United States Patent [19]

Glassey

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[45] **June 25, 1974**

[54] **ISOCHRONOUS GOVERNOR**

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[22] Filed: **Nov. 26, 1971**

[21] Appl. No.: **202,254**

Related U.S. Application Data

[63] Continuation of Ser. No. 845,348, July 28, 1969.

[52] **U.S. Cl.** ..... **123/140 R,** 123/140 MP

[51] **Int. Cl.** **F02d 1/04**

[58] **Field of Search** ..... 123/140 R, 140 I, 140 MP, 123/140 MC, 119 C

[56] **References Cited**

UNITED STATES PATENTS

2,986,291	5/1961	Schick	123/140 MC
3,148,790	9/1964	Ziskal	123/140 R
3,313,283	4/1967	Miller	123/140 MC
3,435,813	4/1969	Wagner	123/140 MP
3,438,361	4/1969	Wagner	123/140 R

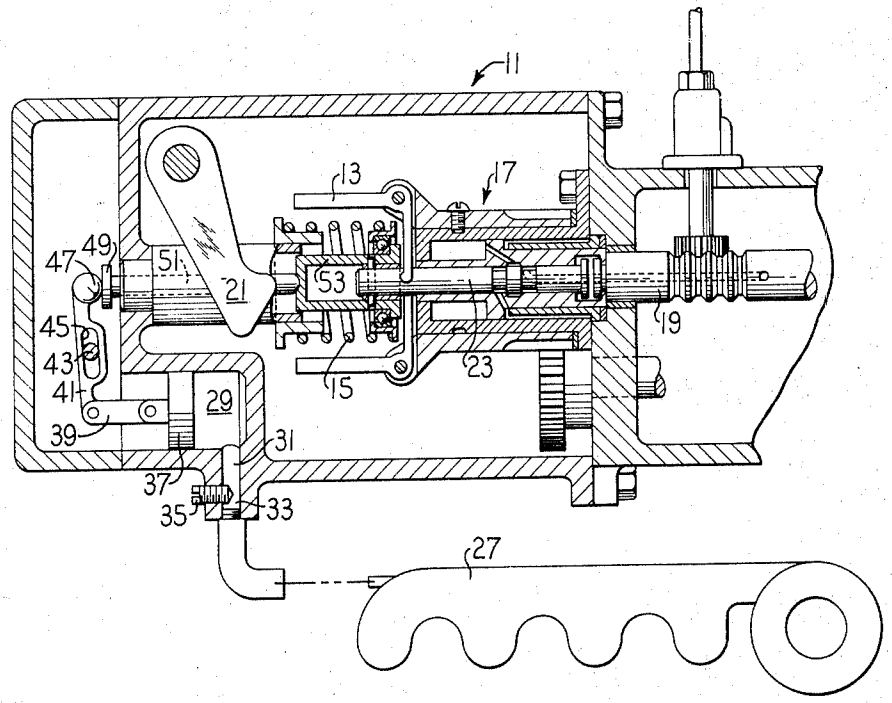
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[57] **ABSTRACT**

An isochronous governor having structure which provides a pressure force to compensate for the relative decrease of governor spring force with respect to flyweight force as engine load increases, thereby allowing the engine controlled by the governor to maintain operation at a constant speed under varying load high idle, no load speed, at all times. In a turbocharged engine, inlet manifold air pressure may be utilized to produce the force. The air pressure directly related to engine load acts upon a small piston and the resulting pressure force, approximately equal to the difference between the spring and the flyweight forces as engine load increases, acts upon the governor structure to properly position the fuel pump rack to maintain a desired engine speed. Engine oil pressure may alternatively be utilized to provide the required pressure force, and a second lever, positioned by the fuel pump rack, serves to preload a relief valve in the engine oil pressure system, thereby controlling the oil pressure in the system as a function of the fuel rack position.

