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A. LICHTE
GOVERNORS
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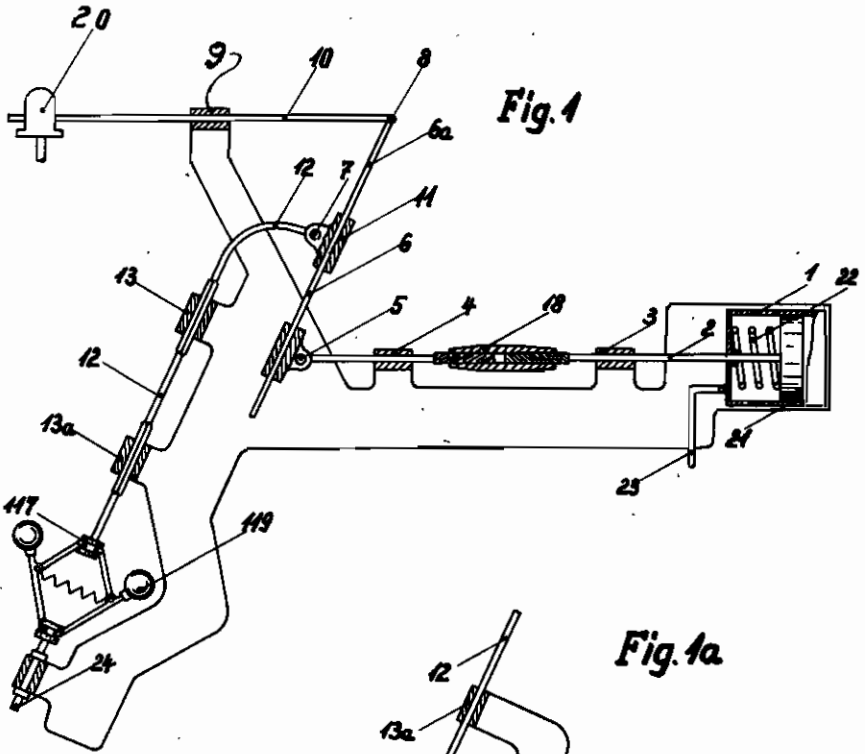

Fig. 1

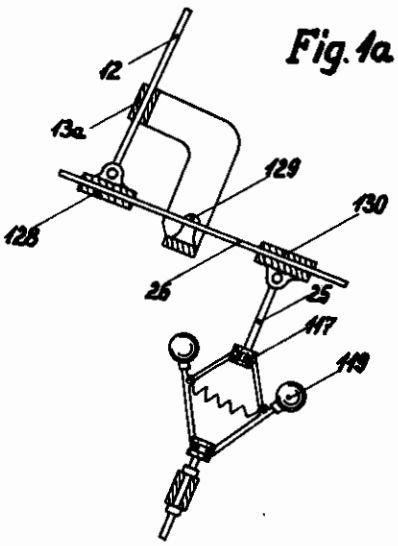

Fig. 1a

Inventor:
August Lichte,
Bailey & Carson
Attorneys

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Fig. 2

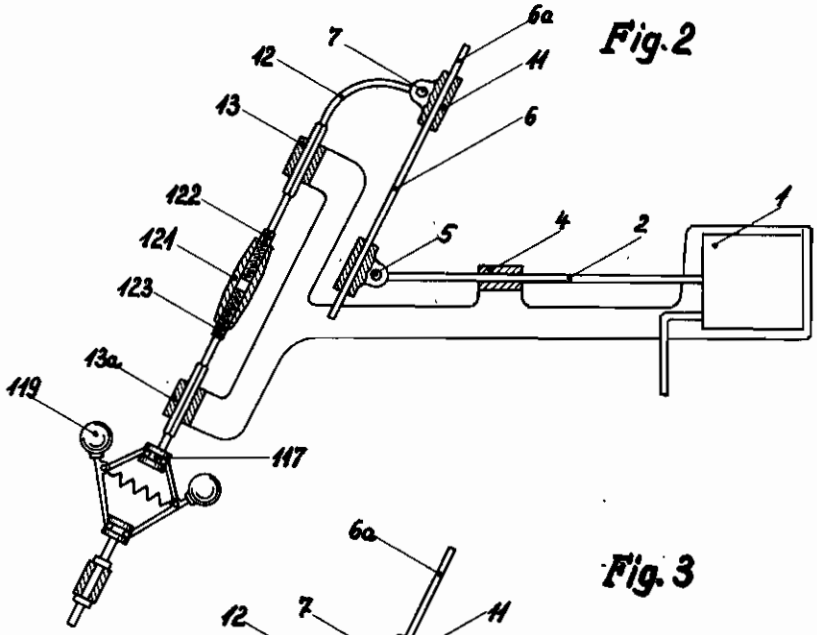
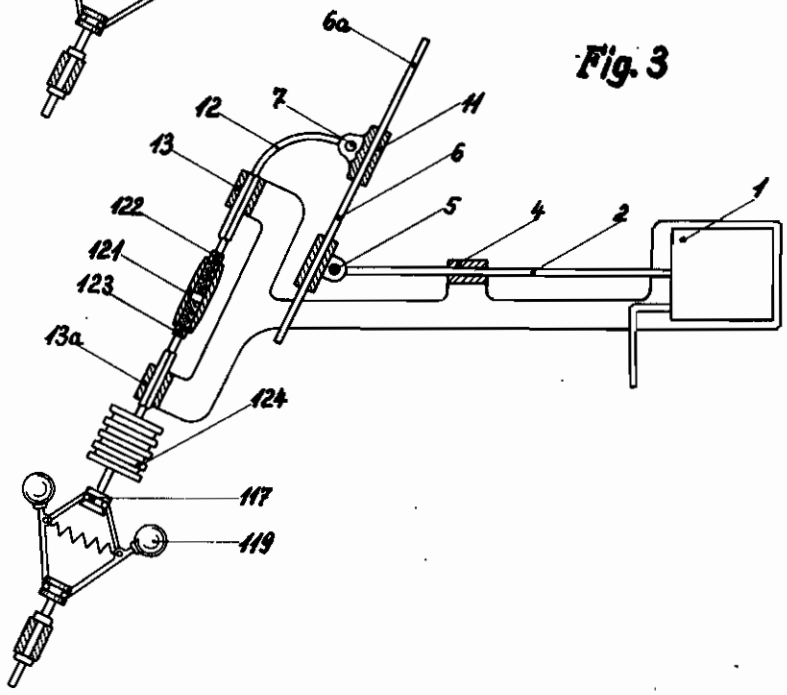


