Oct. 2, 1934. E. RECTOR 1,975,619

ANTIDETONATING MEANS

Filed July 18, 1932 2 Sheets-Sheet 1

Fig. 1.

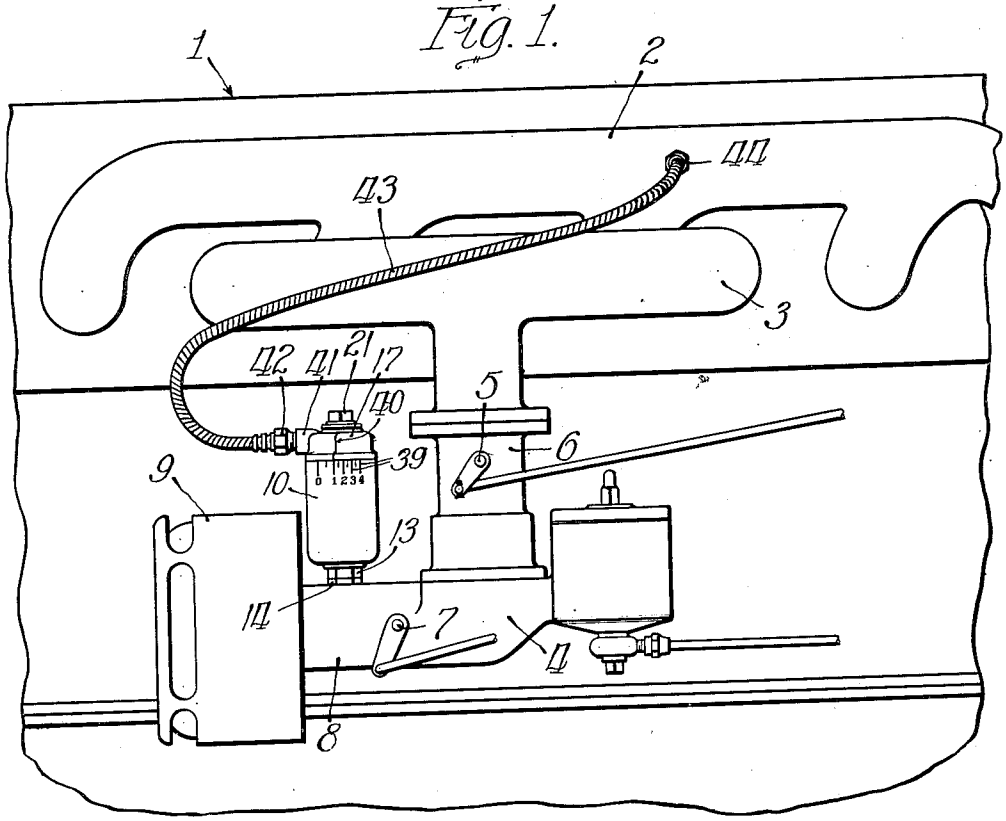


Fig. 2.

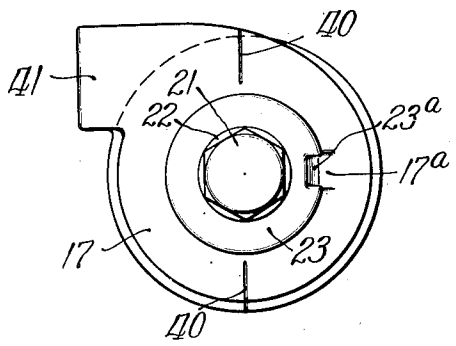
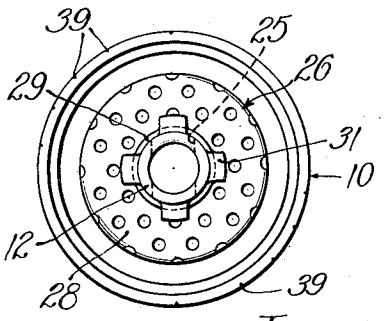


Fig. 3.



