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2,065,582

CHARGE FORMING DEVICE

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2 Sheets-Sheet 1

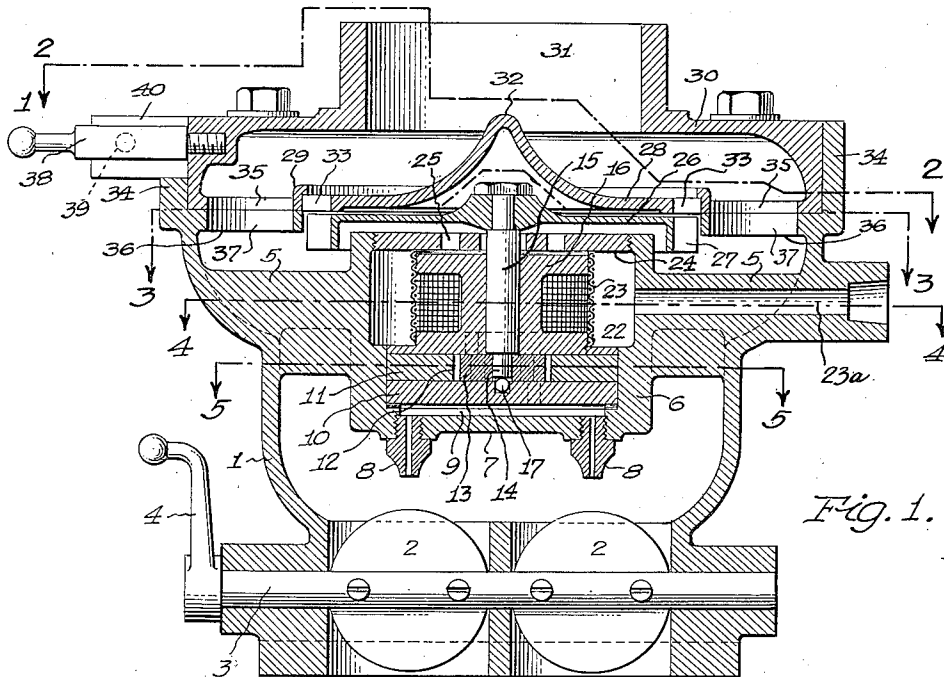


Fig. 1.

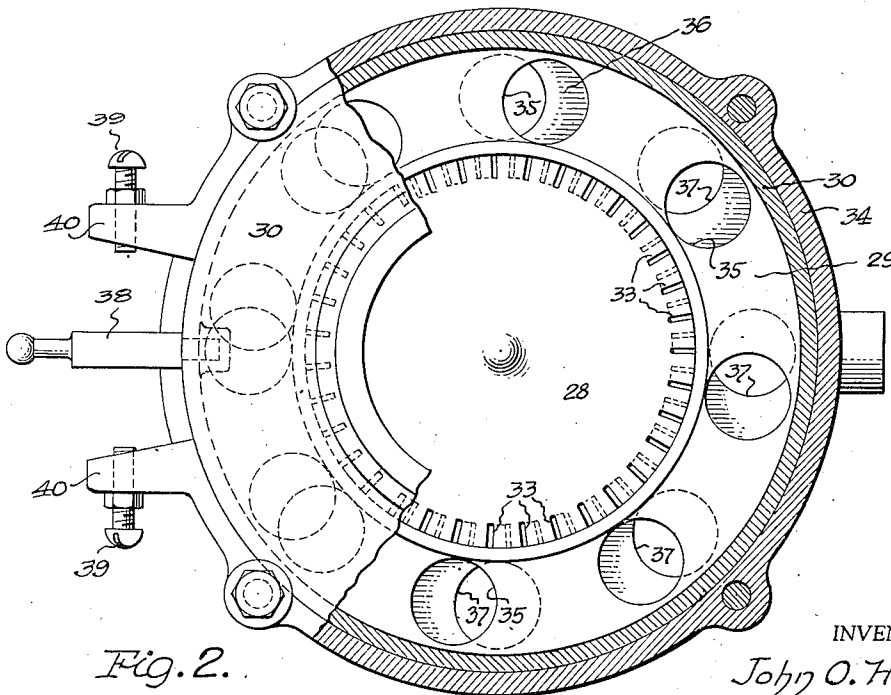


Fig. 2.

