W. A. AND L. D. VAN VOORHIS.

MIXING DEVICE.

APPLICATION FILED SEPT. 29, 1920.

1,406,113.

Patented Feb. 7, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

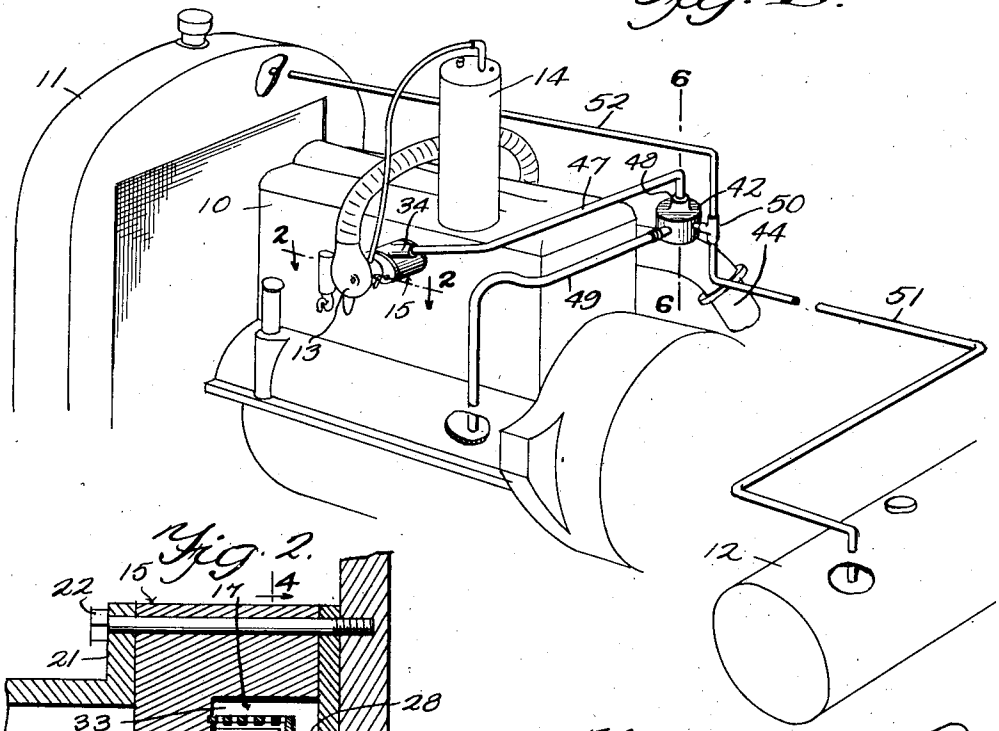


Fig. 2.

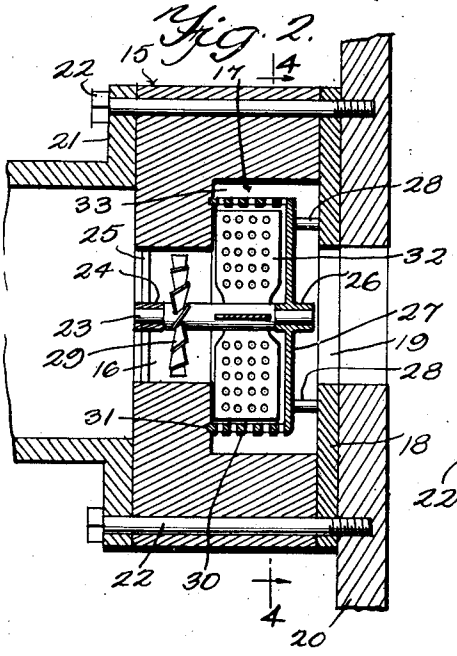
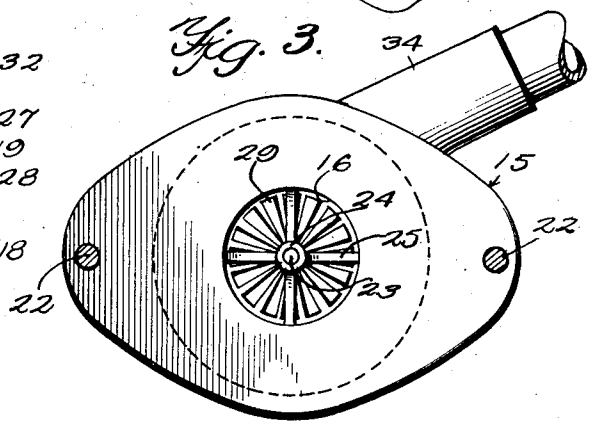


