

May 9, 1939.

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2,157,809

FUEL MIXING DEVICE

Filed Oct. 27, 1937

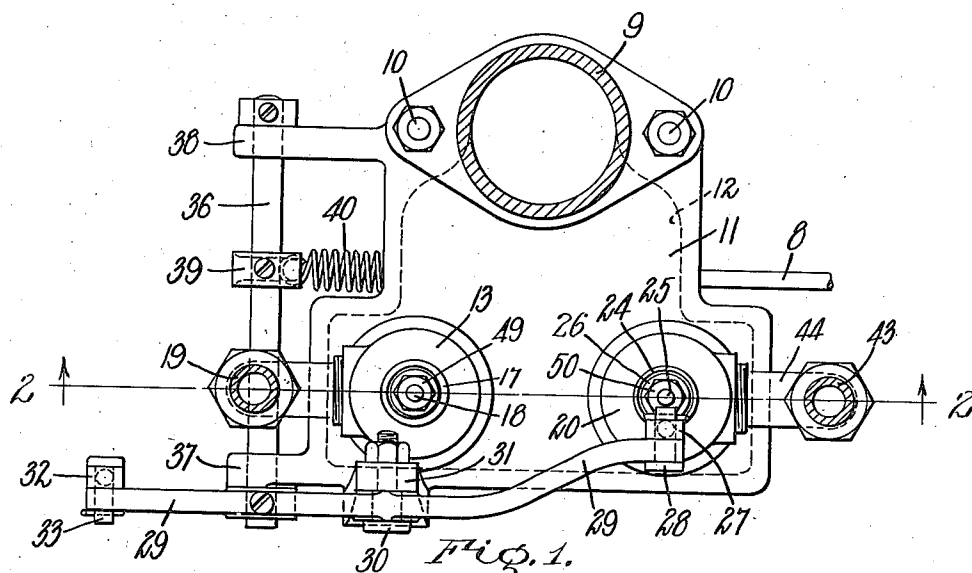


Fig. 1.

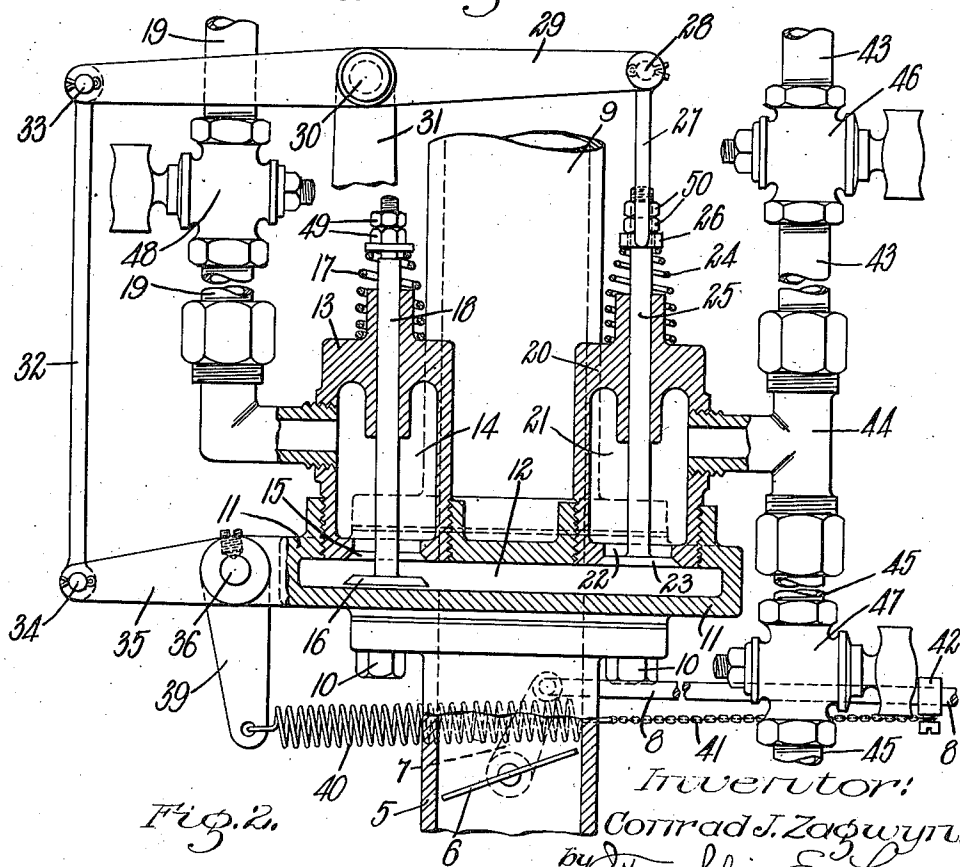


Fig. 2.