3 Claims, 2 Drawing Figures



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SHEET 1 OF 2

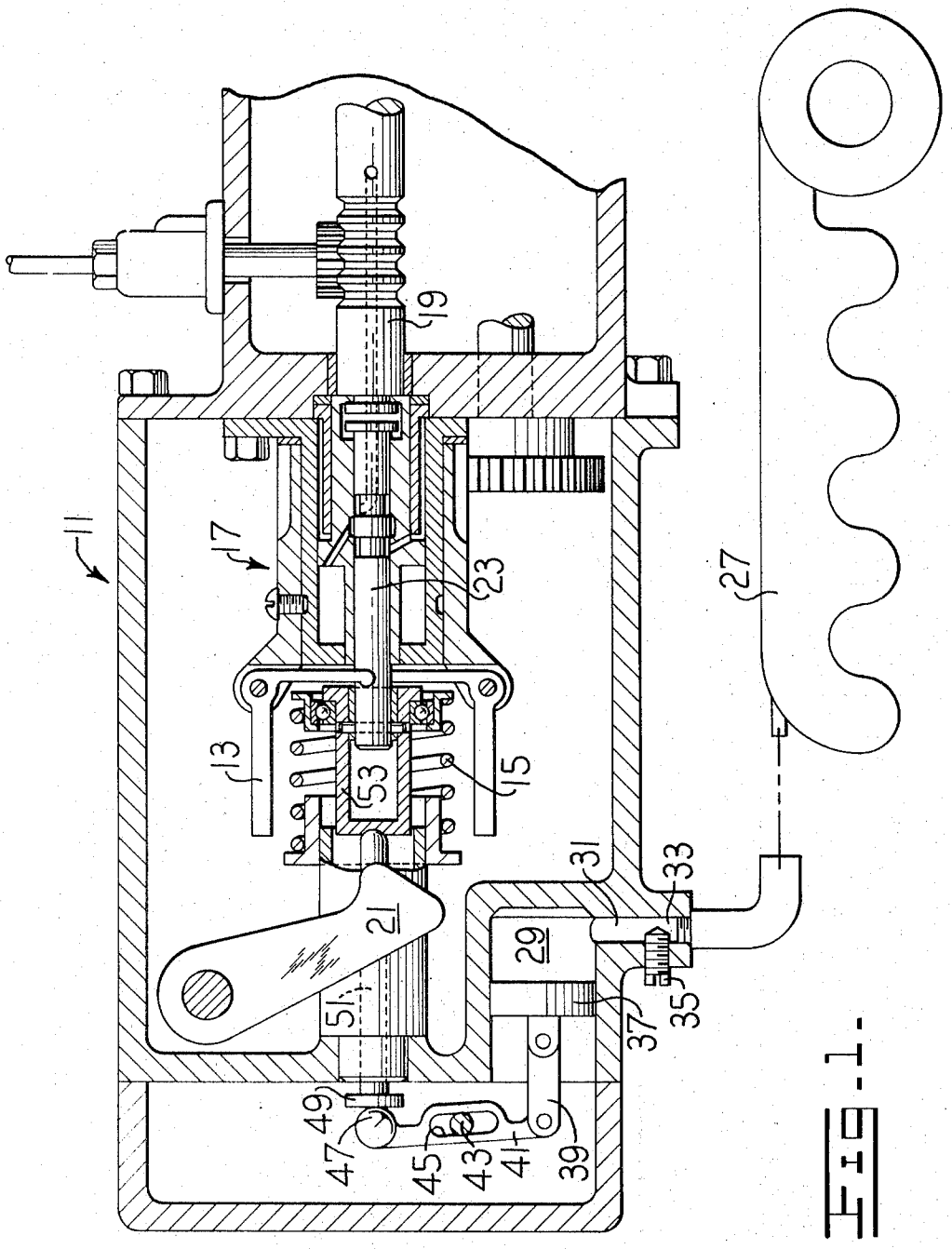


FIG-1-

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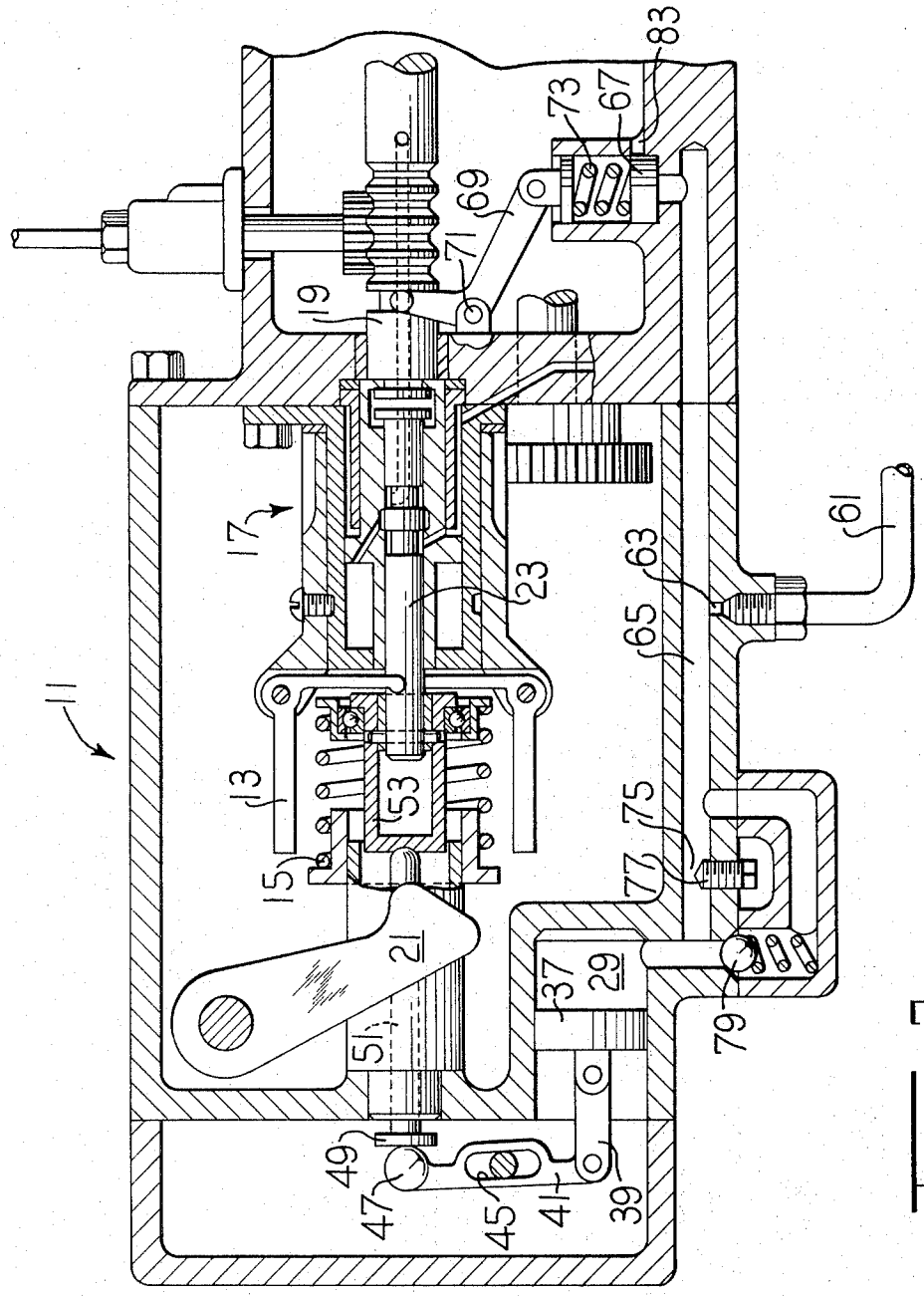


FIG. 2.

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ISOCHRONOUS GOVERNOR

BACKGROUND AND SUMMARY OF THE INVENTION

This is a Continuation of U.S. Pat. application Ser. No. 845,348, filed July 28, 1969.

This invention relates to a mechanism which utilizes inlet manifold air pressure or engine oil pressure as a means of obtaining constant speed governing in a mechanical or hydromechanical governor.

In diesel electric set applications, it is desirable to achieve isochronous governing of the engine so as to insure a constant cycle-per-second output of the generator. Typically, 50 or 60 Hz output is desired. Due to an engine's inherent characteristic of losing speed when load is applied, a governor is used to increase the amount of fuel delivered to the engine so that a constant engine speed is maintained. However, conventional mechanical and certain hydromechanical governors allow engine speed to drop slightly as engine load increases. This characteristic is inherent in such governor designs to insure governor stability. For example, as the governor spring extends, the force it applies diminishes at a faster rate than does the force produced by the flyweights. That is, the rate of decrease of spring force is greater than the rate of decrease of flyweight force as load increases. This occurs when the governor is moving to provide more fuel to the engine, i.e., as load increases. Then, as engine speed increases in response to the governor, the flyweights begin to compress the spring until the force of the spring is equal to or exceeds the flyweight forces. If the force of the spring remained equal to that of the flyweights regardless of the spring's length or engine speed, an unstable governor condition would exist. Therefore, on a conventional governor, due to the fact that the spring force changes at a faster rate than the flyweight force, in order to achieve stability, a load placed on the engine must cause a balance of the forces at a speed slightly lower than the governor achieves under a smaller load or no load condition. Since this condition will therefore vary throughout the load range of the engine, the changing speed condition will influence generator output in an unsatisfactory manner in applications where any variation in current is detrimental, such as in radar operations.

