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HYDRAULIC THROTTLE ADVANCE

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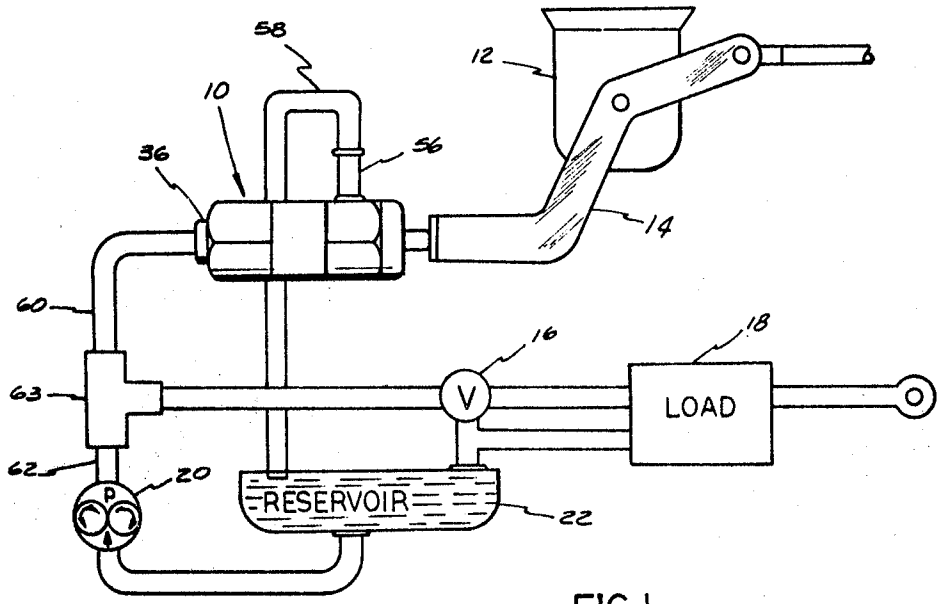


FIG. 1

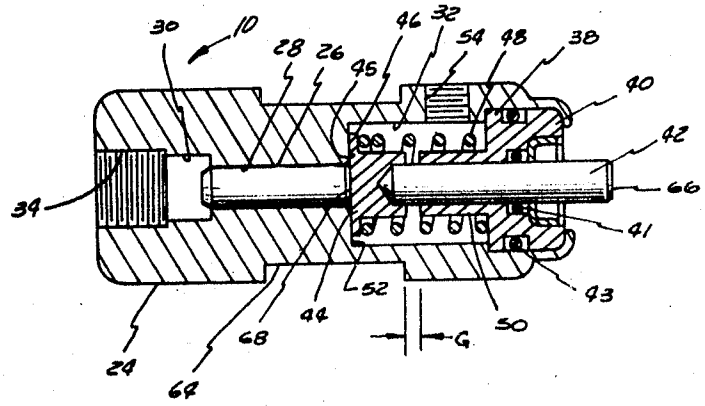


FIG. 2

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HYDRAULIC THROTTLE ADVANCE

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U.S. Cl. 103—17 8 Claims

ABSTRACT OF THE DISCLOSURE

A hydraulic actuator using a flow-by principle wherein a plunger member floats in a non-fluid tight bore that communicates with a high pressure source and a separate rod member is spring biased toward the plunger and axially aligned therewith so that increases in pressure will produce regulated movement of the rod.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to hydraulic throttle advance devices and more particularly to mechanisms for the automatic throttle control for a motor operating a hydraulic pump for actuating various load devices for use on vehicles.

Description of the prior art

In the employment of pumps operated by driving means such as a motor vehicle engine, a problem in many applications of such pumps is the maintenance of a pressure which is relatively constant regardless of the demand upon the pump. This problem is particularly acute in the case of trucks and other vehicles which use hydraulic pumps to do various types of work. The operator has loads, traffic, etc., to watch, and automatic throttle control devices are required to enable him to perform his work without having to monitor the engine revolutions per minute, to concern himself with prevention of vehicle stalling and, where torque converters or fluid couplings are used, to eliminate the problem of the vehicle creeping forward. One type of automatic throttle control device is shown in U.S. Patent No. 2,931,305, issued Apr. 5, 1960, which therein discloses a flow-through or flow-by arrangement pressure responsive mechanism. Still another type of device is disclosed in U.S. Patent No. 3,232,182 issued Feb. 6, 1966 wherein the flow-by concept is not employed and requires internal high pressure sealing means resulting in undesired operating characteristics. The use of high pressure internal sealing means, such as O-rings around the piston, will lead to erratic action of the piston and thus prevent quick response of the pressure compensating means to varying loads. Other disadvantages of the prior art structures such as an excessive number of parts and high manufacturing costs will become apparent in the description of the invention.

