

Sept. 14, 1937.

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2,093,218

PRIMING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed Dec. 27, 1934

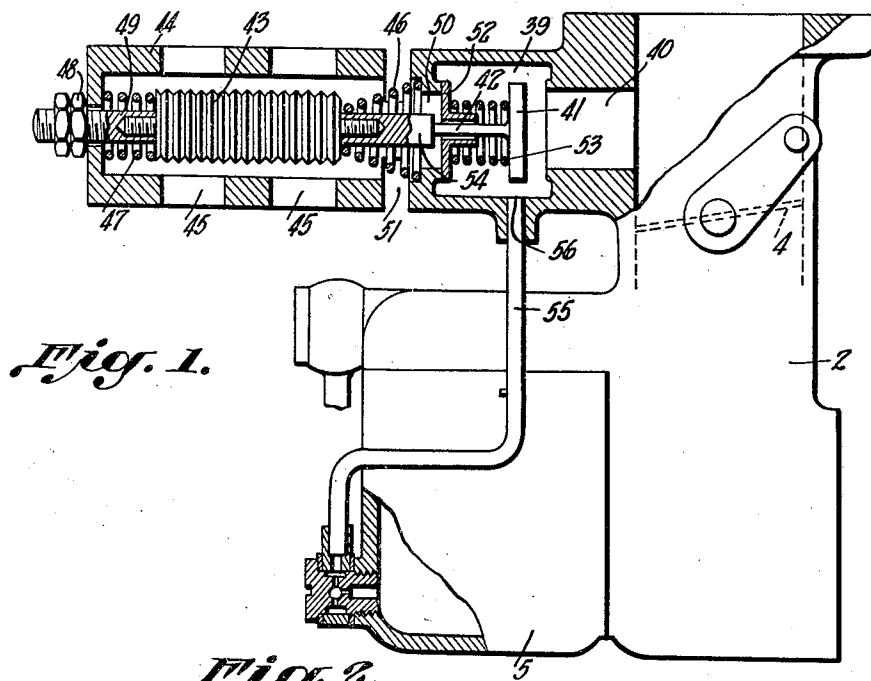


Fig. 1.

Fig. 2.

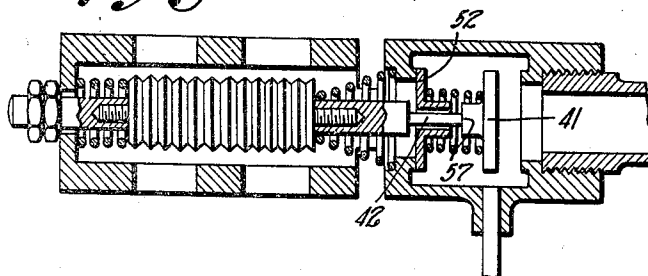
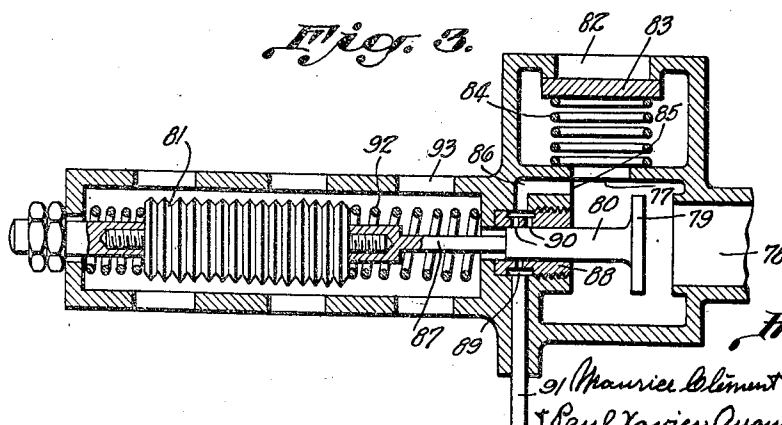


Fig. 3.



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UNITED STATES PATENT OFFICE

2,093,218

PRIMING DEVICE FOR INTERNAL
COMBUSTION ENGINES

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Application December 27, 1934, Serial No. 759,402
In Belgium January 4, 1934

10 Claims. (Cl. 261—39)

The present invention relates to fuel feed de-
vices for internal combustion engines of the type
including a main carburetter provided with a
mixing tube, which will be hereinafter called
"main mixing tube", and an auxiliary starting
carburetter provided with a fuel mixture outlet
opening into said main mixing tube and con-
trolled by means of a valve.

