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CONTROLLING OR REGULATING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed Jan. 26, 1940

Serial No. 315,835

2 Sheets-Sheet 1

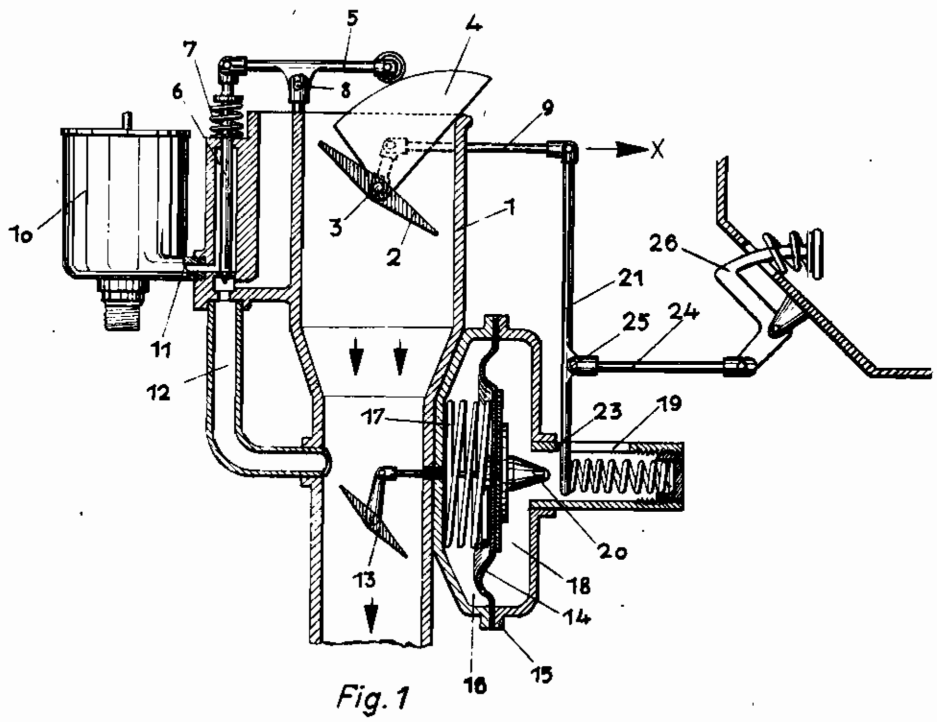

Fig. 1

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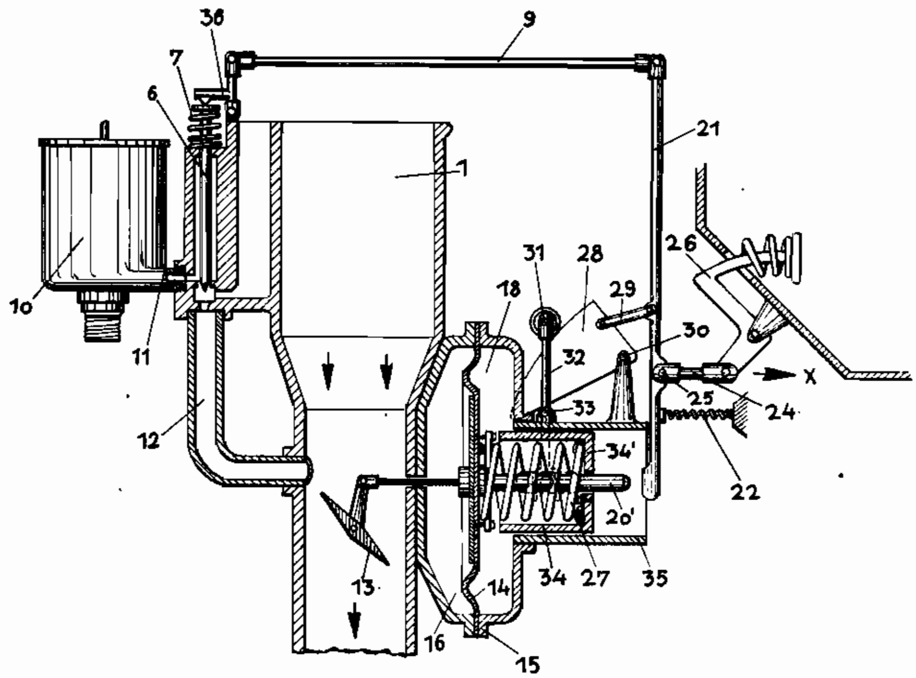

Fig. 2

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ALIEN PROPERTY CUSTODIAN

CONTROLLING OR REGULATING DEVICE FOR INTERNAL COMBUSTION ENGINES

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This invention relates to improvements in or relating to controlling or regulating devices for internal combustion engines of the kind in which an air quantity regulating element and a fuel regulating element are provided for controlling the air supply and the fuel feed, respectively.

The invention aims at providing means for controlling the pressure drop determining the inflowing air quantity regardless of any pressure fluctuation in the intake conduit resulting from pressure fluctuations in the combustion chamber of the engine.

