Jan. 2, 1934.

F. A. KANE

1,942,293

CARBURETOR

Original Filed March 11, 1932

3 Sheets-Sheet 1

Fig. 1.

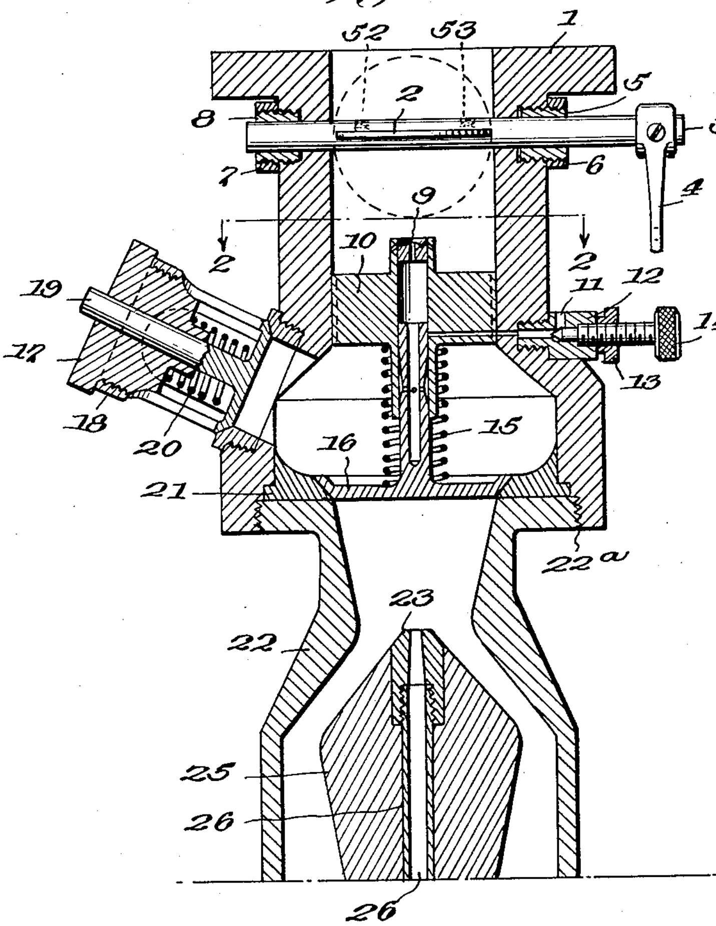
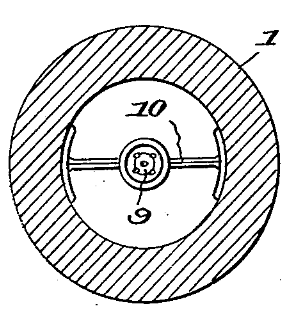


Fig. 2.



