Dec. 25, 1934. M. J. ZUCROW 1,985,271

CARBURATION SYSTEM

Filed Nov. 7, 1930 3 Sheets-Sheet 1

Fig. 1.

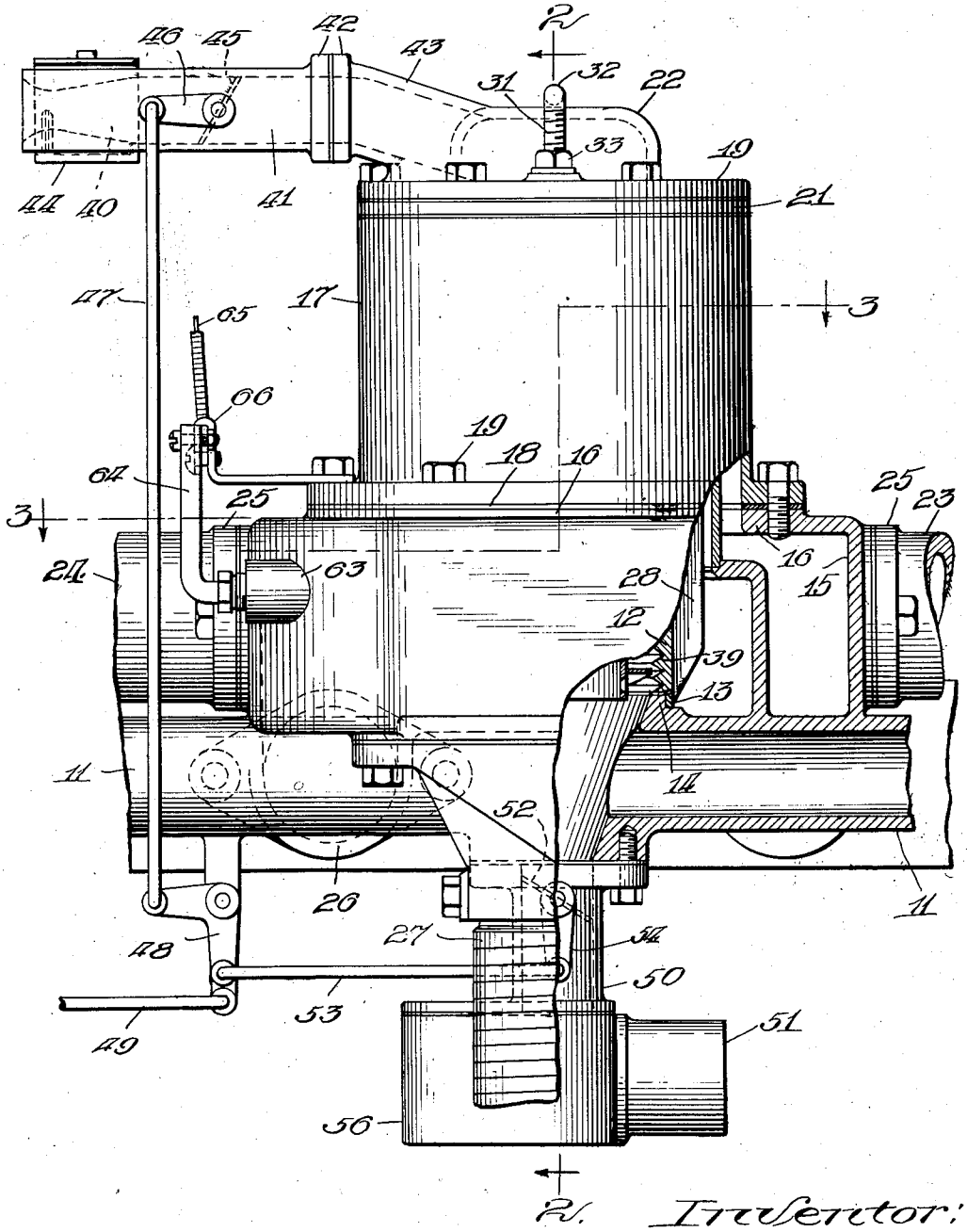

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Fig. 2.

