Oct. 12, 1926. 1,602,390

H. W. BUTLER

HYDROCARBON MIXER

Filed August 15, 1925 2 Sheets-Sheet 1

Fig. 1.

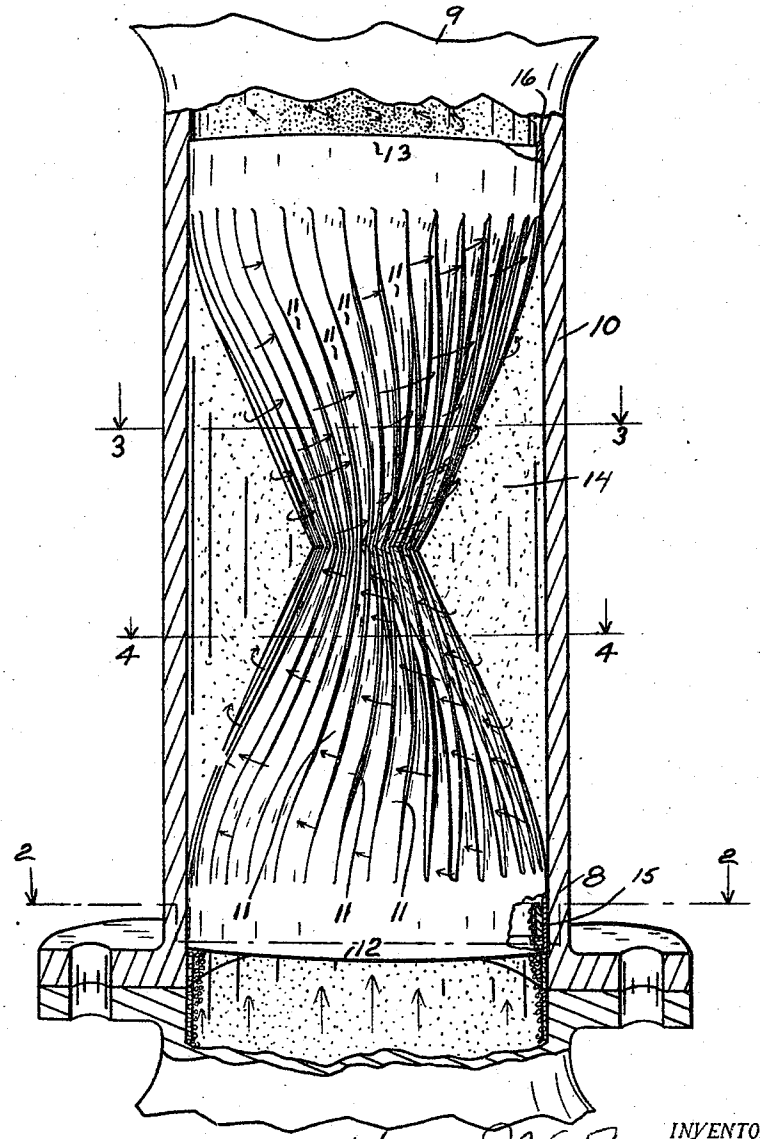

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Fig. 2.

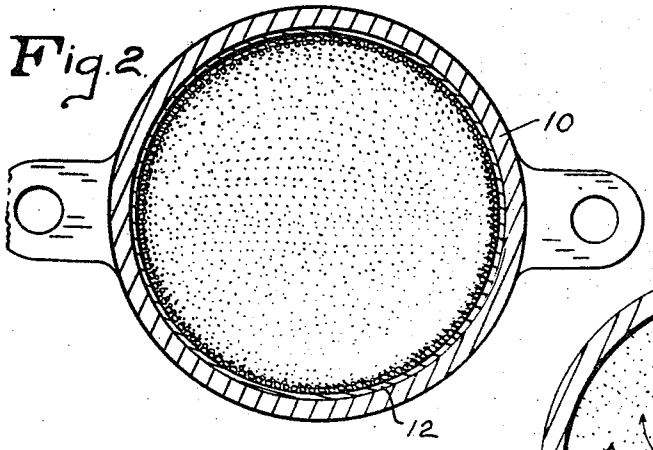


Fig. 4.

