Oct. 14, 1941. C. E. UPPERMAN 2,259,014

FUEL AND AIR MIXING DEVICE

Filed April 10, 1940

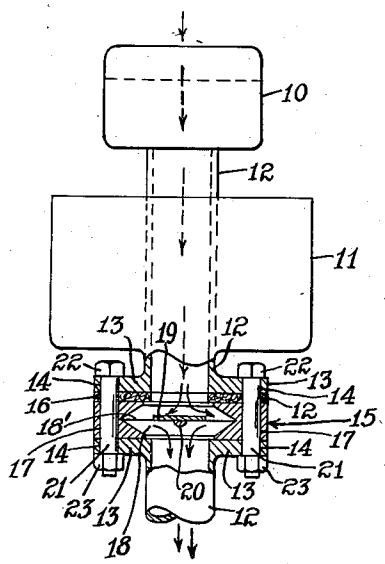

Fig. 1.

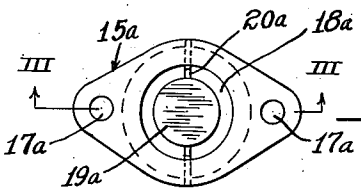

Fig. 2.

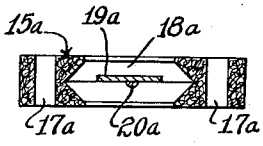

Fig. 3.

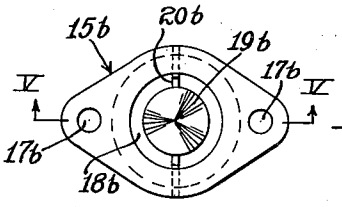

Fig. 4.

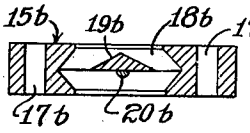

Fig. 5.

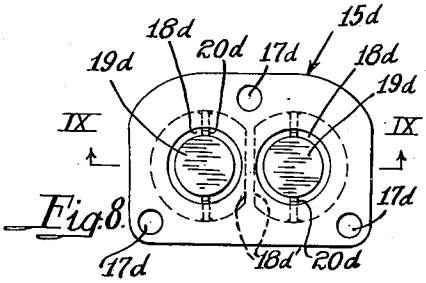

Fig. 8.

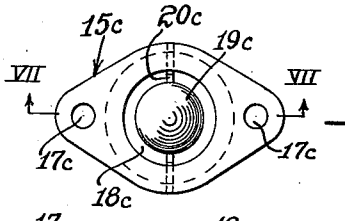

Fig. 6.

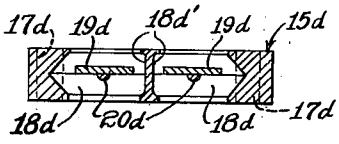

Fig. 9.

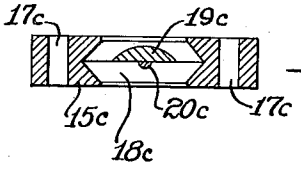

Fig. 7.

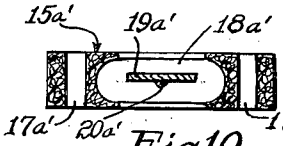

Fig. 10.

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His Attorneys

Patented Oct. 14, 1941 2,259,014

UNITED STATES PATENT OFFICE

2,259,014

FUEL AND AIR MIXING DEVICE

Clyde E. Upperman, Pittsburgh, Pa.

Application April 10, 1940, Serial No. 328,893

5 Claims. (Cl. 48—180)

My present invention relates to a device for mixing fuel, such as gasoline, and air prior to the introduction of the mixture of the two into the cylinders of an internal combustion engine; more particularly, the invention concerns a simple insert without moving parts which is adapted to be interposed between the carburetor and the intake manifold of such an engine for the purposes herein set forth.

It has long been known that, as conventionally constructed, the mixture of gasoline and air supplied to the cylinders of an internal combustion engine is far from complete and uniform, with the result that decreased efficiency is encountered, together with an increase in maintenance costs. A number of attempts have been made to ensure the supplying of a more uniform mixture and, although numerous proposals have been made, no satisfactory solution of the problem has so far been advanced, and certainly none has been adopted. Some of the prior proposals have involved the introduction of a conical member into the pipe leading from the carbureter to the intake manifold in conjunction with the production of a Venturi effect. So far as I am aware, such proposals have not met with success and any theoretical advantage which might be expected to arise has not been realized. Other proposals for producing a better mixture have resided in such expedients as the use of heat for preheating or vaporizing purposes but such have likewise not produced benefits which would justify their retention or general use. The use of devices containing conical obstructions has itself created another difficulty, namely, "vapor lock," this resulting primarily from inadequate insulation of the carbureter against access of heat.