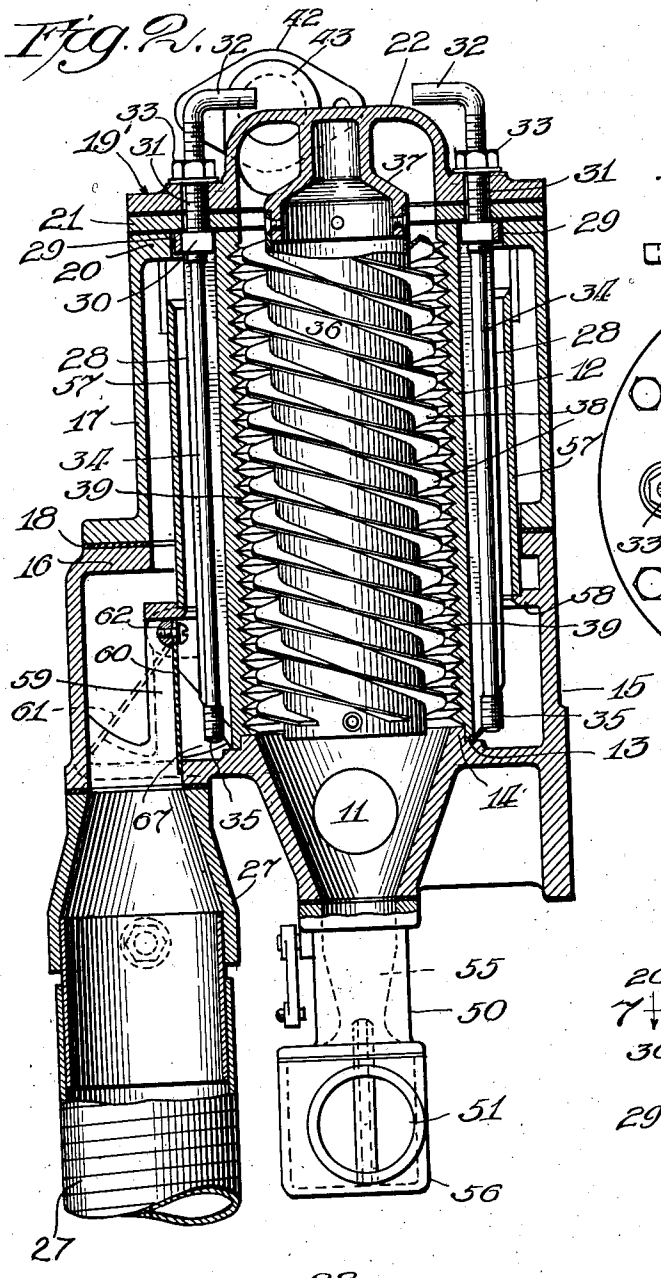


Fig. 4.

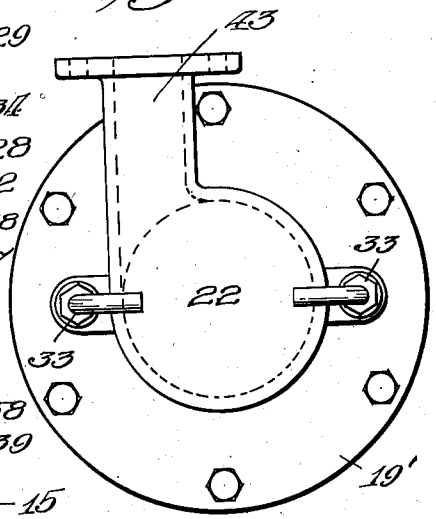


Fig. 6.