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4.

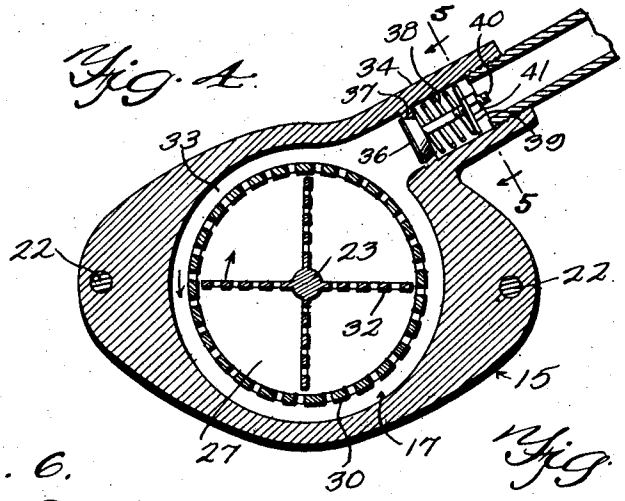


Fig. 6.

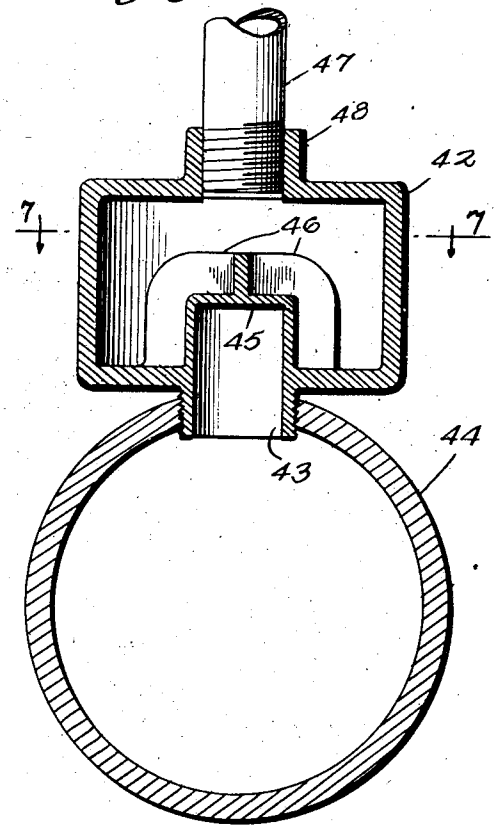


Fig. 5.

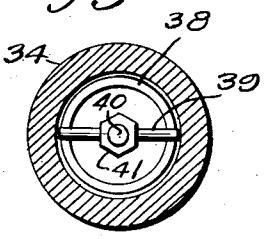
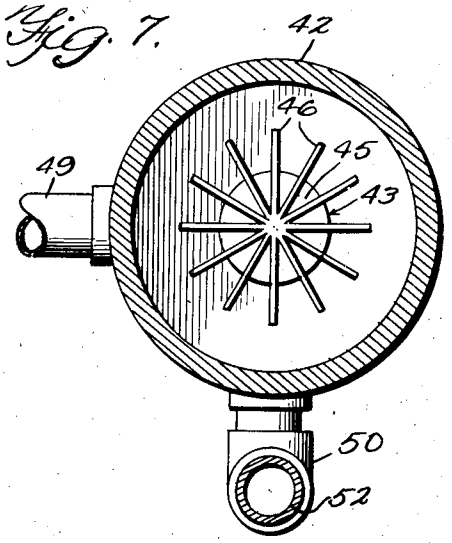


Fig. 7.



