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C. T. RAULE

ELECTRICALLY OPERATED CARBURETOR

Filed July 30, 1915

FIG. 1 -

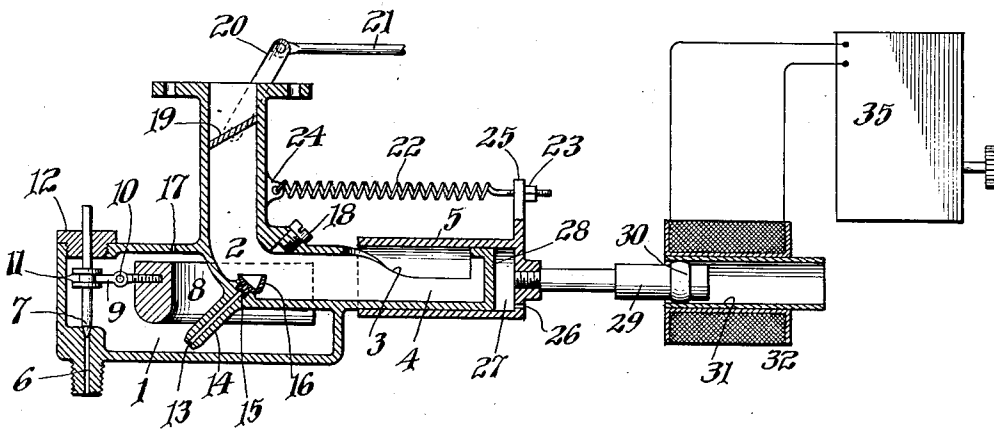
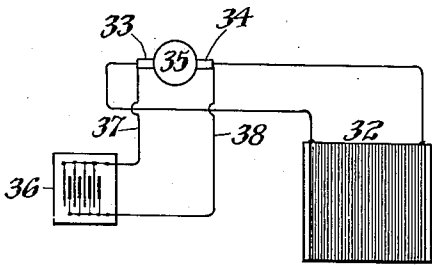


FIG. 2.

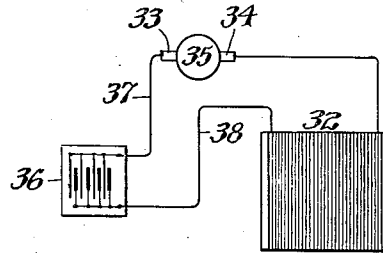
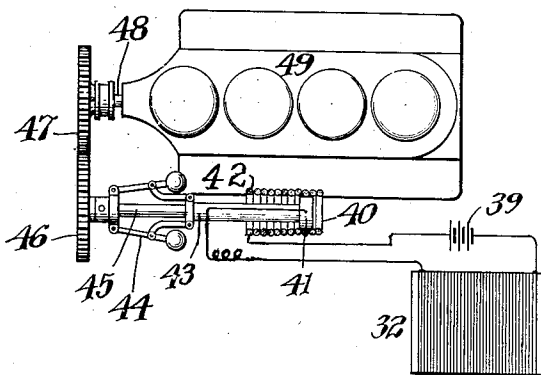


FIG. 3.

FIG. 4.



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CLIFFORD T. RAULE, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO
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ELECTRICALLY-OPERATED CARBURETOR.

Application filed July 30, 1915. Serial No. 42,822.

To all whom it may concern:

Be it known that I, CLIFFORD T. RAULE, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a certain new and useful Electrically-Operated Carburetor, of which the following is a specification.

The purpose of my invention is to utilize the electric current now so generally available in automobiles, to simplify the control of the mixture and render its regulation more accurate.

A further purpose of my invention is to apply the control to the air inlet and to operate it by electromagnetic means, preferably solenoidal, governing the quantity of air inlet in proportion to the speed of the engine.

A further purpose of my invention is to operate the electromagnetic means directly from a generator, whose speed varies directly with the speed of the engine.

A further purpose of my invention is to use a spring-retracted closure for the carburetor air inlet and to open the closure by magnetic pull in approximately uniform proportion to the engine speed.

A further purpose of my invention is to obtain a high efficiency in a carburetor with fewer parts and simpler construction than have previously been considered to be necessary.

