United States Patent

Drazick

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[54] **LATCH ASSEMBLY FOR MOLD BASES**

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[52] **U.S. Cl.** .....**24/230 AV,** 425/450
[51] **Int. Cl.** **A44b 19/00,** A01j 21/00, A21c 3/00
[58] **Field of Search**.....24/230 AV, 230 A; 425/450; 18/30 LA

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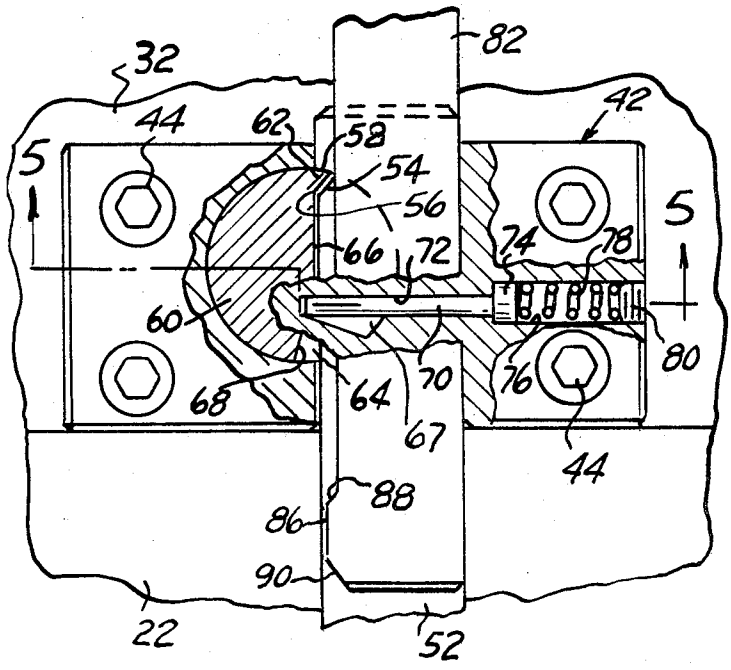
[57] **ABSTRACT**

A latch and release mechanism for predetermined, timed separating movement of a plurality of plate members relative to each other, which includes a longitudinal latch bar secured to one plate member and lockingly engagable by a rotatable detent which is spring biased in locking position; and a longitudinal release bar secured to another plate member which is movable relative to the one plate member; both bars are arranged in parallel overlying alignment and said release bar is provided with at least one cam surface adapted to move said rotatable detent member out of engagement with said latch bar when said another plate member is moved away from said one plate member; the rotatable detent is supported within a third plate member; the arrangement is such that in one position of said latch and release mechanism independent movement of said another plate member relative to said one and said third plate member is permitted and in the release position of said latch and release mechanism the third plate member is caused to move conjointly with said another plate member relative to said one plate member by means of a lost-motion connection between said another plate member and said third plate member and which has a magnitude of lost-motion movement corresponding to the distance of free movement of the longitudinal release bar relative to the longitudinal latch bar until the cam surface engages the rotatable detent thereby moving the detent out of locking engagement to release said third plate member from said one plate member.