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Fig. 4

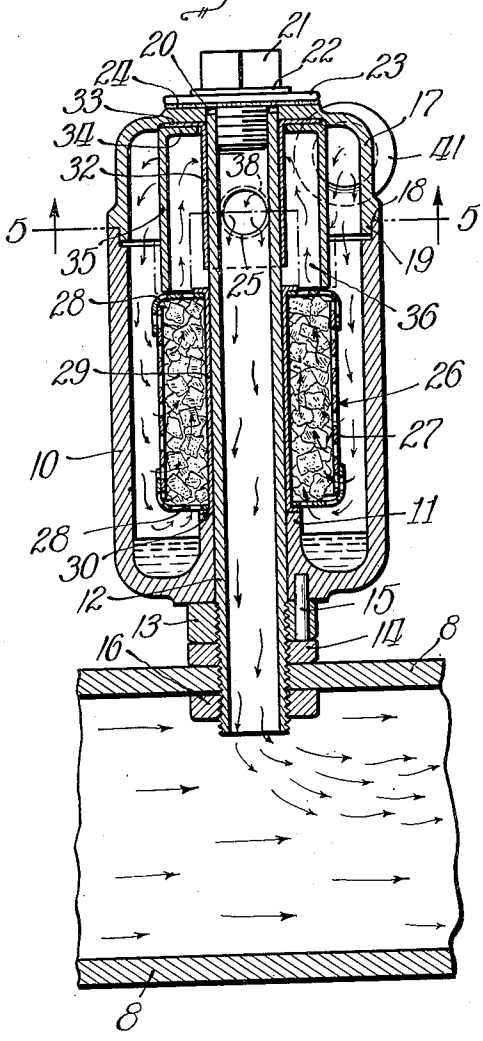


Fig. 5.

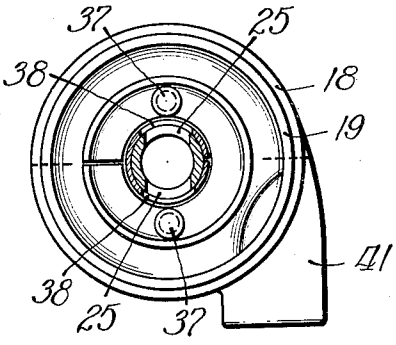
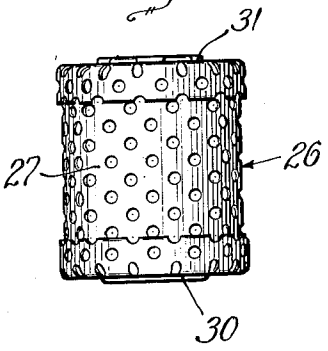


Fig. 6.



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UNITED STATES PATENT OFFICE

1,975,619

ANTIDETONATING MEANS

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Application July 18, 1932, Serial No. 623,104

13 Claims. (Cl. 123—119)

This invention relates to internal combustion engines, and has to do with means for preventing detonation in the operation of such engines.

It is known that, in the operation of internal combustion engines, a fuel knock or detonation occurs, which is particularly noticeable in engines operating on a high compression ratio. This detonation is objectionable as detracting from the operating efficiency of the engine, in addition to being a source of annoyance. It is known that the tendency of a fuel to detonate can be reduced by adding thereto certain chemicals. It is also known that the addition of certain metals to the fuel tends to decrease detonation. One of the most common compounds used is tetra-ethyl lead which, though efficient as reducing the tendency to detonate, is open to the objection that it is poisonous and must be handled with considerable care. Also, in the use of fuel with which tetra-ethyl lead is mixed, there is apt to be excessive deposition of metallic lead in the cylinders and appurtenances thereto resulting in fouling of the spark plugs, and other difficulties.

One of the main objects of my invention is to provide simple and efficient means for supplying to the engine cylinders a substance possessing anti-detonating qualities. A further object is to provide a device of the character stated which can be quickly applied without necessitating any material changes in the engine or the appurtenances thereof, and which can readily be adjusted to regulate the amount of anti-detonating substance delivered to the cylinders in accordance with requirements. Further objects and advantages of my invention will appear from the detail description.

