Oct. 8, 1929. A. P. BRUSH 1,730,641

METHOD AND APPARATUS FOR INTRODUCING EXPLOSIVE MIXTURES INTO INTERNAL COMBUSTION ENGINES

Filed March 12, 1923 2 Sheets-Sheet 1

Fig. 1.

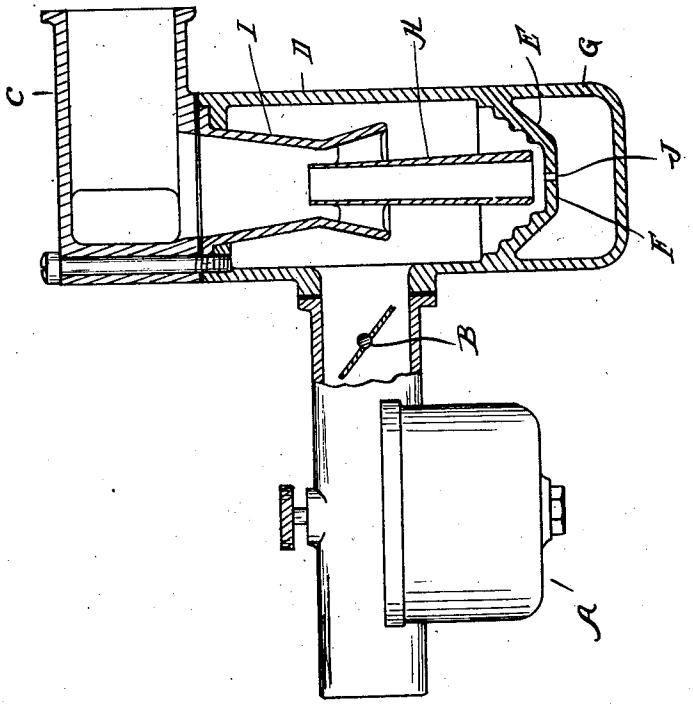
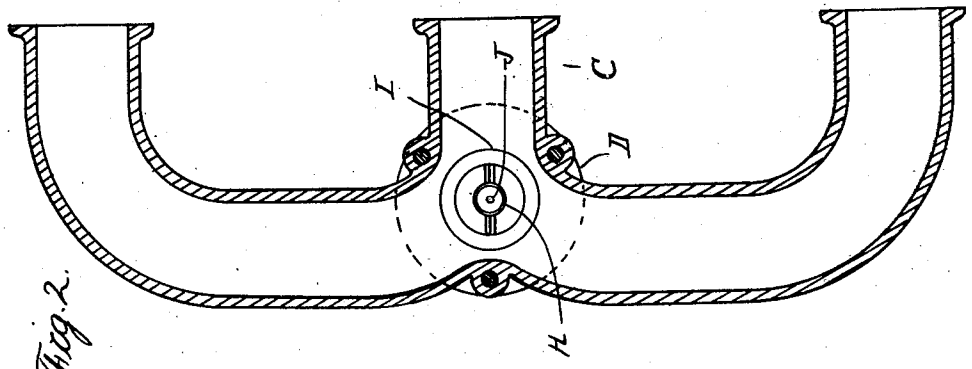


Fig. 2.