4 Claims, 5 Drawing Figures



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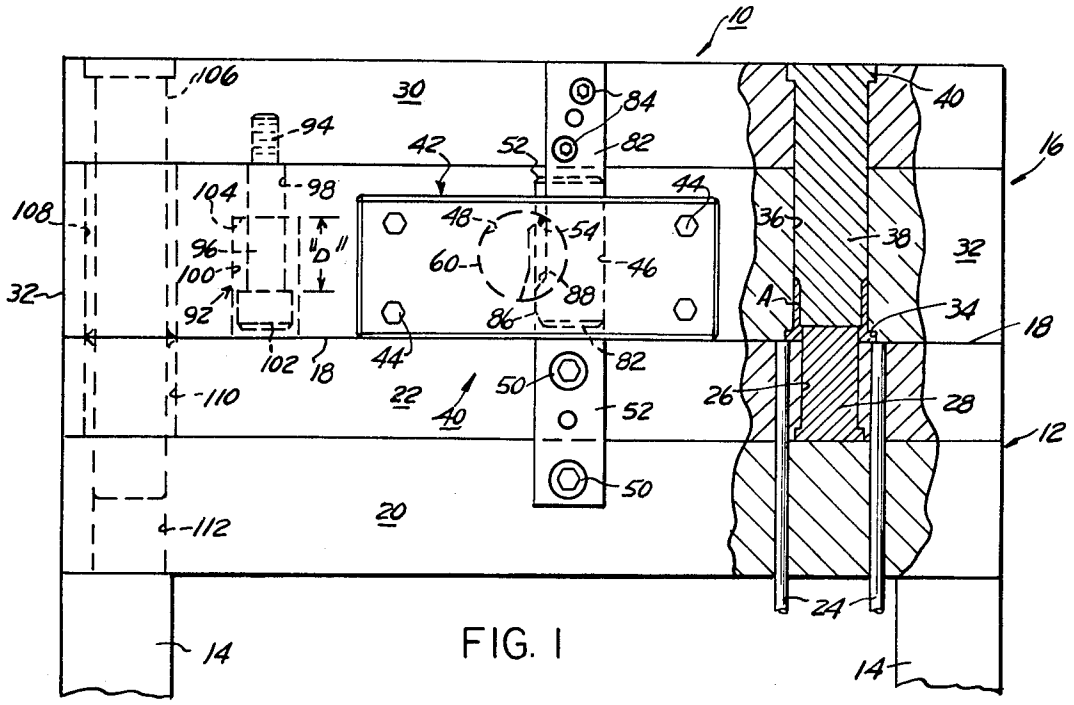

