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F. H. ROYCE

CARBURETOR FOR INTERNAL COMBUSTION ENGINES

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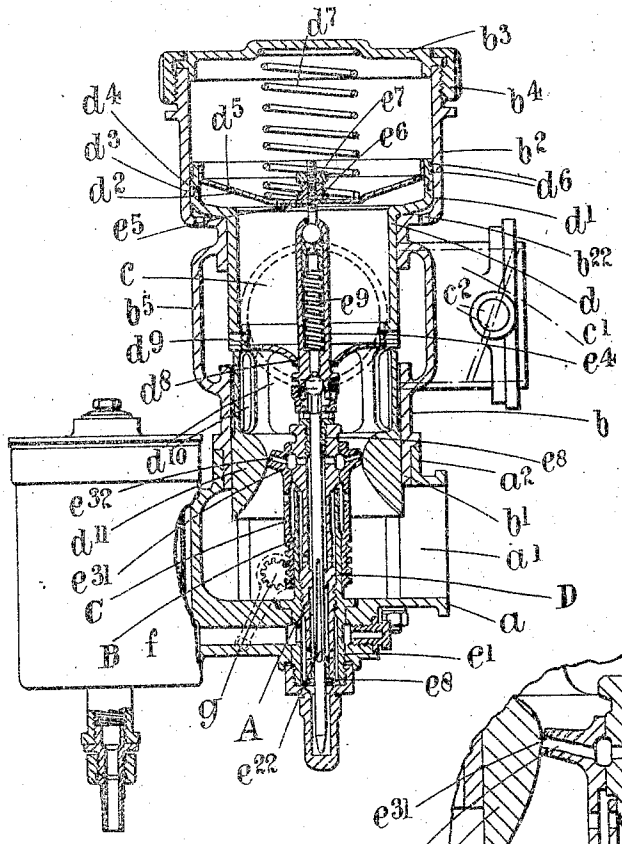


Fig. 1.

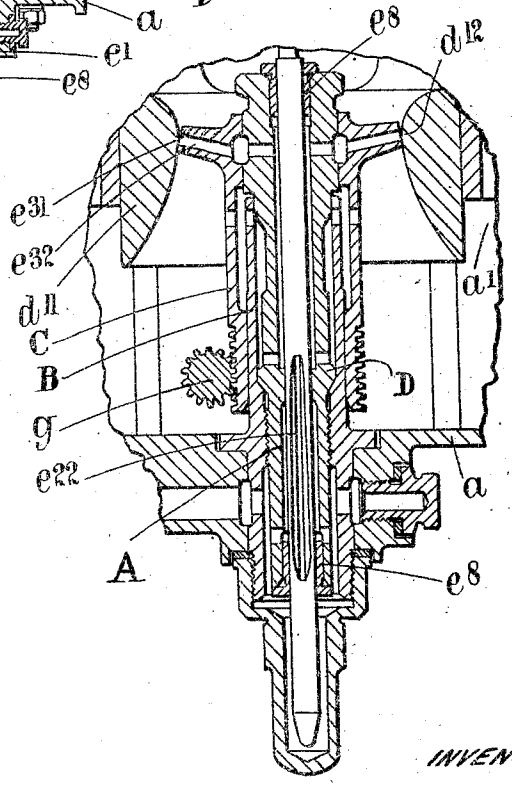


Fig. 2.

INVENTOR

FREDERICK HENRY ROYCE.

ATTORNEY:

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FREDERICK HENRY ROYCE, OF DERBY, ENGLAND, ASSIGNOR TO ROLLS ROYCE LIMITED, OF DERBY, ENGLAND.

CARBURETOR FOR INTERNAL-COMBUSTION ENGINES.

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To all whom it may concern:

Be it known that I, FREDERICK HENRY ROYCE, a subject of the King of Great Britain and Ireland, residing at Derby, England, have invented certain new and useful Improvements in Carburetors for Internal-Combustion Engines, of which the following is a specification.

