

[54] INTAKE MANIFOLD FUEL SYSTEM

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Related U.S. Application Data

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[51] Int. Cl. **F02m 29/04**, F02m 29/14

[58] Field of Search 123/141, 52 M; 48/180, 180 M, 180 R; 261/79; 138/40, 42

[56] References Cited

UNITED STATES PATENTS

1,345,791	7/1920	Livingstone	48/180
1,703,493	2/1929	Leach	48/180
1,973,889	9/1934	Timian	123/141
2,072,353	3/1937	Ball	123/141

2,498,190	2/1950	Weeks	48/180
1,418,877	6/1922	Mabee	138/42
1,095,555	5/1914	Crone	219/271
2,701,557	2/1955	Ramey	123/141
3,437,467	4/1969	Jacobus	48/180
2,685,504	8/1954	Ulbing	48/180

FOREIGN PATENTS OR APPLICATIONS

451,559	10/1927	Germany	123/141
12,416	5/1911	Great Britain	123/141

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[57] ABSTRACT

A fuel system for internal combustion engines comprising a manifold having an inlet passage for a fuel mixture and a plurality of outlet passages to the cylinders of the engine. A fuel mixture distributing device is provided adjacent the inlet passage and comprises a plurality of closely packed sinuous members defining a plurality of generally axially extending twisted passages which are laterally intercommunicating.

9 Claims, 5 Drawing Figures

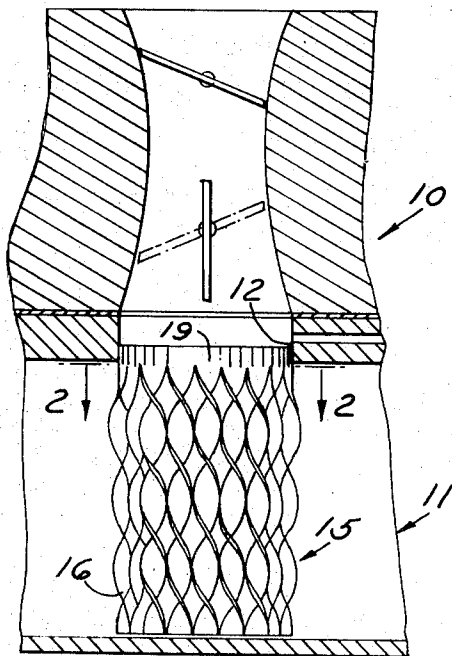
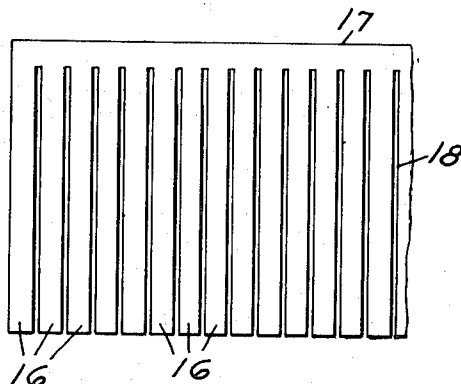
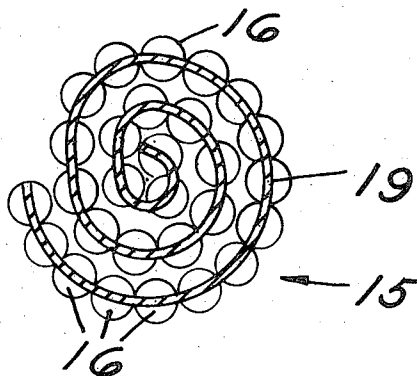