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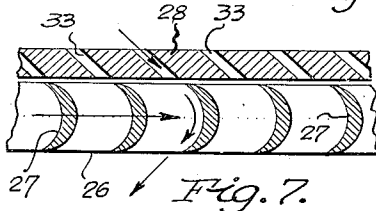
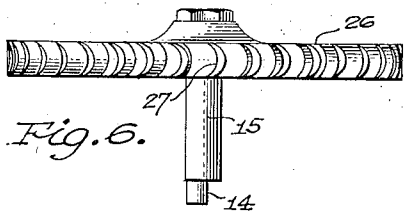
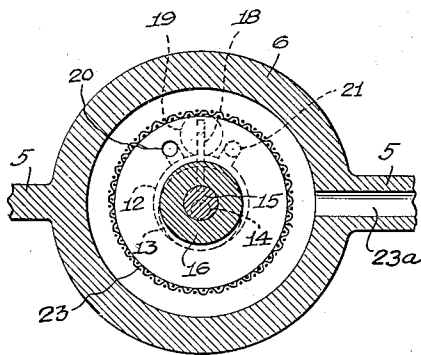
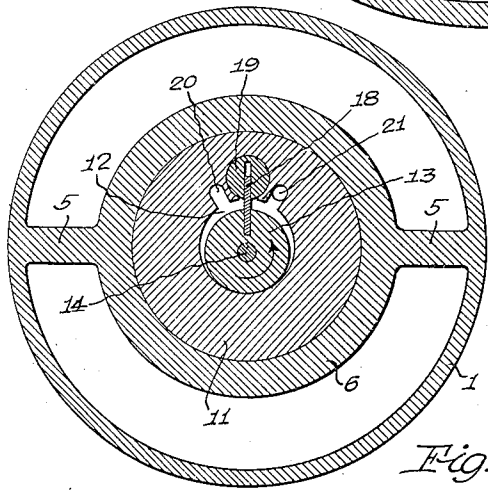
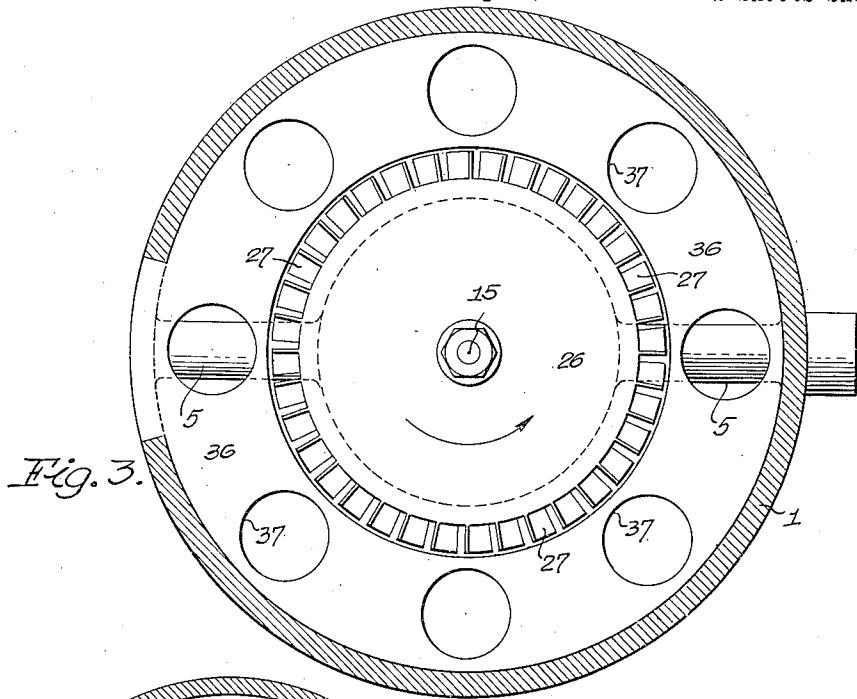
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2 Sheets-Sheet 2



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CHARGE FORMING DEVICE

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Application August 7, 1935, Serial No. 35,025

6 Claims. (Cl. 261—35)

This invention relates to means for forming gaseous mixtures of liquid fuel and air in such determined proportions as to be highly combustible, and relates more particularly to a unit device especially adapted for use in connection with furnaces, internal combustion engines and the like, employing such highly combustible gaseous mixtures as the heating or power medium.

