

Oct. 8, 1946.

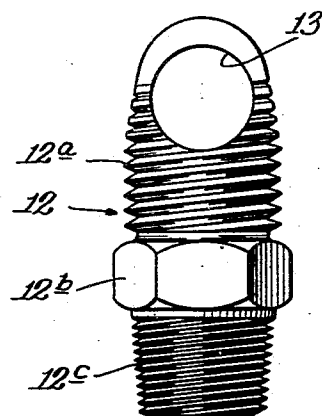
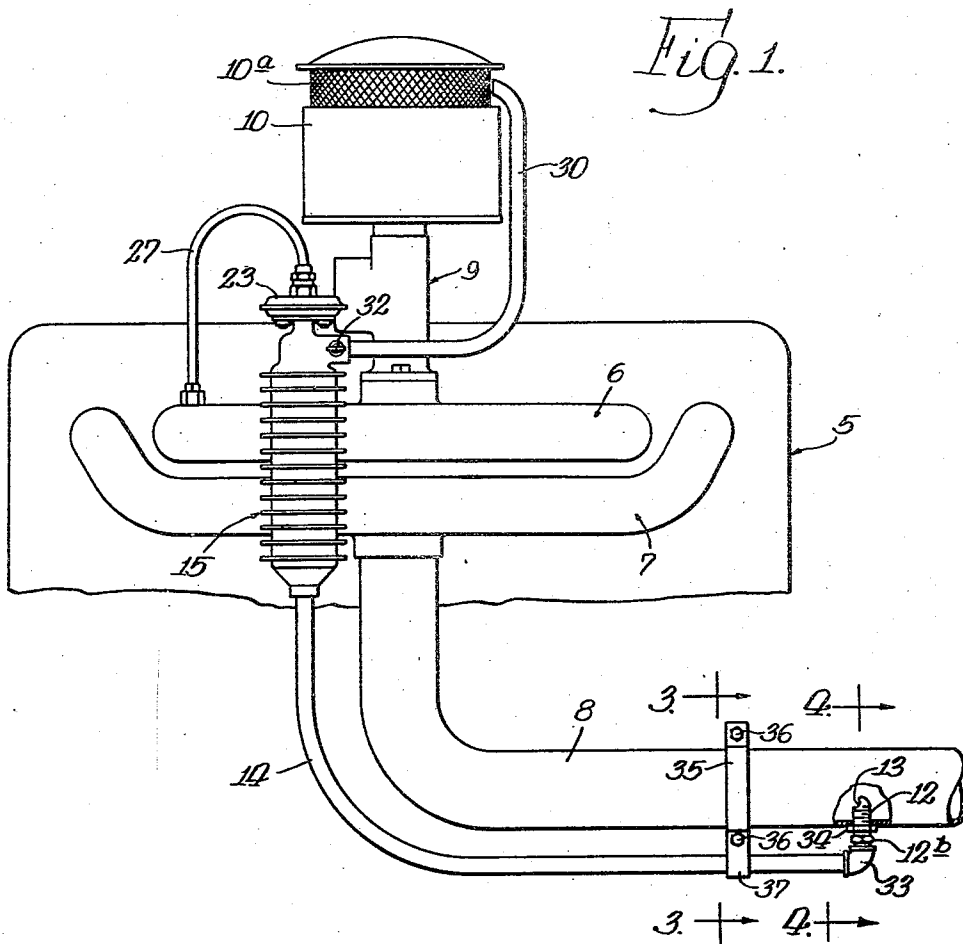
L. D. GOLDEN ET AL

2,408,846

ANTIDETONATION APPARATUS FOR AUTOMOTIVE ENGINES

Filed June 19, 1944

2 Sheets-Sheet 1



INVENTORS.
L. Duke Golden
James Kirk Gregg.

By *By Davis, Lindsey, Smith & Hart*

Oct. 8, 1946.