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UNITED STATES PATENT OFFICE.

WILLIS A. VAN VOORHIS AND LAWRENCE D. VAN VOORHIS, OF GRAYSVILLE, TENNESSEE.

MIXING DEVICE.

1,406,113. Specification of Letters Patent. Patented Feb. 7, 1922.

Application filed September 29, 1920. Serial No. 413,597.

To all whom it may concern:

Be it known that we, WILLIS A. VAN VOORHIS and LAWRENCE D. VAN VOORHIS, citizens of the United States, residing at Graysville, in the county of Rhea and State of Tennessee, have invented certain new and useful Improvements in Mixing Devices, of which the following is a specification.

Our invention relates to a device for atomizing, vaporizing, and mixing hydrocarbon fuel, for internal combustion engines.

An important object of the invention is to provide a device of the above mentioned character, which will properly atomize and vaporize the liquid fuel, for producing a gaseous fuel having a maximum degree of efficiency.

A further object of the invention is to provide means for introducing, in proper amounts, superheated vapors or gases, into the presence of the atomized liquid fuel, for producing a vaporized charge of high efficiency, and which will prevent to a considerable extent, deposits of carbon in the engine.

A further object of the invention is to provide a device of the above mentioned character, formed of few and simple parts, and which may be installed upon the engine without materially altering the construction thereof.

A further object of the invention is to provide means for effecting a high degree of agitation of the divided liquid fuel, for atomizing the same, and subsequently forcing the same through a foraminous surrounding element, for contact with heated gases, traveling around the foraminous element, whereby a most intimate mixture is produced, and the particles of liquid fuel completely vaporized.

A further object of the invention is to provide a device adapted for attachment to the exhaust manifold of the engine, to be heated by the hot gases therein, and adapted to receive therein liquid or vaporized fuel, and water vapor, to thoroughly vaporize and mix the same.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a perspective view of apparatus embodying our invention,

Figure 2 is a horizontal section taken on line 2—2 of Figure 1,

Figure 3 is a side elevation of the atomizing device, removed,

Figure 4 is a transverse section taken on line 4—4 of Figure 2,

Figure 5 is a similar view taken on line 5—5 of Figure 4.

Figure 6 is a vertical section taken on line 6—6 of Figure 1, and,

Figure 7 is a horizontal section taken on line 7—7 of Figure 6.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of our invention, the numeral 10 designates the cylinder blocks of an internal combustion engine of an automobile, having a radiator 11 and fuel holding tank 12, as shown. The numeral 13 designates a carburetor of any well known or preferred type, receiving liquid fuel, such as gasoline, from a vacuum feed device 14, as is customary.

Our atomizing device embodies a casing 15, having a forward propelling chamber 16 and a larger rear atomizing and vaporizing chamber 17. The chambers 16 and 17 are concentrically arranged and in free communication with each other. A plate 18, having a central opening 19, covers the rear end of the chamber 17, contacting with the casing 15. The plate 18 is arranged between the block 10, adjacent the intake manifold of the engine and the casing 15, while the flange 21 of the outlet of the carburetor, is arranged upon the opposite side of the casing 15, these parts being all securely held together by bolts 22, passing through openings therein, as clearly shown in Figure 2. This construction is advantageous, inasmuch as it provides means for rigidly and securely connecting the parts, and permitting of their proper separation, when desired.