FIG. 1

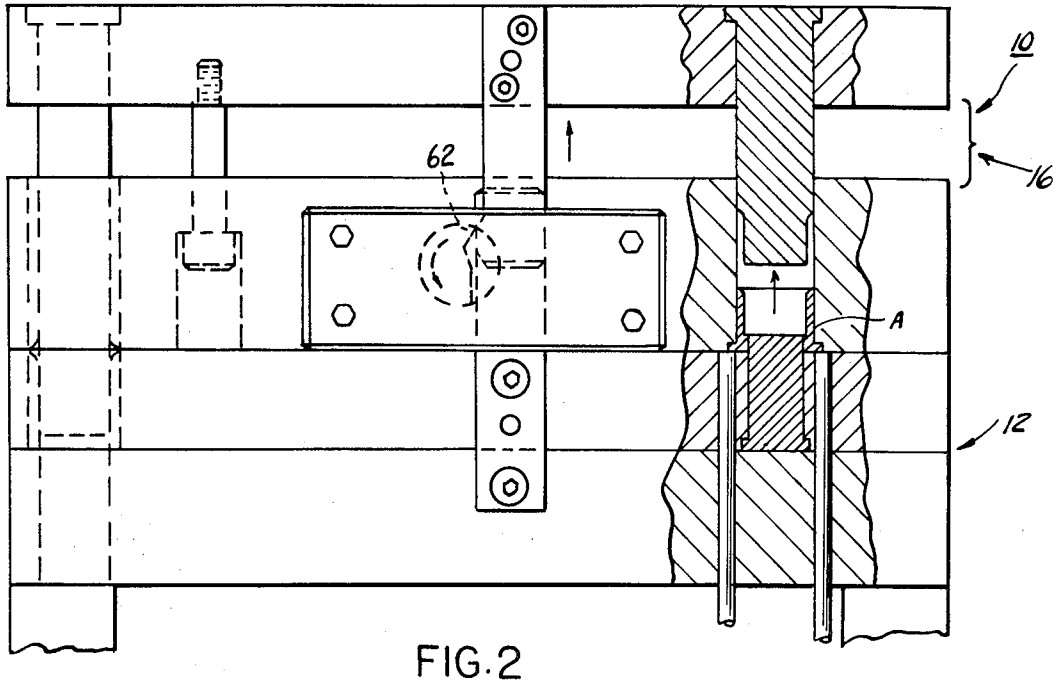

FIG. 2

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FIG.3

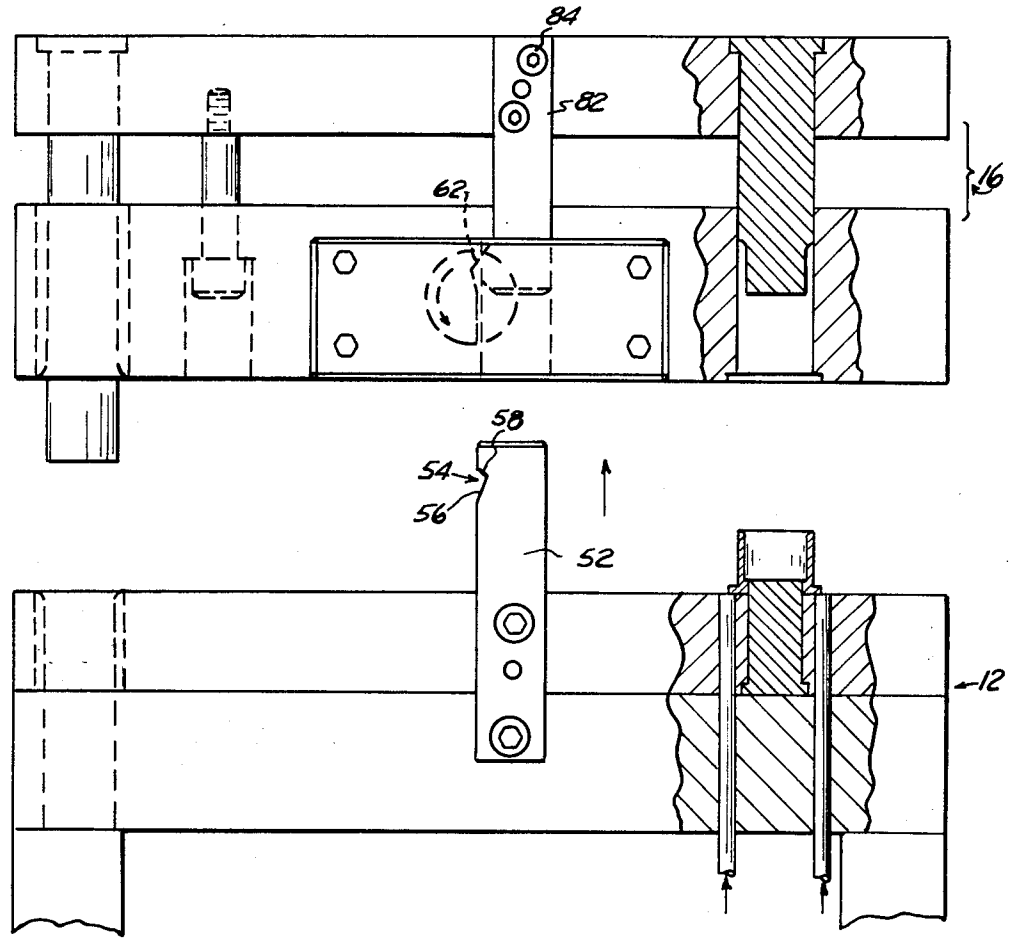


FIG.4

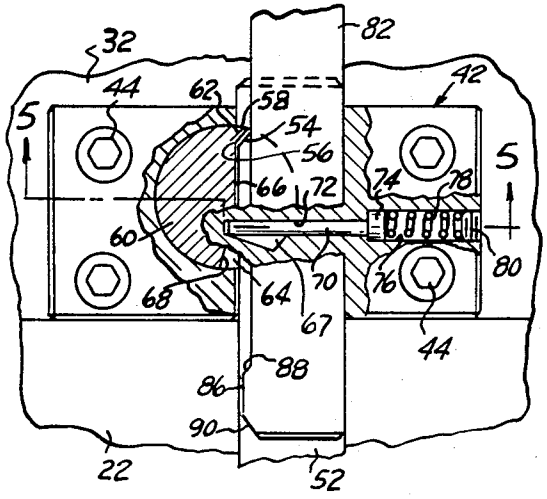
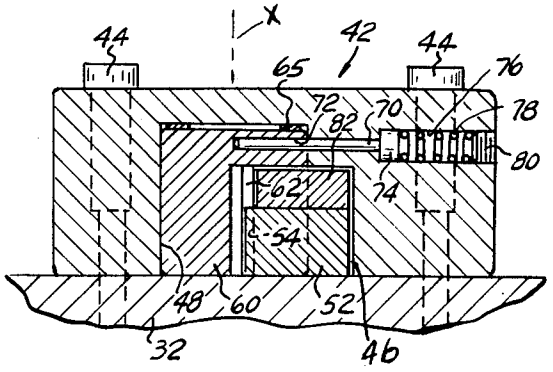


FIG.5



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LATCH ASSEMBLY FOR MOLD BASES

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to a positive self-locking and releasing mechanism for a multiple plate structure in which the individual plate members are required to be moved relative to each other, individually and conjointly. The present invention is particularly adaptable to a multiple plate die and mold assembly, as for instance in injection molding apparatuses, and in which the die and mold assembly is composed of of one plurality of super-imposed die plates. AT least one plate of group of die plates is separately movable with respect to another plate of the same group and a second group of die plates. In another position of the die assembly, conjoint movement of said one die plates and said another die plate of said one group of plates relative to said second group of plates is provided.