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CARBURETOR

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Fig. 1a

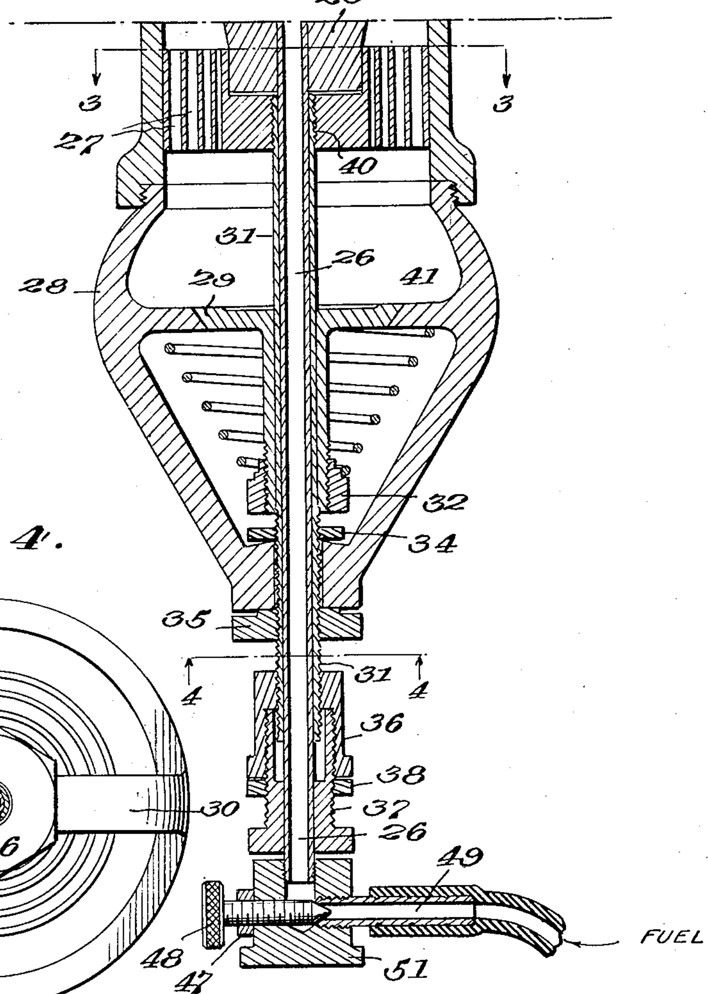

Fig. 4.

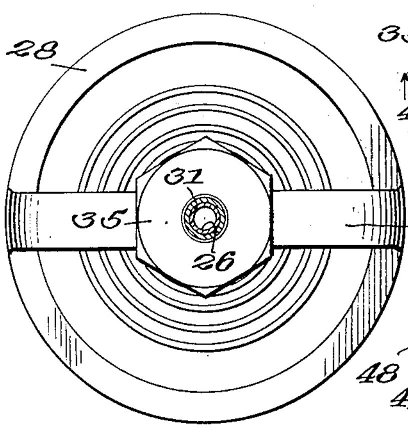

Fig. 3.

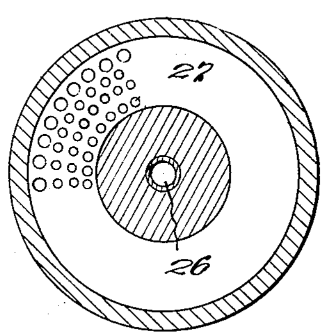

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Fig. 5.

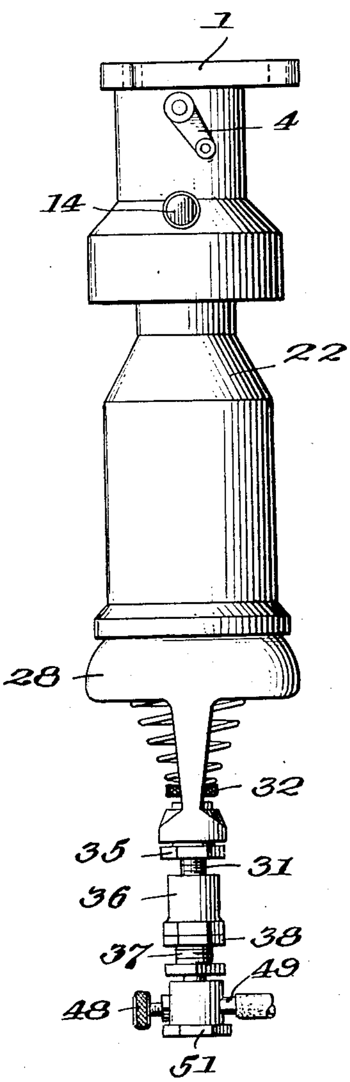
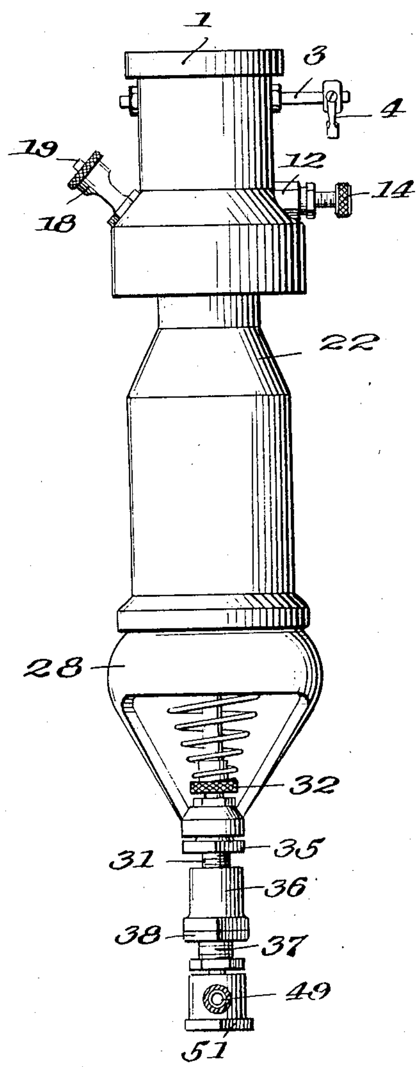


