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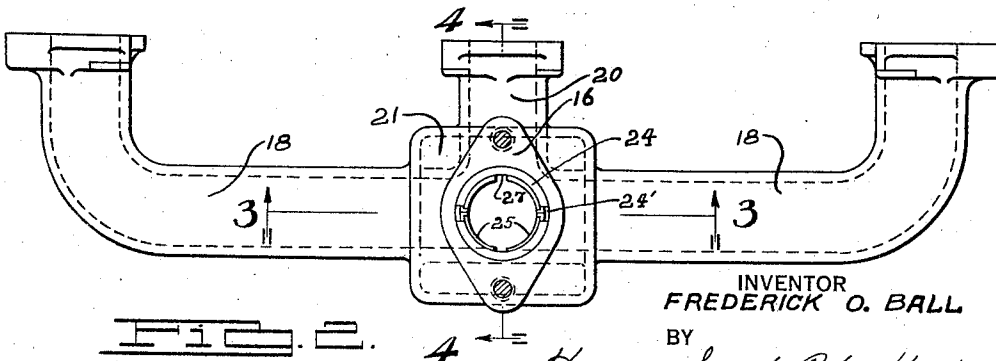
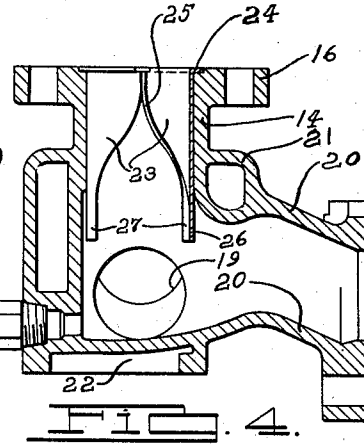
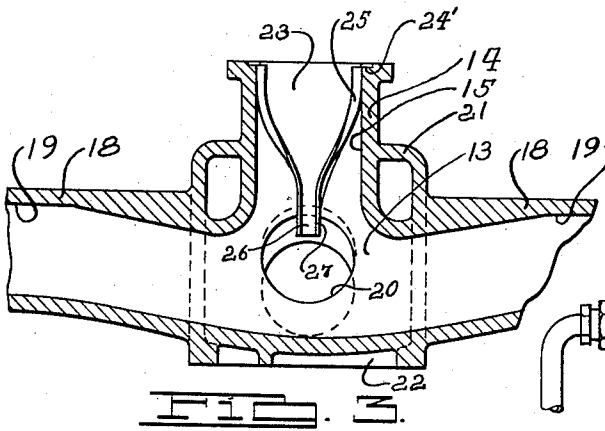
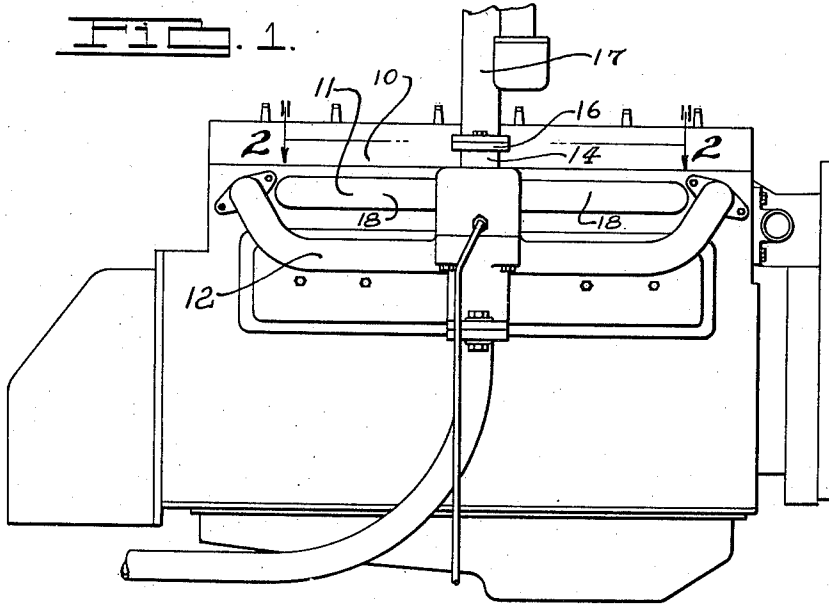
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2,072,353