The chambers 16 and 17 are preferably cylindrical, and a rotatable shaft 23 extends centrally therethrough, the outer end of the shaft being journaled with a bearing 24, carried by an arm 25, secured within the chamber 16, as shown. The rear end of this shaft is journaled in a bearing 26, formed centrally upon an inner imperforate plate 27, rigidly secured to spaced legs 28, which are in turn rigidly secured to the outer plate 18, as shown. The plate 27 is spaced from the plate 18, as shown. The shaft 23 may

be driven by any suitable means, but we prefer to drive the same by means of a propeller 29, rigidly secured thereto, and mounted in the chamber 16.

The numeral 30 designates a preferably cylindrical foraminous screen element, which may be formed of perforated sheet metal, wire gauze, or any suitable material. The forward edge of the screen element 30, preferably projects into an annular groove 31, while its opposite edge has a close contact with the imperforate plate 27.

Arranged within the screen element 30 is an atomizing fan 32, rigidly secured to the shaft 23, and having blades which are preferably perforated.

The screen element 30 is concentric within the chamber 17, but has a substantially smaller diameter, providing an annular or surrounding passage 33, more clearly shown in Figure 4. A tubular inlet 34 leads into a passage 33, preferably at a tangent, whereby the incoming gases rotate about the screen element 30, as indicated by arrows in Figure 4, and this direction of rotation is preferably opposite to that of the atomizing fan 32. The volume of gases passing through the tubular inlet 34 is controlled by a spring-pressed valve 36, normally held to its seat 37 by a spring 38, engaging the top of the seat. The spring engages a transverse rod 39, having a central opening to receive the stem 40 of the valve, and a nut 41 is screwed upon the stem, to adjust the rod 39 thereon, and accordingly regulate the tension of the spring 38. If desired, suitable means extending to the exterior of the inlet 34, may be provided to regulate the tension of this spring. The function of the valve 36 is to control the volume of superheated vapors, to be described, which are supplied into the passage 33.

The numeral 42, Figures 1, 6 and 7, designates a heating or vaporizing casing, having a central tubular portion 43, projecting above and below the bottom thereof. This tubular portion has its lower end screw-threaded into the exhaust manifold 44 of the engine, and the lower end of the tubular portion is open, while the upper end is closed, as shown at 45. Heat radiating fins 46 are formed in the casing 42, and are disposed radially about the tubular portion 43, as shown. As more clearly shown in Figure 1, a pipe 47 leads into the top of the casing 42, through a nipple 48, and this pipe extends into the tubular inlet 34. A breathing or air supply pipe 49 extends into the side of the casing 42, Figure 7, and preferably leads into the crank case of the engine, Figure 1. A T-coupling 50 leads into the casing 42, Figures 1 and 7, and a liquid fuel or vapor supply pipe 51, is connected with the lower end of this coupling, and leads to the fuel supply tank 12. A vapor or water supply pipe 52, is connected with the upper end of the T-coupling 50, and leads into the upper portion of the radiator casing, to receive water or water vapor therefrom.

The operation of the apparatus is as follows:

When the engine is running, the suction in the intake manifold is transmitted to and through the casing 15 to the carburetor 13, and the charge is drawn from the carburetor into the chambers 16 and 17, The charge passes through the chamber 16, rotates the propeller 29, which rotates the atomizing fan 32, at a suitable speed. The charge from the carburetor, consisting of air laden with particles of liquid fuel, pass into the interior of the screen element 30, and are there subjected to the violent agitation or beating section of the perforated fan blades. This serves to atomize the particles of liquid fuel, and more intimately mix them with the air. The imperforate plate 27 prevents the escape of the charge from proximity to the revolving fan 32, and hence the atomizing action is prolonged, the gaseous mixture being finally forced through the strainer element 30, and entering the passage 33. By passing through the strainer element, a further atomizing action is obtained. When the gaseous mixture thus treated, passes radially into the passage 33, it is met by the circularly traveling superheated gases, passing from the inlet 34. This superheated gas contains proper amounts of heated and vaporized liquid fuel, such as gasoline, water and air, which mixture is effected in the casing 42. The superheated gas is drawn into the passage 33 by the suction therein, serving to unseat the valve 36. The atomized charge and superheated gas become intimately mixed at the exterior of the screen element 30, and are drawn laterally from proximity thereto, through opening 19, and through the intake manifold of the engine, to be distributed to the several cylinders.