Although the present invention is described and illustrated herein as being incorporated in a multiple die and mold structure of an injection molding apparatus, it will be clearly understood and fully apprehended by a person skilled in the art, that the present improved self-locking and release mechanism for timed sequence of movement of separate members relative to each other, can be effectively and advantageously utilized in a variety of other apparatuses and devices involving limited, controlled, separating movement between a plurality of members, as will become apparent in the hereafter following detailed description.

In accordance with the present invention the improved self-locking and release mechanism is incorporated in a structure involving at least three members movable in succession separately and conjointly and relative to one another and in timed, predetermined sequence and within predetermined limits of movement. The improved self-locking and release mechanism is comprised of a latch secured to one member which is engagable in locking position by a spring loaded detent secured to a second member, and a releasing cam secured to a third member adapted to cam the detent out of locking engagement with said latch of said first member upon movement of the third member relative to the first and second member along a predetermined distance. Thereafter, the third and second member are caused to move conjointly with respect to the first member; the second and third member being cooperatively connected by means of a loss-motion connection having a predetermined magnitude of free movement corresponding to the free movement of the releasing cam before striking the detent.

Accordingly, it is the primary object of the present invention to provide an improved positive self-locking and release mechanism for multiple member structures in which all members or selected ones, are predeterminedly movable relative to each other in timed sequence and within predetermined distances.

A further object of the present invention resides in the provision of a positive self-locking and release mechanism for a multiple die and mold structure having a plurality of plate members adapted for separate, individual and conjoint movement relative to each other in timed sequence and in which at least one of said plate members is provided with at least one die cavity and another of said plate members is provided with a core for extension into said die cavity; the plurality of plate members being adapted, in closed position of said die and mold assembly, to be latched together by said self-locking and release mechanism, said self-locking and release mechanism being constructed such as to permit separate movement of said core member out of said die cavity prior to complete separating, opening movement of said multiple plate die assembly.

Further distinct advantages and novel features of the present improved self-locking and release mechanism will become fully apparent, or particularly be pointed out, in the following detailed description having reference to the attached drawings forming a portion thereof.

BRIEF DESCRIPTIoN oF THE DRAWINGS

The accompanying drawings illustrate preferred embodiments of the present improved, self-locking and release mechanism for multiple relatively movable members, herein illustrated, for example, as a multiple-plate die and mold structure of an injection apparatus and in which:

FIG. 1 is a cross-section through the upper and lower die assembly of an injection molding apparatus shown in closed position immediately after completion of injection molding and showing the improved self-locking and release mechanism in locked position;

FIG. 2 is a view similar to FIG. 1 illustrating partial separation of the upper die assembly from the lower die assembly by which the core member is being moved out of the die cavity prior to complete separation of the upper die assembly from the lower die assembly;

FIG. 3 is a view similar to FIGS. 1 and 2 showing complete separation of the upper die assembly from the lower die assembly after release of the present improved self-locking and release mechanism;

FIG. 4 is an enlarged fractional front elevation with portions of the upper and lower die assemblies shown in closed position and portions of the improved self-locking and release mechanism being broken away and shown in cross-section for illustrating of the internal structure thereof; and

FIG. 5 is a longitudinal cross-section through the present improved self-locking and release mechanism as seen in the direction of the arrows 5—5, in FIG. 4.

DETAILED DESCRIPTION OF THE INVENTION

With particular reference to FIGS. 1 to 3, there is illustrated, for example, a multiple plate die and mold structure, generally indicated by the numeral **10**, as utilized in an injection molding apparatus. Multiple die and mold structure **10**, in the illustrated instance, is comprised of a lower die assembly **12**, usually rigidly supported on base members **14**, and an upper die assembly **16** adapted for movement relative to lower die assembly **12** between a closed and an open position; the parting line between the die assemblies being indicated at **18** lying in a plane normal to the movement of upper die assembly **16** relative to lower die assembly **12**.