In the drawings:—

Figure 1 is a fragmentary elevation of an internal combustion engine, shown semi-diagrammatically, with an anti-detonating device in accordance with my invention applied thereto;

Figure 2 is a plan view of the device;

Figure 3 is a plan view of a device with the head at the upper end thereof removed;

Figure 4 is a section, on an enlarged scale, taken on a vertical plane extending through the center of the device and lengthwise of the carburetor intake member;

Figure 5 is a section taken substantially on line 5—5 of Figure 4;

Figure 6 is a detail elevational view of the perforated container for the anti-detonating substance;

I have illustrated the device of my invention as applied to an internal combustion engine 1 of conventional type. This engine has associated therewith an exhaust manifold 2, an intake manifold 3 and a carburetor 4, all of known type, the carburetor being connected to the intake manifold in a known manner. A throttle valve 5 is mounted in stack 6 of the carburetor and a choke valve 7 is mounted in air intake member 8 of the carburetor, these valves being operated in a known manner. Preferably, though not necessarily, an air cleaner 9 of known type is suitably mounted at the outer end of the air intake member 8.

The device of my invention comprises a cylindrical casing 1 provided, at its lower end, with an upwardly and inwardly extending neck 11 disposed concentrically with the casing. This neck receives a tube 12 which projects below the casing and extends through an opening in the top wall of air intake member 8. A nut 13 screws onto tube 12 upon which it is secured by a jam nut 14 also screwing onto the tube. A pin 15 enters a suitable recess in the lower end of casing 10 and extends into nut 13, this pin holding the tube and the casing against relative turning movement when they are in assembled relation. A nut 16 screws onto the lower end of tube 12, within member 8, and cooperates with nut 14 for securing tube 12 tightly to the air intake member 8 of the carburetor. In this manner, the device is secured to member 8 and has communication therewith through tube 12.

A cylindrical head 17, provided adjacent its lower end with an outer shoulder 18, fits into the upper end of casing 10, which is rabbeted for reception of flange 19 of the head extending below shoulder 18. Tube 12 extends upwardly within the casing and into an opening 20 extending through the top wall of head 17. A cap screw 21 screws into the upper end of tube 12, the head of this screw bearing upon a lock washer 22 of known type which seats upon a washer 23, between which and the top of head 17, a gasket 24 of asbestos or other suitable material is disposed. Washer 23 is provided with a depressed element 23*a* which engages into a corresponding recess 17*a* in the top wall of head 17. When cap screw 21 is turned tightly into tube 12, nut 13 bears against the lower end of casing 10 and head 17 is securely clamped between washer 23 and the upper end of the casing so as to form a fluid tight closure therewith. The washers 22 and 23 cooperate with each other and with head 17 to hold the cap screw 21 against turning movement. Loosening the cap screw 21 slightly per-

mits of turning movement of head 17 relative to casing 10 for regulating communication between the interior of the casing and tube 12, as will be more fully described.

Tube 12 is provided, adjacent the upper end thereof, with two diametrically opposite openings 25 of appreciable area. These openings are disposed above a container 26 of cylindrical shape and of perforated or foraminous construction. This container comprises a cylindrical body 27, the end portions of which fit into flanged heads 28 through which extends a central sleeve 29, one end of which is beaded over at 30 to provide a flange contacting the outer face of the adjacent head 28. At its other end the sleeve 29 is provided with spaced tabs 31 which are bent outwardly into contact with the outer face of the other head. This sleeve 29 fits snugly about tube 12 and cooperates with the tube and with neck 11 for supporting the container within casing 10 concentrically therewith and above the bottom of the casing but below the openings 25 in the tube.

A sleeve 32 extends downwardly from head 17 and fits snugly about the upper portion of tube 12, this sleeve extending below the openings 25. Sleeve 32 is provided at its upper end with an outwardly extending flange 33 disposed between the under face of head 17 and a flange 34 extending inwardly from the upper end of a cup-shaped closure member 35, the lower end of which is disposed in close proximity to the upper end of container 26. Member 35 is of materially greater diameter than sleeve 32 so as to provide an annular space 36 about this sleeve and the portion of tube 12 above container 26. Sleeve 32 and member 35 are suitably secured to the top wall of head 17, as by means of rivets 37 which pass through the flanges 34 and 33.

