April 29, 1958 E. HAIGH ET AL 2,832,328

INTAKE MANIFOLD

Filed Oct. 25, 1954 2 Sheets-Sheet 1

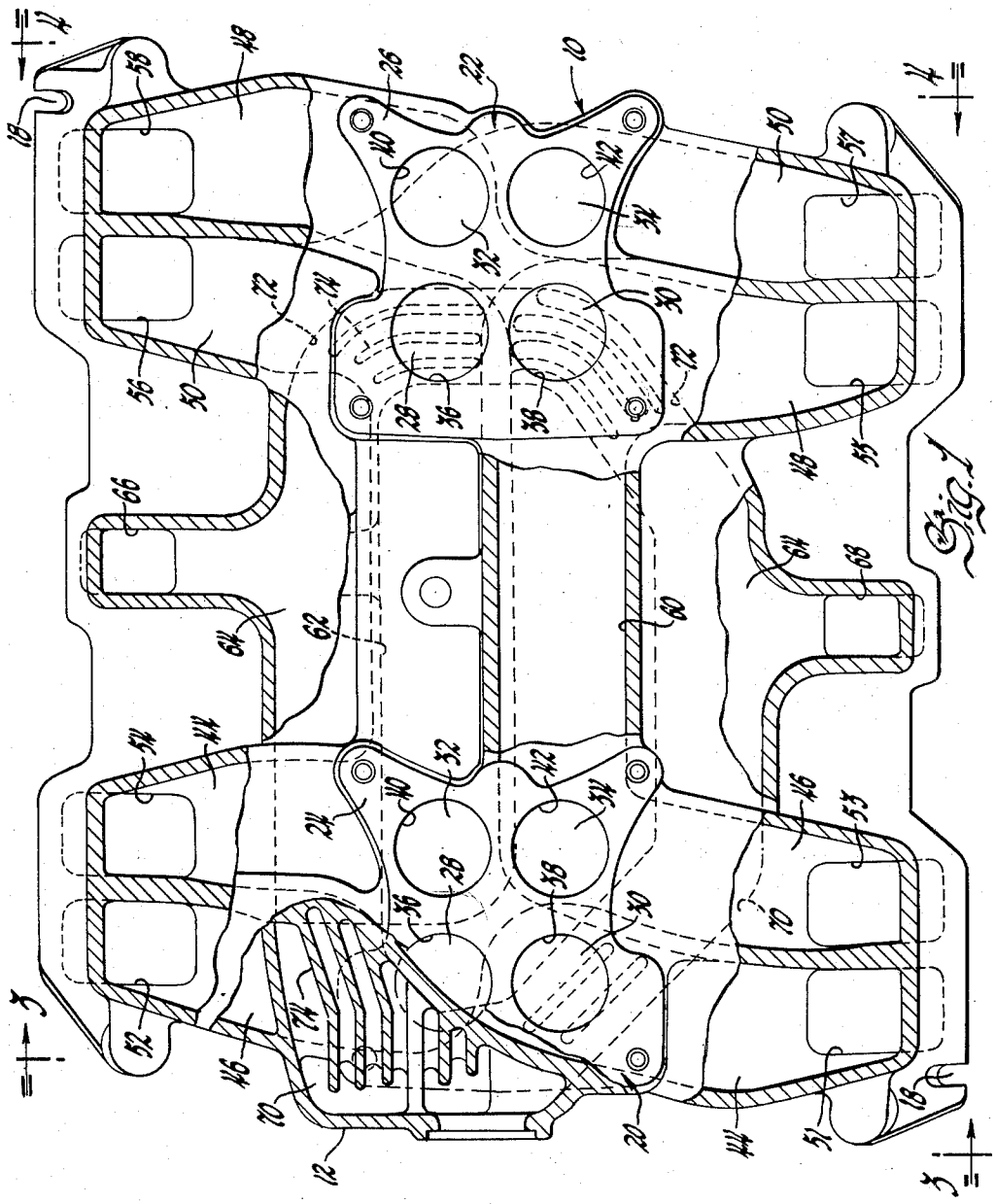


Fig. 1

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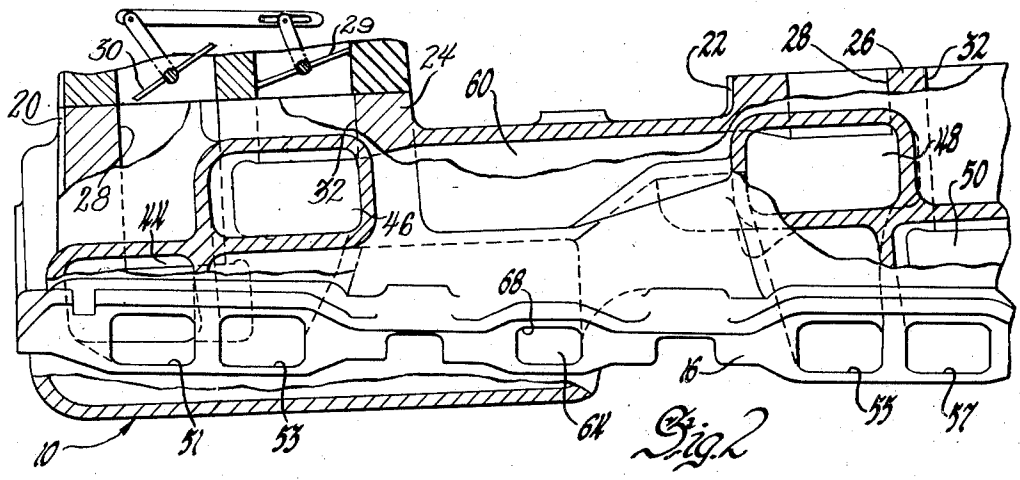


Fig. 2

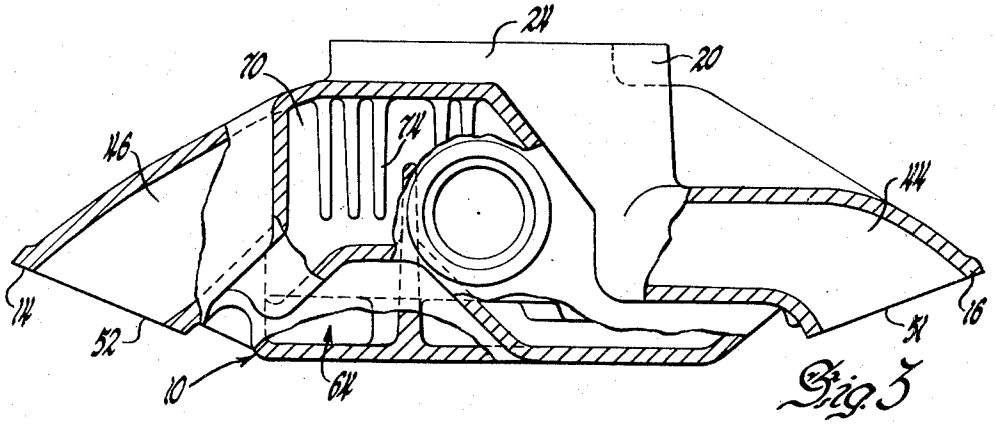


Fig. 3

