

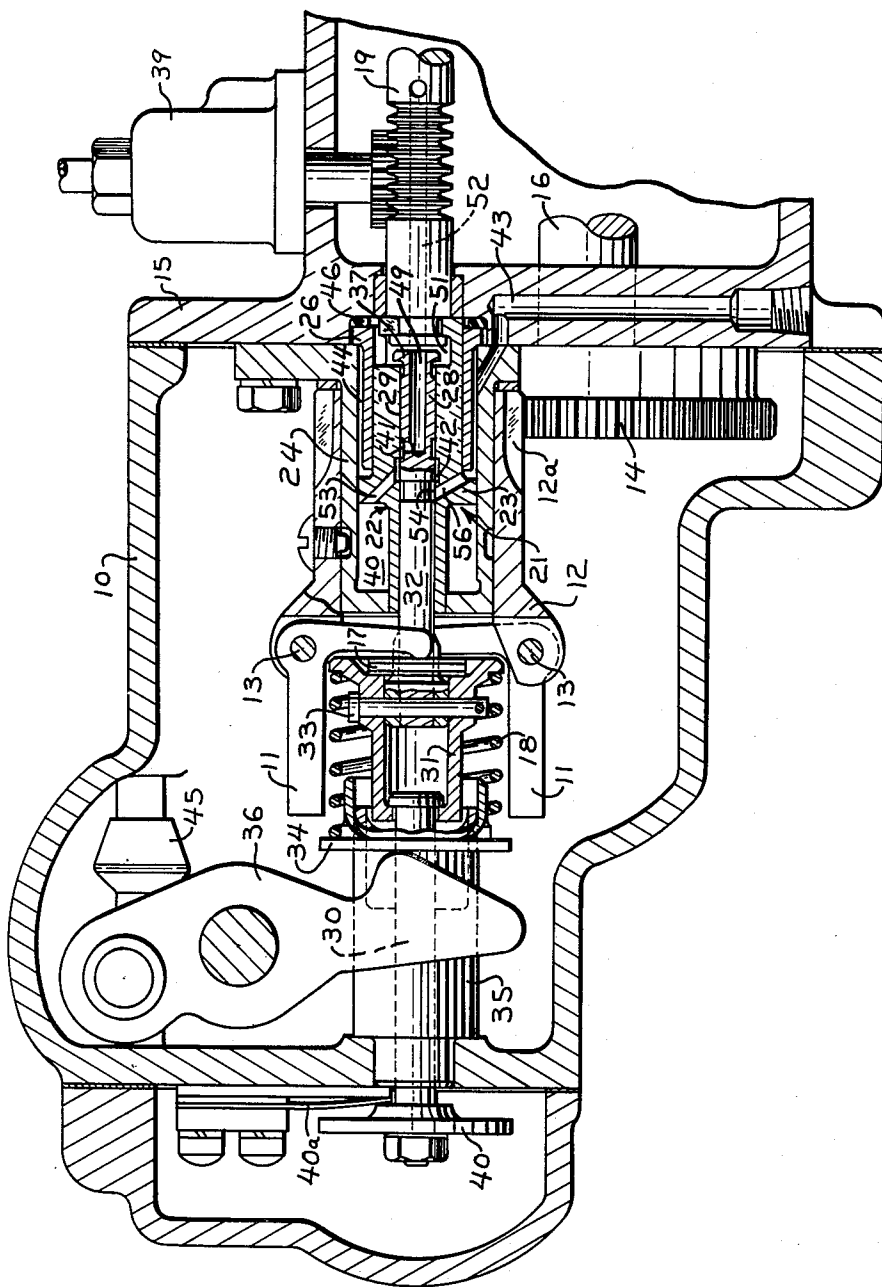
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DOUBLE ACTING HYDRAULIC SERVO GOVERNOR

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1

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DOUBLE ACTING HYDRAULIC SERVO
GOVERNOR

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1 Claim. (Cl. 91-366)

The present invention relates to governors for controlling engine speed and more particularly to an engine speed governor having a hydraulic booster.