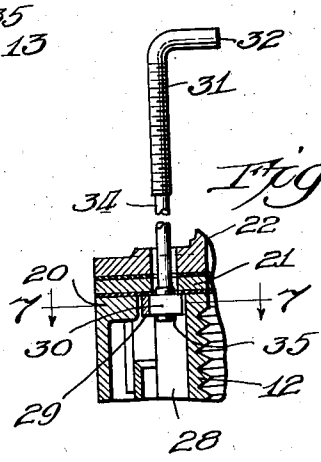
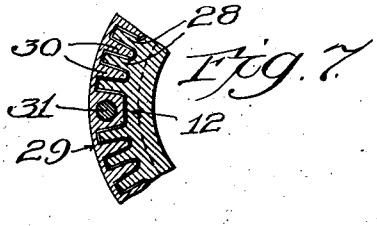


Fig. 7.



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CARBURATION SYSTEM

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Fig. 3.

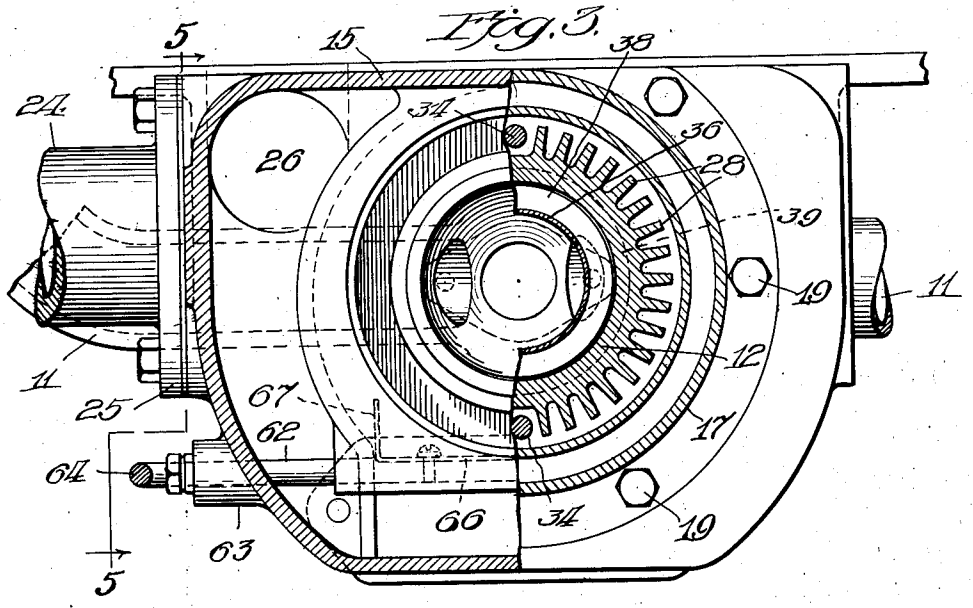
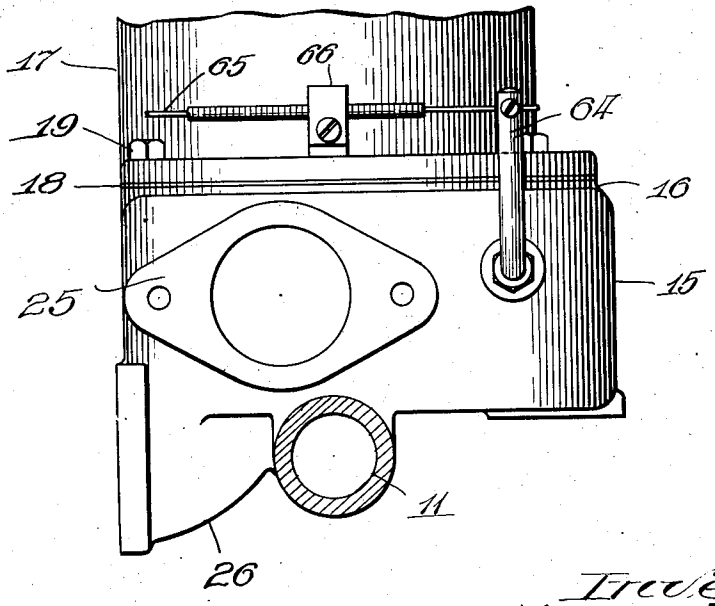


Fig. 5.