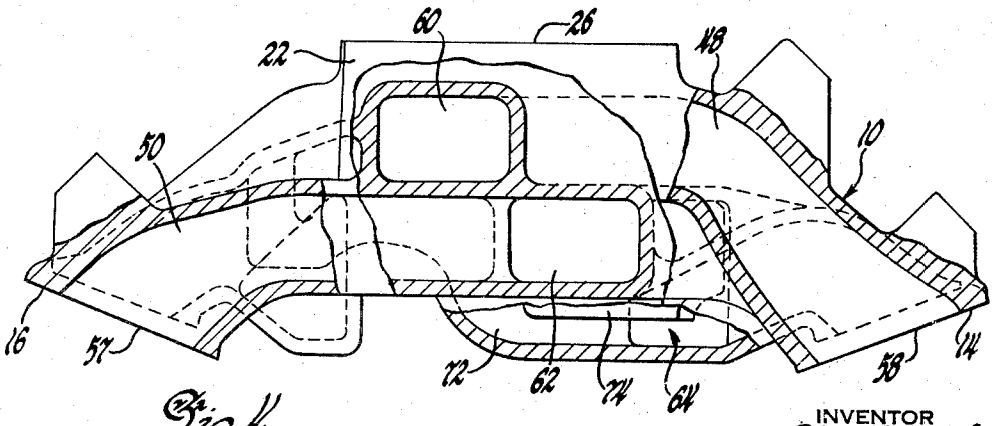


Fig. 4

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INTAKE MANIFOLD

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9 Claims. (Cl. 123—122)

The present invention relates to internal combustion engines and more particularly to intake manifolds therefor.