It is to be understood that the form of our invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of our invention, or the scope of the subjoined claims.

Having thus described our invention, we claim:—

1. In a device of the character described, a casing for connection between the carburetor and intake manifold of an internal combustion engine, having a propeller chamber and an atomizing chamber in communication with each other, a surrounding screen element disposed within the atomizing chamber and spaced from the side thereof for

forming a passage surrounding the screen element, an imperforate plate closing one side of the screen element, a fan rotatable within the screen element, a propeller within the propeller chamber and driving the fan, and separate means for introducing gases into the passage.

2. In a device of the character described, a casing for connection between the carburetor and intake manifold of an internal combustion engine, having an atomizing chamber for receiving gases from the carburetor, a surrounding screen element disposed within the chamber and spaced from the side wall thereof for providing a surrounding passage, a fan rotatable within the chamber, means to drive the fan, an imperforate plate closing one side of the chamber, and separate means for introducing gases into said passage.

3. In a device of the character described, a casing for connection between the carburetor and intake manifold of an internal combustion engine, having an atomizing chamber for receiving gases from the carburetor, a surrounding screen element disposed within the chamber and spaced from the side wall thereof for providing a surrounding passage, a plate closing one side of the screen element, a fan rotatable within the screen element, means to drive the fan, and a separate gas inlet conduit leading into said passage at substantially a tangent thereto.

4. In a device of the character described, a casing, having a forward small chamber and a rear large chamber arranged in end to end relation, a tubular screening element arranged within the large chamber and surrounding the outlet end of the small chamber and spaced from the side wall of the large chamber for providing a surrounding passage, a plate covering the rear side of the screening element, a rotatable fan within the screening element, and means to drive the fan.

5. In a device of the character described, a casing having a forward small chamber and a rear large chamber arranged in end to end relation and providing a shoulder, a tubular screen element arranged within the large chamber and engaging the shoulder and spaced from the side wall of the large chamber, to form a surrounding passage about the screen element, an imperforate plate closing the opposite side of the screen element, a fan rotatable within the screen element, and a plate connected with one side of the casing and serving to carry the imperforate plate.

6. In a device of the character described, a casing having a forward small chamber and a rear large chamber in communication with each other, the large chamber providing a shoulder, a tubular screen element arranged within the large chamber and spaced therefrom to form a passage surrounding the screen element, a plate covering the opposite side of the screen element, and a rotatable fan arranged within the screen element.

7. In a device of the character described, a casing having a chamber and an opening leading therein, a screen element arranged within the chamber and surrounding the outlet of the opening, a plate closing one side of the screen element, a fan rotatable within the screen element, a second plate secured to one end of the casing and having an opening, and spaced elements connecting said plates.

8. In a device of the character described, a casing, a tubular screen element arranged within the casing in spaced relation to form a passage extending about the screen element, means to supply a gaseous charge into the screen element, means to agitate the charge therein, and means for supplying a heated gaseous charge into said passage.

9. In a device of the character described, a casing connected with the exhaust pipe of an internal combustion engine, a pipe connected with the casing and leading to the radiator of the automobile, a pipe connected with the casing and leading to the fuel tank, an atomizing casing, a tubular screen therein and forming with the casing a surrounding passage, a pipe connecting the passage and the first named casing, a rotatable fan within the screening element, and means for supplying a gaseous charge to the atomizing casing.

In testimony whereof we affix our signatures.

WILLIS A. VAN VOORHIS.
LAWRENCE D. VAN VOORHIS.