A further object of the invention is to provide means for simultaneously adjusting the air controlling element and the fuel controlling element and for maintaining a constant pressure drop at said air element as well as at said fuel element. In this way the position of the air element and of the fuel element, respectively, is proportional to the amount of air or fuel flowing in.

Another object of my invention is to provide means for the avoidance of an overcharging of the engine as soon as the air controlling element reaches its terminal open position.

Other aims, advantages and objects of my invention will now be more fully explained with reference to the accompanying drawings, in which

Fig. 1 is a sectional view of one embodiment of the invention comprising an air controlling element and a throttling member in the air intake conduit;

Fig. 2 is a sectional view showing another embodiment comprising only one throttling member in the air intake conduit, and

Fig. 3 shows a detail of the embodiment according to Fig. 2.

In controlling or regulating devices it is important that the air and fuel elements be so adjusted that the air quantity and the fuel quantity are correlated at all engine loads in order to ensure an economic operation of the engine. To this end it does not suffice to positively couple the air member and the fuel member so as to ensure a simultaneous adjustment of both said members. In this manner a correct ratio between the air quantity and the fuel quantity can only be obtained if the pressure drop at the air controlling member and that at the fuel controlling member remain constant in all positions of said members. In the well known devices of this type this condition is not existent due to the fact that the influx of the combustion air into the combustion chamber of the engine fluctuates with the number of revolutions, wherefore the coupling of the air controlling element and the fuel controlling element referred to is inadequate.

In order to eliminate this drawback, the present invention aims at providing pressure sensitive means responsive to the pressure in the air intake conduit in front of the air controlling element for automatically controlling the pressure drop determining the inflowing air quantity in the intake conduit regardless of any pressure fluctuation resulting from the pressure variation in the engine's combustion chamber.

There are two possibilities for realizing this inventive principle:

(1) The pressure sensitive means referred to may be used for maintaining a constant pressure drop at the air controlling element so that the air quantity is merely dependent on the cross section adjusted by the air controlling element. In other words, the air quantity supplied is always proportional to the position of said element.

(2) Instead of maintaining constant the pressure drop and varying the cross section for controlling the air quantity, it is also possible to maintain the cross section constant and to control the air quantity by varying the pressure drop. In the latter event the pressure sensitive means will be combined with means for varying the so-called adjustment value, i. e. the value of the absolute pressure to be maintained constant by the air element.

Referring now to the drawings, Fig. 1 shows an embodiment based on the first mentioned principle. The air intake conduit 1 leading to the engine (not shown) is provided with a butterfly valve 2 rotatably mounted about a fixed axle 3. Fastened to the valve 3 is a cam 4 engaging one end of a lever 5, the other end of which engages a fuel control needle 6 having a spring 7 which holds in engaging relation the lever 5 and the needle 6 as well as the cam 4. The lever 5 has an axle 8 supported in any convenient manner by the conduit 1.

A rod 9 linked with the cam 4 may be manually operated for adjusting the valve 2 and the fuel needle 6 in response to the engine load. If for instance the rod 9 is moved in the direction of the arrow *x*, the valve 2 will be further opened and at the same time the lever 5 moves in a clockwise direction so that the spring 7 further lifts the needle 6, thereby increasing the fuel cross section.

It may be pointed out that the controlling curve 4*a* of the cam 4 may be formed in accordance with any desired variation of the fuel-air ratio upon the simultaneous adjustment of the valve 2 and the needle 6. It may, for instance, be desirable to enrich the fuel-air mixture as a function of the cross section controlled by the valve 2.

The fuel enters a float chamber 10 of the well known type comprising a float for maintaining a constant level in said chamber. A channel 11 leads from said chamber to the needle 6 and communicates with the conduit 12 which in turn communicates with the conduit 1 so that the fuel controlled by the needle 6 enters into the combustion air flowing through the intake conduit 1.

According to the invention, beside the butterfly valve 2 a second throttling member 13 is provided in the conduit 1 behind the valve 2. The second member 13 will be automatically controlled in such manner that the pressure drop at the main valve 2 (to be manually adjusted) remains constant in all positions of said valve. To this end a pressure sensitive means is provided—shown to be a diaphragm 14—arranged in a casing 15 the left hand chamber 16 of which communicates with the conduit 1 and comprises a compression spring 17 exerting a force on said diaphragm. The right hand chamber 18 of the casing 15 is in communication with the outer air via an orifice 19, so that the pressure in 18 is equal to the atmospheric pressure.

The device described operates as follows: Be it assumed that the suction behind the member 13 increases due to an increase in the number of revolutions. Such a change of suction will likewise result in a suction increase in front of the member 13, i. e. behind the main valve 2, whereby the pressure drop at 2 will be increased. Any pressure variation in front of 13 acts upon the diaphragm 14. In case of a suction increase, the pressure variation exerts a force on the diaphragm in the direction toward the conduit 1, so that an anti-clockwise rotation is imparted to the member 13. Therefore the cross section controlled thereby will be decreased and accordingly the suction between 13 and 2 will again be decreased until the predetermined pressure drop to be mainatined at 2 is restored.

As will be readily understood from the foregoing, the member 13 does not only control the pressure drop at the main valve 2, but likewise that at the fuel needle 6, since the conduit 12 is connected to the part of the intake conduit 1 in which the pressure is maintained constant by means of the member 13.

