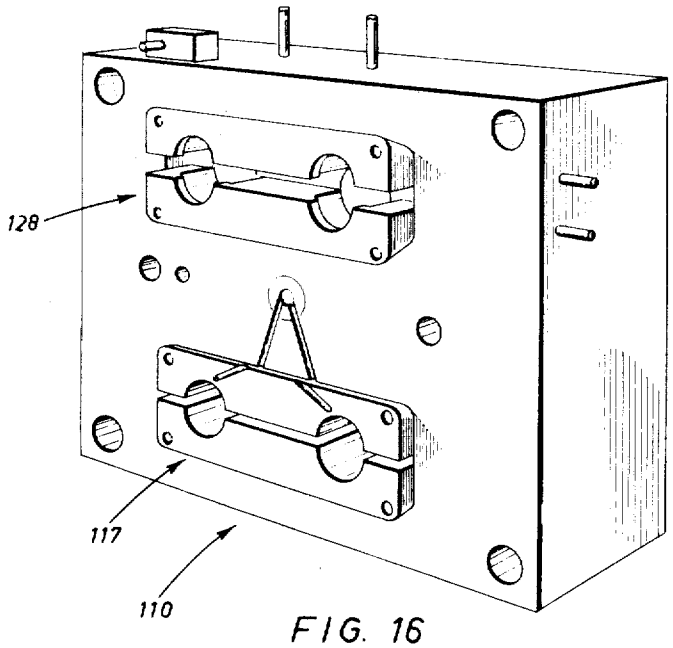


FIG. 16

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PLASTIC MOLDING APPARATUS

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Original No. 3,183,552, dated May 18, 1965, Ser. No. 253,964, Jan. 25, 1963. Application for reissue Dec. 20, 1966, Ser. No. 606,503

15 Claims. (Cl. 18—5)

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

This invention relates to apparatus for forming hollow articles from thermoplastic materials, and in particular relates to the forming of containers with restricted neck openings.

Apparatus for so called "injection molding" of hollow articles, conventionally comprises a mold having axially separable half sections carried in a platen secured to a fixed base, and a device for delivering the fluid thermoplastic material through the platen into the cavity of the mold; in line with the axis of this mold and mounted on a second platen is a plunger or core motivated by pressure means to enter into the mold, at which time the separable half sections close to form a cavity. The thermoplastic material is injected into the closed mold to fill the cavity and after release of pressure the halves of the mold separate axially from each other allowing withdrawal of the plunger which is surrounded by the article. On further withdrawal of the plunger pressure is applied to the article surrounding the core so that it is removed.

It will be clear that such apparatus is limited to the production of containers having unrestricted openings, and to produce articles with restricted openings, e.g. bottles, a method has been developed of first molding a preform or blank in a closed mold and then transferring the preform to a so called blow mold after which it is blown in the latter to the desired size of the article. Apparatus designed solely to carry out this method has been developed but its installation adds considerably to the capital cost of a plant where it is desired to produce a line of articles having both open and restricted necks.

It is an object of this invention to quickly and economically adapt an injection molding machine from the production of open neck containers to closed neck containers.

It is a further object of the machine, so adapted, to produce blanks from preform molds and then blow these blanks in blow molds to containers having restricted necks, at the same time producing a further set of blanks for subsequent transfer to the blow molds.

The invention provides apparatus for molding neck shaped articles from plastic materials which includes a first block carrying blank and blow mold sections in spaced relation with means in the first block to diverge these mold sections a pre-determined distance outwardly thereof. Parallel to the first block and movable away from same is a second block carrying the plungers, these latter being surrounded by neck mold split sections seated in the second block but mounted so they are capable of outward divergent movement therefrom. On application of pressure by one block against the other the mold sections close inwardly to surround the cores located in the blow molds and blank molds and after injection of the plastic material into the former with simultaneous introduction of pressurized air through the core in the latter, the release of pressure by the block and withdrawal of same permits the mold sections to automatically open. On further separation of the blocks the neck mold sections in

line with the blow mold sections are opened by independent means to permit removal of the articles surrounding the plungers, after which the position of one block is moved in a plane substantially parallel in relation to the other to permit the plungers withdrawn from the blow molds to be aligned with the blank molds and the corresponding plungers with the preforms removed from the blank molds to be aligned with the blow molds.