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1,985,271

UNITED STATES PATENT OFFICE

1,985,271

CARBURATION SYSTEM

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Application November 7, 1930, Serial No. 494,083

17 Claims. (Cl. 123—133)

This invention relates to a carburation system which enables operating internal combustion engines on low grade fuels, such as gas oil or distillate, as well as gasoline. This carburation system embodies a vaporizer which functions to gasify these fuels, and also embodies means whereby the final and correct fuel-air mixture can be delivered to the engine cylinder at a temperature and pressure which satisfy the requirements for good combustion, high thermal efficiency and high power output.

For a low grade fuel system to be classed as one which operates an internal combustion engine successfully, it must satisfy certain requirements. The engine must be enabled to develop practically the same power as it develops when it is operated on gasoline, it must burn all of the fuel entering into the cylinders, it must not have excessive carbon formation, and the carburation system itself should not change its characteristics during service nor require more than ordinary maintenance. In other words, a low grade fuel system, to be successful, must duplicate as nearly as possible, the engine performance, operation and maintenance obtained when burning gasoline.

In order to secure effective vaporization or subdivision of the fuel, the exhaust gases are utilized to heat a downwardly directed conduit. This conduit, to facilitate heat exchange, has vertical ribs exposed to the exhaust gases. It is one of the objects of my invention to make it possible effectively to clean these ribs from any material deposition of carbon.

The conduit is so arranged that large fuel particles, not readily usable by the engine are plastered against the heated wall, as by causing the fuel-air mixture to whirl by placing a spiral vane, or vanes, in its path. It is another object of my invention to provide an improved form of conduit that will more uniformly distribute these particles, and with comparatively slight friction losses in the fuel-air mixture.

It is another object of my invention to provide a convenient and simple form of heat control for the conduit, as by the provision of a mechanism that by-passes all, or a part, of the exhaust gases so that the by-passed gases flow directly into the exhaust pipe without coming into contact with the heated conduit.

In some instances, and especially at heavy loads, it is found that the fuel detonates in the cylinder upon ignition; and it has been proposed to add a non-detonating fluid, such as water, to the explosive fuel-air stream. This addition of the non-detonating fluid can be conveniently accomplished in this instance by providing a device in the supplemental air stream, which device can be throttle controlled if desired.

The invention has still further objects and advantages, which will be pointed out in detail in the following description of one embodiment of the device.

Referring to the drawings:

Figure 1 is a front elevation, partly in section, of a vaporizer embodying the invention;

Fig. 2 is a sectional view, taken along plane 2—2 of Fig. 1;

Fig. 3 is a sectional view, taken along plane 3—3 of Fig. 1;

Fig. 4 is a plan view of the cover member;

Fig. 5 is a detail side view, taken along plane 5—5 of Fig. 3;

Fig. 6 is a fragmentary view similar to Fig. 2, and showing how the ribs on the conduit can be cleaned; and

Fig. 7 is a detail section taken along plane 7—7 of Fig. 6.

