Oct. 19, 1943. A. R. BLOOD 2,331,885

ENGINE MANIFOLD

Filed Feb. 21, 1942 2 Sheets-Sheet 1

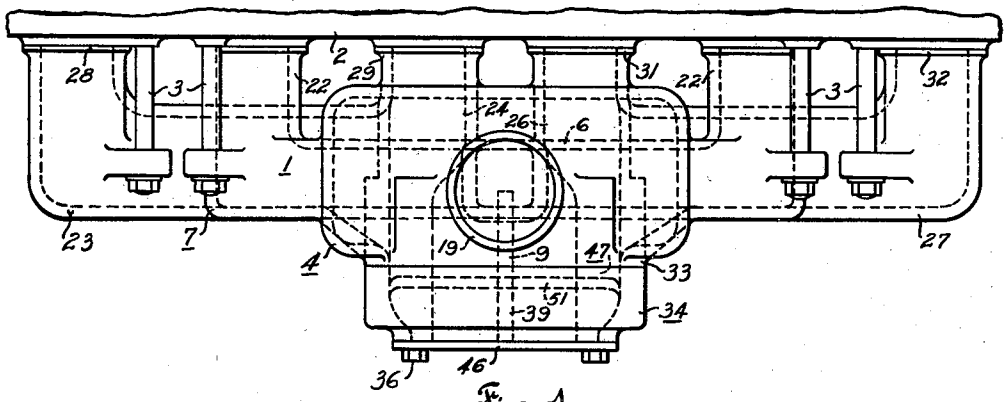


Fig. 1

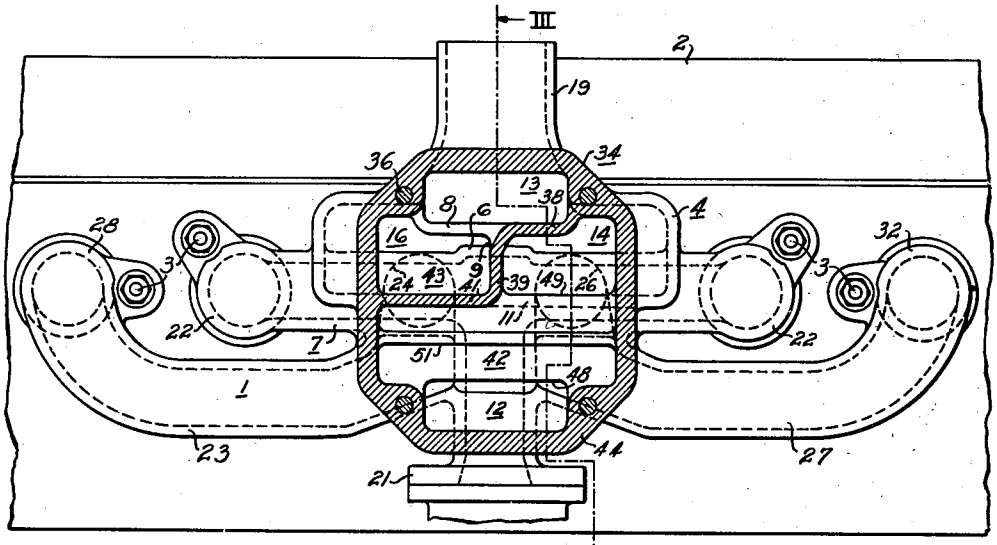


Fig. 2

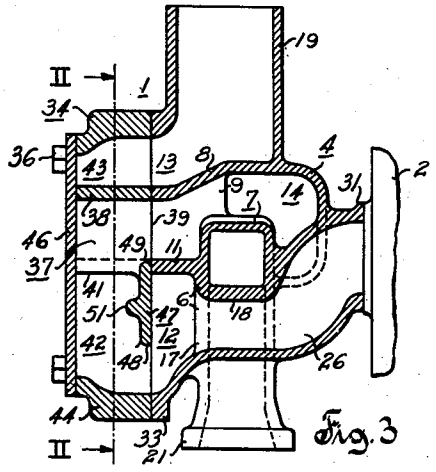


Fig. 3

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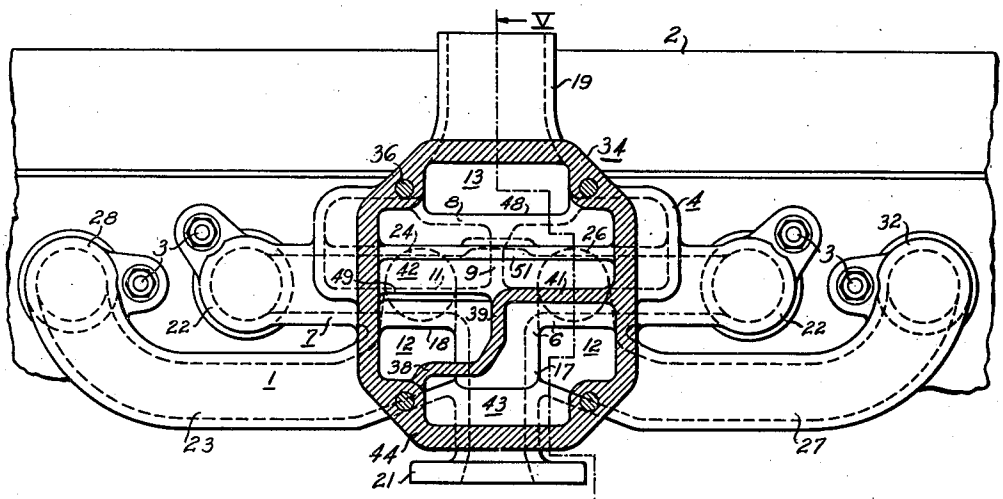


Fig. 4

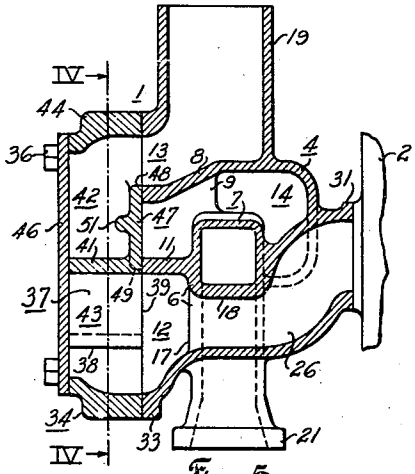


Fig. 5

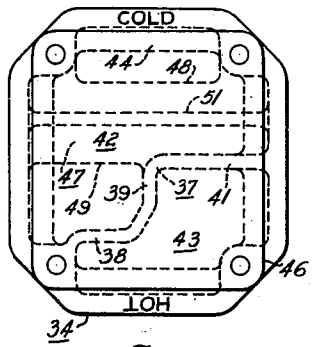


Fig. 6

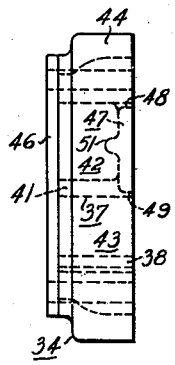


Fig. 7

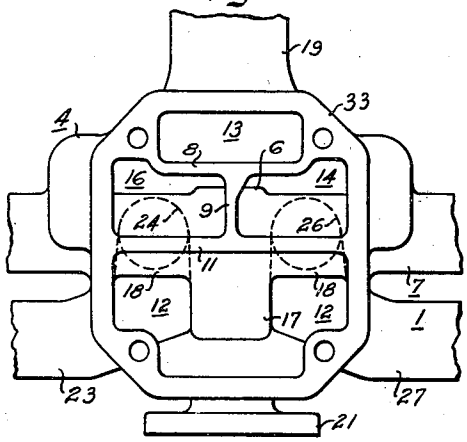


Fig. 8

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UNITED STATES PATENT OFFICE

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ENGINE MANIFOLD

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Application February 21, 1942, Serial No. 431,793

9 Claims. (Cl. 257—241)

This invention relates generally to internal combustion engines and more particularly to unitary dual purpose engine manifold structures embodying intake and exhaust portions having fuel-air mixture and exhaust gas passages correlated for selectively heating the fuel-air mixture.

