July 10, 1934. J. W. HARRELL 1,966,345

HYDROGEN GENERATOR FOR INTERNAL COMBUSTION ENGINES

Filed June 9, 1933

Fig. 1.

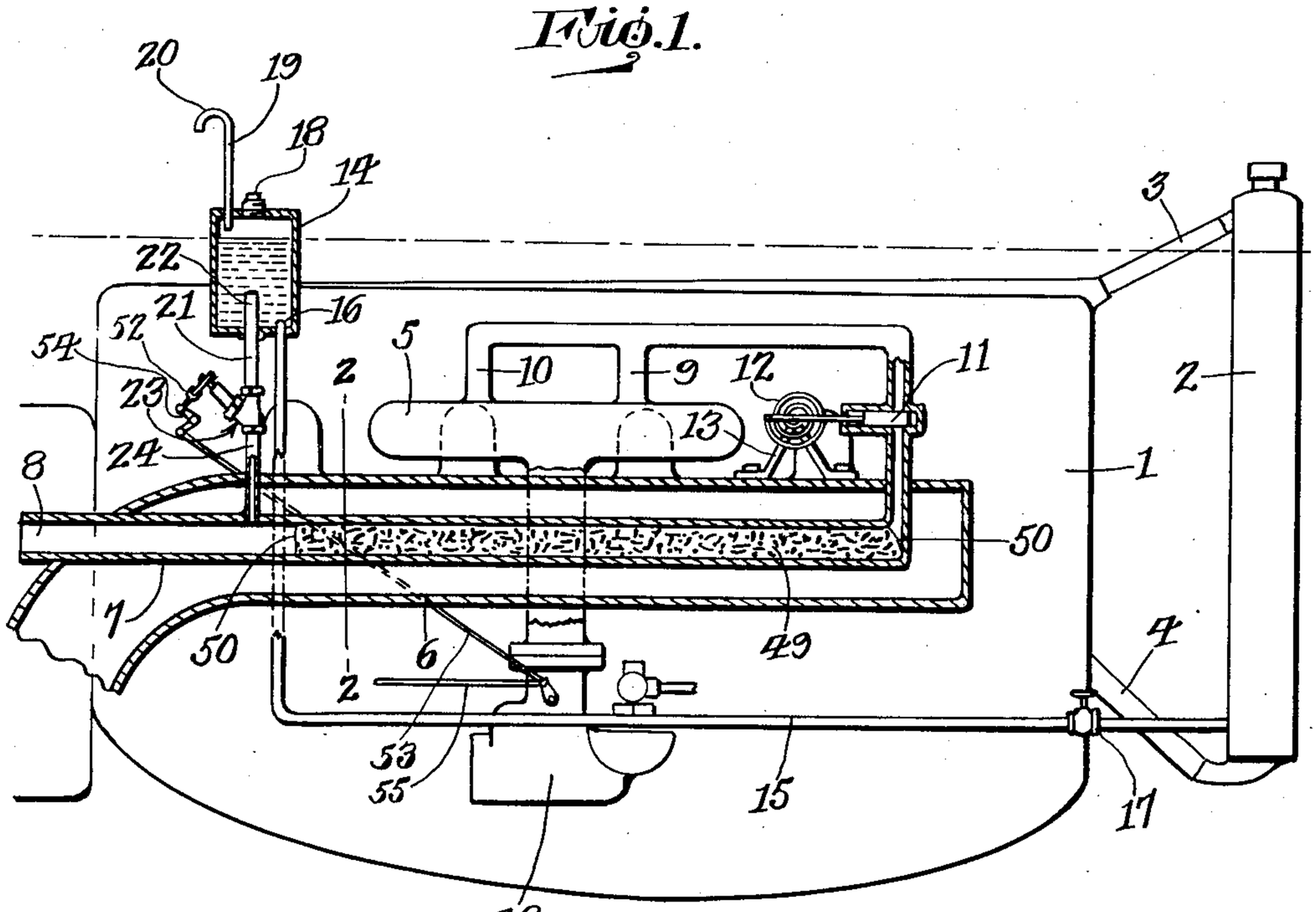


Fig. 2.

