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Holton

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[54] **FLUID ACTUATOR DEVICE**

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[52] **U.S. Cl.** **100/218,** 72/427, 83/98, 425/437

[51] **Int. Cl.** **B30b 15/32**

[58] **Field of Search** ..... 100/45, 218; 83/98, 99; 425/437; 72/328, 344, 345, 427; 249/66 A

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[57] **ABSTRACT**

A fluid actuator device for use in combination with apparatus to control the supply of a fluid such as air delivered thereto during its course of operation, for ejecting stamped parts and/or slugs, molded parts, for directing material through a stamping die and various other operations where a controlled air stream or blast is required. The fluid actuator device is mechanical in operation, hence eliminating the need of an electrical source coupled to it, as in the case of, for example, microswitches.

10 Claims, 5 Drawing Figures

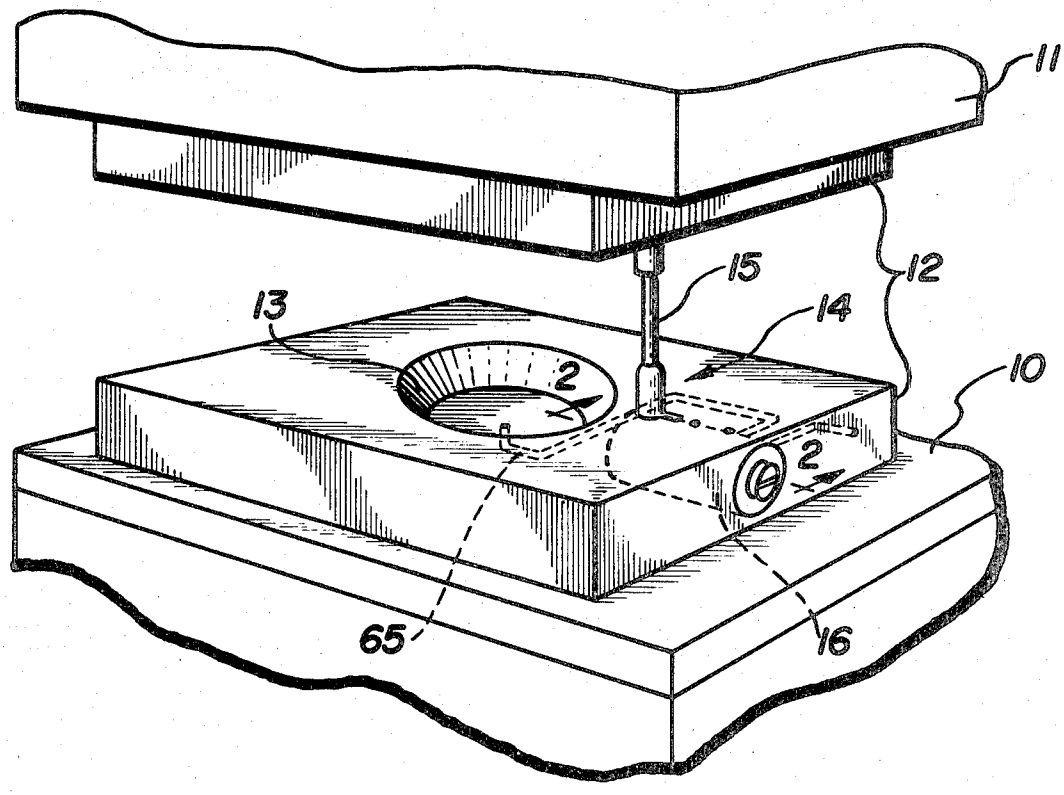

FIG.1

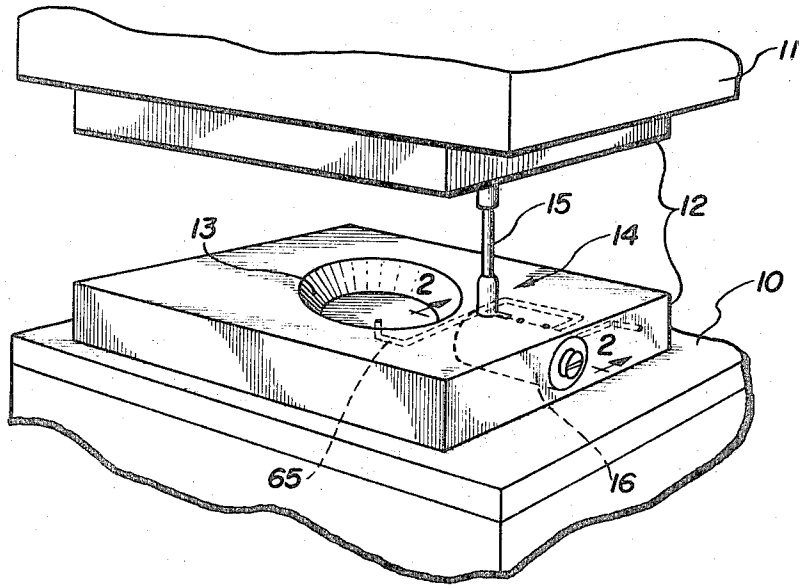
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FIG.2

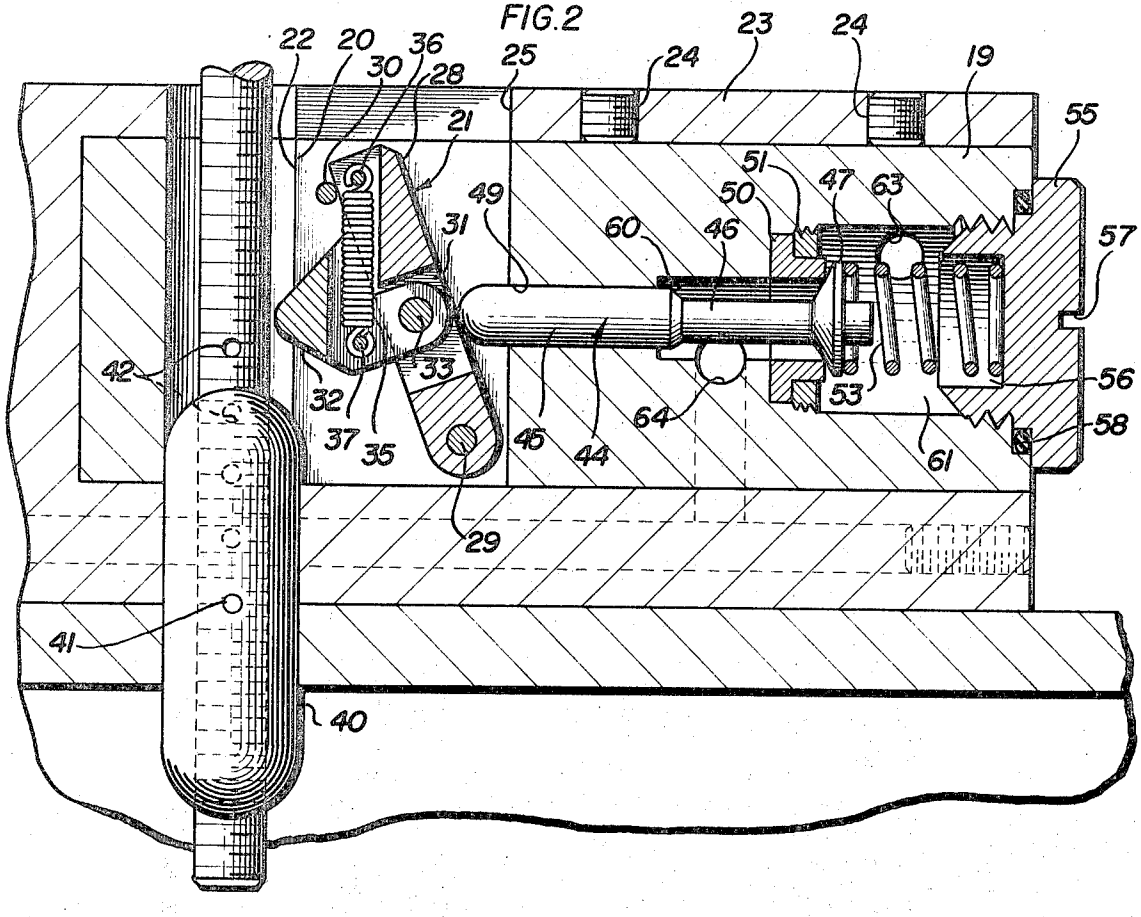
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FIG.3