An object of the present invention is to provide a device for the purpose which is light in weight, simple and compact in construction, and which may be substituted as a unit for the usual carbureting or other mixture supplying device or devices and separate fuel pump for supplying liquid fuel thereto and a further object is to accurately proportion the fuel to the total volume of air entering the engine for the purpose of forming the proper combustible charges or gaseous mixture and give maximum efficiency under all running conditions and at all speeds, said device including fuel feeding means driven by air flow induced by engine inspiration, and air regulating means arranged to proportion, the total air flow between said feeding means and a by-pass around said feeding means, whereby the speed of the feeding means is regulated and the consequent amount of fuel fed thereby, is proportioned according to the volume of air passing through said by-pass and the separate volume passing through and driving said feeding means.

A further object is to provide certain other new and useful features in the construction, arrangement and combination of elements and parts, all as hereinafter set forth and shown in the accompanying drawings, wherein

Fig. 1 is a transverse vertical central section through a device illustrative of an embodiment of the present invention;

Fig. 2 is a transverse section substantially upon the line 2—2 of Fig. 1;

Fig. 3 is a section substantially upon the line 3—3 of Fig. 1;

Fig. 4 is a sectional detail upon the line 4—4 of Fig. 1;

Fig. 5 is a section upon the line 5—5 of Fig. 1;

Fig. 6 is a detail of the rotor of an air turbine showing the same in side elevation and detached; and

Fig. 7 is a sectional detail of a turbine rotor and stator.

As shown in the drawings 1 indicates a suitable casing which is adapted to be secured at its lower end to the intake manifold of an engine (not shown). This device is adapted to be substituted for the usual down draft carburetor but it is obvious that it may be used in other positions and as a substitute for other forms of gaseous fuel supplying means. As shown, the present device is adapted to supply combustible charges to separate manifolds, there being located in suitable passages through the lower end of the casing, a butterfly valve 2 for each passage, said valves being secured to a common shaft 3 which is operated in the usual manner by means of a crank arm 4 upon one end thereof, this arm being operated in any suitable manner, as by the usual push and pull rod for operating the valves and controlling the speed of the motor to which the device is attached.

Midway of its length, the casing is formed with inwardly extending supporting arms 5 to support centrally within the casing, an inner casing member 6 of cylindrical form with its lower end closed by a wall 7 and this wall is bored to receive a pair of nipples or nozzles 8 each having a passage discharging directly into the air stream passing out of the lower end of said casing and communicating at its other end with the chamber 9 formed at the lower end of the inner casing 6 by means of a transverse supporting wall or disk 10, and within the inner casing directly above this wall and in contact therewith is a disk 11 having an axial bore 12 which forms a pump cylinder within which is mounted an eccentric disk-like piston 13 upon an eccentrically positioned pin 14 projecting from the lower end of a shaft 15, said shaft being mounted for free rotation within a bearing member 16 located centrally within the inner casing 6 directly above the fixed disk 11. A ball bearing consisting of a single ball 17 mounted within a recess in the disk 10 provides an end bearing for the eccentric pin 14 and the piston 13 is guided in its eccentric movement within its cylinder 12 by means of a blade or abutment member 18 anchored in the piston at one end and at its other end in the wall of the member 11 by means of a circular head 19 rotatable within a bore in said member 11 and provided with a slot to receive the blade, so that as the piston 13 is moved by rotation of said shaft 15 and the engagement of the pin 14 therewith, said piston is free to rock or move eccentrically within the cylinder 12 and thus provide a pumping action which will draw a combustible fluid, such as gasoline or fuel oil, through an inlet port 20 formed in the member 11 at one side of the blade 18 and force it out through the outlet passage 21 at the other side of the blade. This outlet passage opens into

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the chamber 9 below the supporting disk 10, and the inlet passage 20 is in communication at its upper end with the chamber 22 within the inner casing 6 in which the bearing member 16 is positioned, this bearing member being formed with a chamber into which said inlet opens and said chamber is surrounded by a peripheral screen wall 23 so that gasoline sucked into said chamber 22 through an inlet passage 23a formed in one of the arms or ribs 5, will be filtered through the screen 23 and thence pass through the inlet passage 20 into the pump cylinder 12. The shaft 15 passes through a central opening in a disk closure 24 screwed into the upper end of the inner casing 6 and this disk is also provided with openings 25 for the engagement of a spanner wrench.