Devices of this kind serve to facilitate the
starting of the engine from cold by supplying
a rich mixture which is added to the normal mix-
ture fed by the main carburetter as long as the
engine is not warm enough for working in a
satisfactory manner with the mixture fed by the
main carburetter alone. In these devices, the
valve controlling the auxiliary carburetter fuel
mixture outlet serves to bring said auxiliary car-
buretter out of action when the engine is warm.

In devices of this kind, a thermostatic element
subjected to the same variations of temperature
as the engine controls said valve so as to close it
when the engine is sufficiently warm. With such
an arrangement, the percentage of fuel in the
mixture fed to the engine by the auxiliary car-
buretter remains unchanged for the whole of
the time for which said auxiliary carburetter is
in operation. In other words, while means are
provided for gradually reducing the amount of
mixture fed by the auxiliary carburetter as the
engine is growing warmer, the proportions of
air and fuel in said mixture remain uniform.
Therefore, when the engine is already getting
warm and the above mentioned valve of the aux-
iliary carburetter is but partly closed, the mix-
ture fed to the engine by the auxiliary carbu-
retter is too rich and a defective working of the
engine is the consequence.

This drawback is especially serious when the
auxiliary starting carburetter is so devised as to
supply a fuel mixture in which the percentage
of fuel decreases as the rate of feed of said car-
buretter increases. The purpose of this arrange-
ment is to supply a richer mixture when the
engine is just starting and its speed of revolution
is low than when the engine has already gath-
ered speed. But as the engine gathers speed it
also grows warmer so that, despite the increased
suction resulting from the acceleration of the
engine, the gradual closing of the control valve
of the auxiliary carburetter under the action of
the thermostatic element causes the rate of feed
of the auxiliary carburetter to decrease gradually,
whereby the mixture fed by said carburetter
becomes richer when it should, on the contrary,
become weaker.

The object of the present invention is to pro-
vide a fuel feed device which obviates this draw-
back, that is to say a device with which the per-
centage of fuel in the fuel mixture fed by the
auxiliary starting carburetter decreases as the
rate of feed of this auxiliary carburetter to the
engine decreases in response to a rise of tempera-
ture.

According to the present invention, the aux-
iliary carburetter is provided with both a fuel
mixture valve for controlling the rate of feed
from said auxiliary carburetter to the engine,
and an air inlet valve for controlling the inflow
of air to said auxiliary carburetter, and thermo-
static means subjected to the action of the varia-
tions of temperature of the engine are adapted
to act on the first mentioned valve in the direc-
tion of closing thereof and on the second men-
tioned valve in the direction of opening thereof
when said temperature rises. The suction in the
mixing chamber of the auxiliary carburetter and
therefore the rate of feed of fuel to said cham-
ber decrease when the air inlet valve opens wider,
so that the percentage of fuel in the fuel mixture
fed by the auxiliary carburetter decreases.
Therefore, when the temperature rises, the ther-
mostatic device causes both the rate of feed of
the fuel mixture from the auxiliary carburetter
to the engine and the percentage of fuel in said
fuel mixture to decrease.

When the thermostatic device is so arranged as
to be influenced by both the temperature of the
engine and the temperature of the surrounding
medium, the device according to the present in-
vention modifies the composition of the fuel mix-
ture supplied by the auxiliary carburetter in ac-
cordance with both the temperature of the engine
and the temperature of the surrounding medium.

The thermostatic device may be of any kind
whatever (expansible container filled with a liq-
uid, a gas, or a volatile liquid, bi-metallic strip,
etc.). It may be disposed either close to the
exhaust pipe of the engine, or under the hood
of the engine, or again in the water circulation
system thereof. In any of these cases the ther-
mostatic device is subjected to the action of both
the temperature of the engine and the tempera-
ture of the surrounding medium, since the tem-
perature of the exhaust pipe, the temperature
inside the hood, and the temperature of the cool-
ing water of the circulation system obviously de-
pend on both the temperature of the engine and
the temperature of the surrounding medium.

According to a preferred embodiment of the
present invention, the inflow of air to the aux-

iliary starting carburetter is controlled by means of a spring-loaded valve operative by the suction in the mixing chamber of said auxiliary carburetter and the thermostatic device controls the position of a movable stop limiting the displacements of said valve in the direction of closing thereof. The minimum amount of opening of said valve imposed by said stop therefore increases when the temperature increases. Eventually, this thermostatic device also controls a second movable stop limiting the displacements of said valve in the direction of opening thereof. Owing to this second mentioned stop, the maximum degree of opening of said valve is increased when the temperature rises.