For these and other reasons, automobile and engine manufacturers have not, so far as I am aware, incorporated in their products any device or accessory capable of accomplishing the present objects.

It is accordingly one of the main objects of the present invention to provide a fuel and air mixing device adapted to be inserted in the pipe leading from the carbureter to the intake manifold of an internal combustion engine which shall have none of the defects and disadvantages of prior devices and which shall have new and useful features and advantages peculiar to itself.

Another object of the invention resides in the provision of a simple insert free from moving parts and adapted to be introduced into the pipe leading from the carbureter to the intake manifold of an internal combustion engine and which is so constructed and designed as not only to produce new and hitherto unobtained thoroughness and uniformity of mixture but which also prevents vapor lock.

Another object of the invention resides in the provision of a mixing device for producing internal combustion engine mixtures which shall give the internal combustion engine new qualities of efficiency and desirability of operation.

A still further object of the invention resides in so improving the gasoline and air mixtures supplied to an internal combustion engine as to improve combustion, to decrease carbonization and waste of power, to largely eliminate knocking, to produce a highly improved idling condition, to yield new qualities of smoothness, power and acceleration, to eliminate "gas wash" and, if desired, to make it possible to employ lower test or grades of gasoline or fuel without material sacrifice of satisfactory operation.

Other and further objects and advantages will be understood by those skilled in this art or will be apparent or pointed out hereinafter.

In the accompanying drawing wherein I have illustrated certain desirable forms of my invention:

Figure 1 is an elevational view, partly diagrammatic and partly in section, illustrating the position of the present invention with respect to adjacent portions of the internal combustion engine, and also showing the manner of connecting the device to its associated parts;

Fig. 2 is a side elevational view of a preferred form of the invention which is composed of fibrous heat-insulating material, except for its disc-shaped barrier member and the mounting therefor;

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

Fig. 4 is a view similar to Fig. 2 of a modified form of the invention involving the use of a cone in place of a disc;

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

Fig. 6 is a view similar to Figs. 2 and 4 illustrating a further modification of the invention wherein a plano-convex barrier member is employed;

Fig. 7 is a sectional view taken on line VII—VII of Fig. 6;

Fig. 8 illustrates a modified form of the structure of the invention illustrated in Figs. 1 and 3 but wherein the mixing device is designed for dual carburetion;

Fig. 9 is a sectional view taken on line IX—IX of Fig. 8; and

Fig. 10 is a view similar to Fig. 3 of a further modification of the invention wherein the mixing chamber has a U-shaped peripheral portion.

Like numerals designate corresponding parts throughout the various views of the drawing.

In my studies of internal combustion engines in general, and of the fuel and air mixtures supplied to such engines in particular, I have reached the definite conclusion that there is more or less of a stratification occurring in the pipe leading from the carbureter to the intake manifold and that such stratification is one of the primary causes for the comparatively low engine efficiency and the wastefulness of its operation, particularly when using the lower grades of gasoline. It is my conviction that the relatively wet and heavy liquid and vaporized fuel components tend definitely to travel along, in contact with or close to the inner wall of the pipe or conduit and that the relatively dry, light and faster moving air tends definitely to travel down the center of such pipe or conduit. While, of course, there is a commingling of the liquid and vaporized gasoline with air to some extent, this is not only incomplete but is disadvantageously non-uniform.

As a result, the engine is not supplied with a uniform fuel mixture for combustion purposes. This has a number of effects and results, as will be understood from the present specification. Such a situation does not lend itself to smooth running nor to a good average efficiency; it particularly acts adversely when the engine is in an idling condition and in the lower throttle ranges up to about ⅜ throttle; gas wash is encountered which involves the introduction of raw, wet gasoline directly into the cylinders with well-known adverse consequences; and such conditions are unfavorable with respect to knocking. These as well as other considerations will be recognized and conceded by those skilled therein.