Secured in any suitable manner upon the upper end of the shaft 15, is a disk-like rotor 26 having peripheral buckets 27 and above this rotor 26 is a stator 28 fixed within a horizontally disposed transverse wall 29 formed integral with an adjustable air control cap member 30 having an upwardly extending tubular air intake extension 31 located axially of the casing and directly above and spaced from the stator 28 which stator is formed with a central conical projection 32 with its apex at the axis of the air inlet passage 31 and the peripheral edge of this stator 28 is formed with slots 33 extending in downwardly inclined position, as shown in Fig. 7 to direct air into the buckets 27 of the rotor. An air turbine driven by ingoing air is thus provided for driving the fuel pump piston 13.

The inlet or control cap 30 is seated within an upwardly extending flange 34 at the periphery of the upper end of the casing 1 and is free to rotate a limited distance therein relative to the casing. The transverse wall 29 of this cap member 30 is formed with a series of holes or circular openings 35 arranged around the large central opening within which the turbine stator 28 is mounted and this wall 29 of said control cap 30 is seated upon an inwardly extending flange 36 formed integral with the wall of the casing 1, this fixed flange being also formed with circular holes or openings 37 corresponding to the openings 35 so that by a rotative movement of the control cap, these openings 35 and 37 may be brought into coincidence to provide a free passage for the air, downwardly therethrough and around the inner casing 6 and out of the lower end of the casing 1 past the valve 2 to the engine. By a rotative movement of said control cap in a reverse direction the openings 35 and 37 may be moved out of coincidence, thus closing or partially closing this air bypass past said turbine, thus causing a greater proportion of the flow to impinge upon said rotor, and this rotative movement of said control member is effected through the provision of an arm 38 projecting from one side of said cap member through a notch in the flange 34 of the casing 1 and to which arm 38 a suitable pull and push rod (not shown) or other means may be attached for turning the cap to bring the openings 35 and 37 into or out of coincidence. Stop screws or members 39 are carried by projecting lugs 40 at the sides of the notch in the flange 34 through which the arm 38 extends, these stop members being adapted to be engaged by the arm 38 to limit the turning movement of the cap 30 in both directions to give a high and low limit of adjustment, and these stops are adjustable so that the setting may be changed to change this limit of the opening or closing movement of this control cap and

thus change the proportion of the total air entering the inlet 31, that may flow downwardly through these holes and by-pass to that of the flow which drives the rotor of the turbine and pump piston.

The amount of fuel which will be delivered by the pump is therefore limited by the opening or closing of the by-pass through the holes 35 and 37 and around the inner casing 6 for when these openings are closed by the turning of the cap, the whole volume of air must then pass through the slots 33 in the stator 28 and impinging within the buckets 27 of the rotor, will drive this rotor at high speed and in turn drive the eccentric piston 13 at a high speed causing it to pump more fuel. As the openings 35 and 37 are gradually opened by the turning of the cap 30, more and more air is by-passed around the turbine and less air passes through the slots 33 into impingement with the rotor 26, thus driving the pump at a lower rate of speed and furnishing less gasoline to the chamber 9 and thence through the nozzles 8, into the main air flow at the outlet end of the casing.

By proportioning the air flow between the by-pass and the turbine rotor, the speed of the pump and therefore the amount of the gasoline delivered to the inflowing current of air will be accurately controlled by the adjustment of this control or cap member 30 which controls the openings into the by-pass. Therefore the greater the flow of air through the by-pass, the lesser will be the speed of the pump and less gasoline will be delivered to the ingoing air in proportion to its volume, and inversely as the air flowing through the by-pass is decreased the speed of the pump will be increased to increase the amount of fuel delivered to the ingoing air and the greater will be the proportion of fuel to this volume of air flow.

