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AUTOMATIC REGULATOR FOR INTERNAL COMBUSTION ENGINE FUEL MIXERS

Filed April 12, 1926

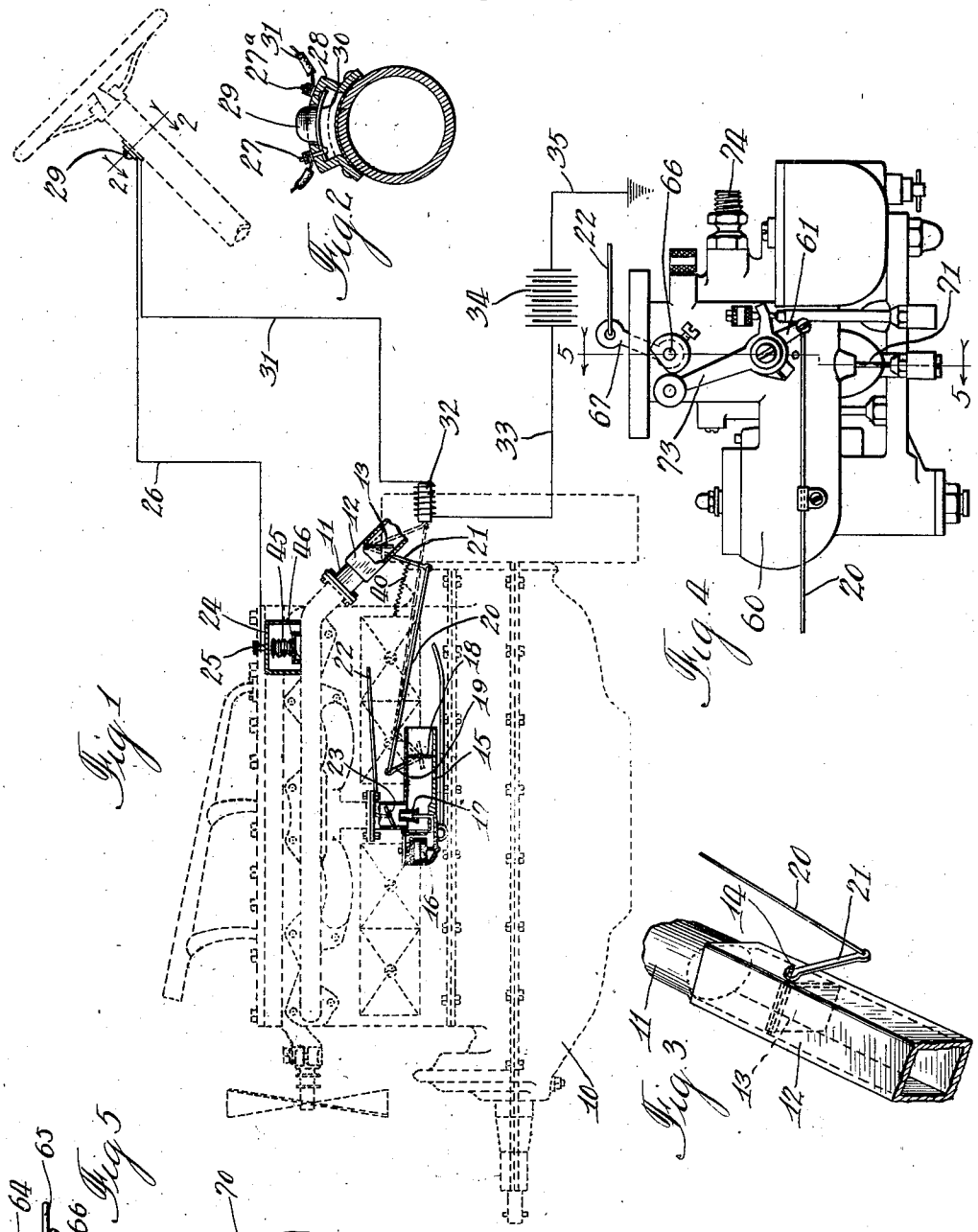


Fig. 1



Fig. 2



Fig. 4



Fig. 3

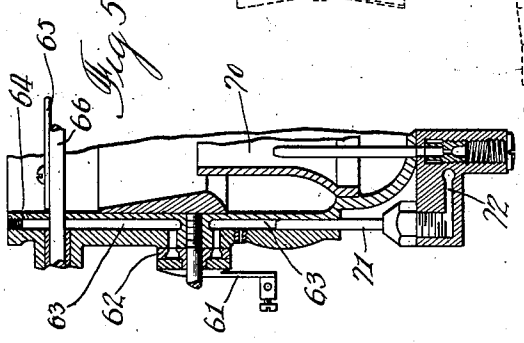


Fig. 5

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# UNITED STATES PATENT OFFICE

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## AUTOMATIC REGULATOR FOR INTERNAL-COMBUSTION-ENGINE FUEL MIXERS

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The invention relates to an automatic device for attachment to internal combustion engines designed to operate automatically for regulating the character of the fuel mixture supplied to a hydro-carbon engine particularly, when it is desired to start the motor when in a cold condition.

I am aware that various devices hand operated have been widely used in connection carburetors and fuel mixers for enriching the supply of the explosive mixture during the starting period. One class of these devices consists in hand operated means for choking or partially closing the air inlet through the carburetor or mixing device, thus raising the vacuum and increasing the velocity of the current through the fuel supplying devices. Such a device is commonly referred to in connection with carburetting or fuel mixing devices as a choke.

Another class of devices also commonly used in connection with carburettors or fuel mixers consists of hand operated means for supplying a supplemental or augmented jet or priming stream of fuel usually to be discharged between the ordinary butterfly valve of the carburettor and the intake manifold, or in some cases, on the carburettor side of the butterfly valve in conjunction with a restriction of the air supply to increase the velocity through the carburettor or mixing device.

These various types of hand controlled devices for use in starting cold engines frequently result in much trouble not only to persons having little experience in the operation of engines but even to experienced persons who open such devices and when the engine warms up after beginning to operate on its own power forget to restore such enriching devices to an inoperative condition with the result that the character of the fuel supply delivered to the engine is so rich as to result in objectionable crank case dilution and wastage of fuel and improper operation of the motor due to improper carburation.