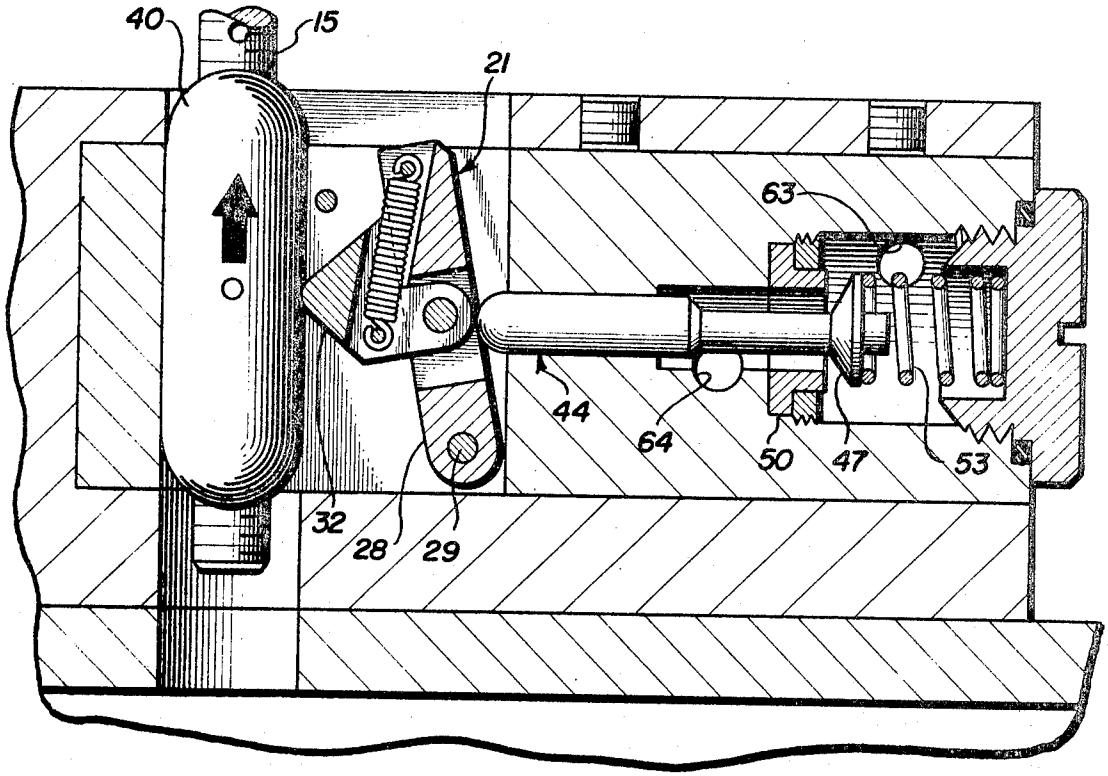


FIG.4

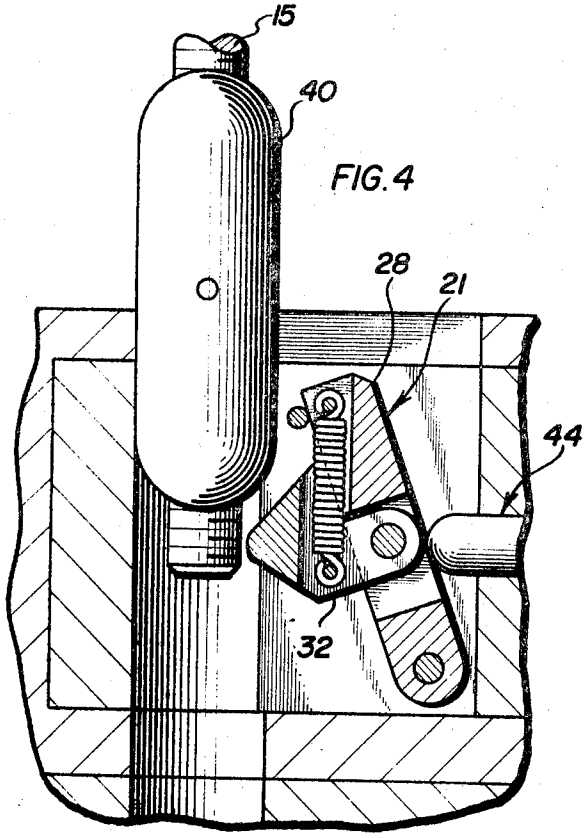
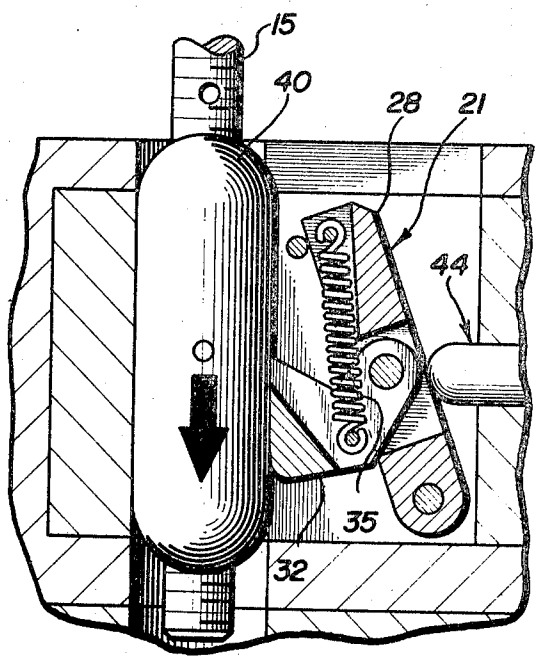


FIG.5



FLUID ACTUATOR DEVICE

This invention relates to an improved fluid actuator device for use in combination with apparatus having a fixed and a movable bed, for controlling the supply of a fluid such as air delivered to the apparatus, during the course of operation thereof.

The air actuator device of the invention is particularly applicable for use in combination with apparatus of the above type for controlling the supply of air delivered thereto during its course of operation, for ejecting stamped parts and/or slugs, molded parts, for directing material through a stamping die and various other operations where a controlled air stream or blast is required. In the past, these types of operations normally have been controlled by microswitches which are affixed to and operated by the apparatus. The microswitches, in turn, control other valves or the like which control the flow of the fluid to the apparatus.

The use of electrically operated devices such as microswitches requires a source of electrical power to be coupled with them. In many cases, such a source is not readily available and, therefore, the proper electrical wiring must be provided. Doing so normally requires the skills of an experienced electrician, thus adding substantially to the cost of any installation. On the other hand, a source of fluid such as compressed air or oil normally must be coupled with the apparatus for its operation, regardless if a source of electrical power is coupled with it. Accordingly, under the circumstances, substantial savings in both time and cost can be provided in any installation, if a non-electrically operated device can be provided for controlling the supply of fluid to the apparatus, for these types of operations.

