Feb. 24, 1948. W. T. HANCOCK 2,436,570

SUPPRESSION OF DETONATION IN ENGINES

Filed May 12, 1942

Fig. 1.

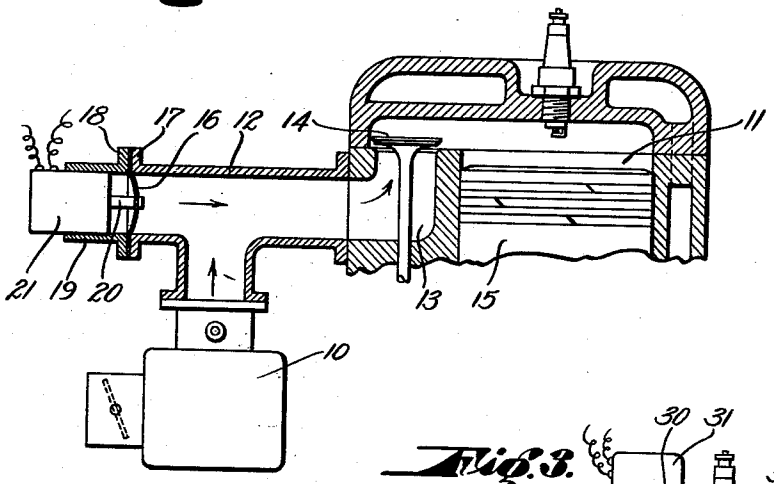
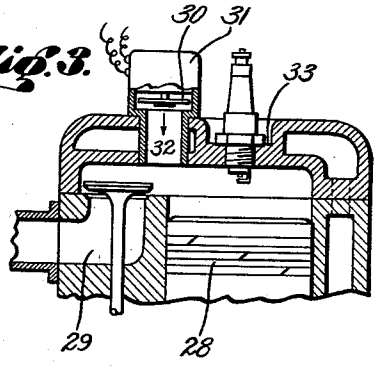


Fig. 3.



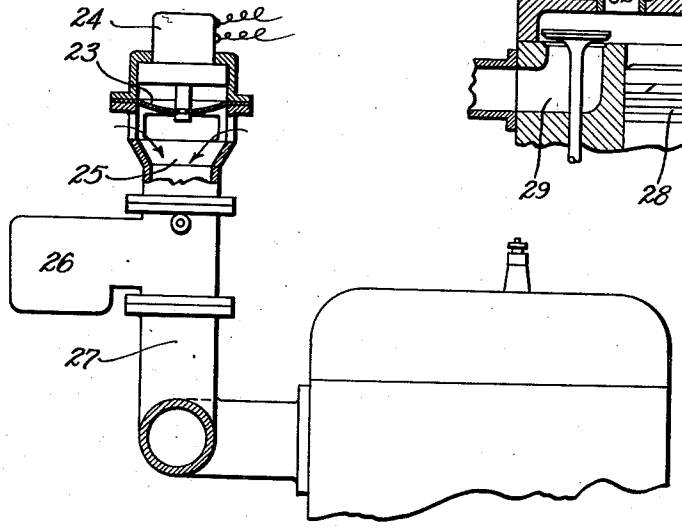


Fig. 2.

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SUPPRESSION OF DETONATION IN ENGINES

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3 Claims. (Cl. 123—198)

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This invention has to do with the suppression of detonation in the operation of internal combustion engines, and is particularly concerned with certain discoveries whereby it is made possible to suppress detonation to an appreciable degree without the use of so-called anti-knock compounds or fuel addition agent.

It has long been common knowledge that, all other conditions remaining the same, the detonating tendencies of an internal combustion engine fuel charge may be affected by the physical and chemical characteristics of the fuel, as well as the use of addition agents having, for reasons not fully understood, the property of reducing or inhibiting the normal tendency of the fuel to exhibit detonation upon combustion. It appears that the combustion characteristics of the fuel are under such circumstances governed in general by the fuel charge itself, i. e. its composition in qualitative and quantitative respects.

I have found that suppression of detonation may also be accomplished by the creation of energy conditions in the charge being fed to the engine, independently of the composition of the charge, although assuming of course that the fuel has proper combustion properties. As a result of tests and detonation measurements, it has been determined that the creation of high frequency pressure pulsations in the fuel charge (fuel and air stream) being delivered to the engine cylinder, has the effect of appreciably reducing the detonation that otherwise would occur upon combustion of the fuel in the cylinder. The reasons underlying the results are unknown, although, as reported below, tests and actual measurements by standard methods show appreciable suppression of detonation to occur by reason of the disturbances set up in the fuel charge.

