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ATTACHMENT FOR CARBURETORS

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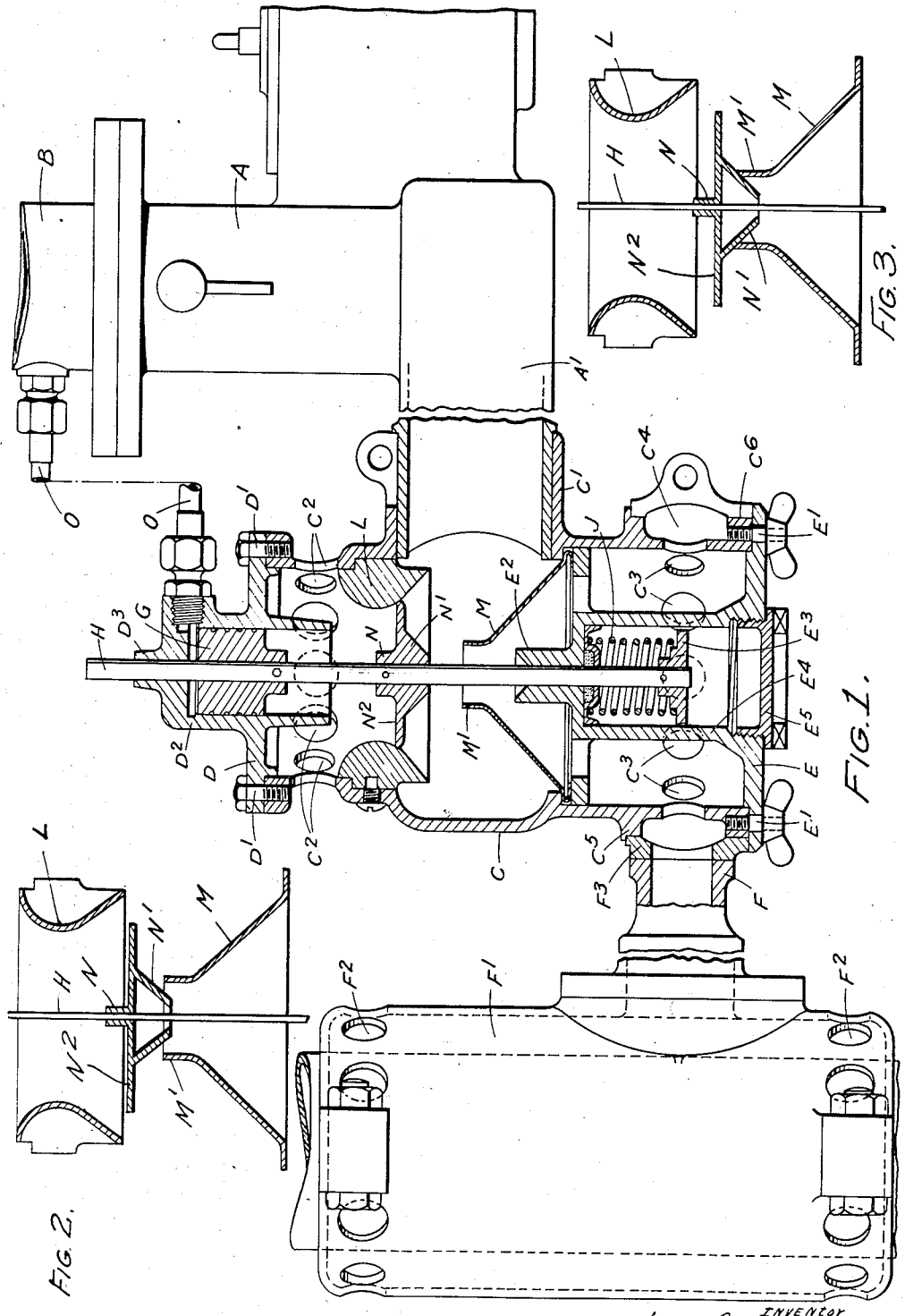


FIG. 1.

FIG. 3.

FIG. 2.

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ATTACHMENT FOR CARBURETORS

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This invention relates to apparatus for supplying air to the carburetors of internal combustion engines of the type in which mechanism is provided whereby the temperature of the air delivered by the apparatus is raised when the engine torque decreases and is lowered when the torque increases for example by mechanism acted upon by a piston subjected to the pressure in the induction pipe of the engine or controlled by the movements of the throttle valve through a resilient connection, means being provided whereby a lag is introduced into the operation of this mechanism so that variations in the torque will not immediately be followed up by corresponding variations in the temperature of the air supplied.

