

July 26, 1949.

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2,477,481

ANTIDETONATING DEVICE

Filed April 30, 1945

3 Sheets-Sheet 1

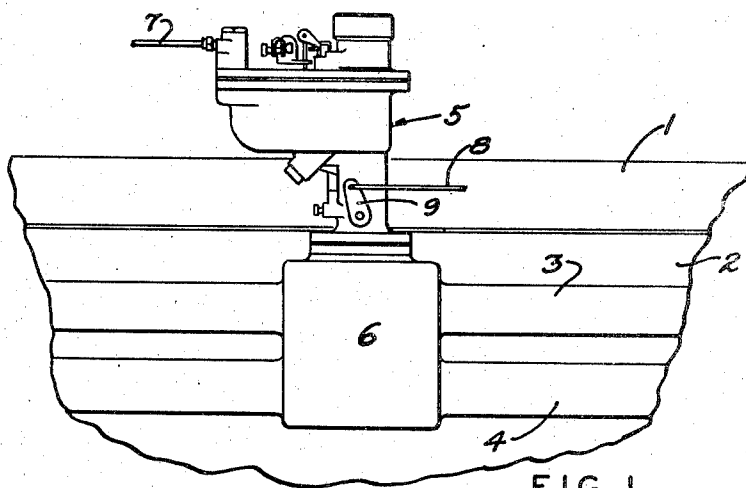


FIG. 1.

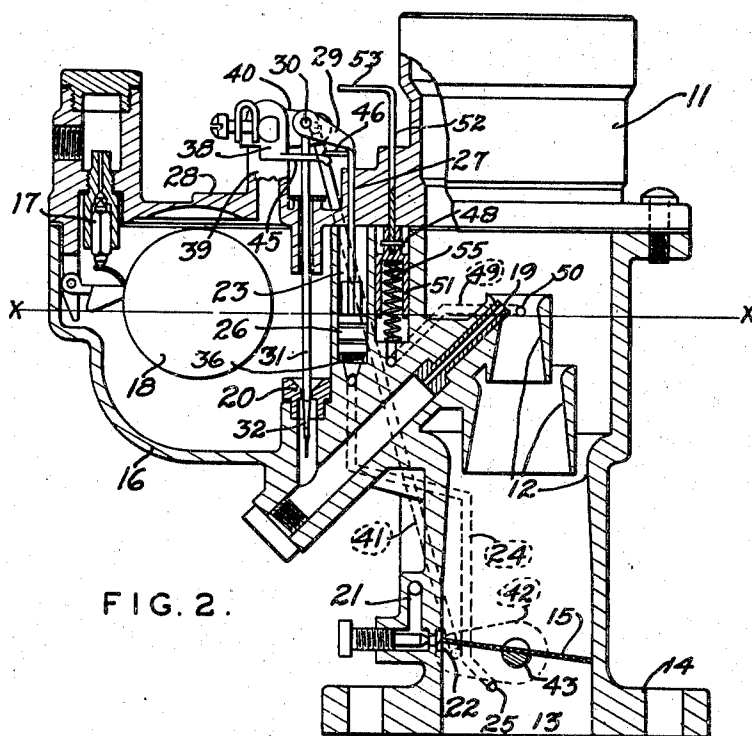


FIG. 2.

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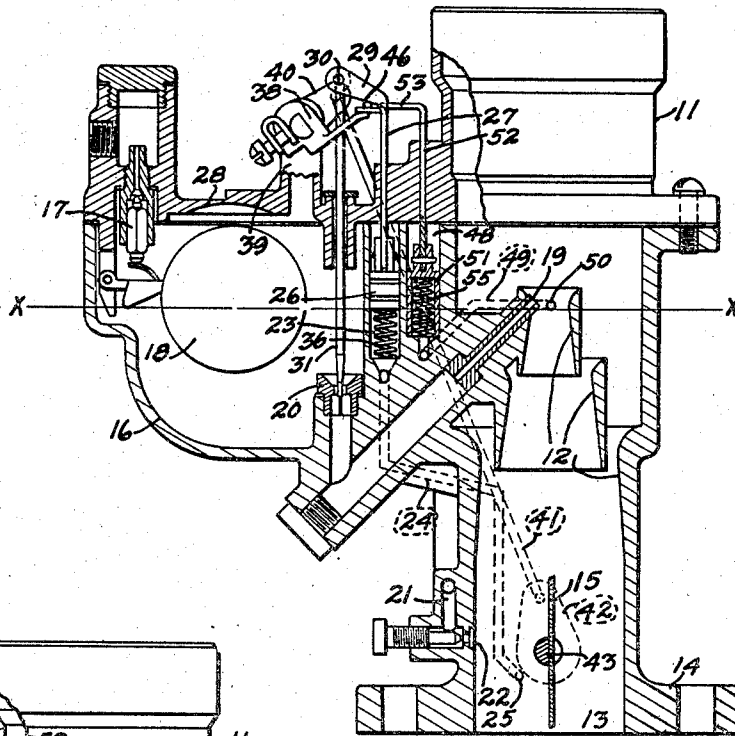