Therefore, the present invention has been devised to provide a force which compensates for the relatively greater decrease in force by the spring relative to the force of the flyweights while allowing the engine to maintain its high idle or no load speed, even though subjected to a loaded condition.

It has been one object of this invention to gain the necessary force to produce this result by utilizing the inlet manifold air pressure of a turbocharged engine, which air pressure is directly related to engine load. Reliance is made upon the fact that as load increases, manifold pressure increases. The inlet manifold air pressure is made to act upon a small piston with the resulting force being approximately equal to the difference between the spring and flyweight forces as the engine load increases. The natural lag of the turbocharger in providing air pressure to the small piston allows only a minute, temporary speed drop to insure the stability of the governor.

It is also an object hereof to provide an invention with a variable orifice so that the mechanism may be utilized on a variety of engine sizes and power ratings.

It is also an object hereof to provide such an invention wherein the force utilized to compensate for the loss of spring force is gained by utilization of engine oil pressure acting on a small piston in a similar fashion.

Additionally, the setting of a pressure relief valve in the engine oil system is controlled by the position of the fuel pump rack bar, so that the pressure exerted on the piston is directly related to the engine load.

This invention, together with its further objects, advantages, modes, and embodiments will become obvious to those skilled in the art by reference to the Detailed Description and accompanying drawings which illustrate what is presently considered to be the preferred embodiments of the best mode contemplated for utilizing the novel principles set forth in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevation, sectional view of the governor of the present invention with the parts broken away illustrating the use of the invention with inlet manifold air pressure;

FIG. **2** is a view similar to FIG. **1**, but showing an embodiment of the invention wherein engine oil pressure is utilized.

DETAILED DESCRIPTION

There is shown in FIG. **1** a hydromechanical governor mechanism **11** which is similar to that described in U.S. Pat. No. 3,145,624, issued to Parks et al. on Aug. 25, 1964, and U.S. Pat. No. 3,499,426, to Bailey, issued Mar. 10, 1970, both of which are assigned to the assignee hereof. The governor has a set of flyweights **13** and a governor spring **15** which interact to control a servo unit **17** which, in turn, controls the movement of a fuel pump rack bar **19.**

A bifuracted lever **21** is adjusted manually to set the preload of the spring **15** to oppose the outward movement of flyweights **13.** This interaction between the spring and flyweights serves to position a valve **23** of the servo unit **17,** establishing the position of the fuel pump rack **19.**

When a load is placed on the engine, speed is reduced, decreasing the amount of centrifugal force acting upon the flyweights, thereby moving them inwardly under the force of spring **15.** This permits a greater volume of fuel to be injected into the engine, thereby increasing engine speed in response to the increase in engine load.

As engine speed increases, the centrifugal force acting upon flyweights **13** will exceed the force exerted by spring **15,** the spring force having decreased as the spring extended. The flyweights will then compress the spring until the spring force and the flyweight force are balanced. However, since the rate of decrease of spring force is greater than the rate of decrease of flyweight force, the spring and flyweight forces will cause the rack bar **19** to reach an equilibrium position wherein the rack bar has not been moved far enough in a rightward direction to maintain the desired speed. Accordingly, a lower speed than desired will result as load increases. This condition is known as "speed droop." To compensate for this speed droop, the instant invention provides a continuous, corrective pressure force in an additive manner with the spring force as will be hereinafter described.

Intake air from a manifold 27 communicates with a chamber 29 in governor body 11 via a passage 31. A rate-of-pressure-change control orifice 33 in the conduit 31 is made variable by an adjusting screw 35 so that the governor may be utilized on a variety of engine sizes.

Air in the chamber 29 urges a piston 37 leftwardly against a link 39, thereby causing the rotation of a lever 41 about a pivot 43. If desired, the leverage of lever 41 may be adjusted by any suitable means such as a slot 45 in the lever.

An end 47 of the lever 41 presses against a shoulder 49 of a rod 51 which is urged against a cylindrical adapter 53 of the governor.

Thus, a third pressure force acts with the spring force in an additive manner to balance the oppositely-directed force due to the centrifugal force of the flyweights. This third force is always present and is exerted due to piston 37.

