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METHOD AND MEANS FOR HOMOGENIZING FLUID FUEL MIXTURES

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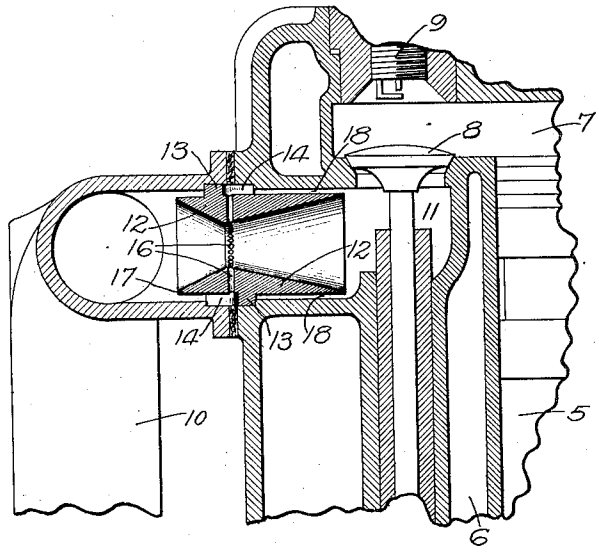


FIG. 1

FIG. 2

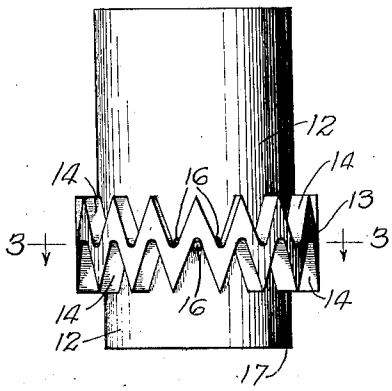
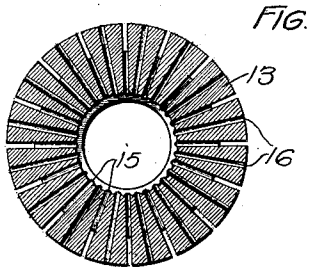


FIG. 3



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METHOD AND MEANS FOR HOMOGENIZING FLUID-FUEL MIXTURES.

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This invention relates to the handling of a combustible fluid fuel mixture and contemplates breaking up and atomizing the liquid relatively non-volatile portions thereof and so commingling the atomized portions with the air and other ingredients of the mixture that a thoroughly homogenized mixture will result which will be most efficient and effective for use.

While my present invention is capable of many uses where homogeneous fuel mixtures are desired, such for instance as liquid fuel burners and gas burners designed for various purposes, I have illustrated it herein in conjunction with an internal combustion engine where it is hightly effective and desirable.

It is well recognized that the low grades of fuel now employed for automotive and other purposes contain a large percentage of relatively non-volatile constituents, commonly called the "heavier ends" of the fuel and which not only are incapable of being completely atomized by the action of the carbureter, but also have a tendency to condense and collect upon the walls of the fuel mixture passage or manifold, as it is commonly termed enroute between the carbureter and the engine cylinders.

It has heretofore been proposed to intercept the flowing stream of fuel mixture or a portion of such stream so as to cause the deposit, condensation and collection of the heavier liquid portions of the mixture and to then deliver the collected condensates into the stream of flowing mixture with a view of thereby re-atomizing these condensed liquid portions which were intercepted from the flowing stream of mixture.

When such a method is followed, the effect of the partial atomization of these heavier liquid particles by the carbureter is lost for the reason that the partially atomized liquid particles are brought together in the collector and condensed into a liquid composed almost wholly of the heavier less volatile ends of the fuel and since these heavier ends are extremely difficult to atomize even when mixed with the more volatile portions of the fuel, it follows that a liquid composed almost entirely of these heavier non-volatile ends which are intercepted from the mixture and caused to accumulate in the collector, is extremely difficult to atomize, and the attainment of a homogeneous fuel mixture for delivery is very rare.

My present invention is characterized by the fact that instead of intercepting the partially atomized heavy relatively non-volatile liquid portions from the flowing streams of mixture, condensing and collecting these particles into a mass of non-volatile liquid, as has heretofore been proposed, it contemplates utilizing or taking advantage of the partial atomization of these heavy particles effected by the carbureter and then, without causing these particles to be subsequently condensed into large globules or masses, further breaking up or atomizing the already partially atomized particles so that when finally delivered to the point of use the fuel mixture is substantially homogeneous in character with all of the liquid particles throughly broken up and atomized and mixed with a sufficient quantity of air to support instantaneous complete combustion.