A principal object of the present invention, therefore, is to provide an improved fluid actuator device which is mechanically and not electrically operated, for controlling the supply of a fluid delivered to apparatus, during the course of operation of the apparatus.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

FIG. 1 is a partial perspective view generally illustrating an air actuator device exemplary of the invention affixed to a molding apparatus;

FIG. 2 is a partial sectional view, illustrating the construction of the air actuator device; and

FIGS. 3–5 are sectional views generally illustrating the manner in which the air actuator device operates.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to the drawings, in FIG. 1 there is illustrated a portion of a molding apparatus having a fixed or stationary bed **10** and a movable bed **11**. The respective die and mold halves are fixed to these beds **10** and **11**, and operate in conjunction with them as the mold is opened and closed. In the illustrated embodiment, a mold cavity **13** is illustrated as being formed in the mold half **12** affixed to the fixed or stationary bed **10**. With molding apparatus of this type, in many cases, it is necessary to provide a short blast of compressed air or the like to eject a molded part from the mold cavity **13**, as the mold halves are opened. As indicated above, in many cases, the blast of compressed air was controlled by means of a microswitch or the like associated with the molding apparatus and arranged to be operated as the mold halves opened and closed. The use of such microswitches and other similar electrically operated devices requires that a source of power be coupled to the molding apparatus.