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UNITED STATES PATENT OFFICE

2,157,809

FUEL MIXING DEVICE

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Application October 27, 1937, Serial No. 171,241

8 Claims. (Cl. 123—119)

This invention relates to a fuel mixing device for internal combustion engines.

The primary object of the invention is to provide a simple, effective device which may be interposed between the carbureter of an internal combustion engine and the intake manifold thereof for the purpose of increasing the efficiency of the engine and reducing the amount of fuel consumed.

Another object of the invention is to provide a device which will admit such fluids as exhaust gases, fresh air, and vapor into the fuel supply passage for an internal combustion engine between the carbureter and the intake manifold thereof at the particular periods during the operation of said engine when said fluids will most effectively contribute to the efficient and economical operation of the engine, the device being to a certain extent automatic in its operation and to a certain extent controlled by the throttle valve operating mechanism.

The invention consists in a fuel mixing device as set forth in the following specification and particularly as pointed out in the claims.

Referring to the drawing:

Fig. 1 is a plan view of a fuel mixing device embodying my invention mounted between the carbureter and intake manifold of an internal combustion engine.

Fig. 2 is a vertical sectional elevation of the device taken on the line 2—2 of Fig. 1, with the throttle valve of the carbureter positioned to cause the engine to idle, the inlet valve for the air and vapor held closed and the inlet valve for the exhaust gases open.

Like numerals refer to like parts throughout the several views of the drawing.

In the drawing, 5 represents the upper portion of a carbureter, 6 is a throttle valve for said carbureter, 7 a throttle valve lever, 8 a connecting rod by means of which the throttle valve 6 is actuated, and 9 is the lower portion of an intake manifold communicating with said carbureter; and it will be understood that the carbureter 5 and its throttle-actuating mechanism, together with the intake manifold 9, may be of any well-known type wherein a volatile liquid fuel is vaporized and discharged into an intake manifold of an internal combustion engine.

Secured between the carbureter 5 and the intake manifold 9 by means of bolts 10 is a casing 11 having a fuel mixing chamber 12 provided therein, which communicates directly with the fuel passages of said carbureter and intake manifold. Detachably mounted upon the top of the

casing 11 is a valve casing 13 having a chamber 14 for exhaust gases provided therein, and said chamber 14 communicates with the chamber 12 of the casing 11 through an inlet port 15 provided with a valve 16 normally held closed by means of a spring 17 surrounding a stem 18 of said valve and interposed between the valve casing 13 and a suitable shoulder provided upon said valve stem. The casing 13 and its chamber 14 are connected by suitable pipe connections 19 to the exhaust manifold or the exhaust pipe of an internal combustion engine for which this device is provided, said connections being provided for the purpose of supplying a quantity of hot exhaust gases to the chamber 14 of the valve casing 13 from which they are discharged into the chamber 12 of the casing 11 and into the intake manifold 9 in a manner to be hereinafter more fully described.

Detachably mounted upon the top of the casing 11 beside the valve casing 13 is a valve casing 20 having a chamber 21 provided therein, which communicates with the chamber 12 of the casing 11 through an inlet port 22 provided with a valve 23 which is normally held closed by means of a spring 24 which surrounds a stem 25 of said valve between the valve casing 20 and the flat lower extremity 26 of a member 27 which is loosely mounted upon the valve stem 25 beneath a suitable shoulder provided upon said valve stem. The spring 24 is normally weaker than the spring 17 provided for the valve 16 for reasons hereinafter to be more fully described. The member 27 is operatively connected at 28 to one extremity of a rocker arm 29 pivotally mounted at 30 upon a standard 31 mounted upon the casing 11 and projecting upwardly therefrom. A rocking movement is imparted to the rocker arm 29 for the purpose of raising and lowering the member 27 by means of a connecting rod 32, one extremity of which is connected at 33 to said rocker arm and the other extremity of which is connected at 34 to an arm 35 fast to a rocker shaft 36 mounted in bearings 37 and 38 provided therefor upon the casing 11. Another arm 39 also fast to the shaft 36 is yieldingly connected by means of a coil spring 40 and chain 41 to a collar 42 adjustably mounted upon the throttle valve connecting rod 8.