In carrying my novel method into effect, I propose to increase the velocity and decrease the pressure of a portion of the flowing stream of fuel mixture, preferably the central portion thereof, which contains the least of the heavier non-volatile ends of the liquid fuel and to divide the remainder of the stream into a series of small individual streams, each consisting of air and partially atomized liquid fuel particles and then, without permitting these streams to commingle so as to allow the liquid particles to further condense and collect into a volume of non-volatile liquid, delivering these individual streams into the area of high velocity and low pressure of the undivided portion of the stream and at an angle to the direction of flow of this stream so that these partially atomized liquid fuel particles are torn apart, disintegrated and diffused throughout the stream so as to result in a thoroughly homogeneous and uniform fuel mixture.

For the purpose of facilitating an understanding of my improved method and one preferred means for carrying the same into effect, I have illustrated in the accompanying drawings one suitable apparatus by means of which my method may be practiced.

Referring to the drawings—

Fig. 1 is a fragmentary sectional view of a gas engine with my invention applied thereto;

Fig. 2 is a plan view of my Venturi tube structure; and

Fig. 3 is a sectional view on the line 3—3 of Fig. 2.

Referring to the drawings, reference character 5 indicates generally the cylinder of a gas engine surrounded by the usual water-jacket 6 and communicating at its upper end with the combustion chamber 7 into which the fuel mixture is delivered past the intake valve 8 and wherein it is fired by the spark plug 9. The fuel mixture is supplied from the carbureter (not shown) through the manifold 10 of any preferred construction, from whence it is delivered through the passage 11 into the combustion chamber.

My improved homogenizer may be mounted anywhere in the fuel mixture passage between the carbureter and the combustion chamber, but for purposes of illustration I have shown it as mounted in a position convenient for assembly at the juncture between the manifold and the engine block.

The homogenizer itself consists of a Venturi tube designated generally by reference character 12 provided on its perimeter with a circumferential flange 13 adapted to fit in the groove formed at the juncture of the manifold and the engine block, this flange being of generally serrated form, providing converging, deflecting or diverting surfaces 14 extending both forwardly and rearwardly from the medial portion of the flange. At the inner apices of these forwardly and rearwardly opening converging passages formed in the zigzag-shaped flange, there are formed radially extending ducts or passages 15 establishing communication between these channels and the throat of the venturi. It will be observed that in the form shown the ducts 15 opening from the channels which extend toward the delivery end of the tube alternate with the ducts 16 which communicate with the channels opening toward the intake end of the tube and that all of the ducts 15 and 16 are disposed in the same diametrical plane. It should be understood, however, that the ducts and channels may be otherwise shaped and arranged within the purview of my invention.

The method of handling the fuel mixture in accordance with my invention is substantially as follows: The mixture of liquid fuel and air produced by the carbureter is drawn through the mixture passage to the cylinders and during its travel through the passage the heavier and only partially atomized fuel particles tend to gravitate toward the perimeter of the flowing stream because of the reduced speed of the marginal portion of the stream resulting from the friction of the surrounding passage walls. As the stream approaches the Venturi tube, the projecting annular edge 17 of the tube divides the stream into a central portion which is drawn through the throat of the tube and a circumferential marginal portion disposed outside the projection 17. This marginal portion is then further divided by the inclined faces 14 of the flange 13 into a series of separate streams, each of which is deflected toward and into its duct 16 through which it is discharged into the throat of the venturi at substantially right angles to the direction of flow of the central portion of the stream therethrough and in the area of high velocity and low pressure of the venturi. By dividing the marginal portion of the stream into a series of separate streams the partially atomized liquid particles of the mixture are prevented from coming together and condensing into large globules or masses of relatively non-volatile liquid, but on the other hand, these particles are diverted with a considerable quantity of air into the ducts 16 by which they are discharged into the throat of the venturi where they are disintegrated by the rapidly traveling central portion of the stream passing through this throat and are dissipated throughout the stream to produce a homogeneous finely atomized mixture.

Should any of the liquid particles fail to be sufficiently atomized upon their delivery from the venturi they will be drawn back in the passage 18 surrounding the venturi and into the ducts 12 by which they will be again discharged into the throat of the venturi for further homogenizing action.

It will be apparent, therefore, that by this invention I am able to thoroughly break up, atomize and homogenize the fuel mixture, and that this effect is secured by utilizing whatever atomizing action has been produced by the carbureter and supplementing this action by my invention without losing the atomizing effect of the carbureter as is done in those devices which intercept, condense and collect into a mass those heavier liquid particles which have been only partially atomized by the carbureter.

I claim:

1. The method of homogenizing a fluid fuel mixture, which consists in dividing a stream of flowing mixture into a plurality of individual streams, redividing one of said streams while preventing collection of the liquid particles contained therein, and delivering certain of said streams into another of the streams at an angle to the direction of flow thereof, whereby to commingle all of said streams into a homogeneous mixture.

2. The method of homogenizing a fluid fuel mixture, which consists in dividing the circumferential marginal portion of a stream of flowing mixture into a plurality of individual streams, preventing co-mingling of said individual streams increasing the velocity of the central undivided portion of said stream, and delivering said individual streams into said central stream at

the point of high velocity thereof at substantially right angles to the direction of flow of said central stream.

