

June 8, 1954

W. R. GROVES
UNLOADING DEVICE

2,680,447

Filed March 6, 1950

2 Sheets-Sheet 1

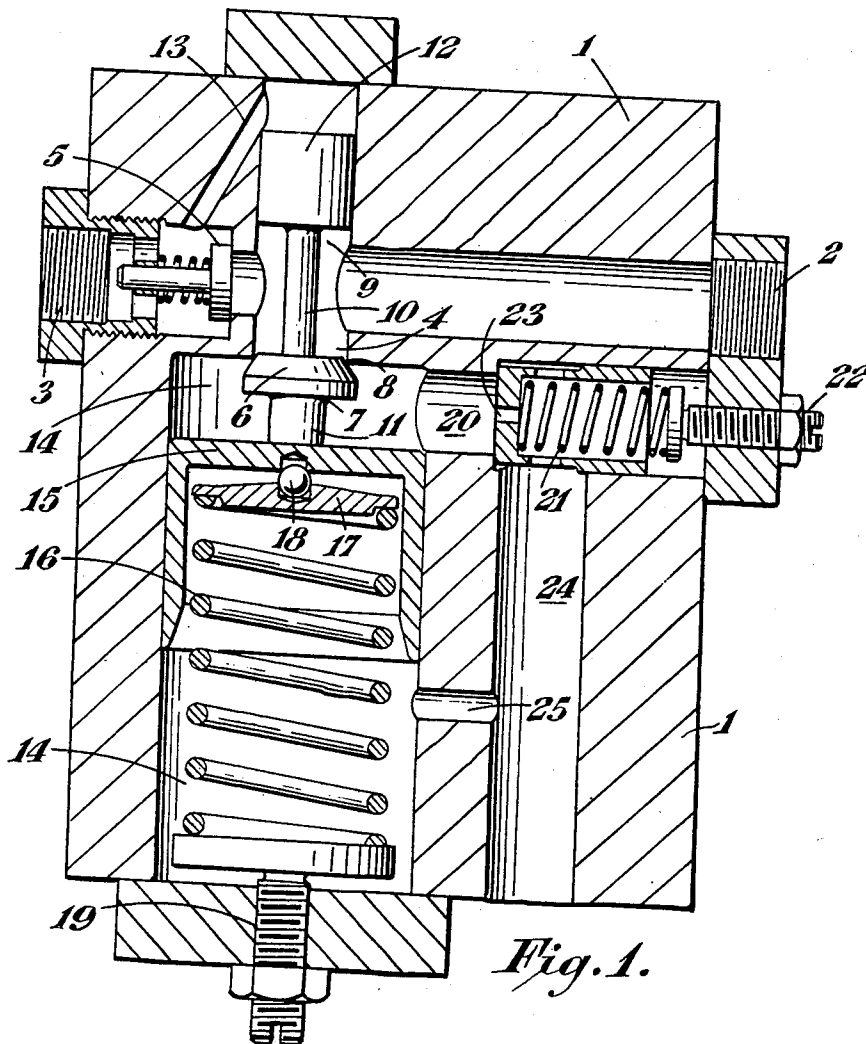


Fig. 1.

Inventor:
Walter Robert Groves;
By his attorneys,
Baldwin, Wright, & Prevost

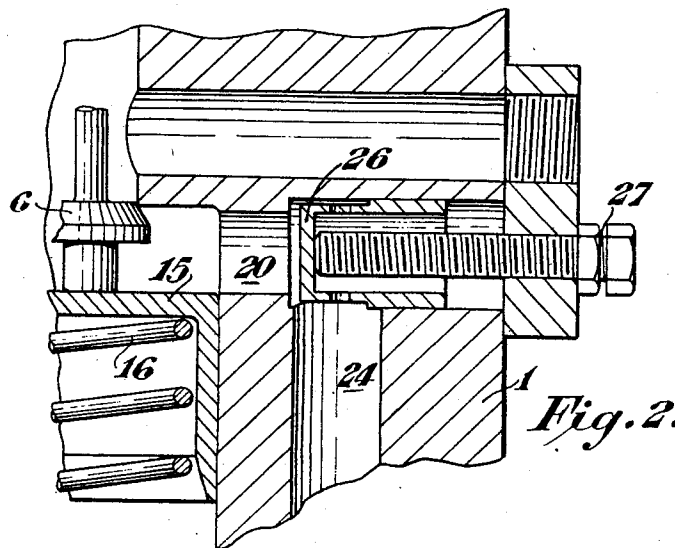
June 8, 1954

W. R. GROVES
UNLOADING DEVICE

2,680,447

Filed March 6, 1950

2 Sheets-Sheet 2



Inventor:
Walter Robert Groves;
By his attorneys,
Baldwin, Wright, & Groves

Patented June 8, 1954

2,680,447

UNITED STATES PATENT OFFICE

2,680,447

UNLOADING DEVICE

Walter Robert Groves, London, England, assignor
to British Industrial Plastics Limited, London,
England, a British company

