

July 10, 1928.

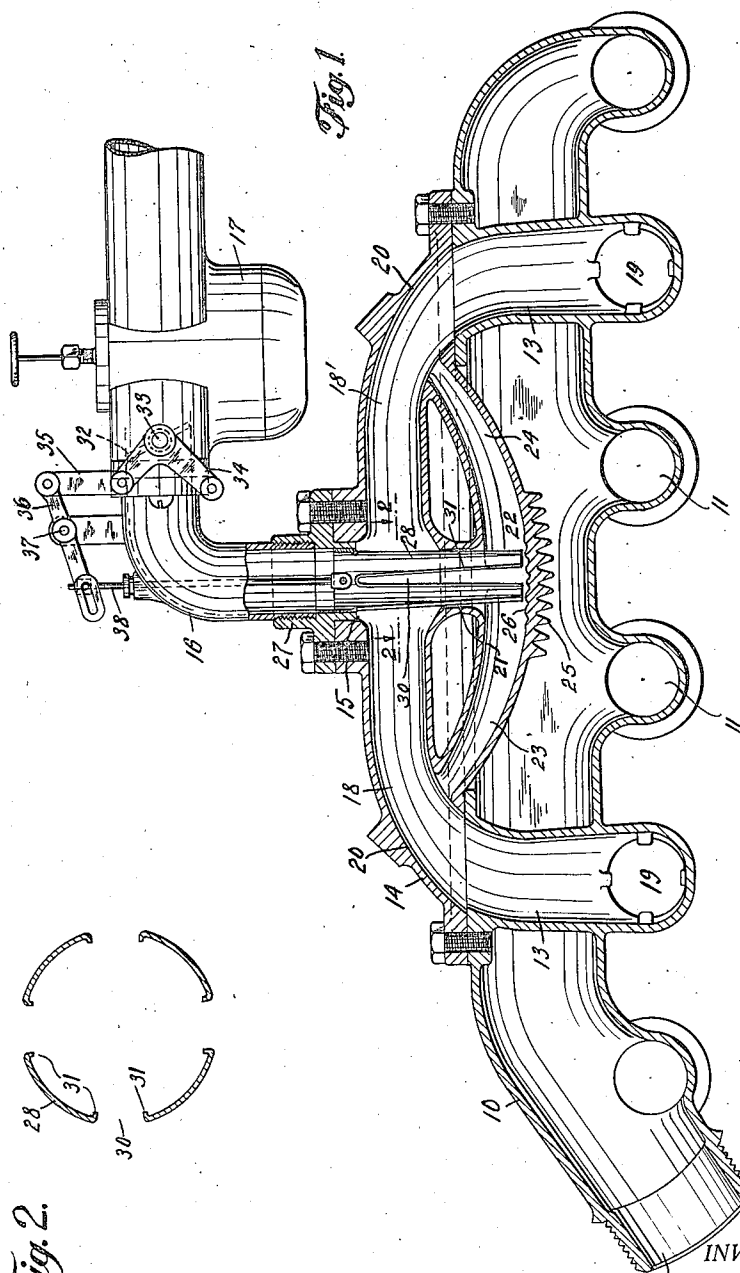
1,676,955

W. E. KEMP

INTAKE MANIFOLD FOR INTERNAL COMBUSTION ENGINES

Filed May 17, 1924

2 Sheets-Sheet 1



INVENTOR
W. E. Kemp
BY
Sigmund Herzog
ATTORNEY

July 10, 1928.

1,676,955

W. E. KEMP

INTAKE MANIFOLD FOR INTERNAL COMBUSTION ENGINES

Filed May 17, 1924

2 Sheets-Sheet 2

Fig. 3.