Accordingly, when load on the engine increases, the pressure force on piston 37 will increase so that valve 23 is motivated not only by the expansion of spring 15 but also by an amount which is a function of the decreasing opposing force due to the flyweights 13 as well as the increasing force on piston 37. The force due to the flyweights on the one hand is thus balanced by the combined force due to spring 15 and pressure force due to piston 37 on the other.

Thus, the force of the intake manifold air compensates for the relative decrease of spring force with respect to the flyweight force, allowing the engine to regain its high idle, no load speed under a loaded condition by acting upon the piston 37. Proper dimensional design causes the force exerted by the air to be approximately equal to the difference between the spring and flyweight forces since the inlet manifold air pressure is directly related to the engine speed for a given load. As previously stated, the natural lag of the turbocharger in providing the air pressure to the piston allows only a very small, temporary speed drop which insures the stability of the governor.

Referring now to FIG. 2 wherein like parts have been indicated with identical labels, there is shown a schematic drawing and embodiment of the invention utilizing engine oil pressure to achieve the desired result. Engine lubricant such as oil enters the system from a passage 61 through an orifice 63 to a passage 65. The oil exerts a pressure upon a relief valve 67. When the engine runs at a constant speed, the flyweights 13 and the spring 15 establish a position for the rack 19. A lever 69 pivoted at a point 71 is controlled by the rack and determines the preload on a spring 73 which acts against the valve 67. Thus, oil pressure within the passage 65 is determined by the position of rack 19 by means of the preload which the rack exerts on the spring 73 via link 69.

When a load is added to the engine, the spring 15 moves the flyweights 13 inwardly, urging rack 19 rightwardly, thereby increasing the volume of fuel injected into the engine. This causes the preload in spring 73 to be increased, creating a greater pressure within the passage 65. The increased pressure in the passage communicates with the chamber 29 via an orifice 75, which orifice may be adjusted by a screw 77. The oil in chamber 29 acts against the piston 37 producing the same result as previously described relative to the air actuated embodiment of the governor.

When the load is removed from the engine, flyweights 13 will move outwardly due to the increased speed of the engine, forcing rack 19 to the left, thereby reducing the preload acting upon the valve 67 through spring 73. This allows the pressure in passage 65 to be reduced, permitting the flyweights 13 to move the shaft 23 leftwardly (as shown in the drawing) against the lever 41, thereby moving the piston 37 to the right. Sufficient movement of the piston 37 to the right will cause oil in chamber 29 to be forced past a check valve 79 and through a passage 81 back to the passage 65. The oil in passage 65 will flow past the relief valve 67 to be exhausted through a passage 83.

The check valve 79 permits a more efficient drainage of the oil when the load is removed from the engine, allowing a greater flow of oil in the reverse direction than would be possible through the orifice 75.

It is to be understood that the foregoing description is merely illustrative of preferred embodiments of the invention and that the scope of the invention is not to be limited thereto, but is to be determined by the scope of the appended claims.

What is claimed is:

1. In an engine governor including a housing having means for maintaining a desired engine speed and having a fuel control member regulating the flow of fuel into the engine, a movable member positioned adjacent to said fuel control member for moving the same, flyweight means mounted adjacent said movable member and controlling its movement and said fuel control member to position the latter to increase the flow of fuel in response to an increased engine load and inward movement of said flyweight means, spring means mounted adjacent to said flyweight means and assisting its movement of said fuel control member upon increased engine load, and fluid pressure means creating an additive force disposed adjacent said spring means and serving to assist its movement and said fuel control member in response to increased engine load to insure that sufficient fuel is entering said engine as said flyweights begin to move outwardly, said fluid pressure means comprising means generating an increasing pressure proportional to engine load, and piston means for converting the pressure into said additive force, said piston means comprising a chamber in said housing, a piston movably mounted in said chamber, linkage means interconnecting one side of said piston with a rod engaging said spring means, said linkage means comprising a generally elongated lever pivotally mounted intermediate its ends about a pivot, one end of said lever adapted for moving said rod and the other end of said lever being linked to said one side of said piston, means in said lever adjusting the lever pivot point for changing the leverage of said lever, conduit means intercommunicating said pressure generating means with said chamber on the other side of said piston, and means adjustably disposed in said conduit means for controlling the pressure therein.

2. The invention of claim 1 wherein the means generating increasing pressure is an engine manifold.

3. The invention of claim 1 wherein the means generating increasing pressure is an engine lubricant system.

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