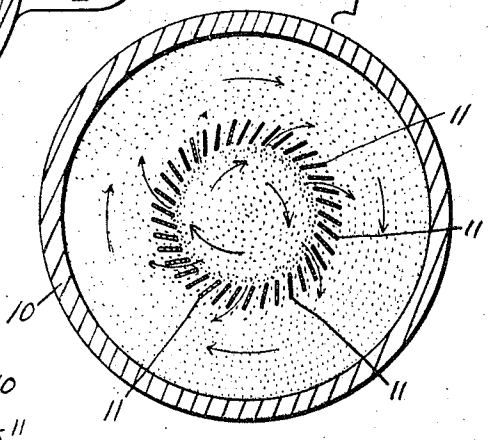


Fig. 3.

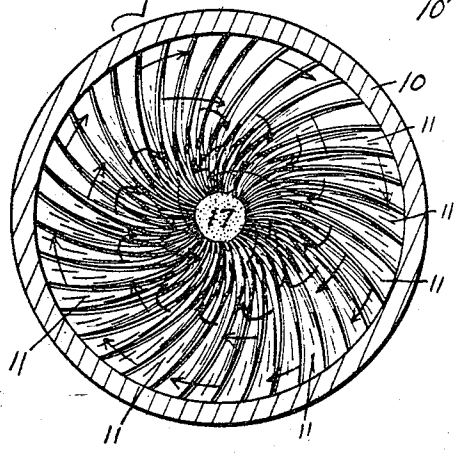
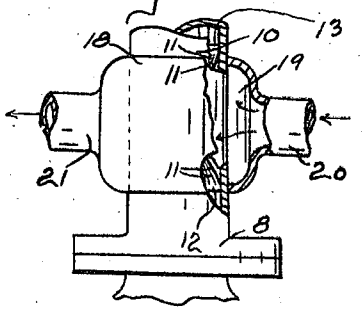


Fig. 5.



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HYDROCARBON MIXER.

Application filed August 15, 1925. Serial No. 50,396.

My invention relates to improvements in hydrocarbon mixers with particular reference to mixing devices employed in the intake manifolds of internal combustion engines to break up particles of hydrocarbon and mix them with air more thoroughly than is done in the mixing chamber of an ordinary carburetor and prevent quantities of the liquid from accumulating on the walls of the intake manifold.

The object of this invention is to provide a more effective mixing device than has heretofore been constructed.

More particularly stated, the object of this invention is to provide mixing devices capable of performing the desired functions with minimum obstruction to the passage of the mixtures through the manifolds, to provide means for developing cyclonic whirls in the mixtures which effectively remove the liquid from the walls of the passage and cause it to be broken up into fine particles and distributed uniformly throughout the air preparatory to delivery of the combustible mixture to the engine cylinders; to provide a mixer which is capable of developing centripetal tendencies in the combustible mixture and thereby reduce the friction upon the walls of the manifold, and to provide means for rotating the moving current of air and hydrocarbon first in one direction and then in another for the purpose of commingling the liquid particles with the air and vapor, and in general, to provide simple, inexpensive and durable mixing means which will effectively prevent so-called condensation in the manifold and maintain the proper proportions of air and hydrocarbon as determined by the carburetor adjustment while the carbureted mixture is being delivered to the engine cylinders.

In the drawings:

Figure 1 is an elevation of my improved mixing device as applied to a portion of the intake manifold of an internal combustion engine, a fragment of said manifold being shown in longitudinal section.

Figure 2 is a sectional view drawn on line 2—2 of view 1.

Figure 3 is a sectional view drawn on line 3—3 of Figure 1.

Figure 4 is a cross sectional view of the parts intersected by a plane indicated by line 4—4 of Figure 1.