Fig. 3



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August Lichte,

Bailey & Pearson
Attorneys

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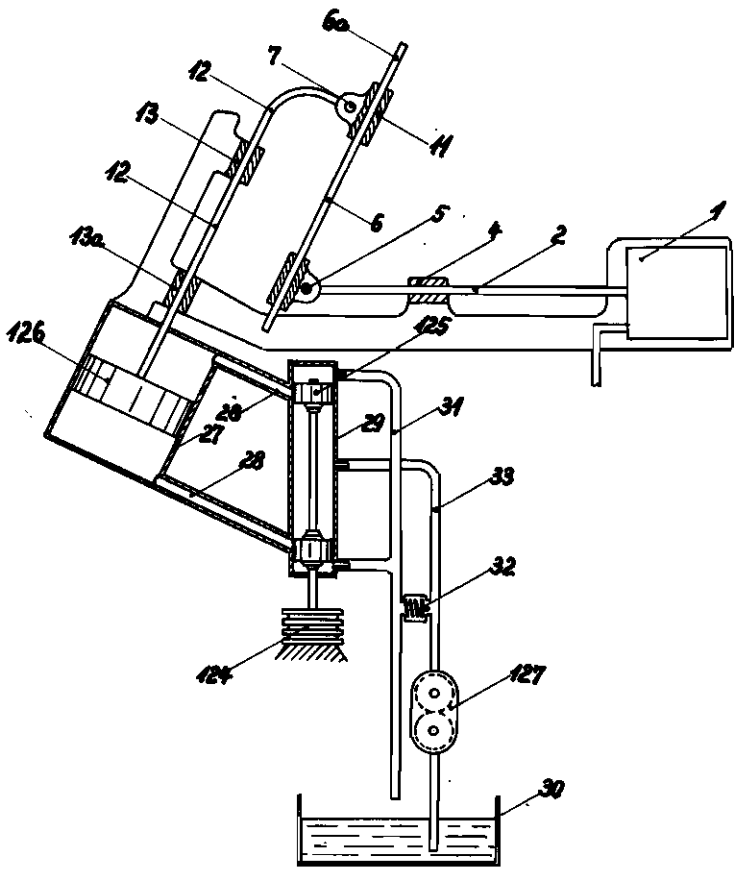
Fig. 4



Inventor:
August Lichte,
Bailey & Carson
Attorneys

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ALIEN PROPERTY CUSTODIAN

GOVERNORS

August Lichte, Dessau-Alten, Germany; vested in the Alien Property Custodian

Application filed April 1, 1939

This invention relates to governors and particularly to governors for the fuel injection mechanism of internal combustion engines.

The primary object of the invention is to provide a governor which is responsive in different respects to different variable conditions of operation of the engine.

A structure has previously been known in which the rate or quantity of injection of a fuel injection mechanism has been varied in accordance with some physical value which varies during the operation of the engine, as, for instance, the suction in the intake manifold, which of course varies with the load on the engine. In addition, means have been provided for adjusting the ratio of such regulation, such adjusting means having been operated manually.

It has now been found that in many cases other physical values which vary during the operation of the engine must be taken into consideration in controlling the fuel injection mechanism. Such values may be, for example, the speed of the engine, the temperature, the atmospheric pressure, the latter being particularly important in the case of aircraft engines which operate at rapidly changing altitudes. A primary object of the invention is to provide a mechanism which automatically utilizes variations in one or more of these physical values to vary the rate, period or time of injection of the pump.

Particularly, the object of the invention is to provide such a device in which one of the physical values operates to vary the fuel pump setting, while the other physical value operates to vary the ratio of transmission with which the force developed by the first value acts on the fuel pump.