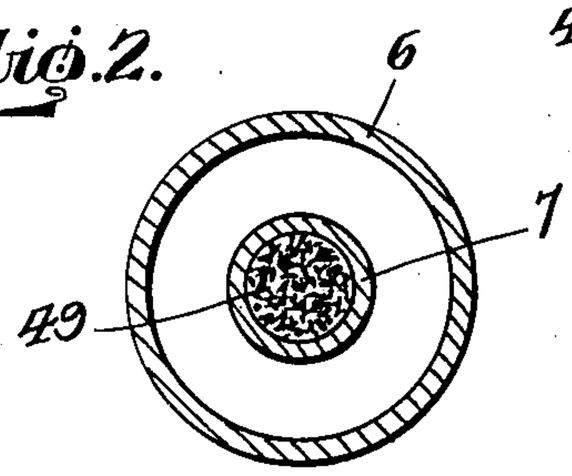
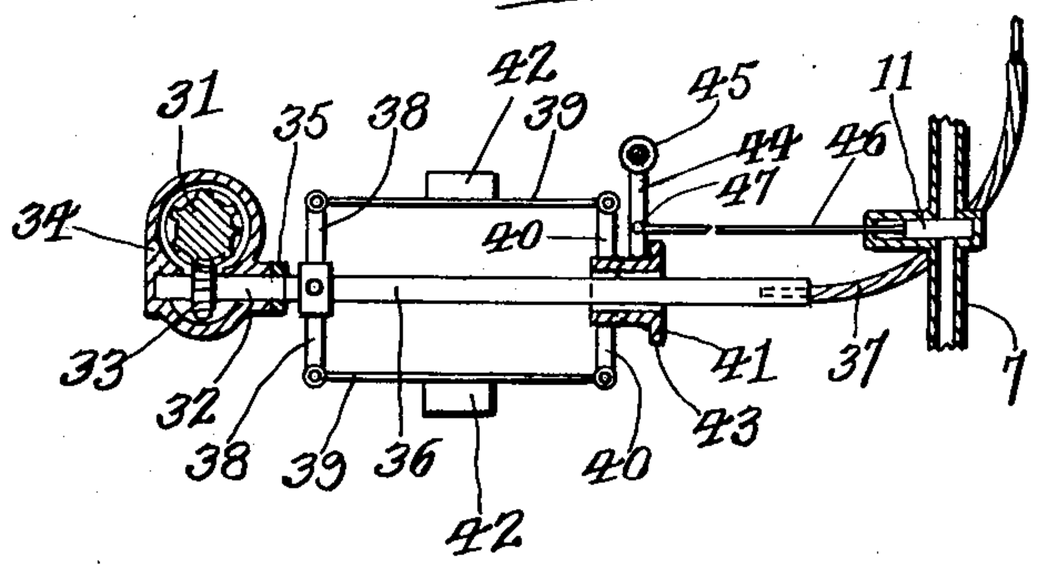


Fig. 4.



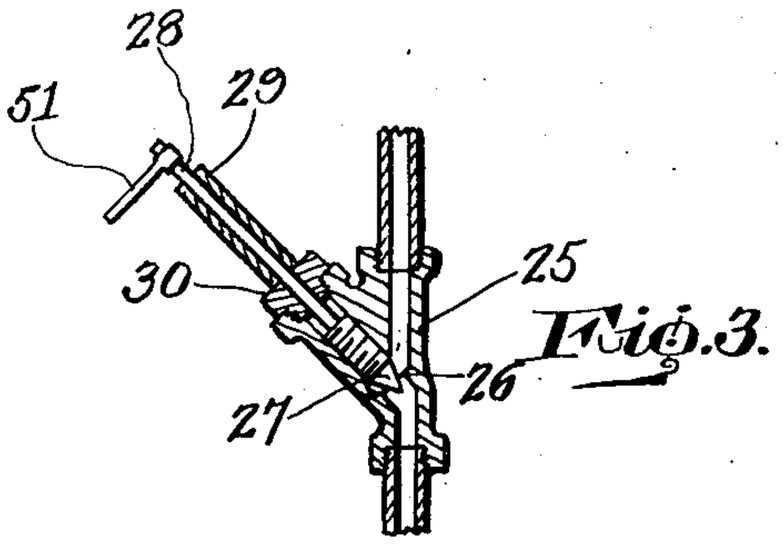


Fig. 3.