The invention may be fully understood from the following detailed description with reference to the accompanying drawings.

In the drawings:

FIGURE 1 is an elevational view of an injection molding machine embodying the invention;

FIGURE 2 is a face view of the first block with the blow molds and blank molds in spaced relation;

FIGURES 3 and 4 are enlarged sections as shown in FIGURE 1 illustrating the arrangement for removal of the solidified plastic left in the channel supplying the liquid plastic material to the blow mold;

FIGURE 5 is a face view of the second block with open and closed neck mold sections and the housing for carrying this block;

FIGURE 5*a* shows the detail of the hinged pins located in the housing for opening the neck mold sections surrounding the plunger carrying the blown article;

FIGURE 6 is a view of the rear of the housing as shown in FIGURE 5;

FIGURE 7 is an enlarged sectional view of the neck mold sections taken along the lines **7**—**7** of FIGURE 5;

FIGURE 8 is an enlarged sectional view taken along the lines **8**—**8** of FIGURE 2;

FIGURE 9 is a sectional view taken through the first and second blocks illustrating the arrangement when a blank and a finished article are simultaneously formed;

FIGURES 10, 11, 12 and 13 show the sequence of operations of the second block in the housing in one full cycle;

FIGURES 10*a*, 11*a*, 12*a* and 13*a* are side elevations showing further the sequence of operations illustrated by FIGURES 10, 11, 12 and 13;

FIGURE 14 is an alternative embodiment of the invention wherein the second block carrying the neck mold sections is rotatable on the housing;

FIGURE 15 shows the linkage for rotating the second block;

FIGURE 16 shows the arrangement of the spaced blanks and blow molds in a first block co-operating with a rotary second block;

Now referring to the drawings:

As shown particularly in FIGURE 1 a block **10** is clamped to a fixed platen **11** secured to a base **12** and disposed centrally through the block **10** is a bush **13** which has a channel **14** extending axially its whole length and communicating through an aperture in the fixed platen **11** with a pressure device **15** for supplying liquid thermoplastic material. The bush **13** is provided with a flange **16** seated in the block **10** to prevent movement as a consequence of the pressure exerted by the standard device **15**.

As shown in FIGURE 2 a blank mold cavity **17** is provided in the block **10**, one on each side of the bush **13**. Each blank mold cavity **17** comprises an upper and lower mold section **17***a* and **17***b* slidably receivable in recesses **18** in block **10** as shown in FIGURE 8. The mold sections **17***a* and **17***b* have inner parallel surfaces to define the mold cavity **17**, but the outer surfaces **19** of the mold sections **17***a* and **17***b* are tapered inwardly towards each other, the inner surface **20** of the recesses **18** in the block **10** being similarly tapered. As shown in FIGURE 8 the seating of the mold cavity **17** is provided by a plate **21**

which has the same dimension as the base of the tapered recesses **18** in the block **10**. Bearing against the end wall of recesses **18** and urging the plate **21** outwards are compression springs **22**. The mold sections **17***a* and **17***b* are carried by guide pins **23** aligned substantially parallel to the outer surfaces **19** of the mold sections **17***a* and **17***b*, and the plate **21** rides on the guide pins **23** in recesses provided in the upper and lower edges of the plate **21**. The guide pins **23** are seated in the block **10** by means of heads **24**. The springs **22** are dimensioned so that the mold sections **17**a and **17**b protrude from the surface of the block **10** to an extent whereby their divergent movement outwards permits the necessary opening of the mold cavities **17** for withdrawal of the blank **25** as shown in FIGURE 9. Capillary tubes **26** are provided in the block **10** to communicate with the channel **14** and deliver liquid thermoplastic material to the blank mold cavities **17**. The upper and lower edges of the mold sections **17**a and **17**b bear on to bushings **27** attached to the surface of the block **10** and suitable recesses are provided in the mold sections **17**a and **17**b to mate with the bushings **27**.