The intake manifold for the internal combustion engine is shown at 11, Figures 1, 2 and 3. The heated conduit 12 for vaporizing the fuel extends above the manifold 11, and forms a downwardly extending passageway communicating with the manifold 11. Although the particular manner in which this conduit 12 is supported is of no consequence, it is shown in this instance as having a telescoping extension 13 fitting over a corresponding seat 14 of the manifold 11. This conduit is made from metal or other good heat conducting material, and is so arranged that its wall can be heated, as by the passage of exhaust gases around it. To accomplish this, the exhaust manifold structure includes a ring-like wall 15 formed in this instance integrally with the manifold casting 11, and extending around the lower portion of conduit 12. A concentric flange 16 can be provided thereon to seat an encompassing cylindrical shell or casing 17. A gasket 18 and bolts 19 can be used to keep this shell tight on flange 16. To complete the exhaust gas chamber around conduit 12, a cover 19′ (Fig. 4) is provided, which is fastened onto flange 20 of shell 17, and over the top of conduit 11, thus closing the chamber at the top. To keep this closure tight, a gasket 21 may be used. The cover 19′ has a dome 22 communicating with the top of conduit 12. It thus provides a place through which fuel and air can be passed so as to be drawn into conduit 12 by the pumping action of the engine. The manner of inducting the

fuel and air to produce a moving column of fuel-air mixture will be detailed hereinafter.

Before proceeding with a description of the mode of operation of conduit 12 to vaporize the fuel, a description of the exhaust passageways that conduct the hot gases from the exhaust of the engine can be set forth. Thus there are shown extensions 23 and 24 (Fig. 1) leading from the exhaust passages of the engine and connected as by flanges 25 into each side of ring 15, thereby communicating with the interior of casing 17. Further conduits from other exhaust passages of the engine can also be provided, as for example, the conduits 26 (Fig. 3) leading downwardly from corners of the ring 15. The outlet to the muffler for the exhaust gases is shown as formed by a downwardly directed extension 27, (Fig. 1), leading from the front portion of ring 15.

It is thus apparent that the conduit 12 can be effectively heated to provide an interior surface to which unvaporized fuel can pass. In order to provide an effective heat exchange between the exhaust gases and the conduit, there may be provided a series of longitudinal ribs 28 on the exterior of the conduit 12. Since occasionally it may be desirable to scrape off any deposit from these ribs, a cleaner ring 29 is placed over the conduit 12, said ring having ribs 30 intermeshing with ribs 28. If this ring be reciprocated on the conduit 12, it would serve to scrape off any deposit, although in normal operation experience has shown that such scraping need be done only at infrequent intervals.

Normally, the ring 29 is held at the top of conduit 12, as by the engagement of threaded rods 31 into the tapped holes in the ring. These rods extend through cover 19 and are capable of being manually rotated, as by handles 32, so as to disengage the ring 29 from the rods and to make it possible to reciprocate it. Nuts 33 can hold the rods 31 in clamped position, but they can be unloosened whenever a cleaning operation is to be performed. These rods have reduced portions 34 and threaded ends 35.

When a rod is unloosened, and its handle 32 rotated, the rod can be moved up so that the lower threaded ends 35 thereof engage the ring 29. Then the end 35 of each rod 31 can be screwed into the ring 29 (Fig. 6). The other rod can be similarly manipulated. These rods thus form a handle for the ring 29, which can then be pulled up and down for cleaning the ribs 28. The extended position of rods 31 is shown in alternative form in Figure 6.

After the cleaning is completed, one of the rods 31 can be unscrewed from the ring 29, while the ring is held by the other rod. Then the said one rod can be pushed down until the upper threaded portion engages the ring, and the rod can be turned until the ring is again secure. After one rod 31 is in inactive position, the other rod can be similarly operated.

The fuel air passage through conduit 12 is preferably made annular in section, as by the provision of a central tube 36 that is closed at the top as by the internal ring 37 depending from below dome 22. This ring also forms a convenient means for fastening the tube 36 in place, by telescoping within each other, and by screws.

Matters are arranged in such a way that if a mixture of fuel and air is caused to progress downwardly through the annular space defined by conduit 12 and tube 36, any unusable fuel particles are urged against the heated inner wall of conduit 12. For this purpose, the air stream is caused to whirl or rotate, so as to set up a centrifugal action and to urge the unvaporized fuel particles outwardly by the force thus generated. Various means for producing this centrifugal action are available; but in this instance there is shown one or more helicoidal vanes 38 disposed around tube 36, which define passages for the air stream which progress angularly about the axis of conduit 12 as it flows downwardly.

