Feb. 12, 1929. 1,701,607

W. C. BRINTON, JR

MIXING DEVICE

Filed March 2, 1926

FIG. 4.

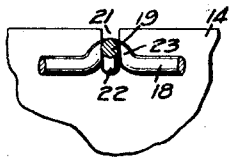
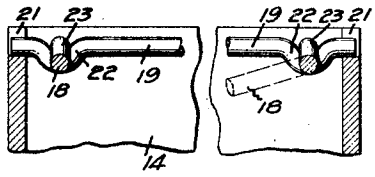


FIG. 5.



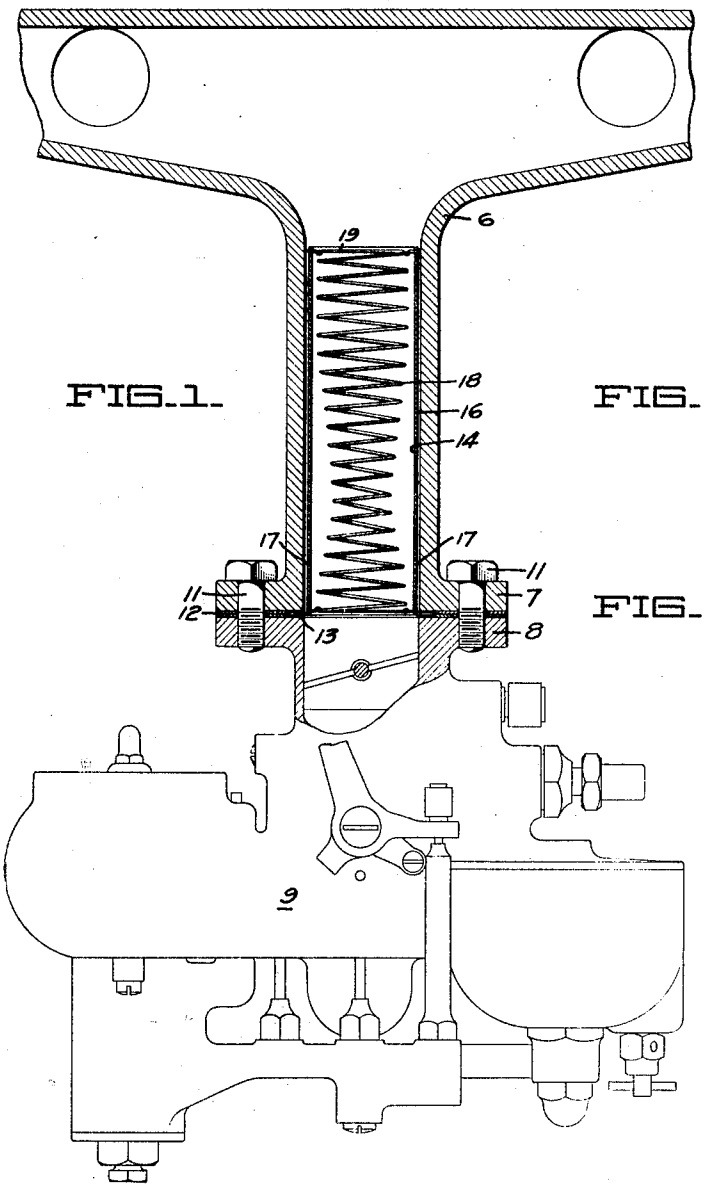


FIG. 1.

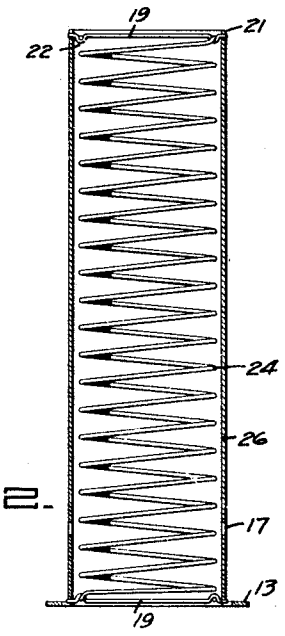
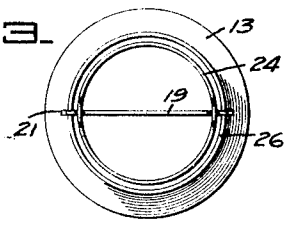


FIG. 2.

FIG. 3.



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Patented Feb. 12, 1929. 1,701,607

UNITED STATES PATENT OFFICE.

WILLIAM C. BRINTON, JR., OF LARKSPUR, CALIFORNIA.

MIXING DEVICE.

Application filed March 2, 1926. Serial No. 91,673.

My invention relates to means for assisting in mixing fuel which is mixed with air to form a combustible mixture, such as is used in internal combustion engines, and relates especially to means for mechanically agitating such combustible mixture after it has left the carbureter of an engine.

An object of the invention is to provide means for maintaining or placing in a vaporized condition the combustible mixture in the intake manifold of an internal combustion engine.