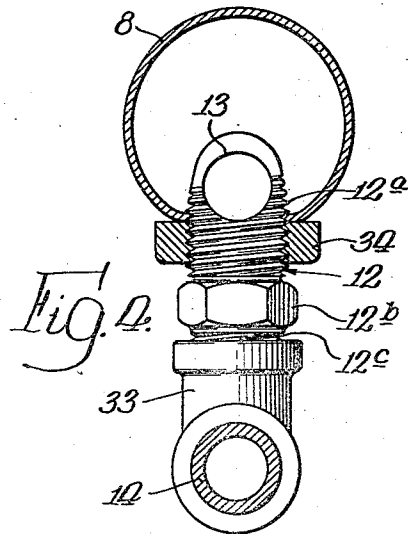
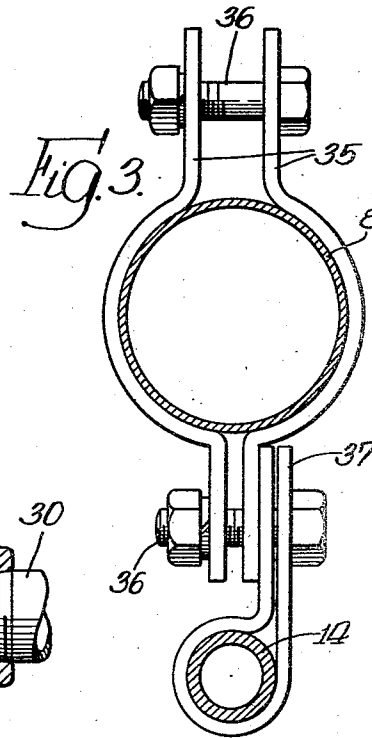
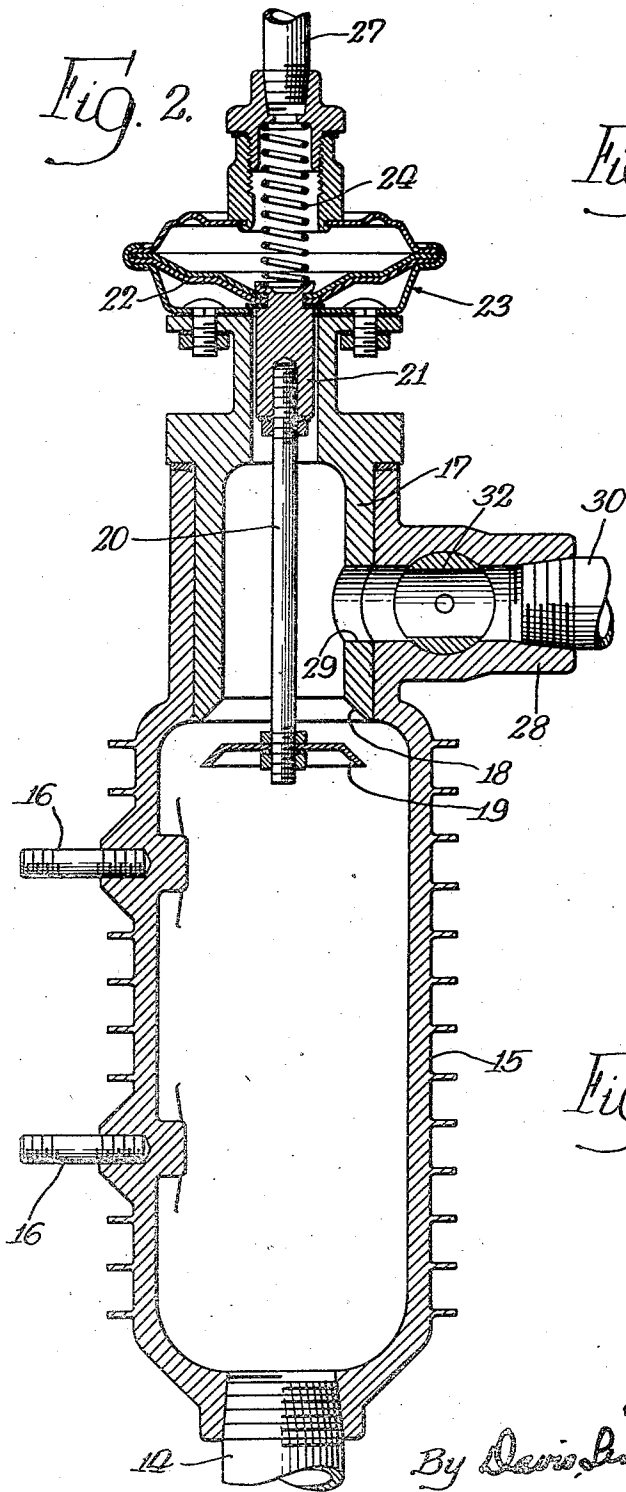
L. D. GOLDEN ET AL