Fig. 6.



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Patented Jan. 2, 1934 **1,942,293**

UNITED STATES PATENT OFFICE

1,942,293

CARBURETOR

Frank Andrew Kane, Long Island City, N. Y., assignor to Kane Carburetor Corporation, Long Island City, N. Y., a corporation of Delaware

Application March 11, 1932, Serial No. 598,297
Renewed June 6, 1933

5 Claims. (Cl. 48—180)

My invention relates to fuel mixers or carburetors and has for its object the improvement of such devices and the methods of their use to produce a more perfect combustible mixture than has heretofore been possible, using gaseous fuels or the gaseous products of liquid fuel. The present application is a continuation in part of my prior copending application Serial No. 487,623, filed October 9, 1930.

In my said prior application I have described and illustrated a carburetor and fuel mixer having as its vital parts a bell chamber body through which the constituents of the finished fuel mixture pass, and a vacuum bell, so called because the air passing up around it in the interior of the bell chamber body produces a partial vacuum above the bell in the same manner that air passing over the cambered surface of an aerofoil produces a partial vacuum above the same. Fuel is admitted preferably vertically through the bell and emerges into the currents of air above the bell where it is caught in the vacuum and rolled to form a homogeneous combustible mixture. The admission of fuel to the mixer as well as opening and closing of the throttle are controlled in said case by a common connecting rod and lever or the equivalent, and the same control applies to the adjustment of the vacuum control bell in the bell chamber body. Thus, the degree of opening of the butterfly valve or throttle to admit the charge to the engine, the amount of fuel supplied at the same time, and the size and shape of the air passages in the bell chamber body around the vacuum control bell are all simultaneously and automatically controlled.

In the present application I describe and illustrate a carburetor and fuel mixer having the same vital parts, but with this difference, that the butterfly valve or throttle is separately controlled and the fuel intake as well as the position of the vacuum control bell in the bell chamber body, are adjusted once for all in the most efficient position for all degrees of opening of the throttle and then locked.

My invention is illustrated in the accompanying drawings, in which

Figs. 1 and 1*a* taken together constitute a vertical central section through the carburetor.

Fig. 2 is a horizontal section on the line 2—2 of Fig. 1 looking downward.

Fig. 3 is a vertical section on the line 3—3 of Fig. 1*a* looking downward.

Fig. 4 is a bottom plan view of the bell chamber body showing the air valve bridge.

Fig. 5 is an elevation of the complete carburetor.

Fig. 6 is a similar view looking from the left side of Fig. 5.

Referring to the drawings and first to Fig. 1, 1 designates the upper section of the containing casing, the lower elements of which are designated as 22 and 28 respectively. The casing 1 is flanged at its upper end for attachment to the intake manifold of an internal combustion engine in the usual manner. Its cylindrical walls are drilled on a horizontal line to receive bushings and nuts 5—6—7—8 containing bearings for the shaft 3 carrying the butterfly valve or throttle 2, and having an operating lever 4 attached to it. No actuating device for this lever is shown, and it may be actuated in the usual or any desired manner.