Above and below the blank mold cavities **17** are a pair of blow mold cavities **28** constructed in a manner identical to that described for the blank mold cavities **17**, though it will be appreciated that they are larger in diameter to permit the necessary expansion of the blank **25** when it is being blown to the finished article **25**a. Also since their location is not associated with a central supply of liquid thermoplastic material, it is convenient for the pair of sections **28**a and **28**b to define a pair of blow mold cavities **28**. It is advisable to provide for cooling of the blow mold **28** and hence cooling tubes **29** communicate with suitable channels **30**, shown in FIGURE 9, provided in the mold sections **28**a and **28**b, these channels **30** registering with the cooling tubes **29** when the mold sections **28**a and **28**b are fully closed. On the upper surface of the block **10** a microswitch **31** is provided which synchronizes the operation of the apparatus, this operation being described later.

Movable towards and away from the block **10** is a housing **32**, shown in FIGURE 5, secured in the rear to horizontal members **33** and also to vertical members **34** which lie between the horizontal members **33** so as to define with them a cavity in the shape of a cruciform. A movable plate **35** is slidably receivable in this cruciform cavity, and secured adjacent to its corners are push back pins **36** which ride in the housing **32**; adjacent and parallel to each of the push back pins **36** are pins **37** hinged intermediate of their ends at **37**a as shown in FIGURE 5a to provide a forward part **37**b. The pins **37** are secured to the surface of the housing **32** extending through vertical flanges **39** on each side of the housing **32**, which are attached to plates **40**. The channels **38** are flared at their front ends with a horizontal axis greater than the vertical axis, so as to permit lateral movement of the hinged forward part **37**b when it is located in the flared portion of the channel **38**.

As shown in FIGURE 1 by means of the horizontal members **33** and vertical members **34**, the housing **32** is secured to a movable platen **41**, having bushes **41**a at its ends which surround parallel tie bars **42**. Attached to the platen **41** and positioned between the tie bars **42**, is a hollow cylindrical block **43** and bridging the tie bars **42**, to the rear of the block **43**, is a first member **44** into which the cylindrical block **43** is threaded so that their relative position can be adjusted. The bridge member **44** has bushings **45** slidable on the tie bars **42**. Spaced at the rear is a second member **47** attached to a base **12**a which also bridges the tie bars **42**. Intermediate of the member **47** is a plunger **48** carrying at its forward end a member **49** slidable within member **47**. A pair of parallel rods **50** positioned intermediate of the tie bars **42** slidably traverse the first bridge member **44** and the slidable member **49**. The rods **50** are attached at their forward ends to a plate **51**, and the opposite ends **52** of the rods **50** are provided with means to adjust their length. The plate **51** has a circumference slightly smaller than the bore of the hollow block **43**, so that on retraction of the member **44** the plate **51** will enter the bore of the block **43**. A link arm, not shown, connects the bridge member **44** to the sliding member **49** controlling the travel of the member **44**. On further withdrawal of the bridge member **44** the ends **52** of the rods strike an end plate **53** restricting further travel and the plate **51** acts as a stop means.

As shown in FIGURE 5 the flanges **39** on the housing **32**, together with the plates **40**, provide a recess in which a block **54** slides by means of abutments **55** disposed on each side. Two pairs of neck mold cavities **56** are provided in the block **54**, one pair being spaced from the other by a distance corresponding exactly to the distance between a blank mold cavity **17** and a blow mold cavity **28** positioned immediately above or below in the block **10**. Each pair of neck mold cavities **56** are formed by upper and lower neck mold sections **56**a and **56**b slidably receivable in recesses **57** in the block **54**. As shown in FIGURE 5 the upper and lower neck mold sections **56**a and **56**b will have inner threaded surfaces **58** to define the neck mold cavities **56** when it is desired to cast articles having screw-on tops, but the outer surfaces **59** of the neck mold sections **56**a and **56**b are tapered inwardly towards each other, the inner surfaces **60** of the recesses **57** in the block **54** being similarly tapered in angularity and depth. The bottom seatings of the neck mold cavities **56** are provided by plates **61**, which have the same width as the base of the tapered recesses **57** in the block **54**. The length of the plates **61** are such that their ends extend outwards beyond the vertical sides of the block **54**, to a point where they intersect the longitudinal axis of the movable hinge pins **37**; the combined thickness of a neck mold section **56**a or **56**b and the backing plate **61** is the same as the depth of the recesses **57**.