FIG. 3.

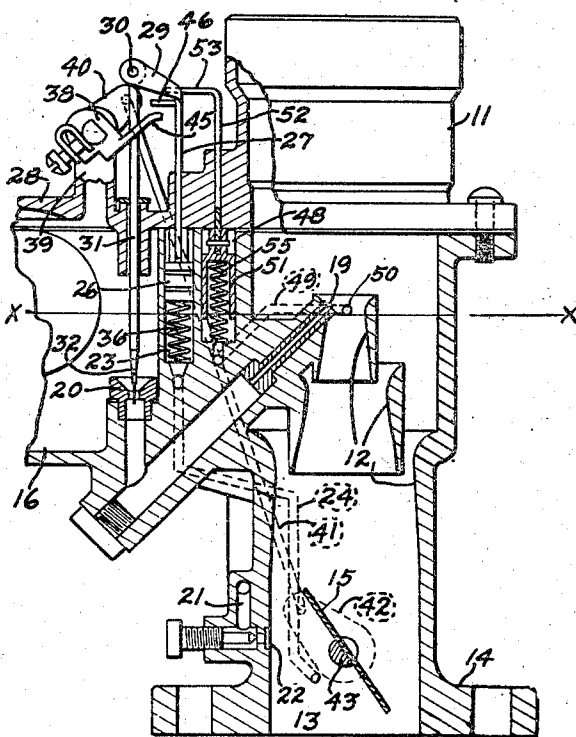


FIG. 4

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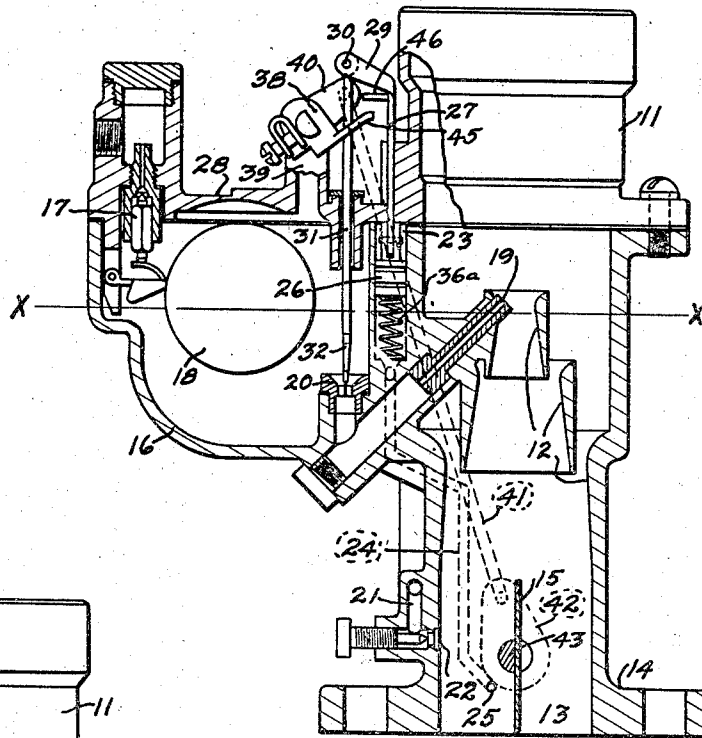


FIG. 5.