During the operation of the internal combustion engine, as the throttle valve 6 is opened and closed to vary the speed of said engine, a variable pull is exerted by the spring 40 acting to hold the valve 23 closed, and under certain conditions of operation, as for example, when the engine is idling slowly, the valve 23 is held closed by the

combined efforts of the springs 25 and 40. As the throttle valve 6 is opened to increase the speed of the engine the pull exerted by the spring 40 is reduced gradually until its tension reaches zero, whereupon the spring 24 is thereafter relied upon to exert the desired pressure tending to close the valve 23.

Normally the spring 17 exerts a greater pressure upon the valve 16 tending to hold said valve closed than is exerted by the spring 24 tending to hold the valve 23 closed.

The chamber 21 of the casing 20 is supplied with fresh air through a pipe 43 and T 44; and a vapor provided from any suitable source of supply may also be delivered into said chamber 21 through a pipe 45 also connected to said T. Valves 46 and 47 are provided for the supply pipes 43 and 45 respectively and may be manipulated as may be desired to control the flow of air and vapor therethrough. A valve 48 is also provided for the exhaust gas supply pipe 19.

The general operation of the device hereinbefore described is as follows: During the operation of the internal combustion engine, when said engine is throttled down and idling slowly, the throttle valve 6 and its connecting rod 8 are positioned approximately as illustrated in Fig. 2 and the spring 40 connected to said rod is under tension to exert an upward pull upon the valve 23 tending to hold said valve closed in co-operation with the spring 24 which is also acting to hold said valve 23 closed. Under these conditions of operation the suction created within the intake manifold 9 and mixing chamber 12 by the pistons of the internal combustion engine while not sufficient to overcome the tension of the springs 24 and 40, tending to hold the valve 23 closed, will overcome the tension of the spring 17 of the valve 16 and cause said valve to open to admit hot exhaust gases from the exhaust manifold of the engine into the fuel mixing chamber 12 where said gases will combine with the vaporized fuel furnished by the carbureter 5. As the hot exhaust gases still retain a considerable amount of combustible matter and enter the mixing chamber 12 under pressure it is evident that their effect upon the vaporized fuel passing from the carbureter to the intake manifold will be to cause a more complete vaporization of the liquid fuel utilized. In accelerating the engine as the throttle valve 6 is opened to admit an increased amount of vaporized fuel to said engine, the connecting rod 8 is moved toward the left in Fig. 2 and the tension of the spring is gradually reduced until finally there is no pull exerted by said spring upon the member 27 tending to hold the valve 23 closed, and said valve is thereafter held closed solely by the action of the spring 24. The spring 24 is normally weaker than the spring 17 and when the valve 23 is released from the pull exerted thereon by the member 27, the suction within the mixing chamber 12 will cause the valve 23 to open to admit either fresh air or vapor, or both air and vapor simultaneously as permitted by the valves 46 and 47 which may be regulated as may be desired to control the flow of said fluids therethrough.

The admission of exhaust gases, fresh air and moist vapor in proper amounts into the fuel supply for an internal combustion engine between the carbureter and intake manifold adds greatly in improving the combustion qualities of the fuel delivered to the engine and greatly reduces the amount of liquid fuel required to operate said engine. It is evident that the amounts of exhaust

gases, fresh air and vapor that may be admitted into the mixing chamber 12 as the engine is accelerated is, to a certain extent, determined by the relative pressures exerted by the springs 17 and 24 upon the valves 16 and 23, and these pressures may be regulated as may be desired by manipulating nuts 49 provided at the top of the valve stem 18, and nuts 50 provided at the top of the valve stem 25. The tension of the spring 40 may also be regulated by varying the position of the collar 42 upon the connecting rod 8. Either or all of the auxiliary fluids for the fuel supply may be eliminated as may be desired and as may be determined by weather conditions and the type of liquid fuel utilized by manipulating the valves provided in the respective supply pipes.

I claim:

1. The combination with a carbureter and intake manifold of an internal combustion engine, of a casing having a fuel mixing chamber therein interposed between said carbureter and manifold and communicating therewith, means to deliver exhaust gases from said engine into said mixing chamber, a pressure valve for said gas delivery means actuated by suction within the mixing chamber, means to deliver air into the mixing chamber, a pressure valve for said air delivery means also actuated by suction within the mixing chamber, and means operable in unison with the throttle valve of said carbureter to vary the force upon the air valve tending to hold said valve closed.