As shown in FIGURE 7, guide pins **62 inwardly inclined** with respect to the axis of the neck mold cavities **56** are attached to the upper and lower neck mold sections **56**a and **56**b, the plate **61** having recesses cut into its upper and lower edges through which the angular guide pins **62** travel. Another set of guide pins **63** also extending inwardly, but in a direction parallel to the axis of the neck mold cavities **56**, are attached to the plate **61**; both angular guide pins **62** and guide pins **63** ride in channels **64** provided in the block **54**. The plate **61** is movable outwards in a direction normal to the block **54** and during such movement is in sliding contact with the neck mold sections **56**a and **56**b; the lateral movement of the neck mold sections **56**a and **56**b is utilized to limit the distance of their outward movement by extending the guide pins **63** through the plate **61** as far as the outer surface of the neck mold sections **56**a and **56**b, and providing slots **65** therein around the ends of the pins **63**. It will be clear that the divergent outward movement of the neck mold sections **56**a and **56**b will be terminated when the guide pin **63** bears on to the side of the slot closest to the common edge of a pair of neck mold sections **56**a and **56**b.

Tubular plungers **66** projecting outwardly are secured at their base in the sliding block **54**; the plunger **66** extends through the plate **61** and through the neck mold sections **56**a and **56**b when closed. Extending within the tubular plunger **66** is a valve assembly **67** comprising a rod **68** shown in FIGURE 9, which is of smaller cross section than the bore of the plunger **66** and having a head **69** at its free end shaped to fit into a seating **70** provided in the end of the plunger **66**. The other end of the rod **68** is threaded on to a guide member **71** biased inwardly by a spring **72** so that during the injection operation in the blank mold cavity **17** the head **69** engages the seating **70** and prevents entry of the liquid plastic material into the plunger **66**; to accommodate the requisite inward movement of the rod **68**, a recess **73** of the requisite depth is provided in the housing **32** in line with

the axis of the blank mold cavity **17**. When the plunger **66** is positioned in the blow mold cavity **28**, the guide member **71** rests in a shallower recess **74** provided in the housing **32** in line with the axis of the blow mold cavity **28** to bias the head **69** outwardly of the free end of the plunger **66**. The tubular plungers **66** registering with the blow mold cavities **28**, and seated in the shallower recesses **74**, communicate through bores **75** provided in the housing **32** and the block **10** and block **54** to a source of pressurized air. The guide member **71** is provided with longitudinal grooves so as to permit the air to enter the blow mold cavity **28**.

As shown in FIGURE 1 the block **54** slides in the housing **32** by means of a linkage comprising a bracket secured to the upper part of the block **54**, which is pinned to a shackle **78**, to which is attached one end of a piston **79** actuated in known manner by fluid pressure in a cylinder **80** carried on a platform **81**, which is attached to the upper part of the housing **32**. The sliding movement of the block **54** is limited by bumper bars **82** attached to the upper and lower side of the housing **32** to ensure corect alignment of the plungers **66** with the blank mold cavities **17** and blow mold cavities **28**. Furthermore, locating pins **83** are secured close to the corners of the housing **32** to mate with suitable recesses **84** provided in the block **10** and finally a further set of locating pins **85** are provided in the block **10** to mate with suitable recesses **86** in the block **54**.