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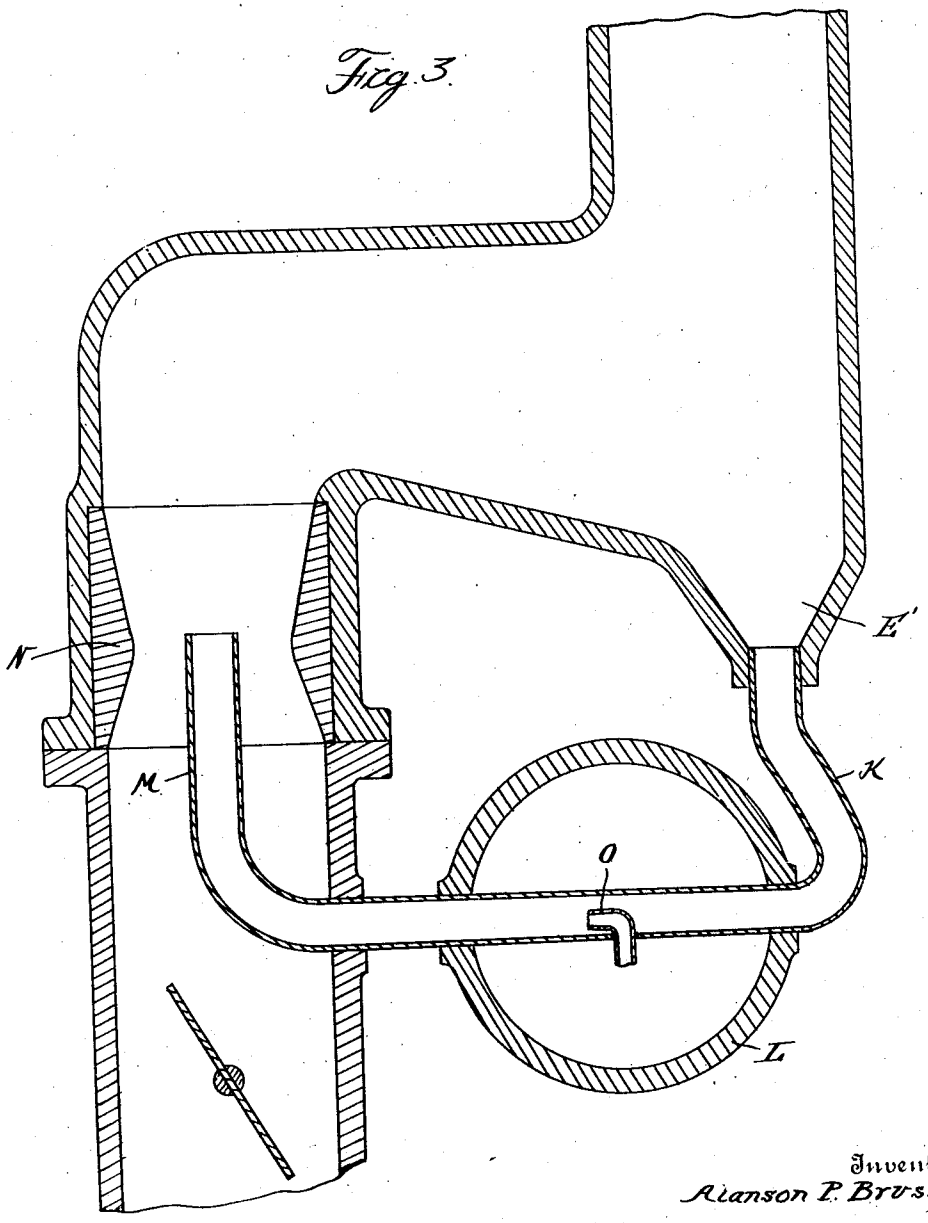
By Whittemore Hulbert Whittemore & Belknap Attorneys

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Fig. 3.



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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR INTRODUCING EXPLOSIVE MIXTURES INTO INTERNAL-COMBUSTION ENGINES

Application filed March 12, 1923. Serial No. 624,629.

The invention relates to the introduction of explosive mixtures into internal combustion engines and has more particular reference to the means for stabilizing the mixture under various conditions of operation so as to maintain a constant proportion.

Proportioned mixtures of air and liquid fuel such as delivered from the carburetor to the inlet manifold of the engine are of an unstable nature, due; first, that certain portions of the fuel (end points) will only vaporize at a comparatively high temperature; second, liquid particles carried in suspension will drop out of the low velocity portions of the current or are thrown out by their own inertia where there is a change of direction of the current. Where the mixture is robbed of a part of the fuel, it is no longer properly proportioned for combustion, and even where the fuel is eventually reintroduced into the mixture, the first effect is to produce an incombustible or imperfectly combustible mixture, hence the difficulty in starting a cold engine.

It is the primary object of the present invention to so stabilize the mixture that a constant proportion of air and fuel will be maintained whether the engine is hot or cold or operating at low or high speeds and power output. This includes means for withdrawing from the mixture any unvaporized fuel which might otherwise drop out on the way to the explosion chamber, together with means for quickly heating such fuel and reintroducing the same into the mixture. Thus even a temporary leaning of the mixture is avoided. It is a further object to facilitate the vaporization of the end points without either overheating the mixture or delaying the reintroduction of the fuel into the same. With these objects in view the invention consists in the method of operation and in the construction as hereinafter set forth.

In the drawings:

Figure 1 is a sectional elevation showing one construction of my improvement;

Figure 2 is a horizontal section through an engine manifold to which the device is applied;

Figure 3 is a central longitudinal section of a modified construction.

Broadly described, my improvement consists in removing unvaporized fuel from the low velocity portions of the current and in heating and quickly reintroducing such removed fuel into a high velocity portion of the current. A further feature is in subjecting the removed fuel while being heated to a current of air of limited volume. This removes the vapor atmosphere and lowers the vapor pressure above of the remaining liquid, thereby facilitating vaporization.