In prior constructions of this type, the most common practice is to provide an exhaust manifold portion in the form of an elongated loop having an upper part directly connected to the exhaust ports of the engine and having a lower part provided with an intermediate enlargement through which extends the riser to the intake manifold portion usually disposed between the upper and lower parts of the loop. The flow of exhaust gas through the lower part of the loop and in heat exchanging relation to the riser disposed therein is controlled by the manipulation of a suitable two-way valve or valves disposed at or adjacent the junction between the upper and lower parts of the loop. In some instances, the exhaust manifold portion is provided with a laterally extending enlargement or with an attachment constituting such an enlargement through which extends a part of the riser to the intake manifold portion disposed thereabove. In a few instances, parts of the branch connections to and immediately adjacent the riser are also included within the enlargement. The flow of exhaust gas into the enlargement and around the riser part of the inlet portion is generally effected by means of a butterfly valve disposed in the opening between the enlargement and the manifold proper and arranged so that when opened a portion of the exhaust gas is directed into and through said enlargement. In many of these arrangements the valve or valves are thermostatically controlled for the purpose of varying the heat applied to the fuel-air mixture in accordance with the temperature of the mixture and/or the temperature of the atmosphere surrounding the engine. However, in general, the apparatus embodying this type of control is neither adapted nor capable of being used to render an engine efficiently operable with either low or high volatile liquid fuels.

Manifolds embodying a looped exhaust portion are bulky and expensive to construct and their bulk renders difficult the mounting of such a manifold in the limited space usually available and its presence in a limited space materially interferes with the repair and the servicing of the adjacent parts of the engine and the related accessories. In addition, the heating of the fuel-air mixture is difficult to control because the control valve bearings warp and large clearances are required in order to prevent the valve from sticking and as a result, the leakage of exhaust gas past the valve is sufficient to materially alter the desired degree of heating. Moreover, the large clearances required result in valve rattle which is objectionable and since the position of the valve can be readily varied by the operator, engine operation may be rendered extremely inefficient due to the carelessness and/or ignorance of the operator. Furthermore, although the part of the intake riser disposed within the lower part of the exhaust loop is usually enlarged in order to reduce the velocity of the moving fuel-air mixture, the velocity of the heavier particles of unvaporized fuel is usually sufficient to carry a large portion of such particles directly through the enlarged portion of the riser and into the branch parts connected thereto without contacting the heated walls of the enlarged portion of the riser, which is commonly termed a vaporizing or gassifying chamber. As a result, the proportion of unvaporized fuel particles contained in the fuel-air mixture entering the engine is in many instances sufficient to render ignition difficult and the operation inefficient due to the incomplete combustion of such particles.

Therefore, the primary object of this invention is to provide an improved dual purpose engine manifold which may be readily cast or otherwise constructed as a compact unitary structure with a minimum of time and expense.

Another object of this invention is to provide an improved compact unitary dual purpose engine manifold which entirely eliminates the use of moving valve parts for selectively controlling the heat applied to the fuel-air mixture.

Still another object of this invention is to provide an improved unitary dual purpose engine manifold which can be readily modified to vary the heat applied to the fuel-air mixture without disturbing any other part of the engine and without the possibility of effecting an improper or an undesired degree of adjustment.

A further object of this invention is to provide an improved unitary dual purpose manifold in which the fuel-air mixture and the exhaust gas passages are so correlated that when the manifold is conditioned for use with a low volatile fuel, the heavy unvaporized fuel particles will be directed against a highly heated wall portion of the fuel-air mixture.

The invention accordingly consists of the various features of construction, combinations of elements and arrangement of parts as is more fully

pointed out in the appended claims and in the detailed description in which:

Fig. 1 is a plan view illustrating a manifold embodying the invention applied to the side of an engine;

Fig. 2 is a partial sectional view taken on line II—II of Fig. 3;

Fig. 3 is a section taken on line III—III of Fig. 2;

Fig. 4 is a partial sectional view taken on line IV—IV of Fig. 5;

Fig. 5 is a section taken on line V—V of Fig. 4;

Fig. 6 is a front elevation of the cover member;

Fig. 7 is a side elevation of the cover member; and

Fig. 8 is a partial front elevation of the manifold shown in Figs. 1, 2 and 4 with the cover member removed.