INTERNAL COMBUSTION ENGINE FUEL SYSTEM

Filed Dec. 20, 1934

2 Sheets-Sheet 1



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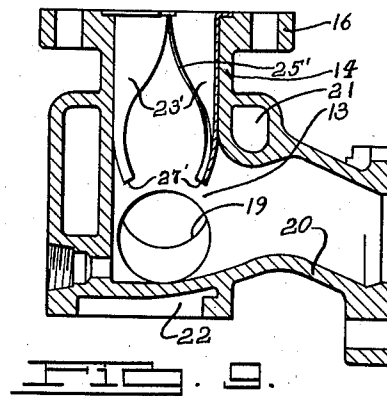
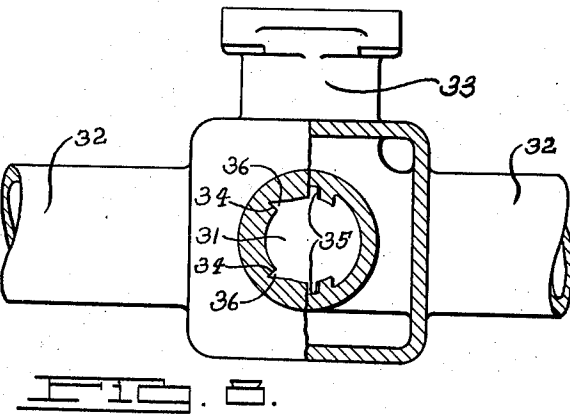
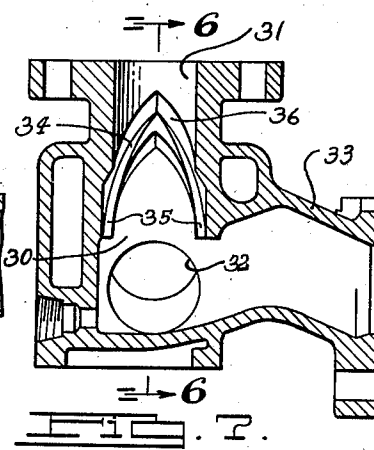
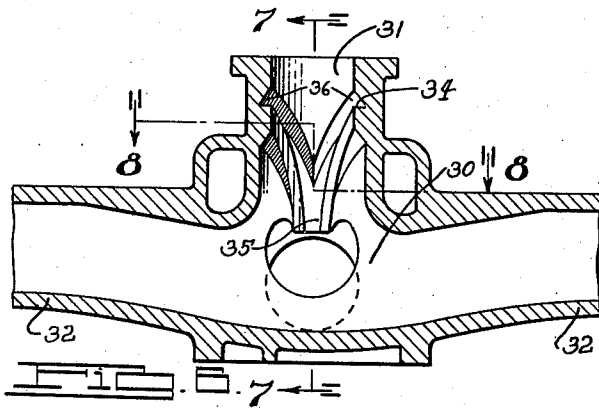
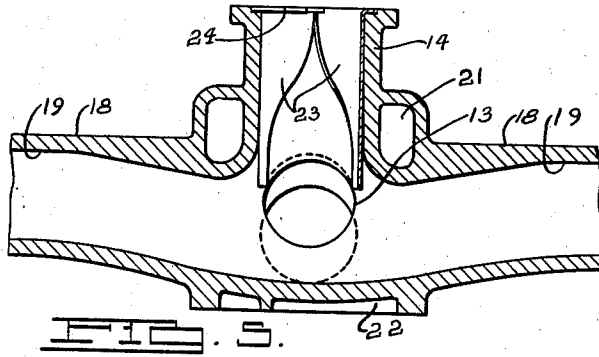
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INTERNAL COMBUSTION ENGINE FUEL SYSTEM

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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INTERNAL COMBUSTION ENGINE FUEL SYSTEM

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11 Claims. (Cl. 123—141)

This invention relates to improved internal combustion engine fuel systems.