As shown in FIGURES 3 and 4 and orifice **87** centrally disposed at the junction of each of a pair of neck mold sections **56***a* and **56***b* and equidistant between a pair of neck mold cavities **56** extends through the plate **61**, the block **54** and the housing **32**; the orifice **87** has an annulus **88** close to the front surface of the block **54**. A push out pin **89** having a slightly smaller cross section than the wall of the orifice **87** is located therein to the rear of a circular recess **88**, the member **89** being biased inwardly by a spring **90** bearing against a head **91** on the end of the pins **89**. It will be clear that dependent on the position of the block **54** either an upper or lower orifice **87** will be in line with the channel **14** and, as shown in FIGURE 3, when the block **10** and the block **54** meet liquid thermoplastic material travelling along the channel **14** will enter the orifice **87** to a point where its further progress is prevented by the member **89**. On separation of the block **10** and block **54** the plastic retained by the annulus **88** will pull out the spru **92** from the end of the channel **14**, thus ensuring that no overlap of material will take place on the face of the block **10** to prevent it mating properly with block **54** on subsequent contact. Attached centrally of the plate **35** is a second push out pin **93** in line with the channel **14**; on forward movement of the plate **35** due to contact with the stop means plate **51** the push out pin **93** moves into the orifice **87** exerting pressure against the spring loaded push out pin **89** which will then move to eject the spru **92** as shown in FIGURE 4.

OPERATION

It will be clear that the spaced relation of the two horizontal recesses **57** in the block **54** being identical with the distance apart of a blank mold cavity **17** and a blow mold cavity **28** immediately above or below the block **10** results in a situation whereby the plungers **66** located in one of the two horizontal recesses **57** will be aligned with the blank mold cavity **17** and the plungers **66** in the other horizontal recess **57** will be aligned with either the upper or lower blow mold cavity **28**, depending on the position of the sliding block **54**, in the housing **32**. Assuming that blanks **25** already on the plungers **66** are in a position to enter block **54**, in the housing **32**. Assume that the upper plungers **66** surrounded by the blanks **25** are aligned with the upper blow mold **28**; hence the lower plungers **66** from which the articles **25***a* have been previously ejected are aligned with the blank mold **17**. On movement of the block **54** towards the block **10** the neck mold sections **56***a* and **56***b* surrounding the lower plungers **66** bear against the split mold sections **17***a* and **17***b*; both the neck mold sections **56***a* and **56***b* and split mold sections **17***a* and **17***b* will close to completely form the blow mold cavity by the time contact is made between the faces of the blocks **54** and **10**. At the same time the upper plungers **66** surrounded by the blanks will have entered the upper blow mold **28** and on completion of the movement of the blocks **54** and **10** the split mold sections **28***a* and **28***b* will have closed around the upper plungers **66** to form the blow mold cavity. On contact of the respective blocks **10** and **54** the microswitch **31** is tripped activating the pressure device **15** for ejecting liquid plastic material through the channel **14** and the capillary tubes **26** into the blank mold cavity **17**, and also simultaneously activating the supply of pressurized air through the bores **75** into the upper set of tubular plungers **66** in the upper blow mold cavity **28**.

After a due period of time has elapsed the platen **41** starts to move backwards to the position shown in FIGURES 10 and 10*a* terminating the action of the microswitch **31**. The split mold sections **17***a* and **17***b* move outwardly by means of the springs **22** to permit easy withdrawal of the lower plungers **66** each carrying a blank **25** whilst split mold sections **28***a* and **28***b* of the upper blow mold **28** move outwardly to permit withdrawal of the upper plungers **66** which carry the blown article **25**. The platen **41** continues its movement backwards until the movable plate **35** strikes the stop plate **51** and on further movement of the platen **41** the hinged pins **37** move forward, the upper pair striking the ends of the plates **61** which extend outwards beyond the vertical side of the block **54**. The neck mold sections **56***a* and **56***b* open outwards and forwards to release their hold on the article **25***a* and the plate **61** then strikes the rim of the article **25***a* to urge it along the plunger **66** sufficient to free the article **25***a* for it to fall away to a suitable container; at the same time the second push out pin **93**, attached to the movable plate **35**, has moved forward and applies pressure against the spring biased member **89** to eject the plastic spru **92** retained in the orifice **87**. The housing **32** then commences its return travel and when the push back pins **36** contact the block **10**, the plate **35** moves backward whereby the push out pin **93** clears the rear of the block **54** at which time the piston **79** actuated by the cylinder **80** and triggered by a suitable timing device, not shown, moves the block **54** downwards as shown in FIGURE 11. The split neck sections **56***a* and **56***b* surrounding the plungers **66** carrying the blank **25** are still closed, as shown in FIGURE 11, and they force the lower pair of hinged pins **37** apart so as to be left unaffected. The block **54** then strikes the lower bumper plate **82** on the housing **32** and the plungers **66** with the blanks **25** obtained from the blank mold cavities **17** are aligned with the lower blow mold cavity **28**; the platen **41** then moves forward and the whole process is repeated.