Apparatus of the type indicated tends to deliver air to the carburetor at a temperature suitable for meeting the varying conditions under which the engine operates but with apparatus of this type previously proposed, if the apparatus was so arranged that it supplied air at substantially the correct temperature when the engine was comparatively cool, it tended under certain conditions to supply air at too high a temperature when the engine was relatively hot and it is the object of the present invention to provide a form of apparatus which will tend to overcome this difficulty.

According to this invention the arrangement is such that the extent of the lag introduced into the operation of the mechanism for controlling the temperature of the air delivered by the apparatus is automatically reduced as the temperature of the engine rises. This is preferably effected by connecting a dash pot device of the liquid control type to such mechanism, the nature of the liquid employed in the dash pot being such that it becomes less viscous when its temperature is raised.

The apparatus for preheating the air may be of various kinds. Preferably, however, the apparatus comprises a passage one end of which is adapted to be connected to the air inlet of the carburetor while into the other end lead two passages through which can flow respectively air at normal atmospheric temperature and air which has been preheated, for example, by passing through a muffle or chamber surrounding the exhaust pipe of the engine. A valve or valves are conveniently provided so operative to control the inflow of normal and preheated air into the passage that the temperature of the air entering the carburetor may be varied, means being provided for actuating the controlling valve or valves, for example either by movement of the throttle valve or by variations in the pressure in the induction passage, so that the temperature of the air will increase or decrease substantially in inverse proportion to the torque of the engine.

In this construction the passage through which preheated air only flows to the passage communicating with the carburetor air inlet is provided with a restricted outlet so that the supply of preheated air is somewhat limited whereby the carburetor jet will be subjected to a slightly increased depression during the period immediately following a sudden opening of the throttle until the temperature controlling valve or valves have fully responded to the new conditions. Thus the carburetor will tend to supply a somewhat richer mixture to the engine during this transition period.

The invention may be carried into practice in various ways but one construction of apparatus according to this invention for supplying air to the carburetor of an internal combustion engine is illustrated by way of example in the accompanying drawings in which

Figure 1 is a side elevation partly in section, and

Figures 2 and 3 are diagrammatic sectional views showing the valves controlling the supply of preheated and cold air to the carburetor in various positions.

In the construction illustrated the apparatus is applied to a carburetor A having an air inlet pipe A^1 and connected to the induction pipe B of an internal combustion engine. The apparatus comprises a hollow casing C having an outlet passage C^1 formed integral therewith and adapted to be clipped or otherwise secured to the air inlet A^1 of the carburetor. The upper end of the casing C is closed

by a cover plate D secured in place by bolts D^1 and is provided with a series of circumferential holes C^2 through which air at atmospheric temperature can enter the casing. The lower end of the casing is also closed by a suitable cover plate E held in place by thumb screws E^1 and is provided with a series of circumferential apertures C^3 opening into an annular passage C^4 which communicates through a pipe F with an air preheating device or muffle comprising a casing F^1 surrounding the exhaust pipe A^2 of the engine, this casing F^1 being provided with openings F^2 adjacent to its ends through which air enters the casing. The inner and upper and lower walls C^5, C^6 of the annular passage C^4 are conveniently formed integral with the casing C while the outer wall is constituted by a ring F^3 the edges of which engage the upper and lower walls C^5, C^6 as shown, this ring being connected to or formed integral with the pipe F.

Formed integral with the cover plate D is a cylinder D^2 having a closed upper end as shown. Disposed within the cylinder D^2 is a piston G mounted on a vertical rod H the upper end of which slides in a suitable guide D^3 in the upper end of the cylinder D^2. The lower end of the rod H passes through a guide E^2 in the cover plate E and carries a piston E^3 adapted to move in a cylinder E^4 formed integral with the cover plate E and closed at its lower end by a screwthreaded plug E^5. A spring J is provided acting at one end on the piston E^3 and at the other on the upper closed end of the cylinder E^4 and thus tending always to move the rod H downwards.

Mounted immediately below the cold air inlet openings is a throat member L of substantially Venturi form, this member constituting a passage through which cold air can pass from the inlet openings C^2 to the inlet passage A^1. Mounted above the preheated air inlet openings is another throat member M of substantially conical form as shown, this member constituting a somewhat restricted passage through which the preheated air can pass from the openings C^3 to the air inlet passage A^1. Mounted on the rod H between the two members L and M is a disc-like valve N, this valve having a conical lower part N^1 adapted to close the outlet end M^1 of the member M when the rod H is in its lowermost position and a disc-like part N^2 adapted to close the throat L when the rod is in its uppermost position. For intermediate positions of the rod H each of the throat members L and M will be partially closed.