It is the primary object of my invention to provide a fuel enriching device adapted for application to various forms of commercial carburettors or fuel mixing devices which shall be automatic in its operation, thus requiring no skill or attention on the part of the operator. For example, it is one of the primary objects of my invention to provide improved means by which the fuel enriching devices of the carburettors or fuel mixers of hydro-carbon engines shall be automatically controlled by the pressure coming from the exhaust ports of the engine.

It is a further object of the invention to provide thermostatically operated means adapted to be operated by engine heat for controlling the position of the fuel enriching device.

It is a still further object of my invention to provide electro-magnetically operated means for actuating the fuel enriching devices of carburettors or fuel mixers for hydro-carbon engines in inoperative position, adapted to be operated by the engine heat for controlling such electro-magnetic device.

It is a further object of my invention to provide an electro-magnetically operated device for controlling the fuel enriching mechanism of a carburettor or mixing device of a hydro-carbon engine, which electro-magnetically operated device shall be under the joint control of the operator of the engine and of a thermostat adapted to be operated by heat generated by the engine.

It is a further object of my invention to provide a control mechanism for the fuel enriching device of a carburettor or mixer of a hydro-carbon engine operable in one direction of its movement by pressure generated by the engine enhaust in conjunction with an electro-magnetically operated device controlled by a thermostat adapted to be operated by the heat of the engine for rendering said fuel enriching mechanism inoperative at predetermined intervals upon the failure of exhaust pressure from the engine.

It is a further object of my invention to provide an improved fuel enriching device for the carburetor or fuel mixing device of a hydro-carbon engine which shall be automatically controlled in inoperative position by the exhaust of the engine, in conjunction

with manually controlled means for rendering the fuel enriching device operable.

Other objects of the invention will appear from the following description of the preferred embodiment of my invention as hereinafter described with particular reference to the drawings which form a part of the specification.