In another embodiment of the invention as shown in FIGURES 14, 15 and 16 the sliding block **54** is replaced in the housing **132** by a block **154** rotatable through an angle of 180° about the central axis of the housing **132**. Due to this rotary displacement it will be evident that the corresponding block **110**, shown in FIGURE 16, only needs one blow mold station **128** to receive the plungers **166** removed from the blank mold station **117** and furthermore, it is only necessary to have one pair of hinge pins **137** for opening the neck mold sections **156***a* and **156***b* after their withdrawal from contact with the block **110**. Finally, only one centrally placed orifice **187** is necessary in the face of the block **154**.

The mechanism for rotating the block **154** on withdrawal of the plungers **166** is shown particularly in FIGURE 15. It comprises a vertical rack **193** disposed in the housing **132** connected to a piston **179** actuated by a cylinder **180** secured to the upper part of the hous-

ing **132**. A gear **194** centrally disposed of the housing **132** co-operates with the rack **193** and axially disposed of the gear **194** and extending there-through is a shaft **195** one end of which carries a bushing **196**, the outer face of which is flush with the face of the block **154** and the other end carries a head **197** which secures it to the rear face of the housing **132**. Centrally disposed of the shaft **195** is the orifice **187** extending its whole length in which the spring loaded push out assembly, already described, is located.

At the side of the housing **132** a locking pin **198** extends inwardly to contact one or other of two suitable recesses provided at opposite sides of the block **154**. This locking pin **198** is biased inwardly by means of a spring **199**, and an arm **200** is secured to the pin **198** inwardly of the spring **199** leading to a microswitch **201** and solenoid **202** for moving the locking pin **198** outwardly of the block **154**, thus freeing the shaft **195** for rotation.

From the foregoing description, it will be seen that the present invention provides a method and apparatus for the successful application of the injection method to the production of plastic containers having restricted openings. While certain embodiments have been illustrated and described for the purpose of disclosure, it will be understood that the invention is not limited thereto, but contemplates such modifications and other embodiments as may be utilized without departing from the invention.

I claim:

1. Apparatus for blow molding articles having necks comprising: a first block and a second block mounted in an opposed spaced apart parallel relationship; said first block *having blow and blank molds,* including at least [a first blow mold and a second blank mold] *first and second molds which are respectively blow and blank, molds,* mounted therein in a spaced apart relationship, said blank [mold] and [said] blow [mold] *molds* each comprising separable sections biased to project in open positions outward of said block and slidable into closed positions flush with said block, said second block having mounted thereon first and second fixed plungers, one individual to each of said *first and second* molds and registrable therewith, a plurality of pairs of separable neck mold sections, one pair surrounding each of said plungers, each of said neck mold sections being slidable into and out of open and closed positions adjacent the outermost extremity of said plungers, and adjacent the near face of said second block respectively, means for moving said first and second blocks into a face to face abutting engagement with said plungers registered with their opposed mold sections; switch means responsive to said engagement; means actuated by said switch means for injecting plastic into said [blank] *second* mold to produce a blank; and means actuated by said switch for simultaneously introducing air into a blank in said [blow] *first* mold to produce one of said articles; and means for *alternatively* aligning said first and second plungers [with said second and first molds] respectively *with a blank mold and a blow mold* on said first block after separation of said blocks.

2. Apparatus as claimed in claim **1** including means to enable opening of said separable neck sections outwardly of said second block after movement of said second block a predetermined distance from said first block.