In the multiple die and mold structure **10**, used herein for illustrating purpose only, is shown in FIG. **1** in the closed position just after finishing of the injection

molding operation; in FIG. 2, multiple die and mold structure 10 is shown partly separated and in FIG. 3, upper die assembly 16 is shown completely separated from lower die assembly 12.

For illustrating purpose, lower die assembly 12, is composed of a back-up plate 20 upon which is stationarily supported a lower die plate 22. Back up plate 20 and lower die plate 22 are coaxially bored at several locations to receive independently movable ejection rods 24, normally flush with parting line 18. Lower die plate 22 is further appertured at 26 between ejection rods 24 to receive a core member 28 which extends a distance beyond parting line 18 for a purpose to appear.

Likewise illustrative, upper die assembly 16, which as mentioned is movable relative to lower die assembly 12 in direction towards and away from parting line 18, is composed of an upper die plate 30 and a lower die plate 32 which is operably connected to upper die plate 30 in such manner as to permit individual separating movement between plates 30 and 32 within a predetermined distance, as more fully described hereafter.

Die plate 32 is provided with a die cavity 34, which may be of any desired configuration of no importance to the present invention. Die cavity 34 is open towards lower stationary die plate 22 and core member 28 of lower stationary die plate 22 extends partially into die cavity 34, as shown. Both die plates 30–32 of upper die assembly 16 are coaxially bored at 36 to likewise receive a core member 38 which is axially supported in die plate 30 by means of flange 40. The lower end of upper core member 38 extends into die cavity 34 in planar abutment against the top surface of lower core member 28.

It will be understood by those skilled in the art, that the multiple die and mold structure 10 may provide a multiple of die cavities 34 and associated core members 2838, which, however, is of no importance to the present invention. As will be further understood, in operation of the illustrative multiple die and mold structure 10, upper die assembly 16 is closed upon lower die assembly 12, thereby closing die cavity 34 along parting line 18. Die cavity 34 is then filled by injection, or other means, with a molding material to produce a molded article having a shape defined by the configuration of die cavity 34 and the opposite core members 28-38. After molding and curing of the material in die cavity 34, conventionally, upper die assembly 16 is moved away from lower die assembly 12, permitting the ejector rods 24 (which are reciprocable by any known conventional means) to eject the finished article, previously formed in die cavity 34, from the upper end of lower core member 28.

In order to permit the core member 38 of upper die assembly 16 to recede from die cavity 34 without relative movement of the molding die 32 itself, in order to prevent distortion or other irregularities to be affected upon the freshly molded article in die cavity 34, (which is liable to happen if both die members 30 and 32 of the upper die assembly 16 were a single unit and moved simultaneously) the present improved self-locking and release mechanism, indicated by reference numeral 40, has been provided.

Conventionally, the upper die assembly would be a single unit to recede from the lower die assembly after the molding of an article in die cavity 34, which, also conventionally, would normally be provided in the lower, stationary die assembly 12. However, in the illustrated instance, die cavity 34 is provided in the movable upper die assembly 16 and co-operates with a pair of opposed co-axial core members 28–38 to shape thin walled tubular articles. Since the thin walled tubular portion of the article to be molded in die cavity 34 is produced between the internal bore 36 of die plate 32 and upper core member 38, there is a possibility of excessive extrusion and consequent dimensional inaccuracies of the freshly molded article if both upper die plates 30–32 will be moved simultaneously with upper core member 38. In order to prevent this effect, the upper die assembly 16 is made up of two separate die plates 30–32 which are adapted to be moved individually and in succession relative to the lower die assembly 12, to permit retraction of upper core member 38 out of die cavity 34 without movement of die cavity plate 32 to maintain circumferential and radial confinement of the thin walled section of the freshly molded tubular article in die cavity 34 for designed dimensional accuracy of the molded article.

The present improved self-locking and release mechanism 40 comprises a housing or bracket 42, which is secured to one lateral side surface of upper die plate 32 by means of bolts 44, or the like. The bottom of housing 42 facing the side of die plate 32 (as most clearly seen in FIGS. 4 and 5) is provided with a longitudinal transverse recess or slot 46 extending across the width of housing 42. Transverse longitudinal recess 46 is partially intersected by a circular, blind bore 48 having an axial center line X which is slightly offset outwardly of longitudinal recess 46 (FIG. 5).