In accordance with the present invention, a mechanically operated air actuator device **14** is coupled with the molding apparatus, and is operable to control the supply of fluid such as air to the apparatus during its course of operation. The air actuator device **14** includes a plunger **15** which, in the illustrated embodiment, is fixed to the movable bed **11** and an air switch assembly **16** which, in the illustrated embodiment, is affixed to the fixed or stationary bed **10** thereof. It will be apparent from the description below that the position of the plunger **15** and the air switch assembly **16** can be reversed, if desired. Also, in the illustrated embodiment, the air switch assembly **16** is illustrated as being formed as an integral part of the mold half **12** affixed to the stationary bed **10**, however, under normal circumstances, the air actuator device **14** preferably and advantageously has the plunger **15** and the air switch assembly **16** affixed to the stationary bed **10** and the movable bed **11**, in operable relationship with one another. In other words, instead of specially forming the mold halves **12** to receive the plunger **15** and the air switch assembly **16**, the latter are separately formed and affixed to the beds of the molding apparatus, in operable relationship with one another.

In FIG. **2**, the construction of the air switch assembly **16** is shown and it can be seen to include a housing **19** which preferably is a solid block of material such as metal having a slotted cavity **20** formed therein for receiving a lever trigger assembly **21** and a bore **22** for receiving therethrough the plunger **15**, as described more fully below. A top plate or cover **23** is affixed to the housing **19**, by means of set screws **24** or the like. The top plate **23** has a keyhole-like slot **25** formed therein for receiving the plunger **15** and for exposing a portion of the lever trigger assembly **21**.

The lever trigger assembly **21** includes an elongated generally rectangular-shaped lever arm **28** which is pivotally secured within the slotted cavity **20** by means of a pivot pin **29** disposed in one end thereof, so that the lever arm **28** rotatably pivots back and forth, about its one end. A stop pin **30** is provided within the slotted cavity **20** and is engaged by the upper end of the lever arm **28** to control its forward most position.

A trigger lever **32** is pivotally secured by means of a pivot pin **33** within a generally centrally disposed slotted cavity **31** within the lever arm **28**. The trigger lever **32** is generally triangular shaped, with a portion of its base abutted against the face of the lever arm **28** and with its apex disposed within the bore **22** so as to be engaged by the plunger **15**, as more fully described below. An extension on the base of the trigger lever **32** extends into the slotted cavity **31** and is bored to receive the pivot pin **33**.

The lever arm **28** and the trigger lever **32** both are provided with a bore for receiving therein a biasing means **35** in the form of a helical spring which has its opposite ends secured by means of retaining pins **36** and **37**. The biasing means or spring **35** normally biases the base of the trigger lever **32** against the face of the lever arm **28**, as illustrated.

The plunger **15** has a plunger sleeve affixed to it which has its upper and lower ends rounded to provide a camming surface which engages the rounded apex of the trigger lever **32,** to operate the latter as more fully described below. The plunger sleeve **40** is positionally secured on the plunger **15,** by means of a pin **41** extended through a bore in it, and one of a series of cross holes **42** in the plunger **15,** as more fully described below. The plunger sleeve **40** is of a length which is proportioned to provide a blast of compressed air for a predetermined time interval, in a manner described more fully below. Accordingly, a number of the plunger sleeves **40** normally are provided, with each being of a different length so various different time intervals can be established. Each of these plunger sleeves is adapted to be inserted onto the plunger **15** and then secured in position thereon, in the manner described above.

The lever arm **28,** upon being pivotally operated, engages the end of a cylinder-shaped piston valve **44** to operate it, as described below. The piston valve **44** has a head portion **45** which is slidably received within a bore **49** extending longitudinally through the housing **19** of the air actuator device **14.** The opposite end of the piston valve **44** is formed with a valve seat portion **47** and, between the end portion **45** and the valve seat portion **47** there is a reduced diameter portion **46.** Progressively larger diameter bores **60** and **61** concentric with the bore **49** are formed in the housing **19.** The innermost end of the bore **61** is provided with a valve seat **50** which may be of nylon or the like, with the same being retained in operative relationship with the valve seat portion **47** on the piston valve **44,** by means of a threaded seating ring **51.** The opposite end of the bore **61** is closed by means of a threaded plug **55.** An O-ring **58** can be disposed between the housing **19** and the plug **55,** to seal the bore **61** when the plug **55** is threaded into the housing **19.** A cavity **56** is formed in the plug **55.** Biasing means in the form of a helical spring **53** is provided within the bore **61,** with its one end seated within the cavity **56** in the plug **55** and with its other end engaged with the valve seat portion **47** of the piston valve **44.** The spring **53** normally biases the piston valve **44** to seatingly engage its valve seat portion **47** with the valve seat **50,** to close or block the bore **60.** A slot **57** for a screwdriver or the like can be provided in the terminal end of the plug **55,** for removing and replacing it. An air inlet **63** is provided into the bore **61,** and an air outlet **64** is provided into the bore **60.** The air inlet **63,** in the illustrated embodiment, is coupled with a source of compressed air and the air outlet **64** is coupled with a tubing **65** (FIG. **1**) having its end disposed within the cavity **13** in the mold half **12.** In operation, in the illustrated embodiment, when the piston valve **44** is operated to open, the compressed air is allowed to flow from the bore **61** into the bore **60,** and from there through the tubing **65** to provide a blast of air for ejecting molded parts from the cavity **13.**