3. Apparatus as claimed in claim **1** wherein said separable mold sections of said first block are supported by pins in said first block which pins are inclined towards one another.

4. Apparatus as claimed in claim **1** wherein said neck mold sections are supported by pins in said second block which pins converge inwardly towards a common plane.

5. Apparatus as claimed in claim **3** including spring means secured between said first block and said separable sections to normally urge said sections to project from the face of said first block opposed to said second block.

6. Apparatus as claimed in claim **1** including means for ejecting said article from said plungers subsequent to withdrawal of said plungers from said first block.

7. Apparatus as claimed in claim **1**, including a housing, a shaft extending from said housing said second block being rotatably mounted thereupon, and means for rotating said block relative to said housing.

8. Apparatus as claimed in claim **4** including a movable base surrounding each of said plungers in sliding contact with said neck mold sections said base extending at least on one side beyond said second block, and second guide pins attached normally to said base and slidably engaged with corresponding channels in said second block and means limiting the outward movement of said base around said plunger.

9. Apparatus as claimed in claim **8** including a housing, said second block being mounted thereon, means for ejecting said blown article from said plunger subsequent to withdrawal from said first block comprising, a pin slidably extending through said housing, the forward end thereon being positioned to the side of said second block in line with the extension of said base, stop means positioned at the rear of said housing whereby on movement away of said second block from said first block the rear of said pin is arrested by said stop means and said extension of said movable base surrounding said plunger carrying said article strikes said pin for divergent opening of said neck mold sections and said movable base moves forward to exert pressure on the article on said plunger to effect its removal.

10. Apparatus as claimed in claim **9** wherein said second block is displaceable on said housing whereby said first and second fixed plungers register alternately with [said first] *a* blow mold and [second] *a* blank mold and the forward end of said pin is hingably movable with respect to said housing whereby on displacement of said block the extension of said movable base surrounding said plunger removed from said blank mold contacts the side of said hinged end of said pin, the latter moving outwards leaving unaffected the neck mold sections surrounding the blank removed from said blank mold.

11. Apparatus for blow molding articles having necks comprising: a first block and a second block mounted in an opposed spaced apart parallel relationship; said first block having blow and blank molds, including at least first and second molds which are respectively blow and blank molds, mounted therein in a spaced apart relationship, said blank and blow molds each comprising separable sections biased to project in open positions outward of said block and slidable into closed positions adjacent to the face of said block, said second block having mounted thereon first and second plungers each individually registrable with a mold, positionable means for aligning said plungers with individual molds, said aligning means being effective in one position to align said first and second plungers respectively with said first and second molds for registration therewith, a plurality of pairs of separable neck mold sections, one pair surrounding each of said plungers, each of said neck mold sections being slidable into and out of open and closed positions respectively spaced outwardly from and adjacent to the near face of said second block, means for moving said first and second blocks into a face to face abutting engagement with said plungers registered with their opposed mold sections; means actuated in response to engagement of said blocks for injecting plastic into said second mold to produce a blank; and means actuated in response to engagement of said blocks for introducing air into a blank in said first mold to produce one of said articles.

12. Apparatus for blow molding articles having necks comprising: a first block and a second block mounted in an opposed spaced apart parallel relationship; said first block having blow and blank molds, including at least

first and second molds which are respectively blow and blank molds, mounted therein in a spaced apart relationship, said blank and blow molds each comprising separable sections biased to project in open positions outward of said block and slidable into closed positions adjacent to the face of said block, said second block having mounted thereon first and second plungers, which are alignable with the molds and individually registrable therewith, said first and second plungers being first aligned respectively with said first and second molds, a plurality of pairs of separable neck mold sections, one pair surrounding each of said plungers, each of said neck mold sections being slidable into and out of open and closed positions respectively spaced outwardly from and adjacent to the near face of said second block, means for moving said first and second blocks into a face to face abutting engagement with said plungers registered in the mold sections with which they are aligned; means actuated in response to engagement of said blocks for injecting plastic into the blank mold in which a plunger is registered, to produce a blank on the plunger; and means actuated in response to engagement of said blocks for introducing air into a blank in the blow mold in which a plunger carrying said last-mentioned blank is registered, to produce one of said articles; means for separating the blocks after they have been engaged with the plungers in their aforesaid first alignment, to permit removal of the produced article, and means for re-aligning said first and second plungers respectively with a blank mold and a blow mold on said first block after said separation of said blocks.