More particularly, the invention pertains to an improved manifold fuel centralizer.

One of the main objects of the invention is to provide a fuel centralizer for directing the unvaporized liquid fuel which normally tends to flow down the walls of the fuel mixture inlet of the manifold away from the junction of the latter walls and the walls of the manifold branches.

Another object of the invention is to provide means of this character in an intake manifold which is adapted to centralize the liquid fuel that tends to flow down the walls of the fuel mixture inlet passage and to discharge it at a location in the primary distribution zone of the manifold from which equal distribution of the fuel occurs between the various branches of the manifold.

A further object of the invention is to provide means in the manifold for centralizing and discharging the main portion of the unvaporized liquid fuel content of the fuel mixture supply of a manifold onto a heated wall thereof.

A still further object of the invention is to provide means of this character which so equalizes the distribution of fuel between the various branches of the intake manifold as to facilitate smooth, low as well as high speed operation of the engine with which it is associated, with a comparatively early spark advance, substantially lean mixture and relatively large compression ratio without causing pinging and accompanying power losses.

An additional object of the invention is to provide intake manifold fuel centralizing means of this kind which materially increases the performance and economy of an internal combustion engine.

Another object of the invention is to provide a fuel centralizing device of this character which is adapted to maintain equal distribution of fuel between the various branches of a vehicle engine manifold while the latter is inclined during up-hill and down-hill travel of the vehicle.

Other objects of the invention are to provide spaced pairs of inwardly extending helically converging, vein-like baffles on the wall of the fuel mixture inlet passage of a manifold for directing liquid fuel which normally flows along such walls away from the junction of the latter and the walls of the various branches of the manifold; to provide pairs of vein-like baffles of this character, each of which may be conveniently constructed and arranged to centralize the liquid fuel that normally tends to flow along different

predetermined areas of the wall of the fuel mixture inlet so as to facilitate accurate pre-determining of the distribution of fuel to the various branches, particularly in intake manifolds in which the film of liquid fuel on the mixture passage walls thereof varies in thickness; and to provide fuel centralizing means of this kind which may be cast integral with the intake manifolds or formed independently thereof from sheet metal and conveniently installed in intake manifolds of conventional constructions without requiring radical revision or reconstruction of the latter.

Further objects of the invention are to provide a pair of helically converging vein-like baffles of this kind in a fuel inlet mixture passage of a manifold which promotes the rotation of portions of the fuel mixture so as to centrifugally urge the liquid content thereof outwardly with respect to the inner edges of the baffles so as to prevent spilling of such liquid fuel thereover; to provide baffles of this kind which, though relatively narrow, are extremely effective in holding the liquid content of fuel mixture against flowing over the baffles, due to the centrifugal action they produce; to provide relatively narrow baffles of this kind which present comparatively negligible physical and aerodynamic opposition to the flow of the fuel mixture and around which the air and vaporized fuel content of the latter may freely flow from the spaces between the baffles, which progressively become smaller and smaller at successive cross-sections of the fuel mixture passage, and into the portions of the passage adjacent such spaces.

The above being among the objects of the present invention the same consists in certain novel features of construction and combination of parts to be hereinafter described with reference to the accompanying drawings, and then claimed, having the above and other objects in view.

Illustrative embodiments of the invention are shown in the accompanying drawings, in which:

Fig. 1 is a diagrammatic side elevational view of the internal combustion engine having an intake manifold provided with my improved fuel centralizer.

Fig. 2 is a top plan view of the intake manifold and fuel centralizer.

Fig. 3 is a longitudinal, vertical sectional view taken on the line III—III of Fig. 2.

Fig. 4 is a transverse, vertical, central sectional view taken on the line IV—IV of Fig. 2.

Fig. 5 is a fragmentary, longitudinal sectional view of the manifold and fuel centralizer illustrated in Fig. 3, but showing the fuel centralizer

disposed in a 90° rotated position with respect to the location thereof shown in Figs. 2, 3 and 4.

