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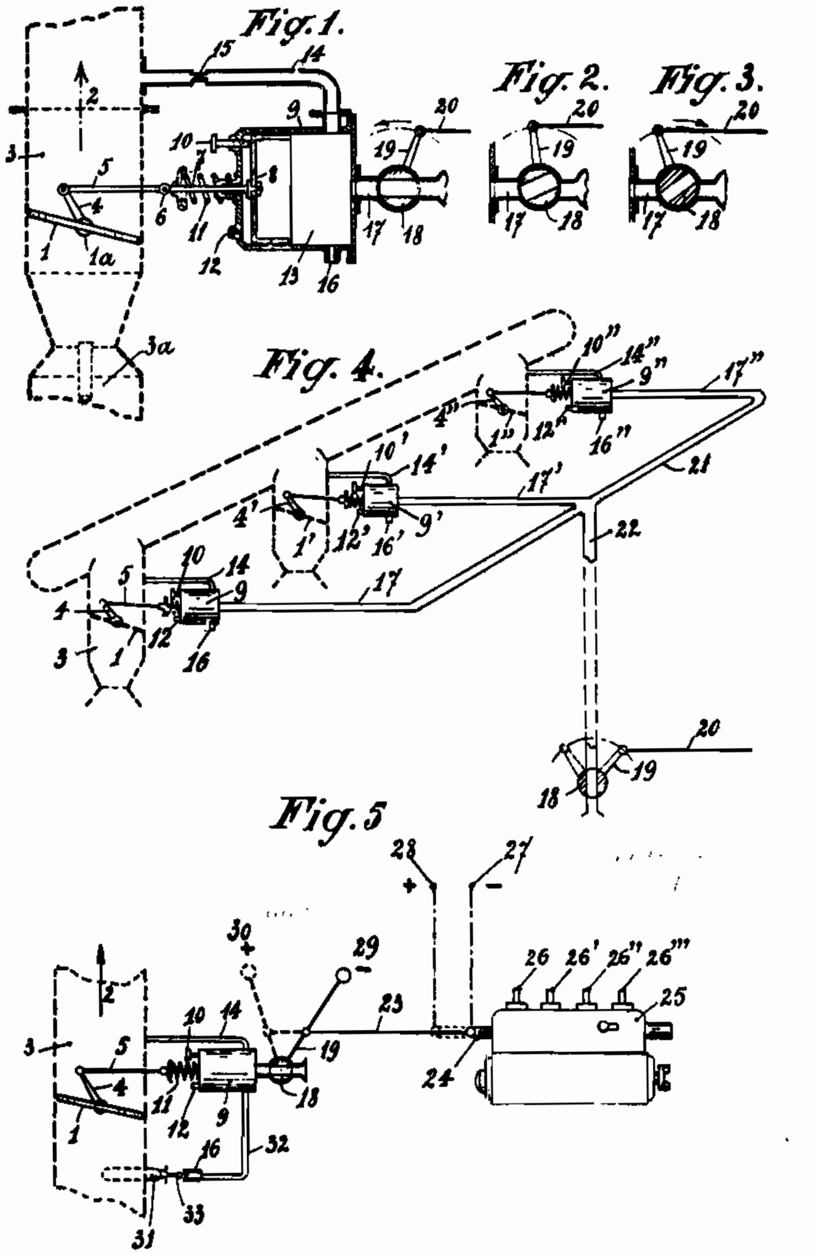

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EXPLOSION OR COMBUSTION ENGINES

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The present invention, which applies to explosion or combustion engines, provided with a carburetor or with a fuel injector, operating under fixed or variable working conditions, relates to an actuating device for opening or closing the throttles governing the admission of air or of carburetted gases supplied to these engines.

By this device the throttle or throttles are automatically actuated by a manometric relay influenced on the one hand by the partial or total atmospheric pressure and on the other hand by the partial or total vacuum prevailing in the admission conduct of the engine after the throttle or throttles. During normal operating conditions, only the action of the manometric relay prevails, without the intervention of any human force, nor of any other positive action whatever on the throttles taking place, the latter being consequently free to assume at any moment that position which depends on the value for which the partial vacuum is set in the manometric device, either by positive actuating means or by—for a given adjustment of this actuating means—the variations of working conditions resulting from the variations in the load of the engine.

The description which will follow, with reference to the appended drawing, given by way of non-limitative example, will allow a thorough understanding of how the invention can be embodied.

Fig. 1 is a diagrammatical sectional view of the manometric control device acting in conjunction with the throttle regulating the admission of the gases coming from a carburetor.