In accordance with the invention, high frequency pressure pulsations are created in the fuel charge, preferably as it is being delivered to the engine cylinder, by a suitable mechanical means acting to create such pulsations in the fuel stream flowing through the suction passage to the cylinder. It is contemplated that each individual pulsation shall be of substantial magnitude, and that the frequency of the pulsations shall be sufficiently high to create intense vibrations or pressure disturbances in the gaseous charge. Tests have been made to obtain the standard knock meter readings by a CFR motor method octane machine, on the combustion of fuels with and without the charges being subjected to high frequency disturbances as herein contemplated. Average results showed a lowering of the meter reading by approximately ten points when the high frequency pulsations were created in the fuel charge, thus indicating an increase of approximately two in the effective octane value of the fuel.

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The method whereby the fuel charge may be subjected to conditions of high frequency vibrations as discussed in the foregoing will be understood to better advantage from the following detailed description of certain typical and illustrative embodiments of the invention. In the description, reference is had to the accompanying drawing, in which:

Fig. 1 is a sectional view, diagrammatic in part, illustrating the transmission of high frequency pulsations to the fuel stream in the suction passage at a location between the carburetor and the cylinder;

Fig. 2 is a similar view illustrating a modification according to which the pulsations are transmitted from a location at the inlet side of the carburetor; and

Fig. 3 illustrates a further variation in which the pressure pulsations are delivered directly into the cylinder, independently of the fuel intake passage.

Referring first to Fig. 1, the gaseous fuel stream, consisting for example of air and gasoline vapors, is passed from the conventionally illustrated carburetor 10 into the engine cylinder 11 through a suction passage or manifold 12 through a passage 13 in the engine block controlled by the usual valve 14. It will be understood that the showing is conventional only, and that the fuel inlet passage and its particular relationship to the carburetor may take various specific forms and arrangements. As in the normal course of operation, the fuel charge is drawn into the cylinder 11 during at least the down-stroke of the piston 15 and while the inlet valve 14 is open, as illustrated.

Provision is made for transmitting to the fuel charge flowing into the cylinder, high frequency pressure pulsations projected at least generally in the direction of flow of the fuel stream. Any suitable mechanical means may be employed for creating such pressure pulsations, as by the use of a movable element given high frequency vibrations by a suitable power source. As typical, the pressure pulsations are shown to be created by a diaphragm 16 positioned coaxially with the horizontal run of the suction passage above the carburetor, and suitably mounted, as between flanges 17 and 18 of the suction passage branch, and a tubular housing 19, respectively. The dia-

phragm is shown to be reciprocally vibrated through its connection 20 with an actuating mechanism 21, which, for example, may be of a solenoid type or other well-known forms. Satisfactory results have been obtained using an automobile horn type diaphragm or vibrating element and actuating mechanism combination.

During the intervals of fuel intake to the cylinder 11, the high frequency vibrations set up in the charge are transmitted through the suction passage and valve-controlled inlet, into the charge within the cylinder. As previously explained, although the reasons are not understood, the high frequency disturbances set up in the fuel charge cause an appreciable suppression of detonation upon combustion of the fuel in the cylinder.

The system illustrated in Fig. 2 is essentially similar to that described, except that in this instance the vibrating element 23 and its actuator 24 are shown to be positioned directly opposite the suction passage mouth 25 at the inlet side of the carburetor 26. For such installations, it is preferred to use a form of carburetor presenting minimum restriction of the suction passage 27 in order to effectuate transmission of the pressure pulsations with maximum effectiveness through the full length of the suction passage into the engine cylinder.

In Fig. 3 I have illustrated a further variational embodiment of the invention in which the high frequency pressure pulsations are delivered directly to the engine cylinder 28, independently of the valve-controlled fuel inlet passage 29. In this instance, high frequency pressure pulsations are transmitted from a vibrating element 30 driven by motor or actuator 31, through passage 32 leading directly through the engine head 33 into the upper interior of the cylinder. As illustrated, a substantially balanced type vibrator 30 may be used to enable transmission of the pulsations to continue during the compression stroke of the piston after the full charge has been received in the cylinder. Substantial balancing of the pressure against the opposite sides of the vibrator, also permits continuance of its operation during firing of the charge in the cylinder and throughout the interval of combustion.

I claim:

1. The combination comprising an engine cylinder, means forming an intake passage through which a gas is fed to the cylinder, and a reciprocally moving vibrator outside the cylinder but communicable therewith to create high frequency pressure pulsations constantly in the gas atmosphere within the cylinder.

2. In an internal combustion engine, a passage for supplying a mixture of fuel and air to said engine, a diaphragm aimed along said passage, means for supporting the diaphragm at its periphery, and means for vibrating said diaphragm, said means being arranged to act upon the center of said diaphragm.

3. In combination, an internal combustion engine having hollow means for receiving gas therein, a support mounted in said means, and further means mounted on the support for vibrating the gas in said means.

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