Since the liquid and vaporized gasoline and the air do tend to stratify and to travel as distinct entities, I have discovered that this condition can be alleviated very simply and yet very effectively by introducing my new mixing device into the pipe or conduit leading from the carbureter, which is preferably of the down-draft type, to the intake manifold. The invention is based upon the conception that thorough mixing of fuel and air and substantially complete fuel vaporization must be accomplished to give the desired results and that these results must be secured in such manner as to avoid the creation of other disadvantages such as vapor lock. My invention is also based upon the conception that the proper results cannot be secured when the mixing operation occurs at or adjacent a constricted passage or throat such as is involved in a venturi. On the contrary, my invention involves an actual increase of the effective area of the mixing chamber of the device.

Referring now to Fig. 1 of the drawing, the numeral **10** indicates a diagrammatically shown conventional air cleaner through which atmospheric air is drawn for use in forming the combustion mixture. The numeral **11** indicates a diagrammatically shown conventional carbureter of the down-draft type, although it is to be understood that my invention may be adapted for use in connection with old-style carbureters wherein an up-draft is involved. The carbureter **11** has an idling jet and a main jet and may be of any suitable type, design or construction. The arrows on Fig. 1 indicate the general direction of the air through the air cleaner and carbureter and the piping **12** forming the necessary adjuncts thereof.

The piping **12** would normally lead uninterruptedly from the bottom of the carbureter to the intake manifold (not shown) of the associated internal combustion engine (not shown). For purposes of the present invention, the pipe or conduit may be provided on each side with lugs or flanges **13** and with bolt openings **14** near the ends thereof. Between the flanges **13** a device designated as a whole by the numeral **15** and which responds to my present invention is inserted and adjacent the same and between it and the carbureter **11** is a fibre gasket or washer **16** which has heat insulating characteristics adequate to prevent undue access of heat back to the carbureter, thus preventing vapor lock.

The mixing device **15** of Fig. 1 is composed of a solid block of metal of any desired kind which is resistant to the conditions involved in the operation of an internal combustion engine, i. e., the metal should be one which is non-corrosive. I have found that such metals as brass, stainless steel and a number of other metals and alloys satisfactorily answer the necessary requirements in this respect. The block of metal is of generally elliptical shape, as will be understood by reference to Fig. 2, for example, and at each end thereof a suitable opening **17** is drilled or cut therethrough or otherwise formed therein. The block of metal is also provided with a mixing chamber **18** which, as will be noted from the sectional views, terminates in a V-shaped peripheral portion **18'**, apex outward. The shape of the mixing chamber **18** is such as, in effect, to provide a central cylindrical portion which is substantially equal to and registering with the openings in the adjacent piping **12**, and has a V-shaped annular extension so arranged as to have its apex directed outwardly. Therefore, the mixing chamber is actually an enlarged chamber, and instead of cutting down the volume of materials passing therethrough actually makes possible an increase in such volume and thus at the same time may be said to produce an anti-Venturi effect.

Disposed substantially centrally within the mixing chamber is a disc-shaped barrier member **19**. This member is maintained in position by means of a suitable support or rod **20** which traverses the mixing chamber and the ends of which are suitably mounted or embedded in the material of the block. The ends of the rod may terminate flush with the outer surface of the metal, as will be understood by a reference to Fig. 2, although this condition is not essential since the rod may terminate further inwardly just so long as it is securely held in position in such manner as to prevent rotation. The rod **20** is preferably provided with a central flattened portion on the disc side thereof, and the assembly between the disc and rod is maintained by soldering, welding, brazing or any other suitable type of connection.

The device **15**, as will be best understood from Fig. 1, is interposed between the flanges **13** and is maintained in position by means of the studs **21** which pass through the openings in the flanges and the openings in the member **15** itself. Any suitable type of fastening may, of course, be employed, and the studs **21** with their enlarged heads **22** and nuts **23** on the lower threaded ends thereof are only intended to constitute an ex-

ample of a suitable fastening means. In order to prevent vapor lock resulting from the undue access of heat to or the inadequate insulation of the carbureter, I interpose a fibre gasket or washer 24 of substantial thickness on the carbureter side of device 15 and between it and the adjacent flanges 13. This may be of any required thickness and material necessary for heat insulating purposes under the particular conditions of any given engine design. As will hereinafter be explained, I prefer, however, to make the device itself with a fibrous heat insulating body.

The disc 19 is, as will be observed, directly in the path of the fuel and air components as the same leave the carbureter, and the disc is substantially equal to the inside diameter or bore of the pipe or conduit 12. Thus, the tendency for the inspirated air to travel down the center of the pipe is definitely prevented.