The air inlet control valve operated by the thermostatic device may act on the whole of the air entering the auxiliary starting carburetter or on the main air flow. But, according to another feature of the present invention, said control valve may also act on an air inlet conduit opening into the fuel feed pipe leading to the main mixing chamber of the auxiliary carburetter. With this arrangement, the opening of this control valve reduces the suction in said fuel feed pipe and therefore weakens the fuel mixture when the temperature rises.

It has been suggested to make use, in auxiliary starting carburetters, of a submerged jet for supplying fuel to the fuel feed conduit. Owing to the known properties of submerged jets, the mixture produced by such a device becomes weaker when the rate of feed of the auxiliary carburetter increases, together with the speed of revolution of the engine, which is favorable for starting from cold. The present invention can be applied to devices of this kind by causing a valve operated through thermostatic means to control the passage through which emulsifying air is fed to the submerged jet. When the section of flow through said passage increases as a result of a rise of the temperature, the rate of fuel flow through the submerged jet decreases.

These and other features of the present invention will clearly result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described with reference to the accompanying drawing, given merely by way of example, and in which:

Fig. 1 is a longitudinal sectional view showing, an auxiliary starting carburetter provided with a suction actuated valve for controlling the air inlet;

Fig. 2 is a longitudinal sectional view of a modification of this auxiliary carburetter;

Fig. 3 is a longitudinal sectional view of an auxiliary starting carburetter in which the main air inlet is controlled by a suction actuated valve, while the emulsifying air inlet is controlled through thermostatic means.

In the embodiment shown in Fig. 1, the auxiliary starting carburetter comprises a mixing chamber 39 connected with the mixing pipe of the main carburetter 2 posterior to the throttle valve 4 thereof through a fuel mixture outlet 40. This outlet 40 is controlled by a valve 41 the rod 42 of which is operatively connected with one end of a thermostatic box 43. Said box 43 is mounted in a casing 44. A spring 46 is interposed between said casing and the end of box 43 that carried rod 42. A spring 47, stronger than 46, is interposed between the other end of box 43 and the corresponding end of casing 44. The position of box 43 in

casing 44 is determined by a stop 48 carried by a rod 49 operatively connected with the last mentioned end of said box 43, said stop being adapted to bear against the outer face of casing 44.

This apparatus may be fitted directly on the intake manifold of the engine, as shown. In this case, thermostatic box 43 is subjected to the action of a temperature of the air present in the hood of the engine, and holes 45, provided in the wall of casing 44, permit air blown by the fan to circulate around box 43, so as to facilitate the heating of this box. The apparatus may also be fixed at another place, for instance in the vicinity of the exhaust pipe. In the latter case the fuel mixture outlet 40 is connected to the intake manifold through any suitable conduit.

A fuel outlet 56 opening into mixing chamber 39 is connected to the float chamber 5 of the main carburetter 2 through a fuel conduit 55. Air is fed to said chamber 39 through an air inlet 50 communicating with the atmosphere through ports 51 provided in casing 44. This air inlet 50 is controlled by a valve 52 slidable along the stem 42 of outlet valve 41. This valve 52 is subjected to the action of a spring 53 interposed between valve 52 and valve 41. Stem 42 is provided with a shoulder 54 adapted to prevent valve 52 from being applied onto its seat by spring 53 when thermostatic box 43 is expanded.

This device works in the following manner:

Fig. 1 shows the position of the parts when the engine is not running, said engine being cold and the atmospheric temperature being supposed to be low. Box 43 is sufficiently shrunk for placing shoulder 54 in a position such that air valve 52 can rest upon its seat under the effect of the thrust of spring 53. In this position of stem 42 valve 41 is at a sufficient distance from its seat for fully opening mixture outlet 40. When the engine is started, it creates a suction which is transmitted through outlet 40 and chamber 39 to air valve 52 and moves said valve away from its seat as soon as this suction is capable of overcoming the resistance of spring 53. The suction in chamber 39 draws in fuel through fuel inlet 56. As the speed of revolution of the engine increases, valve 52 opens more and more and spring 53 is more and more compressed. This gradual opening of valve 52 prevents the suction in chamber 39 from increasing as rapidly as the air feed. Therefore the rate of feed of the fuel sucked in through fuel inlet 56, which depends on the suction in chamber 39, increases less rapidly than the air feed, so that the mixture fed by the auxiliary carburetter becomes weaker as the speed of revolution of the engine increases.