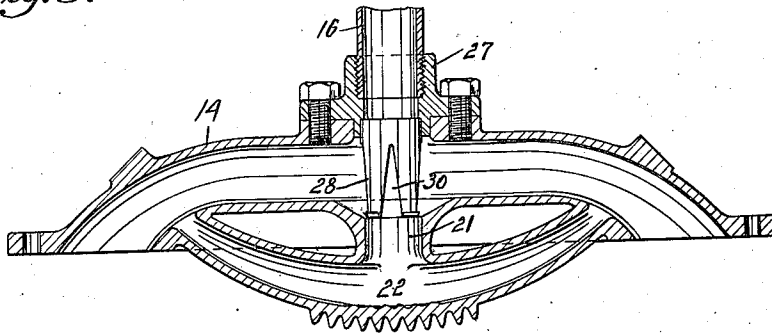
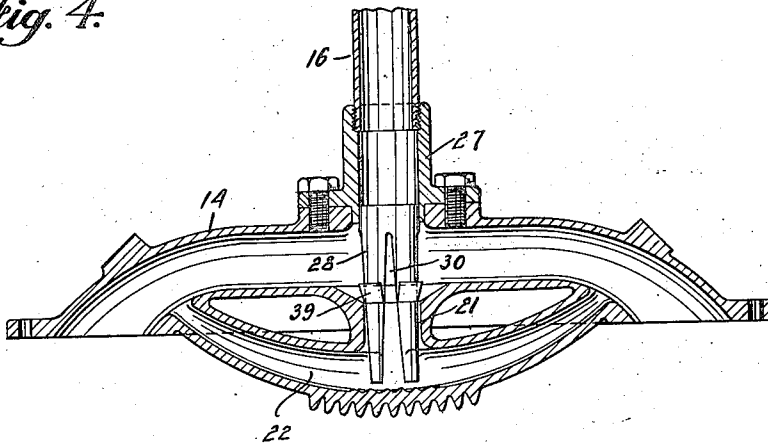


Fig. 4.



INVENTOR

W. E. Kemp

BY

Signmund Herzog

ATTORNEY

UNITED STATES PATENT OFFICE.

WILLIAM E. KEMP, OF NEW YORK, N. Y.

INTAKE MANIFOLD FOR INTERNAL-COMBUSTION ENGINES.

Application filed May 17, 1924. Serial No. 714,144.

The present invention relates to improvements in intake-manifolds for internal combustion engines.

It is commonly known that most of the carburetion difficulties experienced with the present day gasoline and particularly heavier hydrocarbons is due to the fact that the heavy fuel particles settle in or on the wall of the intake-manifold, particularly at low speeds, and run to the bottom, where they gather to such an extent as to seriously interfere with the normal cycle of operation of the engine. Most troubles arise at low engine speed, because the cylinders do not receive a uniform mixture, since the combustible mixture running past the stagnating liquid or condensed hydrocarbon in the intake-manifold is intermittently made richer than desirable. On the other hand, when the speed of the engine is increased, it misfires.

The main object of the present invention is to so construct the intake-manifold that the heavy fuel particles in the charges are separated therefrom by gravity and inertia and are trapped, to be vaporized in the trap and then caused to flow with the combustible mixture to the cylinders of the engine. Furthermore, liquid particles which have settled onto the wall of the passage leading to the intake-manifold are guided or directed into the said trap.

With these and other objects in view, which will more fully appear as the nature of the invention is better understood, the same consists in the combination, arrangement and construction of parts hereinafter described, pointed out in the appended claims and illustrated in the accompanying drawings, it being understood that many changes may be made in the size and proportion of the several parts and details of construction within the scope of the appended claims, without departing from the spirit or sacrificing any of the advantages of the invention.

A few of the many possible embodiments of the invention are illustrated in the accompanying drawings, in which:—

Figure 1 is a central vertical section taken through a combined intake and exhaust-manifold constructed in accordance with the present invention; Fig. 2 is a section taken on line 2—2 of Fig. 1; and Figs. 3 and 4 are sections similar to that shown in Fig.

1 of portions of modifications of the invention.