Obviously the member 13 upon an anti-clockwise movement may influence the pressure drop at the main valve 2 until it reaches its terminal open position. As soon as this position is reached, the cross section controlled by the member 13 cannot be further increased. Therefore it is possible that in the completely open position of the member 13 the pressure drop at the main valve 2 does not remain constant. In order to overcome this difficulty, additional means are provided for closing the fuel needle 6 and the main valve 2 as soon as the member 13 approaches its terminal open position. In the embodiment according to Fig. 1 this auxiliary means comprises a stud 20 fixed to the diaphragm 14 in the chamber 18, said stud being adapted to engage upon a nearly full right hand stroke of the diaphragm 14 a lever 21, the lower end of which is by means of a spring forced against a stop 23. The lever 21 is linked to the rod 9 and connected to any suitable controlling rod 24 to be manually operated by the gas lever 26. Upon adjustment of the gas lever 26 the lever 21 rocks about the stop 23 as a pivot point. As soon as the member 13 approaches its terminal open position, the stud 20 shifts the lever 21 away from the stop 23, thereby rocking it about the point 25 in an anti-clockwise direction so that the main valve 2 and the fuel needle 6 are closed.

Fig. 2 represents another embodiment based on the principle according to which the cross section of the intake air flow remains always constant, whilst the air quantity is controlled by varying the pressure drop determining the intake air flow.

The various parts of this embodiment also mentioned above in connection with Fig. 1 have the same reference numerals and therefore need not be enumerated in distinction from Fig. 1. The main air valve 2 is dispensed with so that the air inflow is only controlled by means of the throttle member 13 operatively connected to the diaphragm 14 in the same manner as described with reference to Fig. 1. Whilst the main valve 2 was provided for varying the air inflow by varying its cross section, the embodiment according to Fig. 2 leaves the cross section of the intake opening of the conduit 1 unchanged. The pressure drop of the air intake through said unchanged cross section will be determined by the position of the throttling member 13. Instead of the compression spring 17 in the chamber 16 (Fig. 1), a tension spring 27 is arranged in the chamber 18 as shown in Fig. 2. The tension force of this spring corresponds to the counterforce exerted by the suction in the chamber 16. As long as the tension force of said spring 27 remains unchanged, the position of the throttling member 13 likewise remains unchanged so that the pressure in front of the member 13 and the pressure drop at the intake opening of the conduit 1 remain constant. As may be readily understood, by any change in the tension force of said spring 27 a corresponding variation of said pressure drop and of the air quantity flowing in will be obtained. Accordingly means are provided for varying the initial tension of the spring 27 in response to the air quantity to be supplied. In the same manner as shown in Fig. 1 these means are controlled by the gas lever 26. The rod 24 operatively connected to the gas lever is linked to the lever 21 as at 25. The lever 21 is connected to a cam 28 by means of a link 29, said cam being rotatably mounted at 30 and engaged by a roller 31 provided at the end of a lever 32. This lever is swingably mounted at 33 and engages with its fork-shaped lower end a sleeve 34 slidably mounted in a housing 35 fastened to the diaphragm casing 15. The tension spring 27 being fastened to the bottom 34' of said sleeve 34, any displacement of the sleeve due to a controlling movement of the gas lever results in a corresponding change of the initial tension of the spring and accordingly in a corresponding change in the pressure drop as well as in the air quantity flowing in.

The lever 21, in a manner similar to that shown in Fig. 1, is held in contact with a stop 23 by means of a spring 22' (corresponding to the spring 22 of Fig. 1).

If now for instance the gas lever is depressed, the lever 21 and the cam 28 rock in a clockwise direction so that the lever 32 rocks in an anti-clockwise direction and displaces the sleeve 34 to the right. As a result the initial tension of the spring 27 is increased and the throttling member 13 is further opened until the suction in the conduit 1 and in the diaphragm chamber 16 reach the greater value necessary to restore the equilibrium. An increased suction in the conduit 1 results in an increased amount flowing in.

At the same time the fuel quantity controlled by the needle 6 will be correspondingly increased as shown in Fig. 2, the clockwise movement of the lever 21 is varied by a movement of a bell crank lever 36 in like direction so that the spring 7 as described in connection with Fig. 1 raises the needle 6.

With reference to the auxiliary means (stud 20) for additionally influencing the controlling operation, the embodiment according to Fig. 2 likewise corresponds to that of Fig. 1. As may be seen from Fig. 2, the diaphragm 14 is again provided with a stud 20' into the path of which projects the lower end of the lever 21, so that, as described above, this lever will be rocked in an anti-clockwise direction about the stud 23 as pivot point as soon as the stud 20' contacts with the lever 21 immediately before the controlling member 13 reaches its terminal open position.

The cam 26 provided for varying the initial tension of the spring 27 may also be used to serve the same purpose as the cam 4 in the arrangement according to Fig. 1. The form of the controlling curve of the cam 26 should therefore be in accordance with the variations of the fuel-air ratio as described in detail with reference to Fig. 1.

GUIDO WÜNSCH.