Fig. 6 is a fragmentary, vertical, longitudinal sectional view of an intake manifold having fuel centralizing means integrally cast therein and embodying a modified form of the invention.

Fig. 7 is a transverse, vertical sectional view taken on the line VII—VII of Fig. 6.

Fig. 8 is a horizontal sectional view taken on the line VIII—VIII of Fig. 6.

Fig. 9 is a transverse sectional view, similar to Fig. 4, but showing fuel centralizing means embodying a further development of the invention.

In Figs. 1 to 4, inclusive, is illustrated an embodiment of the invention in a down-draft fuel mixture system of an internal combustion engine 10 having an intake manifold 11 and an exhaust manifold 12. For the purpose of illustration, a six cylinder internal combustion engine and a corresponding intake manifold is shown, it being understood that the invention may be used to advantage in internal combustion engines having a greater or lesser number of cylinders as well as in up-draft internal combustion engine fuel systems.

The intake manifold 11 includes a central or primary distribution zone 13 and it is provided with an upwardly extending fuel mixture inlet tube 14 having a fuel mixture passage 15 leading from the distribution zone 13. The upper end portion of the fuel mixture inlet tube 14 is provided with a substantially horizontally extending apertured flange 16 to which a carburetor 17 is detachably securable by bolts or other suitable means. Extending outwardly from opposite sides of the distribution zone 13 are manifold branches 18 having fuel mixture passages 19 therein through which fuel mixture is conveyed to the outer end pairs of cylinders of the engine. An intermediate manifold branch 20 extends substantially laterally of the length of the manifold from the distribution zone 13 thereof to a port in the engine through which fuel is supplied to the intermediate pair of cylinders. The adjacent end portions of the passages of the manifold branches 18 and 20 open into the distribution zone 13 and they are disposed in adjacent relationship with respect to each other, the adjoining wall portions of the branches being of any desired angular or curved contour. Surrounding the adjacent end portions of the branches and the distribution zone 13 is an exhaust jacket 21 having an open lower side 22 which is adapted to be arranged in communication with a suitable port (not shown) provided in the exhaust manifold 12 for supplying some of the exhaust gases of the latter to the jacket so as to maintain the distribution zone at a desired temperature during operation of the engine.

In the form shown in Figs. 1 to 4, inclusive, my improved fuel centralizing device includes a pair of sleeve sections 23 which, in the illustration shown, are substantially identical. Each sleeve section 23 comprises a fragmentary portion of a cylindrical tube having an outer diameter substantially equal to the diameter of the fuel mixture passage 15 in which it is removably mounted and supported in suspended relation by an outwardly extending radial flange 24 seated in a shallow counterbored recess 24' provided in the outer extremity of the fuel mixture inlet 14. When the carburetor is assembled on the flange 16 of the intake manifold there is provided between the latter and the corresponding flange of the carburetor a gasket (not shown),

which engages the outermost surface of the flange 24 and holds the sleeve section 23 against displacement with respect to the manifold.

The sleeve sections 23 taper in shape from their uppermost extremities and they are provided with helically extending lateral edge portions on which are formed inwardly extending radial flanges or vane-like baffle 25. The lateral side edges of each sleeve section 23 and the flanges 25 thereof converge helically from the upper extremity of the sleeve section, as viewed in Fig. 3, to a location substantially adjacent the discharge end of the fuel mixture inlet 14. From this location, the lateral sides of each sleeve section 23 and the corresponding portions of the flanges 25, thereof continue in substantially parallel relationship, and their outer edges are interconnected by a relatively narrow web 26 so as to provide a channel-shaped discharge element 27 at the lower end of each sleeve section.

The sleeve sections 23 need not necessarily be identical but they are preferably complementary at their wide or upper end portions so as to extend throughout the entire circumference of the outer extremity of the passage 15 of the fuel mixture inlet 14. If desired, these sleeve sections may be made in one integral piece, the division of the device into two sections being recommended merely for purposes of convenience of manufacture.