The output characteristics of an internal combustion engine are largely dependent upon the charge delivered to the combustion chambers of the engine. In order to obtain a high thermal efficiency, it is necessary that the individual charges delivered to each of the cylinders be substantially identical and have the same air-fuel mixture ratio, and in order to obtain a high power output, it is desirable to have as high a volumetric efficiency as possible. Heretofore, internal combustion engines and particularly those of the so-called V-8 type have employed intake manifolds wherein the distribution passages have different lengths and shapes. This has resulted in the carburetor means being disposed at unequal distances from the various cylinders. As a consequence the resistance presented to the various charges flowing to the cylinders varies and therefore, there is a considerable amount of variation in the individual charges actually delivered to each of the cylinders. Since there is a centrifugal separating of the fuel particles from the charge as it travels around the bends in the distribution passages, the differently shaped passages will cause different amounts of fuel to be separated from the charges so that the various cylinders will not all receive charges of uniform richness.

It is now proposed to provide an intake manifold in which the carbureting means are disposed as close as possible to the engine intake ports and are connected thereto by means of substantially identical distribution passages. This will not only materially reduce the flow resistance for the charge and thereby increase the volumetric efficiency of the engine, but since the distribution passages between the carburetor means and each of the cylinders are substantially identical, each cylinder will receive substantially identical charges. This is to be accomplished by employing an intake manifold having a pair of transverse distribution passages adjacent each end of the manifold. Compound carburetor means may be mounted adjacent each end of the manifold so as to discharge into the centers of the distribution passages.

In order to facilitate the operation of an engine which is below its normal operating temperature, it is desirable to preheat the combustible charge before it is drawn into the cylinders especially when the engine is lightly loaded. This will tend to prevent any fuel particles precipitating out of the charge and in the event such precipitation does occur, the heat will cause the fuel particles to be re-evaporated into the charge. When the engine becomes heavily loaded, there will be a large volume of charge flowing through the manifold. This will create a large amount of turbulence that will retain the fuel in the charge and thereby reduce the necessity for the application of heat to the charge. Although heating of the charge is highly desirable when the engine is cold, the heat causes the charge to expand and thereby reduces the volumetric efficiency. Accordingly, since the amount of heat required decreases with the load, it is desirable to reduce the

amount of heating of the charge when it is desired to obtain maximum power from the engine.

It is now proposed to provide means that will adequately heat the charge when the engine is lightly loaded but will not cause excessive heating of the charge when the engine is heavily loaded. This is to be accomplished by providing an intake manifold in which heat is applied to only that portion of the distribution passages carrying a charge at light load conditions. In the present instance the manifold includes compound carbureting means in which at least one primary fuel supply passage delivers a charge to the engine at all times and at least one secondary supply passage delivers a charge at heavy loads only. The heat is applied to one wall of the distribution passage so as to create a hot spot in substantial alignment with the primary supply passage without heating the area in and around the secondary fuel supply passage. Accordingly, when the engine is lightly loaded, all of the charge will flow through the primary fuel supply passage and the heat will be applied to the entire charge as it flows over the hot spot. However, when the engine is heavily loaded, and the charge is flowing through both the primary and secondary fuel supply passages, that portion of the charge flowing through the secondary passage will not be heated even though the engine is operating at subnormal temperatures. Accordingly, even though the engine is heavily loaded, when the engine is fully loaded, the volumetric efficiency will be high and maximum power will be obtainable.

In the two sheets of drawings:

Figure 1 is a plan view of an intake manifold embodying the present invention with portions thereof being broken away to more clearly show the details thereof.

Figure 2 is a side view of the intake manifold of Figure 1 with portions thereof being broken away.

Figure 3 is an end view of the manifold of Figure 1 taken substantially along the plane of line 3—3 in Figure 1.

Figure 4 is an end view of the manifold of Figure 1 taken substantially along the plane of line 4—4 in Figure 1.

Referring to the drawings in more detail the present invetion may be embodied in any suitable intake manifold **10**. In the present instance the manifold **10** is particularly adapted for installation on an engine of the socalled V-type having a cylinder block with a pair of angularly disposed banks of cylinders. Each of these banks may include four cylinders with a cylinder head secured to the block for closing the upper ends of the cylinders and thereby forming combustion chambers. Intake passages may extend through the heads to form intake ports on the inner sides of the heads.

The intake manifold **10** may comprise a member **12** formed by casting or any other suitable means. The member **12** may have faces **14** and **16** machined along the opposite sides thereof to mate with the inner sides on the heads. One or more bolt holes **18** may be provided in the manifold member **12** that extend therethrough for facilitating securing the manifold **10** in position on the engine.

