March 2, 1926. 1,575,369

E. JUILLARD

BURNER FOR LIQUID FUEL

Filed July 11, 1923

Fig. 1.

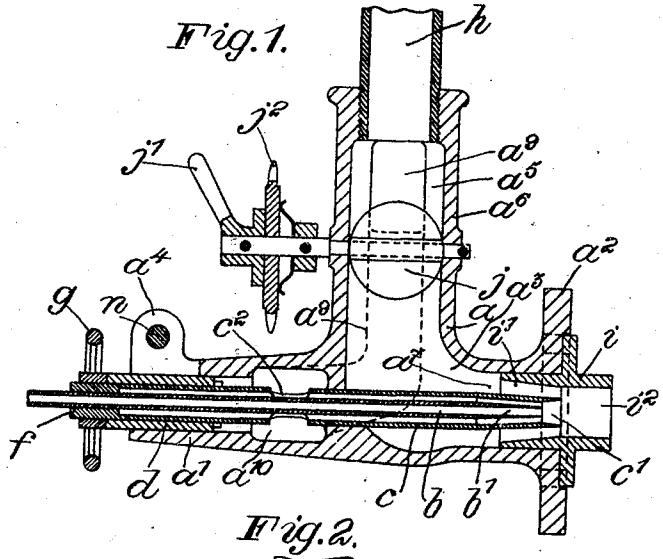


Fig. 2.

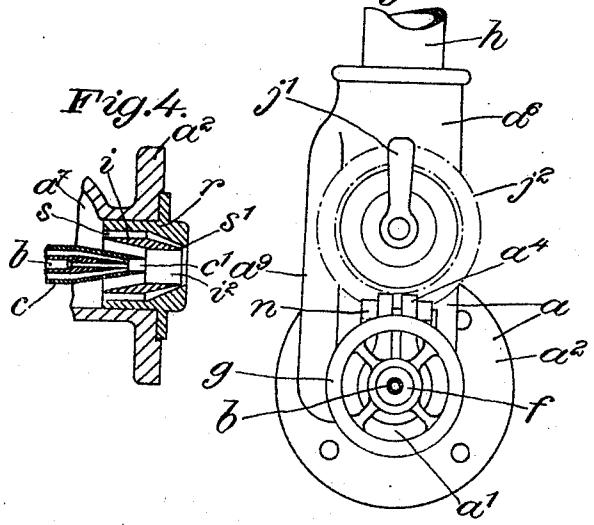
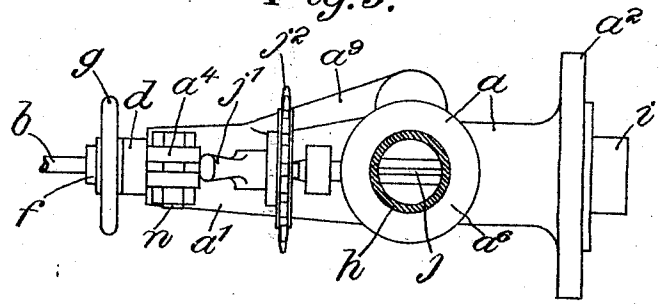


Fig. 4.

Fig. 3.



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Patented Mar. 2, 1926. 1,575,369

UNITED STATES PATENT OFFICE.

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BURNER FOR LIQUID FUEL.

Application filed July 11, 1923. Serial No. 650,741.

To all whom it may concern:

Be it known that I, ERNEST JUILLARD, a citizen of Switzerland, residing at Geneva, Canton of Geneva, in the Confederation of Switzerland, have invented certain new and useful Improvements in Burners for Liquid Fuel, of which the following is a specification.

This invention relates to burners for liquid fuel and more particularly to that class of burners which are adapted for the use of very light liquid fuel such as petrol but which may serve equally as well for burning fuels which are viscous, such for instance as tar or crude oil or masut.

The burner according to my invention is characterized by the fact that it is provided with two Venturi tubes, one of which with a comparatively small free cross section surrounds the opening of the spray nozzle and serves to cause the flowing out of the fuel and its atomizing if its consumption is but small, whilst the other Venturi tube of relatively large free cross section is adapted to cause in conjunction with said first tube the flowing out of the fuel and its atomization whenever the consumption of fuel is considerable.

