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HYDRAULIC PRESSURE COMPENSATING MEANS FOR INTERNAL COMBUSTION ENGINE SYSTEMS

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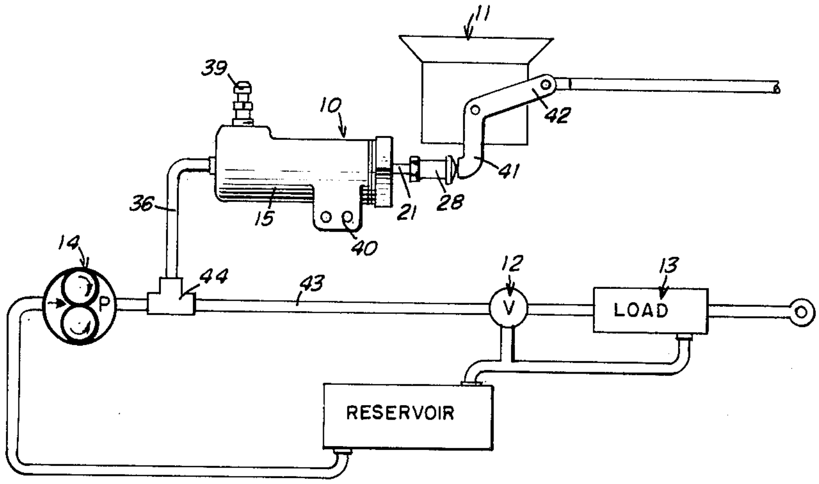

FIG. 1

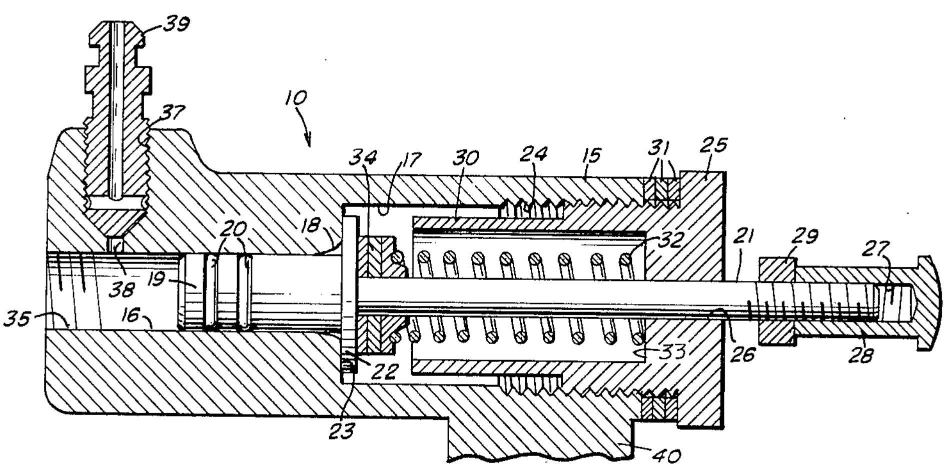

FIG. 2

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HYDRAULIC PRESSURE COMPENSATING MEANS FOR INTERNAL COMBUSTION ENGINE SYSTEMS

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This invention relates to hydraulic pressure responsive devices, and more particuladly to mechanisms for controlling the supply of hydraulic fluid provided by a pump system driven by a prime mover such as an internal combustion engine for actuating various load devices associated with an automobile driven by the engine.

One of the difficulties which has been encountered in the past in the operation of hydraulic servo-assisted power steering mechanisms provided on many automobiles, trucks and buses is that these devices require excessive amounts of power to be supplied by the hydraulic pumping mechanism under certain conditions, such as when the vehicle's wheels are sharply turned when the vehicle is at rest.

When the vehicle is standing, the internal combustion engine is usually operating at idling speed, under which condition it is capable of delivering only the minimum amount of power to the hydraulic system. As a result, the sudden demand on the hydraulic supply system for turning the wheels quite frequently results in putting a sufficient load on the engine to cause it to stall.

One solution for this problem is to adjust the idling speed of the internal combustion engine to such a rate that an overload of this type will not cause it to stall. However, this arrangement is disadvantageous because the engine will thus use more fuel than necessary for it to maintain its normal idling speed.