The opposite ends of the manifold **10** may be provided with carburetor risers **20** and **22** that extend upwardly to form mounting flanges **24** and **26**. Each of these flanges **24** and **26** are adapted to have a carburetor of the so-called downdraft type mounted thereon so as to project vertically upwardly from the top of the manifold **10**. A plurality of substantially vertical fuel supply passages **28**, **30**, **32** and **34** may extend through the carburetor risers **20** and **22** with the upper ends thereof forming openings **36**, **38**, **40** and **42** in the flanges **24** and **26**.

In the present instance there are two pairs of fuel supply passages in each of the risers. The pair **28** and **30**

adjacent one of the ends of the risers 20 and 22 are preferably primary fuel supply passages which communicate with primary mixture passages in a carburetor mounted on the flange 24 or 26. The fuel charge flow in the primary passage is controlled by primary throttles 27 and will flow at all times. The pair 32 and 34 adjacent the other ends of the flanges 24 and 26 may be secondary fuel supply passages that communicate with the secondary mixture passages in the carburetor. The flow of charge in the secondary passages is controlled by secondary throttles 29 and occurs only when the engine is loaded heavily enough to require a greater charge than is supplied by the primary passages 28 and 30.

A pair of transversely extending distribution passages 44—46 and 48—50 may be provided adjacent each end of the manifold 10. The passages in each pair may have the centers thereof disposed directly below the risers 20 and 22 with the opposite ends of the passages forming outlets 51 through 58, inclusive, in the faces for registering with the intake ports in the sides of the heads. The center portions of the passages 44, 46, 48 and 50 that are disposed below the flanges are preferably positioned at different elevations. Thus the passages may cross each other immediately below the flanges 24 and 26. It is therefore apparent that one end of each of the distribution passages 44, 46, 48 and 50 will form openings 51, 52, 58 and 57, respectively adjacent the ends of the faces and the opposite ends of the passages will form openings 54, 53, 55 and 56 in the other face which is adjacent the end opening in the second face. It has been found preferable that the two distribution passages that form the center ports on one side be at one elevation while the passages that form the center ports on the other side will be at a different elevation. The primary and secondary fuel supply passages may extend downwardly so as to intersect the distribution passages adjacent the centers thereof.

It may be seen that since the distribution passages cross each other below the risers, the diagonally opposite fuel supply passages in each riser may communicate with a common distribution passage, i. e., passages 28 and 34 intersect one passage while 30 and 32 intersect another. Thus there will be a primary and a secondary fuel supply passage interesecting each of the distribution passages at points disposed symmetrically about the centers thereof. Thus the distance from each supply passage to its nearest port will be substantially identical and the average distance from the two supply passages to the ends of the distribution passage will be uniform.

Balance passages 60 and 62 may be provided which extend longitudinally of the manifold 10 so as to interconnect the center of the distribution passage on one end of the manifold with a distribution passage on the other end of the manifold. These passages 60 and 62 are preferably disposed at different elevations so that the higher balance passage 60 may be straight and interconnect the two highest distribution passages 46 and 48. The lower passage 62 may then also be straight and interconnect the two lower distribution passages 44 and 50. It should be noted that in the present instance the balance passages are disposed closest to the side in which its respective distribution passages form the center ports. These balance passages are preferably at least as large as the distribution passages so as to allow a free flowing of the charge therethrough.

When the engine is lightly loaded, the charge will flow only through the primary passages 28 and 30. However, as the engine becomes more heavily loaded, the charge will commence to flow through the secondary passages 32 and 34 and accordingly, the charge will enter the distribution passages from all of the fuel supply passages. Thus when the engine is heavily loaded, the flow resistance will be reduced to a minimum with the average distances from the pair of supply passages 28 and 34 or 30 and 32 communicating with each distribution passage to the ends of that passage being very short and substantially equal. Accordingly, each cylinder will receive the maximum charge and all of the charges will be identical. It should be noted that if the engine's demand for fuel becomes large enough, some of the charge may be drawn from the supply passages at the opposite end of the manifold by means of the balance passages 60 and 62.