In the present instance, four such spiral vanes are shown. By providing such a multi-thread system of vanes, the fuel and air mixture progresses downwardly with less obstruction because the pitch is steeper. A plurality of vanes is also beneficial in promoting a more uniform distribution of the fuel over the conduit wall.

It is of course understood that fuel in liquid form is passed into the air stream that flows down conduit 12 into manifold 11, by any appropriate means; and that due to the whirling action of this stream around vanes 38, those particles of fuel not readily usable by the engine are urged or plastered by centrifugal force against the inner wall of conduit 12. After vaporization thereon, the fuel returns to the air stream by diffusion and is finally inducted into the engine in the form of a homogeneous fuel air mix. To increase the area of the heated conduit surface, this interior surface can be grooved, as indicated at 39.

While the fuel is strongly heated, the air stream from which it is ejected receives considerably less heat.

The fuel introduction is shown as accomplished in this instance by aid of a Venturi jet device 40 formed in the open end of a short conduit 41. This conduit is fastened, as by flanges 42, to a short downwardly sloping connection 43, leading into dome 22. As shown most clearly in Figure 4, this connection can be made tangential of the interior conduit 12, to assist in giving the air a whirl, although this is merely a matter of choice.

The venturi 40 is open to the atmosphere and air enters into it by the action of the engine. Fuel is inducted at the throat from a float bowl 44 of any desired form. A throttle 45 can also be provided in conduit 41, and can be manually controlled, as by lever arm 46, link 47, crank 48, and accelerator rod 49.

At times, it may be advisable to cool the fuel-air mix entering manifold 11 at the bottom of conduit 12. This cooling as before stated, should not be sufficient to cause any condensation of fuel particles, and yet the temperature should be as low as permissible. Furthermore, the carbureting device 40 can be such that a rich mixture is obtained to which must be added a supplemental air stream to provide enough oxygen to burn the fuel completely.

In order to accomplish both these results, there is provided a conduit 50 extending into the bottom of manifold 11. Cool air is drawn from the outside through this conduit 50, and commingles with the fuel-air mixture proceeding through conduit 12. The air inlet to conduit 50 is shown at 51. A throttle 52 controlling the flow in conduit 50 can if desired be used, and can be simultaneously operated with throttle 45, as by the provision of a link 53 between crank 48 and arm 54 of the throttle.

The injection into the fuel stream of a non-detonating fluid such as water can readily be accomplished through conduit 50. Thus proportioning device 55 such as a Venturi jet and float bowl, can be located in this conduit, and can serve

to induct the fluid from a bowl 56, the amount so taken up being proportioned to satisfy the engine requirements.

In order to provide effective heating of conduit 12, the exhaust gases can be conducted in a downward direction past the ribs 28. For this purpose, a baffle 57 can be included in the space enclosed by casing 17 and placed around conduit 12. This baffle thus separates the space in casing 17 into a pair of annular portions. The baffle 57 is supported on an inner shelf 58 extending around the ring 15. The top of baffle 57 is however spaced below the top of cover 19, so as to permit the exhaust gases to enter from outside baffle 57 up over its top and then downwardly past conduit 12, finally emerging through an opening 59 into conduit 27.

In order to make it possible to control the degree of heating of conduit 12, an arrangement can be provided whereby the exhaust gases can be at least partially by-passed without progressing inside of baffle 57. For this purpose a gate or valve 60 is used. This valve controls the passage of the gases in a manner now to be described.