2,408,846

ANTIDETONATION APPARATUS FOR AUTOMOTIVE ENGINES

Filed June 19, 1944

2 Sheets-Sheet 2



INVENTORS.

*L. Duke Golden
James Kirk Gregg,*

By Davis, Lindsay, Smith & Hunt Attys

UNITED STATES PATENT OFFICE

2,408,846

ANTIDETONATION APPARATUS FOR
AUTOMOTIVE ENGINES

Lucius Duke Golden and James Kirk Gregg, Richmond, Ind., assignors to The Perfect Circle Company, Hagerstown, Ind., a corporation of Indiana

Application June 19, 1944, Serial No. 540,972

4 Claims. (Cl. 123—119)

1

This invention relates to internal combustion engines for automotive vehicles, such as automobiles, trucks and airplanes.

Heretofore, there have been many proposals to introduce, throughout the operation of the engine, an inert fluid, such as exhaust gas, water or steam, into the intake manifold of an internal combustion engine with the intention of accomplishing better fuel economy, improving lubrication and preventing carbon deposits on the walls of the combustion space, the spark plugs, valves, pistons and piston rings. So far as we know, however, these proposals have not proven very satisfactory in actual use. Demonstrations have established that they were not as efficacious as anticipated and that they have introduced other problems and developed objectionable faults.

It has been known for many years that detonation in an engine tends to break spark plug porcelains, pistons and piston rings, and that it also increases the rate of wear on the crankshaft and connecting rod bearings and on the piston pin, and causes the engine to run at too high a temperature with resultant decrease in efficiency and in the length of time that the engine will run satisfactorily without service. Fuels of high octane value or with anti-knock additives, such as tetraethyl lead, have been developed and are on the market, one of the purposes of which being to prevent detonation, but these fuels are more costly than the regular standard gasolines and hence increase the cost of operation.

The primary object of our invention is to provide an arrangement or structure which automatically introduces suitable quantities of an inert fluid, such as exhaust gas, water or steam, into the intake system of the engine only during those relatively short periods of time when detonation would be most likely to occur. We have found that our invention prevents detonation and thus overcomes its deleterious results, while at the same time our invention effects economies in operation and eliminates the problems and faults present in the above-mentioned prior proposals.

A further object of our invention is to employ the vacuum in the intake manifold for controlling the introduction of the inert fluid into the intake system so that it will flow only during the periods of time when detonation is likely to occur.

It is also an object of our invention to provide a novel and simple structure whereby part of the exhaust gas will be diverted from the exhaust manifold, pipe or muffler through a vacuum controlled valve and into the intake system during the periods of time when detonation is likely to occur.

Yet another object of our invention is to provide such a structure that it may be readily at-

2

tached to engines already in use, as well as be incorporated in new engines when they are built.

