March 10, 1970 J. M. BAILEY 3,499,426

MAXIMUM-MINIMUM GOVERNOR DEVICE

Filed May 29, 1968

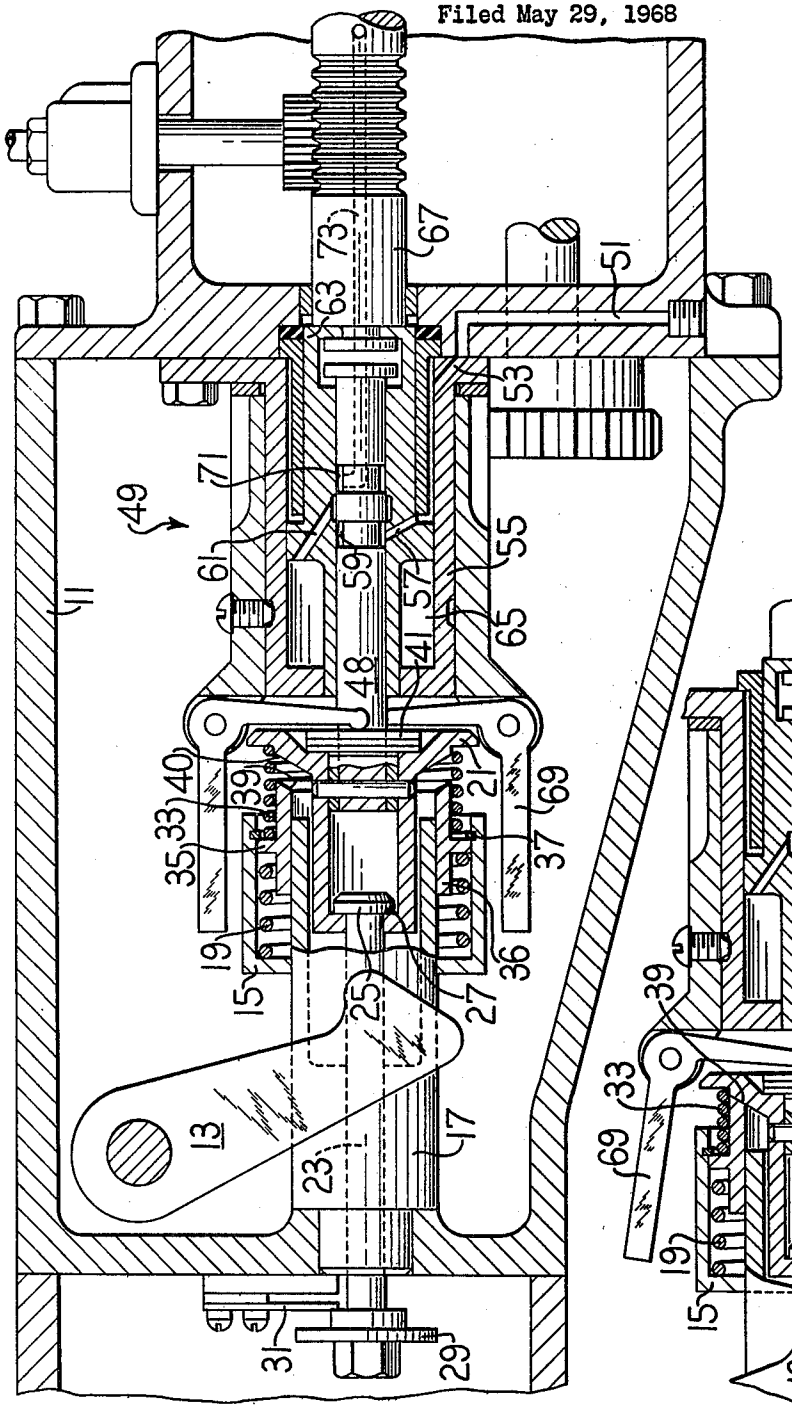


Fig. 1.

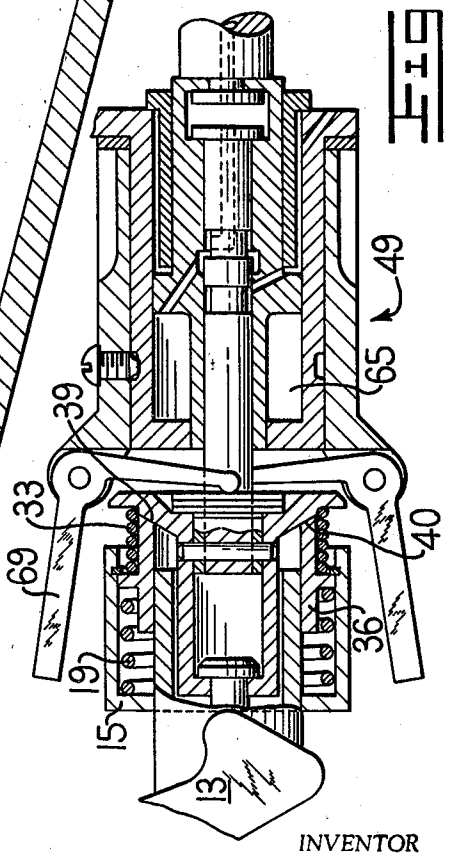


Fig. 2.