As the engine grows warmer, the temperature under the hood of the engine, where box 43 is located, rises. Box 43 expands and causes valve 41 to move toward its closed position. This closing displacement of valve 41 gradually reduces the rate of feed of the fuel mixture to the engine. As air valve 52 is urged toward its closed position by spring 53, if said valve were left free to move, the section of flow past said air inlet valve 52 would decrease as the section of flow past mixture outlet valve 41 decreases, so that the suction in chamber 39 would decrease much less rapidly than the rate of feed of air past valve 52. Therefore, since the rate of feed of fuel through fuel outlet 56 varies in accordance with the suction in chamber 39, this rate of feed of fuel would decrease less rapidly than the rate of feed of air past valve 52, which would correspond to the

mixture fed to the engine becoming richer when it must, on the contrary, become weaker.

But the shoulder 54 carried by the stem 42 of valve 41 is adapted to cooperate with valve 52 so as to prevent it from closing when valve 41 has been moved a certain distance toward its closed position by the expansion of thermostatic box 43. In other words, from a certain temperature up, box 43 imposes, through shoulder 54, a minimum amount of opening of valve 52, which minimum amount increases as the temperature rises.

This minimum opening of valve 52 imposed by the position of stop 54 reduces the suction in chamber 39 which acts on fuel outlet 56, thus suitably reducing the feed of fuel through said fuel outlet.

As the temperature further increases, the expansion of box 43 finally brings valve 41 onto its seat, so as to fully close the mixture outlet 40 and, from this time on, further expansion of box 43 compresses spring 47 and moves nut 48 away from the outer end face of casing 44.

When the engine is cold and not running, if the atmospheric temperature is relatively high box 43 may be sufficiently expanded for bringing shoulder 54 in a position such that valve 52 is partly open. Under these conditions, the mixture fed by the auxiliary carburetter when the latter is brought into action is weaker than for low atmospheric temperatures, which correspond to said valve 52 being applied against its seat.

In the device shown in Fig. 1, the valve 52 is caused to open more and more against the pressure of spring 53 as the suction increases due to an increase in the engine speed, and the mixture supplied grows accordingly weaker and weaker. It was found that in certain engines this weakening action was objectionable from a predetermined speed up, the mixture becoming too weak beyond said speed.

In the apparatus shown by Fig. 2, the opening displacement of air valve 52 under the action of the suction in chamber 39 is limited by a stop 57 carried by the stem 42 of mixture valve 41, whereby the mixture is prevented to become too weak as the engine speed increases. It is pointed out, however, that the suitable mixture to be supplied to the engine at high speeds should be weaker as the temperature rises. Shoulder 57, which moves together with valve 41 and the stem 42 thereof, under the action of thermostatic box 43, increases the maximum permissible opening of valve 52 when the temperature rises, whereby the mixture supplied at high engine speeds, for which the suction maintains valve 52 against shoulder 57, becomes weaker as the temperature rises.

The device shown in Fig. 3 includes a mixing chamber 77 connected with the intake manifold of the engine through a mixture outlet 78 controlled by means of a valve 79. Valve 79 is carried by a rod including a cylindrical portion 80 and another cylindrical portion 87 of smaller diameter which is connected with one end of thermostatic box 81. The cylindrical portion 80 of the valve stem is slidable in the cylindrical bore of a piece 88 provided, on its outer surface, with an annular groove 89. This groove 89 is connected with the cylindrical bore of piece 88 through radial holes 90 which are normally closed by cylindrical portion 80 of the valve stem.

Mixing chamber 77 is provided with an air intake 82 controlled by a valve 83 operated by the suction in chamber 77, against the action of a

spring 84. Mixing chamber 77 is fed with fuel through an outlet 85 supplying air emulsified with fuel, said outlet being connected with the float chamber of the main carburetter (not shown) through a passage 86, annular groove 89, and a conduit 91 communicating with the float chamber.

When the temperature rises, thermostatic box 81 moves outlet valve 79 in the closing direction thereof through stem 87—80 and holes 90 are successively uncovered by cylindrical portion 80. These holes then connect groove 89 with the atmosphere through chamber 92 and ports 95 provided in the wall of said chamber. Emulsifying air is thus introduced into fuel conduit 86, and reduces the rate of feed of fuel through outlet 85. Independently of the temperature, spring loaded valve 83, which controls the main air intake 82, weakens the mixture supplied by the auxiliary carburetter when said air valve is lifted from its seat, thus admitting a greater amount of air, when the speed of revolution of the engine increases.

While we have, in the above description, endeavored to disclose what we deem to be practical and efficient embodiments of the present invention, it should be well understood that we do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the appended claims.