Another object of my invention is to provide means actuated by the vibration of an internal combustion engine and by the pulsation in the flow of fluid thru the intake manifold thereof for agitating the combustible mixture in the manifold.

A further object of my invention is to provide a means for agitating the combustible mixture in the intake manifold of an internal combustion engine which does not materially restrict the area of the manifold.

An additional object of my invention is to provide means for producing turbulence of the combustible mixture flowing in the intake manifold of an internal combustion engine.

The invention possesses other advantageous features, some of which with the foregoing will be set forth at length in the following description where I shall outline in full that form of the mixing device of my invention which I have selected for illustration in the drawings accompanying and forming part of the present specification. In said drawings I have shown one form of mixing device embodying my invention, but it is to be understood that I do not limit myself to such form since the invention, as set forth in the claims, may be embodied in a plurality of forms.

In the drawings:

Fig. 1 is a cross section of a portion of the intake manifold of an internal combustion engine showing one form of my mixing device installed therein.

Fig. 2 is a cross section of a modified form of my mixing device which is designed to be inserted in an intake manifold in the manner disclosed in Fig. 1.

Fig. 3 is an end view of the mixing device shown in Fig. 2.

Fig. 4 is an enlarged detail of the means for supporting the spring in the shell.

Fig. 5 is an enlarged cross sectional view of the shell showing the spring supporting means.

The mixture of fuel and air leaving the carbureter of an internal combustion engine, although sometimes nearly as uniform as a gas, is more often but an association of fuel globules with air and is not possessed of the homogeneous characteristics of a good combustible mixture. As it leaves the carbureter, the mixture is inducted thru the intake manifold where it comes into contact with cold and, usually, rough manifold walls. Whatever its condition upon leaving the carbureter, the mixture when encountering the manifold is influenced by the low temperature, the rough walls, and the comparatively low velocity of flow adjacent the walls to resolve itself into large drops or globules of fuel suspended in a current of air. Such a non-uniform mixture is conducive to poor combustion, and in addition, some of the drops of fuel gather on the walls of the manifold and are intermittently taken up by the air stream and again deposited or are carried into the cylinders, depending somewhat upon the pulsations of the fluid flow through the manifold. The mixture is therefore not only not homogeneous but also is extremely variable in the proportion of fuel to air.

The effects on the engine of such a poorly mixed and non-uniform association of fuel and air are well known. Charges of various constituencies and weights are delivered to the different cylinders and produce uneven and erratic running accompanied by vibration, especially at low speeds. In the cylinders themselves, a primary result is slow combustion due to the low rate of flame propagation thru a non-homogeneous mixture. Detonation is facilitated, the globules of fuel destroy the oil film in the cylinder and dilute the lubricating oil, carbon is easily formed, and numerous other undesirable conditions obtain.

Various attempts have been made to overcome these defects and have been principally concerned with applying heat to an appropriate portion of the intake manifold. While the lighter constituents of the fuel are readily vaporized in that manner, the heavier portions of the fuel are not so readily vaporized, and in fact, require so much heat that the volumetric efficiency of the engine is seriously impaired.

These expedients and conditions are dis-

advantageous and obviously undesirable and to overcome them I provide what in its broad concept comprises a spring positioned within the manifold and vibrated by pulsations in the fluid flow and by engine vibration so that the inflowing mixture is mechanically agitated and a high degree of turbulence is produced, not only in proximity to the walls of the manifold but thruout the mixture as well.

Any convenient method of positioning a suitable spring in the intake manifold may be employed. An effective way is shown in Fig. 1, in which the intake manifold 6 is provided with a flange 7 at its lower end to cooperate with a corresponding flange 8 at the upper portion of a carbureter 9. The flanges are properly apertured for the reception of studs 11 which affix the carbureter and the manifold firmly together. Between the flanges are interposed two gaskets 12 of the usual kind which clamp between them a flange 13 formed at the lower end of a cylindrical shell 14 disposed within the manifold 6. In this manner the cylindrical shell is properly positioned in the straight portion of the manifold and, due usually to roughness of the manifold walls, a slight space 16 remains between the shell 14 and the walls of the manifold. Fuel condensing in the upper portion of the manifold and running down the walls would ordinarily be entrapped in the space 16 and would be liable to spill over the top of the shell. The quality of the combustible mixture is adversely affected by such an occurrence and means are consequently provided for returning any entrapped fuel to the inflowing mixture adjacent the bottom of the shell. For this purpose, the shell is pierced in one or several places to provide apertures 17 thru which the collected fuel may flow and again be carried toward the cylinders by the current of combustible mixture. The walls of the shell are preferably made very smooth and with the agitating means functioning properly there is but slight fuel condensation and the apertures 17 are needed only under conditions very unfavorable to the maintenance of a good mixture.

