United States Patent [19]

Danielson

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[54] **ANTI-HOLDDOWN DEVICE WITH DIAPHRAGM ACTUATING SWITCH AND PISTON**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 276,886, July 31, 1972, abandoned.

[52] **U.S. Cl.** ..... **200/83 J,** 200/83 T, 200/34, 200/159 R

[51] **Int. Cl.** **H01h 35/34,** H01h 35/38

[58] **Field of Search** ..... 200/33 R, 34, 83 T, 160, 200/159 R, 82 R, 83 R, 83 S, 83 J

[56] **References Cited**

UNITED STATES PATENTS

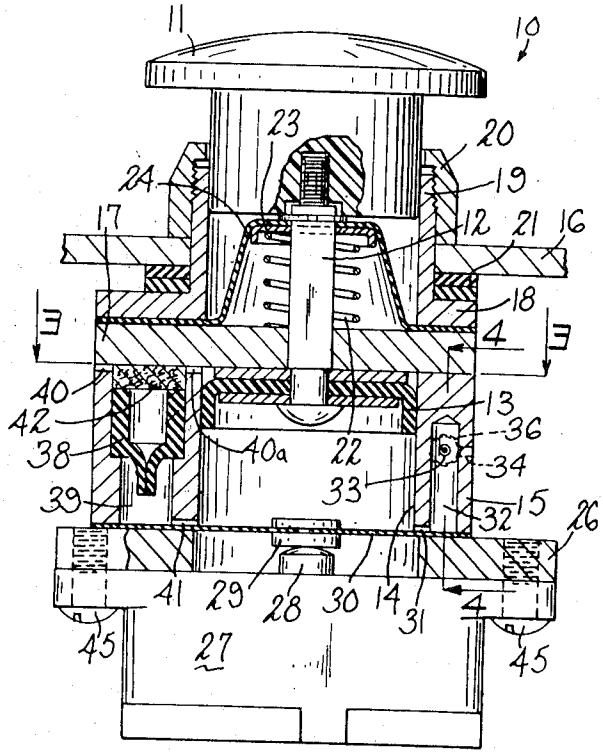
1,059,013	4/1913	Urquhart	200/34
3,109,076	10/1963	Bochan	200/34
3,156,792	11/1964	Long	200/83 T
3,246,094	4/1966	Zaske	200/83 T
3,535,479	10/1970	Smyers, Jr.	200/83 T

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Assistant Examiner—Gerald P. Tolin
Attorney, Agent, or Firm—DeLio and Montgomery

[57] **ABSTRACT**

This specification discloses an anti-holddown switch actuating mechanism in which a switch is operated by an increase in air pressure upon actuation of a piston-like plunger in a closed chamber, and means are provided to bleed off the increase in air pressure at a predetermined rate to insure opening of the switch a predetermined time after actuation thereof.

9 Claims, 7 Drawing Figures



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SHEET 1 OF 2

Fig. 1.

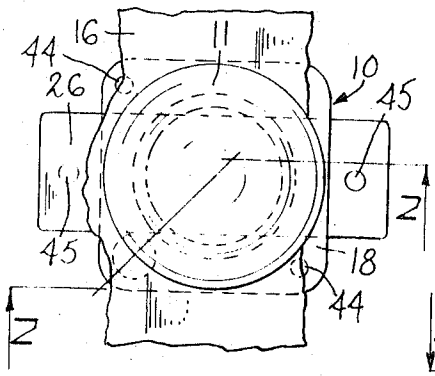


Fig. 2.