What we claim is:

1. An auxiliary carburetter for use in conjunction with a main carburetter, which comprises, in combination, an air inlet, a suction actuated loaded valve for controlling said air inlet, thermostatically controlled means for simultaneously reducing the rate of feed of fuel mixture delivered by said auxiliary carburetter and increasing the rate of feed of air entering said auxiliary carburetter as the temperature rises.

2. An auxiliary carburetter for use in conjunction with a main carburetter, which comprises, in combination, an air inlet, a suction actuated loaded valve for controlling said air inlet, thermostatically controlled means for simultaneously reducing the rate of feed of fuel mixture delivered by said auxiliary carburetter and the richness of said mixture as the temperature rises.

3. An auxiliary carburetter for use in conjunction with a main carburetter, which comprises, in combination, a mixing chamber having a mixture outlet and an air inlet, a valve arranged to control the flow of fuel mixture through said outlet, a spring loaded valve operative by the suction in said chamber for controlling the flow of air through said inlet, movable stopping means for limiting the closing displacements of said spring loaded valve, and thermostatically controlled means for simultaneously closing the first mentioned valve and moving said stopping means in the direction that increases the minimum degree of opening of said second mentioned valve when the temperature of said thermostatic means rises.

4. An auxiliary carburetter for use in conjunction with a main carburetter, which comprises, in combination, a mixing chamber having a mixture outlet and an air inlet, a valve arranged to control the flow of fuel mixture through said outlet, a spring loaded valve operative by the suction in said chamber for controlling the inflow of

air through said inlet, movable stopping means for limiting the closing displacements of said spring loaded valve, movable stopping means for limiting the opening displacements of said spring loaded valve, and thermostatically controlled means for simultaneously closing the first mentioned valve and moving both of said stopping means in the direction that increases the minimum and the maximum degree of opening of said second mentioned valve when the temperature of said thermostatic means rises.

5. An auxiliary carburetter for use in conjunction with a main carburetter, which comprises, in combination, a mixing chamber having a mixture outlet and an air inlet, a fuel feed conduit opening into said chamber, a rod extending through said air inlet, a valve adapted to control the flow of fuel mixture through said mixture outlet operatively connected with said rod, a valve slidable on said rod adapted to cooperate with said air inlet for controlling the inflow of air therethrough, means for yieldingly opposing the opening displacements of said slidable valve under the effect of the suction in said chamber, a stop carried by said rod on the outer side of said slidable valve so as to limit the closing displacements thereof, and a thermostatic expansible box having one of its ends connected to said rod so as to force it in said chamber and gradually close said mixture outlet when the temperature rises.

6. An auxiliary carburetter according to claim 5, further comprising a second stop on the opposite side of said slidable valve so as to limit the opening displacements thereof.

7. An auxiliary carburetter for use in conjunction with a main carburetter, which comprises, in combination, a mixing chamber having a mixture outlet and a main air intake, a suction actuated loaded valve in said main air intake, valve means for controlling the flow of fuel mixture through said outlet, a fuel feed conduit opening into said chamber, an air intake for introducing

emulsifying air into said conduit, valve means for controlling the inflow of air through said second mentioned air intake, and thermostatically controlled means for simultaneously closing the first mentioned valve means and opening the second mentioned valve means when the temperature rises.

8. An auxiliary carburetter according to claim 7, further including a submerged jet arranged to control the flow of fuel to said fuel feed conduit.

9. An auxiliary carburetter for use in conjunction with a main carburetter, which comprises, in combination, a mixing chamber having a mixture outlet and a main air intake, a spring loaded valve for controlling the inflow of air through said intake, valve means for controlling the flow of fuel mixture through said outlet, a fuel feed conduit opening into said chamber, an auxiliary air intake to said mixing chamber, valve means for controlling the inflow of air through said auxiliary air intake, and thermostatically controlled means for simultaneously closing the first mentioned valve means and opening the second mentioned valve means when the temperature rises.

10. An auxiliary carburetter for use in conjunction with a main carburetter, which comprises, in combination, a mixture outlet and an air inlet, a spring loaded valve operative by the suction in said chamber for controlling the inflow of air through said inlet, a fuel feed passage opening into said chamber, a valve for controlling the flow of fuel mixture through said outlet, a rod for said valve, means operative by said rod for introducing air into said fuel feed passage, and thermostatically controlled means for causing said rod to simultaneously close the second mentioned valve and bring said means for introducing air into said fuel feed passage into action, when the temperature rises.

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