In detail and as shown in Figure 1, A is a carburetor of any suitable construction, B the throttle valve thereof, and C the manifold leading to the several cylinders of the engine. Formed either as a part of this manifold or intermediate the same and the carburetor is a casing D which forms an expansion chamber, lowering the velocity of the current passing therethrough. As shown, the casing D has a depending portion E forming a well or receptacle for the liquid fuel dropping out of suspension. The bottom F of this well is preferably of a conical form and is heated by suitable means, such as by forming a chamber G for the exhaust gases therebeneath. H is an ejector tube extending upward from the well E, its upper end being arranged in a Venturi passage I, the arrangement being such that the pressure drop in the venturi communicated to the passage in the tube H will cause the flow of a limited volume of the mixture through said tube and the sweeping of this current over the fuel on the bottom of the well. Consequently, not only will the vapor be drawn upward and reintroduced into the main current, but also unvaporized portions carried in suspension.

It will be understood that in the operation of the device above described, there will be little delay in the reintroduction of any fuel dropping out of the current, for the ejector tube is in constant operation and will carry the fuel with the current passing therethrough. When the engine is cold, these parts will function merely as a commingler, but when the bottom wall is heated, the heat will pass by conduction into the liquid and will facilitate vaporization. The more refractory portions or end points of the fuel

will be retained longest in contact with the heated surface and as the current is sweeping away the vapor as fast as formed, this will have the effect of lowering the vapor pressure above the liquid and facilitating vaporization.

If desired, the ejector effect may be stimulated by the formation of a jet aperture J through the bottom wall F in axial alignment with the tube H. This will discharge a limited quantity of the exhaust gases into the tube, increasing the velocity of the moving current and also contributing to a small extent to the heat supplied to the fuel.

With the modified construction shown in Figure 3, which forms the subject matter of my copending application, Serial Number 624,630, filed March 12, 1923, instead of placing the ejector tube in the fuel well, a conduit K is connected to the fuel well E′ and returns therefrom to a portion of the manifold in rear of the well, first passing through the exhaust conduit L and terminating in a nozzle M. The nozzle M is placed in connection with the Venturi passage N, which will produce the necessary pressure drop to cause a flow of current through the conduit K. For introducing exhaust gases into the ejector tube there is provided a nozzle O communicating with the exhaust conduit L and inserting into the conduit K in the direction of the flow therethrough. This construction will function in a similar manner to the construction previously described, the only difference being the specific construction of means for reintroducing the fuel and the point in the manifold at which said fuel is reintroduced.

My improvement has many advantages, among which are; first, its operativeness when the engine is cold, as in the starting of the same; second, it avoids overheating the air or complete mixture and thus prevents loss in power; third the fuel will be vaporized at a lower temperature so as to avoid danger of destructive distillation or the forming of carbon; fourth, there is little delay in the reintroduction of the fuel, such as would be occasioned by the trapping of the same in in a fixed pocket.

What I claim as my invention is:

1. The combination with the intake of an internal combustion engine having a throttle valve, of an expansion chamber above said throttle valve for separating by gravity from the explosive mixture a portion of the liquid fuel content, means for continuously reintroducing into the main current said separated liquid content together with a limited volume of the mixture, and means intermediate the point of separation and reintroduction for heating the fuel.

2. The combination with the induction conduit of an internal combustion engine, of an expansion chamber having a well in the lower portion thereof for receiving a portion of the liquid fuel content separated by gravity, means for heating the bottom wall of said well, an ejector tube leading from said well into the main current, and a Venturi restriction at the discharge end of said ejector tube, for the purpose described.

3. The combination with the induction conduit of an internal combustion engine, of an expansion chamber having a well in the lower portion thereof for receiving the portion of the liquid fuel content separated by gravity, an ejector tube etxending from said well into the main current for reintroducing the liquid fuel into said current, means operated by the exhaust gases for heating the fuel while in said well, and means for discharging a portion of said exhaust gases into said ejector tube to stimulate the action thereof.

4. The combination with an induction conduit of an internal combustion engine, of an expansion chamber having a well in the bottom thereof for receiving a portion of a liquid fuel content separated by gravity, and an ejector operated by the main current for lifting and reintroducing the separated fuel, said ejector having its inlet end arranged to admit a limited volume of mixture thereto and heating means for the fuel intermediate the point of separation and reintroduction, said heating means being out of contact with the main current of the mixture.

5. The combination with the induction conduit of an internal combustion engine having a substantially horizontal section, of a vertically disposed expansion chamber communicating intermediate its ends with said horizontal section and having a well in the lower portion thereof for receiving a portion of the liquid fuel content separated by gravity, means for heating the bottom wall of said well, an ejector tube leading from the said well into the main current, and a Venturi tube having its inlet adjacent the point of communication of said expansion chamber with said horizontal section and having its restricted portion at the discharge end of said ejector tube.

In testimony whereof I affix my signature.

ALANSON P. BRUSH.