Under certain engine operating conditions, the fuel particles may precipitate out of the charge particularly at subnormal engine temperatures. Therefore in order to prevent this, it may be desirable to preheat the charge flowing through the manifold 10. Accordingly, suitable heating means may be provided in the intake manifold 10 for heating the walls of the distribution passages 44, 46, 48 and 50. In the present instance this means includes an exhaust passage 64 that extends through the manifold 10 to form openings 66 and 68 in the center of the faces for communicating with exhaust passages in the cylinder heads. The flow of exhaust gases in the exhaust passages may be controlled by a thermostat that will divert hot exhaust gases therethrough when the engine is cold. The present exhaust passage 64 in the manifold 10 forks into two separate branches 70 and 72 with each of these branches extending below one of the carburetor risers 20 or 22, so that the hot exhaust gases will be in heat exchanging relation with the walls of the distribution passages.

Although these exhaust gases may heat a large portion of the distribution passages, it has been found preferable to confine the heat transfer to a small area that will form a hot spot. These spots may then be formed on one of the walls of the distribution passages in substantial alignment with the primary fuel supply passages 28 and 30. Accordingly, as the charge flows out of the primary fuel supply passages 28 and 30 into the distribution passages, it will flow directly onto these spots before it spreads towards the opposite ends of the distribution passages. Thus if there are any fuel particles in the charge which are tending to precipitate out of the charge, they will be centrifugally thrown therefrom so as to impinge upon the hot spot as the charge turns to enter the distribution passages. As soon as the particles strike the hot spots, they will rapidly be heated until they become hot enough to re-evaporate into the charge.

A plurality of fins 74 may be provided on one of the walls of the exhaust branches 70 and 72 so as to project into the exhaust passages. This will greatly increase the amount of surface area exposed to the exhaust gases and as a result the amount of heat absorbed out of the exhaust gases and transferred to the hot spots will be greatly increased. It has been found that factors such as the air circulated by the engine fan may cause one end of the manifold to be cooler than the other end. Under such circumstances it may be desirable to apply more heat to the primary charge flowing through the cooler end of the manifold. Accordingly, fins 74 on one end of the manifold may be larger and/or of a different configuration than those on the opposite end thereby insuring the desired amount of heat being transferred to each of the primary passages.

When an engine is operating under heavy loads, a large volume of charge will be drawn through the intake manifold 10 thereby causing a tremendous amount of turbulence to occur in the charge. This turbulence will tend to maintain the fuel particles thoroughly mixed into the charge and prevent precipitation of the charge. Accordingly, it may be seen that although it is desirable to heat the charge at light loads, the necessity for doing so at heavy loads is greatly reduced with the result that the accompanying decrease in volumetric efficiency will become objectionable. It is therefore desirable that the hot spot be localized or confined to the area disposed in substantial alignment with the primary fuel supply passages 28 and 30 without heating of the area in and around the secondary fuel supply passages 32 and 34. Thus when

the engine is lightly loaded, all of the charge will be subjected to heat. However, when the engine becomes more fully loaded, the charge in the secondary passages will not be heated and the amount of heat applied to the total charge will be proportionately less. Therefore when the engine is operating at full throttle, the heating effect will not materially reduce the volumetric efficiency.

Various changes and modifications of the embodiment of the invention described herein may be made by those skilled in the art without departing from the spirit and principles of the invention.

What is claimed is:

1. An intake manifold for an internal combustion engine comprising a member having at least one distribution passage extending therethrough, at least one primary fuel supply passage communicating with said distribution passage for carrying a fuel charge during all engine operating conditions, at least one secondary fuel supply passage communicating with said distribution passage for carrying a fuel charge during only a portion of said engine operating conditions, and heating means for heating only that portion of said passages in the immediate vicinity of the junction of said primary passages and said distribution passages.

2. An intake manifold for an internal combustion engine having exhaust means therefor, said manifold comprising a member having at least one distribution passage extending therethrough and a plurality of fuel supply passages intersecting said distribution passage, a portion of said fuel supply passages being primary fuel supply passages for carrying a fuel charge at all engine load conditions, and the remainder of said supply passages being secondary fuel supply passages for carrying a fuel charge during only particular engine load conditions, and an exhaust passage communicating with said exhaust means and being disposed in heat exchanging relation with only the portion of said distribution passages in the immediate vicinity of the junction thereof with said primary passages.

3. An intake manifold comprising a member having at least one distribution passage extending therethrough, a carburetor riser on said member, said riser having at least one primary fuel supply passage therein intersecting said distribution passage at substantially right angles for discharging a fuel charge into said distribution passage during all engine operating conditions, said riser also having at least one secondary fuel supply passage therein intersecting said distribution passage at substantially right angles for discharging a fuel charge into said distribution passage only during certain operating conditions, and an exhaust passage disposed in heat exchanging relation with said distribution passage so as to form a hot spot on only a limited portion of the walls of said distribution passage, said hot spot being in substantial alignment with said primary passage.

