Sept. 13, 1960 S. REIS 2,952,267

SELF-REGULATING FLUID PRESSURE OPERATED POWER CYLINDER

Filed Nov. 22, 1957

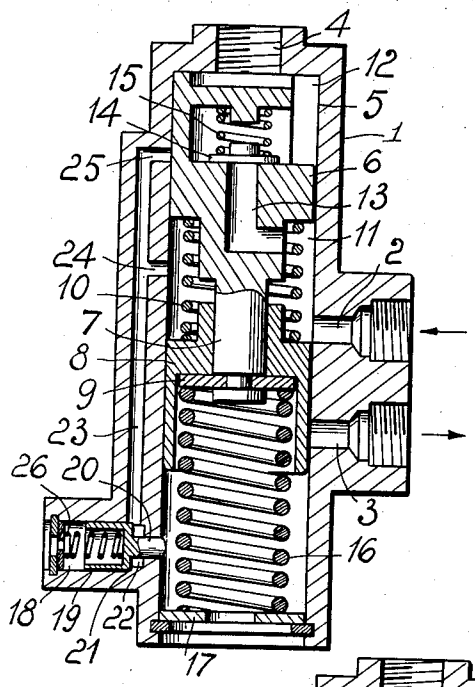


FIG. 1

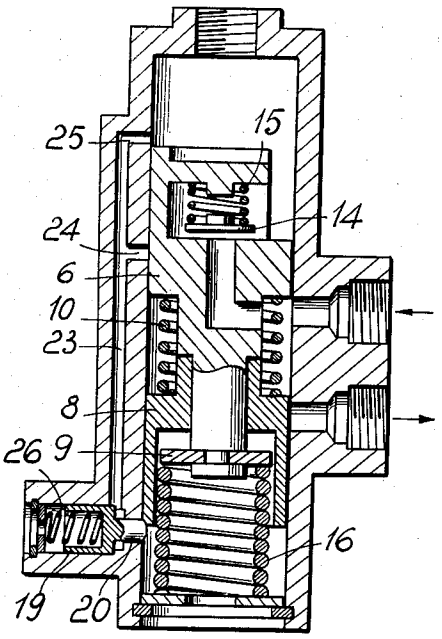


FIG. 2

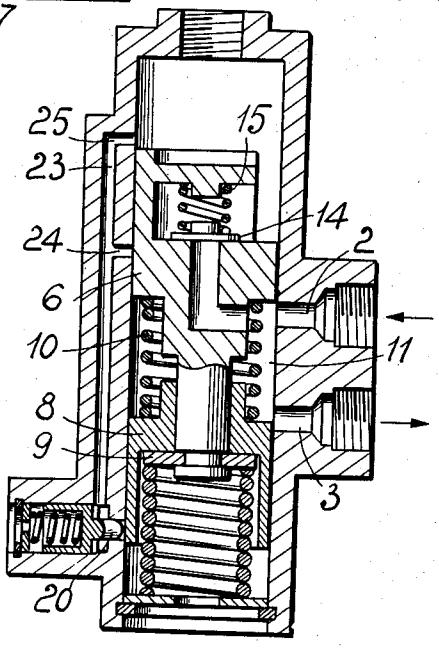


FIG. 3

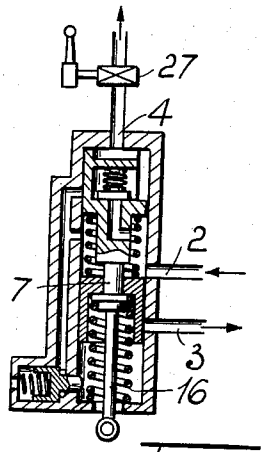


FIG. 4

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SELF-REGULATING FLUID PRESSURE OPERATED POWER CYLINDER

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2 Claims. (Cl. 137—115)

This invention relates to a fluid pressure operated power cylinder adapted to open and close automatically the supply of the operating fluid, when its pressure reaches a pre-set upper, respectively lower limit, thus relieving the source of fluid pressure from load, at the upper limit.