Furthermore, if an automatic transmission for driving the vehicle is associated with the engine, the idling speed thus required to maintain a sufficient reserve of power to compensate for overloading the hydraulic system will also be too great to enable the vehicle to remain at rest, with the automatic transmission engaged in the drive line unless the vehicle brakes are set.

In order to overcome the difficulties enumerated above, it is one of the objects of the present invention to provide an hydraulic compensating means, whereby the idling speed of the engine connected with a pump for supplying hydraulic fluid to load devices, such as power steering mechanisms, and other such vehicle accessories, will be automatically increased during such time as an excessive overload exists in the hydraulic supply system to prevent stalling of the engine.

It is a further object of the invention to provide a hydraulic compensating mechanism for internal combustion engines which is capable of being quickly and easily modified for use with a variety of engines having varying operating characteristics and driving, and associated with hydraulic systems having varying operating pressure.

Other objects and advantages will be apparent to those skilled in the art after reading the attached specification in connection with the accompanying drawings, in which:

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

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

Referring now to the drawing in detail, the compensating means is indicated generally by the numeral **10** in FIG. 1, and is arranged to operate in cooperation with the carburetor, indicated generally by the numeral **11**,

of an internal combustion engine (not shown). As will be explained later, the compensating means is effective, upon the opening of a valve means, indicated generally by the numeral **12**, for the purpose of operating a hydraulically operated device, or load, indicated generally by the numeral **13**, the power for which means is supplied by a hydraulic pump, indicated generally by the numeral **14**.

The load means **13** may be any one of numerous devices supplied on automobiles, trucks or buses of today, and operated by hydraulic fluid such as a servo-mechanism for assisting in steering the vehicle, a power-operated convertible top, window lifters, etc. Naturally, the the valve means **12** may be a simple manual or electrically operated valve, or it may comprise a relatively complex double-acting valve such as is common in the case of hydraulic power steering mechanisms.

However, before describing the operation of the system in detail, the internal construction of the compensator will first be described.

In FIG. 2, a detailed cross-sectional view of the compensating device **10** is shown as comprising an elongated casing **15** having a longitudinally extending bore **16** at one end, and having an aligned counterbore **17** of larger diameter at the other end, in communication with the bore **16**. The bore **16** may have its inner end slightly flaired, as at **18**, to facilitate the insertion of a piston **19** which, in turn, is provided with one or more annular grooves to receive the sealing rings **20**. The piston is also provided with an elongated stem **21** and has a radially extending flange or stop **22** which limits movement of the piston in one direction by abutment with the base **23** of the counterbore **17**.

The open end of the counterbore is threaded as at **24** to removably receive a closure plug **25** provided with a central opening **26** for slidably guiding the projecting end of the stem **21**. The end of the stem is also threaded as at **27** to adjustably receive an internally threaded cap or button **28** and a lock nut **29**.

The plug **25** is also counterbored to provide an elongated tubular shroud **30**, the outer end of which provides an abutment or stop to limit movement of the piston by engagement with the flange **22** when moving in a direction opposite to that caused by abutment of the flange with the bottom of the counterbore **17**.

The extent of movement of the piston toward the right, as viewed in FIG. 2, may be adjusted by the insertion of one or more spacers **31** between the head of the plug **25** and the end of the casing **15**.

Biasing means, such as the helical spring **32**, is provided to urge the piston towards the left, as viewed in FIG. 2. This spring surrounds the stem **21** and is received within the counterbore of the plug, one end of the spring bearing against the base **33** of the counterbore, the other end of the spring being in engagement with one or more spacers **34** placed on the stem **21**, these spacers, spacers, in turn, bearing against the flange **22**. By the addition or removal of these spacers, the force exerted by the spring may be varied to suit the conditions of operation. It will also be evident that the spacers could be placed at the other end of the spring or, if necessary, spacers could be inserted at both ends of the spring.

The open end of the bore **16** is threaded, as at **35**, to receive a conventional hydraulic fitting (not shown) for connection with the conduit **36** (see FIG. 1). The casing **15** is also provided with a threaded opening **37** which is in communication with the bore **16** by means of the aperture **38**. A conventional bleeder valve **39** is received in the opening **37** so that air may be removed from the system after the hydraulic connections have been made. The casing **15** is also provided with a bracket **40** to enable the device to be mounted on an internal combustion engine.