4. An intake manifold comprising a member having sets of distribution passages adjacent each end thereof, said passages extending transversely therethrough to form outlets on the opposite sides of said manifold, a carburetor riser on said manifold, said riser having at least one primary fuel supply passage communicating with one of said distribution passages for discharging a fuel charge thereinto during all engine operating conditions, said riser also having secondary fuel supply passages intersecting said distribution passages, an exhaust passage extending transversely therethrough to form exhaust ports on said manifold between said outlets, said exhaust passage having a portion thereof disposed in heat exchanging relation with only the portion of said distribution passages adjacent the intersection thereof and said primary supply passages.

5. An intake manifold comprising a member having a pair of distribution passages adjacent each end thereof, said passages extending transversely therethrough for forming outlets on the opposite sides of said member, a carburetor riser provided adjacent each of said ends and

having a plurality of fuel supply passages disposed normal to said distribution passages so as to communicate therewith, each of said distribution passages having a primary fuel supply passage and a secondary fuel supply passage communicating therewith, an exhaust passage extending transversely through said manifold so as to form exhaust openings on the opposite sides of said manifold between said outlets, said exhaust passage dividing into separate branches, each of said branches being disposed in heat exchanging relation with a limited portion of said distribution passages to form a hot spot on the walls of said distribution passages in substantial alignment with only said primary fuel supply passages.

6. An intake manifold comprising a member having a pair of distribution passages adjacent each end thereof, said passages extending transversely therethrough to form outlets on the opposite sides of said manifold, a carburetor riser adjacent each of said ends, each of said risers including two pairs of fuel supply passages with each of said pairs including a primary fuel supply passage for delivering fuel during all engine operating conditions and a secondary fuel supply passage for delivering fuel only during certain operating conditions, each of said pairs of supply passages intersecting one of said distribution passages at substantially right angles thereto, and an exhaust passage extending through said member and being in heat exchanging relation with the portion of said distribution passage adjacent the intersection of said primary passages and said distribution passages.

7. An intake manifold comprising a member having a pair of distribution passages adjacent each end thereof, said passages extending transversely therethrough to form outlets on the opposite sides of said manifold, the center portions of the passages in each pair being disposed at different elevations and crossing each other, a carburetor riser adjacent each of said ends and being disposed above said crossing center portions, each of said risers including two pairs of fuel supply passages with each of said pairs including a primary fuel supply passage for delivering fuel during all engine operating conditions and a secondary fuel supply passage for delivering fuel only during certain operating conditions, each of said pairs of supply passages intersecting one of said distribution passages at substantially right angles thereto and at points symmetrically disposed about the crossing of said distribution passages, an exhaust passage extending through said member to form exhaust openings in the sides of said member between said outlets, said exhaust passage dividing into branches with each branch passing in heat exchanging relation with the distribution passages in one of said pairs of distribution passages so as to form hot spots in the walls thereof, said hot spots being disposed in substantial alignment with said primary passages only.

8. An intake manifold having a pair of transverse passages adjacent each end thereof, the center portion of one passage in each pair being disposed at a different elevation from the center portion of the other passage in that pair and at substantially the same height as a corresponding passage in said other pair, the center portions of the passages in each pair crossing each other so that said corresponding passages will form outlets in one side of said manifold adjacent the ends thereof and center outlets in the opposite side thereof, and balance passages interconnecting said corresponding passages, said balance passages being substantially straight and parallel to each other and at substantially the same height as the center portions of said corresponding passages, and primary and secondary fuel supply passages communicating with each of said distribution passages, the intersection of said primary and secondary passages with the distribution passages being substantially symmetrically disposed about the center of the distribution passage.

9. An intake manifold having a pair of transverse passages adjacent each end thereof, the center portion of one passage in each pair being disposed at a different eleva-

tion from the center portion of the other passage in that pair and at substantially the same height as a corresponding passage in said other pair, the center portions of the passages in each pair crossing each other so that said corresponding passages will form outlets in one side of said manifold adjacent the ends thereof and center outlets in the opposite side thereof, and balance passages interconnecting said corresponding passages, said balance passages being substantially straight and parallel to each other and at substantially the same height as the center portions of said corresponding passages, each of said balance passages being disposed closet to the side in which its associated distribution passages form the center openings, and primary and secondary fuel supply passages communicating with each of said distribution passages, the intersection of said primary and secondary passages with said distribution passages being substantially symmetrically disposed about the center of the distribution passage.

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