Referring to the drawings and particularly to Figs. 1, 3, 5 and 8, it is seen that the dual purpose manifold 1, which is removably secured to the engine head or block 2 by any suitable means such as the stud bolts 3, comprises an open faced hollow structure 4 having disposed therein a T-shaped portion 6 of the intake manifold section 7 and a plurality of partition elements 8, 9 and 11 which coact and form with each other and with the included T-shaped portion 6 vertically spaced first and second non-communicating chambers designated 12 and 13, respectively, and third and fourth communicating chambers designated 14 and 16, respectively. Chamber 12 is defined by the side and bottom walls of the hollow structure 4, the underside of partition element 11, and the front side wall surfaces of those parts of the T-shaped portion 6 which extend below the partition element 11; namely, the stem part 17 and the lower portion of the head part 18 as is best seen in Fig. 8. Chamber 13, which terminates in an exhaust gas emission conductor 19, is defined by the side and rear walls of the hollow structure 4 and the upper side of the partition element 8. Chambers 14 and 16, which are disposed between the chambers 12 and 13, are placed in communication by terminating the intermediate partition element 9, which is common to chambers 14 and 16, short of the rear wall of the hollow structure as is best seen in Figs. 3 and 5. Chambers 14 and 16 are both defined by a side wall and a portion of the rear wall of the hollow structure 4, the underside of partition element 8, the upper side of partition element 11, and the common partition element 9.

The stem part 17 of the T-shaped portion 6 extends through the bottom wall of the hollow structure 4 and terminates in a flanged portion 21 adapted for connection with a carburetor or other fuel-air mixture supplying device (not shown). The head part 18 of the T-shaped portion 6 extends through the opposite side walls of the hollow structure 4 and terminates in spaced flanged end portions 22 adapted for connection with the usual engine intake ports (not shown). The lower portion of the hollow structure 4 is provided with a plurality of laterally extending exhaust gas conductors 23, 24, 26 and 27 which communicate with the first chamber 12 and which terminate in flanged free end portions 28, 29, 31 and 32 adapted for connection with the usual engine exhaust ports (not shown). The open face of the hollow structure 4 is provided with a marginal flange 33 adapted to receive a hollow open faced cover member 34 which is removably secured thereto by any suitable means such as the cap screws 36.

Referring also to Figs. 6 and 7, it is seen that the lower interior portion of the cover member 34 is provided with a partition 37 which extends from adjacent one corner to the approximate center of the cover and then to the midportion of the opposite sidewall thereof. Partition 37 includes a first horizontal portion 38 the length of which is materially less than half the width of the cover member, a vertically extending portion 39 and a second horizontal portion 41, the length of which is approximately equal to half the width of the cover member. Partition 37 divides the interior of the cover member 34 into two non-communicating chambers or compartments 42 and 43 and the inner edge of the partition is substantially flush with the inner edge of the cover side wall 44 which is adapted to abut the marginal flange 33 on the hollow structure 4. The outer wall 46 of the cover member 34 may be formed as a separate piece and secured thereto by the cap screws 36 which are used to attach the cover member to the hollow structure 4 as is clearly indicated in Fig. 1. The inner upper marginal surface of the horizontal portion 41 of partition 37 merges with the lower edge of a vertical partition element 47 which extends horizontally entirely across the cover member 34 and forms a partial rear or inner wall for the chamber 42. The inner surface of the partition element 47 is substantially flush with the inner edges of the cover side wall 44 and the inner edge of the partition 37. The width of the element 47; i. e., its vertical dimension, is substantially equal to the vertical distance between the partitions 8 and 11 in the hollow structure 4 plus the thickness of said partitions. The element 47, which has a free edge 48 spaced from the opposed side wall portion 44 and the free portion 49 of its opposite edge spaced from the opposed horizontal portion 38 of the partition 37, is preferably provided on its outer surface with a central longitudinally extending strengthening rib 51.