This invention may also be used in any fluid pressure operated power system, for maintaining the fluid pressure between pre-set limits. It provides a very simplified construction, which operates with effective precision in response to exact pressure limits, and avoids any condition that may cause to any components, what is commonly known as "chattering."

The objects, advantages and aims of this invention, will appear substantially, from the description given below with reference to one embodiment and its operation, shown schematically in the accompanying drawing wherein Fig. 1 shows a sectional view taken axially through the power cylinder; Fig. 2 shows the power cylinder with its components in one operative position; Fig. 3 shows the power cylinder with its components in a second operative position; and Fig. 4 shows the power cylinder in an arrangement for operating a power user.

With reference to the Fig. 1, the cylinder body **1** has a closed upper end, a lateral inlet port **2**, and a lateral outlet port **3**. The inlet port **2** is situated between the outlet **3** and the closed end of the cylinder **1**. A second outlet port **4**, is situated at the closed end of said cylinder **1**.

In the bore **5** of the cylinder **1** is arranged slidably, a compound piston **6–8** having a first upper part **6** with a stem **7**, and a second lower part **8** axially slidable thereon Said lower part **8** is kept at a certain distance from said upper part **6**, urged by a spring **10** against a retainer **9** fixed to said stem **7**. Said spring **10** is arranged between said parts **6** and **8**, in an intermediate portion of their length, said intermediate portion being recessed to form a first chamber **11**.

The upper part **6** is shaped so as to form in co-operation with the closed end of the cylinder **1**, a second pressure chamber **12**.

The first chamber **11** is in permanent communication with the inlet **2**, while the pressure chamber **12** is permanently communicating with the outlet **4**. A duct **13** in said upper part **6** connects the chambers **11** and **12**, and a valve **14**, loaded by a spring **15**, controls the passage through said duct **13**, so that fluid can flow from chamber **11** into chamber **12**, but not inversely.

A spring **16**, arranged between the retainer **9** and a second retainer **17** fixed to the open end of the cylinder **1**, urges said compound piston **6—8** upwards to the inner end of its stroke. At this position, the lower part **8** closes the outlet **3**.

A second bore **18** with a second piston **19** therein, is situated at the open end of the cylinder **1**, perpendicularly to the main bore **5**. A plug **20** fixed to the second piston **19**, projects through a hole of the cylinder wall, into the main bore **5**, and is adapted to stop the lower part

8 of the compound piston **6—8** on its way downwards to the outer end of its stroke, just before said lower part **8** can open the outlet **3**.

The second piston **19** is urged against an abutment **21**, formed by a restricted portion **22** of the bore **18**, by a spring **26**. The plug **20** fits the hole through which it projects into the main bore **5**, so that fluid from the restricted portion **22** cannot pass into said main bore **5**. The restricted portion **22** is communicating through a duct **23** and a port **24**, with the first chamber **11**, and through said duct **23** and a second port **25**, with the chamber **12**. The port **25** is situated so that it remains normally closed by the upper part **6** of the compound piston **6—8**, and is opened when said part reaches the outer end of its stroke, while the port **24** is situated so that it is closed by the same part **6**, before the port **25** is opened.

When the invention is to be used as a power cylinder, a cock **27**, (Fig. 4); or any known device adapted to open and close the outflow from chamber **12**, will be fitted to the outlet port **4**, and the power will be transmitted to the power user not shown, through the piston stem **7**, to which said power user will have to be connected. In this case, the cylinder will work under load, when the outlet **4** will be closed.

For use to maintain pressure between pre-set limits in a fluid pressure operated system, the pressure pipe (not shown) through which pressure fluid is supplied to said system will have to be connected to said outlet **4**.