3. The method of homogenizing a fluid fuel mixture, which consists in dividing the circumferential marginal portion of a stream of flowing mixture into a plurality of individual streams, preventing condensation of the liquid particles of said individual streams, and discharging said individual streams into the central undivided portion of said stream at substantially right angles to the direction of travel of said central portion.

4. The method of homogenizing a fluid fuel mixture, which consists in diverting the circumferential portion of a flowing mixture stream into a plurality of individual streams, preventing accumulation of condensed liquid particles of the mixture in said individual streams, increasing the velocity of the central undivided portion of said stream, and delivering said individual streams at an angle into said undivided central portion in said area of increased velocity.

5. The method of homogenizing a fluid fuel mixture comprising, separating the marginal portions of a fuel stream, reintroducing said marginal portions into said fuel stream under high velocity, collecting any relatively unatomized particles thereafter separated from said stream and reintroducing said particles into said fuel stream.

6. The method of homogenizing a fluid fuel mixture comprising, separating the marginal portions of a fuel stream, reintroducing said marginal portions into the center portion of said fuel stream under reatomizing conditions, thereafter separating relatively unatomized fuel particles from said stream and reintroducing said particles into said fuel stream.

7. The method of homogenizing a fluid fuel mixture comprising, separating the marginal portions of a fuel stream, reintroducing said marginal portions into the center portion of said fuel stream under reatomizing conditions, thereafter separating relatively unatomized fuel particles from said stream and reintroducing said fuel particles into the center portions of said fuel stream under reatomizing conditions.

8. The method of homogenizing a fluid fuel mixture comprising, separating the marginal portions of a fuel stream in a plurality of distinct paths, reintroducing said marginal portions into said fuel stream under high velocity and in a plurality of distinct paths, collecting any relatively unatomized fuel particles thereafter separated from said stream and reintroducing said particles into said fuel stream.

9. The method of homogenizing a fluid fuel mixture comprising, separating the marginal portions of a fuel stream, reintroducing said marginal portions into said fuel stream under high velocity, collecting any relatively unatomized fuel particles thereafter separated from said stream in a plurality of distinct paths and reintroducing said particles into said fuel stream in a plurality of distinct paths.

10. The method of homogenizing a fluid fuel mixture comprising, separating the marginal portions of a fuel stream in a plurality of distinct paths, reintroducing said marginal portions into said fuel stream under high velocity and in a plurality of distinct paths, collecting any relatively unatomized fuel particles thereafter separated from said stream in a plurality of distinct paths, and reintroducing said particles into said fuel stream in a plurality of distinct paths and at a point of high velocity of said fuel stream.

11. The method of homogenizing a fluid fuel mixture comprising, dividing the marginal portions of a fuel stream therefrom, increasing the velocity of the resultant portion of said stream, reintroducing said marginal portions into said stream at the point of increased velocity, thereafter dividing out any relatively unatomized particles from said stream beyond the particles of high velocity and reintroducing said particles into high velocity area.

12. A device for homogenizing a fluid fuel mixture, comprising a Venturi tube adapted to be disposed within a fuel mixture passage and provided with means for dividing the marginal portion of a mixture stream flowing through said passage into a plurality of individual streams, and means for separately directing each of said streams into the throat of said venturi where the streams are commingled with the mixture flowing therethrough.

13. The combination with a fluid fuel mixture passage, of a Venturi tube disposed therein and provided on its periphery with means for dividing the marginal portion of a flowing mixture stream into a series of individual streams and also provided with passages through which said individual streams are delivered into the throat of said venturi.

14. A liquid fuel homogenizer, comprising a Venturi tube adapted to be disposed in a mixture passage, said tube being provided on its periphery with a circumferential sinuous flange and having conduits establishing communication between the inner apices of said flange and the throat of said venturi.

15. A fluid fuel homogenizer, comprising a Venturi tube adapted to be disposed within a fuel mixture passage, said tube being provided on its periphery with a zigzag-shaped circumferential flange and having in its

walls openings establishing communication between the inner apices of said flange and the throat of said venturi.

16. A fluid fuel homogenizer, comprising a Venturi tube provided on its periphery with deflecting surfaces adapted to divide the flowing mixture stream without intercepting the same, and having ducts for delivering the divided portion of the mixture into the throat of the venturi at substantially right angles to the direction of flow therethrough.

17. A homogenizer, comprising a Venturi tube provided on its periphery with a circumferential flange having converging, deflecting surfaces terminating in ducts communicating with the throat of the venturi.

18. A fuel homogenizer, comprising a Venturi tube provided with a circumferential flange shaped to provide forwardly and rearwardly disposed converging deflecting surfaces, and ducts leading from the point of convergence of both said front and rear surfaces to the throat of the venturi.

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