Oct. 5, 1937. G. A. SPELTS 2,094,829

INJECTOR MIXING VALVE

Filed Nov. 4, 1935

Fig. 1.

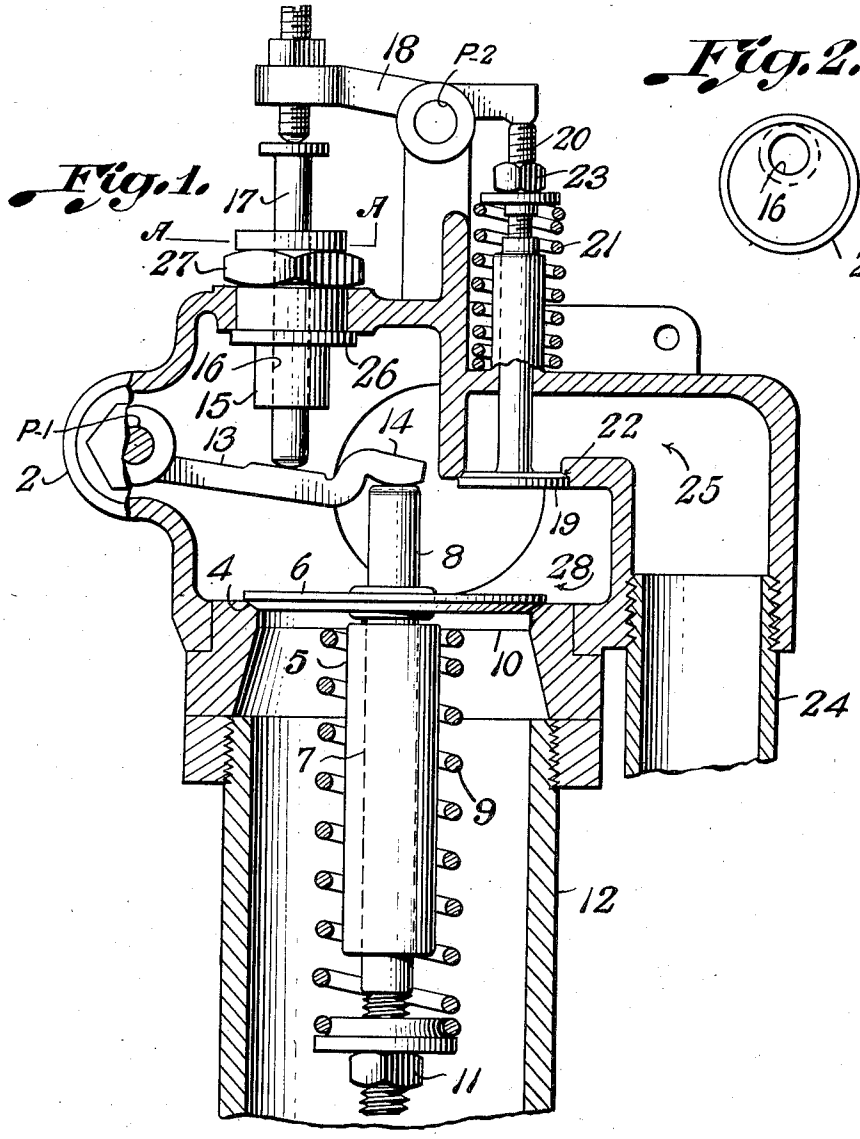

Fig. 2.

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Patented Oct. 5, 1937

2,094,829

UNITED STATES PATENT OFFICE

2,094,829

INJECTOR MIXING VALVE

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Application November 4, 1935, Serial No. 48,215

3 Claims. (Cl. 137—165)

My invention relates to internal combustion engines in general, and particularly to such engines utilizing gaseous fuel, such as natural gas.

It is the general practice to feed an internal combustion engine utilizing gas as a fuel an amount of gas with each intake of gas and fuel, proportional to the power output required. The amount of air admitted during each intake period is generally not varied with power output required. As a rule a speed governor actuates the gas valve and as the engine tends to reduce speed due to an increase in load, the gas valve is opened an additional amount in order to maintain engine speed within the regulatory limits of the governor.

The above described general practice is indeed a poor practice, as obviously the combustible mixture is not maintained at a ratio most advantageous for developing a smooth and complete combustion of each charge. As a consequence, engines of this type often miss fire and are poor in fuel economy.

It is therefore an object of my invention to provide means for maintaining a proper combustible mixture at all permissible loads.

It is also common practice to obtain a combustible mixture by virtue of a displacement of available air by a gas. That is, during the intake stroke of an engine, the suction which pulls in air, creates a gas flow into the incoming air. Therefore, for a given piston displacement, approximately 10% to 15% by volume is gas and 90% to 85% is air, taking the piston displacement as 100%.

It is therefore an object of my invention to provide means for obtaining 100% air volume per cycle and add the necessary volume of fuel in addition, thus obtaining full benefit of the engine capacity for delivering power without resorting to supercharging.

Gaseous fuels are not uniform in B. t. u. units available per unit quantity of gas. Therefore, another object of my invention is to provide adjustable means for maintaining a proper ratio of gas and air for all loads to compensate for the discrepancies in heat content of the different fuels.