Referring now first to Figs. 1 and 2 of the drawings, the numeral 10 indicates the exhaust-manifold of an engine, in the form of a chambered body, provided with a plurality of inlet ports 11, connected with the exhaust ports of an internal combustion engine, and with an outlet 12, through which the exhaust gases are led away in the usual manner. Through this exhaust-manifold extend conduits 13, in the present case two, which communicate with and form part of an intake-manifold 14, that is mounted upon and partly disposed within the exhaust-manifold, as presently will be more fully described. The intake-manifold is mounted on top of the exhaust-manifold and is provided in its top portion with an inlet 15, communicating through a pipe 16 with a carbureter 17 of any suitable construction. The mixture of air and hydrocarbon, entering the port 15, is adapted to flow through two curved branches 18 and 18' of the manifold 14 to the conduits 13, which communicate through ports 19 with the inlet ports of the engine. The transverse cross-section of each branch of the intake-manifold is larger than the area of the port 15 and is somewhat increased in the bends 20, immediately above where it joins the respective conduit 13. In alignment with the port 15 the branches 18 and 18' of the intake-manifold communicate with a passage 21, leading to a duct 22, which has oppositely extending portions 23 and 24, communicating with the two branches of the intake-manifold a little distance above the levels at which the said branches are joined with the conduits 13. The major portion of the duct 22 is disposed with the exhaust-manifold and thus in direct contact with the exhaust gases flowing therethrough. Radiating ribs 25 and 26 are formed on the outer end inner faces, respectively, of the duct 22, for the well known purpose. The cross-sectional area of each branch of the duct 22 decreases gradually from the passage 21 to its point of junction with the respective branch of the intake-manifold, for a purpose hereinafter to be described.

In the coupling 27, connecting the intake-manifold with the pipe 16, and in the passage 21 is slidably arranged a vertically extending tubular member 28. This tubular member is provided with a plurality of

longitudinal slots 30 of any suitable configuration. In the case illustrated in the drawings, these slots are of wedge-shaped configuration, increasing in width from their upper to their lower ends. The edges of each slot are turned inwards, as clearly shown at 31, for a purpose hereinafter to be described.

The carbureter 17 includes, as usual in these constructions, a throttle 32, in the case illustrated a butterfly valve, to the spindle 33 of which is fixed a bellcrank lever 34. One arm of this bellcrank lever is connected to an actuating rod (not shown), while its other arm is connected by a link 35 with a lever 36, fulcrumed at 37 to a support. This lever engages a vertical pin 38, which, in turn, is connected to the tubular member 28. The pin 38 extends slidably through the intake-manifold. The arrangement is such that, when the throttle is in its fully closed position, the tubular member 28 is in its lowermost position, and, as the throttle is shifted toward open position, the said tubular member is raised.

The operation of this device is as follows: If, in the operation of the engine on which the device is employed, air flows past the nozzle, not shown, of the carbureter, liquid hydrocarbon is entrained, atomized or sprayed, the resulting combustible mixture being composed of air and liquid hydrocarbon gasified or vaporized in part and in part suspended in liquid form. The mixture is drawn at high velocity into the intake-manifold, where it passes through the slots 30 in the tubular member 28 to the branches 18 and 18' of the intake-manifold, and thence to the conduits 13, if flowing through the latter to the intake ports of the cylinders. The heavy liquid particles or less volatile hydrocarbon are carried by inertia and gravity into the passage 21 and settle on the bottom of the duct 22, more particularly on the ribbed portion 26 thereof. Considering now the position of the elements shown in Fig. 1 of the drawings, it will be noted that the throttle of the carbureter is nearly closed for slow operation or light load of the engine. In such case obviously the charges are deflected by impingement on the throttle against the wall of the pipe leading to the manifold, whereby a portion of the charge is liquefied, creeping along the said wall toward the inlet 15. This liquefied portion of the charge flows along the inner wall of the tubular member 28 and is thus directed and guided by the latter into the passage 21, to settle on the bottom of the duct 22. The intumed edges 31 of the slots 30 prevent this liquefied portion of the charge from being carried along by the mixture to the branches 18 and 18' of the intake-manifold. Since the intake-manifold is in direct contact with the exhaust-mani-