Conventional governors utilized to control engine speeds generally operate through the interaction of flyweights and an opposing governor spring. The flyweights are mounted on a member which rotates at a speed proportional to the engine speed. The flyweights assume a position consistent with the centrifugal force supplied by the rotating member, and thereby determine the position of a fuel control member such as a fuel pump rack bar. When the rack bar is positioned to supply fuel to the engine to operate it at a speed which rotates the flyweights with sufficient centrifugal force to counteract the opposing governor spring, constant speed operation is obtained. Adjustment of the governor spring, therefore, obtains a selected operating speed.

The high speeds at which modern engines often operate, poses a particular problem with conventional governors. The flyweights which must be of a sufficient weight to operate the rack bar when low engine speed is desired exert great forces against the opposing governor spring when the engine is alternately operated at high speeds. It becomes necessary to employ a governor spring capable of exerting high counter balance forces, and such springs necessarily have high resistance to distortion. It has been found in practice that springs having sufficient resistance to properly operate the governor at high engine speeds are exceptionally difficult to adjust when a variation in operating speed is desired. It thus becomes desirable to provide a governor which furnishes accurate control at both high and low engine speeds with the use of light flyweights, thereby enabling a governor opposing spring of moderate resistance to be used.

Accordingly, it is an object of the present invention to provide an improved hydraulic servo system to be used in an engine speed governor.

It is another object of the present invention to provide a hydraulic servo system which enables the use of light flyweights and an opposing spring of moderate resilience in a governor capable of accurately controlling the speed of an engine over a large range of speeds.

Further and more specific objects and advantages of the invention are made apparent in the following specification wherein a preferred form of the invention is described by reference to the accompanying drawing.

The drawing is a side elevation sectional view of the governor of the present invention with parts broken away.

Referring to the drawing, the governor of the present invention is illustrated as comprising flyweights 11 pivotally mounted in a carrier 12 as by pins 13. Carrier 12 is toothed as at 12a to provide a pinion in constant mesh with a drive gear 14 secured to a shaft 16 forming a part of the timing gear train of an engine. Governor housing 10 and a fuel pump housing 15 secured thereto form an enclosure in which the various parts of the invention reside.

Flyweights 11 move radially under the influence of changing engine speed to move a thrust member 17 against the opposing force of a governor spring 18. This axial movement of member 17 urges the fuel control member or engine rack bar 19 through an intermediate hydraulic servo system generally indicated at 21. Servo system 21

2

includes a ported piston 22 having a piston head 23 slidable in a cylinder 24 and a piston body of reduced diameter slidably maintained within a fixed sleeve 26. A valve spool 28 is slidably maintained within a central bore 29 of piston 22. A valve spool 28 is connected to an adaptor 31 by means of a connecting rod 32 which is affixed to the adaptor 31 as by a pin 33. Adaptor 31 engages thrust member 17 and serves as one of the seats for governor spring 18. The other end of spring 18 engages spring seat 34 which is adjustably positioned by means of a lever 36. Adjustment of lever 36 by manually actuated linkage (not shown) varies the position of seat 34 to adjust the opposing force of spring 18 as desired. Axially aligned with the rod 32 is a control rod 30 slidably journaled within a hollow bearing support 35 pressed into the governor housing 10 as shown. Spring seat 34 is slidably carried on the bearing 35. A contact plate 40 secured to the end of rod 30 engages lever 36 upon clockwise rotation thereof. Spring blade 40a prevents damage to plate 40 through contact with housing 10. The manner of operation of lever 36, plate 40, rod 30 and a cam surface 45, is fully described in Patent No. 2,961,229, issued November 22, 1960, to J. H. Parks for a "Centrifugal Governor."

