

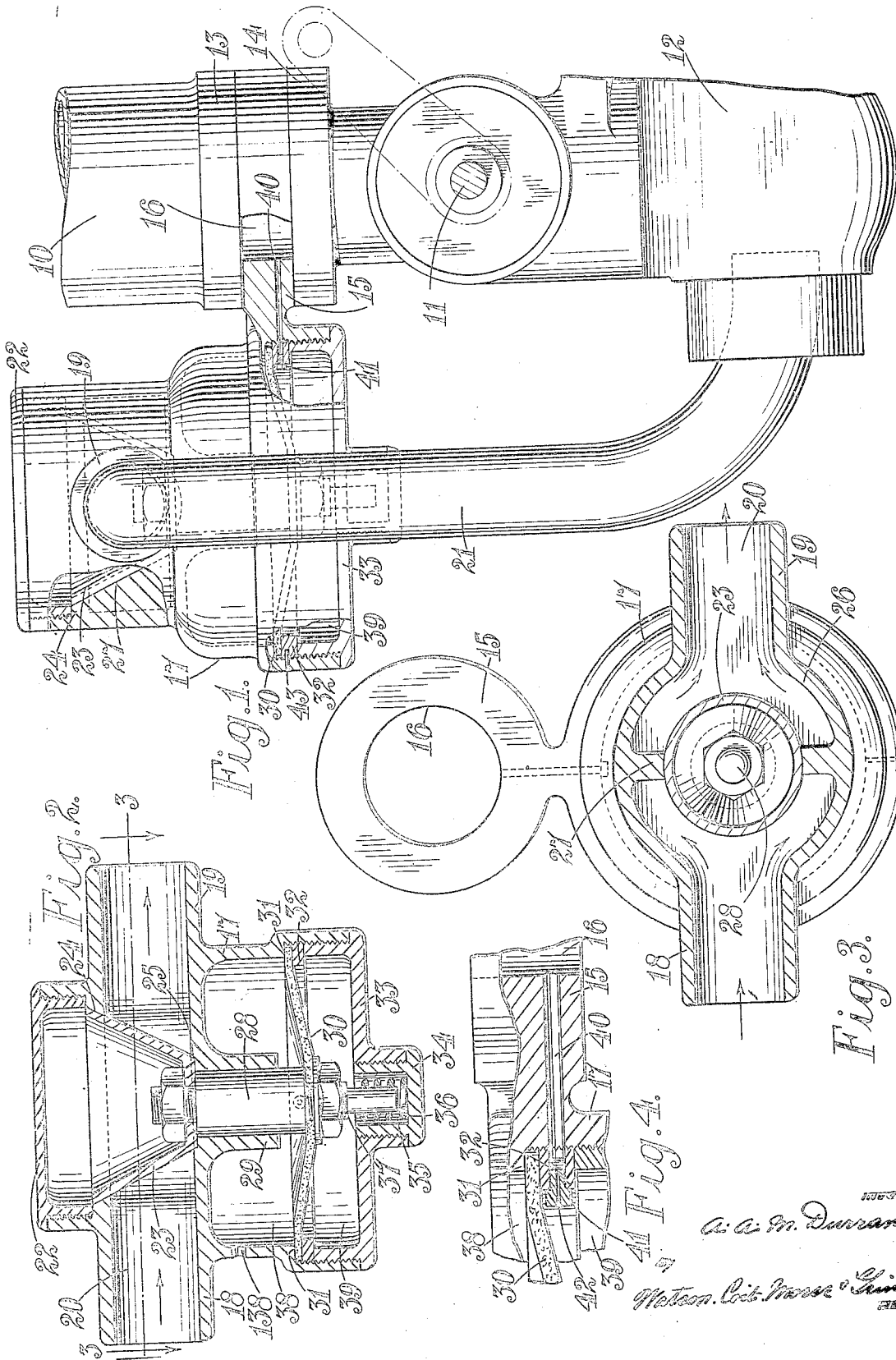
Aug. 26, 1924.

1,506,166

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REGULATION OF THE COMBUSTIBLE MIXTURE IN INTERNAL COMBUSTION ENGINES

Filed Jan. 2, 1923



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UNITED STATES PATENT OFFICE.

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REGULATION OF THE COMBUSTIBLE MIXTURE IN INTERNAL-COMBUSTION ENGINES.

Application filed January 2, 1923. Serial No. 610,394.

To all whom it may concern:

Be it known that I, ALBERT ARTHUR MOLTENO DURRANT, a subject of the King of England, residing at Dulwich, London, England, have invented certain new and useful Improvements in the Regulation of the Combustible Mixture in Internal-Combustion Engines, of which the following is a specification.

This invention is for improvements in or relating to apparatus for regulating the combustible mixture in internal-combustion engines. The type of apparatus to which the invention relates is that wherein a conduit for the supply of an anti-detonating agent to the engine cylinder is controlled by a valve which is operated by a movable member, such as a piston, the movement of which is controlled by the suction action produced by the partial vacuum in the main fuel and air passage of the engine.