This invention comprises an improved carburetor for liquid fuel for internal combustion engines and has for its object to secure a more perfect and regular carburation and a more intimate and thorough mixture of the fluid and air for all engine speeds and throttle openings than are attained by all or many of the carburetors heretofore in use.

In a carburetor constructed according to my invention, the nozzle is concentrically located in a cylindrical tube or chamber and has a comparatively wide head. The orifices from which the fuel is sucked are radially arranged around the head on the line of its largest circumference, and around the nozzle is positioned an automatically and vertically moving choke tube fitting and sliding in the said cylindrical chamber, said choke tube being internally bulged inwards on a suitable curve or contour to bring about the following conditions, viz: firstly, from each end of its internal diameter it is gradually contracted to a point or plane which, when the choke tube is at the lowest position of its permitted movement, coincides with the plane of the widest part of the nozzle; secondly, at such point or plane the diameter is of such dimension that there is only a small clearance between the choke member and the nozzle; and thirdly, on the lifting of the choke tube the passageway between it and the nozzle is gradually opened and enlarged to admit the required air.

The nozzle is also provided with an automatic valve which controls the passageway of the fuel from the minimum to the maximum required, the automatic control of the choke tube and that of the valve being brought about by means of the vacuum created by the engine.

With this construction, I am able to provide that in all positions the narrowest part of the airway and hence the part in which the air is traveling at the greatest velocity is across the mouth of the orifices of the nozzle. Further, by means of such a choke tube and of a suitably shaped diaphragm above it and moving with it, I am able to provide an appropriately shaped spraying chamber, and to shape and suitably restrict the pathway through the ports of said spraying chamber into the throttle chamber to facilitate the mixing of fuel and air and to maintain a rapid flow, thus preventing condensation and deposit of fuel.

Preferably, I adopt the form of nozzle commonly known as a diffuser nozzle; that is to say, a nozzle which opens into a chamber under suction of the engine and with which air holes also communicate, the fuel and air mixing together in the chamber and being drawn out through suction passages by the engine.

In the accompanying drawings is shown an example of my invention, Fig. 1 being a sectional central elevation and Fig. 2 a like section of the nozzle on an enlarged scale.

In said drawings a indicates a horizontal cylindrical member open at one end a^1 to constitute the air inlet, said cylindrical member having an opening at its upper side from the edges of which projects the upstanding part a^2 and a suitably shaped opening on the lower side to receive and locate the fixed portion of the nozzle hereinafter described.

b indicates a cylindrical member formed with an extension b^1 fitting into the upstanding part a^2, and b^2 indicates an enlarged part of the member b, closed by an air-tight cover b^3 secured by a nut b^4 engaging a thread on the part b^2 (hereinafter called the piston chamber). b^{22} indicates a row of holes to admit air under atmospheric pressure, and b^5 is an enlarged part of the member b which constitutes the throttle chamber.

c indicates the throttle tube (also shown extended by broken lines at c^1 to illustrate the throttle valve c^2) branched from, and its walls merging with the walls of the part b^5.

d indicates a cylindrical member sliding in the member b and which constitutes the automatically operative part of the carburetor. d^1 indicates an enlarged part of said member d which fits the chamber b^2, and d^2 is a dished diaphragm extending across and attached to the walls of part d^1, this part and the said diaphragm constituting a piston sliding in the piston chamber b^2. d^3

indicates an annular groove and d^4 a row of holes formed in and through the wall of the part d^1, whilst d^5 represents a hole through the diaphragm. d^6 indicates smaller annular grooves in the wall of the part d^1 (the function of the various grooves being set forth hereinafter), d^7 a spiral spring acting between the cover b^3 and the diaphragm d^2, d^8 a diaphragm extending across, and attached to, the member d, this diaphragm being curved upwards and outwards from the centre and so placed that when said member d is at its lower limit of movement, the diaphragm is just above the lip of the enlarged part b^5. d^9 indicates a circumferential row of holes through the wall of the member d, d^{10} elliptical holes through the wall of and equi-spaced around member d, and d^{11} a part of the member d with its interior circumference bulged inwards on a suitable curve to form the choke tube. The bore of the choke tube d^{11} has a small portion of its wall, indicated at d^{12} (Fig. 2), which is substantially parallel with the axis of the bore, so as to enable an initial lifting movement of the element d^{11} without any substantial enlargement of the space between such element and the nozzle outlets.