The attached drawing shows by way of example a working form of the burner according to invention and another one departing somewhat from the design of the first one.

Fig. 1 is a central longitudinal section of an oil burner made in accordance with my invention.

Fig. 2 is a front elevation of the same.

Fig. 3 is a plan of the same, and

Fig. 4 is a partial section illustrating a modified form of the invention.

According to this working form the burner consists of a hollow fitting a in the form of an upset T. The horizontal shank a^1 of the fitting a is of a cylindrical form and has on its right hand side a flange a^2 which serves for connecting the fitting to the wall of a hearth, not shown and in which the combustion is to take place. On the axis of the member a^1 a spray nozzle b is arranged which on its right has a conical end part b^1. This nozzle is supplied with fuel by a container in which the level of the liquid fuel is kept constant, for instance between 0 and 150 mm. below the axis of a^1.

Around the nozzle b is arranged a cylindrical-tube c whose conical end part c^1 constitutes the above mentioned Venturi tube c of small free cross section which surrounds the opening of the nozzle b. The tube c is rigidly connected to a shell d which is inserted into part a^1 of the fitting a and is also rigidly fixed to it by means of the lugs a^4 into which this part on its left hand is divided, and a screw bolt and nut n. The inner wall of the shell d is provided with a screw thread for receiving a correspondingly threaded member f which is rigidly connected to the nozzle b and to a controlling wheel g. By turning said controlling wheel g the opening of the nozzle b may be displaced within the tube c.

By means for instance of a fan compressed air is introduced through pipe h to the duct a^5 provided for in the branch a^6 of the fitting a and leading to a duct a^7 of part a^1 which duct extends to the flange a^2. On the right hand side of this duct a^7 a sleeve i is introduced whose bore constitutes the second of the Venturi tubes mentioned above. Its interior has the form of two obtuse cones contacting with their smaller faces and its free cross section is rather large as compared with that of the tube c^1. This sleeve i is rigidly fixed into the fitting a but the position of the outflow opening of the tube c^1 with regard to the smallest cross section of sleeve i is adjustable by displacing tube c within the part a^1. In the duct a^5 a throttle valve j is provided, which may be adjusted by means of a key j^1 or by means of a chain pinion j^2 controlled by a governor. By operating the throttlelvalve the volume of the air arriving through the duct a^5 to the nozzle b will be varied. On the outer side of the throttle-valve j a duct a^9 is branched off which leads to a chamber a^{10} provided for in part a^1 and which is connected with the interior of tube c through its openings c^2.

The working manner of this burner is as follows:

If the burner is consuming but little fuel the throttle-valve j is entirely closed. Thereupon the air which is under a water column pressure of from 40 to 100 cm. will flow out through the small Venturi tube in a relatively small quantity only but which will be sufficient to secure a good combustion.

The speed of the air is sufficiently great to atomize the fuel. Besides the nozzle *b* is by means of the controller wheel *g* displaced with regard to the tube *c* until the mixture of atomized fuel and air burns without causing any smoke.

If the consumption of fuel is greater, the throttle-valve *j* is opened. Thereupon compressed air will flow out from the Venturi tube c^1 as well as from the Venturi tube *i*. The stream of air passing through the latter tube creates, as has been shown by experience, an increase of the suction effect exerted by the first tube upon the nozzle *b*, so that the increase of air flow will result in an increase in the flow of the liquid fuel. The combustion will always take place under favorable conditions and the temperature produced will increase in proportion to the opening of the throttle-valve *j*. By the sole operation of the throttle-valve the arrival of air and of fuel is controlled.

If the sleeve *i* were cylindric in its interior the increase of the flow of air alone would not create an increase of the suction effect on the nozzle *b* so that the arrival of fuel would then remain constant whilst the volume of the outflowing air would increase. Therefore the atomized mixture would become poorer. It would on the other hand be possible to give to the inner double cone i^1 and i^2 of the sleeve *i* sufficiently great inclinations with regard to the axis and at the same time suitably arrange the position of the sleeve and thereby obtain a suction effect upon the nozzle that becomes greater than the outflow of air: the mixture of atomized fuel and air would become richer and the flame would produce smoke. From this it becomes evident that a rather constant relation must be maintained between the volume of the fuel and the volume of the air in order to obtain combustion without smoke and also in order to maintain the mixture rich enough so that its burns not as an entire unit but only on its borders. It is known that owing to the poorness of the mixture the latter becomes explosive, that is to say each particle of fuel is surrounded by a sufficient amount of air permitting its entire combustion. Under these circumstances the combustion of the entire unit takes place similar to an explosion. The combustion is irregular and the flame extinguishes without a visible cause owing to the sudden decrease of richness, for instance owing to impurities of the fuel, or owing to a blow of the compressed air or owing to an accidental external air blast.