FIG. 1

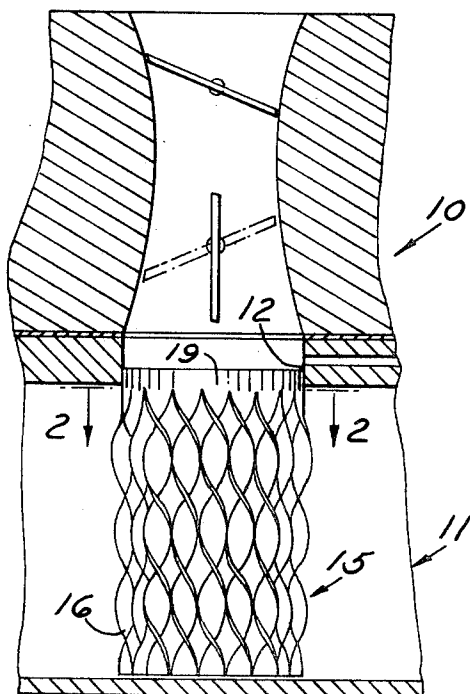


FIG. 2

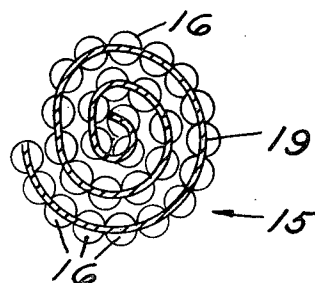


FIG. 3

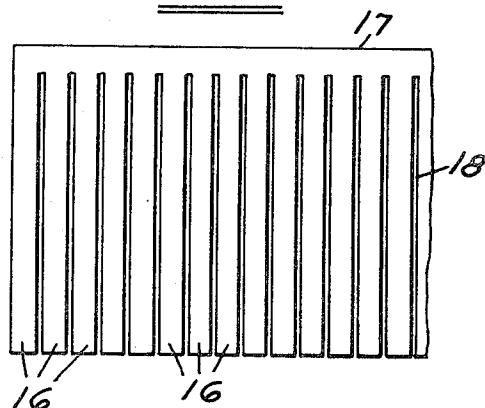


FIG. 4

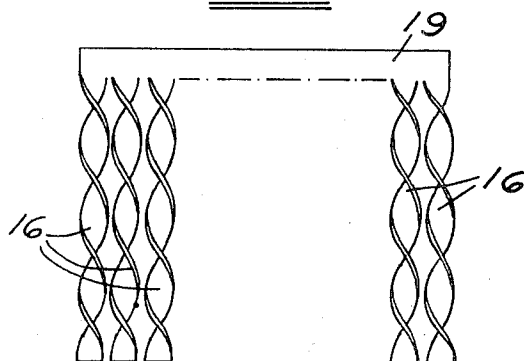
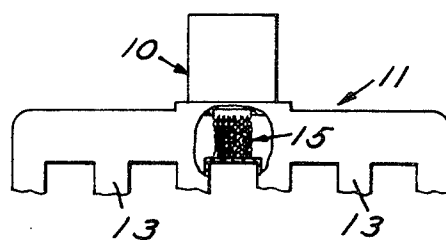


FIG. 5



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INTAKE MANIFOLD FUEL SYSTEM

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation of applicants' application Ser. No. 858,730, of the same title, filed on Sept. 17, 1969, and now abandoned.

This invention relates to fuel systems for internal combustion engines.

BACKGROUND OF THE INVENTION

In the presently-used systems, several basic problems have become generally accepted as necessary evils. The most obvious of these problems is the passage of totally-liquid fuels along the walls of the carburetor and intake manifold, and finally into the firing chamber. Aside from the substantial waste of fuel involved, a primary condition of concern is the production of carbon monoxide, a direct result of incomplete combustion. Carbon monoxide is rapidly becoming a primary menace to the public health in many larger cities.

An additional problem is the result of the ineffectual manifold systems presently employed. Improper mixing of the fuel and air creates a problem in that the high-octane fuel particles tend to go to the most remote branches of the manifold and are not inclined to enter the short-range, or central branches of the manifold which are nearest the carburetor outlet, due largely to the inertial effect of the heavy tetraethyl lead contained in the fuel; consequently, and "overdose" of the tetraethyl lead is required to prevent detonation in the central cylinders. Consequently, the consumer is required to use costlier fuel, and the exhaust emissions contain almost lethal quantities of metallic lead.

Yet another area of the present systems which requires improvement is the idling system. The choked condition of the present systems during the idle period accelerates the production of carbon monoxide, especially in slow-moving urban traffic.

In searching the prior art of the categorical areas which include carburetion and manifolding, it was found that several persons had received patents on inventions which had the same basic objectives; that is, they indicated an appreciation of some of the problems inherent in the present-day carburetion-manifolding systems. Specifically, three such inventors realized the problems arising from either wall surface flow of liquid fuel, or from poor atomization of such liquid fuel.

Reference is being made to these three prior inventions only to further show the advantages offered by this invention; it should be noted that each system described has improved one condition at the cost of another of equal importance.

First reference is made to U.S. Pat. No. 1,012,380, which comprised a substantial number of baffled passages which serve to break up fuel particles and effect a more complete fuel-air dispersion. However, in introducing such a large number of surfaces parallel to the flow of the mixture, a boundary flow problem of substantial magnitude is created.

U.S. Pat. No. 2,072,353 depicts a system wherein the flow is carried from the walls of the carburetor throat to a central location in the manifold body. Since the object of the invention is a "dumping" technique, in that the fuel is gathered in this central area of the manifold, a problem is automatically created by virtue of the tendency of leaded fuel particles to travel beyond proximate branchlines due to inertia of the particles. Conse-

quently, the purpose of the device is defeated in the manifold area; prior to the entry of the mixture into the firing chambers.