The two sections 1 and 22 of the body are connected by a screw thread 22*a*, the purpose in separating them at this point being to insert an annular valve seat 21, which is clamped in place between them. This is the seat of an automatic pressure valve 16, which is lifted up when the throttle is opened and not only permits passage of the mixture from beneath it, but also opens a water valve and injects a spray of water into the mixture as it passes. The sprayer is shown at 9 carried in a vertical tube supported axially in the casing by a bridge 10. Spring 15 for the pressure valve 16 encircles the tube and abuts against the bridge. Inside the tube the stem of the valve 16 slides up and down as the valve moves, and in its uppermost position, the valve is open. It opens a slide valve to permit water to enter through a horizontal channel in the bridge which communicates through the valve casing 12 carrying needle valve 14 and locknut 13. The water supply enters the casing 12 through inlet port 11, the external connections of which are not shown.

On the opposite side of the casing from the water valve I have shown a pressure relief valve 19 with a compression spring 20 which is adjusted in tension so as to permit the valve to open at any pressure above that which should normally exist either above or below the valve 16.

The foregoing features may be changed or varied without departing from the spirit of the invention, as all parts above the valve 16 are incidental to the main features of invention which are as follows:

The central section 22 of the casing I call the bell chamber body and within it is housed what I call the vacuum control bell. The bell chamber body is closed at its lower end by a horizontal disk 27 containing annular sets of perforations and this disk with its perforations I call my air vent duct. Its functions are exceedingly important as will be presently pointed out. The central part of this disk is counter-sunk from the top to receive the lower end of the vacuum control bell 25 having a central tube 26 extending through it and terminating in a conical nozzle 23 at its upper end. The bell 25 speaking roughly, is pear-shaped, that is to say, it is contracted at the top and bottom in a double conical figure having an annular camber or shoulder around its upper portion. This bell is shaped complementarily to the inner walls of the bell chamber body which are also conical and lie parallel to the upper outer walls of the bell, which as already stated are conical, the nozzle or tube 23 forming the apex of the cone. The lower portion of the bell 25 is also conical but inverted and really forms the frustum of a cone, while the corresponding zone or portion of the inner walls of the bell chamber body is cylindrical and vertical. It should be noted that the air ducts in the disk 27 are also vertical and are in four annular rows, the outer two of which lie in cylindrical figures outside the camber or shoulder of the bell 25 while the inner two rows lie within the circle of the greatest projection of the camber or shoulder around the bell. The purpose of this will be pointed out in the statement of operation.

It will be understood that the dimensions and shapes herein shown and described represent only one species and are subject to change either in manufacture or adjustment, to meeting varying conditions, without departure from the invention.

The tube 26, which is integrally attached to the bell at its upper end carries fuel to the nozzle 23 and so into the vacuum chamber above the nozzle. This tube 26 extends down through the bell chamber body, through the hollow stem of the air valve 29 and through the bridge 30 to the fuel supply connection at the bottom of the device, which is effected through the needle valve block 51. This central tube 26 is smooth surfaced, and while it may be adjusted with respect to the surrounding tube 31, such adjustment is not ordinarily necessary, the vacuum control bell 25 being ordinarily fixed with respect to the air vent duct 27. The outer tube 31 is tapped into the air vent duct plate at 40 and furnishes direct means for adjustment of the vacuum bell 25, together with air vent duct plate, in the bell chamber body. This tube 31 extends downwardly through the lower chamber 41 in the bell chamber body, thence down through the hollow stem of the air valve 29 through the bridge 30 and so to a coupling connection 36—37—38 which enables the outer tube 31 to be adjusted and thereby to adjust the position of the vacuum bell in the air vent duct plate. The adjustment of these parts is by hand and when adjusted they are locked and in position by setting up the lock nuts 34—35—36—37—38. It should be noted that the construction thus described also permits adjustment of the vacuum control bell with respect to the air vent duct plate 27. This is accomplished by loosening up the lock nut 38 and turning the nut 36 on the tube 31 whose inner surface is smooth so that it may slide on the inner tube 26. When the desired adjustment is reached, the nut 38 is set up again and the two tubes may then be moved as one unit, assuming one or both of the nuts 34—35 to be slacked off, whereby the tubes may move up or down in the bracket.