If the tube *c* and the nozzle *b* are displaced together with regard to the plane passing through the smallest section of the Venturi tube *i*, the suction or aspiration effect upon the nozzle *b* is adjusted for a constant volume of outflowing air and in accordance with the adjusting provided for an explosive mixture is secured of rather constant proportion of fuel and air independent from the volume of air flowing out, or a mixture may be obtained which in accordance to predetermined laws becomes richer or poorer when the volume of outflowing air is increased.

The adjustment of the position of the two Venturi tubes c^1, *i* and of the nozzle *b* is made once for all and is determined only by the degree of viscosity of the liquid fuel used, and consequently remains the same as long as the fuel of the same properties is burnt.

Since it is the air arriving through the pipe *h* which in all cases aspirates the fuel out of the nozzle *i*, the obturating of the air conduit will immediately cause the stoppage of the flow of the fuel. For this reason no explosion is risked owing to an untimely outflow of the fuel from the nozzle.

In some cases it may prove desirable or advantageous to heat the fuel before it reaches nozzle *b*.

The suction effect exerted upon the nozzle *b* may reach high values, it may for instance become equal to a pressure of 250 cm. water, so that the working manner of the burner is independent from variations of the density of the fuel, from the degree of its viscosity or from its level in the container.

The governor not represented in the drawing, which operates the chain pinion j^2 is made responsive to an influence depending upon the temperature produced by the burner, for instance from the temperature in the hearth, or the steam pressure of a boiler heated by the burner, whereby the control valve is subjected to a given law, and for instance must be a constant one.

It is easily possible to maintain the throttle-valve open if little fuel is consumed. Under these circumstances a little compressed air will arrive also through the Venturi tube *i*.

The variation represented in Fig. 4 is adapted particularly for the combustion of a very viscous fuel such as tar or masut or crude oil. The burner is arranged in such a manner that the formation of carbonlike residues at the exit of the Venturi tube *i* is prevented. For this purpose the latter is arranged within a circular hollow body *r* whose interior is of a cylindrical-conical shape and leaves between itself and tube *i* a circular channel *s*. The latter at its rear part is in connection with a channel a^7 through which compressed air is supplied. The channel *s* is provided at its front end with a restriction s^1 in the immediate neighbourhood of the exit of the nozzle *b*.

When the burner is consuming little fuel the compressed air flows in an overwhelming proportion out of the Venturi tube c^1 and a

smaller portion only is supplied through the Venturi tube *i* and the channel *s*, since then the throttle-valve is not fully closed. If the consumption of fuel is great the air is supplied in great volume through the duct a^7, and passes through the Venturi tube *i* and the circular channel *s*. In both cases the air passing through the restriction s^1 will be sufficient to prevent the formation of carbon residues at the exit of nozzle *b*.

Having now described my invention and the manner in which it is to be carried out, I declare that what I claim is:

1. A liquid fuel burner comprising an air supply conduit, a Venturi tube fixed in the air supply conduit, a fuel spray tube within and concentric with the said Venturi tube, a second Venturi tube surrounding the discharge end of the first Venturi tube, and a device for controlling the passage of air through the said supply conduit to the passage between the said Venturi tubes, there also being a passage from the said supply conduit, independent of the said device therein, for conveying air to the space between the said fuel spray nozzle and the first Venturi tube.

2. A liquid fuel burner according to claim 1 including means for adjusting the fuel spray nozzle relatively to the first Venturi tube.

3. A liquid fuel burner according to claim 1 having means for simultaneously adjusting the first Venturi tube and the fuel spray nozzle within the same relatively to the said second Venturi tube.

In testimony whereof I have affixed my signature.

ERNEST JUILLARD.