The third reference is U.S. Pat. No. 2,384,681. A brief study of the flow pattern of this last patent being referred to indicates an obvious tendency for the unit to centrifuge the fuel mixture and actually magnify the problem of boundary flow. Rotation of the mixture prior to entry into the firing chamber is, in itself, substantially ineffective in providing suitable atomizing functions, and cannot be considered comparable, in any way, to this invention or that of U.S. Pat. No. 1,012,380, to which previous reference was made, in providing a generally homogenous mixture.

Accordingly, the prime object of this invention is to provide a system having more efficient combustion; this being the result of the introduction to the firing chamber of a perfectly homogenous fuel mixture. More specifically, an object of this invention is the production of such a homogenous mixture.

A further object of this invention is to provide not only fuel economy as a result of leaner mixing, but also the significant reduction of carbon monoxide, particulate hydrocarbons and metallic lead in the emitted exhausts.

A further object of this invention is to provide a system having the variable-circuit function to comply with the various functions experienced in carburetion; some of these functions being choked or semi-choked operation, acceleration, deceleration, high speed and idling operations.

Further objects of this invention are the provision of a low-cost system; a system which will require a minimum of service and which will provide a maximum life-span; a system which will provide improved fuel economy by facilitating the use of a leaner mixture, and by also facilitating the use of lower octane rated, and consequently less expensive, fuels.

SUMMARY OF THE INVENTION

A fuel system for internal combustion engines comprising a manifold having an inlet passage for fuel mixture and a plurality of outlet passages to the cylinders of the engine. A fuel mixture distributing device is provided adjacent the inlet passage and comprises a plurality of closely packed sinuous members defining a plurality of generally axially extending twisted passages which are laterally intercommunicating.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary sectional view of a system embodying the invention.

FIG. 2 is a fragmentary sectional view taken along the line 2-2 in FIG. 1.

FIG. 3 is a plan view of a blank utilized in forming a portion of the device utilized in the invention.

FIG. 4 shows an intermediate step in the forming of the device.

FIG. 5 is a diagrammatic view showing the fuel system embodying the invention.

DESCRIPTION

Referring to FIG. 5, the system embodying the invention comprises a carburetor 10 that is adapted to direct a fuel mixture to a manifold 11 through an inlet passage 12. In turn the manifold 11 directs the fuel mixture to a plurality of outlet passages 13 for supplying the vari-

ous cylinders of the internal combustion engine in accordance with conventional practice.

Referring to FIG. 1, in accordance with the invention a fuel mixture distributing device 15 is provided at the inlet passage. The device comprises a plurality of closely spaced generally parallel members 16 which are twisted. The members thus define spiral paths. The paths are laterally interconnected so that intercommunication is provided between the paths.

Referring to FIGS. 3 and 4, the device 15 is preferably made from a blank 17 which is provided with slits 18 to form the axially extending member 16. The members are then twisted as shown in FIG. 4 in the same direction and at the same pitch. The blank is then spirally wound as viewed in FIG. 2. The portion 19 of the blank which supports the member 16 is adapted to be received in the passage 12.

In operation, the fuel mixture passage from the carburetor is directed through the plurality of sinuous or twisted paths defined by the members. This produces a swirling motion to the fuel mixture, different portions of the mixture being provided with separate swirling action. Since the passages defined by the members are laterally intercommunicating, the paths through which the fuel mixture moves are not uniform and a turbulence is achieved throughout the entire device. As a result, separate drops of fuel from the carburetor are unable to follow any individual swirl pattern due to their momentum. The drops of fuel are therefore exposed to various fuel paths and because of the high turbulence the drops are broken up into even smaller fuel drops, and finally are evaporated.

With the increased turbulence and evaporation a more uniform fuel-to-air mixture exists and is directed throughout the manifold. As a result, there is a lesser tendency toward rich mixture in the end cylinders as occurs with conventional fuel systems. Further, a more equal air-to-fuel ratio will exist in each cylinder.

With such better distribution to each cylinder the air-fuel ratio can be adjusted for complete combustion rather than compromising the adjustment for conditions that are not uniform. Finally, with better combustion brought about by the uniform distribution of fuel, the engine will produce less undesirable contaminants such as carbon monoxide.

The following tables illustrate the desired results that have been achieved with the fuel system embodying the invention.