When the present device is installed upon a motor car, by means of a suitable pull and push rod (not shown), the control cap 30 may be accurately rotated and thus accurately adjust the proportion of air between the by-pass and the passage through the rotor, thus adjusting the proportion of the fuel to ingoing air until the motor is operating at its best under the conditions of use at that time and therefore, the driver of the car, while he is driving along the road, may adjust his carburetor to suit the particular conditions under which the engine is working to give him a lean mixture, if desired, or to give a very rich mixture, such as when starting the engine or in going up a steep grade. A very simple accurate adjustment is therefore secured and when such adjustment gives the best results under the conditions at that time, the adjustment may be retained and the carburetor will perform its functions the same as the ordinary carburetor which has just been adjusted to meet the particular conditions of the moment.

By the present arrangement a device is secured which is of simple construction and is very light in weight due to the small size of the pump piston and its arrangement in connection with the driving rotor. The parts are so constructed as to facilitate manufacture and may be made from a light metal so that, particularly the pump piston, will have but little centrifugal force even when driven at very high speeds to produce a suction which will readily lift the gasoline from the rear tank on the motor car without the intervention of the usual pump which is usually separate from the carburetor.

The present fine proportioning of fuel to in-

going air is secured through the proportioning between the flow of air through the by-pass and the flow of air through the driving rotor and this proportioning is secured in a very simple manner by means of the rotatable cap or air inlet member.

What I claim is:—

1. A device for the purpose described including a casing having a main air passage for the flow of air therethrough, means within said casing driven by said air flow through said passage to supply liquid fuel to said flow, said casing having a by-pass communicating with said passage to by-pass a portion of the flow to said passage, past said means, and means for controlling the flow through said by-pass to vary the proportion of air flow utilized for driving said fuel supplying means to the total air flow.

2. A device of the character described including a casing having a main air passage and a by-pass, a liquid fuel heating unit within said casing including a rotor in said main passage operated by air flow through said passage, and flow controlling means operative to divert a portion of the total air flow through said by-pass past said rotor and proportion the total air flow between the flow to said rotor and by-passed flow, thereby regulating the speed of the rotor and the feeding of fuel by by-passing a portion of the total air flow around said rotor.

3. A device for the purpose described including a casing having opposite open ends for an induced flow of air through said casing, liquid fuel feeding means in said casing, driving means for said fuel feeding means operated by air flow through said casing, said casing having an air passage therein extending past said driving means to receive a portion of the total air flow entering at one end of the casing and to discharge the same into the outlet end of said casing, and air flow controlling means for controlling the flow of air through said air passage past said driving means to proportion the flow through said passage to the flow for driving said driving means and regulate the speed of said driving means and the amount of fuel supplied by said fuel feeding means in accordance with the amount of flow passing through said passage.

4. A device for the purpose described including a casing having opposite open ends for an in-

duced flow of air through said casing, a pump device supported centrally within said casing and discharging into the total air flow through said discharge end of said casing, a driving member driven by air flow through said casing for driving said pump, a means dividing said casing into an intake end and a discharge end with said driving member in communication with said intake end and discharging into said discharge end, air flow control means for by-passing air past said driving member into said discharge end of said casing to control the speed of said driving member by controlling the amount of air flow through said driving member.

5. A device for the purpose described comprising a casing open at its ends and divided intermediate its ends by means forming a wall with a central opening, a turbine including a stator in said opening and a rotor adjacent said stator driven by air flow passing through said stator, a pump unit driven by said rotor for supplying a liquid fuel, said pump discharging into the total air flow through the outlet end of said casing, and air flow controlling means to by-pass a portion of the total air flow past said stator, said air flow controlling means being adjustable to vary the amount of by-passed air flow.

6. A device for the purpose described comprising a casing open at its ends and divided intermediate its ends by means forming a wall with a central opening, a turbine including a stator in said opening and a rotor adjacent said stator driven by air flow passing through said stator, an inner casing supported centrally within said main casing and adjacent said rotor with said rotor discharging around said inner casing, a pump in said inner casing comprising a circular cylinder and an eccentric disk-like piston in said cylinder driven by said rotor, said pump having outlet means discharging into the total air flow through the outlet end of said main casing, and air flow control means including an annular member seated on said dividing wall and surrounding said stator, said annular member and said wall being formed with openings to be brought into registry by rotative movement of said member to by-pass a part of the total air flow around said turbine.

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