The outer top and bottom portions of the cover member 34 are preferably marked cold and hot respectively as shown in Fig. 6, and the arrangement of the partition 37 and the partition element 47 is such that when the cover member is applied to the open face of the hollow structure 4 with the portion bearing the word "hot" uppermost, which application is shown in Fig. 2 and Fig. 3, the inner edge of the partition 37 and the inner surface of the partition element 47 abut the outer edges of the partitions 8, 9 and 11 in the hollow structure 4 as follows: the horizontal portion 41 engages the left half of the edge of partition 11 and the right half thereof is engaged by the inner marginal surface of the partition element 47 which is adjacent its edge 49 and forms in effect a continuation of the horizontal portion 41; the vertical portion 39 engages the edge of partition 9; and the horizontal portion 38 engages the right half of the edge of partition 8. The space existing between the edge 48 of partition element 47 and the opposed portion of the cover side wall 44 places chamber 12 in communication with chamber 42 which in turn communicates with the chamber 14 in the hollow structure 4 by virtue of the space existing between the edge portion 49 of partition element 47 and the opposed horizontal portion 38 of partition 37. As previously described, termination of the partition 9 short of the rear wall of the hollow structure 4 places chamber 14 in communication wtih chamber 16 and the latter is

placed in communication with the chamber 13 by virtue of the chamber 43 in the hollow cover member 34. Therefore, it should now be obvious that with the cover member 34 in the hot position just described, exhaust gases passing into the chamber 12 from the conductors 23, 24, 26 and 27 will then flow serially through chambers 42, 14, 16, 43 and 13 in the order named and then to atmosphere through the emission conductor 19. It should be particularly noted that the exhaust gases while entering and while within the chamber 12 only contact a small portion of the underside of the T-head part 18, which is made relatively thick as shown in Figs. 3 and 5 to retard the flow of heat therethrough, and that while passing through the chambers 14 and 16 the exhaust gases are in continuous contact with substantially the entire upper half of the surface presented by the included portion of said head part which, as shown in Figs. 3 and 5, is made relatively thin to effect a high rate of heat transfer therethrough. It should also be particularly noted that with the cover member in its hot position all of the exhaust gases must pass through the chambers 14 and 16, thereby imparting a high degree of heat to substantially the entire upper half of the head part 18; that the highly heated portion of the head part 18 overlies the adjacent end of the stem part 17; and that as a result all of the heavy unvaporized and partially vaporized fuel particles will either impinge against or pass in close proximity to the highly heated top surface of the head part, thereby effecting a substantially complete vaporization of such particles.

When the cover member 34 is applied to the open face of the hollow structure 4 with the portion bearing the word "cold" uppermost, which application is shown in Figs. 4 and 5, the inner edge of the partition 37 and the inner surface of the partition element 47 abut the outer edges of the partitions 8, 9 and 11 in the hollow structure 4 as follows: the horizontal portion 41 engages the right half of the edge of partition 11 and the left half thereof is engaged by the inner-marginal surface of the partition element 47 which is adjacent its edge 49 and which forms in effect a continuation of the horizontal portion 41; and the opposite inner marginal surface of partition element 47, which is adjacent its edge 48, engages the entire edge presented by the partition 8. In other words, the partition element 47 in effect abuts the entire outer edges of the partitions 8, 9 and 11 and thereby substantially completely closes chambers 14 and 16. The chamber 43 in cover member 34 communicates with the right-hand portion of chamber 12 (see Fig. 4), but the gases entering chamber 43 have no means of escape therefrom. However, the left-hand portion of chamber 12 is in communication with chamber 42 in the cover member 34 by virtue of the space existing between the edge 49 of partition element 47 and the horizontal portion 38 of partition 37. Chamber 42 is also in communication with chamber 13 by virtue of the space existing between the edge 48 of partition element 47 and the opposed portion of the cover side wall 44 and it should therefore be obvious that with the cover member 34 in the cold position just described, the exhaust gases passing into the chamber 12 from the conductors 23, 24, 26 and 27 will then flow serially through chambers 42 and 13 in the order named and then into the atmosphere through the emission conductor 19. Consequently, it should also be obvious that with this arrangement no material heating of the fuel mixture is effected since only a small portion of the thickened underside T-head part 18 is contacted by the exhaust gases entering the chamber 12 and since the wall portions of the T-stem part 17, which are exposed to the chamber 12 and to the interior of conductors 24 and 27, are also materially thickened (see Figs. 1, 3 and 5) in order to retard the heat flow therethrough. That portion of the rear wall of the stem 17, which is disposed between the conductors 24 and 27, is exposed to the atmosphere and is made relatively thin to prevent overheating of the fuel mixture passing therethrough.