INVENTOR
JOHN M. BAILEY

BY
Fryer, Tjensvold, Fix, Phillips & Lempio
ATTORNEYS

United States Patent Office 3,499,426 Patented Mar. 10, 1970

3,499,426

MAXIMUM-MINIMUM GOVERNOR DEVICE

John M. Bailey, Dunlap, Ill., assignor to Caterpillar Tractor Co., Peoria, Ill., a corporation of Illinois

Filed May 29, 1968, Ser. No. 733,134
Int. Cl. F02d 1/04
U.S. Cl. 123—140 1 Claim

ABSTRACT OF THE DISCLOSURE

A hydro-mechanical governor in which a cup shaped spring seat has mounted therein a sleeve biased to an extended position. The spring seat and sleeve construction is biased away from an adapter actuated by centrifugal flyweights. The construction allows the engine operator to control the fuel pump rack within the operating range while still having a governed low idle and maximum speed.

This invention relates to an improvement in a double acting hydraulic servo governor such as that shown in U.S. Patent No. 3,145,624 to Parks et al., and assigned to the assignee hereof. More specifically, the invention relates to a spring biased spring seat member having, effectively, a lost motion capability therein. The addition of the lost motion capability serves to convert the governor from a full range governor as disclosed in Parks et al. to a maximum-minimum fuel control governor. This arangement provides a vehicle operator with a means for directly controlling the fuel pump rack of an engine throughout the operating range while still having a governed low idle and maximum speed.

Of primary concern when using conventional, mechanical, or hydraulically assisted governors in highway vehicles, is the lack of positive control of the fuel pump rack by the operator. The use of a governor wherein a control lever adjusts a spring which interacts with flyweights to obtain governed speeds is well known as shown in the above cited patent. In such a device, the speed selected by the operator is regulated by compression or extension of the governor spring by the control lever. This is a highly desirable feature in industrial applications such as generator engines, etc., wherein it is desired that the governor control the fuel input to the engine throughout the full range of engine power output. However, this is not desirable when the engine is utilized in an application such as a truck drive system wherein the operator's foot must counteract the force of the flyweights at all time. In such cases, the spring would always be in the mechanical control circuit. In foot actuated accelerator linkage, this action transmits a "spongy effect" to the operator through the accelerator linkage.

A further disadvantage of such structure is that a small movement of the fuel pump rack is obtained only through a much larger movement of the control lever and spring.

In those governors presently known, another problem encountered is that excessive flyweight forces are transmitted from the governor to the accelerator linkage during engine operation. Obviously, the higher the engine speed the more force transmitted to the accelerator linkage, and the greater the effort on the part of the engine operator.

It is therefore an object of the present invention to provide a hydro-mechanical governor which produces a high quality of engine control with fuel injection governing at low idle speed and maximum speed.

It is an object of this invention to provide such a governor having a reduced stress creating effect on the accelerator linkage.

It is also an object of this invention to provide such a governor having a suitably "firm feel" to the operator, while requiring a lesser effort on his part to maintain desired engine speed.

Further and more specific objects and advantages of the invention will become apparent upon reading the following specification wherein a preferred embodiment of the invention is described by reference to the accompanying drawing.

In the drawing:

FIGURE 1 is a side elevation sectional view of the governor of the present invention with parts broken away as necessary.

FIGURE 2 is a view similar to FIGURE 1, showing a portion of the invention with certain parts in a different position.

Referring to the drawing, a governor **11** has a bifurcated control lever **13** which engages a cup-shaped spring seat **15** that is slidable on a support member **17**. When lever **13** is rotated counter clockwise, the spring seat **15** is urged to the right, as shown in the drawing, tending to compress or load a governor spring **19**. The entire spring seat assembly acts upon an adapter **21** which is restricted in its movement to the right by a rod **23** having a shoulder **25** engaging a complementary shoulder **27** on the adapter. Rod **23** is limited in its rightward movement by retainer **29** which abuts a stop **31**.

A spring **33** extends between a shoulder **35** of a sleeve **36** and the adapter **21**. Sleeve **36** is telescopically axially slidable within spring retaining member **15** and is biased toward an extended position by the spring **19** wherein it is retained by a ring **37**. Since spring **19** is preloaded within retainer **15**, the low idle spring **33** tends to force sleeve **36**, spring **19**, and retainer **15** to the left as shown in the drawing.

To increase engine speed, lever **13** is moved in a counter clockwise direction against spring retainer **15**. This tends to compress spring **33**, thereby urging adapter **21** rightwardly against the force of flyweights **69**.