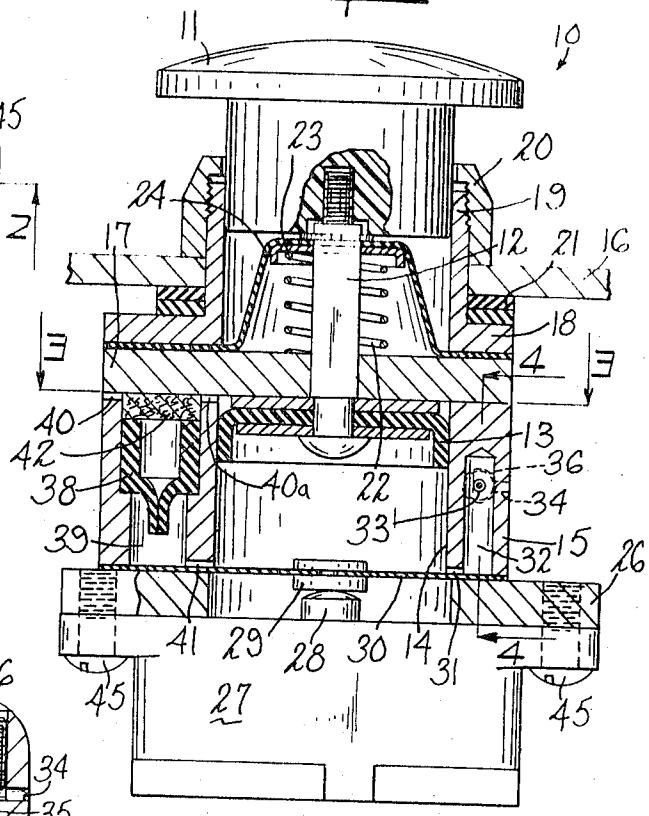


Fig. 3.

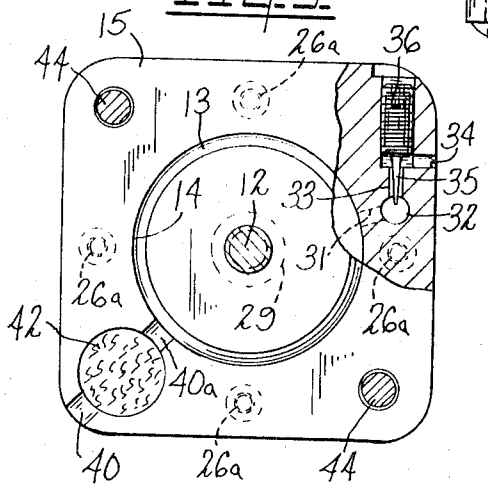


Fig. 4.

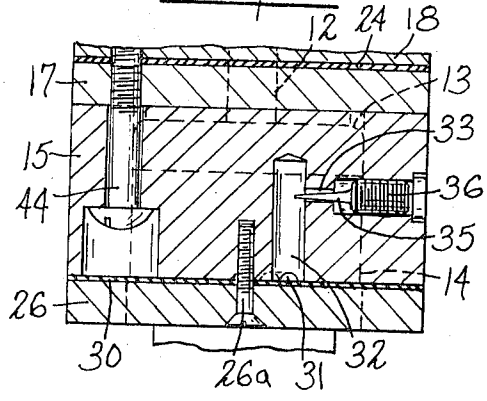


Fig. 5.

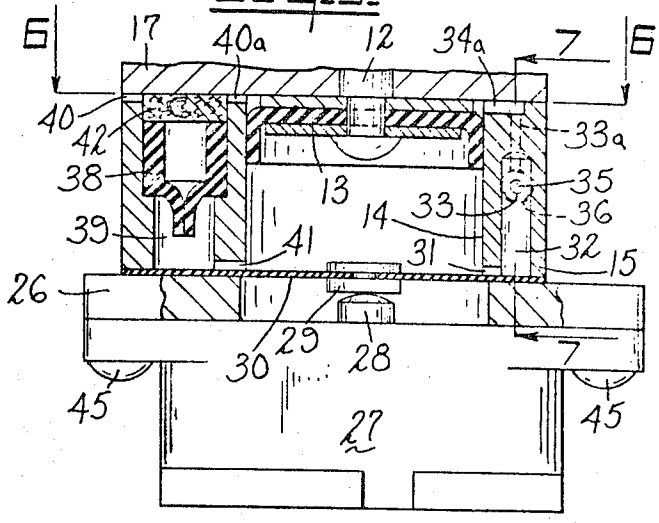


Fig. 6.