A dual purpose manifold constructed in accordance with this invention is extremely compact and is entirely devoid of moving parts, such as valves and the like, for controlling the application of heat to the fuel-air mixture passing therethrough. The manifold proper, i. e., without the cover member 34 which is cast or otherwise formed as a separate unit, can be readily cast as a unitary structure with a minimum of time and expense. Its compactness renders the installation of the manifold an extremely simple operation and when once installed, the application of heat to the fuel-air mixture can be readily varied without disturbing any other engine part or accessory and without any possibility of making an improper adjustment, simply by inverting the cover member as previously described.

The invention is shown and described as applied to a manifold for a four cylinder engine, but it should be understood that the invention is applicable to internal combustion engine manifolds generally and that it is not intended to limit the invention to the exact details of construction herein shown and described as various modifications within the scope of the appended claims may occur to persons skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. A dual purpose engine manifold comprising an open faced hollow structure embodying a portion of a fuel mixture conductor and a plurality of partition elements coacting to provide therein a plurality of non-communicating chambers one of which is formed in part by a wall portion of said mixture conductor, an exhaust gas admission conductor communicating with another one of said chambers, an exhaust gas emission conductor communicating with a remaining one of said chambers, and a hollow partitioned cover member securable to the open face of said hollow structure in a selected one of two different positions and being effective when in one of its said two positions to serially connect said another chamber, said one chamber, and said remaining chamber in the order named and being effective when in the other of its said two positions to substantially completely close said one chamber and to connect the said another chamber and with the said remaining chamber.

2. A dual purpose engine manifold comprising an open faced hollow structure embodying a portion of a fuel mixture conductor and a plurality of partition elements coacting to provide therein a plurality of non-communicating chambers one of which is formed in part by a wall portion of said mixture conductor, an exhaust gas admission conductor communicating with another one of said chambers, an exhaust gas emission conductor communicating with a remaining one of said chambers, and a hollow partitioned cover

member securable to the open face of said hollow structure in a selected one of two different positions and presenting when in one of its said two positions a compartment communicating with said one and with said another one of said chambers and another compartment communicating with said one and with said remaining one of said chambers and presenting when in the other of its said two positions a partition element substantially completely closing said one chamber and a compartment communicating with said another one and with said remaining one of said chambers.

3. A dual purpose engine manifold comprising an open faced hollow structure embodying a portion of a fuel mixture conductor and a plurality of partition elements coacting to provide therein first and second non-communicating chambers and third and fourth communicating chambers which are formed in part by a wall portion of said mixture conductor, said hollow structure being provided with exhaust gas admission and emission conductors communicating with said first and second chambers, respectively, and a hollow partitioned cover member securable to the open face of said hollow structure in a selected one of two different positions and presenting when in one of its said two positions a compartment communicating with said first and third chambers and another compartment communicating with said second and fourth chambers and presenting when in the other of its said two positions a partition element substantially completely closing said third and fourth chambers and a compartment communicating with said first and second chambers.

4. A dual purpose engine manifold comprising an open faced hollow structure embodying a portion of a fuel mixture conductor and a plurality of partition elements coacting to provide therein first and second non-communicating chambers with said first chamber being formed in part by a wall portion of said mixture conductor and third and fourth communicating chambers which are formed in part by another portion of said mixture conductor, said hollow structure being provided with exhaust gas admission and emission conductors communicating with said first and second chambers respectively, and a hollow partitioned cover securable to the open face of said hollow structure in a selected one of two different positions and presenting when in one of its said two positions a compartment communicating with said first and third chambers and another compartment communicating with said second and fourth chambers and presenting when in the other of its said two positions a partition element substantially completely closing said third and fourth chambers and a compartment communicating with said first and second chambers.