My invention possesses many other advantages and has other objects which may be made more easily apparent from a consideration of certain embodiments of my invention. For this purpose I have shown one form of my invention in conjunction with a two stroke cycle natural gas burning internal combustion engine. I shall now proceed to describe this form in detail, which illustrates the general principles of my invention, but it is to be understood that this description is not to be taken in a limiting sense, since the scope of my invention is best defined in the subjoined claims.

In the drawing:

Figure 1 represents, in part, a cross section of my injector mixing valve.

Figure 2 represents a view taken through the plane A—A as shown in Figure 1.

Referring now to Figures 1 and 2 in greater detail, I show an injector valve 1 having a main frame 2. The main frame is provided with an air intake valve insert 3 having a valve seat 4 and a valve guide 5. A valve 6 having a stem 7 and a stub 8 serves to close the air intake by being urged against valve seat 4 by means of a spring 9 held against the under side of valve guide spider 10. The tension of the spring may be varied by means of nut 11. Incoming air is provided through air pipe 12 joined to air valve insert 3.

Arm 13 is pivoted at P—1 on main frame 2 and end 14 rests on stub 8. Adjustable bushings 15 in main frame 2, provided with guide opening 16 (see Figure 2) guides a tappet 17, which in turn operates rocker arm 18. Rocker arm 18 is pivoted at P—2 on main frame 2. This rocker arm operates gas valve 19 by urging valve stem 20 downwardly against the pressure exerted by spring 21, which spring normally closes valve 19 on gas valve seat 22. Nut 23 is provided to adjust the spring tension to a proper value, said value being at least sufficient to hold valve 19 tightly against its seat to prevent gas under pressure conducted to the valve by means of pipe 24 attached to gas chamber 25 in main frame 2 from entering mixing chamber 28. The spring pressure must also be sufficient to return the valve to its seat quickly after rocker arm 18 ceases to depress valve stem 20.

It will also be noted by referring specially to Figure 2 that the guide opening 16 in adjustable bushing 15 is excentric with respect to the center line of the bushing. I provide bushing 15 with a flange 26 and a nut 27 which, when tightened, holds the bushing in a fixed position. I can now adjust the position of the tappet 17 with respect to pivot P—1 by rotating the bushing (with the nut loosened) until the proper relationship is obtained between the movement of valve 6 and valve 19. Nut 27 is then tightened.

Thus, when air enters mixing chamber 28 through pipe 12, the air lifts valve 6 off its seat by an amount proportional to rate of air entry

into chamber 28. Since, with modern practice, the gas in pipe 24 is kept at some desirable but constant pressure such as 10 or 15 pounds to the square inch, valve 19 will open by an amount sufficient to allow gas to enter mixing chamber 28 in exact proportion to the amount of air entering past valve 6. As soon as air stops entering, valve 6 shuts and valve 19 also shuts.

In my injector mixing valve, the gas is added to the amount of air by injection to the air. In conventional methods of carburetion, gas is sucked into the intake manifold and therefore the maximum power developed is less by the amount of air displaced by the incoming gas.

Having described my invention,

I claim:

1. In a mixing device for mixing two fluids in a predetermined adjustable proportion, the combination comprising a body having a mixing chamber provided with two inlets and one outlet, valves normally closing each inlet, a pivoted arm operated by one inlet valve, a shaft actuated by the arm to move along the longitudinal axis of the shaft, and being adjustably mounted in an eccentric bushing to adjust the distance between the pivot of the arm and the longitudinal axis, and a rocker arm operating the second inlet valve in response to longitudinal movement of the shaft.

2. In a mixing device, the combination comprising, a body having a mixing chamber provided with two inlets and one outlet, valves normally closing the inlets, one of said valves being actuated to open in proportion to the flow of a fluid through the corresponding inlet, and adjustable means for opening the other inlet valve in proportion to the opening of the first inlet valve, thereby causing a second fluid to enter the mixing chambers in predetermined ratio to the first fluid entering the mixing chamber, the means comprise two pivoted arms, one operated by the first inlet valve and the other operating the second inlet valve, and an adjustable linkage between the pivoted arms comprising a shaft operated by the first arm and imparting motion to the second arm, an adjustable bushing constricting the shaft to movements along its longitudinal axis, said bushing being capable of changing the effective distance between the pivot of the first arm and the axis of the shaft.

3. In combination with an internal combustion engine, an air and gaseous fuel mixing device comprising a body having a mixing chamber provided with two inlets and one outlet, both inlets being provided with valves normally closing the inlets, one inlet valve being capable of opening in proportion to a flow of air urged through the inlet by the engine, means operated by the first inlet valve causing the second inlet valve to open in proportion to the opening of the first inlet valve, and a supply of gaseous fuel connected to the second inlet valve, said outlet being connected to the intake of the engine, the means comprising a pivoted arm operated by the first inlet valve, a second pivoted arm operating the second inlet valve, a member urged by the first arm to operate the second arm, an adjustable bushing constricting the movement of the member along an axis perpendicular to the axis of the pivots, said bushing being capable of adjusting the effective distance from the member axis to the pivot axis, thereby causing a change in the proportion the second inlet valve opens to the opening of the first inlet valve.

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