fold and partly disposed within the same, it is heated by the exhaust gases, the result being that the fuel particles on the bottom of the duct 22 are heated and consequently evaporated, flowing through the duct 22 into the branches of the intake-manifold at an acute angle to the direction of flow of the combustible mixtures through the said branches, thereby properly intermingling with the main charge. The cross-sectional areas of the portions 23 and 24 of the duct 22 decrease gradually toward their outlets in order to cause the evaporated fuel in the said duct to pass into the main fuel streams in the intake-manifold at relatively high velocity and also to prevent wire drawing of the fuel, as it flows from the said duct into the intake-manifold proper. Should the evaporated fuel flow back into the branches 18 and 18' through the passage 21, it will intermingle with the main charge, as the same enters through the inlet 15. When the throttle of the carbureter is shifted toward open position, obviously a smaller portion of the charge will be liquefied by reason of the fact that a smaller portion of the charge is directed against the wall of the pipe leading to the inlet 15. The throttle and tubular member 28 being connected, as above specified, the latter is raised in proportion to the throttle opening, providing a larger area for the increased volume of charges.

Such heavy particles of the combustible mixture which are carried in the main stream through the branches 18 and 18' impinge against the bends 20 of the intake-manifold. Inasmuch as these bends of the intake-manifold are heated to some extent by the exhaust gases, these particles will be vaporized before passing into the conduits 13. The cross-section of each branch of the intake-manifold is increased in the bends 20 to permit of an expansion of the charges due to the rise in temperature to which they are subjected by the heated intake-manifold.

From the foregoing it appears that the fuel, while flowing through the intake-manifold, is thoroughly vaporized by heat, maintaining its substantially gaseous state until it is received in the engine cylinders, settling of heavy fuel particles or less volatile carbon oils is thoroughly prevented, so that the engine cylinders do always receive a uniform mixture in suspended form. Carbon deposits within the cylinders are thus eliminated to a great extent. Furthermore dilution of lubricating oil, caused by liquid fuel finding its way down the cylinder wall to the crank case, is prevented.

Attention is called to the fact that part of the intake-manifold is heated to a higher degree than other parts thereof, more particularly the duct 22 which is disposed within the exhaust-manifold. The main passages of the intake-manifold, that is to say

the branches 18 and 18', are heated by convection only. The purpose of this arrangement is to prevent undue expansion of the main charge as it flows through the branches 18 and 18', while superheating the liquid fuel which settles on the bottom of the conduit 22. It is obvious that, if the entire intake-manifold were heated to the same degree by disposing the same wholly within the exhaust-manifold, the entire charge would be overheated and consequently expanded, resulting in a loss of power of the engine. Moreover, the overheated charges would travel at such speed through the intake-manifold to prevent a settling of the heavy or less volatile hydrocarbon particles.

It is to be observed that, generally speaking, the device herein described automatically separates the heavy fuel or less volatile hydrocarbon particles and also the liquid portions thereof from the charges flowing through the intake-manifold, evaporates the said particles and causes the same, after vaporization, to intermingle with the main charges, without unduly expanding the latter. These functions of the device are made possible by the fact that the combustible charges have an initial downward flow in the intake-manifold, which permits inertia and gravity to cause a settling of the heavy and less volatile particles, the tubular member 28 guiding and directing the settled liquid particles to and onto the bottom of the duct 22.

It is obvious that while herein the intake-manifold has been described as mounted on and partly within an exhaust-manifold, it may be combined with a heater of any suitable type to which heat is supplied either by the exhaust-manifold of an engine or from any other source.

The modification illustrated in Fig. 3 of the drawings differs from the one above described in that the tubular body 28 is kept stationary within the intake-manifold. It is, obviously, shorter in this case. Otherwise the construction and operation of the elements are the same as of those described in connection with Fig. 1 of the drawings.