13. Apparatus for blow molding articles having necks comprising: a first block and a second block mounted in an opposed spaced apart parallel relationship; said first block having a blow mold and a blank mold, mounted therein in a spaced apart relationship, said blow mold comprising separable sections biased to project in open positions outward of said block and slidable into closed positions adjacent to the face of said block, said second block having mounted thereon a plunger, selectively registrable with each of said blow and blank molds in accordance with the relative alignment of the blocks, a pair of separable neck mold sections surrounding said plunger, said neck mold sections being slidable into and out of open and closed positions respectively spaced outwardly from and adjacent to the near face of said second block, means for moving said first and second blocks into and away from a face to face abutting engagement with said blocks aligned for registration of said plunger with a selected one of said blow and blank molds; means actuated in response to said engagement of said blocks with said blocks aligned to register said plunger with said blank mold, for injecting plastic into said blank mold to produce a blank to be carried on the plunger; means operable when the blocks are disengaged after production of said blank on the plunger, for re-aligning said blocks to effect registration of the blank-carrying plunger with said blow mold, said block-moving means being adapted to effect engagement of the re-aligned blocks with the plunger registered in said blow mold; and means actuated in response to said last-mentioned engagement of said blocks for introducing air into said plunger-carried blank in said blow mold to produce one of said articles.

14. Apparatus for blow molding articles having necks comprising: a plunger and means for applying a blank of plastic thereto, to be carried on said plunger; said apparatus further comprising a first block assembly and a second block assembly mounted in an opposed spaced apart relationship; said first block assembly including a blow mold mounted therein, said blow mold comprising separable sections biased to project divergently into open position outward toward said second block assembly and slidable in the opposite direction convergently into closed position, said second block assembly having said plunger mounted thereon in outwardly extending position and alignable for registration with said blow mold, said second block assembly having separable neck mold sections which surround said plunger and which are slidable into and out of open and closed positions and are arranged, in closed position, for neck-defining engagement with the plastic on the plunger; means for moving said first and second block assemblies into and away from a face to face abutting engagement with said blank-carrying plunger registered with said blow mold, means actuated in response to said engagement of said block assemblies for introducing air into the blank on said plunger in said blow mold to produce one of said articles, said neck mold sections having structure maintaining them in closed position when said block assemblies are moved into said engagement, and means for moving said neck mold sections into open position to release the neck of the produced article and permit removal of said article from the plunger on moving said block assemblies away from said engagement.

15. Apparatus for blow molding articles having necks comprising: a plunger and means for applying a blank of plastic thereto, to be carried on said plunger; said apparatus further comprising a first block assembly and a second block assembly mounted in an opposed spaced apart relationship; said first block assembly including a blow mold mounted therein, said blow mold comprising separable sections movable relative to each other into and out of open and closed positions, said second block assembly having said plunger mounted thereon in position extending outwardly in the direction of the axis of the plunger and alignable for registration with said blow mold, said second block assembly including separable neck mold sections which surround said plunger and which are slidable into and out of open and closed positions and are arranged, in closed position, for neck-defining engagement with the plastic on the plunger; means for moving said first and second block assemblies in the direction of the axis of the plunger, into and away from a face to face abutting engagement of said block assemblies with said blank-carrying plunger registered with said blow mold, said blow mold sections being arranged to be moved into closed position by movement of said block assemblies into said engagement, and having means moving said blow mold sections into open position in response to movement of said block assemblies away from said engagement; and means actuated in response to said engagement of said block assemblies for introducing air into the blank on said plunger in said blow mold to produce one of said articles, said neck mold sections having structure maintaining them in closed position when said block assemblies are moved into said engagement, and means for moving said neck mold sections into open position to release the neck of the produced article and permit removal of said article from the plunger on moving said block assemblies away from said engagement.

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