5. A dual purpose engine manifold comprising an open faced hollow structure embodying a portion of a fuel mixture conductor and a plurality of partition elements coacting to provide therein spaced first and second non-communicating chambers with said first chamber being formed in part by a wall portion of said mixture conductor and third and fourth communicating chambers which are disposed between said first and second chambers and which are formed in part by another portion of said mixture conductor, said hollow structure being provided with exhaust gas admission and emission conductors communicating with said first and second chambers respectively, and a hollow partitioned cover member securable to the open face of said hollow structure in a selected one of two different positions and presenting when in one of its said two positions a compartment communicating with said first and third chambers and another compartment communicating with said second and fourth chambers and presenting when in the other of its said two positions a partition element substantially completely closing said third and fourth chambers and a compartment communicating with said first and second chambers.

6. A dual purpose engine manifold comprising an open faced hollow structure embodying a T-shaped portion of a fuel mixture conductor and a plurality of partition elements coacting to provide therein first and second non-communicating chambers with said first chamber being formed in part by a portion of the wall surface presented by one side of the stem and head parts of said T-portion and third and fourth communicating chambers which are formed in part by another portion of the continuous surface presented by the head part of said T-portion, said hollow structure being provided with exhaust gas admission and emission conductors communicating with said first and second chambers respectively, and a hollow partitioned cover member securable to the open face of said hollow structure in a selected one of two different positions and presenting when in one of its said two positions a compartment communicating with said first and third chambers and another compartment communicating with said second and fourth chambers and presenting when in the other of its said two positions a partition element substantially completely closing said third and fourth chambers and a compartment communicating with said first and second chambers.

7. A dual purpose engine manifold comprising an open faced hollow structure embodying a T-shaped portion of a fuel mixture conductor and a plurality of partition elements coacting to provide therein spaced first and second non-communicating chambers with said first chamber being formed in part by a portion of the wall surface presented by one side of the stem and head parts of said T-portion and third and fourth communicating chambers which are disposed between said first and second chambers and which are formed in part by another portion of the continuous surface presented by the head part of said T-portion, said hollow structure being provided with exhaust gas admission and emission conductors communicating with said first and second chambers respectively, and a hollow partitioned cover member securable to the open face of said hollow structure in a selected one of two different positions and presenting when in one of its said two positions a compartment communicating with said first and third chambers and another compartment communicating with said second and fourth chambers and presenting when in the other of its said two positions a partition element substantially completely closing said third and fourth chambers and a compartment communicating with said first and second chambers.

8. A dual purpose engine manifold comprising an open faced hollow structure embodying a T-shaped portion of a fuel mixture conductor having the stem part of the T extending downward from the head part thereof and a plurality

of partition elements coacting with each other and with the head part of said T to provide therein vertically spaced first and second non-communicating chambers with said first chamber being formed in part by a portion of the wall surface presented by one side of the stem and head parts of said T and third and fourth communicating chambers which are disposed between said first and second chambers and which are formed in part by the continuous surface presented by the top wall of the head part of said T, said hollow structure being provided with exhaust gas admission conductors opening into said first chamber and with an exhaust gas discharge conductor extending upward from said second chamber, and a hollow partitioned cover member securable to the open face of said hollow structure in a selected one of two different positions and presenting when in one of its said two positions a compartment communicating with said first and third chambers and another compartment communicating with said second and fourth chambers and presenting when in the other of its said two positions a partition element substantially completely closing said third and fourth chambers and a compartment communicating with said first and second chambers.

9. A dual purpose engine manifold comprising a partitioned open-faced hollow structure embodying intake and exhaust manifold parts, said structure presenting a plurality of non-communicating chambers including an exhaust gas receiving chamber communicating with said exhaust part, an exhaust gas emission chamber adapted for connection with an exhaust gas discharge pipe and an intermediate chamber defined in part by a wall portion of said intake part, and a hollow partitioned cover member securable to the open face of said hollow structure in a selected one of two different positions and being effective when in one of its said two positions to serially connect said receiving, intermediate and emission chambers for the flow of exhaust gas therethrough in the order named and being effective when in the other of its said two positions to substantially completely close said intermediate chamber and to connect said receiving chamber with said emission chamber.

ARTHUR R. BLOOD.