March 23, 1954 T. HARRIS 2,672,892

HYDRAULIC ACTUATOR

Filed April 10, 1953

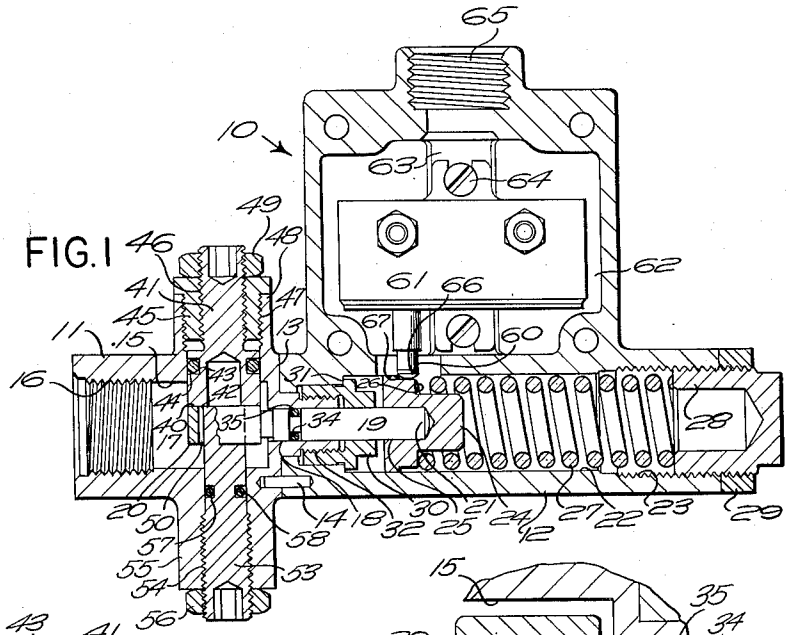


FIG. 1

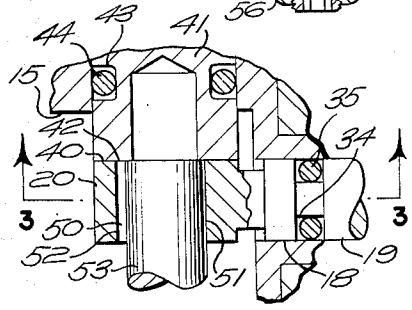


FIG. 2

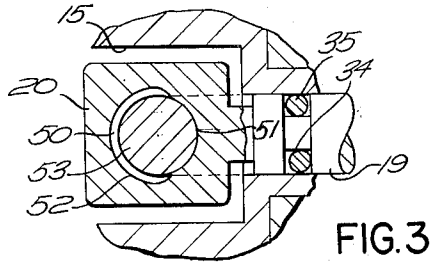


FIG. 3

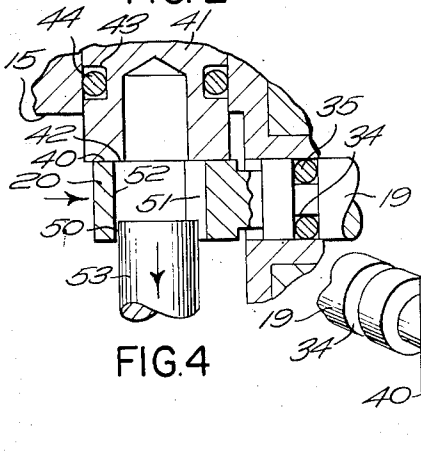


FIG. 4

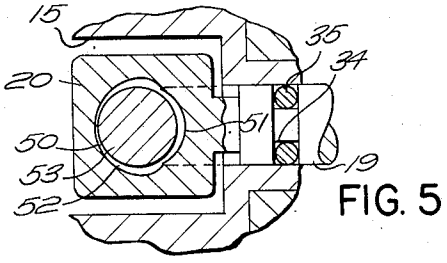


FIG. 5

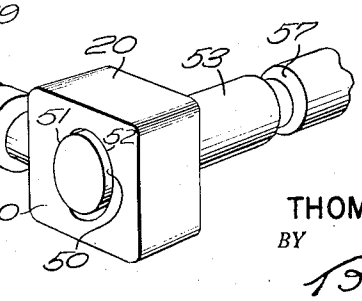


FIG. 6

INVENTOR.
THOMAS HARRIS
BY
Barlow & Barlow
ATTORNEYS

Patented Mar. 23, 1954 2,672,892

UNITED STATES PATENT OFFICE

2,672,892

HYDRAULIC ACTUATOR

Thomas Harris, Warwick, R. I., assignor to Harris & Stevenson Engineering & Development Co., Inc., a corporation of Rhode Island

Application April 10, 1953, Serial No. 348,086

5 Claims. (Cl. 137—792)

1

This invention relates to a device in which a plunger is hydraulically actuated, which plunger in turn controls some other mechanism such for instance as an electric switch.