With the valve 60 hanging in the vertical position in opening 59, no exhaust gas entering downwardly into baffle 57 can escape at the bottom thereof, consequently the exhaust gases take the path of least resistance and simply pass downwardly outside of baffle 57 and out through conduit 27, without passing over conduit 12. Of course some heat by conduction is still transferred, even if the valve 60 is in the position shown. Now if valve 60 is moved to the angular position indicated at 61 (Fig. 2), the top of exhaust outlet conduit 27 is open to the interior of baffle 57 but closed to its exterior. Therefore substantially all of the exhaust gases must pass downwardly through baffle 57 and out by way of conduit 27. Under such circumstances, a maximum heat transference is obtained between the exhaust gases and conduit 12. For intermediate positions of valve 60, intermediate effects are obtained.

This temperature control can be made automatic or manual, as by mounting valve 60 on a shaft 62 extending through and outside of casing ring 15, and appropriately journaled. A boss 63 (Figs. 1 and 3) can be provided to house a packing for this shaft. A lever 64 formed on the end of the shaft serves as a convenient means for rocking it, to vary the gate opening. A pull cable 65 (Fig. 5) can be attached to the lever for this purpose, and can if desired be appropriately guided in a clevis 66. Furthermore, the gate 60 can have side wings 67 (Fig. 3) to make it of chute-like form and to ensure that the exhaust gases emerging past the gate, must pass below its lower edge.

Of course the design should be such that the ultimate fuel mix is not so cold as to cause condensation of the fuel, but should be in the neighborhood of that temperature. With the aid of this invention, such a result is not difficult to obtain, because there is never any undue heating of the whole fuel-air stream, but rather, a selective heating of the fuel particles carried thereby. Due to the downwardly directed flow of the fuel-air stream, only moderate velocities need be attained to pull the mixture into the engine. Consequently, the pressure in the inlet manifold under wide open throttle or full load conditions can be maintained at a comparatively high value.

I claim:—

1. In a device of the character described, a conduit leading to the intake manifold of an internal combustion engine, said conduit being annular in section, means for heating the outer wall of the conduit, and a plurality of helicoidal vanes in the annular space to guide the flow of the stream in the conduit in a plurality of paths.

2. In a device of the character described, a conduit leading downwardly to the intake manifold of an internal combustion engine, and carrying a fuel-air mixture, means for heating the outer wall of the conduit, a tube in the conduit defining an annular space between it and the conduit, and a plurality of helicoidal vanes in the annular space to guide the flow of the mixture in a plurality of paths through the conduit.

3. In a vaporizer for hydrocarbon fuels, a conduit for conducting a fuel-air mixture to the intake manifold of an internal combustion engine, means defining a space around the outside of the conduit, means for leading exhaust gases to the space, a cleaner ring disposed around the conduit and in the space, and means for moving the ring along the conduit.

4. In a vaporizer for hydrocarbon fuels, a conduit for conducting a fuel-air mixture to the intake manifold of an internal combustion engine, means defining a space around the outside of the conduit, means for leading exhaust gases to the space, a cleaner ring disposed around the conduit and in the space, one or more rods connected to the ring and extending out of the space for moving the ring along the conduit.

5. The combination as set forth in claim 4, in which the rods have each a pair of spaced portions for connecting it detachably to the ring, whereby one portion can be used when the ring is inactive, and the other when the ring is active.

6. In a vaporizer for hydrocarbon fuels, a conduit for conducting a fuel-air mixture to the intake manifold of an internal combustion engine, means defining a space around the conduit into which exhaust gases can be led, a tube surrounding the conduit in the space and shorter than the conduit to permit exhaust gases to pass through the space between the tube and the conduit, means forming an exhaust passage for the gases from the lower portion of the space outside of the tube, and a valve adjacent said exhaust passage for controlling the relative degree of openings to the exhaust passage from the inside and from the outside of the tube.

7. A vaporizer comprising a jacketed fuel mixture conduit, an axially arranged cylinder in said conduit and with said conduit forming an annular mixture passage, and a head for said conduit having integrally formed centrally thereof a dome closing the end of said cylinder and which dome supports said cylinder within the conduit.

8. A vaporizer comprising a jacketed fuel mixture conduit, an axially arranged cylinder in said conduit and with said conduit forming an annular mixture passage, and a head for said conduit having a dome closing the end of said cylinder and which dome supports said cylinder within the conduit.