Inventor
John W. Harrell

By Geo. P. Kimmel
Attorney

Patented July 10, 1934 1,966,345

UNITED STATES PATENT OFFICE

1,966,345

HYDROGEN GENERATOR FOR INTERNAL COMBUSTION ENGINES

John W. Harrell, Cincinnati, Ohio, assignor of thirty-five per cent to Harry Schiff, Cincinnati, Ohio

Application June 9, 1933, Serial No. 675,132

6 Claims. (Cl. 123—121)

This invention relates particularly to a device for generating and supplying hydrogen to an internal combustion engine.

In the past, various means have been devised for injecting air into the intake manifold of internal combustion engines. Also, various means have been provided for introducing moist air into the intake manifold in order to promote a complete and proper combustion of the charge of gasoline vapor normally supplied by the carbureter.

The object of this invention, however, is to furnish a means whereby the heat from the exhaust gases which is normally wasted may be utilized for the purpose of generating hydrogen which is then injected into the intake manifold and mixed with the gasoline fuel normally used. It has been found that a certain amount of hydrogen when so injected into the intake manifold not only reduces the consumption of gasoline or other fuel used in running the engine, but also improves the operation of the engine to a very considerable degree. The engine is found to possess more pep and flexibility while at the same time a great deal of the unevenness and vibration ordinarily experienced is eliminated thus resulting in a smoother flow of power. The amount of power produced is likewise found to be considerably increased.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawing, it being distinctly understood that the same are by way of illustration and example only and are not to be taken as in any way limiting the spirit or scope of this invention. The spirit and scope of this invention is to be limited only by the prior art taken in connection with the accompanying claims.

Referring now more particularly to the drawing in which like numerals indicate corresponding parts throughout:

Figure 1 is a side elevation of an automotive engine illustrated diagrammatically with an attachment constructed in accordance with this invention in place thereon.

Figure 2 is a section taken along the line 2—2 of Figure 1.

Figure 3 is a detail sectional view illustrating the needle valve mechanism utilized in connection with this invention.

Figure 4 is a view partly in section illustrating a modified form of valve actuator for use in connection with this attachment.

In the drawing there is illustrated in diagrammatic form an internal combustion engine 1, the same being provided with a radiator 2 connected thereto by upper and lower hose connections 3 and 4 for the purpose of cooling the engine in the customary and well known manner. This engine is also provided with intake and exhaust manifolds 5 and 6 respectively which are substantially of the same form as those customarily employed.

In accordance with this invention, however, an iron pipe 7 extends through the interior of the exhaust manifold, having one of its ends 8 projecting out through the wall of the exhaust manifold and open to the atmosphere. The opposite end of this pipe 7 likewise extends outwardly through the wall of the exhaust manifold and is provided with two branches 9 and 10 respectively communicating with the interior of the intake manifold 5. Intermediate the point where it emerges from the exhaust manifold and the point where it branches to enter the intake manifold, this pipe is provided with a slide valve 11 actuated by a thermostat 12 supported by means of the bracket 13 upon the surface of the exhaust manifold 6. This thermostat and slide valve are so arranged that the valve will be in closed position when the exhaust manifold is cold, but when the exhaust manifold is heated up the thermostat will move the valve 11 to its open position thus allowing communication between the portion of the pipe 7 that is within the manifold and the interior of the intake manifold.

Positioned substantially on a level with the level of the water in the radiator, there is provided a small reservoir 14, this reservoir being connected with the lower tank of the radiator by means of a pipe 15 which enters through the bottom of the reservoir and projects slightly above the bottom of the reservoir as shown at 16. This pipe 15 is provided with a valve 17 by which communication between the radiator and the reservoir 14 may be cut off. The reservoir 14 is provided with a filling plug 18 which may be used in the event that it becomes desirable to disconnect the reservoir from the radiator, and is likewise provided with a vent pipe 19. The vent pipe 19 is bent over at its upper end 20 so as to prevent the entrance of dirt which might otherwise be dropped therein.

Extending through the bottom of the reservoir 14 is a pipe 21, the upper end 22 of this pipe extending upwardly from the bottom of the reservoir a distance greater than the end 16 of the pipe 15. The lower end of the pipe 21 is connected by means of a needle valve generally indicated at

23 to a section of pipe 24 which in turn extends through the wall of the exhaust manifold and communicates with the interior of the pipe 7.