In Figs. 2 and 3 I have illustrated what I have so far discovered to be the best and most effective form of the invention. In this case the mixing device 15*a* is composed of a fibrous body having heat insulating characteristics. As before, the device has a somewhat elliptical shape and has openings 17*a* formed therethrough near the ends thereof. The mixing chamber 18*a* is composed as before of a cylindrical central portion and a V-shaped peripheral portion, apex outward. The metal disc 19*a* of brass, stainless steel or any other suitable material is the same as that already described in connection with Fig. 1 and is similarly mounted, as will be noted.

In Figs. 4 and 5 I have illustrated a further modification of the invention wherein the mixing device 15*b* is made of metal but wherein the barrier member 19*b* is in the form of a cone with its apex directed toward the carbureter. In this form of the device the air impinges upon the cone and then sweeps downwardly and outwardly along the oblique surfaces of the cone, producing a good mixture of air with the wet and heavy vapors and unvaporized portions of gasoline, although I have discovered that the flat disc form of barrier member is even more efficient than a cone. The conical face is relatively flat and broad, as will be noted. The physical characteristics of the device of Figs. 4 and 5 are the same as previously described, as will be noted from the numerals employed. It will be understood, however, that in this form of the invention the body of the mixing device may be composed of heat insulating fibrous material as per Figs. 2 and 3, and that when metal is employed the fibrous heat insulating gasket or washer 16 of Fig. 1 is employed.

Figs. 6 and 7 are the same as Figs. 4 and 5, except that a plano-convex barrier member 19*c* of mixing device 15*c* replaces the cone 19*b*. I have found that this form of barrier is intermediate in effectiveness between that of the cone 19*b* and the flat disc 19*a*. The other features of this modification will be clearly understood in view of what has preceded.

Some engine designs involve so-called dual carburetion as, for example, wherein a motor block is made, in effect, like two individual motors insofar as carburetion is concerned. Such may, for example, be the case in connection with the V-types of engines which are, in effect, twin fours, twin sixes, twin eights, etc. These and other types of engines require dual carburetion for best operation, and the modification of my invention illustrated in Figs. 8 and 9 is designed for such purpose. In these figures the mixing device 15*d* is of a more nearly rectangular shape and is provided with a plurality of suitably spaced bolt or stud openings such as those indicated at 17*d*, the number and disposition of which depend upon circumstances and the design of the engine involved. The device 15*d* may be composed of a solid metal block through which the requisite openings are formed or it may be composed of heat insulating fibrous material as explained in connection with Figs. 2 and 3. There are two distinct mixing chambers 18*d* in this form of the invention, each one of which is, except for a small central lateral portion, of the same nature as the mixing chambers heretofore described in the other forms of the invention. Figs. 8 and 9 show such a flat or straight wall portion at 18*d'* which is to prevent overlapping of the mixing chambers and to make it possible to provide the chambers in a device of minimum size. Two flat discs 19*d* are employed mounted as before on transversely fixed rods 20*d*, but it is to be understood that the conical or plano-convex type of member may be alternatively employed if desired. It is also within the purview of my invention to make the device 15*d* entirely of fibrous heat insulating material.

In Fig. 10, I have illustrated a modification which is the same as that of Fig. 3 except that the mixing chamber has a U-shaped peripheral portion. In some installations this is preferred as it provides even greater space around the barrier member and thus has a still better anti-Venturi effect.

The operation of the device will be clear from what has preceded, but for convenience of summary I point out that the barrier member, whether it be a flat disc, a low cone or a plano-convex member, breaks up stratification and directs the air downwardly and outwardly so that it mixes thoroughly with the heavier, wetter and more slowly moving fuel components. This action not only causes a commingling of the components of the mixture which would otherwise tend to stratify but ensures complete vaporization of the gasoline. Thus, the mixture has better combustion properties and combustion after ignition is more complete, thus not only preventing fuel waste but materially diminishing carbonization of the engine. The fact that a uniform mixture is at all times furnished to the cylinders of the engine materially improves the idling characteristics of the engine and makes it possible to cut down the idling speed; at the same time, power and acceleration from idling position up to about ⅜ throttle is very materially enhanced, thus giving better efficiency and performance in the lower ranges of the throttle position where it is most needed. Another advantage obtained by the use of the present device is the ability to employ lower grades of fuel without materially sacrificing motor performance, and this has important economical benefits, particularly where fuel is scarce or expensive. The all-round efficiency and performance of the engine are increased, with the result that a longer trouble-free life and service can be anticipated. Repairs and maintenance are minimized and the device itself, unlike prior devices, cannot itself cause trouble since it has no moving parts. Vapor lock is prevented due to the fact that the carbureter is adequately insulated against access of heat from the engine. Gas wash is likewise prevented and thus no raw, wet, liquid gasoline can find its way into the cylinders; hence the re-

sultant ill effects of this are eliminated. Due to the fact that the mixing chamber is larger than the conduit or piping with which it communicates no constriction is caused in such mixing chamber.