Further purposes will appear in the specification and particularly in the claims thereof.

I have preferred to illustrate my invention by but two main forms thereof, both of which are simple, practical, efficient, reliable and relatively inexpensive and which at the same time well illustrate the principles of my invention.

Figure 1 is a vertical longitudinal section through one form of my invention.

Figures 2 and 3 show diagrammatic connections that may be used in Figure 1.

Figure 4 shows in top plan view, partly sectioned a second form of control which may be applied in Figure 1.

In the drawings, similar numerals indicate corresponding parts.

When speeding up a gasoline engine as, for example, when suddenly opening the throttle valve, all carburetor designers have experienced difficulty in protecting against excessive influx of air, which would corre-

spond to the desired speed but is greatly in excess of the permissible air feed for the speed at which the engine is then operating.

The crowding of the mechanism in the modern automobile has rendered it very desirable in this class of work that all control of moving parts be effected by the simplest connections from mechanism already in use and has placed a high premium upon the avoidance of other moving parts than are absolutely necessary. This and the flexibility, reliability and accuracy of electric operation through the use of the generators with which most automobiles are now already equipped, have rendered electric control of the gas mixture highly desirable in automobile service.

The current produced by the existing automobile generators for lighting and starting systems is ordinarily proportionate to the speed of the engine; and where this is not the case, may readily be made so. Where no generator is used one giving current nearly proportionate to the engine speed may be installed.

The construction of the main parts of the carburetor with which I have illustrated my invention differs in no particulars from carburetors already on the market; though the invention is obviously applicable to a wide range of carburetors. It has the float chamber 1, mixing chamber 2 and air inlet opening 3, in the side of a tubular member 4 and capable of closure to varying degrees by a sleeve 5 mounted upon and guided by the tubular member. It also has float control of the gasoline entering through passage 6 by valve 7, automatically closed when the gasoline rises to the correct level in the float chamber by float 8 operating through lever 9, pivoted at 10 against the collars 11 upon the valve. The float valve is guided in a screw closure 12 whose removal gives additional accessibility to the parts.

These prior carburetors were also provided with gasoline passage 13 through a tube 14 and terminating in a spray nozzle 15. I have surrounded the spray nozzle by a cup 16 within which gasoline is intended to accumulate, when the engine is stopped, for the purpose of providing a surplus of gasoline for starting purposes. Its effect is similar to that of priming. Atmospheric pressure in the float chamber is ensured by the opening 17.

The removable plug 18 gives accessibility for machining the parts and placing the nozzle. The carburetor, as thus far described, except for the cup, operates in the usual manner and my invention has been directed primarily toward the control of air admission in more exact proportion to the speed in any simple form of carburetor construction. I prefer to control the inlet mixture to the engine from the wheel by butterfly valve 19 operated from the wheel, in the case of an automobile, through arm 20 and rod 21.

I utilize electromagnetic pull for the opening of the valve, which is normally held in closed or nearly closed position by means of a spring 22, adjustable in tension as seen at 23 and secured to the body and valve at any suitable points, as 24 and 25.

In order to prevent dash pot action of the valve, I pierce its end, as at 26, permitting free flow of air therethrough. I close the space 27 from the interior of the carburetor by an end 28. The sleeve 5 is connected with a paramagnetic solenoid core 29 in the form chosen for illustration.

The contour of the air inlet 3 is designed from point to point to cooperate with the electromagnetic pull produced, as against the spring 22, so as to secure the most desirable extent of opening for each engine speed.

I have preferred spring retraction for the closure to other means, gravity retraction, for example, because the spring retraction is not only reliable over a wide range, but is independent of the position of the parts and may be made to compensate for the weight of the closure, if required.

I prefer to use the solenoidal form because it secures the most uniform electromagnetic pull in proportion to the current passed through it with which I am familiar. The core is shown as guided and supported by any suitable packing 30, where desired, within the bore 31, of a solenoid 32, preferably having both its ends open.

I connect the brushes 33 and 34 of the generator 35 with the solenoid winding. Where the generator is utilized for other purposes I place the solenoid winding either in multiple, as in Fig. 2, or in series, as in Fig. 3, with whatever other electric circuit may be provided, much preferring the parallel form, since the current received from it will be very much more nearly in exact proportion to the engine speed. In Figures 2 and 3 the additional electric circuit comprises the storage battery 36 and connections 37 and 38.