A further object of the invention is to provide a servo-motor for increasing the power exerted by the second physical value, to vary the transmission ratio.

Further objects and advantages of the invention will appear more fully from the following description, particularly when taken in conjunction with the acompanying drawings which form a part thereof.

In the drawings:

Fig. 1 shows in side elevation a mechanism embodying the invention;

Fig. 1*a* shows a modification of a portion of the structure of Fig. 1; and

Figs. 2, 3 and 4 show, respectively, other modified forms of the invention.

As shown in Fig. 1, the mechanism is intended to control the position of the control rod 10 of a conventional fuel injection mechanism 20, such as an ordinary fuel pump. This rod is guided in a fixed guide 9 to slide longitudinally therein.

The position of the control rod 10 is accomplished from a rod 2 slidable in fixed guides 3 and 4. Rod 2 is connected to a control mechanism 1, including a piston 21 with which rod 2 is rigidly connected, a coil spring 22 urging the piston to the right, and a pipe 23 which may lead, for instance, to the intake manifold of the engine. It is obvious that variations in the intake pressure will vary the position of piston 21 and thereby of rod 2.

Rods 2 and 10 are connected by a lever having two arms 6, 6*a* to which they are pivoted at 5 and 6, respectively. The center portion of the lever 6, 6*a* is supported in a slidable sleeve 11, mounted on a pivot 7 which forms the fulcrum of the lever.

The length of rod 2 may be adjusted by a turnbuckle mechanism 18.

Such a construction has been previously suggested, in which the pivot 7 is fixed or is adjustable manually. It has been found, however, that it is desirable to bring into play certain other values which vary during the operation of the engine, and to utilize these values also for controlling the fuel pump. It has further been found that these values may conveniently be used, not to act directly on one of the rods 2 and 10, but instead to shift the position of pivot 7 and thereby to vary the ratio of transmission between the rod 2 and the rod 10.

To accomplish this result pivot 7 is mounted on the end of a rod 12 slidably mounted in fixed guides 13, 13*a*. Rod 12 is connected at its other end to the movable member 117 of a ball governor 118 mounted on a shaft driven by the engine.

The operation of this mechanism is as follows:

As the speed of the engine varies, the position of balls 118 will vary and the rod 12 will be shifted up or down, thus changing the position of pivot 7. This varies the relative leverage of the arms 6 and 6*a*, and thus varies the movement imparted to the rod 10 by any given movement of the piston 21 and rod 2. At the same time, if the rod 2 remains stationary, movement of pivot 7 will of course cause a corresponding movement of the rod 10. Thus the speed of the engine as well as the load enters into the control of the fuel pump 20.

Fig. 1*a* shows a modified form of connection between the governor 118 and the rod 12, to produce an amplification of the power of the

governor. In this modification, the movable member 117 of the governor carries a rod 25 pivoted to a sleeve 130 slidable on a lever 26. Lever 26 is pivoted at 129, and its other end is pivotally connected through a sleeve 129 to rod 12. By varying the relative position of sleeves 129 and 130, the leverage between the governor and the rod 12 can be changed.

Fig. 2 shows a modified form. In this construction, rod 12 is not of fixed length, but means are provided for adjusting its length, which may be desirable under certain conditions. For this purpose, the rod is provided with the threaded portions 122 and 123 connected by a threaded sleeve 121, the whole structure constituting a turnbuckle by which the length of the rod may be modified. In this structure, rod 2 is of invariable length.

In the form of the invention shown in Fig. 3, two variable physical values are simultaneously taken into account in determining the position of pivot 7. This form differs from Fig. 3 in that between the lower end of rod 12 and the movable member 117 of the governor there is inserted a bellows device 124, containing a gas or fluid under a predetermined pressure. It is obvious that by suitable construction of the member 124 its effective length will vary, either as a function of the atmospheric pressure or as a function of the atmospheric temperature as desired. Thus both the speed of the engine and the pressure, or temperature, may be taken into account in controlling the fuel feed mechanism.

In some instances, the power exerted by the ball governor or by any other control device may be insufficient to shift the pivot 7. In such a case the mechanism shown in Fig. 4 may be used. This includes the use of a servo-motor to control the position of pivot 7. Rod 12 is connected to a piston 126 movable in a cylinder 27, supplied by pipes 28 from a valve chamber 29. A control valve 125 is slidable in the chamber 29, and is connected, for example, to the barometric capsule 124. Fluid under pressure is supplied to the valve chamber 29 by a pump 127 from a suitable reservoir 30. Return fluid flows through pipe 31 back to the reservoir. A pressure relief valve 32 may be provided between the feed pipe 33 from pump 127 to valve chamber 129 and the return pipe 31.

The operation of this latter device should be evident. Variation in atmospheric pressure will cause a change in the effective length of the barometric device 124, which will shift valve 125 in one direction or the other. This will permit the flow of fluid under pressure to one side or the other of the piston 126, and will thereby shift the rod 12. The fluid from the other side of the piston will of course return to the reservoir through pipe 31.

AUGUST LICHTE.