In the form of the invention illustrated in Figs. 1 to 4, inclusive, the sleeve sections 23 are arranged so as to position the discharge elements 27 thereof in substantially transverse alignment with respect to the length of the manifold 11 and midway between the adjacent extremities of the manifold branch passages 19. The discharge element 27 extends beyond the inner extremity of the fuel inlet tube 14 and into the distribution zone 13 of the manifold.

In the form of the invention illustrated in Fig. 5, all parts of the structure including the sleeve sections 23 thereof are substantially identical in construction to the corresponding parts shown in Figs. 2, 3 and 4 and they are designated by the same numerals used in the latter figures. In this instance, the sleeve sections 23, however, are located in a 90° rotated position from the locations thereof illustrated in Figs. 2, 3 and 4. The channel shaped discharge elements 27 are symmetrically arranged on respectively opposite sides of the transverse central plane of the manifold and are substantially in alignment in the vertical plane of the axis of the manifold branch 20.

In Fig. 9 of the drawings is illustrated a further development of the invention, the manifold shown for the purpose of illustration being substantially identical to the manifold structure shown in Figs. 1 to 4, inclusive, and the parts thereof being designated by corresponding numerals. The sleeve sections 23' of this form of the fuel centralizing means are substantially identical to the sleeve sections 23 with the exception that the liquid fuel discharge elements 27' thereof are bent inwardly so as to direct liquid fuel to the central portion of the distribution zone 13. These sleeve sections have helically converging inwardly extending, substantially radial flanges 25' on their lateral edges which continue substantially throughout the length of the device and become parallel with each other throughout that portion thereof which provides the discharge element 27'.

In Figs. 6, 7 and 8 is illustrated an embodiment of the invention in which the fuel centralizing means is integrally cast with the structure of the intake manifold, the manifold shown being substantially identical in external contour to the intake manifold illustrated in Figs. 1 to 4, inclusive. It includes a central distribution zone 30, with which a fuel inlet tube 31 communicates, and manifold branches 32 extending in opposite directions from respectively opposite sides of the distribution zone 30 for supplying fuel mixture to the opposite end pairs of cylinders of an internal combustion engine. An intermediate manifold branch 33, which also communicates directly with the distribution zone 13, is provided for supplying fuel mixture to the intermediate pair of cylinders of the engine. The adjacent extremities of the manifold branches 32 and 33 have adjoining wall portions which may be formed to any desired angular or curvilinear contour.

Formed integral with the fuel mixture inlet 31 are substantially diametrically opposite pairs of helically converging vane-like baffles 34 which project inwardly radially of the fuel mixture inlet passage. The converging end portions of each pair of vane-like baffles 34 extend into the distribution zone 30 of the manifold and they are located in lateral alignment with respect to the length of the manifold, providing liquid fuel discharge elements 35 for discharging liquid fuel at locations spaced from the adjoining wall portions of the manifold branches. These discharge elements also direct the liquid fuel content of the fuel mixture to a location in the distribution zone 30 from which equal distribution occurs with respect to the adjacent ends of the passages of the manifold branches and the cylinders of the engine they serve.

A groove 36 is provided in the wall of the fuel inlet tube adjacent the outer side of each vane-like baffle 34. The grooves 36 follow the contour of the baffles and provide recesses for accommodating the flow of liquid fuel in paths adjacent thereto. Although the discharge elements of the integrally cast fuel centralizing means illustrated in Figs. 6 to 8, inclusive, are shown to be symmetrically located with respect to the longitudinal axis of the end branches 32 of the manifold, it should be understood that the sections of the fuel centralizing device and the discharge elements 35 thereof may, if desired, be located on opposite sides of the central transverse vertical plane of the manifold in an arrangement corresponding to that shown in Fig. 5 and the discharge elements 35 may be curved inwardly as shown in Fig. 9.