SUMMARY OF THE INVENTION

According to the present invention, the prior art difficulties are eliminated by means of the improved hydraulic actuator for the throttle of vehicle engines that permits the engine to maintain its revolutions per minute at near idle while varying amounts of loads, up to maximum lifting loads, are imposed upon the engine. Applicant has used the flow-by principle in his device in connection with a unique independent primary plunger and secondary operating rod arrangement which allows the hydraulic fluid to by-pass the plunger so that it is free floating in operation. Another feature of applicant's invention is the fact that the plunger will not permit free flow of the hydraulic fluid through the actuator and restricts flow to the passage created by the non-fluid tight fit between the floating plunger and its cooperating bore, and thus prevents a substantial loss of the hydraulic fluid through the actuator. Further, the fact that a relatively small amount of fluid bypasses the plunger to the return conduit, means that a substantially constant pressure exists during the operation of the actuator with the result that the pressure acting on the plunger is not affected except by changes in the back pressure on the pump.

An object of the present invention is the provision of a hydraulic actuator which has improved response to varying loads.

Another object of the present invention is to provide a hydraulic actuator that is simple in construction and requires a minimum of parts.

A further object of the invention is the provision of a hydraulic throttle which is adaptable to the requirements of various installations and operations.

Further objects and advantages of the invention will become apparent from the following description of the preferred embodiment thereof, reference being made to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of the hydraulic circuit of a conventional engine illustrating the operation of a preferred form of a hydraulic actuator means constructed in accordance with the present invention; and

FIG. 2 is a cross-sectional view on an enlarged scale of the actuator shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, there is shown in FIG. 1 a hydraulic circuit in which the actuator means is indicated generally by the numeral **10**, located adjacent a carburetor **12**, which it will be understood is attached to an internal combustion engine in any one of various types of vehicles such as a fork lift truck, for example. The speed of the engine is controlled by a conventional throttle or butterfly valve operated through a lever **14** which is automatically controlled by the actuator means or pressure responsive mechanism **10** of the present invention. Suitable valve means are provided at **16** for the purpose of operating a hydraulic load device, indicated by the numeral **18**. The power for operating the hydraulic load device is supplied by pump **20**. Fluid returning from the load **18** is discharged into a sump or reservoir **22** which is connected to the intake side of the pump **20** to complete the hydraulic circuit. All of the separate elements may be of conventional construction.

The pressure responsive mechanism **10** will now be described in detail. Referring to FIG. 2 the housing **24**, which in the instant embodiment is formed from hex bar stock as the housing material, is shown in partial cross section.

Within the housing **24** is a plunger **26** which is free-floating in a closely held bore **28**. The bore **28** has aligned counterbores **30** and **32**, shown at each end of the housing, which communicate with the bore **28**. The smaller bore **30**, located at the left end of the housing **24** in FIG. 2,

is shown threaded at 34 to receive a conventional hydraulic fitting indicated at 36 in FIG. 1.

The aligned counterbore 32, at the right hand end of the housing 24 in FIG. 2, is of larger diameter than the bore 30, and the bore 32 is in turn counterbored at 38 for the reception of gland member 40, within which a secondary piston rod 42 is positioned for slidable movement. The gland member 40 has O-ring seals 41 and 43 to seal head member 44, fixedly attached to rod 42, within bore 32. Biasing means, such as the helical spring 48, is provided to urge the head 44 and the rod 42 towards the left, as viewed in FIG. 2. The spring 48 is disposed concentrically of head 44 and the stem 50 of gland member 40. The spring 48 is compressed between the head flange 46 and gland member 40 so that under no load conditions the spring 48 retains the head 44 in abutment with base 52 of bore 32. It will be noted that the free end of stem 50 provides a stop portion to limit the free movement of head 44. The length of the gap between the head and stem, indicated by the letter G, can be changed to suit different engine applications.

The housing 24 is connected to the low pressure side, denoted by the reservoir 22 of the fluid system by means of a port 54 extending into the bore 32, provided with a fluid coupling 56 (FIG. 1) for connecting bore 32 to conduit 58 which communicates with the reservoir 22. As indicated above, the high pressure side of the fluid system is connected to the housing 24 through a threaded opening 34 for connecting the bore 30 to line 60 which is in turn, connected to line 62 by T-member 63 such that the discharging pressure of pump 20 is reflected within the chamber 30. While it is noted in FIGS. 1 and 2 that the coupling 56 is shown connected to the top portion of the housing 24 for purposes of description, the preferred arrangement of the actuator housing would be in a position rotated 90° such that the coupling 56 would extend in a horizontal plane. The casing is provided with grooves 64 to enable the devices to be mounted by bracket members (not shown) to an internal combustion engine.