Now that the construction of the air actuator device **14** has been described, its operation may be described as follows. As indicated above, the plunger **15** and the air switch assembly **16** are affixed to the movable and stationary beds in any suitable fashion, so that the plunger **15** extends into and through the bore **22,** as the mold halves close. In the illustrated embodiment, the air actuator device **14** is used to control the supply of compressed air to the cavity **13** to eject a molded part therefrom, hence the air actuator device **14** is positioned to be operated on the upstroke, or when the mold halves are being opened.

Accordingly, for the purpose of explaining the operation of the air actuator device **14,** assume that the mold halves are closed and that the plunger sleeve **40** on the plunger **15** have been extended through the bore **22,** to the position illustrated in FIG. **2.** As the mold halves open, it can be seen that the plunger **15** and hence the plunger sleeve **40** moves upwardly through the bore **22,** and the end of the plunger sleeve **40** engages the end of the trigger lever **32** and forces the end of it out of the bore **22,** as illustrated in FIG. **3.** When the trigger lever **32** is engaged by the plunger sleeve **40,** a portion of its base is forcibly engaged against the face of the lever arm **28,** causing it to pivot rearwardly within the slotted cavity **20,** about the pivot pin **29.** The lever arm **28,** in pivoting, engages the end of the piston valve **44,** to unseat the valve seat portion **47** from the valve seat **50,** against the action of the biasing spring **53.** With the piston valve **44** open, the compressed air is permitted to flow in through the air inlet **63,** through the bore **61,** into the bore **60,** and out of the air outlet **64,** to provide a blast of compressed air to eject the molded part from the cavity **13.** The blast of compressed air continues until the plunger sleeve **40** is withdrawn from the bore **22,** and disengages from its contact with the trigger lever **32,** as illustrated in FIG. **4.** At this time, the biasing spring **53** again seats the valve seat portion **47** with the valve seat **50,** to close the piston valve **44** and cut off the supply of compressed air from the bore **61** into the bore **60.** The lever arm **28** pivots forwardly within the slotted cavity **20,** until it engages against the stop pin **30.**

As can be seen in FIGS. **3** and **4,** the time duration of the blast of compressed air is dependent upon the overall length of the plunger sleeve **40** affixed to the plunger **15.** In other words, the longer the length of the plunger sleeve **40,** the longer will be the duration of the blast of compressed air. Accordingly, by changing the length of the plunger sleeve **40,** the time duration of the blast of compressed air can be lengthened or shortened. Also, the time at which the blast of compressed air is provided can be controlled by the position of the plunger sleeve **40** on the plunger **15,** i.e., by raising or lowering the plunger sleeve **40** on the plunger sleeve **15.**

On the next downstroke of the plunger **15,** when the mold halves are closed, the plunger **15** and the plunger sleeve **40** thereon are again extended through the bore **22** in the air switch assembly **16.** At this time, however, when the plunger sleeve **40** engages the trigger lever **32,** it is caused to pivot downwardly about the pivot pin **33,** as illustrated in FIG. **5.** In pivoting in this fashion, the base of the trigger lever **32** does not engage or operate the lever arm **28** to actuate the piston valve **44,** thus the valve remains closed. When the plunger sleeve **40** passes beyond the trigger lever **32,** as illustrated in FIG. **2,** the biasing spring **35** causes the trigger lever **32** to again pivot about the pivot pin **33** so that its base portion is engaged against the face of the lever arm **28.** Now, when the plunger **15** and the plunger sleeve **44** are again drawn upwardly through the bore **22,** as in FIG. **3,** the lever trigger assembly **21** is again operated to engage the piston valve **44** to open it.