Attached to stationary lower die plate 22 and backup plate 20 of lower die assembly 12 by means of fasteners 50, is a longitudinal latch bar 52 which extends upwardly through the recess 46 in housing 42 of the lock and release mechanism 40 attached to upper movable die plate 32. As seen from FIG. 5, latch bar 52 is of rectangular, flat-sided cross-section and is provided at its upper end (at one lateral edge surface) with a notch 54. Notch 54 has an inclined rear surface 56 joined by an opposite curvilinear front surface 58. Notch 54 is adapted (in closed position of upper die plate 32 upon lower die plate 22 as illustrated in FIGS. 1 and 4) to be engaged by a radial tongue portion 62 of a cylindrical detent member 60.

Cylindrical detent member 60 is rotatably retained within blind bore 48 of housing 42 and is upwardly supported against a wear ring 65, or the like, within the inner end of blind bore 48, and on the other side rests upon the lateral side surface of upper die plate 32.

As more in detail illustrated in FIG. 4, segmental cut-out 64 has an axial dimension substantially corresponding to the depth of longitudinal recess 46. Segmental cut-out 64 permits extension of latch bar 52 therethrough and has an intermediate surface portion 66 which is parallel with the lateral edge of latch bar 52. Surface portion 66, at one side of detent member 60, culminates into the radial tongue portion 62 for engagement within notch 54 on latch bar 52 and at the other end extends into an inclined surface 68 which (in the locked position of the mechanism as shown in FIGS. 1 and 4) extends outwardly away from the lateral

edge of latch bar 52 to permit counter-clockwise rotation of detent member 60 into releasing position whereby radial tongue 62 is moved out of notch 54 in latch bar 52, as seen in FIG. 3.

Normally, detent member 60 is rotatably biased into locking position with latch bar 52 by means of a retainer pin 70, retained in the upper portion of housing 42. Retainer pin 70 extends transversely across and above longitudinal recess 46 for extension into a blind bore 72 provided in the upper, solid portion of detent member 60 which extends partially over the top surface of longitudinal recess 46, as seen in FIG. 5. Blind bore 72 for retainer pin 70, as most clearly seen in FIG. 4, is tapered radially outwardly to provide radially extending slot formation 67 to accommodate counter-clockwise release rotation of detent member 60. Retainer pin 70 abuts against the inner end of blind bore 72 within detent member 60 and its opposite end is provided with an enlarged head portion 74 adapted for seating engagement upon the inner end of counter-bore 76 within housing 42. Counter-bore 76 receives an expansion spring 78 for abutment against head portion 74 of retainer pin 70 and is retained within counter-bore 76 by means of an adjustable screw-in plug 80 by means of which the spring force of spring 78 can be adjusted periodically.

The transverse longitudinal recess 46 in housing 42 of lock and release assembly 40 is further adapted to receive a releasing bar 82 which, as seen from FIG. 5, is likewise of substantially flat, rectangular cross-section and disposed in overlying parallel relationship with longitudinal latch bar 52. The longitudinal release bar 82 is secured by means of fasteners 84, or the like, to the upper die plate 30 of upper die assembly 16 for extension across the lateral side of cavity die plate 32 of the upper die assembly.

The release bar 82 is of smaller cross-sectional width than latching bar 52, in order to normally clear the radial locking tongue 62 of the detent member 60 during relative longitudinal movement between the latch bar 52 and release bar 82, as will be described.

The free end of releasing bar 82 is shaped into a cam configuration 86 providing a first inclined surface 88 and a second inclined surface 90. The second inclined surface 90 is disposed at an angle substantially smaller than the angle of the inner, inclined cam surface 88, for a purpose to be described hereafter.

Normally, that is in the locked position of die and mold structure 10 as shown in FIGS. 1 and 4, the end of releasing bar 82 extends substantially all the way through longitudinal transverse recess 46 of the housing 42, overlying a substantial portion of the front end of latch bar 52. In this position, the cam configuration 86 at the end of releasing bar 82 is disposed a predetermined distance from the radial locking tongue 62 of detent member 60 disposed in locking position within notch 54 of latch bar 52.