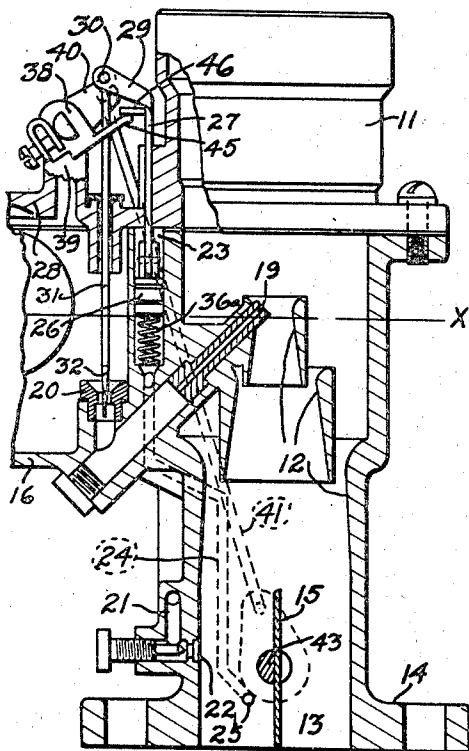


FIG. 6.

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ANTIDETONATING DEVICE

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5 Claims. (Cl. 261—51)

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This invention relates to a fuel control device for internal combustion engines and consists in novel means for elimination of objectionable detonation under certain conditions as, for instance, when operating at low speed with the throttle in open position.

One of the main advantages of the invention is that it permits the use of higher cylinder head compression ratios and fuels with lower octane ratings than is otherwise practical. The invention will be better understood upon consideration of the following specification and accompanying drawing, referring to which

Figure 1 is a diagram illustrating the relative position of the fuel control device mounted on an internal combustion engine.

Figure 2 is a sectional view of the device showing the mechanism for accomplishing the purpose of the present invention.

Figures 3 and 4 are similar to Figure 2, but show the parts in different operating positions, Fig. 3 illustrating the positions of the parts under high speed full-open throttle operation of the engine, and Fig. 4 showing the positions occupied by the parts when the engine is operated at low speed with the throttle open.

Figure 5 shows a modified form of the invention.

Figure 6 is similar to Figure 5, but shows the parts in different operating positions.

The engine represented in Fig. 1 comprises a cylinder head 1, block 2 on the side of which is mounted the usual intake manifold 3 and the exhaust manifold 4. A carburetor 5 is mounted in the usual manner on the hot spot 6 of the manifolds 3 and 4. Fuel is supplied to the device through conduit 7 from any suitable source of supply, and the device is manually controlled through rod 8 and throttle arm 9 connected to the throttle valve 15.

Figs. 2, 3, and 4 show a device in which a down-draft mixture conduit includes an air horn 11, venturis 12, and outlet portion 13, flanged at 14 for attachment to the intake manifold 3 of an associated internal combustion engine. A throttle valve 15 is pivotally mounted in the outlet portion of the mixture conduit and is controlled by the throttle arm 9.

Adjacent the mixture conduit is a bowl 16 within which fuel is maintained at a substantially constant level $x-x$ by needle valve mechanism 17 controlled by float 18. Fuel is supplied to the mixture conduit through a main nozzle 19 opening into the throat portion of the smallest venturi 12 and communicating with the fuel bowl 15

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through a calibrated metering orifice member 20. Fuel for idling and low speed operation is supplied through a passage shown at 21, opening into the mixture conduit through a port 22 adjacent the edge of the throttle valve when closed.

Formed in the wall of the mixture conduit is a cylinder or chamber 23 communicating through a passage 24 with opening 25 into the mixture conduit posterior to the throttle valve. Slidable within chamber 23 is a piston 26 having an elongated rod 27 projecting thereabove through cover 28 of the fuel bowl and having at its upper portion a laterally offset arm 29 pinned as at 30 to a metering rod 31 having a stepped lower portion 32 extending into metering orifice member 20 for varying the effective cross-sectional area thereof.

A spring 36 in the suction chamber constantly urges piston 26 upwardly and may be calibrated to move the smallest portion of the metering pin into operative relationship with orifice member 20 to provide an extra rich mixture when the suction posterior to the throttle drops below a predetermined value, say, three inches of mercury. At other times, the metering pin will be drawn down so as to bring a larger portion thereof into the metering orifice to provide an economical mixture for normal, part throttle operation.