Sleeve 32 is provided with two diametrically opposite openings 38 disposed in the plane of openings 25 and moved into and out of register with the latter in accordance with the adjustment of the sleeve about tube 12. Referring more particularly to Figures 1 to 3, casing 10 is provided, at the upper end and at opposite sides thereof, with graduation marks 39 numbered from 0 to 4. Head 17 is also provided, at opposite sides thereof, with index marks 40 which are intended to be brought into register with the marks 39 selectively by turning movement of head 17. This turning movement of the head imparts turning movement to sleeve 32 with corresponding variation in the relation between openings 38 of this sleeve and openings 25 of tube 12. The marks 39 are so disposed with respect to sleeve 32 that openings 38 are in full register with openings 25 when mark 40 is in register with the number 4 graduation of the graduation marks 39. By turning the head 17 in a clockwise direction, as viewed in Figure 2, the openings 38 are turned out of register with openings 25, thus progressively reducing the effective size of the openings establishing communication between tube 12 and the interior of casing 10. When the head 17 is turned into such position that index mark 40 registers with the graduation mark 39 which is indicated as of 0 value, openings 38 of sleeve 32 are entirely out of register with openings 25 of tube 12, thus completely cutting off communication between this tube and the interior of the casing. After the desired adjustment of the head has been effected, cap screw 21 is again turned tightly into position so as to secure the head against turning movement in the manner previously described. This adjustability of the head and the sleeve 32 carried thereby renders it possible to adjust the device quickly and with facility to suit the particular engine and the conditions of operation thereof, to which the device is applied.

A short neck 41 extends from head 17 substantially tangentially thereto and opens into the head between member 35 and the surrounding depending wall of the head. This neck is interiorly threaded for reception of a similarly threaded connecting member 42 at the lower end of a flexible tube or conduit 43 which is provided at its upper end with a similar connecting member 44 which screws into exhaust manifold 2, the outer wall of which is suitably bored and threaded for this purpose. Tube 43 serves to conduct exhaust gases from manifold 2 into head 17 of casing 10. These gases flow downwardly within the casing about member 35 and container 26 and then flow through the container and the substance therein, these gases and the entrained particles of anti-detonating substance then flowing upwardly within space 36 from which they enter tube 12 by means of openings 38 and 25, the gases and entrained particles of anti-detonating substance then flowing to the carburetor, through member 8, and thence into the engine cylinders.

The substance within the container 26 may be any suitable substance which possesses desirable anti-detonating qualities. It is known that lead is suitable for this purpose, but, for reasons previously stated, the use of lead mixed with the fuel is objectionable as causing deposition of metallic lead resulting in fouling of the terminals of the spark plugs.

Preferably, the substance within the container 26 is in the nature of an alloy of lead, zinc and antimony. This alloy is composed of approximately 50% lead, 40% zinc and 10% antimony, by weight, though these proportions may be varied. The resulting alloy is more or less crystalline in form, and is cut or broken into pieces of approximately cubiform, with which the container is charged. When subjected to the action of the exhaust gases, the alloy liberates fine metal particles, producing a metal powder or flour which is entrained by the exhaust gases. This metal powder is highly efficient in suppressing detonation.

It is known that carbon monoxid is a strong reducing agent and has the property of uniting with certain metals when passed over them. The exhaust gases taken from the manifold 2 contain carbon monoxid. I have used an anti-detonating substance which contains lead and is of a nature to react with the exhaust gases, and the carbon monoxid thereof, so as to release small quantities of the lead in fine particles which are entrained by the gases. This produces a fine powder or flour which comprises minute metal particles. This powder or flour is entrained by the exhaust gases and passes therewith, and with the fuel mixture from the carburetor, into the engine cylinders. This metal powder produces a marked effect upon the combustion of the fuel mixture in the engine cylinders, greatly reducing or completely eliminating detonation while producing smoothness and increased efficiency in operation of the engine. The metal powder appears to be completely consumed during combustion of the fuel mixture, or substantially so, and no difficulty is encountered due to fouling of the terminals of the spark plugs or other appurtenances by deposition of lead or other metal. In this respect, I find that the device of my invention is superior

to the ordinary means and methods for preventing detonation and in which tetra-ethyl lead, or lead in other form which causes the deposit of metallic lead in the cylinders, is mixed with the fuel. By adjusting the head 17 in the manner previously described, the amount of the anti-detonating substance which is supplied to the engine cylinders may be varied within wide limits to suit the characteristics of the engine and the conditions of operation thereof, while avoiding objectionable deposition of metallic lead in the cylinders. When the substance within the container 6 has been exhausted, this container is removed and replaced by another container filled with the anti-detonating substance used.