2. The combination with a carbureter and intake manifold of an internal combustion engine, of a casing having a fuel mixing chamber therein interposed between said carbureter and manifold and communicating therewith, means to deliver exhaust gases from said engine into said mixing chamber, a pressure valve for said gas delivery means actuated by suction within the mixing chamber, means to deliver air and vapor simultaneously into the mixing chamber, a pressure valve for said air and vapor delivery means actuated by suction within the mixing chamber, and means operable in unison with the throttle valve of said carbureter to vary the force upon the valve for the combined air and vapor tending to hold said valve closed.

3. The combination with a carbureter and intake manifold of an internal combustion engine, of a fuel mixing chamber interposed between said carbureter and manifold and communicating therewith, means to deliver exhaust gases from said engine into said mixing chamber, a valve for said gas delivery means, means to deliver air into the mixing chamber, a valve for said air delivery means, a spring normally holding said air valve closed against suction within the mixing chamber acting to open said air valve to admit air into the mixing chamber, and means operable in unison with the throttle valve of said carbureter to vary the tension upon said air valve spring tending to hold the air valve closed.

4. A fuel mixing device for internal combustion engines comprising, in combination, a casing provided with a fuel mixing chamber therein, means to deliver a gaseous fuel into said chamber, a throttle valve for said fuel delivery means, means to deliver exhaust gases from said engine into the mixing chamber, a valve for said gas delivery means, means to deliver air into the mixing chamber, a valve for said air delivery means, a spring normally holding said air valve closed against suction within the mixing chamber acting to open said valve to admit air into the mix-

ing chamber, and means operable in unison with said throttle valve to vary the tension upon said valve spring tending to hold the air valve closed.

5 5. A fuel mixing device for internal combustion engines comprising, in combination, a casing provided with a fuel mixing chamber therein, means to deliver a gaseous fuel into said chamber, a throttle valve for said fuel delivery means, an operating rod therefor, means to deliver exhaust gases from said engine into the mixing chamber, a valve for said gas delivery means, means to deliver air into the mixing chamber, a valve for said air delivery means, a spring normally holding said air valve closed against suction within the mixing chamber acting to open said valve to admit air into the mixing chamber, and means operatively connected to said air valve and including a spring connected to said throttle valve operating rod to hold said air valve closed with variable pressures determined by the position of the throttle valve.

10 6. A fuel mixing device for internal combustion engines comprising, in combination, a casing provided with a fuel mixing chamber therein, means to deliver a gaseous fuel into said chamber, a throttle valve for said fuel delivery means, means to deliver exhaust gases from said engine into the mixing chamber, a valve for said gas delivery means, a spring normally holding said gas valve closed against suction within the mixing chamber acting to open said valve to admit gas into the mixing chamber, means to deliver air into the mixing chamber, a valve for said air delivery means, a spring normally holding the air valve closed against suction within the mixing chamber acting to open said valve to admit air into the mixing chamber, and means operable in unison with said throttle valve to vary the tension upon said air valve tending to hold the air valve closed.

7. A fuel mixing device for internal combustion engines comprising, in combination, a casing

provided with a fuel mixing chamber therein, means to deliver a gaseous fuel into said chamber, a throttle valve for said fuel delivery means, means to deliver exhaust gases from said engine into the mixing chamber, a valve for said gas delivery means, a spring normally holding said gas valve closed against suction within the mixing chamber acting to open said valve to admit gas to the mixing chamber, means to deliver air and vapor into the mixing chamber, a valve for said air and vapor delivery means, means to exclude the vapor from the delivery means, a spring normally holding said last-named valve closed against suction within the mixing chamber acting to open said valve to admit air and vapor into the mixing chamber, and means operable in unison with said throttle valve to vary the tension upon said last-named spring tending to hold the valve for the combined air and vapor closed.

8. A fuel mixing device for internal combustion engines comprising, in combination, a casing provided with a fuel mixing chamber therein, means to deliver a gaseous fuel into said chamber, a throttle valve for said fuel delivery means, an operating rod therefor, means to deliver exhaust gases from said engine into the mixing chamber, a valve for said gas delivery means, a spring normally holding said gas valve closed against suction within the mixing chamber acting to open said valve to admit exhaust gases into the mixing chamber, means to deliver air into the mixing chamber, a valve for said air delivery means, a spring normally holding said air valve closed against suction within the mixing chamber acting to open said air valve to admit air into the mixing chamber, and means operatively connected to said air valve and including a spring connected to said throttle valve operating rod to hold the air valve closed with variable pressure determined by the position of the throttle valve.

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