Rocker arm 38 is pivotally mounted on station 39 above the fuel bowl cover 28 and is moved in fixed relation to the throttle valve by arm 40, link 41, and throttle arm 42 on the throttle shaft 43. A lip 45 extending from rocker arm 38 is so positioned as to extend under a laterally offset lip 46 formed on the upper portion of the elongated piston rod 27 for limiting the downward movement of metering rod 31 in accordance with a predetermined positioning of throttle valve 15 to provide a proper fuel mixture.

Formed in the wall of the mixture conduit is a second cylinder or chamber 48 communicating through passage 49 with opening 50 into the throat of the smallest venturi 12. Slidable within the chamber 48 is a piston 51 having an elongated rod 52 projecting thereabove through cover 28 of the fuel bowl and having at its upper portion a laterally offset arm 53 protruding into the path of lip 46 on piston rod 27. A spring 55 in the suction chamber 48 constantly urges piston 51 upwardly and may be calibrated so that the piston is moved downwardly when the suction in the small venturi 12 exceeds a predetermined value.

Objectionable detonation occurs in an engine

when it is operated with a low manifold vacuum, as in hill climbing or at low speeds, for instance, up to 40 M. P. H.; and I have found that this objectionable detonation can be eliminated by enriching the fuel mixture beyond the richness which is necessary for maximum power.

Naturally, it would be undesirable to use any excessive gasoline over that required for maximum power except for very limited periods and where special advantages can be obtained. In order to obtain these special advantages, I increase the compression ratio of the engine to a point substantially higher than that which could be used without detonation with a fuel mixture of richness corresponding to the optimum for maximum power. It will be understood by those skilled in the art that the maximum economy richness is much leaner than that required for maximum power, so that the engine is normally operated with a fuel mixture leaned out for best economy. This mixture is stepped up to a richness corresponding to the optimum for maximum power, but, according to my invention, the maximum power mixture is supplemented by a further increment of fuel for anti-detonating effect when the engine speed and throttle position are such as to cause the introduction of a full charge of fuel into the cylinders which would cause objectionable detonation except for the provision of special means to prevent it.

In order to achieve maximum economy and also maximum power, I increase the compression ratio of the engine cylinders beyond that which would be usable with ordinary methods of fuel supply, supply an optimum economy mixture for normal operating conditions, an optimum power mixture for high speed operating conditions, and an optimum anti-detonating mixture for maximum power at low and intermediate speeds.

Fig. 3 illustrates the position the elements take during high speed driving with the metering rod 31 positioned in orifice 20 for the delivery of the required amount of fuel for power operation of the engine. With the engine so operating, the degree of suction in the smallest venturi and that in the mixture passage posterior to the throttle are such as to permit the springs 55 and 36 to locate the respective pistons 51 and 26 in about the positions shown in Fig. 3, wherein with the throttle substantially full-open to position the rocker arm 38 as shown, the off-set arm 53 may be in contact with the lip 46 of rod 27, and lip 46 in engagement with the rocker arm lip 45. Thus the metering rod 31 will be related to the orifice 20 as appears in this figure.

In Fig. 4, the metering rod 31 is shown in the position for delivery of the extra amount of fuel to the mixture conduit with the throttle in a partially opened position and when the vacuum in the venturi 12 is comparatively low as when the engine is operated at speeds below 40 M. P. H. with the throttle more than half way open. With the throttle in a substantially open position during low speeds, the required suction in the mixture conduit to hold the pistons 26 and 51 down is lost. Pistons 26 and 51 and their associated rods are thus allowed to move under the influence of the springs 36 and 55 respectively to their uppermost positions whereby the metering rod 31 is positioned as shown in Figure 4. As the acceleration of the engine increases, suction in the small venturi 12 increases to a predetermined value sufficient to lower piston 51 and rod 52 which in turn forces rod 27 and piston 26 down sufficiently to position metering rod 31 in the

metering orifice member 20 for normal economical high speed operation of the engine as indicated in Fig. 3.