Other objects and advantages will become apparent as this description progresses and by reference to the drawings, wherein—

Figure 1 is a diagrammatic view showing a system embodying my invention;

Fig. 2 is an enlarged vertical section, taken through the vacuum control valve and the silencer for the exhaust gases;

Fig. 3 is a cross section taken through the exhaust pipe and shows a bracket mounted thereon, the section being on the line 3—3 of Fig. 1;

Fig. 4 is a cross section taken through the exhaust pipe, on the line 4—4 of Fig. 1, and shows the fitting for diverting some of the exhaust gases from the exhaust pipe; and

Fig. 5 is a side view of the fitting.

Referring to Fig. 1, the internal combustion engine, shown diagrammatically at 5, may be of any conventional design, being provided with the usual cylinders, pistons, valves, etc. Mounted on one side of the engine, as is usual on engines for automobiles, is an intake manifold 6 for supplying the gaseous explosive mixture to the various cylinders, and an exhaust manifold 7 through which the burned or spent gases, expelled from the cylinders, escape, the exhaust manifold being provided with the usual exhaust pipe 8 leading to a muffler, which is not shown. The usual carburetor 9 is mounted on the intake manifold, and above the carburetor is mounted an air filter 10, which is illustrated generally as being of the screen type, though any conventional oil type of air filter may also be employed.

A fitting 12 (Fig. 5) projects into the exhaust pipe (Figs. 1 and 4) and is secured to the pipe in a manner to be later described. The end of the fitting projecting into the exhaust pipe has an opening 13 which faces the flow of the exhaust gases through the exhaust pipe. A pipe 14 is connected at one end to the lower end of the fitting 12 and the other end of the pipe 14 is connected to the lower end of a hollow body 15 (Figs. 1 and 2) which serves to cool the exhaust gases passing through it and also as an auxiliary muffler for eliminating the noise which would otherwise occur due to the pulsations of the exhaust gas through the pipe 14. The housing is detachably connected to the manifolds 6 and 7 by means of studs 16.

Mounted in the upper end of the body 15 is a valve casing 17 (Fig. 2) which has a valve seat 18 at its lower end. A valve 19 is carried by a stem 20 which at its upper end is secured to a plunger 21 fastened at its upper end to the center of a diaphragm 22. The edges of the diaphragm are clamped between the two parts of a casing 23 secured to the upper end of the valve casing 17. A spring 24 presses downwardly on

3

the diaphragm. The chamber above the diaphragm is connected by a pipe 27 (Fig. 1) to the intake manifold 6.

The upper end of the silencer body 15 has a boss 28 (Fig. 2), the opening through which is in alignment with a hole 29 in the valve body 17. A pipe 30 (Fig. 1) is connected at one end to the boss, and the upper end of the pipe terminates in close proximity to but out of contact with the screen 10^a of the filter. A rotatable valve 32 (Figs. 1 and 2) is mounted in the boss and is designed to be adjusted by hand.

Referring to Fig. 4, the upper portion of the fitting 12 is provided with screw threads 12^a and the middle portion with a wrench engaging portion 12^b to enable the upper screw threaded portion to be screwed into a round opening cut in the exhaust pipe. A nut 34 on the threaded portion 12^a is turned to tightly contact the exhaust pipe after the fitting has been screwed into position. The lower portion 12^c (Fig. 5) of the fitting has a pipe thread to receive pipe elbow 33 which connects the fitting to the rear end of the pipe 14.

Referring to Figs. 1 and 3, a two part clamp 35 is mounted, by means of connecting bolts 36, on the exhaust pipe. Mounted on the lower bolt 36 is an additional clamp 37 which extends around the pipe 14. It will be clear that the fitting 12 is securely mounted on the exhaust pipe and that its connection to the pipe 14 together with the clamps 35 and 37 prevent the fitting 12 from working loose and the fitting and pipe 14 from rattling.