In the said drawings, Fig. 1 is a broken outline view of an engine adapted for use on ordinary motor cars and the like, the principal details of my invention being applied thereto and shown partially in section.

Fig. 2 is a detailed sectional view on line 2—2 of Fig. 1 looking in the direction indicated by the arrows.

Fig. 3 is an enlarged broken detail view showing a portion of the exhaust line leading from the exhaust manifold of the engine, showing a detail of the control valve therein.

Fig. 4 is a side elevational view of a carburettor of a form in which the fuel enriching device operates directly upon the fuel rather than upon the air supply as is the case in connection with the carburettor shown in Fig. 1.

Fig. 5 is a detail sectional view on line 5—5 of Fig. 4 looking in the direction indicated by the arrows.

In carburettors for hydro-carbon engines the general practice is to enrich the fuel mixture in starting by temporarily diminishing the air supply, thereby increasing the vacuum or by augmenting the fuel supply by the addition of a jet or stream of liquid fuel or in some instances by operating upon both the air and fuel supply.

In the form of the invention as shown more particularly in Fig. 1 I have shown the invention applied to the type of carburettor in which the choking or fuel enriching means operates solely upon the air supply, the effect being to restrict the air intake of the carburettor, thereby increasing the vacuum and enhancing the richness of the fuel mixture in one of the ordinary methods of choking the carburettor, as it is termed for enriching the fuel mixture in starting an engine and particularly a cold engine.

In Fig. 1 my invention is shown applied to the conventional form of gasoline engine in which the outline of the engine is designated generally by reference character 10 and is shown in full lines. 11 designates a portion of the exhaust pipe connected to the usual exhaust manifold. The exhaust pipe 11 may advantageously, although not necessarily have a portion thereof formed rectangular or approximately square in cross section as designated by reference character 12 and having on the interior an opening that may be square or rectangular in form, the same being an extension of the opening or passageway on the interior of the exhaust pipe. 13 is a flap valve pivotally mounted at 14 in the walls of the rectangular portion of the exhaust pipe 12 so that the opening in the exhaust pipe will be substantially closed when the valve is impelled to a closed position. 15 designates generally the casing of a carburettor of the aforesaid type in which the liquid fuel to be fed to the engine is maintained in a float chamber, the float of which is designated generally by reference character 16 so that the liquid fuel is maintained and supplied to the Venturi tube 17 to be taken up by the air current or by vacuum for supplying the intake manifold of the engine. The air intake of the carburettor is shown supplied with the usual butterfly valve 18, 19 being an arm for controlling the pivotal movement of the valve 18 through the medium of the pitman or link 20 which latter is pivotally connected with an arm 21 on the pivot pin 14 of the flap valve 13. On the carburettor of Fig. 1 the reference character 22 indicates the usual throttle rod for operating the butterfly valve 23 which is located in the passageway of the carburettor leading from the Venturi tube to the intake manifold.

24 designates generally a metallic casing or frame attached in any suitable manner, not shown, to the exhaust manifold pipe or header of the engine as illustrated in Fig. 1, although the same may be attached to other parts of the engine that may be subjected more or less directly to heat generated by explosions in the cylinders of the engine. 25 designates a binding post that must be insulated in the frame 24, the same serving as a terminal post for the circuit line 26 leading to the terminal post 27 of the hand switch designated generally by reference character 28, the details of which are shown in section in Fig. 2. 29 is a button controlling a make and break leaf 30, one end of which is rigidly connected to the terminal post 27 of the switch and the other end being held by spring pressure in contact with the companion post $27^a$ leading to line 31 which is connected with a magnet designated generally by reference character 32 in Fig. 1, 33 being a continuation of the line 31 beyond the magnet to the battery 34 connected with ground line 35.