Application March 6, 1950, Serial No. 147,795

Claims priority, application Great Britain
March 7, 1949

6 Claims. (Cl. 137-108)

1

This invention relates to cut-out valves which control a fluid pressure supply to a fluid pressure system through a non-return valve, it being required to maintain the fluid in the fluid pressure system within a certain range of pressures. The fluid pressure supply in said fluid pressure system is hereinafter termed "supply pressure," and the fluid pressure in said fluid pressure system is hereinafter termed "system pressure." Such a cut-out valve is herein defined as a valve which, when the system pressure exceeds a certain predetermined value, instead of opening just enough to allow the unwanted delivery from the pressure system to escape at full pressure as in a relief valve, opens wide so as to reduce the supply pressure to some value at or near zero.

The invention essentially relates to such cut-out valves of a type comprising a main valve operably associated with a smaller piston adapted to be acted upon by a system pressure so as to effect an initial minor opening of the main valve when the system pressure exceeds a certain value, and also operably associated with a larger piston which is spring-loaded so as to maintain the main valve on its seating during normal operation, but which is adapted to be influenced by fluid passing the main valve after said initial opening to effect a further and major opening of the main valve.

A cut-out valve of this type is described in my prior British Patent No. 567,645, but the construction of this valve involves certain disadvantages. The main disadvantage is that the duct leading from the main valve and through which the supply pressure is relieved is constituted by a hollow stem of the main valve into which fluid flows through holes drilled in the mushroom head of the main valve. Since the cylindrical stem of the main valve is necessarily of limited diameter, it is not possible to obtain as speedy a relief of the supply pressure as may often be desired.

It is the object of the present invention to produce an improved design which overcomes this disadvantage.

According to the present invention, a cut-out valve of the type specified is characterised in that the fluid pressure supply is adapted to pass between the main valve and that face of the smaller piston not acted upon by the system pressure and the fluid which passes the main valve is adapted to act on one side of the larger piston, against the spring, there being provided a duct formed in the outer casing of the cut-out valve which connects said side of the larger

2

piston via a restriction to the other side of the larger piston and to an exhaust pipe.

In the preferred form of the device the small piston is integral with a stem of the main valve and the two pistons and the main valve are preferably coaxial. There are certain advantages to be obtained by making the area of the face of the smaller piston which is acted upon by the supply pressure slightly greater than the area of the face of the main valve which is also acted upon by the supply pressure, but the device works quite satisfactorily if these areas are equal and this would usually be preferable from the design point of view.

There may suitably be provided means for adjusting said restriction from the outside of the casing.

The restriction has the purpose of causing a differential pressure on the two sides of the larger piston and may suitably comprise an adjustable aperture or a combination of a set aperture with a lightly spring-loaded valve. The use of the adjustable aperture by itself is generally preferable and can be used to advantage when the delivery of the pump providing the supply pressure is constant, but when the said delivering may vary to a substantial degree it is desirable to use the said combination of aperture and valve.

As an illustration of the invention, a suitable device will now be described by reference to the accompanying drawing in which:

Figure 1 is a sectional elevation of the device using a valve restriction, and

Figure 2 is a sectional elevation of part of the device showing the use of an adjustable aperture restriction instead of valve restriction.

A compact unit with an outer casing 1 has a connection 2 to a pressure supply and a connection 3 to a fluid pressure system. Between the connections 2 and 3, there is located a valve chamber 4 fed from the pressure supply and a non-return valve 5 preventing backflow from the system to the valve chamber 4. The head 6 of a spring-loaded main valve 7 acts on a seating 8 formed in one wall of the valve chamber 4. In the opposite wall is a cylinder 9 which is coaxial with stems 10 and 11 of the main valve 7 and within which operates a small piston 12 which is integral with the stem 10. The diameter of the cylinder 9 is equal to the diameter of the valve seating 8. On the other side of the non-return valve 5, a bore 13 through the casing 1 connects the fluid pressure system with the top face of the piston 12.

3 On the underside of the valve head 6 is another cylinder 14 coaxial with the cylinder 9 and within which operates a large piston 15, adapted to contact the stem 11 of the valve head 7. The face area of the large piston 15 is 8-10 times greater than the area circumscribed by the valve seating 8. On the underside of the piston 15 is a powerful spring 16 which acts between the bottom end of the cylinder 14 and a spring plate 17 bearing on the center of the underside of the piston 15 through a small polished ball bearing 18 to allow a constant axial thrust of the spring 16 on the piston 15, the thrust constituting the spring-loading of the main valve 7. The loading on the spring 16 is adjustable by means of a screw 19.