The invention will be described in connection with the actuation of an electric pressure switch although it will be readily apparent that the hydraulic means employed for actuating this switch may have uses in connection with other mechanism.

Spring-pressed plungers which have a part located in a hydraulic pressure chamber may be caused to move against the action of the spring pressing them when the pressure in the chamber becomes greater than a certain predetermined value exercised by the spring, which may be controlled by an adjustment of the spring pressure applied to the plunger. When this predetermined value is exceeded, the plunger will move against the action of the spring, and as soon as the pressure in the chamber which forces the plunger against the action of the spring falls below this predetermined amount, the plunger then moves under pressure of the spring back into the chamber or to its original position. Such a device usually does not present an opportunity for any widespread differences in pressure for the opening and closing or movement of the plunger in one direction or the other automatically.

One of the objects of this invention is to provide for the movement of the plunger against the action of the spring at one predetermined pressure and the movement of the plunger under action of the spring back to its original position at a much lesser pressure.

Another object of this invention is to provide the movement in one direction and the return in the other direction under control of the liquid in the chamber by a control of the exposed areas which are used for the movement or resisting movement of the plunger in opposition to the spring pressure which is exerted thereon.

Another object of this invention is to provide an adjustment for varying the areas which are exposed, which adjustment may be made externally of the device.

With these and other objects in view, the invention consists of certain novel features of construction as will be more fully described and particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is a sectional view illustrating the hydraulic actuator as connected to an electric switch;

2

Figure 2 is a sectional view of a fragmental part of the plunger;

Figure 3 is a sectional view on line 3—3 of Figure 2;

Figure 4 is a sectional view similar to Figure 2 with the parts in a different relative position;

Figure 5 is a sectional view similar to Figure 3 with the parts in a different relative position;

Figure 6 is a perspective view of the plunger and the shield member in assembled relation which co-operate in the operation of the device.

In proceeding with this invention, I provide a chamber which receives liquid under pressure, which pressure is in turn to provide for the actuation of the device. A plunger extends out of this chamber but with a portion in the chamber so as to be subjected to the liquid pressure therein. A spring tends to force the plunger into the chamber but the plunger will be forced out of the chamber when the pressure in the chamber reaches a predetermined amount acting upon an area of the plunger which is in the chamber. A shield is provided for covering the area which may be utilized for forcing the plunger from the chamber against the action of the spring, and this shield may be adjusted so as to cover more or less of this area. When the plunger moves, its area which is shielded moves away from the shield and an increased area is exposed to the pressure in the chamber. Thus, the more the area that is covered, the greater will be the range of expanse between the pressure which will cause pushing the plunger outwardly of the chamber and the return of the plunger into the chamber under the actuation of the spring.

With reference to the drawings, the casing is designated generally 10 and is formed in two sections 11 and 12 abutting along the surface 13 and aligned by a dowel 14. A bore 15 in the casing 11 has a threaded end 16 and provides a chamber 17 which contains liquid under pressure which is to supply the motive force for actuating the mechanism. A bore 18 extends from the chamber 17, in which bore there is slidably located plunger 19 having a head 20 located in the chamber 17 and a free end portion 21 projecting into the bore 22 in the casing section 12, which is enlarged and threaded at 23 at its outer end.

A cap 24 fits on to the end 21 of the plunger 19 by reason of its recess 25 and is reduced to provide a shoulder 26 against which spring 27 presses for forcing the plunger into the chamber 17. The spring may be adjusted as to tension by a plug 28 engaging thread 23 and held in adjusted position by lock nut 29.

Nut 30 engages a shoulder 31 at the inner end of the bore 22 and has threaded engagement as at 32 with the portion of the casing section 11 so as to draw the casing sections 11 and 12 firmly together along the seat 13. This nut also has an opening through which the plunger passes and which also provides a bearing for the plunger in its movement. The plunger 19 is recessed as at 34 to receive O-ring 35 so as to prevent the passage of liquid in chamber 17 along the bore through which the plunger slides.