Increased speed of the engine will induce flyweights 11 to move outwardly and thereby urge adaptor 31 to the left, as shown in the drawing, against the opposing force of spring 18. Valve spool 28 which is connected to adaptor 31 will also move to the left. Spool 28 will move relative to piston 22 and thereby align a recessed area or circumscribing groove 41 in valve spool 28 with an opposing groove 42 in piston 22. A supply of hydraulic fluid as from the engine lubricating oil system (not shown) is supplied to the servo system 21 through intake line 43 which communicates with the piston head 23 through a space 44 between cylinder 24 and sleeve 26. An O-ring 46 forms a seal between fuel pump housing 15 and sleeve 26 to prevent the leakage of oil. Recessed portion 41 of spool 28 communicates with a central bore 49 in the spool which opens into an area 51 containing a flange 37 on the spool. Oil accumulated in area 51 is free to pass therefrom through a central bore 52 in rack bar 19 which, in turn, empties into the fuel pump housing which communicates with a supply reservoir, in this case the engine crank case.

The alignment of groove 41 with groove 42 provides a path between chamber 40 in cylinder 24 and the central bore of spool 28 through piston port 53. Hydraulic fluid under pressure in chamber 40 is then free to be discharged therefrom allowing the hydraulic pressure on the other side of piston head 23 to urge piston 22 to the left. The leftward movement of piston 22 in response to the hydraulic pressure causes movement of rack bar 19 and adjustment of fuel pumps 39 (one of which is shown). This leftward movement of piston 22 is relative to spool 28 causing misalignment of groove 42 and recess 41 so as to discontinue communications therebetween. The over-all result of increased engine speed is a leftward movement of rack bar 19 with the aid of servo system 21 to reduce the amount of fuel metered to the engine to compensate for change of load, and thereby restore the engine to operation at a constant predetermined speed.

When flyweights 11 move inwardly due to a decrease in engine speed the force from the flyweights against thrust member 17 is reduced allowing spring 18 to urge adaptor 31 to the right carrying with it spool 28. Spool 28, displaced to the right relative to the piston 22, establishes communication between a groove 54 in the spool and groove 42 in piston 22. This communication completes a path between the hydraulic input line 43 and the chamber 40 through area 44, port 56 in piston 22, recess 54 and port 53. The hydraulic fluid then admitted into

3

chamber 40 creates a force on the left side of the piston greater than that on the right side moving the piston and rack bar 19 to the right to increase the fuel metered from fuel pumps 39 to the engine. As piston 22 moves to the right the communication between recess 54 and recess 42 is obstructed due to the relative motion between the piston and spool valve 28 bringing the servo to rest after the engine has re-established its operating speed.

Thus, it is seen that in either adjusting the engine to receive more fuel or less fuel, the servo system supplements the action of spring 18 to properly position rack bar 19. In this way, the force of spring 18 need only be moderate even when control at high speed operation is desired.

The present invention has the desirable feature of being operative in the absence of hydraulic fluid. Thus, a failure in the hydraulic fluid supply would not allow the engine to over-speed. In the absence of a source of hydraulic fluid rack bar 19 is positioned to the left by means of the flanged end 37 of spool 28 engaging piston 22, and to the right by the direct contact of spool 28 with rack bar 19.

What is claimed is:

In an engine governor for controlling the position of a fuel control member and having rotatable flyweights opposed by a spring, comprising in combination:

hydraulic servo means operatively disposed between the flyweights and the fuel control member whereby the flyweights do not operate the fuel control member directly except when there is a loss of hydraulic fluid pressure, said servo means including:

a cylinder disposed coaxially with the axis of rotation of the flyweights;

a piston reciprocally mounted in the cylinder and connected with the fuel control member, said piston

4

having an axial bore extending therethrough and valve ports therein;

a valve spool slidably disposed in the bore of said piston, said spool extending beyond the end of the axial bore adjacent the fuel control member, the portion of spool extending out of the bore having a flange thereon wherein the flange is larger in diameter than the bore, said flanged end abutting the control member when said spool is urged toward the control member relative to said piston;

means connecting said spool for adjustment by said flyweights and spring such that movement of said flyweights outwardly urges said spool in one direction while movement inwardly urges said spool in the other direction;

a source of fluid under pressure in communication with one side of said piston; and

co-acting valving elements between the spool and the piston for communicating the fluid source with the other side of said piston in response to movement of the spool in one direction and communicating a fluid reservoir with the other side of said piston in response to movement of said spool in the other direction.

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