Figs. 2 and 3 represent a detailed view of a part of Fig. 1 in two different operating positions.

Fig. 4 is a perspective diagrammatical view of the manometric control device applied to the synchronized control of the throttles of several carburetors.

Fig. 5 shows this device, operating in conjunction with the throttle regulating the admission of air, in an engine to which fuel is supplied by an injector pump with volumetric output.

On Fig. 1, the throttle 1 controls the admission of the carburetted gases led towards the cylinders of an engine in the direction of the arrow 2 in the conduct 3 which constitutes the prolongation of a carburetor partially shown at 3*a*.

The throttle pivots about a spindle 1*a* and can be actuated by means of a lever 4 and a connecting rod 5 connected to the pin 6 of a rod 7 secured onto a piston 8. This piston 8 slides under airtight conditions in a cylinder 9. The throttle 1 can be pushed into its closed position, and the piston 8 held against the stop 10, by the action of a spring 11 compressed between the cylinder 9 and an abutment integral with the rod 7.

The outer face of the piston is made to communicate with the atmosphere by means of an orifice 12 which may be calibrated so as to brake the movements of the piston.

On the inner face of the piston, a chamber 13 communicates with the admission piping 3, after the throttle 1, by means of a conduct 14 and a choke 15. The chamber 13 is, moreover, in communication with the atmosphere by means of a calibrated orifice 16 and, if desired, by a conduct 17 and a valve 18 which can be operated by the lever 19 and the actuating means 20. The valve 18 is shown in different positions in Figures 2 and 3.

The operation is as follows:

For the position of throttle 1 shown, the admission into the cylinders is a minimum and corresponds to a no-load, low speed operation of the engine. The partial vacuum existing in 3 is, under these conditions, very superior to the contrary stress of the spring 11. The valve 18, shown in an entirely open position, allows the admission of air which destroys the partial vacuum transmitted to 13 and thus permits the spring 11 to hold the piston 8 up against the stop 10 and the throttle 1 in its minimum admission position.

Operating valve 18 in order to close it (Fig. 2) will result in partially reestablishing the partial vacuum in the chamber 13. The piston 8 will then be displaced and at the same time the throttle 1 will progressively open. This opening action will be interrupted when the depression prevailing in 3, communicated to the chamber 13, tempered by the admission of air through the orifice 18 and and the valve 18, will counterbalance the resistance of the spring 11 for a determined position of the valve 18.

In the position shown in Fig. 3, the valve 18 is shown completely shut and the partial vacuum prevailing in 3 is thus entirely communicated to the chamber 13. This corresponds to full admission conditions.

Under these conditions, the stress of the spring 11 will, for example, be predetermined to counterbalance the partial vacuum prevailing in 3 and communicated, in 13, to the inner face of the piston, when the engine operated at its maximum rate and the throttle 1 is wide open.

It is quite comprehensible that any reduction in the working speed resulting from an increase in the power required of the motor will have for effect a drop in the partial vacuum in 3 and in 13. The spring 11 will no longer be counterbalanced and the piston 8 will be drawn forward thereby progressively shutting the throttle 1, which will result in a modification of the partial vacuum in 3.

The same operation will take place again for all positions of the valve 18 between the slowing down and full admission, which is equivalent to saying that a determined value of the pressure in the conduct 3 will correspond to each position of the said valve, whatever changes may occur in the speed and load of the engine.

Moreover, the partial vacuum communicated to 13 can be modified at will by calibrating the air admission orifice 16 so as to be proportional to the size of the orifice 15 which communicates the partial vacuum. This arrangement will allow to determine without difficulty the proper choice of the spring 11, or, for example, for any given spring, to control the said partial vacuum in 13 in order to cause the supply pressure in the engine in the conduct 3 to vary independently of the action of the valve 18.

These arrangements result in the obtention of the following advantages:

For instance, it is possible to maintain the partial vacuum after the throttle 1 constant at full load, this condition ensuring a more regular operation of the motor and a better utilization of the fuel.

The spring 11 may be chosen to answer definite aims: either because it is desired to limit the admission pressure to a determined maximum value, during full load operation; or because what is wanted is to completely fill up the engine at high duties with the possibility of automatically closing the throttle 1 for the low full load speeds in order to, for example, allow a better atomisation of the fuel by an increase in the speed of the air current at the level of the throttle 1. In this latter case, the strength of the spring 11 will be predetermined so as to be insufficient to counterbalance the partial vacuum at the maximum full-load rate and, as a result, the closing of the throttle as a consequence of load variations will occur only after a substantial decrease in the working speed.