The means for mechanically agitating the mixture is preferably a spring 18 which is constructed of wire of the proper size and material to produce vibrations having approximately the frequency of sound waves. A wire admirably suited to the purpose is piano or music wire of approximately 12 gage and it is preferably coiled into a generally helical form, as such a form offers but little restriction of the manifold, an important consideration. The helical spring is preferably formed with a constriction intermediate its ends so that the general contour of a Venturi tube is followed. This may easily be done by winding the spring on a properly shaped form having a suitable constriction and subsequently elongating the spring the requisite amount. The diameter of the spring is such that there is a small amount of clearance between the spring and the wall of the shell 14, at the upper and lower portions of the spring, while the spring is made of a length sufficient to allow several nodes in the spring when it is vibrating.

To support the spring 18 in the shell firmly and at the same time under tension, to permit the spring to be freely vibratile, a transverse rod or support 19 is disposed diametrically across each end of the shell and is seated in suitable notches 21 cut in the ends of the shell. Each of the supports 19 is indented adjacent its ends to provide depressions 22 in which corresponding depressions 23 in the end convolutions of the spring may seat. The spring is stretched between the two supports and the spring tension is sufficient to maintain all the parts in place. If desired, the various connections may be more firmly bonded by means of solder.

The pulsations in the flow of fluid through the shell 14 and the vibrations of the engine when it is operating set up corresponding vibrations in the spring 18. The spring by its rapid vibration causes a great deal of agitation and turbulence thruout the stream of ingoing air and fuel which break up the drops of fuel into fine particles and produce a uniform mixture. The Venturi tube shape of the spring aids in increasing the velocity of fluid flow without offering substantial resistance inasmuch as the fluid itself naturally assumes such a shape. Also, a portion of the fluid may pass between the convolutions of the spring and flow between the shell 14 and the spring in which case the spring functions as a screen for breaking up the fuel drops but does not materially restrict the manifold. The upper and lower portions of the Venturi spring are relatively close to the manifold walls, on which fuel is most apt to condense, and produce turbulence close to the walls where it is most effective in dislodging and atomizing the deposited fuel.

In the modified form of vaporizer shown in Fig. 2, the helical spring 24 is made generally cylindrical in shape and may be used with great effectiveness in installations where the Venturi spring is not considered desirable. The spring 24 is supported in a shell 26 similar to the shell 14 and functions in a manner comparable to that of the spring 18.

By the use of my invention, the fuel and air flowing to the cylinders are agitated until they form a thoroughly homogeneous and uniform mixture. It is not necessary to impair the volumetric efficiency of the en-

gine by heating the ingoing fluid and it is not necessary to encumber the engine with jackets and tubes for supplying heat to the fuel and air. The uniform mixture produced by the vibrating spring is evenly distributed to all the cylinders and produces even, complete and rapid explosions which permit of practically no carbon, reduce dilution of the oil and reduce markedly the engine vibration.

While in general the natural frequency of the tensioned spring will produce an audible sound, it will be clear that it would be possible to so tension a spring that the frequency of vibration would be beyond the audible range although the mixing effect would be equally pronounced. Accordingly, the term "sound frequency" used in the claims is intended to include not only audible frequencies but also high frequencies above the audible range.

I claim:

1. A mixing device comprising a helical wire spring adapted to vibrate at sound frequency and tensioned between two supports spaced sufficiently far apart to permit the formation of a plurality of nodes in the vibrating spring.

2. A mixing device comprising a cylindrical shell adapted to be fitted within the intake manifold of an internal combustion engine, a flange at one end of said shell for positioning said shell in said manifold, apertures adjacent one end of said shell to permit the drainage of fuel entrapped between said shell and said manifold, a support disposed diametrically across each end of said shell, and a freely vibratile helical spring tensioned between said supports and mounted coaxially with said shell.

3. A mixing device comprising a support having a passage therein for conducting a mixture of fuel and air, and a spiral spring maintained in the passage under sufficient tension so that said spring will have a frequency of free vibration equal to sound frequency.

4. A mixing device comprising a spiral spring having a diameter at its central portion less than its end diameters and supporting means for said spring, said spring having a frequency of free vibration equal to sound frequency, said spring and supporting means being adapted for reception in a fuel and air mixture conducting passage with the axis of the spring extending in the direction of flow.

5. A mixing device comprising a passage for conducting a mixture of fuel and air, and a vibratile spiral spring supported therein with its axis in the direction of flow through said passage, the diameter of said spring varying throughout its length to give the spring the shape of a Venturi tube.

6. A mixing device comprising a passage for conducting a mixture of fuel and air, and a vibratile spiral spring supported therein with its axis in the direction of flow through said passage, the diameter of said spring varying throughout its length to give the spring the shape of a Venturi tube, said spring having a frequency of free vibration equal to sound frequency.

7. A mixing device comprising a support having a passage therein for conducting a mixture of fuel and air, and a spiral spring maintained in the passage with its axis in the direction of flow through said passage and having coils thereof adjacent the walls of said passage, said spring being held under sufficient tension so that it will have a frequency of free vibration equal to sound frequency.

In testimony whereof, I have hereunto set my hand.

WILLIAM C. BRINTON, JR.