It is well known that in some types of internal-combustion engines, particularly with certain fuels, faulty or incomplete combustion of the fuel regularly occurs, with resulting loss in power and efficiency, whenever certain conditions of compression or engine speed exist. This unsatisfactory combustion has been described in certain theories as being due to "detonation", and to overcome it, anti-detonating agents have been proposed to be introduced into the combustible mixture. For example it has been proposed to add inert gases, such as exhaust gases, to the combustible mixture for this purpose, this being done either by incomplete scavenging or by adding the exhaust gases to the stream of incoming combustible mixture. When the compression in the engine cylinder is increased beyond a certain figure, which figure will vary depending upon the type of engine, and type of fuel used, and upon other circumstances, the losses due to unsatisfactory combustion are much greater than at lower degrees of compression, but, of course, a high compression is normally sought after because a higher efficiency is theoretically obtainable thereat than at low compressions.

This invention has for its main object to provide an improved construction of apparatus of the type referred to such that the anti-detonating agent will be supplied to the combustible mixture even at high de-

grees of compression in the engine cylinder.

A specific object of the invention is to supply a gaseous anti-detonating agent to the air intake of the engine carburetor.

In apparatus of the type referred to proposed heretofore, the movable member in the form of a piston has been loaded by a spring that tended to keep the valve seated so that the supply of the anti-detonating agent was normally cut off. In such an arrangement, if the suction action in the main passage was so weak, owing to the throttle being fully open, that the load of the spring on the piston could not be overcome by it, the passage for the supply of the anti-detonating agent would be closed when the compression in the cylinder was high.

According to this invention, apparatus of the type described for regulating the combustible mixture in internal-combustion engines is characterized by the fact that the spring or its equivalent acts on the movable member in such a manner that the latter tends to open the valve against the action of the said suction effect which controls the movement of the movable member. In this construction, therefore, the supply of anti-detonating agent to the combustible mixture is controlled by means which are only operative when the engine compression exceeds a predetermined amount. For effecting this automatic control, the compression in the cylinder may be estimated or measured by the degree of opening of the main throttle or the degree of partial vacuum in the engine induction pipe on the cylinder side of the main throttle, since the engine compression will normally be at its greatest when the throttle is fully opened and similarly in such a state of affairs there will be the least amount of partial vacuum in the engine induction pipe.

Where the engine compression is estimated by the degree of partial vacuum in the engine induction pipe on the cylinder side of the main throttle, and the suction action is operative directly on one face of the movable member aforesaid, according to another feature of the present invention the said movable member is in the form of a flexible diaphragm to which the stem of said valve is attached. As this diaphragm and the valve controlled by it is spring loaded the valve will only be opened when there is but

little partial vacuum in the engine induction pipe.

In the foregoing there has been described means for regulating the supply of anti-detonating agent in accordance with variations in the engine compression. As the compression increases, supplies of anti-detonating agent are introduced into the combustible mixture and thus, although the latter is with certain anti-detonating agents rendered less efficient so far as its power factor is concerned, yet this loss is more than counterbalanced by the increased efficiency obtained owing to the prevention of "detonation".

For a more complete understanding of the invention there will now be described, by way of example only and with reference to the accompanying drawings, certain constructional forms of mechanism according to the present invention. It is to be understood, however, that the invention is not limited to the precise constructional details set forth.

In these drawings:—

Figure 1 is an outside view, partly in section, of certain parts of an internal-combustion engine with one form of mechanism according to the present invention applied thereto;

Figure 2 is a cross-section through a part of the mechanism shown in Figure 1;

Figure 3 is a section on the line 3—3 of Figure 2, and

Figure 4 is a detail sectional view on a scale larger than that of the preceding figures showing a portion of the mechanism.

Like reference numerals indicate like parts throughout the drawings.

Referring to the drawing, the engine induction pipe is indicated at 10, the main throttle at 11 and the carburetor at 12. Clamped between flanges 13 and 14 is a lug 15 having a perforation 16 to coincide with the bore of the induction pipe. The lug 15 projects from a valve casing 17 having bosses 18 and 19 which are bored to form a throughway 20. The boss 18 is intended to be coupled to a supply of the anti-detonating agent such as cylinder exhaust gases, and the boss 19 is coupled to a conduit 21 leading to the air intake of the carburetor 12. The casing 17 has an aperture at its top which is closed by a cap 22, and below this cap is situated a valve 23 which controls the passage 20. The valve 23 is of conical formation and has circular seatings 24 and 25 in the casing. The passage 20, where it passes the valve 23, is increased in width (at 26 Figure 3) and is provided with ribs 27 which also form seatings for the valve. When the valve is down upon its seatings the passage 20 will be closed but it will be seen that the formation and arrangement of the parts is such that only a slight lift of the

valve will afford a substantial opening for passage of a fluid past it.