The operation of the device is as follows:

When the engine is cold the position of the various parts above described of the carburettor and its control will be as shown in full lines in Fig. 1 with the butterfly or choke valve 18 in the air supply line of the carburettor closed. When the engine is cranked the vacuum in the cylinders will be operative to draw in an enriched supply of fuel by reason of the choking action of the butterfly valve 18. When the explosive charges in the cylinders of the engine begin to ignite pressure will be set up in the exhaust pipe and operating on the flap valve 13 the arm 21 will be moved to the position indicated in dotted lines in Fig. 1 with the arm 21 approaching

or substantially in contact with the pole of the magnet 32 against the action of the closure spring 40 which normally tends to hold the flap valve 13 as well as the butterfly valve 18 in the carburettor in closed position. If the engine after picking up or operating on its explosive charge continues to operate properly the pressure in the exhaust line will be maintained and the choke valve 18 will remain in the open position indicated in dotted lines in Fig. 1. As soon as the engine begins to operate properly on its own power the heat of the exhaust line will operate on the explosive thermostatic control member 45 which may be an accordion shaped closed compartment of cylindrical shape made preferably of copper or some analogous material mounted upon a base of conducting material designated by reference character 46. When the engine reaches a normal or predetermined temperature the heat generated and acting upon the expansible member 45 will cause the upper end thereof to contact with the binding post 25 which is insulated from the supporting casing 24 so that this terminal of the circuit line 26 will be grounded and the circuit completed to energize the magnet 32 thus making this magnet effective to act upon the arm 21 and hold it in the dotted line position shown in Fig. 1 against the tendency of the contractile spring 40 to close the same. Thus it will be seen that if the engine should operate on its own power for but a brief period of time so that sufficient heat would not be generated to operate the thermostat 45 if the engine should stop the spring 40 would be effective to close both the flap valve in the exhaust line and the choke valve in the carburettor, but if stoppage occurs after the engine is warmed up the flap valve in the exhaust line and the butterfly valve or the choke valve in the carburettor will not close until the magnet 32 is de-energized by the breaking of the thermostatically controlled circuit so that if, while the engine is warm, an attempt should be made to start it the explosive mixture will not be enriched beyond its normal character. This mechanism, I have found in practice, makes the starting of gasoline engines comparatively easy for persons of little experience as no skill whatever is required in adjusting the mixture of the fuel supply and as my fuel enriching means is automatic in both its opening and closing, it will be employed only when actually needed in starting the engine and no undue loss of fuel will result with the attendant harmful results of crank case dilution of the lubricating fluid in gas engines.

When it is desired to use the invention in conjunction with carburettors of the well known commercial type in which the regulation of the carburettor is determined by valves controlling the liquid fuel supply, the invention is easily applied by the attachment of the pitman or connecting rod 20 controlling the exhaust line flap valve 31 to the fuel enriching device, which, in the case of the carburettor illustrated generally by the reference character 60 is a short lever 61 controlling a valve 62 in an auxiliary fuel supply line 63 terminating in a port 64 which discharges into the exhaust throat of the carburettor on the engine side of the usual throttle or butterfly valve, which, in Fig. 5 is designated by the reference character 65 being pivotally carried on shaft 66 that may be connected with and controlled by a throttle rod like or similar to the rod 22 shown in Fig. 1. When the carburettor of the type shown in Figs. 4 and 5 is employed it will be obvious that the connection will be such that the valve 62 will be opened to supply the rich starting mixture through the auxiliary port 64 whenever the flap valve 13 in the exhaust line of the engine is closed and the valve 62 will obviously be operated to a closed position by the opening of the flap valve 13 against the action of the spring 40 whenever the engine is operating normally under its own power and may, if desired, be held in that closed position by the magnet 32 under the control of the thermostat 45 to cause the type of carburettor of Fig. 4 to operate normally and upon a fuel supply of normal richness just as the carburettor shown in Fig. 1 is enabled under the same conditions to operate normally with the choke or butterfly valve 18 in its corresponding open position.

Since the details of the different types of carburettors aside from the fuel enriching features forms no part of my invention, these details have not been elaborated upon in the drawings or description, but it will suffice to state that in the form of carburettors of Figs. 4 and 5 the normal fuel supply will be furnished through the Venturi device designated generally by the reference character 70. It will also be apparent that the liquid fuel will be supplied to the line or by-pass 63 through the small supply tube 71 connected with the by-pass 72 in the carburettor frame communicating with the fuel supply in the float chamber. In Fig. 4, 73 is a lever for controlling the main fuel supply valve operated by contact with an eccentric portion operated by the lever 67 and the fuel line will be connected with the carburettor through the nipple 74.