In the operation of an engine having a manifold provided with the improved fuel centralizing means, the unvaporized liquid fuel content of the fuel mixture which normally tends to flow along the wall of the fuel mixture inlet is diverted from its normal course by the flanges 25 of the sleeve sections, or by the baffles 34, and discharged at predetermined locations in the distribution zone of the manifold, preferably at portions thereof which are spaced from the adjoining wall portions of the manifold branches. The helically converging contour of the flanges 25 and 25' shown in Figs. 1 to 5, inclusive, and Fig. 9, respectively, and the corresponding contour of the vane-like baffles 34, shown in Figs. 6, 7 and 8, cause that portion of the liquid fuel content of the fuel mixture which normally tends to spread out over a comparatively large area

of the wall of the fuel mixture inlet to be confined into relatively narrow stream-like discharges which are accurately directed to those portions of the distribution zone from which equal distribution between the various manifold branches take place.

The helical contour of the vane-like baffles causes rotation of the fuel mixture as it passes through the fuel inlet. This rotary movement of the fuel mixture subjects the liquid fuel content thereof to centrifugal action thereby tending to urge the liquid outwardly with respect to the axis of the fuel mixture inlet. The liquid fuel is in this manner held against flowing over the edges of the baffles and therefore there is no necessity for the use of comparatively wide baffles which would objectionably obstruct the passage of the fuel mixture through the inlet. The relatively narrow baffle permits the air and vaporized fuel content of the fuel mixture to flow freely therearound from the spaces between adjacent pairs of helically converging baffles into the adjacent portions of the interior of the fuel mixture inlet. This free passage of air and vaporized fuel content of the fuel mixture from the decreasing spaces between the converging baffles into relatively unrestricted spaces prevent the building up of pressure which would aerodynamically oppose the flow of fuel mixture through the fuel mixture inlet.

The liquid fuel is preferably discharged from the centralizing means at locations in the distribution zone where the air velocity is relatively high and as a result a relatively large portion thereof is atomized. The unatomized liquid fuel is sprayed directly upon the lower wall of the distribution zone which is heated sufficiently by exhaust gases, admitted thereto through the opening 22, to vaporize such liquid fuel.

Where, as in some instances, the film of liquid fuel which normally tends to flow along the wall of the fuel mixture inlet varies in thickness at diverse portions, the vane-like baffles may be so constructed and arranged as to equalize the discharge of such liquid fuel at selected locations in the distribution zone. This can be conveniently accomplished by including between the converging baffles of one pair, a greater portion of the inner peripheral area of the fuel mixture inlet than that included between the other pair of baffles.

An internal combustion engine having an intake manifold provided with any of the foregoing forms of fuel centralizing means will, due to the equal distribution of fuel to the various cylinders thereof, operate smoothly with a comparatively early spark advance and a substantially lean mixture. The extent to which the fuel is distributed with respect to the various cylinders of a multiple cylinder combustion engine also enables the employment of a comparatively large compression ratio without causing pinging and the accompanying power loss.

Although but several specific embodiments of the invention are herein shown and described, it will be understood that various changes in the size, shape and arrangement of parts may be made without departing from the spirit of my invention, and it is not my intention to limit its scope other than by the terms of the appended claims.

What I claim is:

1. In an internal combustion engine having an intake manifold including a fuel mixture inlet passage and outlet branch passages leading from

said inlet passage; a fuel centralizer including a body portion adjacent the walls of said inlet passage for diverting the flow of liquid fuel from said walls including means extending from said body portion toward the axis of said inlet passage for confining the discharge of said liquid fuel at a location adjacent the longitudinal axis of one of said branch passages and spaced from the junctions of the wall of said inlet passage and the walls of said branch passages.

2. In an internal combustion engine having an intake manifold including a fuel mixture inlet passage and outlet branch passages leading from said inlet passage; a fuel centralizer in said manifold for diverting liquid fuel normally tending to flow along the wall of said inlet passage and means extending inwardly toward the central axis of said inlet passage forming spaced channels for confining the discharge of selected portions of said diverted liquid fuel to opposite locations adjacent the open ends of said branch passages, one of said discharge locations being substantially at the longitudinal axis of one of said branch passages.