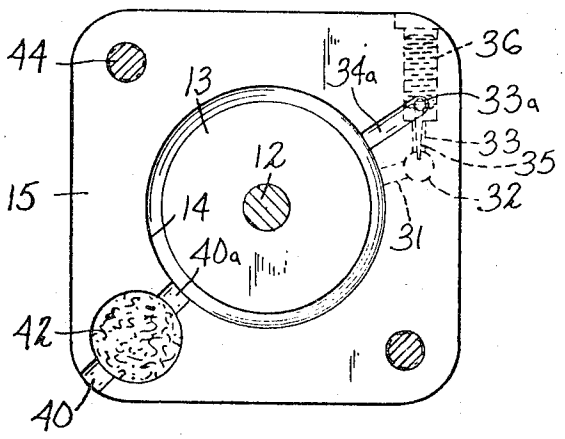
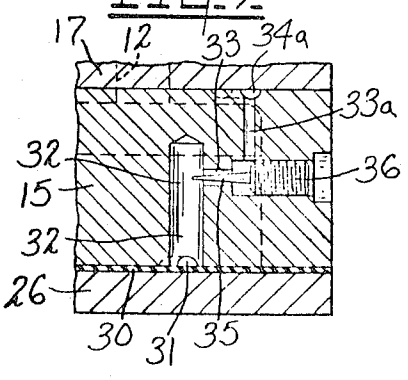


Fig. 7.



ANTI-HOLDDOWN DEVICE WITH DIAPHRAGM ACTUATING SWITCH AND PISTON

This application is a continuation-in-part of my co-pending application, Ser. No. 276,886, filed July 31, 1972, and now abandoned.

This invention relates to switches, and more particularly relates to switch actuating mechanisms which are termed anti-holddown devices in that the switch will open after a predetermined time after actuation thereof regardless of whether the operator maintains pressure on an operating knob or plunger.

Switches are often used in industry to operate forming tools and so arranged that the operator is required to depress two switch handles or levers simultaneously in order to operate the device. The general reason for this is to insure that the operator's hands are removed through a forming operation of the machine and thus minimize the possibility of injurious accident.

However, in many cases, the machine operators have attempted to disable the safety feature by laying a heavy object on or tying down one of the switches so that the switch would be permanently closed. This has led to the development of switches or switch-operating mechanisms which have a time-delay built in so that the switch will open a predetermined time after the closing thereof; hence, the name of anti-holddown switch.

The present invention relates to switches of this type and operates through the creation of an increased air pressure due to depression of a plunger. This build-up in pressure is bled off and the switch will then open a predetermined time later determined by the bleed rate. Such switches are generally known. However, those which are known are rather complicated in construction and expensive.

Accordingly, the present invention provides a switch actuating mechanism for an anti-holddown device which is simplified in construction, positive in operation in both the closing and opening modes and may be utilized with virtually any type of switch mechanism.

Briefly stated, the invention in one form thereof comprises wall means defining a cylindrical bore which is closed at one end thereof by a flexible diaphragm. A return biased piston or plunger is received within the bore and upon depression thereof increases the pressure in the chamber to a magnitude sufficient to flex the diaphragm and operate a switch. A passage is defined in the wall means communicating with the ambient atmosphere and the area of said passage may be controlled to predetermine the rate at which pressure is bled off and therefore the opening of the switch. A further passage may be defined in the walls communicating, in one direction, with the ambient atmosphere to aid in resetting of the piston.

An object of this invention is to provide a new and improved switch actuating and release mechanism of the type described.

Another object of this invention is to provide a switch actuating mechanism of the type described having new and improved means for regulating the time of resetting of a switch operated thereby.

A further object of this invention is to provide a switch actuating mechanism of the type described having new and improved means for decreasing the time of resetting of the switch operating piston.

The features of the invention which are believed to be novel are particularly pointed out and distinctly

claimed in the concluding portion of this specification. The invention, however, both as to its operation and organization, together with further objects and advantages thereof, may best be appreciated by reference to the following detailed description taken in conjunction with the drawings, wherein:

FIG. **1** is a top plan view of a device embodying the invention;

FIG. **2** is a view seen in the plane of lines **2**—**2** of FIG. **1**;

FIG. **3** is a view seen in the plane of lines **3**—**3** of FIG. **2**;

FIG. **4** is a view seen in the plane of lines **4**—**4** of FIG. **2**;

FIG. **5** is a view similar to a portion of FIG. **2**, showing another embodiment of the invention;

FIG. **6** is a view seen in the plane of lines **6**—**6** of FIG. **5**; and

FIG. **7** is a view seen in the plane of lines **7**—**7** of FIG. **5**.