What I claim as my invention and desire to secure by Letters Patent is:

1. In a device of the class described, the combination with a carburettor having means normally in operative position for enriching the explosive mixture supplied to an internal combustion engine, of fluid actuated means for rendering said enriching means inoperative, means for holding said enriching

means in inoperative position, and means for rendering said holding means inoperative.

2. In a device of the class described, the combination with a carburettor having means normally in operative position for enriching the explosive mixture supplied to an internal combustion engine, of fluid actuated means for rendering said enriching means inoperative, automatically operated means for holding said enriching means in inoperative position, and manually operated means for rendering said holding means inoperative.

3. In a device of the class described, the combination with a carburettor having means normally in operative position for enriching the explosive mixture supplied to an internal combustion engine, of means actuated by the exhaust pressure created by explosions in said engine for rendering said enriching means inoperative, an electro-magnet for holding said enriching means in inoperative position, and means for controlling the energizing and de-energizing of said magnet.

4. In a device of the class described, the combination with a carburettor having means normally in operative position for enriching the explosive mixture supplied to an internal combustion engine, of means actuated by the exhaust pressure created by explosions in said engine for rendering said enriching means inoperative, an electro-magnet for holding said enriching means in inoperative position, means actuated by the heat of said engine for controlling the energizing of said magnet, and manually operated means for deenergizing the magnet.

5. In a device of the class described, the combination with a carburettor having means for enriching the explosive mixture supplied to an internal combustion engine, of means for holding said enriching means yieldingly in operative position, means actuated by the exhaust pressure from said engine and operable against the action of said holding means for rendering said enriching means inoperative, an electro-magnet for holding said enriching means in inoperative position, means actuated by the heat of said exhaust for controlling the energizing of said magnet, and manually operated means for rendering said heat actuated means inoperative to control the energizing of said magnet.

6. In a device of the class described, the combination with a carburettor having a choke valve, of means for holding said valve yieldingly in closed position, fluid actuated means for opening said valve, and means for holding said valve in open position.

7. In a device of the class described, the combination with the carburettor of an internal combustion engine, said carburettor having a choke valve, of means for holding said valve yieldingly in closed position, a flap valve pivotally mounted in the exhaust passage of said engine and adapted to be operated by the exhaust pressure passing therethrough for opening said choke valve; an electro-magnet for holding said valves in open positions, a diaphragm actuated by the heat of said exhaust pressure for controlling the energizing of said magnet, and manually operated means for rendering said diaphragm ineffective for controlling said magnet.

8. In a device of the class described, the combination of a carburettor having means normally in operative position for enriching the explosive mixture supplied to an internal combustion engine, means actuated by fluid pressure generated by said engine for rendering said enriching means inoperative, means for holding said enriching means in inoperative position, means automatically actuated by heat generated by said engine for operating said holding means, and means manually operated for releasing said holding means.

9. In a device of the class described, the combination with a carburetor having means for enriching the explosive mixture supplied to an internal combustion engine, of means for holding said enriching means normally in operative position, means actuated by exhaust pressure generated in said engine for rendering said enriching means inoperative, means for holding said enriching means in inoperative position, and means actuated by the heat from the exhaust pipe of said internal combustion engine for controlling said last mentioned holding means.

10. A choke control device comprising a thermostat positioned to be heated by the heat of an internal combustion engine, yieldable connections between the thermostat and the air valve of a carbureter, and an exhaust gas actuated element controlling the action of said air valve independently of said thermostat.

11. A choke control device comprising, in combination with the carbureter and exhaust pipe of an internal combustion engine, a thermostat arranged to be heated by the engine, a connection between the thermostat and the carbureter for controlling the latter, a valve in the exhaust pipe to be actuated by the exhaust gases passing through the pipe, and a direct connection between the said exhaust pipe valve and the carbureter for controlling the latter independently of said thermostat.

In testimony whereof I have signed my name to this specification, on this 23rd day of March, A. D. 1926.

MAURICE F. DUFFY.