From the above description it can be seen that the air actuator device is operative to provide a blast of air at

a predetermined time during the sequence of operation of the molding apparatus, by merely properly positioning the plunger sleeve **40** on the plunger **15.** Also, by properly proportioning the length of the plunger sleeve **40,** the length or duration of the blast of compressed air also is adjustable. The operation is mechanical in operation, hence no electrical power is required, as in the past. Further still, while the air actuator device **14** is illustrated to be operable on the upstroke of the plunger **15,** it is readily apparent that the operation of the device can be made to operate on the downstroke of the plunger **15,** merely by turning the air switch assembly **16** upside down. Further still, while in the illustrated embodiment, the air actuator device **14** is used to control a blast of compressed air to eject a part from the mold, it can as well be used to eject stamped parts and/or slugs, or to direct material through a stamping die, or for various other operations where a controlled air stream or blast is required.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and certain changes may be made in the above construction. Accordingly, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Now that the invention has been described, what is claimed as new and desired to be secured by Letters Patent is:

1. In combination with apparatus having a stationary bed and a movable bed, a fluid actuator device for controlling the supply of a fluid to said apparatus to eject a workpiece therefrom during the course of operation thereof comprising, in combination: a plunger affixed to one of said stationary and movable beds, a fluid switch assembly affixed to the other one of said stationary and movable beds having a house, a bore extending through said housing for receiving therethrough said plunger as said movable bed is moved relative to said stationary bed, a lever trigger assembly within said housing having a lever arm pivotally affixed with respect to said housing and a trigger lever pivotally affixed to said lever arm in a position and fashion such as to pivotally operate said lever arm when said plunger is extended through said bore in one direction and to permit said plunger to pass through said bore in the other direction without said lever arm being pivotally operated, and a piston valve for controlling fluid flow through said fluid switch assembly to said apparatus, said piston valve normally being biased closed to block fluid flow therethrough and being operated by said lever arm when the latter is pivotally operated by said trigger lever to permit fluid flow therethrough.

2. The fluid actuator device of claim **1,** further including plunger sleeve means on said plunger for operating said trigger lever, said plunger sleeve means being adjustably positioned along the length of said plunger and thereby controlling the time of operation of said trigger lever as said plunger is extended through said bore.

3. The fluid actuator device of claim **2,** wherein the length of said plunger sleeve means determines the time duration of the operation of said trigger lever.

4. The fluid actuator device of claim **3,** further including a plurality of said plunger sleeve means each of a different length, whereby the time duration of the operation of said trigger lever is variable.

5. The fluid actuator device of claim **1,** further including plunger sleeve means on said plunger for operating said trigger lever, the position and length of said plunger sleeve means both being adjustable, whereby the time of and the duration of the operation of said trigger lever can be variably controlled.

6. The fluid actuator device of claim **1,** wherein said fluid switch assembly is adapted to be reversibly affixed to the other one of said stationary and movable beds, whereby said fluid actuator device can be made to operate on the downstroke or on the upstroke of said apparatus.

7. The fluid actuator device of claim **1,** further including stop means, one end of said piston valve being engaged with said lever arm and normally biasing it against said stop means, an end of said trigger lever being disposed within said bore to be engaged by said plunger when said lever arm is biased against said stop means.

8. The fluid actuator device of claim **7,** further comprising biasing means normally biasing said trigger lever in operative relationship with said lever arm, whereby said lever arm is pivotally operated by said trigger lever when said plunger is extended through said bore in said one direction, said plunger in being extended through said bore in the other direction operating said trigger lever against said biasing means out of operative engagement with said lever arm.

9. The fluid actuator device of claim **8,** wherein said biasing means comprises a helical spring.

10. The fluid actuator device of claim **9,** further including plunger sleeve means on said plunger for operating said trigger lever, the position and the length of said plunger sleeve means both being adjustable, whereby the time of and the duration of the operation of said trigger lever can be variably controlled.

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