3. In an internal combustion engine having an intake manifold including a fuel mixture inlet passage and a pair of outlet branch passages extending in opposite directions from said inlet passage; a fuel centralizer in said manifold for diverting liquid fuel normally tending to flow along the wall of said inlet passage including means for substantially equally dividing said liquid fuel with respect to said branch passages and confining the discharge thereof to zones of limited size, at least one adjacent the longitudinal axis of one of said branch passages, said means including helically extending vanes protruding inwardly from the wall of said inlet passage.

4. In an intake manifold having a fuel mixture inlet passage and outlet branch passages leading from said inlet passage; a fuel centralizer for diverting liquid fuel normally tending to flow along the wall of said inlet passage for substantially equal distribution with respect to said branches, said means including a pair of converging helically extending vanes protruding inwardly from the wall of said inlet passage and projecting beyond the outlet end of said inlet passage.

5. In an internal combustion engine intake manifold including a fuel mixture inlet passage and having a distribution zone communicating with the discharge end thereof and having outlet branches leading from said distribution zone each having a fuel mixture passage therein; fuel centralizing means in said inlet passage for diverting the flow of liquid fuel along the walls thereof including converging helically extending vanes protruding inwardly from the wall of said inlet passage, the converging end portions of said vanes extending beyond the discharge end of said inlet passage and having an adjoining web providing a channel for directing liquid fuel to a selected location in said distribution zone.

6. In an intake manifold including a fuel inlet tube and having branch tubes communicating with and extending outwardly from the discharge end of said inlet tube; a fuel centralizing device means including a tapered sleeve section disposed in said inlet tube and having helical edge portions extending inwardly of said inlet tube and converg-

ing toward the discharge end thereof for diverting liquid fuel normally tending to flow over a substantial area of the wall of said inlet tube and discharging such liquid fuel at a predetermined location relative to said branch tubes.

7. In an intake manifold including a fuel inlet tube and having branch tubes communicating with and extending outwardly from the discharge end of said inlet tube; a fuel centralizing means including a pair of tapered sleeve sections disposed in said inlet tube, each having edge portions extending inwardly of said inlet tube and converging toward the discharge end thereof for diverting liquid fuel normally tending to flow over predetermined areas of the wall of said inlet tube and discharging such liquid at selected locations relative to said branch tubes respectively.

8. In an intake manifold comprising a fuel inlet tube and having a pair of end branch tubes communicating with and extending outwardly from the discharge end of said inlet tube; a fuel centralizing device for diverting the liquid fuel normally tending to flow over selected predetermined areas of the wall of said inlet tube including a pair of liquid fuel discharge elements each having inward extending flanges forming channels having discharge ends located substantially midway between the adjacent extremities of said end branch tubes and substantially aligned transversely of the length of said manifold.

9. In an intake manifold including a fuel inlet tube having a pair of end branch tubes communicating with and extending outwardly from the discharge end of said inlet tube; a fuel centralizing device for diverting the liquid fuel normally tending to flow over selected predetermined areas of the wall of said inlet tube including a pair of liquid fuel discharge elements, each having inwardly extending flanges forming channels having discharge ends located substantially in the vertical plane of the axis of one of said end branch tubes respectively.

10. In an intake manifold including a fuel inlet tube having a pair of end branch tubes communicating with and extending outwardly from the discharge end of said inlet tube; a fuel centralizing device for diverting the liquid fuel normally tending to flow over selected predetermined areas of the wall of said inlet tube including a pair of sleeve sections each having a discharge element thereon and being adapted to be selectively positioned in said manifold for bringing said discharge elements into desired locations with respect to the adjacent extremities of said branch tubes, said discharge elements comprising channels for confining the fuel discharge into relatively isolated zones.

11. In an intake manifold including a fuel inlet tube and having branch tubes communicating with and extending outwardly from the discharge end of said inlet tube; a fuel centralizing device including means for diverting the liquid fuel normally tending to flow over selected predetermined areas of the wall of said inlet tube, discharge elements on said device for discharging such liquid fuel at selected locations relative to said branch tubes respectively, said discharge elements extending inwardly in converging relation with respect to the axis of said inlet tube.

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