The upper closed end of the cylinder D^2 communicates through a pipe O with the induction pipe B between the carburetor A and the engine so that it is subjected to variations in the pressure in the induction pipe. Thus when the pressure in the induction pipe is low the piston will tend to move upwards and thus carry the rod H with it so as to close the throat L and open the throat M, thus admitting reheated air to the carburetor. When the induction pressure rises, however, the spring J will move the rod H downwards so as to tend to close the throat M and open the throat L, thus admitting a charge of colder air to the carburetor.

The piston E^3 is conveniently of slightly less diameter than the interior of the cylinder E^4 and this cylinder is filled with a liquid so as to act as a dash pot controlling the movements of the rod H the liquid employed being of such a nature that it becomes less viscous when it is heated so that the retarding effect of the dash pot device will become less as the engine heats up. In this way it is possible to ensure that there will be a slight time lag in the movements of the valves following variations in the pressure in the induction pipe so as to prevent choking when the throttle is suddenly opened the extent of this lag being reduced as the engine heats up. In the construction illustrated the dash pot device is disposed so as to be subjected to the temperature of the air flowing from the muffle F^1 but if desired the cylinder E^4 may be disposed for example beneath the plate E so as not to be subjected to the temperature of this air, the whole device being in this case situated adjacent to some part of the engine so that the liquid in the cylinder E^4 will be subjected to heat therefrom.

The operation of the device is as follows:—

When the throttle is nearly closed and the engine is idling, the pressure in the induction pipe B is low with the result that the piston G is moved upwards against the action of the spring J and carries with it the rod H so that the apparatus occupies the position shown in Figure 1, in which only air which has been preheated by passing through the muffle F^1 is admitted to the casing C and supplied to the carburetor A, the cold air inlet L being completely closed. As the throttle is opened, however, the pressure in the induction pipe B rises and thus permits the rod H to move downwards under the action of the spring J, thus partially opening the throat L and admitting a limited quantity of cold air into the casing C as shown in Figure 2. This air mixes with the preheated air entering through the throat M so that the air actually supplied to the carburetor is at a temperature depending on the relative quantities of preheated and cold air admitted respectively through the throats M and L. When the throttle is fully opened, the pressure in the induction pipe B approximates to atmospheric pressure and thus permits the rod H to move downwards until the valve N has wholly closed the throat M, M^1 while the throat L is fully open as shown in Figure 3. Thus when the throttle is fully open and the engine is thus running under maximum

torque conditions, air at substantially atmospheric temperature only is supplied to the carburetor so that the greatest possible weight of charge is drawn in.

Further, suppose that the engine is running on a reduced load with the throttle partially closed so that preheated air is being supplied to the carburetor and the throttle is then suddenly opened to a greater extent so that the pressure in the induction pipe is suddenly increased without a corresponding increase in the rate of flow in the induction pipe, the dash pot device constituted by the piston E^3 and cylinder E^4 then prevents the rod H moving immediately so as to reduce the temperature of the air supplied to the carburetor. The lag thus introduced into the operation of the rod H will be larger when the engine is cold than when it is hot owing to the viscosity of the liquid in the cylinder E^4 becoming less as it heats up so that warm air will tend to be delivered to the carburetor for a longer period following a sudden opening of the throttle when the engine is cold and thus requires warmer air than when it is hot, thus tending always to supply air at the temperature best suited to the varying running conditions. Further when the throttle is thus suddenly opened an additional depression is produced on the carburetor jet owing to the restricted outlet M^1 of the throat M, this additional depression tending to cause the carburetor to supply a somewhat richer mixture than is the case when the temperature controlling valves have taken up their new position of equilibrium. Thus for a short while after the sudden opening of the throttle, preheated air will still be supplied to the carburetor and will thus tend to prevent the particles of liquid fuel from coalescing and depositing on the walls of the induction pipe owing to the reduction in pressure before the rate of flow in the induction pipe is increased sufficiently to prevent such deposition. Further, a somewhat richer mixture will tend to be supplied. When the throttle is suddenly closed on the other hand, although the dash pot will have the effect of causing cold air to be supplied to the carburetor for a short period after such closing of the throttle, this will have no adverse effect since, when the throttle is thus suddenly closed, the engine will do no useful work until its speed has considerably dropped and the time necessary for this drop in speed to take place will also enable the valve N to move and take up its new position of equilibrium.

As stated above the mechanism for controlling the temperature of the air delivered to the carburetor may, instead of being controlled as illustrated by a piston G subjected to the induction pipe pressure, be controlled from the throttle valve through a resilient connection. In such an arrangement a construction similar to that illustrated may be employed except that the piston G, cylinder D^2 and pipe O are dispensed with and the throttle is connected to the rod H through the resilient connection. It will be seen that with this arrangement the dash pot device constituted by the piston E^3 and cylinder E^4 acts in a similar manner to that above described with reference to the construction illustrated so as to introduce a lag into the operation of the member H which will be greater when the engine is cold than when it is hot, the resilient connection between the rod H and the throttle allowing for this lag.