Figure 5 is a view on a reduced scale similar to Figure 1, but showing a modified construction in which provision is made for utilizing the heat of exhaust gases for vaporizing purposes.

Like parts are identified by the same reference characters throughout the several views.

In Figures 1 to 4, inclusive, my invention is illustrated as applied to the common supply duct 10 of an ordinary intake manifold of an internal combustion engine. The portion 8 of this duct may be assumed to be connected with an ordinary carburetor in the usual manner and the portion 9 may be assumed to have the branches leading to the several cylinders of the engine in accordance with common practice.

The space within the passage 10 is subdivided by a mixing member having the general form of an hour glass or of a pair of hollow truncated cones having their axes aligned and their smaller ends integrally connected. Between their outer ends, the walls of these hollow cones are composed of a series of curved baffles converging toward the meeting ends of the cones and formed by slitting the walls of the cylinder to subdivide it into a series of narrow strips 11 and then twisting and pressing each strip inwardly and progressively from its outer ends toward its central portion to such an extent that the central portions of the strips are each turned substantially at right angles to their outer end portions, whereby said central portions lie substantially in radial planes. The ends 12 and 13 of the mixing member are cylindrical and are formed to fit within the tube 10.

This mixing member is preferably formed of sheet metal which is slitted as above described and then rolled about a mandrel into the cylindrical or hour glass form. The twisting of the strips may be accomplished either before or after the sheet is rolled cylindrically and the metal has sufficient resilience to allow the meeting margins to be brought entirely together or overlapped to facilitate inserting the member into the tube

10, whereupon it is permitted to expand against the interior surface of the tube wall. The inlet end is then anchored by a ring 15 slightly tapered and driven into the lower end of member 10. The outlet end is preferably engaged in an undercut channel 16.

The wall of the mixing member has a thickness which is considerably less than the width of the strips and the degree of convergence is such as to maintain a substantially uniform spacing of the strips from points near their outer ends to the central portion, the twisting of the strip compensating for its convergence toward the adjacent strips in correspondence substantially to the difference between its width and thickness. This forms a series of passages between the strips, the walls of which are nearly tangentially disposed at their outer ends and nearly radially disposed in the central portions.

The combustible mixture enters the end 12 of the mixing member and the major portion thereof passes between the strips or baffles 11 before reaching the central portion, and is deflected by the faces of the strips in such a manner as to cause it to follow a spiral path and develop a vortex which rotates in the direction in which the strips are progressively twisted. But upon passing the central portion of the mixing member, the fluid in the cavity 14 between it and the wall of the tube 10 is compelled to re-enter the mixer as it approaches the end 13 thereof and is deflected in the opposite direction, thereby reversing the vortex.

The currents passing between the strips along the outlet portion of the mixing member are directed by the opposing faces of the strips inwardly and tangentially to the central current which passes through the opening 16 thereby developing a cyclonic whirl or vortex which is found to be very effective in preventing liquid particles from being thrown against the walls of the manifold beyond the mixer to collect thereon in the manner heretofore found to interfere very materially with the proper operation of an ordinary carburetor when the walls are cold.

Any particles of liquid hydrocarbon collecting upon the walls of the passage, i. e. upon the walls of members 8 and 10 as shown in Figure 1, are prevented from following said walls in the direction of the engine beyond the inlet end 12 of the mixer and are directed into the mixer where they are caught by the air currents passing through the openings between the baffle strips and carried into the vortices above described. These particles are broken up by contact with the baffle strips and by contact with each other when the initial vortex in the cavity 14 is reversed. Therefore the particles of liquid hydrocarbon are reatomized and commingled with the air to produce a homogeneous mixture and the mixture finally brought toward the central portion of the passage and delivered in the direction of the engine cylinder with reduced friction upon the wall of the passage in a manner which appears to more than compensate for any obstructing effect due to the presence of the mixing member in the passage. In fact, a development of the centripetal vortex in the outlet portion of the mixing member tends to concentrate the mixture and thus increase the total volume thereof to be delivered to the engine cylinder during the suction stroke of the piston.