Fuel supply in this assembly is through a fuel tube 49 and the needles secured in the block 51, the flow being controlled by a needle valve 48 locked when set by means of a nut 47. Because of the fixed relationship of the tube 49 and other fuel supply parts to the fuel supply tube and other fixed parts, it will be noted that the couplings 36—37—38 are made of such a nature that the two tubes 31 and 26 may be caused to slide upon each other without turning and the outer tube 31 may raise and lower the vacuum bell and the air vent duct plate without turning the inner tube 26.

I have shown in Fig. 4 a bottom plan view of the bell chamber body, to show that the bracket or bridge 30 extends across it leaving open spaces on both sides so that access may be had to the nuts 32 and 34 and the valve 29, if necessary.

The operation of the foregoing fuel mixer is briefly as follows: the amount of fuel supply at maximum suction of the engine is determined by adjusting the needle valve stem 48, after which the same is locked by means of the nut 47. The best position of the vacuum bell 25 in the bell chamber is determined by moving the assembly of tubes 26 and 31 and locking the same by means of the nuts 34, 35, 36, 37 and 38. The amount of air to be admitted for any particular degree of suction by the engine is determined by adjusting the nut 32 on the hollow stem of the valve 29 whereby the tension of the spring is adjusted. The maximum pressures above and below valve 16 having been thus determined, the tension of the spring 20 of the relief valve is adjusted accordingly and the device is ready to operate.

One of the most important features in the device is the air vent duct with its vertical vents or openings 27. As shown, these are in four annular rows and extend entirely through the disk all around. The fuel being admitted at the tip 23 of the vacuum bell 25 when the parts are properly set there is a definite relation between the conical head and the camber or shoulder on the vacuum bell and the air vent duct openings 27, also between the conical head of the vacuum bell and the overhanging conical walls of the bell chamber body 22. The lower walls of this bell chamber are cylindrical, permitting the incoming jets of air to pass from the ducts 27 vertically under practically atmospheric pressure which impels them with a velocity determined by the degree of suction or exhaust produced by the engine above the valve 16, which under such condition is opened by the air pressure beneath it and remains open as long as there is any suction. Directly beneath this valve is what I call the vacuum chamber in which the conical surface of the head of the vacuum bell 25 and the conical surface of the vacuum chamber above said bell, both center. A vacuum is formed directly above the tip 23 of the bell supplemental to the vacuum produced by engine suction. This formation is due to the air currents passing over the camber of the bell and being deflected by the inner wall of the bell chamber over and above the tip 23 which is the inlet point for the fuel. The best form of apparatus for developing the air streams and developing this condition of vacuum above the tip has been determined experimentally and is that which is shown and described herein. In as much as it is very difficult to make detailed measurements or graphs of the several air streams inside the bell chamber, several theories of operation have been worked out. One is that a supplemental vacuum is set up between the tiny ribbons of air as they emerge from the air vent duct, which causes them to spread upon themselves and to impinge upon each other before making contact with the cambered surface of the vacuum bell or the inner wall of the bell chamber. Another theory is that the air streams merge one upon the other, and follow each other closely, each stream paralleling adjacent streams into the compressed space, rather than spreading and impinging upon themselves or each other. In either case the air streams of the different annular rows of ducts impinge either on the conical upper face of a wall of the bell chamber or on the side of the vacuum bell below the camber, and are all ultimately deflected toward the tip of the cone immediately above the tip of the vacuum bell. By properly adjusting the rows of openings in the conical duct and also the position of the bell with respect to the vacuum chamber walls, the supplemental vacuum surrounded by turbulent rotating currents of air causes the fuel to be drawn up from the tip 23 directly into the vacuum where it is thoroughly mixed with and in the turbulent air currents. This mixture is drawn through the valve 16 and moistened by the jet 9 as it passes up into the discharge vent as determined by the throttle valve 2.