The nozzle consists of three parts, comprising the tubular elements A, B, C; and cooperating therewith is a fuel valve e^2 which moves with the piston diaphragm d^2 and has formed on it three taper grooves e^{22} which bridge a restriction D in the fuel conduit. The outer part C of the nozzle is movable by the operator, as hereinafter explained, and comprises the tubular element or sleeve e^3, which is formed with a widened part e^{31}, at the outer edge of which are the spray openings e^{32}. e^4 indicates an elongated tubular member or sleeve passing through a hole in the diaphragm d^8, said sleeve e^4 being connected to the valve e^2 at one end and to a threaded rod e^5 at the other end by ball-and-socket joints. The threaded rod e^5 passes through a hole in the diaphragm d^2 and is secured by nut and lock nut e^6 and e^7, respectively. e^8 indicates bushings through which the valve e^2 slides, and e^9 indicates a helical spring adapted to keep the joint sockets in position and avoid any slackness.

f designates the float tank, and g a rod or pinion which (within limits) can be rotated by the operator through suitable connections (not shown) and having axial serrations about its periphery which engage teeth formed on the part e^3 of the nozzle.

The operation of the carburetor is as follows:—

On the engine being turned over, the partial vacuum created in the throttle chamber is communicated via the holes d^9 to the space within the sliding piston member d, and thence via the holes d^4 and annular groove d^3 and the clearance between the parts d^1 and b^2, and also via the hole d^5 in the diaphragm d^2, to the piston chamber above said diaphragm. Thereupon the atmospheric pressure operating through the holes b^{22} will lift the member d whereby the air passageway adjacent the spray openings e^{32} will be enlarged. At the same time the depression will be communicated via the holes d^{10} to the spraying chamber and a current of air will be sucked past the nozzle at high velocity, the most restricted part of the air passage being that immediately adjacent the nozzle outlets. As the member d rises, the passage through the holes d^{10} to the throttle chamber will be enlarged, and the flow of fuel will also be increased by raising valve e^2 and all the passages will open or close in relation to the extent of depression in the throttle chamber. The shape of the choke tube and of the groves of the fuel valve are such that at all speeds and throttle openings the required mixture of air and fuel is attained. The shape of the choke tube, the spraying chamber, diaphragm d^8 and ports d^{10} with their openings into the throttle chamber secure a restricted passage from the spraying chamber to the throttle chamber and hence a rapid flow with a consequential inhibition of condensation and deposit of fuel. By means of the pinion g the operator can raise or lower the nozzle sleeve e; such movement of the part e producing, as a result thereof, the movement of the choke tube d^{11} and valve rod e^5 in the same direction, the position of the grooves e^{22} in said rod relative to the restriction D being consequently varied, so that the richness of the mixture supplied is thus controlled within limits. This movement of the choke tube and valve rod at the same time and in the same direction as the sleeve C is due to the fact that the movement of said sleeve brings its spray orifices e^{32} nearer to the wall of the choke tube (assuming that the sleeve is moved upward) and, in consequence, restricts the air space or passage between the peripheral edge of the part e^{31} of the sleeve wherein said orifices are formed and the aforesaid choke tube wall. This, as will be apparent, intensifies the vacuum in the throttle chamber and, hence, on the top of the piston, with the result that the latter rises, carrying with it the choke tube and the valve rod, so that the position of said parts relative to sleeve C is thereby restored. The reverse takes place when the sleeve is lowered, as will be understood.