The modification illustrated in Fig. 4 of the drawings differs from those above described in that the tubular element 28 is shiftably mounted within the manifold in the manner described in connection with Fig. 1 of the drawings, but not connected with the throttle of the carbureter. Intermediate its ends, the tubular body is provided with a flange 39, adapted to rest on the inlet portion of the passage 21. There being suction exerted on the upper face of the flange 39 and a pressure on the lower face of the same, this tubular body will be lifted in proportion to the pressure difference in the branches and passage 21. Obviously, the greater the pressure difference,

the higher will be said tubular body rise, just as it is being shifted by the throttle of the construction shown in Fig. 1 of the drawings. Otherwise the construction and operation of the elements are the same as of those described above.

What I claim is:—

1. The combination with a heater, of a branched intake-manifold having a duct extending into said heater and communicating with the branches of the manifold, said manifold being provided with an inlet at the point of junction of the branches thereof and situated to permit of an initial downward flow of the combustible charges thereinto, a passage in said manifold in alignment with said inlet and leading downwards to said duct, and means inserted between the inlet to said manifold and said passage for leading liquid particles which have separated from the charges to the bottom of said duct.

2. In a device according to claim 1, the transverse cross-sectional areas of said duct decreasing gradually from said passage to the points of junction with said branches.

3. The combination with a heater, of an intake-manifold operatively arranged in relation thereto so as to be heated thereby, means for causing the heavy fuel particles flowing with the combustible charges into said manifold to settle by gravity onto a heated portion of said manifold, a slotted tube in said manifold for leading onto said heated portion liquid particles of the charges which have separated therefrom prior to their entry into said manifold.

4. The combination with a heater, of an intake-manifold operatively arranged in relation thereto so as to be heated thereby, means for causing the heavy fuel particles flowing with the combustible charges into said manifold to settle by gravity and inertia onto a heated portion of said manifold, and a slotted tube in said manifold for leading onto said heated portion liquid particles of the charges which have separated therefrom prior to their entry into said manifold.

5. The combination with a heater, of an intake-manifold operatively arranged in relation thereto so as to be heated thereby, means for causing the heavy fuel particles flowing with the combustible charges into said manifold to settle by gravity and inertia acting in the same direction onto a heated portion of said manifold, a slotted tube in said manifold for leading onto said heated portion liquid particles of the charges which have separated therefrom prior to their entry into said intake-manifold.

6. The combination with a heater, of a branched intake-manifold having a duct extending into said heater and communicating with the branches of the manifold,

said manifold being provided with an inlet at a point of junction of the branches thereof and situated to permit of an initial downward flow of the combustible charges thereinto, a passage in said manifold in alignment with said inlet and leading downwards to said duct, and a slotted tube inserted between the inlet to said manifold and said passage for leading liquid particles which have separated from the charges to the bottom of said duct.

7. In a device according to claim 6, said tube being shiftable in said manifold so as to increase the direct communication between said inlet and the branches of said manifold in inverse proportion to the vacuum in the said branches.

8. A device according to claim 6, comprising a charge-forming device communicating with said manifold and including a throttle, and a connection between the said throttle and said tube for causing the latter to increase the direct communication between the inlet to the said manifold and the branches thereof in direct proportion to the opening movement of said throttle.

9. A device according to claim 1, comprising a charge-forming device communi-

cating with said manifold and including a throttle, and a connection between said throttle and said liquid particle separating means to increase a direct communication between the inlet to the said manifold and the branches thereof in direct proportion to the opening movement of said throttle.

10. The combination with a heater, of an intake manifold operatively arranged in relation thereto so as to be heated thereby, means for causing the heavy fuel particles flowing with the combustible charges into said manifold to settle by gravity onto a heated portion of said manifold, means for directing onto said heated portion liquid particles of the charges which have been separated therefrom prior to their entry into said manifold, a charge-forming device including a throttle, said directing means being movable, and a connection between said throttle and said directing means for causing the latter to move in unison with said throttle.

Signed at New York, in the county of New York, and State of New York, this 19th day of September, A. D. 1923.

WILLIAM E. KEMP.