The neck 11 and the lower portion of the surrounding wall of casing 10 provide a receptacle for containing the moisture condensed out of the exhaust gases entering the casing. This prevents this moisture from entering the carburetor and, possibly, freezing therein in cold weather. After the device has been in operation for a short time, however, and the casing 10 and associated parts have been warmed up, the water within the lower portion of the casing is re-evaporated and flows with the exhaust gases and the metallic flour or powder above referred to, to the carburetor and thence to the engine cylinders. The receptacle or trap for the condensate, in casing 10, is particularly desirable in cold weather as preventing flow of moisture to the carburetor and the engine cylinders in sufficient quantity to cause difficulty in starting the engine due to fouling of the spark plugs or freezing of moisture in the carburetor. After the engine has been started and warmed up, the flow of moisture referred to is not objectionable. Also, in exceptionally cold weather, a considerable amount of moisture is condensed from the exhaust gases. This moisture may collect and freeze in the casing 10 to such an extent as to prevent flow of gases therethrough to the carburetor and intake manifold. While this may render the anti-detonating device temporarily inoperative, it is advantageous in that it prevents freezing up of the carburetor, in extremely cold weather, since under such conditions no moisture flows from this device to the carburetor. The provision of the condensate trap is, therefore, of considerable importance as eliminating possibility of fouling of the spark plugs or freezing of the carburetor, due to moisture condensed from the exhaust gases, in either moderately or extremely cold weather.

In the preferred application of my invention, the casing 10 is mounted upon the carburetor intake member 8 in the manner illustrated and above described, which is advantageous as assuring intimate mixing of the anti-detonating substance with the fuel. This is not essential, however, in all cases and I contemplate mounting the casing 10 so as to establish communication between tube 12 thereof and the intake manifold in any other suitable or preferred manner.

What I claim is:—

1. In combination with an internal combustion engine, an exhaust manifold, an intake manifold, a carburetor connected to the intake manifold and provided with an air intake member, a casing having an outlet opening into said member, means for supplying to the casing exhaust gases from said exhaust manifold, and a mass of a substance supported within the casing in the path of flow of the exhaust gases therethrough, said substance being of a character to produce fine particles of a metal possessing anti-detonating qualities, when subjected to the action of the exhaust gases.

2. In combination with an internal combustion engine, an exhaust manifold, an intake manifold, a carburetor connected to the intake manifold, a casing having an outlet communicating with the intake manifold, means for supplying to said casing exhaust gases from the exhaust manifold, means for varying the flow of exhaust gases to the casing, and a solid mass of a metallic substance supported within the casing in the path of flow of the exhaust gases therethrough, said substance being of a character to liberate fine particles of a metal possessing anti-detonating qualities, when subjected to the action of the exhaust gases.

3. In combination with an internal combustion engine, an exhaust manifold, an intake manifold, a carburetor connected to the intake manifold, a casing having an outlet communicating with the intake manifold, means for supplying to said casing exhaust gases from the exhaust manifold, a perforated container within the casing in the path of flow of exhaust gases therethrough, and a mass of a solid metallic substance within the container and of a character to liberate fine particles of a metal possessing anti-detonating qualities, when subjected to the action of the exhaust gases.

4. In combination with an internal combustion engine, an exhaust manifold, an intake manifold, a carburetor connected to the intake manifold, an intake member communicating with said intake manifold, a casing, a tube extending into the casing and having one end secured to and opening into the intake member, said tube having an opening within the casing, means for varying the effective size of said opening within the casing, a conduit connecting the casing to the exhaust manifold, and a perforated container within the casing and in the path of flow of exhaust gases therethrough for supporting a mass of an anti-detonating substance to be entrained by the exhaust gases flowing in contact therewith.

5. In combination with an internal combustion engine, an exhaust manifold, an intake manifold, a carburetor connected to the intake manifold, an intake member communicating with said intake manifold, a casing, a tube extending into the casing from one end thereof, the end of the tube at said end of the casing being secured to and opening into the intake member, said tube having an opening within the casing, a foraminous container mounted about the tube within the casing for supporting a mass of an anti-detonating substance to be entrained by exhaust gases flowing in contact therewith, a member forming a closure with one end of the container and extending about the tube and the opening therein in spaced relation thereto, and a conduit communicating with the exhaust manifold and opening into the casing exterior of the closure member.