The foregoing is intended primarily as illustrative and not as restrictive, and within the terms of the appended claims I may resort to such other or further additions, omissions, substitutions and modifications as will occur to those skilled in the art without departing from the principles hereof. It is to be understood that any of the forms of the invention hereinabove described may be made either of metal or of fibrous heat insulating material and that in the former case a fibrous heat insulating gasket or washer is employed on the carburetor side of the device. It is also to be understood that the single or dual form of the invention hereinabove described may employ the flat disc, the cone or the plano-convex type of member. Any such member may furthermore be provided with surface irregularities such as depressions, recesses, grooves, knurling or the like so as to ensure breaking up of any well-defined streams which may tend to exist or become created. All such are specifically deemed to be a part of this invention. Finally, while I have illustrated the rod form of support, it should be understood that any other suitable supporting means may be employed so long as the same does not act unduly to cut down the effective volumetric capacity of the mixing chamber or chambers. At the same time, the device must not act to retard movement of the mixture or the components thereof to such extent as to require change in the adjustment or design of the engine itself. Insofar as the fuel is concerned such constitutes no limitation upon the present invention which is or may be adapted for use with any of the usual fuels, e. g., gasoline, kerosene, crude oil, alcohol, benzol, etc.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A fuel and air mixing device which comprises an elliptical body member having openings therethrough for fastening purposes and provided with a central mixing chamber which has its maximum effective cross-section substantially at the center of said body member and which decreases in size symmetrically toward the inlet and outlet ends of the chamber, a baffle positioned in said mixing chamber and having at least one flat disc-like surface disposed normal to the direction of fluid flow through said chamber and means for mounting said baffle substantially at the point of greatest diameter of said chamber, the relationship between the said chamber and the said baffle being such as to produce an anti-Venturi effect.

2. A fuel and air mixing device which comprises an elliptical body member composed of fibrous heat-insulating material having openings therethrough for fastening purposes and provided with a central mixing chamber of U-shaped section which has its maximum effective cross-section substantially at the center of said body member and which decreases in size symmetrically toward the inlet and outlet ends of the chamber, a baffle positioned in said mixing chamber and having at least one flat disc-like surface disposed normal to the direction of fluid flow through said chamber and means for mounting said baffle substantially at the point of greatest diameter of said chamber, the relationship between the said chamber and the said baffle being such as to produce an anti-Venturi effect.

3. A fuel and air mixing device which comprises an elliptical body member composed of non-corrodible metal having openings therethrough for fastening purposes and provided with a central mixing chamber of V-shaped section which has its maximum effective cross-section substantially at the center of said body member and which decreases in size symmetrically toward the inlet and outlet ends of the chamber, a baffle positioned in said mixing chamber and having at least one flat disc-like surface disposed normal to the direction of fluid flow through said chamber and means for mounting said baffle substantially at the point of greatest diameter of said chamber, the relationship between the said chamber and the said baffle being such as to produce an anti-Venturi effect.

4. A fuel and air mixing device which comprises an elliptical body member capable of preventing vapor lock and having a mixing chamber therein which has its maximum effective cross-section substantially at the center of the body member and which decreases in size symmetrically toward the inlet and outlet ends of the chamber, a baffle member in the form of a flat disc disposed in said chamber and centered with respect thereto, said baffle being positioned normal to the direction of fluid flow through the chamber and means for holding said baffle in place, the construction and arrangement being such as to produce an anti-Venturi effect on fluids traversing the device.

5. A fuel and air mixing device which comprises an elliptical body member capable of preventing vapor lock and having a U-shaped mixing chamber therein which has its maximum effective cross-section substantially at the center of the body member and which decreases in size symmetrically toward the inlet and outlet ends of the chamber, a baffle member in the form of a flat disc disposed in said chamber and centered with respect thereto, said baffle being stationary, smaller than said chamber and positioned normal to the direction of fluid flow through the chamber and means for holding said baffle in place, the construction and arrangement being such as to produce an anti-Venturi effect on fluids traversing the device.

CLYDE E. UPPERMAN.