A device **10** embodying the invention comprises an operating knob **11** threadably attached to a plunger **12** at one end of the plunger. The other end of the plunger carries a resilient piston member **13** disposed within a cylindrical bore **14** defined by a housing means **15**. The device, as shown, is attached to a mounting panel or other support **16**.

Plunger **12** extends through a top wall member **17** which is secured to a support member **18** threaded along its upper portion **19** to receive a matingly threaded clamping collar **20**. One or more resilient spacing members **21** may be disposed between member **18** and panel **16** to insure tight fastening of the apparatus to the panel member. A return spring **22** acts between the upper surface of wall member **17** and a spring seat **23** carried on plunger **12**. A flexible diaphragm and cover **24** may enclose the spring return mechanism as illustrated.

As thus far described, the mechanism from wall **17** up including the plunger **12** (without piston **13**) is a fairly common, manually operated, spring return actuating device.

A mounting member **26** is secured to housing **15** as by means of bolts **26***a*. A standard switching mechanism **27** is carried by member **26**. The switch within housing member **27** has an operating plunger **28** which is spring returned. Plunger **28** is engaged by a contact button **29** carried by a flexible diaphragm **30** of rubber, nylon, or similar material disposed between the bottom of housing **15** and member **26** and sealing the lower end of cylindrical bore **14**.

When operating knob **11** is depressed to move plunger **12** and piston member **13** downwardly, the air pressure in cylindrical bore **14** increases which distends diaphragm **30** downwardly carrying contact button **29** therewith. The plunger **12** is of insufficient length to directly actuate the switch. Button **29** depresses plunger **28** to close the switch. The increase in air pressure in cylindrical bore **14** may bleed off through a small orifice **31**, a passage **32** defined in wall member **15** and, hence, through passages **33** and **34** to the ambient atmosphere. The effective area of passage **33** is controlled by a tapered portion **35** on an adjustment screw **36** where the tapered portion **35** extends into passage **33** and regulates the area thereof. By varying the position of adjustment screw **36** the effective area of pas-

sage **33** for bleeding of pressure from cylindrical bore **14** may be regulated.

Thus, as the air pressure in cylindrical bore **14** is increased to cause contact button **29** to depress switch plunger **28,** the air pressure in cylindrical bore **14** will be greater than atmospheric and will begin to bleed off through orifice **31,** passage **32** and passages **33** and **34.**

After a predetermined time, dependent upon the setting of screw **36,** the pressure in cylindrical bore **14** will have decreased to a point where it is insufficient to distend diaphragm **30** and hold plunger **28** down. The bias on switch plunger **28** will release the switch regardless of whether the operator maintains knob **11** in a depressed condition. Assume that the operator has released knob **11** after actuation of the switch, and plunger **12** starts to move upwardly under the influence of energy previously stored in spring **22.** Due partially to the sealing engagement of piston **13** against the wall of bore **14** and the resulting friction thereof, there will be a delay in complete resetting of knob **11.** Also, as the spring **22** moves the piston upwardly the pressure in cylindrical bore **14** will decrease as the volume increases. This acts as a resistance against spring **22.** To overcome this and provide a more positive return, a one-way fluid diode **38** is provided, carried in a recess **39** provided therefor in housing **15.** Diode **38** provides communication through openings **40** and **41** to bore **14.**

The fluidic diode **38** has a filter **42** provided at the opening thereof in communication with passage **40.** Fluidic diode **38** acts as a check valve. When piston **13** is moved to compress the air in bore **14,** the diode **38** remains closed. However, as the piston **13** moves upwardly as viewed in FIG. **2** and the pressure in bore **14** decreases, ambient air may flow through orifice **40,** filter **42,** diode **38,** passage **41** and into bore **14** to increase the recovery rate of the actuating mechanism. Additionally, an opening **40***a* is provided in bore **14** leading to passage **39** so that as piston **13** rises, the air therein is provided with an escape. Filter **38** guards against any possibility of a build-up of dust or other solids in bore **14.**

A device embodying the invention is relatively economical to manufacture and produce inasmuch as it utilizes a readily available standard actuating mechanism as previously described, and a common switch. These elements may be readily attached to the pressure section as by means of bolts **44** which attaches housing member **15** to member **17** and bolts **45** which attaches switch **27** to member **26.**

It will be understood that when the switch is normally used, i.e., depression and release of knob **11,** switch plunger **28** is released after actuation thereof. Piston **13** then quickly recovers aided by the air admitted through diode **38.**

A further embodiment of the invention is shown in FIGS. **5 – 7** wherein like parts to the structure of FIGS. **1 – 4** bear like reference numerals.