The needle valve 23 consists in general of a housing 25 having a valve seat 26 and provided with a needle valve 27 for engagement therewith. The needle valve 27 is closed or opened by means of turning the stem 28 within the sheathing 29. A packing nut 30 may be provided if desired for the purpose of preventing leakage. The stem 28 is provided with a lever 51 connected through the links 52 and 53 and the bell crank 54 to the throttle control 55 for operation therewith.

With reference to Figure 4, there is here illustrated an optional means of operating the valve 11. This means consists of a governor device which is connected with the propeller shaft 31 through the intermediary of the shaft 32 and the worm gear 33 normally provided for the actuation of the speedometer cable. The shaft 31 is normally housed within a housing 34 and is provided with a connection at 35 for connecting it with the speedometer cable. The governor mechanism made use of in this connection consists of a shaft 36 having one end adapted to fit into the connection 35 and having the other end adapted to receive the end of a speedometer cable 37. Secured to this shaft 36 at a point adjacent the connection 35 are a pair of arms 38 projecting radially therefrom and carrying pivotally at their outer ends one end of each of the springs 39. The other ends of these springs are carried by similar arms 40 mounted on a ring 41 which is in turn slidable with respect to the shaft 36. Intermediate the ends of the springs 39 each spring is provided with a weight 42 which is adapted to move outwardly when the device is rotated. As illustrated, the ring 41 is provided with a radially extending flange 43 adapted to abut the end of the lever 44 pivotally mounted on some fixed support at 45. A cable 46 is secured to the lever 44 at the point 47 and extends by way of any necessary direction changing means such as pulleys or the like to operate the valve 11 according to the speed of the vehicle.

The intake manifold 5 is of course connected with the conventional carbureter 48 for the purpose of receiving therefrom a vaporized fuel. Also, within the pipe 7 between the point where the pipe 24 communicates therewith and the point where the pipe 7 emerges from the exhaust manifold in its path to the intake manifold, this pipe is provided with a body of iron filings 49. These iron filings are prevented from movement in either direction through the pipe 7 by means of screens 50.

In operation the engine is started in the ordinary manner and as soon as it has warmed up sufficiently the valve 11 will be opened by means of the thermostatic control 12. When the throttle is opened up, the needle valve 23 will be opened slightly so as to allow a small quantity of water from the reservoir 14 to run downwardly and drip onto the interior of the pipe 7. This pipe 7 being within the interior of the exhaust manifold, is very hot, and the water dripping down onto the interior thereof is immediately turned into steam. By virtue of the suction from the intake manifold, air is drawn in through the open end 8 of the pipe 7 and the air with the steam is conveyed past the iron filings 49. As this mixture is conveyed past the iron filings, the oxygen from the steam will combine with the iron to form iron oxide thus liberating the hydrogen from the steam. This hydrogen is immediately conveyed past the valve 11 and through the branches 9 and 10 into the intake manifold 5. In the intake manifold 5 it is mixed with the vaporized gas from the carbureter and is conveyed through cylinders in the ordinary manner and burned. Although, in accordance with the foregoing description, steam is passed by iron filings for the purpose of forming hydrogen, it is to be understood that other metals such as zinc, magnesium or aluminum might be used with the same results. The chemical action in each case is practically identical, the metal serving to reduce the steam so as to liberate the hydrogen.

If the governor device illustrated in Figure 4 be used in place of the thermostat 12, it will be apparent that when the vehicle is in motion at a sufficient speed to actuate the governor mechanism, the valve 11 will be opened and hydrogen may be injected into the intake manifold as above set forth. On the other hand, if the vehicle is at rest, the valve 11 will automatically be closed so that no hydrogen will be allowed to enter the intake manifold.

It has been demonstrated in actual use that the above described invention attains all of the objects set forth above and produces a very desirable and satisfactory arrangement.

More power is obtainable from the engine with a very considerable fuel economy. The flow of power is smoother, the pick up quicker and the motor generally more flexible in its operation. Less shifting of gears is required and easier starting is experienced. At the same time the engine has been found to accumulate less carbon and requires less repairs.

It is to be understood that various changes in design and arrangement of parts, to accommodate the device of this invention to various types of engines, and for other purposes, may be made without departing from the spirit or scope of this invention.

What I claim is:—

1. In combination with a vehicle propelled by an internal combustion engine provided with intake and exhaust manifolds and a water cooling radiator, a pipe forming a generator chamber and positioned within said exhaust manifold, said pipe passing through said exhaust manifold and being open to the atmosphere at one end thereof and passing through said exhaust manifold and communicating with the intake manifold at the other end thereof, a water reservoir above said exhaust manifold, a pipe connecting said water reservoir to the radiator to be supplied therefrom, a valve in said pipe for opening and closing the same, a vent pipe for said reservoir, an outlet pipe for said reservoir projecting through the bottom of said reservoir to a point above the bottom thereof, whereby the bottom of said reservoir will serve as a sediment trap, said outlet pipe communicating with the interior of said generator chamber to admit water thereto, a valve in said outlet pipe for controlling the admission of water to the generator chamber, a body of iron filings in said chamber, a valve for controlling communication between said generator chamber and the intake manifold, and a governor mechanism controlled by the speed of the vehicle for opening said last mentioned valve when the speed of the vehicle is greater than a predetermined value and to close the same when the speed of the vehicle falls below such value.

2. In combination with a vehicle propelled by an internal combustion engine provided with intake and exhaust manifolds and a water cooling

radiator, a pipe forming a generator chamber and positioned within said exhaust manifold, said pipe passing through said exhaust manifold and being open to the atmosphere at one end thereof and passing through said exhaust manifold and communicating with the intake manifold at the other end thereof, a water reservoir above said exhaust manifold, a pipe connecting said water reservoir to the radiator to be supplied therefrom, a valve in said pipe for opening and closing the same, a vent pipe for said reservoir, an outlet pipe for said reservoir projecting through the bottom of said reservoir to a point above the bottom thereof, whereby the bottom of said reservoir will serve as a sediment trap, said outlet pipe communicating with the interior of said generator chamber to admit water thereto, a valve in said outlet pipe for controlling the admission of water to the generator chamber, a body of iron filings in said chamber, a valve for controlling communication between said generator chamber and the intake manifold, and temperature controlled means on said exhaust manifold to open said last mentioned valve when the exhaust manifold is hot and to close the same when the exhaust manifold is cold.

3. In combination with a vehicle propelled by an internal combustion engine provided with intake and exhaust manifolds and a water cooling radiator, a pipe forming a generator chamber and positioned within said exhaust manifold, said pipe passing through said exhaust manifold and being open to the atmosphere at one end thereof and passing through said exhaust manifold and communicating with the intake manifold at the other end thereof, a water reservoir above said exhaust manifold, a pipe connecting said water reservoir to the radiator to be supplied therefrom, a valve in said pipe for opening and closing the same, a vent pipe for said reservoir, an outlet pipe for said reservoir projecting through the bottom of said reservoir to a point above the bottom thereof, whereby the bottom of said reservoir will serve as a sediment trap, said outlet pipe communicating with the interior of said generator chamber to admit water thereto, a valve in said outlet pipe for controlling the admission of water to the generator chamber, a body of iron filings in said chamber, and a valve for controlling communication between said generator chamber and the intake manifold.

4. In a device of the type described, in combination with an internal combustion engine having exhaust and intake manifolds, a generator chamber within the exhaust manifold to receive heat from the exhaust gases, means for admitting water to said chamber to form steam, a body of filings of a metal having an affinity for oxygen within said chamber for reducing said steam to hydrogen, said chamber having an inlet opening therein for admitting air to be mixed with the steam, means for conducting said hydrogen and air to the intake manifold, and means controlled by the temperature of the exhaust manifold for shutting off communication between the generator and the intake manifold when the exhaust manifold is cold and establishing such communication when the exhaust manifold is hot.

5. In a device of the type described, in combination, a generator chamber positioned to receive heat from exhaust gases, means for admitting water into said chamber to form steam, an outlet for said chamber adapted to communicate with an intake manifold, a quantity of metal having an affinity for oxygen positioned between the point where water is admitted and the outlet for the chamber, and speed controlled means for shutting off communication between said chamber and the intake manifold when the speed is less than a certain predetermined amount and establishing such communication when the speed exceeds such amount.

6. In a device of the type described, in combination, a generator chamber positioned to receive heat from exhaust gases, means for admitting water into said chamber to form steam, an outlet for said chamber adapted to communicate with an intake manifold, a quantity of a metal having an affinity for oxygen positioned between the point where water is admitted and the outlet for the chamber, and means controlled by the temperature of the exhaust manifold for shutting off communication between said chamber and the intake manifold when the exhaust manifold is cold and establishing such communication when the exhaust manifold is hot.

JOHN W. HARRELL.