The operation of our invention, as applied, for example to an internal combustion engine for automobiles, is as follows:

During operation of the automobile, under ordinary conditions, at which times detonation is not likely to occur, the vacuum in the intake manifold is sufficiently high to counteract the action of the spring 24, so that the atmospheric pressure in the chamber of the diaphragm casing below the diaphragm maintains the valve 19 in closed condition. When, however, the operation of the automobile engine is such that detonation is likely to occur, as, for example, when the throttle is wide open or nearly wide open and detonation conditions exist, the vacuum in the intake manifold is low and the increased pressure on the top of the diaphragm, in addition to the action of the spring, flexes the diaphragm downwardly and opens the valve 19 as shown in Fig. 2. With the valve open, a small part of the exhaust gases passing through the exhaust pipe, enters the opening 13 in the fitting 12 and the diverted quantity of exhaust gases flows through the pipe 14 and the silencer 15, past the valves 19 and 32 and through the pipe 30 from which it is ejected, and thence passes with the air through the air cleaner into the carburetor unit. A small quantity of the exhaust gas is thus mixed with the combustible mixture which flows through the inlet manifold and into the combustion spaces of the engine cylinders. The small addition of the exhaust gases to the explosive charges prevents the detonation which would otherwise occur. As soon as detonation is not likely to continue, the vacuum increases sufficiently to close the valve 19 against the spring pressure since it is raised against its seat 18 by the lifting of the diaphragm. The valve 32 may be set by hand to regulate the quantity of exhaust gases passing into the intake system when the valve 19 is open.

We claim:

4

1. In an apparatus for preventing detonation in an automotive vehicle internal combustion engine having an exhaust system and an intake system, including an intake manifold, a carburetor and an air filter, having a screen, the combination of means for conducting a portion of the exhaust gases from the exhaust system to the air filter, said means including a pipe having its open end terminating in close proximity to the exterior of said screen, a valve normally closing said conducting means, and a diaphragm device automatically controlled by the vacuum in the intake manifold for opening said valve only when detonation is likely to occur and thus permit a portion of the exhaust gases to be mixed with the explosive mixture of the engine and thereby prevent detonation.

2. In an apparatus for preventing detonation in an automotive vehicle internal combustion engine having an exhaust and an intake system including a manifold, carburetor and air filter, the combination of means including a silencer, a pipe connecting the silencer to the exhaust system, and a pipe leading from the silencer to the filter and adapted to deflect and conduct a portion of the exhaust gases from the exhaust system to the filter, a valve normally closing said conducting means, and a diaphragm device connected at one side to the valve, a pipe connecting the other side of the diaphragm device to the intake manifold so that the diaphragm device is controlled by the vacuum in the manifold to open the valve only when detonation is likely to occur and thus permit a quantity of the exhaust gases to be mixed with the explosive mixture of the engine and thereby prevent detonation.

3. In an apparatus for preventing detonation in an automotive vehicle internal combustion engine having an intake system, including a carburetor, and an exhaust system, the combination of means adapted to conduct a portion of the exhaust gases to the air inlet of the carburetor, a valve normally closing said conducting means, means automatically controlled by the engine for opening said valve only when the vacuum is low and detonation is likely to occur and thus permit a portion of the exhaust gases to be mixed with the explosive mixture of the engine and thereby prevent detonation, and a manually adjustable valve for regulating the quantity of exhaust gas passing to the air inlet of the carburetor when said first mentioned valve is open.

4. In an apparatus for preventing detonation in an automotive vehicle internal combustion engine having an intake manifold, a carburetor, an air filter and an exhaust system, the combination of means adapted to deflect and conduct a portion of the exhaust gases from the exhaust system to the air filter, a valve normally closing said conducting means, a diaphragm automatically controlled by the vacuum in the intake manifold to open the valve when the vacuum decreases to where detonation is likely to occur and thus permit a quantity of the exhaust gases to be mixed with the explosive mixture of the engine and thereby prevent detonation, the diaphragm closing the valve when the vacuum rises above the point where detonation is likely to occur, and manually controlled means for regulating the quantity of exhaust gas passing to the air filter when the aforesaid valve is open.

L. DUKE GOLDEN,
JAMES KIRK GREGG;