Fig. 5 illustrates a simplified form of the invention wherein the structure generally is in conformity with the structure of Fig. 2 and bears the same reference numerals on the corresponding parts. However, one important difference in the simplified form is that the piston 51, rod 52, and passage 49 in the embodiment of Fig. 2 are here omitted. In this form, the only other difference is that the spring 36 as employed in the arrangement of Fig. 2, is here replaced by a spring 36a which must be very delicately calibrated and, when so calibrated, gives very satisfactory results. Thus in the operation of the modified arrangement, when the engine is running at a relatively low speed with the throttle more than half way open or full open as indicated in Fig. 5, and such that the suction in the mixture passage posterior to the throttle is less than a predetermined value, say three inches of mercury, the spring 36a then is effective to locate the piston 26 in its uppermost position (Fig. 5). In such piston position, the metering rod 31 will be thereby disposed as shown, wherein the smallest step of the rod portion 32 is in the orifice 20, thereby affording an extra rich mixture which will serve to prevent detonation.

Further with regard to the modified arrangement, as the engine speed increases under the foregoing condition of near or full open throttle, the piston 26 will lower against spring 36a in response to the resulting rise in the mixture passage suction posterior to the throttle, thereby lowering the metering rod 31 from the raised position thereof as shown in Fig. 5, ultimately to the position illustrated in Fig. 6. In the latter position, as limited by the full open position of the throttle through abutment of the piston rod element 46 with the throttle positioned rocker arm lip 45 (Fig. 6), the next larger step of the metering rod stepped portion 32 will be effective in the orifice 20, to determine the mixture for normal speed operation of the engine. At part open throttle positions, with correspondingly lowered positions of the lip 45, increased suction will cause further lowering of the metering rod to bring larger diameter portions of the rod stepped end 32 into coaction with the orifice 20, such as to effect adjustments of the mixture in accordance with part throttle operation of the engine.

I claim:

1. In a fuel control device for an internal combustion engine, means forming a mixing conduit, a throttle valve in said conduit, operating means for said throttle valve, a fuel supply chamber, a fuel control device for regulating the supply of fuel from said chamber to said conduit, pressure operated means for adjusting said fuel control device in response to suction posterior to said throttle, means operably connecting said throttle and fuel control device to open the latter in accordance with throttle position and regardless of said pressure operated means, said last named means operating to limit the closing movement of said control device when the latter is actuated independent of said throttle, and means including a fluid responsive device for limiting the opening movement of said control device in response to pressure anterior to said throttle.

2. A charge forming device for internal combustion engines comprising means forming a mixing conduit, a throttle valve for controlling the flow through said conduit, a fuel supply cham-

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ber, a passageway connecting said supply chamber with said mixing conduit, a metering pin for regulating the flow of fuel through said passageway, fluid motor means for operating said metering pin to supply a fuel mixture of optimum richness for economy when the throttle is in slightly open position and when the vacuum posterior to said throttle is high, a member controlled by the movement of said throttle for adjusting said metering pin to regulate the mixture to the optimum for maximum power when the throttle is moved to fully open position, and an additional fluid operated motor, responsive to mixing conduit vacuum anterior to said throttle, said motors cooperating to adjust said metering pin for enriching the mixture beyond the optimum richness for maximum power when the vacuum in the mixing conduit both anterior and posterior to the throttle is low.

3. A charge forming device for an internal combustion engine comprising a mixture conduit, a fuel supply chamber, a fuel supply system connecting said chamber and said conduit, a metering valve in said system, means normally urging said valve toward its fuel enriching position, stop means for limiting movement of said valve in said direction to a position for supplying an abnormally rich, anti-detonating mixture, and means operable responsive to predetermined suction in said conduit for affecting said stop means so as to limit enriching movement of said valve to a normal, power mixture.

4. A charge forming device for an internal combustion engine comprising a mixture conduit, a fuel supply chamber, a fuel supply system connecting said chamber and said conduit, a metering valve in said system, means for varying the

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position of said valve between positions for supplying normal and abnormally rich mixtures, stop means for limiting movement of said valve in the enriching direction, and means operable responsive to predetermined suction in said conduit for shifting said stop means, at least in part, so as to limit enriching movement of said valve to its normal mixture position.

5. A charge forming device for an internal combustion engine comprising a mixture conduit, a throttle valve therein, a fuel supply chamber, a fuel supply system connecting said chamber and said conduit, a metering valve in said system, means including a spring and an element responsive to suction in said conduit posterior to said throttle for varying the position of said valve between its normal and abnormally rich mixture supplying positions, stop means for limiting movement of said valve, and means operable responsive to predetermined suction in said conduit anterior to said throttle for affecting said stop means so as to limit enriching movement of said valve to a normal mixture position.

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