It is to be understood that although the invention has been particularly described with reference to apparatus in which the air is preheated by heat derived from the exhaust gases and in which the temperature variations are effected in accordance with the pressure in the induction pipe, the heat may be derived from some other source, such as an electric heater, while the temperature may be controlled either by a mechanical connection with the throttle lever or by other convenient means without departing from this invention.

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

1. In apparatus for supplying air to the air inlet of the carburetor of an internal combustion engine, the combination with an air heating device, of a conduit leading from said device to the carburetor air inlet, means actuated by increase in pressure in the induction pipe of the engine for decreasing the temperature of the air delivered to the carburetor inlet, and means varying in effectiveness in response to temperature changes in the engine for retarding the operation of said first named means.

2. In apparatus for supplying air to the air inlet of the carburetor of an internal combustion engine, the combination with an air heating device, of a conduit leading from said device to the carburetor air inlet, means actuated by change in pressure in the induction pipe of the engine for altering the temperature of air delivered to the carburetor inlet, the extent of change of temperature being approximately inverse to the change in pressure, and means varying in effectiveness in response to temperature changes in the engine for retarding the operation of said first named means.

3. Apparatus for supplying air to the air inlet of the carburetor of an internal combustion engine including in combination an air heating device, a passage leading from this device to the carburetor air inlet, mechanism whereby the temperature of the air delivered to the carburetor air inlet can be varied, means for controlling such mechanism so that the temperature of air delivered tends

to be raised when the pressure in the induction pipe falls and lowered when this pressure rises, the air heating device being rendered inoperative by the action of said means when the induction pipe pressure approaches atmospheric pressure, and means associated with said first named means for retarding the operation of the temperature controlling mechanism, said last mentioned means being so constructed and arranged that the extent of retardation will be reduced automatically as the temperature of the engine rises.

4. Apparatus for supplying air to the air inlet of the carburetor of an internal combustion engine including in combination an air inlet to the carburetor, an air heating device, a passage leading from this device to the air inlet, a passage for cold air leading to the air inlet, valves controlling the flow of air to the air inlet through the passages for cold and heated air, an interconnection between the valves such that as one is opened the other is closed, mechanism for controlling such valves so that the cold air inlet valve is progressively closed as the pressure in the induction pipe falls and opened as this pressure rises, and the hot air inlet is completely closed when the pressure in the induction pipe approaches atmospheric pressure, and means associated with said mechanism for retarding the operation of the mechanism, said means being so constructed and arranged that the extent of retardation will be reduced automatically as the temperature of the engine rises.

5. Apparatus for supplying air to the air inlet of the carburetor of an internal combustion engine including in combination an air inlet to the carburetor, an air heating device, a passage leading from this device to the air inlet, a passage for cold air leading to the air inlet, valves controlling the flow of air to the air inlet through the passages for cold and heated air, an interconnection between the valves such that as one is opened the other is closed, mechanism for controlling such valves so that the cold air inlet valve is progressively closed as the pressure in the induction pipe falls and opened as this pressure rises, and the hot air inlet is completely closed when the pressure in the induction pipe approaches atmospheric pressure, and a dash pot device of the liquid type associated with this mechanism so as to retard the operation of such mechanism, said dash pot device being disposed where it can receive heat from the air flowing through the hot air passage and employing a liquid such that it becomes less viscous as its temperature is raised for the purpose set forth.

6. Apparatus for supplying air to the air inlet of the carburetor of an internal combustion engine including in combination an air mixing chamber, an outlet from this chamber to the carburetor air inlet, an air heating device, coaxial inlets for admitting heated and cold air respectively to the mixing chamber, a hot air passage leading from the air heating device to the hot air inlet and mechanism controlling the hot and cold air inlets comprising an axially movable rod disposed coaxially with such inlets, at least one valve mounted on the rod and adapted to control the two inlets simultaneously so that as one inlet is opened the other is progressively closed, an induction pipe leading from the carburetor, a piston secured to the rod, a cylinder in which the piston moves, a pipe forming communication between this cylinder and the induction pipe, a spring tending to move the rod in a direction to close the hot air inlet against the action of the piston due to reduced pressure in the induction pipe, and a dash pot device situated in the hot air inlet passage and comprising a cylinder containing a liquid of a kind which becomes less viscous as its temperature rises, and a piston member mounted on the rod and disposed within the cylinder.

In testimony whereof I have signed my name to this specification.

HARRY RALPH RICARDO.