TABLE I

	Without Generator	With Generator
35MPH. 1700RPM.		
B.H.P.	5.05	5.43
FUEL		
LBS/HR.	11.53	9.45
FUEL		
LBS/B.H.P. HR.	2.28	1.74
THERMAL		
EFFICIENCY %	5.50	7.20
COOLING		
LOSS %	31.19	43.75
MAN.FOLD VACUUM		
INCHES OF Hg.	17.40	16.85
EXHAUST DEG.		
TEMP. F.	891	1020
EXHAUST		
GAS		
CO ₂	% VOLUME	% VOLUME
	8.70	13.00
O ₂	0.30	0.65
N ₂	83.30	85.15
CO	7.70	1.20
	CO RATIO	FUEL RATIO
I/II	6.42:1	1.31:1

TABLE II

	Without Generator	With Generator
35MPH. 1700RPM.		
B.H.P.	18.00	17.26
FUEL		
LBS/HR.	14.88	13.60
FUEL		
LBS/B.H.P. HR.	0.825	0.790
THERMAL		
EFFICIENCY %	15.19	15.90
COOLING		
LOSS %	33.80	36.25
MANIFOLD VAC.		
INS. Hg.	11.25	10.45
EXHAUST TEMP.		
DEG. F.	1174	1200
EXHAUST		
GAS		% VOLUME
CO ₂	12.50	13.20
O ₂	0.50	1.80
N ₂	85.80	84.95
CO	1.20	0.05
	CO RATIO	FUEL RATIO
I/II	24:1	1.04:1

TABLE III

	Without Generator	With Generator
35MPH. 1700 RPM.		
B.H.P.	37.20	36.48
FUEL		
LBS/HR.	26.88	27.25
FUEL		
LBS/B.H.P. HR.	0.724	0.747
THERMAL		
EFFICIENCY %	17.32	16.78
COOLING		
LOSS %	22.75	22.20
MANIFOLD VAC.		
INS. Hg.	1.17	1.11
EXHAUST TEMP.		
DEG. F.	1315	1315
EXHAUST		
GAS		% Volume
CO ₂	10.90	10.80
O ₂	0.40	0.40
N ₂	85.60	85.50
CO	3.10	3.30
	CO RATIOS	FUEL RATIOS
I/III	62:1	1.13:1
II/III	66:1	1.17:1

We claim:

1. In an intake manifold having an inlet passage for a fuel mixture and a plurality of outlet passages, a fuel mixture distributing device mounted adjacent said inlet passage and extending in the direction toward said outlet passages, said device comprising a plurality of generally parallel closely spaced sinuous members in lateral side-by-side relation defining a plurality of radially spaced generally axially extending twisted paths, said paths being non-uniform but laterally intercommunicating whereby a fuel mixture flowing axially through said device is caused to move through a plurality of laterally spaced interconnected axially extending non-uniform paths to effect turbulence of the fuel mixture and whereby droplets of fuel mixture are prevented from moving through the device along the walls of a manifold, said members being made from a spirally wound single piece comprising a plurality of parallel slits defining each said member, each said member being thereafter twisted to the final form.
2. The combination set forth in claim 1 wherein the ends of said members remote from said inlet passage are free and unconnected.
3. The combination set forth in claim 1 wherein said members have the same pitch.
4. The combination set forth in claim 1 wherein each said member is twisted in the same direction.

5. For use in an intake manifold having an inlet passage for a fuel mixture and a plurality of outlet passages,

a generally circular fuel mixture distributing device having its inlet mounted adjacent said inlet passage and having a large portion extending into the manifold,

said device comprising a plurality of generally parallel closely radially spaced sinuous members in lateral side-by-side relation defining a plurality of generally axially extending twisted paths,

said paths being laterally intercommunicating whereby a fuel mixture flowing axially through said device is caused to move through a plurality of laterally spaced interconnected axially extending non-uniform paths to effect turbulence of the fuel mixture and whereby droplets of fuel mixture are prevented from moving along the outside of the device and along the walls of a manifold,

said members being made from a spirally wound single piece comprising a plurality of parallel slits defining each said member,

each said member being thereafter twisted to the final form.

6. The combination set forth in claim 5 wherein the ends of said members remote from said inlet passage are free and unconnected.

7. The combination set forth in claim 5 wherein said

members have the same pitch.

8. The combination set forth in claim 5 wherein each said member is twisted in the same direction.

9. For use in an intake manifold having an inlet passage for a fuel mixture and a plurality of outlet passages,

a generally circular fuel mixture distributing device having its inlet mounted adjacent said inlet passage and having a large portion extending into the manifold,

said device comprising a plurality of parallel closely radially spaced sinuous members in lateral closely spaced side-by-side relation adapted to fill substantially the entire area of said inlet passage and defining a plurality of axially extending twisted paths,

said paths being laterally intercommunicating and the spaces between adjacent sinuous members being unrestricted in an axial direction throughout the lengths of said sinuous members whereby a fuel mixture flowing axially through said device is caused to move through a plurality of laterally spaced interconnected axially extending non-uniform paths to effect turbulence of the fuel mixture and whereby droplets of fuel mixture are prevented from moving along the outside of the device and along the walls of a manifold.

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