What I claim as my invention and desire to secure by Letters Patent of the United States is:—

1. A carburetor, comprising an outer cylindrical member provided with an enlarged circumferential portion constituting a throttle chamber and having a fuel nozzle

therein, and an induction pipe communicating with such portion; an inner cylindrical member slidable in the outer member and formed with circumferential ports which, according to the relative positions of the two members, open more or less into said chamber; a diaphragm in the inner member above said ports; and means whereby the position of the inner member within the outer member is automatically adjusted by the degree of vacuum in the throttle chamber.

2. A carburetor, comprising an outer cylindrical member provided with an enlarged circumferential portion constituting a throttle chamber and having a full nozzle therein, and an induction pipe communicating with such portion; an inner cylindrical member slidable in the outer member and formed with upper and lower series of circumferential ports, the upper series opening constantly into said chamber, and the lower series opening more or less thereinto according to the relative positions of the two members; a diaphragm in the inner member between the two series of ports; and a piston at the upper end of the inner member movable within the outer member and having means for transmitting the vacuum prevailing in the throttle chamber through the upper series of ports to the part of the outer member above the piston, and said outer member having inlets for atmospheric air below said piston, whereby the positions of the piston and the inner member will be automatically adjusted in conformity with the degree of such vacuum.

3. In a carburetor, the combination of a choke tube; a nozzle comprising a fixed, inner tubular member, a rod movable axially through said member to control the supply of fuel thereto, and an outer tubular member telescoped on the inner tubular member and having spray outlets for the fuel delivered thereto from the latter member; means for raising and lowering said rod and said choke tube; and separate means for adjusting the position of the outer tubular member on the inner tubular member relatively to the same and to the choke tube.

4. In a carburetor, the combination of a choke tube; a nozzle comprising a fixed, inner tubular member, a rod movable axially through said member to control the supply of fuel thereto, and an outer tubular member telescoped on the inner tubular member and having spray outlets for the fuel delivered thereto from the latter member; suction-controlled means for automatically adjusting the position of said rod within the inner tubular member; and manually-controlled means for independently adjusting the position of the outer tubular member on the inner tubular member relatively to the same and to the choke tube.

5. A carburetor, comprising an outer cylindrical body member; an inner cylindrical member slidable therein, having its lower portion shaped to form a choke tube and communicating with the air inlet; a nozzle with which the choke tube is associated; a throttle chamber in communication with the outer member; and a suction-actuated diaphragm carried by the upper portion of the inner member for controlling the sliding movements of that member, the portion of said inner member between the diaphragm and the choke tube being provided with circumferential ports for adjustably controlling communication between the interior of the inner member and the throttle chamber, to regulate the passage of fuel mixture from the said inner member to the throttle chamber.

6. A carburetor for internal combustion engines, comprising an outer cylindrical body member having a circumferentially-enlarged portion constituting a throttle chamber from which the induction pipe to the engine is branched; an inner cylindrical member slidable in the outer member having its lower portion shaped to form a choke tube and communicating with the air inlet; a nozzle with which the choke tube is associated; and a suction-actuated diaphragm carried by the upper portion of the inner member for controlling the sliding movements of that member, the portion of said inner member between the diaphragm and the choke tube being provided with circumferential ports which open more or less fully into said throttle chamber according to the position of the inner member, to regulate the passage of fuel mixture from the said inner member to the throttle chamber.

7. A carburetor for internal combustion engines, comprising, in combination, a diffuser nozzle; a cylindrical body member wherein the nozzle is concentrically arranged; a throttle chamber; a valve for controlling the supply of fuel to said nozzle, a choke tube concentrically and slidably arranged in said body member and encircling the head of the nozzle, the cross-sectional area of the choke tube at its narrowest part equaling except for a very small clearance the cross-sectional area of the broadest part of said nozzle head, such narrowest and broadest parts lying in the same plane when the engine is at rest, and said choke tube widening out from said plane in both directions and providing through it the only air supply; and a single means for controlling the position of the choke tube and the fuel valve.

In witness whereof I have signed this specification.

FREDERICK HENRY ROYCE.