To install the compensator, the casing should be attached to the engine in such a position that when the piston **19** is in its retracted position (as shown in FIG. 2) the cap **28** will just be in contact with an abutment **41** of the throttle control arm **42** of the carburetor when the throttle is in its idling position, care being taken, of course, to see that the compensator is position so that movement of the piston under the influence of excess pressure in the bore **16** will cause the throttle to open slightly.

Conduit **36** may then be connected to the high pressure side of the gear pump **14** by removing the high pressure supply conduit **43** and substituting a T fitting **44**. The high pressure conduit is then re-connected to the T whereby the conduit **36** and bore **16** will thereafter be under the influence of fluid under the same pressure as exists in the conduit **43**.

In operation, whenever the gear pump **14** is called upon to supply fluid to actuate the load device **13** as a result of operation of the valve **12**, if an excessive force must be applied to the load device, the pressure developed in conduit **43** will be communicated through conduit **36** to the piston **19**. If the pressure is not abnormal, movement of the piston will be resisted by the biasing means **32** and the idling speed of the engine will not be affected.

However, if the force required by the load is excessive, the pressure built up in the fluid system, including conduits **43** and **36** behind the piston **19**, will exceed the resistive forces of the spring **32** and movement of the piston and its associated stem **21** toward the right in FIG. 2 will take place to a limited extent. This movement of the stem will cause a slight opening of the throttle of the carburetor **11** causing the engine to increase speed to prevent stalling. The extent of opening of the throttle will be in proportion to demand of the hydraulic system for abnormal power.

A particular advantage of the present invention is the fact that the device is capable of attachment to various makes and models of engines, without the necessity of producing a separate type of device for each engine. For example, the location of the casing **15** with respect to the throttle arm of the carburetor may be varied in view of the fact that the effective length of the stem **21** can be changed by rotation of the cap **28**.

Secondly, in order to prevent inadvertent "racing" of the engine, the movement of the piston, under excess hydraulic pressure, to open the throttle is limited by virtue of the stop or abutment of the flange **22** with the shroud **30** and the position at which this limiting action takes place can be varied by the addition or subtraction of spacers **31**.

Finally, the resistive force of the spring **32** may be regulated by means of the addition or subtraction of spacers **34** so that the device may be adapted to hydraulic systems having varying operating pressures.

It will thus be evident that this invention provides an extremely flexible device capable of use as an attachment or replacement in a widely varying number of applications.

Having described and shown a preferred form of the invention, various modifications and improvements may be made in the construction of the invention which would come within the scope of the annexed claims.

I claim:

1. In a compensating mechanism for use with hydraulically driven load devices supplied with fluid under pressure by a pump driven by an internal combustion engine having a carburetor throttle valve having an idling position and movable in one direction to increase engine power, the combination including, an elongated casing having a bore at one end and a piston slidable therein, means for placing said bore in communication with fluid supplied to a load device by a pump driven by an internal combustion engine to move said piston in one direction in response to fluid pressure increase, said casing having a second bore at the other end, said piston including a steam extending exteriorly of the casing through said second bore for connection with the throttle valve of an internal combustion engine to move said throttle valve to increase engine power in response to movement of the piston in said one direction, elongated plug means removably received axially within the second bore, stop means connected with said piston and arranged for abutting engagement with said plug means to limit movement of the piston, coil spring means connected between the plug means and the piston for yieldably resisting movement of the piston, spacer means for adjustably axially positioning the plug means, means for adjusting the force of the coil spring.

2. The invention as defined in claim **1**, wherein the ends of the coil spring means includes a spacer positioned between one end of the coil spring means and one of the elements between which the coil spring means is connected.

3. The invention as defined in claim **1**, wherein the free end of the stem includes an axially adjustable element.

References Cited by the Examiner

UNITED STATES PATENTS

2,634,681	4/1953	Rowell	103—16
2,690,712	10/1954	Foote	103—16
2,918,040	12/1959	Lieser	92—13
2,931,305	4/1960	Stratton	103—16

FOREIGN PATENTS

545,445	7/1922	France.

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