The upper die plates 30–32 are further operably connected by means of a lost-motion connection, generally indicated at 92, which comprises a threaded bolt 94 threaded into upper die plate 30. The unthreaded shank 96 of bolt 94 extends freely through an aperture 98 provided in die plate 32 for longitudinal reciprocable movement therein. Aperture 98 extends into a counter bore 100 which receives the head 102 of bolt 94. The lower end of counter bore 100 provides a shoulder 104 to limit outward movement of head 102 and to provide a means of operable connection between upper die 30 and cavity die plate 32 for conjoint movement relative to the lower die assembly 12, as fully described hereafter.

To maintain the upper die plates 30–32 in parallel aligned position relative to each other and to assure axial alignment of the upper core member 38 relative to lower core member 28, as well as to maintain axial longitudinal alignment of latch bars 52–82 relative to longitudinal recess 46 in latch bar housing 42, a plurality of dowels 106 are provided in the die and mold structure 10. The upper end of the dowel 106 is rigidly secured to the upper die plate 30 and freely extends through coaxially aligned apertures 108 in die plate 32, 110 is the lower die plate 22 and 112 in back up plate 20 for relative free longitudinal movement therein.

In operation of the device and in reference to FIG. 1 of the drawings, after completion of the molding operation forming a tubular article A in die cavity 34, upper die assembly 16 must be moved away from the lower die assembly 12 in order eject the molded article A from die and mold structure 10. During the molding operation, die plates 30–32 of upper die assembly 16 are rigidly locked in tightly closed position upon lower die assembly 12 by means of the present improved self-locking and release mechanism 40. In the locked position of the mechanism, illustrated in FIGS. 1 and 4, radial tongue portion 62 of rotatable detent member 60 is biased into notch 54 of latch bar 52 and is retained therein by means of the spring force acting on retainer pin 70.

With reference now to FIG. 2 of the drawings, initial parting movement of upper die assembly 16 relative to lower die assembly 12 (by any known conventional motion transmitting device usually employed in injection molding apparatuses of this type) the upper die plate 30 is caused to move first independently and separately and thereafter conjointly with associated cavity die plate 32, as provided for by the lost-motion connection 92.

The free moving distance D of lost-motion connection 92, is defined by the distance between the inner end surface of head portion 102 of bolt 94 and shoulder 104 at the bottom of counter-bore 100 and substantially correspondes to the distance the releasing bar 82 has to move to bring cam portion 86 into engagement against radial tongue portion 62 of detent member 60.

Thus, as illustrated in FIG. 2, upper die plate 30 is initially independently and individually moved relative to associated die plate 32 and lower die assembly 12, until head portion 102 of bolt 94 of lost-motion connection 92 abuts against shoulder 104 in counter-bore bore 100. In that position, cam member 86 of release bar 82 is positioned such as to move radial cam portion 62 of detent member 60 out of recess 54 in latch bar 52 by means of engagement of inclined cam surface 88 thereagainst. This causes counter-clockwise rotation of detent member 60 against the force of spring 78 moving tongue portion 62 out of recess 54. Similarly, in this position of die and mold structure 10, as shown in FIG. 2, the upper core member 38, which is rigidly secured to upper die plate 30 is longitudinally moved out of the finish molded tubular article A (which remains in posi-

tion around the upper end of lower core member **28**) and is moved upwardly within die cavity **34** and bore **36** of die plate **32**.

Further receding movement of upper die assembly **16** from lower die assembly **12**, causes conjoined movement of upper die plates **30–32** by means of abutment of the head portion **102** of loss-motion connection **92** against inner shoulder **104**.

It will be understood that, normally, a plurality of such loss-motion connections **92** will be provided in die and mold structure **10** at circumferentially equally spaced distances to provide a rigid, motion transmitting connection between upper die plates **30** and **32**. As even in FIG. **3**, continuous conjoined receding movement of upper die assembly **16** from lower die assembly **12** causes the latch bar **52** to be completely moved out of longtidual transverse slot **46** in the latch assembly housing **42** for complete separation of the upper die assembly from the lower die assembly along parting line **18**. As upper die plate **32** recedes from lower die plate **22**, die cavity **34** is moved away from finish molded article A which, as mentioned before, remains in position around the upper end of lower core member **28** and on top of upper die plate **22**. Thereafter, the ejector rods **24** are manipulated by any known conventional mechanism, to move upwardly to push finish molded article A from the end of the lower core member **28**.