The fluid supplied through the inlet port **2** reaches the pressure chamber **12** through the first chamber **11**, the duct **13** and the valve **14**, the latter being forced to open, by the same pressure fluid. With the outlet **4** opened, there is no rise in pressure more than necessary to keep the valve **14** open and to overcome the resistance to flow. When the outlet **4** is closed, the pressure in chamber **12** rises and the compound piston **6—8** moves as one solid piece, downwards to the open end of the cylinder **1**, until the lower edge of its lower part **8** will be stopped by the plug **20**. The pressure will continue to rise until the tension of the spring **10** is overcome. At this point, while the lower part **8** is withheld by the plug **20**, the upper part **6** continues to move downwards, closing first the port **24** (Fig. 2) and opening successively the port **25** (Fig. 2 and Fig. 3).

Pressure is now admitted within the restricted portion **22** of the bore **18**, urging the piston **19** to withdraw the plug **20**, so that the spring **10**, whose tension, properly selected, is higher than that of the spring **16**, will force rapidly the lower part **8** of the compound piston **6—8**, downwards to the outer end of its stroke, thus opening the outlet **3**. The pressure within the first chamber **11**, and thus also that of the source that supplies it, is therefore relieved, while the pressure in chamber **12** remains maintained, the valve **14** closing the passage back to the duct **13**.

When the outlet **4** is opened, or the pressure in the pressure pipe to it connected, drops below a limit depending upon the tension of the spring **16**, the compound piston **6—8** is urged again upwards to the inner end of its stroke, closing the outlet **3** and the port **25**, and opening the port **24**, through which also the second piston **19** and the restricted portion **22** of the bore **18**, will be relieved of pressure. The plug **20** and the second piston **19** can thus be returned by the spring **26** to their initial position.

If now the outlet **4** is closed again, or the pressure in the pipe connected to said outlet **4** rises again, the described operation will be repeated.

It will be remarked that the upper limit of pressure can be made to depend either upon the tension of the spring **10**, or that of the spring **26**. In this latter case,

the upper pressure limit setting may be regulated from outside, by means of any well known arrangement adapted for this purpose.

It will further be remarked that there is no possibility for chattering of any of the movable components of this invention, because there is none that can remain in an uncertain condition, wherein the opening of a fluid passage has been started, but cannot be completed.

I claim:

1. A self regulating fluid pressure operated power cylinder comprising a cylinder body with a cylinder bore, a first upper piston part therein and a stem fixed thereto for transmitting the piston power to any power user outside said power cylinder, a second lower piston part carried slidable on said stem, a spring between said piston parts urging the lower piston part against a retainer of said stem apart from the upper piston part, a recessed portion between said upper and lower piston part forming a first chamber in said cylinder bore, an inlet port opening permanently into said first chamber for continuously admitting pressure fluid therein, a relief outlet located along the cylinder bore so as to be fully opened into said first chamber by the lower piston part when said lower piston part is at the outer end of its stroke, a second chamber for the fluid under pressure formed between the upper piston part and the upper closed end of the cylinder bore, an outlet port of said second chamber for the egress of said fluid under pressure therefrom, the upper piston part separating said first from said second chamber, a duct and a valve between said chambers for admitting pressure fluid from the first into the second chamber but not inversely, resilient means urging the stem and the upper piston part to the inner end of its stroke, withdrawable springloaded means to stop the lower piston part along the piston stroke at a position just before the relief outlet begins to open and fluid pressure operated means for withdrawing said springloaded means so that the lower piston part can be freely displaced to the outer end of its stroke by its expanding spring, thus opening fully said relief outlet.

2. A self regulating fluid pressure operated power cylinder as in claim 1, including a duct for transmitting fluid pressure to actuate the withdrawing means, a port connecting said duct to the first chamber and another port connecting said duct to the second chamber, the said other port being kept normally closed by the upper piston part and located along the cylinder bore so that it is uncovered when said upper piston part reaches the outer end of its stroke, and the said port being normally open and located so that it is closed by the upper piston part just before said other port is uncovered.

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