Another advantage can be obtained by that type of control which allows, in the case of the so-called "floating" engines, the suppression of the abrupt opening of the admission and the transmission shocks which result therefrom at low, full-load speeds as a consequence of torque irregularities. This result can be easily obtained by giving the orifice 12 the proper calibration, with a view to breaking the too rapid acceleration of the piston 8 in conjunction with the displacements of the positive control means actuating the valve 18.

Fig. 4 diagrammatically represents three manometric devices acting in conjunction with three carburetors mounted on a common admission conduct. The branch conducts 17, 17' and 17'' of the manimetric devices are connected one to another by a canal 21. A feeder, the length of which may, incidentally, vary, joins the canal 21 to the only valve 18.

Each one of the throttles operates in exactly the same manner as described above. The valve 16 simultaneously controls the three relays, atmospheric air being distributed to each one of the cylinders 9, 9', 9'' by means of the piping 22, 21, then 17, 17' and 17''. The feeder 22 may be given a sufficient diameter to avoid any loss of load, and may be given a convenient length to simultaneously obtain the possibility of governing at a distance and a transmission free from mechanical play, thus ensuring a perfect synchronization in the actuating of the throttles. This arrangement naturally applies in the case of several motors operating synchronously and controlled by a single valve 18.

In the embodiment shown in Fig. 5, the conduct 3 supplies pure air, in the direction of the arrow 2, to an engine provided with an injector in which the fuel is sent into the cylinders by a pump 25 and conducts 26, 28', 26'' and 28'''. The throttle 1 is connected to the same organs as in Figures 1 and 2. Moreover the control lever 19 of the valve 18 is connected by a rod 23 to the axis of a rack 24, the displacements of which, between the positions 27 and 28, control the variations in the discharge of the pump 25. The extreme points 27 and 28 correspond respectively to the points 28 and 30 of the total displacement of the lever 18. Finally, a capsule 31, sensitive to temperature variations controls the movements of an arrow 33 which can vary the cross-section of the orifice 16 connected to the chamber 13 by an appropriate canal 32.

The operation of the manometer control means of the throttle 1 remains the same as that described in the preceding examples and ensures, in addition to those advantages already indicated, the automatic control of the air-fuel ratio in function of speed and load variations of the engine.

For, as has been explained hereabove, the pressure, for all positions of the valve 18, assumes a constant value in the conduct 3, whatever may be the working speed variations resulting from changes in the load. Consequently, if, on the one hand, the connection between the control means of the valve 18 and that of the rack 24, which regulates the output of the pump 25 is arranged in such a way that a suitable fuel supply corresponds to each value of the air pressure in 3 determined by a given position of the valve 18, and if, on the other hand, for this same position of the valve 18, the fuel supply discharged by the injector pump remain proportional to the working speed of the engine, the constancy of the air-fuel ratio will automatically be maintained by the action of the piston 8, said action being a function of the working speed variations resulting from the load variations of the motor. This same result will obviously be obtained for all positions of the control means actuating the valve 18 and the rack 24.

On Figure 5, the device ensuring the liaison between the control means of the valve 18 and the rack 24 of the pump is supposed to be a connecting rod 23. Such a connection means may not allow to obtain the suitable relation between the displacements of the valve 18 and those of the rack 24. To obtain the desired relation, which relation or law is itself a function of the shape of the valve and of the constitution of the pump, it is possible to ensure the liaison between the control means of the valve and the rack 24 in any suitable manner, by means of an adequate profile cam for example. This cam may be, for example, mounted on the axis of the valve 18 and will act on the rack 24 by means of a rod resting on its profile.

A liaison ensured by means of a connecting rod may also be maintained by giving the valve opening or port 18 an appropriate shape so that the cross-section of the passage way varies according to a determined law.

Finally, it would be possible to arrange in the same manner the internal control means of the pump.

Moreover, the variations in the air supply which may be the result of temperature changes will be rectified by the action of the capsule 31 and the arrow 33 which, by increasing or diminishing the size of the orifice 18 for the admission of air will modify the motive partial vacuum acting at all times on the piston 8 and, by so doing, will diminish or increase the air supply in 3 in relation to the temperature.

The embodiments shown do not in any way limit the invention but are only given by way of example.

In particular, the piston 8 may be constructed in all sorts of ways or even replaced by a membrane or bellows without departing, by so doing, from the scope of the invention.

The same remark applies to the liaison means between the piston 8 and the throttle, which connecting means may consist in a rack or any other suitable mechanical device.

The valve 18 which proportions the atmospheric pressure inside the manometric device may be different from the tap represented on the drawing; it may be constituted by a needle valve or by any other appropriate device.

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