After the molded article has been removed from die and mold structure **10**, the dies and mold structure is closed again upon parting line **18** for the next injection molding operation. Downward movement of upper die assembly **16** upon lower die assembly **12**, causes latch bar **52** to move back into transverse slot **46** of latch assembly housing **42** and dowel pin **106** is caused to move back into aperture **110** of lower die plate **22**. After abutment of upper die cavity plate **32** upon stationary lower die plate **22**, further downward movement of upper die assembly **16** causes individual movement of upper die plate **30** into closing position upon die cavity plate **32** by means of loss-motion connection **92**. Closing movement of upper die plate **30** upon die cavity plate **32**, results in advancement of release bar **82** through slot **46** in latch assembly housing **42** in opposite direction to movement of latch bar **52**. By further movement of latch bar **52** inwardly of slot **46**, cam portion **86**, is moved away from the radial tongue portion **62** of detent member **60** which is then free to rotate in clockwise direction by means of the spring force on retaining pin **70**, to move tongue portion **62** into locking engagement within notch **54** of latch bar **52**, thereby rigidly locking die cavity plate **32** to lower die plate **22**. At the same time, upper core member **38** will have advanced through aperture **36** into die cavity **34** for closing abutment upon the top of lower stationary core member **28**, to again resume the position illustrated in FIG. **1**.

It will be evident from the foregoing description in connection with the accompanying illustrations, that the present invention provides an improved positive self-locking and release mechanism for a plurality of relatively movable members adapted for movement relative to one another and in which at least two members are operably connected for successive, separate and thereafter conjoined movement by means of a loss-motion connection in conjunction with the present cam lock and release mechanism.

It will be obvious to the person skilled in the art, that the present improved self-locking and release mechanism **40** may be constructed for locking any number of relatively movable members together, and it will be further understood that the present improved, positive, self-locking and release mechanism is not restricted for use in die and mold structures.

Furthermore, the present improved self-locking and release mechanism provides a suitable means of positively determining the traveling distance of one or more associated moving components relative to another component or components. By suitable variation of the number and shape of the cam and notch of the release bar and latch bar, respectively, multiple, timed movements of a variety of movable components can be accomplished.

In summary, the present improved self-locking and release mechanism can be used in any application requiring a predetermined, timed movement of various components relative to each other or to other stationary components.

What is claimed is:

1. An automatic, positive lock and release mechanism to successively lock and release a plurality of plate members adapted for individual separating movement relative to one another in superimposed relationship along a common axis; said positive lock and release mechanism comprising: at least one latch housing secured to a first of said members; said latch housing supporting a spring loaded detent member; a latch bar extending into said latch housing in a longitudinal direction and provided with cam means engageable by said detent member to normally lock said latch bar in said latch housing; said latch bar being secured to a second of said plate members adapted for movement relative to one another in timed sequence; a release bar longitudinally disposed in said at least one latch housing in superimposed parallel relationship with said latch bar; being provided with at least one cam formation formed thereon normally out of engagement with said detent member and adapted to move said detent member out of locking engagement with said latch bar upon separating movement of said release bar relative to said latch bar; said release bar being operably secured to a third of said plate members; the arrangement being such that, upon movement of said third plate member away from said first plate member, said release bar, after a predetermined distance of movement between said third and said first plate member, causing movement of said detent member out of locking engagement with said latch bar for continuous conjoint movement of said first and said third plate member relative to said second plate member in predetermined timed sequence.

2. In the lock and release mechanism as defined in claim **1**, said latch bar being attached to a plurality of said plate members and said release bar being rigidly attached to a stationary plate member.

3. In the lock and release mechanism of claim **1**, said latch bar being attached to a movable first plate member; said release bar being attached to another plate member and the latch housing being securely attached to a third plate member movable relatively to this plate member to which said latch bar is attached.

4. In a positive self-locking release mechanism as defined in claim **1**, there being a first and second latch

housing, the first latch housing being secured to a first plate member and the second latch housing secured to another plate member movable relative to the first plate member; a latch bar secured to a stationary plate member and extended in to the first and second latch housings, and a release bar attached to a stationary plate member opposite the first stationary plate member to which said latch bar is secured and adapted to extend into said latch housings and overlying and longitudinally aligned with said latch bar; said release bar having two spaced cam portions adapted to successively release said locking engagement of the latch bar with the first and the second housing to permit successive timed movement of said first and second plate members to which first and second said latch housings are attached to one another and in the respect to said first and second stationary plate member.

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