In the second embodiment, the increased pressure in bore **14** due to depressing piston **13** is bled off to the upper portion of bore **14** through passage **34***a* defined in the upper surface of housing **15.** A passage **33***a* provides communication between passages **33** and **34***a.* There is no direct communication to the outside of housing **15.** The rate of bleed is determined by the setting of valve screw **36** and tapered portion **35** thereof in passage **33,** as heretofore explained.

This arrangement recirculates the air within housing **15,** and minimizes the amount of fresh air brought into the housing, thereby minimizing the possibility of dirt and dust entering the chamber defined by housing **15** or from clogging passage **34** from the outside.

In operation, as plunger **12** is depressed, piston **13** moves down, increasing the pressure therebelow and forcing diaphragm **30** downwardly to actuate switch **27.** The pressure commences to bleed off through orifice **31,** passage **32, 33** and **34***a* to the portion of bore **14** above piston **13.** This relieves the pressure below piston **13** and times release of the switch as heretofore explained. At the same time, the amount of air otherwise entering bore **14** above piston **13** is minimized. As piston **13** rises under the bias of spring **22,** the air above piston **13** is expelled through passage **40***a* and will be drawn through filter **42** and fluid diode **38** to the lower portion of bore **14** through passage **41.**

While the foregoing description describes an embodiment of the invention in closing a normally open switch, it will be apparent that the actuator may be utilized to open a normally closed switch.

It may thus be seen that the objects of the invention set forth as well as those made apparent from the foregoing disclosure are efficiently attained. Modifications to the disclosed embodiments of the invention as well as other embodiments thereof may occur to others skilled in the art. Accordingly, the appended claims are intended to cover all modifications to the disclosed embodiments as well as other embodiments thereof which do not depart from the spirit and scope of the invention.

What is claimed is:

1. An anti-holddown switching device comprising a housing member defining a pressure chamber having opposite ends, a flexible diaphragm closing said chamber at one end thereof, a switch disposed adjacent said diaphragm at said one end of said chamber and operable by said diaphragm when the pressure on said diaphragm reaches a predetermined value, a piston in said chamber adjacent the other end thereof and movable in a direction to decrease the volume of said chamber between said piston and said diaphragm and increase the pressure therein, a passage defined in said housing member by which pressure in said chamber between said piston and said diaphragm is bled therefrom, whereby pressure created in said chamber by said piston is reduced and said diaphragm releases said switch after a predetermined time independent of the position of said piston in said chamber.

2. The device of claim **1** further including a second passage in said housing member providing one way communication of air into said chamber between said piston and said diaphragm.

3. The device of claim **2** further including an opening in said housing member providing communication to said second passage from a point on the other side of the piston from said diaphragm.

4. The device of claim **2** further including a filter in said second passage.

5. The device of claim **1** wherein said passage provides communication to the ambient atmosphere.

6. The device of claim **1** wherein said passage provides communication to the chamber on the other side of the piston from said diaphragm.

7. An anti-holddown switching device comprising a housing member defining a pressure chamber having opposite ends, a flexible diaphragm closing said chamber at one end thereof, a switch disposed adjacent said diaphragm at said one end of said chamber and operable by said diaphragm when the pressure on said diaphragm reaches a predetermined value, a piston in said chamber adjacent the other end thereof and movable in a direction to decrease the volume of said chamber between said piston and said diaphragm and increase the pressure therein, a first passage defined in said housing member by which pressure in said chamber between said piston and said diaphragm is bled therefrom whereby, pressure created in said chamber by said piston is reduced and said diaphragm releases said switch after a predetermined time independent of the position of said piston in said chamber, means defining a second passage providing one-way communication of air into said chamber between said piston and said diaphragm, and an opening in said housing member providing communication to said second passage from said chamber.

8. The device of claim 7 wherein said first passage provides communication to the ambient atmosphere.

9. The device of claim 7 wherein said first passage provides communication to the chamber on the other side of the piston from said diaphragm.

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