The portion 19 of the plunger is generally cylindrical but the head 20 is generally rectangular in shape, presenting an upper flat surface 40 which is engaged by a plug 41 also presenting a flat end along which the plunger may slide but which by reason of the engagement of these flat surfaces 40 and 42 will prevent the plunger from rotating in the bore in which it slides. This plug 41 is provided with a recess 43 which receives O-ring 44 to prevent the leaking of liquid from the chamber 17 along its surface, and it may be threaded into the chamber through the bushing 45 by reason of the threads 46, which bushing is also threaded as at 47 into boss 48 extending from the casing. A lock nut 49 serves to secure the plug 41 in adjusted position.

The head 20 of the plunger is provided with an opening 50 of a shape best shown in Figure 6. The wall 51 of this opening, which is nearest to the cylindrical portion 19 of the plunger, is cut away to a larger size as shown by wall 52 of the opening 50 at a point where a projection of the cylindrical portion 19 of the plunger would intersect this opening, as shown by dotted lines.

A shield 53 comprises a cylindrical member threaded as at 54 into a boss 55 of the casing so as to project into the chamber 17 different amounts depending upon the rotation thereof. A nut 56 locks this member in an adjusted position, while recess 57 and O-ring 58 serve to prevent liquid in the chamber 17 from passing along its surface. This shield 53 extends into the opening 50 and is of such a size as to engage the wall 51 thereof throughout its entire arc. Thus, if the shield 53 is moved into the chamber 17 to the position shown in Figure 2, the entire area of the arcuate surface 51 will be shielded from action by the pressure of the liquid in the chamber 17 and will also provide a stop to limit the movement of the plunger 19 into the chamber 17 under action of the spring 27. With the shield in this position, it will be apparent that the head of the plunger is perfectly balanced in the chamber and the pressure in the chamber will not in any way move or tend to move the plunger.

It will also be apparent that if the shield 53 is completely withdrawn from the opening 50, the maximum area of the arcuate surface 51 will be exposed to the fluid pressure which will all be unbalanced, tending to force the plunger against the action of the spring 27, and if this condition prevails, when the pressure in the chamber 17 reaches a predetermined amount to overcome the pressure of the spring 27, the plunger will move

to the right, as shown in Figure 1, and compress the spring, and just as soon as the pressure in the chamber 17 gets a little below the pressure of the spring, it will again move the plunger to the left. Should the shield 53 be half way into the opening, half of the surface area 51 would be exposed so that when the fluid pressure reached for instance one thousand pounds acting on half of this arcuate surface 51, it might overcome the pressure of the spring so that the plunger would be moved to the right. However, as soon as the plunger is moved to the right, the entire arcuate surface 51 is exposed to such pressure so that double the area is provided and the pressure would have to drop down to something in the neighborhood of five hundred pounds before the spring would return the plunger to its original position. By varying the shield 53 along the surface 51, I may provide different pressures at which the plunger will move in one direction and return in the other, thus varying the spread of these two values.

The cap 24 which moves the plunger 19 engages a switch actuator 60 projecting from a switch 61 which is mounted in chamber 62 of casing section 12 on a bracket 63 by means of screw 64. Conduits to this switch may be provided through the opening 65. The curved end 66 of this actuator 60 will ride up over a shoulder 67 on the cap to provide for this actuation. The cap might engage other arms to be moved as desired, or the plunger may actuate some other device.

I claim:

1. A device of the character described comprising a chamber for receiving liquid under pressure, a bore communicating with said chamber, a plunger in said bore with a head at one end located in said chamber, a spring urging said plunger into said chamber, a shield movable laterally of the movement of said plunger to cover varying amounts of the surface of said head exposed to the liquid pressure to select by choice of the area exposed the pressure at which the plunger will move against the action of the spring.

2. A device as in claim 1 wherein said plunger upon a movement leaving the shield exposes additional area for receiving liquid pressure to move the plunger against the action of the spring whereby a pressure drop is required materially below the amount for initial movement of the plunger for the return of the plunger under action of the spring.

3. A device as in claim 1 wherein said head has an opening into which said plunger projects.

4. A device as in claim 1 wherein said plunger engages but a portion of the wall forming said opening and on the side of the opening nearest said spring and acting as a stop to limit the movement of the plunger.

5. A device as in claim 1 wherein said shield being cylindrical and having threaded engagement with a portion fixed to the chamber to be rotated to vary its covering relation.

THOMAS HARRIS.

No references cited.