9. A vaporizer having a helical fuel-air-mixture passage and a surrounding exhaust jacket therefor, means for introducing fuel-air mixture to one end of said passage and for transferring the heated mixture from the other end of the passage to the intake of an engine, and means operable from the exterior of the vaporizer for cleaning a surface within said jacket.

10. A vaporizer having a ring-shaped member having a relatively large opening in its upper

face and having a base with a smaller opening communicating with an intake-manifold connection, a cylinder passing through the upper opening and seated against said base with the smaller opening inside the cylinder, a jacket member seated against the upper face of the ring-shaped member and cooperating therewith and with said cylinder to form an annular exhaust gas jacket surrounding said cylinder, means in said cylinder and cooperating therewith to form an annular fuel mixture passage heated by exhaust gases in said jacket, means for passing fuel mixture through said annular passage to be heated, and means for closing off the upper ends of said jacket and said passage.

11. A vaporizer having a ring-shaped member having a relatively large opening in its upper face and having a base with a smaller opening communicating with an intake-manifold connection, a cylinder passing through the upper opening and seated against said base with the smaller opening inside the cylinder, a jacket member seated against the upper face of the ring-shaped member and cooperating therewith and with said cylinder to form an annular exhaust gas jacket surrounding said cylinder, means in said cylinder and cooperating therewith to form an annular fuel mixture passage heated by exhaust gases in said jacket, means for passing fuel mixture through said annular passage to be heated, and means for closing off the upper ends of said jacket and said passage and which carries and supports the means inside the cylinder.

12. A vaporizer having a ring-shaped member having a relatively large opening in its upper face and having a base with a smaller opening communicating with an intake-manifold connection, a cylinder passing through the upper opening and seated against said base with the smaller opening inside the cylinder, a jacket member seated against the upper face of the ring-shaped member and cooperating therewith and with said cylinder to form an annular exhaust gas jacket surrounding said cylinder, means for passing fuel mixture through said cylinder to be heated, and means for closing off the upper ends of said jacket and said cylinder.

13. A vaporizer comprising a fuel-air-mixture conduit, means for introducing fuel-air mixture into said conduit, an outlet for said mixture from the conduit, a heating jacket surrounding said conduit, means for introducing heating medium into the space between the conduit and jacket, and means operable from the exterior of the vaporizer for cleaning a surface within said jacket which is exposed to the heating medium.

14. A vaporizer comprising a fuel-air-mixture conduit, means for introducing fuel-air mixture into said conduit, an outlet for said mixture from the conduit, a heating jacket surrounding said conduit, means for introducing heating medium into the space between the conduit and jacket, a member in said space, and means extending to the exterior of the vaporizer for moving said member to clean a surface within the jacket.

15. A vaporizer comprising a fuel-air-mixture conduit, means for introducing fuel-air mixture into said conduit, an outlet for said mixture from the conduit, a heating jacket surrounding said conduit, means for introducing heating medium into the space between the conduit and jacket, a member in said space, means extending to the exterior of said vaporizer and engageable with said member for moving the same to clean a surface within the jacket, and means for retaining said member in inoperative position.

16. A vaporizer comprising a conduit having heat transferring ribs thereon, means for heating said conduit, and a member operable from the exterior of the vaporizer and movable longitudinally of said ribs for cleaning the same.

17. A vaporizer for engines comprising a conduit, means for introducing a fuel-air mixture into one end of said conduit, an outlet for mixture at the other end of the conduit connected to the intake of an engine, heat transferring ribs on the outer surface of said conduit, a heating jacket surrounding said conduit, means for introducing a heating medium into the space between said conduit and heating jacket, a member in said space interfitting with said ribs, and means extending to the exterior of the vaporizer for moving said member along the ribs to clean the same.

MAURICE JOSEPH ZUCROW.