6. In a device of the character described, a casing, a tube extending into the casing from one end thereof, a perforated container within the casing for containing an anti-detonating substance, the tube having openings beyond said container, a head closing the other end of the casing and turnable on the axis of the tube, a sleeve secured to the head and fitting snugly about the tube and extending therealong beyond said openings, the sleeve having openings disposed to be brought into and out of register with the tube openings by turning of the head,

a member extending from the head about the sleeve in spaced relation thereto and having its inner end in close proximity to said container, and means for connecting the interior of the casing to an exhaust manifold of an internal combustion engine.

7. In a device of the character described, a casing, a tube extending into the casing from one end thereof and held against turning movement relative to the casing, a perforated container within the casing for containing an anti-detonating substance, the tube having openings beyond said container, a head closing the other end of the casing and turnable on the axis of the tube, a sleeve secured to the head and fitting snugly about the tube and extending therealong beyond said openings, the sleeve having openings disposed to be brought into and out of register with the tube openings by turning of the head, a member extending from the head about the sleeve in spaced relation thereto and having its inner end in close proximity to said container, and means for connecting the interior of the casing to an exhaust manifold of an internal combustion engine.

8. In a device of the character described, a casing, a tube extending into the casing from one end thereof and held against turning movement relative to the casing, a perforated container mounted about the tube and within the casing for containing an anti-detonating substance, the tube having openings beyond said container, a head closing the other end of the casing and turnable on the axis of the tube, a sleeve secured to the head and fitting snugly about the tube and extending therealong beyond said openings, the sleeve having openings disposed to be brought into and out of register with the tube openings by turning of the head, a member extending from the head about the sleeve in spaced relation thereto and having its inner end in close proximity to said container, and means for connecting the interior of the casing to an exhaust manifold of an internal combustion engine.

9. In a device of the character described, a casing, a tube extending into the casing from one end thereof and held against turning movement relative to the casing, an abutment member secured on the tube and contacting the outer face of said end of the casing, a perforated container mounted about the tube and within the casing for containing an anti-detonating substance, the tube having openings beyond said container, a head seating in the other end of the casing for relative turning movement, a sleeve secured to the head and fitting snugly about the tube and extending therealong beyond said openings, the sleeve having openings disposed to be brought into and out of register with the tube openings by turning of the head, means engaging the inner end of the tube and cooperating with the head for forcing the tube and the head toward each other and thereby clamping the head in closed position and in adjustment, a closure member secured to the head and extending about the sleeve in spaced relation thereto and having its inner end in close proximity to the container, and means for connecting the interior of the container to an exhaust manifold of an internal combustion engine.

10. In a device of the character described, a casing provided at its lower end with a central inwardly extending neck, a tube extending into the casing through said neck and held against turning movement relative to the casing, an abutment member secured on the tube and contacting the under face of the casing, a perforated container mounted on the tube within the casing and seating upon the upper end of the neck, the tube having openings above the container, a head seating in the upper end of the casing for relative turning movement, a sleeve secured to the head and fitting snugly about the upper portion of the tube, said sleeve extending below the tube openings and having openings disposed to be brought into and out of register with said tube openings by turning of the head, a closure member secured to the head and extending about the sleeve in spaced relation thereto, the lower end of said member being in close proximity to the upper end of the container, and means comprising a member having threaded engagement with the upper end of the tube for forcing said tube and the head toward each other, the head having a connecting member opening thereinto.

11. In combination with an internal combustion engine, an exhaust manifold, an intake manifold, and means for conducting exhaust gases from the exhaust manifold to the intake manifold, said means comprising a member for trapping moisture condensed from the exhaust gases and for supporting a substance having anti-detonating qualities in the path of flow of the exhaust gases.

12. In combination with an internal combustion engine, an exhaust manifold, an intake manifold, a carburetor communicating with the intake manifold, a casing having an outlet opening connected to the carburetor, a conduit connecting the casing to the exhaust manifold, and means for supporting an anti-detonating substance within the casing in the path of flow of exhaust gases therethrough, said casing being provided with means for trapping moisture condensed from the exhaust gases.

13. In combination with an internal combustion engine, an intake manifold, an exhaust manifold communicating with the intake manifold, and means for supporting an anti-detonating substance in the path of flow of the exhaust gases to the intake manifold and for trapping moisture condensed from the exhaust gases.

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