The valve 23 is secured upon a stem 28 guided in a boss 29 and this stem is secured at its lower end to a flexible diaphragm 30 of leather, corrugated flexible metal, or other suitable material. The outer edges of the diaphragm 30 are secured against a face 31 in the casing 17 by a clamping ring 32 and below the clamping ring there is screwed into the casing 17 a cap 33 with a detachable plug 34. The plug 34 is recessed at 35 to house a spring 36 which at one end bears against a surface of the plug and at the other end bears against an abutment 37 on the stem 28. The spring 36 tends to open the valve 23.

The diaphragm 30 divides the interior of the casing 17 into two separated chambers 38 and 39. The chamber 38 has a vent 138 to provide communication with the outside and the chamber 39 is in communication with the interior of the engine induction pipe 10 on the cylinder side of the throttle 11. For this purpose the passage 40 which extends between the perforation 16 and the clamping ring 32 is provided. The clamping ring 32 also has fitted into it a plug 41 having a bore 42 of smaller diameter than the bore 40. In this way communication is established between the interior of the induction pipe 10 and the chamber 39, the smallness of the bore 42 operating to damp the fluctuations in pressure and secure regularity in the movements of the diaphragm due to such fluctuations in pressure. A securing pin 43 is provided which is passed through the casing 17 into the ring 32 and which operates to prevent the latter from slackening and to maintain it in appropriate alignment with the bore 40.

In operation, it will be appreciated that when the engine compression is high, there will not be a very considerable vacuum established in the engine induction pipe, consequently the difference in pressures in the two chambers 38 and 39 will be such that the spring 36 will be able to open the valve 23. When, however, the compression in the cylinder falls, the vacuum in the induction pipe will become greater and this will operate to maintain the valve 23 closed despite the pressure of the spring 36. The spring 36 may be made adjustable to vary the amount of vacuum required to close the valve.

The anti-detonating agent employed may be exhaust gases from the engine which may be cooled if desired before they are returned to the engine cylinder; or steam generated say in a coil surrounding the exhaust pipe may be employed; or some other inert diluent may be employed, or instead of an inert gas a combustible gas may be employed which has properties capable of correcting

the detonating propensities of the main fuel, for example alcohol injected through a needle valve may be employed. It will also be understood that the supply of anti-detonating agent may reach the cylinder by a path other than that of the engine carburetor.

Further, the precise constructional details hereinbefore set forth may be modified in various ways without departing from the scope of the invention as defined in the claims. For example, instead of employing the flexible diaphragm 30, the same result will be obtained by employing collapsible corrugated bellows, say of spun copper to operate the controlling valve.

I claim:—

1. The combination of an induction conduit for fuel and air leading to the cylinder of an internal-combustion engine, a valve controlling said conduit, a carburetor supplying said conduit, a supply conduit for the supply of a gaseous anti-detonating agent to the air intake of the carburetor, a valve controlling said supply conduit, a chamber connected to said induction conduit at the cylinder side of the first said valve, a controlling member operatively connected with the latter valve and movable in said chamber under the suction action therein in a direction to close the latter valve, and a spring operative on the second said valve tending to open the same against the suction action on said controlling member.
2. The combination of an induction conduit for fuel and air leading to the cylinder of an internal-combustion engine, a valve controlling said conduit, a carburetor supplying said conduit, a supply conduit for the supply of a gaseous anti-detonating agent to the air intake of the carburetor, a valve controlling said supply conduit, a suction chamber whereof one wall is constituted by a flexible diaphragm so connected to the latter valve that suction in the chamber tends to flex the diaphragm so as to close the latter valve, a duct connecting said

chamber to said induction conduit on the cylinder side of the first said valve, and a spring operative on the second said valve tending to open the same against the action of suction in said chamber.

3. The combination with a valve arranged to control a conduit for the supply of a gaseous anti-detonating agent to the air intake of the carburetor of an internal-combustion engine, of a suction chamber, a controlling member movable in said chamber and operatively connected to the valve and arranged to seat the valve under the action of suction in the chamber, and a spring tending to open the valve, said chamber having a duct for connection to the induction pipe of an internal-combustion engine.

4. The combination with a valve arranged to control a conduit for the supply of a gaseous anti-detonating agent to the air intake of the carburetor of an internal-combustion engine, of a suction chamber whereof one wall is in the form of a flexible diaphragm that is carried by the stem of the valve is arranged to seat the valve under the action of suction in the chamber, and a spring tending to open the valve, said chamber having a duct for connection to the induction pipe of the internal-combustion engine.

5. The combination with a valve arranged to control a conduit for the supply of engine exhaust gases to the air intake of the carburetor of an internal-combustion engine, of a suction chamber whereof one wall is in the form of a flexible diaphragm that is carried by the stem of the valve and is arranged to seat the valve under the action of suction in the chamber, and a spring in said chamber tending to open the valve, said chamber having a duct for connection to the induction pipe of the engine, which duct has a restricted end that opens into the said chamber, for the purpose described.

In testimony whereof I affix my signature.

ALBERT ARTHUR MOLTENO DURRANT.