What I claim is:

1. A charge forming apparatus comprising the following instrumentalities: a casing, an air inlet and a fuel feed pipe therefor, a bell chamber contained within said casing, a vacuum control bell in said bell chamber, said bell having a conical head and a body tapering downward, with an annular camber or shoulder between them, means to adjust said bell axially in said bell chamber, means to lock the same when adjusted, conical tapering walls in the upper part of the bell chamber above the conical top of the bell, with an annular air passage between them having a central discharge opening over the tip of the bell cone, an air vent duct surrounding the lower end of said bell, with a discharge pipe and a throttle valve controlling the discharge.

2. A charge forming apparatus comprising the following instrumentalities: a casing, an air inlet and a fuel feed pipe therefor, a bell chamber contained within said casing, a vacuum control bell in said bell chamber, said bell having a conical head and a body tapering downward, with an annular camber or shoulder between them, means to adjust said bell axially in said bell chamber, means to lock the same when adjusted, conical tapering walls in the upper part of the bell chamber above the conical top of the bell, with an annular air passage between them having a central discharge opening over the tip of the bell cone, an air vent duct surrounding the lower end of said bell, with multiple channels extending through it parallel to the axis of the bell, with a discharge pipe and a throttle valve controlling the discharge.

3. A charge forming apparatus comprising the following instrumentalities: a casing, an air inlet and a fuel feed pipe therefor, a bell chamber contained within said casing, a vacuum control bell in said bell chamber, said bell having a conical head and a body tapering downward, with an annular camber or shoulder between them, means to adjust said bell axially in said bell chamber, means to lock the same when adjusted, conical tapering walls in the upper part of the bell chamber above the conical top of the bell, with an annular air passage between them having a central discharge opening over the tip of the bell cone, an air vent duct surrounding the lower end of said bell, with multiple channels extending through it parallel to the axis of the bell, and a vacuum chamber in the upper part of the bell chamber above the bell, with a discharge pipe and a throttle valve controlling the discharge.

4. A charge forming apparatus comprising the following instrumentalities: a casing, an air inlet and a fuel feed pipe therefor, a bell chamber contained within said casing, a vacuum control bell in said bell chamber, said bell having a conical head and a body tapering downward, with an annular camber or shoulder between them, means to adjust said bell axially in said bell chamber, means to lock the same when adjusted, conical tapering walls in the upper part of the bell chamber above the conical top of the bell, with an annular air passage between them having a central discharge opening over the tip of the bell cone, an air vent duct surrounding the lower end of said bell, with multiple channels extending through it parallel to the axis of the bell, with a discharge pipe and a throttle valve controlling the discharge, together with means for adjusting the position of said air vent duct in the bell chamber, and means for locking the same when adjusted.

5. A charge forming apparatus comprising the following instrumentalities: a casing, an air inlet and a fuel feed pipe therefor, a bell chamber contained within said casing, a vacuum control bell in said chamber, said bell having a conical head and a body tapering downward, with an annular camber or shoulder between them, conical tapering walls in the upper part of the bell chamber above the conical top of the bell, with an annular air passage between them having a central discharge passage over the tip of the bell cone, an air vent duct surrounding the lower end of said bell with multiple channels extending through it parallel to the axis of the bell, with a discharge pipe and a throttle valve controlling the discharge, a bridge secured to the casing, means for adjusting the air vent duct axially of the bell chamber comprising an externally threaded tube carrying the air vent and threaded in the bridge, means for locking the threaded tube in the bridge, and means to adjust the vacuum bell axially in said bell chamber comprising a cylindrical support carrying the vacuum bell and slidably mounted in the said threaded tube with means for locking the cylindrical support in relation to the threaded tube.

FRANK ANDREW KANE.