Obviously, even in the form of my invention selected for illustration, the connections of the electric circuit, the tension of the spring, the size, material and extent of normal introduction of the core within the solenoid at the time when the air inlet is most completely closed by the sleeve and the extent of movement of this core and sleeve per-

mitted may be greatly varied and still further opportunity for variation will be afforded by the application of my invention in the forms and to other carburetors. In all of these the purpose and effect are that the variant electric currents generated at different engine speeds shall open the air inlet to the proper distances for an extent of air admission which shall be correct for each different speed.

In Figure 4 I show another application of the electric current in which the source of current is a battery of any suitable character, shown as a primary battery 39 and the current from it through the solenoid is varied by a rheostat 40. One terminal of the circuit is connected to the contact 41, movable within the rheostat and the other terminal is secured to a rheostat terminal at 42. The contact 41 is mounted upon a sleeve 43 which is moved in proportion to any predetermined function of the engine speed by a governor 44. The sleeve slides along a shaft 45 which is rotated by a gear 46 meshing with a gear 47 upon the shaft 48 of the engine 49.

In this additional form of my invention the same solenoid is shown and it may be applied to operation of the carburetor by the same structure and to the same type of carburetor as in Figure 1.

It will be evident that the electric current may be utilized in other ways and for opening and closing of other types of air inlet closure, replaced by other means than I have shown, without departing from the spirit and scope of my invention herein.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a device for varying the proportion of gas and air in a carburetor inlet, a carburetor having an air inlet, a slidable closure for said inlet, embracing and guided thereupon, an engine-operated electric generator, an electromagnet having its circuit connected with the generator and paramagnetic material connected with the closure and moved by the electromagnet to increase the inlet opening with increase of current in the electromagnet.

2. In a device for varying the proportion of gas and air in a carburetor inlet, a carburetor having an air inlet, a tubular cover therefor, a solenoid, a core connected with the cover and adapted to enter the solenoid, increasing the inlet opening with increased core entry within the solenoid, an electric generator, connections between the generator and the solenoid and engine connections for operating the generator.

3. In a device for varying the proportion of gas and air in a carburetor inlet, a carburetor having a tubular member and an air inlet in the side thereof, a tubular closure for the inlet mounted upon and guided

by the tubular member, a solenoid core directly connected to the tubular closure, a solenoid surrounding the core, and adapted to increase the inlet opening with increased solenoid current, an electric generator and connections from the brushes of the generator to the solenoid.

4. In a device of the character stated, a carburetor having an air inlet of non-uniform cross section, a longitudinally movable closure for the inlet, an engine, an electric generator driven by the engine, a solenoid winding connected with the generator and a solenoid core affected by the winding and connected with the closure to move the closure so as to open the inlet at a non-uniform rate with increase of current from the generator.

5. In a device for varying the proportion of gas and air in a carburetor, a carburetor having an air inlet at one end, a closure for the inlet movable away from the carburetor to open the inlet, a solenoid, a solenoid core connected with the closure and movable away from the carburetor to enter the solenoid, a generator operated by the engine supplied by the carburetor and connections from the generator to the solenoid increasing the pull of the solenoid and the opening of the air inlet with increase of engine speed.

6. In combination with a carburetor, a side opening valve and electromagnetic means for exposing different extents of opening to vary the proportion of air to fuel in the mixture supplied by the carburetor.

7. In a device for varying the proportion of gas and air in the carburetor, a carburetor, an air inlet therefor, a closure for the inlet and electromagnetic means for moving the closure to open with increasing engine speed, the movement of the closure with respect to the opening and the speed of the engine being so proportioned that at the beginning the inlet is opened to an extent disproportionate to the extent of increase of speed of the engine.

8. In combination with a carburetor, a side opening air inlet valve having the opening therein of non-uniform extent in cross section, in combination with a closure for the opening movable longitudinally thereof, a solenoid, an engine-controlled supply of current for the solenoid and a solenoid core connected with the closure to cause opening of the valve with increase in engine speed.

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