A passage 20 connects the top half of the cylinder 14 to a lightly spring-loaded valve 21, e. g. arranged to lift at about 8 p. s. i., contained in the outer casing 1 and adjustable by a screw 22. A leak aperture 23 is disposed in the head of the valve 21. A passage 24 connects the valve 21 to a storage tank or to a pump means providing the supply pressure. Another passage 25 connects the passage 24 to the cylinder on the underside of the piston.

In Figure 2 there is shown the valve 21 replaced by a cock 26 which is adjustable by a screw 27.

In the working of this device under normal conditions the non-return valve 5 is open and the pump is charging the pressure system through the valve chamber 4. The supply pressure has no influence on the main valve 7 at this stage since its pressure thereon is counteracted by its pressure against the underside of the piston 12. The only forces then to be considered are the spring 16 acting upwards on the underside of the piston 15 and the system pressure acting downwards on the upper side of the piston 12. So long as the predetermined loading on spring 16 exerts more force than the system pressure, the main valve 7 will remain closed, but as soon as the system pressure exceeds a predetermined cut-out value the spring 16 will be overcome by the system pressure acting upon the upper side of the piston 12 and the main valve 7 will crack and reduce the pressure in the valve chamber 4, the non-return valve then automatically closing to maintain the pressure in the pressure system. The fluid flowing past the cracked main valve 7 will build up a small pressure differential between the two sides of the piston 15 due to the restriction constituted by the valve 21 or the cock 26 and this will cause the piston 15 to move downwards to compress the spring 16 and relieve the spring loading on the valve 7. The main valve 7 will then open wide as a result of the increased pressure differential between the system pressure which acts on the top of the small piston 12 and the pressure in the valve chamber 4, thereby relieving the supply pressure practically to zero.

As soon as the system pressure falls below the predetermined cut-in value the spring 16 will overcome the combination of the said pressure differential and the pressure exerted by the system pressure and the main valve will begin to close thereby reducing the flow of fluid past it. This drop in flow will reduce the said pressure differential and spring 16 will then be enabled to force the main valve 7 onto its seating 8.

A typical working range is for the cut-in value to be 950 p. s. i. and the cut-out value 1050 p. s. i.

I claim:

1. In a cut-out valve device, the combination

of a housing having an inlet for fluid under pressure and an outlet for fluid under pressure, a main duct passing through said housing and connecting said inlet to said outlet, a relatively small cylinder projecting laterally in one direction from said main duct and communicating at one end therewith, a relatively small piston in said cylinder having one end subject to pressure in said main duct, a relatively large cylinder projecting laterally in the opposite direction from said duct, said housing being provided with a port between said relatively large cylinder and said main duct, a main valve engageable with the end of said port remote from said main duct and movable away from the latter to open position, said valve being connected to said relatively small piston, a relatively large piston in said relatively large cylinder engaging said valve, spring means in said relatively large cylinder urging said relatively large piston toward said main duct to bias said valve to closed position, a differential fluid pressure passage connected to the end of said relatively large cylinder adjacent said port and having a restriction therein, a check valve controlling communication between said main duct and said outlet and biased to closed position away from said outlet, and an unrestricted passage communicating between said outlet and said relatively small cylinder at the end of the latter remote from said main duct to subject the other end of said relatively small piston to pressures in said outlet.

2. A cut-out valve device according to claim 1 comprising a spring-loaded valve serving to adjust said restriction.

3. A cut-out valve device according to claim 1 comprising means for adjusting said restriction, said means comprising a valve, and means for imposing a predetermined limit upon movement of said valve.

4. A cut-out valve device according to claim 1 provided with manually operable adjusting means for adjusting the restriction in said differential fluid pressure passage.

5. A cut-out valve device according to claim 1 in which said spring means comprises a compression spring in the end of said relatively large cylinder remote from said main duct, a plate between said compression spring and said relatively large piston and forming a seat for said spring, and a ball interposed between said plate and said relatively large piston axially thereof.

6. A cut-out valve device according to claim 1 in which said main valve is formed with a stem abutting said relatively large piston.

References Cited in the file of this patent

UNITED STATES PATENTS

	Number	Name	Date
60	404,684	Colven	June 4, 1889
	1,949,930	Davidson	Mar. 6, 1934
	2,212,997	Blanchard	Aug. 27, 1940
	2,277,656	Falls	Mar. 24, 1942
	2,351,512	Holt	June 13, 1944
65	2,375,411	Grant	May 8, 1945
	2,411,930	Mathys	Dec. 3, 1946
	2,416,881	Osborn	Mar. 4, 1947
	2,429,489	Roth	Oct. 21, 1944
	2,434,799	Higgins	Jan. 20, 1948
70	2,568,026	Pigott	Sept. 18, 1951
	2,639,722	Teague, Jr.	May 26, 1953