As described in the above cited patent to Parks et al., rightward movement of adapter **21** causes a movement to the right of fuel pump rack **67** in the following manner. Oil is supplied to the valve **49** through an oil supply passage **51** which communicates with a passage **53** in the cylinder **55**. The oil then flows through a passage **57** to an annulus **59** in the spool **48** and from there to a passage **61** in a piston **63** and into chamber **65**. When the oil pressure in chamber **65** becomes great enough, piston **63** will move to the right and urge a fuel pump rack **67** in the same direction thereby increasing engine speed. Continued movement of lever **13** in a counter clockwise direction causes the compression of spring **33** until a face **39** of sleeve **36** abuts the adapter **21** at a face **40** thereof as shown in FIGURE 2. Due to the movement of the lever **13** in the counterclockwise direction in response to a signal from the operator, the governor spring **19** will maintain the relative position of the sleeve **36** and cup-shaped member **15** throughout the normal operating speed range of the engine. Proper selection of the generator spring will allow the spring to act to hold the member **15** and sleeve **36** as far apart as possible throughout this range. However, when the engine tends to run at a speed greater than the maximum speed of its operating range, the amount of force generated by the lever **13** and the flyweight **69** will be such as to cause the spring **19** to begin to compress and act to oppose the over-speed in the known manner.

In a decrease in engine speed lever **13** is rotated in a clockwise direction as shown in the drawing. This allows the flyweight **69** to move out radially, urging adapter **21** and valve spool **48** to the left blocking the oil supply passage **57**, allowing oil in cavity **65** to escape through passage **61**, around a groove **71**, and out a passage **73**. The dumping of the oil allows adapter **21** to pull rack

67 leftwardly, thereby decerasing the volume of fuel being injected into the engine.

When lever 13 is set in a low idle position, flyweights 69 move radially under the influence of engine speed to urge adapter 21 against the opposiing force of low idle spring 33. The axial movement of adapter 21 adjusts the fuel pump rack 67 to its low idle position through the servo system described above. When the opposing force of spring 33 balances the forces acting against flyweights 69, a low idle speed is obtained.

Thus, low idle speed is governed through the use of spring 33 and a maximum speed is governed through the use of governor spring 19. Should engine speed become greater than the maximum safe limit, the force acting upon flyweights 69 moves adapter 21 leftwardly from a position shown in FIGURE 2 upon spring 19 through the direct contact of sleeve 36 with the adapter. As adapter 21 moves to the left, rack 67 is moved to reduce the volume of fuel injected into the engine thereby decreasing engine speed. When a safe engine speed is reached, the force of spring 19 is sufficient to return sleeve 36 to its operational range setting against ring 37.

Thus, the applicant has provided a means to permit the operator of a highway vehicle direct control of the fuel pump rack in the operating speed range of the engine while governing the idle and maximum speeds. This is accomplished by preloading spring 19 and retaining it in a set position throughout the operating speed range. Because spring 19 acts as a solid member throughout this range, direct contact is maintained with the adapter 21 by sleeve 36, allowing the operator direct control of rack 67 without experiencing the "spongy effect" of the spring. Eliminating use of the spring in the operating range permits a shorter movement of the governor lever to obtain a corresponding movement of the fuel pump rack. Thus a large portion of the operating range is removed from the governor. Use of suitable linkage between the accelerator and the governor lever will provide suitable mechanical advantage such that only reduced forces can be transmitted from the governor to the accelerator thus minimizing operator fatigue.

What is claimed is:

1. An engine governor for controlling the maximum and minimum speeds at which an engine can run while allowing direct operator control of the fuel delivered to the engine between said maximum and minimum speeds comprising:

a fuel control member,

an adapter member,

an hydraulic servo means operatively connected to said fuel control member and to said adapter member,

a set of flyweights driven by the engine and bearing on said adapter member to tend to motivate said servo means and said fuel control member to a decreased fuel input position,

a sleeve member movably mounted adjacent said adapter and having

a flange thereon,

a first spring positioned for compression between said adapter member and said flange to a position causing abutment of said adapter member and said sleeve member,

a spring seat slidably mounted relative to said sleeve member,

a second spring positioned for compression between said flange and said spring seat, and

fuel control linkage operatively connected to said spring seat for moving said fuel control member to an increased fuel input position via said spring seat, said second spring, said sleeve member, said adapter member, and said servo valve without loss of force through compression of said second spring when said first spring is compressed to allow said sleeve member to abut said adapter member.

References Cited

UNITED STATES PATENTS

2,669,983	2/1954	Reddy et al.	123—140
2,727,503	12/1955	Reiners	123—140
3,145,624	8/1964	Parks et al.	123—140 XR
3,426,739	2/1969	Bailey et al.	123—140

LAURENCE M. GOODRIDGE, Primary Examiner