An inventive feature of applicant's device that allows improved operating characteristics in the arrangement of the plunger 26 without sealing means, by means of a non-fluid tight fit in the bore 28, so as to be floatably slidable therein. Other types of so-called floatable piston arrangements, while eliminating internal sealing means, still require high pressure seals. However, due to applicant's novel two-part constructed wherein the plunger 26 is a separate member from the members 42 and 44, allows the plunger 26 to float free of any sealing members. The seal 41, because it is not in hydraulic communication with the high pressure side of bore 30, does not require a heavy seal which would cause sluggish and erratic action of rod 42.

In applicant's invention the head 44 acts as an anvil to receive the plunger force created by the axial movement of the plunger 26 under influences of increase in pressure in the bore 30. Another feature of the invention is that of the applicant's unique flow-by arrangement of the hydraulic fluid whereby the plunger 26 is able to move into the bore 32 an amount determined by gap distance G and the hydraulic fluid is never permitted to have an uninterrupted passage from bore 30 into bore 32 to communicate with the port 54. The fluid is always required to bypass the plunger 26 which provides, with bore 28, a small tolerance passage so that a controlled amount of fluid will float plunger 26 and enter bore 32 to eliminate pressure buildup in the spring cavity while at the same time preventing excessive loss of the hydraulic fluid.

It will be appreciated that with a low back pressure on the pump, the head 44 will be in contact with the abutment surface 52, as shown in FIG. 2. An increase in the fluid pressure in chamber 30 will force plunger 26 to the right in contact with head 44 to allow the head to overcome the biasing action of spring 48. The hydraulic fluid located between face 68 of plunger 26 and the face 45 of head 44 will be forced radially outwardly by the movement of the plunger. The radial flow of the hydraulic fluid between the surfaces 45 and 52 together with the pressure or blow of the plunger against the head 44 will combine to result in prompt opening of the throttle with a relatively low back pressure on the pump.

Applicant's two-part construction, wherein the plunger 26 is separate from the rod and head assembly, eliminates alignment problems of a one-piece rod and plunger design. Also by means of replacing the gland member 40, the gap G can be changed to cover different engine applications.

It should be understood of course that the foregoing disclosure relates to only a preferred embodiment of the invention and that numerous modifications or alterations may be made.

What is claimed is:

1. In an automatic control device for controlling the throttle of an engine operating a pump having an inlet side and ana outlet side, said automatic control device comprising a housing having an inner wall defining a first bore at one end to which said pump outlet side is directly connected, a plunger member slidably mounted in said first bore, said housing having a second bore at the other end coaxial with and registering with said first bore, a head member in said second bore axially aligned with said plunger but separate therefrom and serving as anvil means to receive the force of said plunger when said plunger is moved in one direction due to an increase in fluid pressure in said first bore, said plunger being movable within said first bore to a position out of engagement with head member, a rod coaxial with said plunger secured to said head member and extending to the exterior of said housing, resilient biasing means between said head member and said housing urging said head member into contact with said plunger, said second bore being connected to the inlet side of said pump, and said plunger member being spaced from the wall defining said first bore to provide a continuous passage connecting said first bore to said second bore wherein both said plunger and said rod are axially movable within said bores in response to pressure changes therebetween without requiring internal sealing means to seal against the high pressure fluid of said pump.

2. The automatic control device as defined in claim 1, wherein said rod is slidably received within a stem portion extending into said second bore such that said stem portions free end provides a stop to limit the axial movement of said head member in said one direction.

3. The automatic control device as defined in claim 1, wherein said second bore has a diameter at least twice the diameter of said first bore and counter-bored for receiving a gland member for enclosing said second bore of said housing, said gland member slidably receiving said rod and provided with an integral stem portion for guiding the axial travel of said rod.

4. The automatic control device as defined in claim 3, wherein said gland stem and said head member have the same diameter and said biasing means is a coil spring surrounding said head member and stem and retained thereby for urging the head member in the opposite direction from said one direction.

5. The automatic control device as defined in claim 4, wherein said head member is provided with a flange at its plunger engaging end for seating said coil spring.

6. The automatic control device as defined in claim 1, wherein the axial length of said plunger exceeds the axial length of said first bore so that said plunger cannot escape into said second bore and thereby cause excessive loss of the hydraulic fluid.

7. The automatic control device as defined in claim 4, wherein said head member and said stem are separated by a gap and said gap can be varied for different engine applications.

8. The automatic control device as defined in claim 1,

wherein low pressure external sealing means are provided between said rod and said housing.

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WILLIAM L. FREEH, Primary Examiner

U.S. Cl. X.R.

91—47, 392; 129

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,459,131 Dated August 5, 1969

Inventor(s) Oaklan R. Senf

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

IN THE SPECIFICATION

Column 3, line 41, "in" should be

--is--.

Column 3, line 47, "constructed" should be

--construction--.

IN THE CLAIMS

Claim 1, line 19, "ana" should be

--an--.

Claim 1, line 30, following "with" insert

--said--.

SIGNED AND
SEALED
MAY 19 1970

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents