

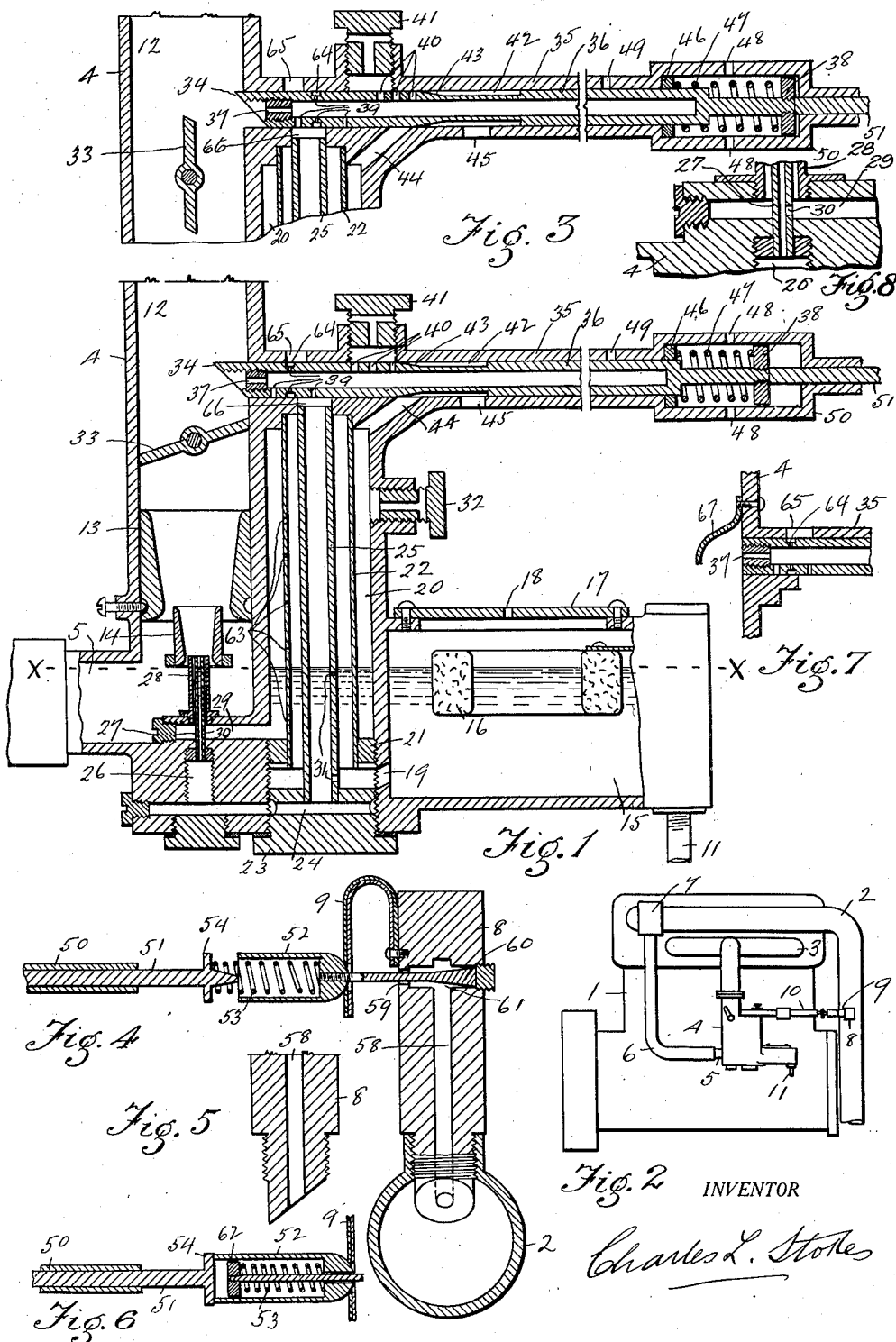
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AUTOMATIC FUEL REGULATOR

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AUTOMATIC FUEL REGULATOR

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3 Claims. (Cl. 123—119)

My invention relates to improvements in automatic fuel regulation for internal combustion engines.

The principal object of my invention is to provide an automatically regulated carburetor for an internal combustion engine by means of which the mixtures of fuel and air are properly proportioned under all conditions of engine operation.

Another object of my invention is to incorporate in a carburetor an automatic primer, controlled by the vacuum and temperature of the engine, which not only performs the function of priming the engine to start the same, but also functions to control the main liquid fuel supply to the engine.

Another object of my invention is to provide a simple, cheap and efficient carburetor having a minimum of moving parts.

Referring to the drawing in which the same numbers indicate like parts:

Fig. 1 is a vertical sectional view of my carburetor with my improvements incorporated therein.

Fig. 2 is a view showing my invention attached to an internal combustion engine.

Fig. 3 is a sectional view showing the mechanism of Fig. 1 in another position.

Fig. 4 is a transverse sectional view of part of Fig. 2.

Fig. 5 is a sectional view of part of Fig. 4.

Fig. 6 is an alternative construction for part of Fig. 4.

Fig. 7 is an alternative construction for part of Figs. 1 and 3.

Fig. 8 is an enlarged fragmentary sectional view of the discharge nozzle.

The invention disclosed in this application is an improvement over that disclosed in my copending application Serial Number 106,012, filed May 1st, 1926, and copending application, Serial No. 142,761, filed October 19, 1926.

An internal combustion engine 1 has the usual exhaust pipe 2 and intake pipe 3, to which latter is attached a carburetor 4 having an air inlet 5 connected by a hot air pipe 6 to a stove 7 surrounding exhaust pipe 2. A metal block 8 extends from exhaust pipe 2 and has mounted thereon a bi-metallic thermostat 9 adapted to operate through suitable mechanism 10 for controlling the action of carburetor 4.

Carburetor 4 is fed by any suitable system with liquid fuel through a pipe 11 and comprises a mixing chamber 12 containing a large venturi 13 and a small venturi 14 adapted to discharge at the throat of large venturi 13. Liquid fuel

through pipe 11 passes into a liquid reservoir 15, maintained substantially at a constant level X—X, containing a float 16 operating in a well known manner a valve (not shown) for controlling the inlet of liquid fuel through pipe 11. Reservoir 15 is closed by a cover 17 and is open to atmosphere through a port 18.

Liquid fuel passes through a passage 19 to the lower part of a well 20 which latter is divided into an upper and lower section by a plug 21 supporting a tube 22. The lower part of well 20 is closed by a plug 23 containing a passage 24 and supporting a tube 25 and passage 24 leads to a passage 26 and a nozzle 27. A second nozzle 28 surrounds nozzle 27 and is adapted to register through a passage 29 with the upper part of well 20. A small orifice 30 is drilled in nozzle 27 for permitting liquid fuel, in restricted quantity, to flow from the upper part of well 20 to the interior of tube 25. Tube 25 has orifices 31, the lower one of which is relatively large compared with the upper orifice and the upper orifice is located just below the liquid level X—X.

Air is supplied to well 20 through an air adjusting valve 32. A throttle 33 controls the discharge of liquid fuel and air from carburetor 4 to the cylinders of engine 1, responsive to the vacuum therein.

The engine vacuum, on the engine side of throttle 33 is applied to the interior of a casing 35, forming an extension of carburetor 4, for operating a valve 36 which in turn controls the passage of liquid fuel and air through the valve 36 by way of a restricted orifice 37 as will presently appear. On the outer end of valve 36 is mounted a disc 38. Valve 36 contains a plurality of liquid fuel orifices 39 and a plurality of air orifices 40, the fuel orifices 39 being adapted to register at times with the upper discharge of tube 25 and the air orifices 40 being adapted to register at times with atmosphere through the regulating valve 41.

Valve 36 has an annular groove 42 cut therein with a tapered portion 43 adapted to control at times the supply of air to the upper portion of well 20 through passages 44 and 45. The outer end of valve 36 is squared to work through a guide 46 so that the positions of orifices 39 and 40 will always remain the same and a spring 47 encircles the outer end of valve 36 for limiting its movement in one direction, disc 38 limiting its movement in the other direction. Disc 38 is adapted to work in an enlarged extension 50 which is open to atmosphere through ports 48, suitable clearance being allowed between disc 38

and casing 50. An orifice 49 is provided for suitably locking valve 36 in any predetermined position by means of a pin, or otherwise, if so desired.

Casing 50 is adapted to contain a rod 51 having a head 54 thereon and a member 52 rests against thermostat 9 and contains a spring 53 working against head 54 to the end that the motion of thermostat 9 will be conveyed through spring 53 and rod 51 for controlling the position of valve 36, it being noted that valve 36 is always in contact indirectly with thermostat 9 through the aforesaid elements, excepting at such times as will be hereinafter explained.

Engine exhaust gases pass through pipe 2 to atmosphere and on their way come in contact with a bevelled face of block 8, a portion thereof being thus diverted to pass through a passage 58 and a port 59 to atmosphere. Block 8 is adapted to contain valve 60 threaded into member 52 and adapted to work in an enlarged passage 61 for closing port 59 at times, the exhaust gases passing through port 59 are arranged to impinge on thermostat 9. It will be seen that spring 53 forms a substantially universal joint between member 52 and rod 51 and in the alternative shown in Fig. 6. It will be noted that the stem of valve 60 is adapted to move freely in member 52 and has a disc 62 provided on the end of valve 60 for flexibly seating valve 60.

Tube 22 is provided with a plurality of liquid feed orifices 63, some of which are above and some below the liquid level X—X. A groove 64 is cut in valve 36 and adapted to register at times with atmosphere through a passage 65 and groove 64 is connected with the interior of valve 36 through orifices 39. The upper ends of tubes 22 and 25 fit snugly in the metal of carburetor 4, the upper end of tube 22 being spaced a desired amount from the valve 36 to form a reservoir 66 of any desired content.

The operation of the device is as follows:

If it be assumed that engine 1 is very cold, throttle 33 will be closed, as shown in Fig. 1, and engine 1 will be cranked. A partial vacuum is thus applied to mixing chamber 12, which partial vacuum is very low due to the low cranking speed and therefore valve 36 will be in the position shown in Fig. 3 due to the action of spring 47 and thus a plurality of the orifices 39 will be in registry with the upper discharge of tube 25 for raising liquid fuel and discharging the same in large volume through orifice 37 for priming the engine, it being noted at this time that only one, or perhaps none, of the orifices 40 is in connection with atmosphere through valve 41.

After a period of cranking, sufficient liquid fuel will have been drawn in the engine, together with a limited amount of air past throttle 33, and the mixture is fired in the cylinders of engine 1, whereupon a sudden jump in vacuum occurs whereby valve 36 advances to the position as shown in Fig. 1 thus closing some of the orifices 39 and suddenly reducing the supply of liquid fuel to the engine. The number of orifices thus cut off will be determined by the particular engine to which carburetor 4 is applied. At this time more of the air orifices 40 will permit passage of atmosphere to the interior of valve 36, thus reducing the vacuum applied for raising liquid fuel through the remaining orifices 39 and groove 64 will also be open to atmosphere thus minimizing any tendency of the engine vacuum to draw liquid fuel between valve 36 and casing 35. Also at this time, the upper part of well 20 will be in connection with atmosphere through

port 45, groove 42 and passage 44. Thermostat 9, being in its fully contracted position, will thus not exert any influence on valve 36 and consequently, upon opening throttle 33 wide for sudden acceleration, valve 36 will be drawn by spring 47 to its outermost position as shown in Fig. 3 whereby passage 44 will be closed to atmosphere thus throwing the full suction at the throat of venturi 14 upon nozzles 27 and 28 and thus upon orifices 63. Said suction will be also applied when the engine is cold in greater strength to orifices 31 because groove 64 will be shrouded and only a limited amount of air may pass through orifices 40 and 39 to the interior of tube 29, but this amount of air is sufficient to permit the drop of the column of liquid fuel in tube 25 for quick accelerating discharge through nozzle 27 and thereafter permitting as before stated, an enhanced application of the engine vacuum to orifices 31, the result of all which is to increase the richness of the mixture supplied to the engine at low temperatures.

The sudden opening of throttle 33 also increases the speed at which the contents of tube 25 are discharged through nozzle 27 because valve 36 is tapered at 34 on its inner end to form a projection in the air stream in chamber 12 whereby a portion of the air, due to its velocity, impinges on said projection 34 and is diverted through orifices 37 and 39 to the interior of tube 25, this diversion being accentuated by the difference in vacuum on the engine side of throttle 33 and the throat of venturi 14.

A modification of this construction is shown in Fig. 7 wherein a deflector 67 is provided in place of projection 34.

During the period of operation described, exhaust gases will have passed through passage 58 in block 8 to impinge on thermostat 9 and also to heat block 8 for heat transmission to thermostat 9 and thus thermostat 9 will expand to bring spring 53 and rod 51 gradually in contact with disc 38 whereby, when optimum engine operating temperatures are reached, valve 36 will be at its innermost position whereby when throttle 33 is closed at idling speeds, only one of the orifices 39 will register with the discharge from tube 25 for providing an idling mixture. Thereafter under such optimum conditions, upon suddenly opening throttle 33 wide for acceleration, or for opening the same for slow acceleration, the compression of spring 47 is sufficiently greater than the tension of thermostat 9 to permit the recession of valve 36 only to the extent of maintaining groove 64 in registry with both port 65 and the upper discharge from tube 25 and at the same time permitting passage 44 to be only partially closed. Thus acceleration is provided for under all conditions and an economical mixture is provided at optimum engine temperatures.

The actual position of orifices 63 and 39 can be determined only by trial and may vary as to size depending on the engine to which they supply liquid fuel. A regulating valve 32 controls the discharge from orifices 63 at optimum temperatures and thereafter valve 36 automatically controls the degree of vacuum applied through nozzle 28 to the upper portion of well 20 for raising a column of liquid fuel therein and varying the head under which the same discharges through orifices 63.

Thus, in effect, two wells are provided for supplying liquid fuel and air to engine 1 in the proper mixture proportions under all conditions of load, speed and temperature, one well comprising the

upper part of well 20 supplying through nozzle 28, the other being tube 25 supplying through nozzle 27 and at times through 36.

A compensating effect is obtained due to the
5 varying amounts of air bled into the wells with varying degrees of vacuum on either side of throttle 33, whereby these two compensating wells take care of engine operation under all conditions.

10 The various orifices, well sizes, etc., may be determined only by trial for a particular engine but thereafter require no adjustment. Valves 32 and 41 may even be replaced by set orifices. If desired to operate without thermostatic control, valve 36 may be permitted certain movement
15 only for operating under optimum temperature conditions, as described, and this can be accomplished by changing the position of disc 38 along valve 36, so that the outermost position of valve 36 may be limited as required for a given effect.

Block 8 may be an integral part of exhaust pipe 2 and, as preferred, comprising a considerable block of metal capable of forming a reservoir for heat to the end that after engine 1
25 has been stopped for some time, thermostat 9 will be contracted more or less in proportion to the loss of heat from the engine itself, but passage 58 and port 59 provide that thermostat 9 will be reactive in proportion as the engine warms
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up and in this manner the control of carburetor 4 is assured for giving the effects already described.

I claim:

1. A carburetor having an intake passage, a
5 liquid fuel reservoir, a throttle in said passage, a well between the reservoir and said passage and connected to each, and deflecting means in said passage for circulating air from the passage through the well and past said throttle. 10

2. A carburetor having a mixing chamber, a liquid fuel reservoir, a throttle controlling the outlet from the mixing chamber, two wells between the reservoir and mixing chamber and connected to each and means responsive to temperature and vacuum for controlling the admission of air to both wells and deflecting means on the posterior side of said throttle for circulating air through the well and past said throttle. 15

3. The combination with an internal combustion engine of a carburetor having a mixing chamber, a liquid fuel reservoir, a throttle controlling the outlet from the mixing chamber, a well between the reservoir and mixing chamber and connected to each, and means jointly controlled by the engine vacuum and temperature for controlling the circulation of air from the mixing chamber through the well and past said throttle. 20

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