Referring now to Figure 5, it will be observed that the wall of the tubular member 10 is there illustrated with an enclosing jacket 18 forming a cavity 19 for an inlet 20 and an outlet 21 whereby an exhaust pipe leading from the exhaust manifold of the engine may connect to the inlet 20 for the purpose of heating the tubular member 10 and, to some extent, the mixture passing therethrough. A slight degree of heat in the walls of the passage 10, even if insufficient to materially raise the temperature of the mixture, will at least overcome any tendency of the particles of liquid hydrocarbon to collect on the interior surface of the tube 10 within the cavity 14.

This application is a continuation-in-part of my former application, Serial No. 13,618, filed March 6, 1925, said part being the subject matter of each and all of the following claims.

I claim:

1. The combination with the walls of a passage for carbureted mixtures, of a mixing device having a series of spirally disposed vortex producing baffle portions of which are adapted to direct the fluid along a spiral path in one direction and other portions of which are adapted to direct the fluid along a spiral path in an opposite direction within said passage, portions of said baffles being spaced from the walls of the passage and from each other to provide inner and outer substantially unobstructed mixing chambers.

2. The combination with the intake manifold of an internal combustion engine, of a mixer therein having the general form of an hour glass with ends in substantial contact with the interior surfaces of the manifold, said mixer, intermediate of its ends, having its wall subdivided into strips each of which has a portion twisted in the direction of a plane radial to the axis of the manifold.

3. The combination with the intake manifold of an internal combustion engine, of a mixer therein having the general form of an hour glass with ends in substantial contact with the interior surfaces of the mani-

fold, said mixer, intermediate of its ends, having its wall subdivided into strips each of which has a portion twisted in the direction of a plane radial to the axis of the manifold and also deflected in the direction of the axis whereby the several strips converge toward a common point in said axis.

4. A mixer for combustible materials comprising a member having substantially cylindrical end portions and intermediate portions longitudinally subdivided into strips each of which is of a width greater than its thickness, said strips being each bodily twisted and bent toward the longitudinal central axis of said member with its marginal side edges turned toward a common longitudinal plane radial to such axis.

5. A mixer for combustible materials comprising a member having substantially cylindrical end portions and intermediate portions longitudinally subdivided into twisted strips the central portions of which have their respective surfaces in planes transverse to the planes of the end portions thereof, and all in greater proximity to the central axis of the mixer.

6. The combination with a tubular passage for hydrocarbon combustible mixtures, of a mixing member therein having an inlet portion composed of a series of strips progressively twisted and bent toward the axis of the passage, and an outlet portion having similar strips progressively twisted in the opposite direction and bent into substantial contact with the walls of the passage at the outlet end of the mixing member.

7. The combination with a tubular passage for hydrocarbon combustible mixtures, of a mixing member therein having an inlet portion composed of a series of strips progressively twisted and bent toward the axis of the passage, and an outlet portion having similar strips progressively twisted in the opposite direction and bent into substantial contact with the walls of the passage at the outlet end of the mixing member, each of said strips having a width greater than its thickness and cooperating with the other strips to form a series of vortex producing baffles disposed in the inner portion of said member to cause the rotation of fluid in one direction and in the outlet portion of said member to cause rotation of said fluid in the opposite direction.

8. A mixer for combustible materials comprising a split member having substantially cylindrical end portions and intermediate portions longitudinally subdivided into twisted strips each of which is of a width greater than its thickness in the central portions of said strips, said strips being conically converged in one portion of the mixer and arranged with their wider surfaces opposed.

9. The combination with the walls of a passage for carbureted mixtures, of a series of vortex producing baffles in said passage arranged to provide a series of mixing chambers partially separated from each other by said baffles, said baffles being also formed to provide a substantially unobstructed central passage for a portion of the mixture, each of the baffles being adapted to co-operate with others in directing the fluid from one chamber to the next along spiral lines differently pitched in the successive chambers.

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