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H. F. MÉLOT

1,979,757

LIQUID FUEL BURNER

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Fig. 1

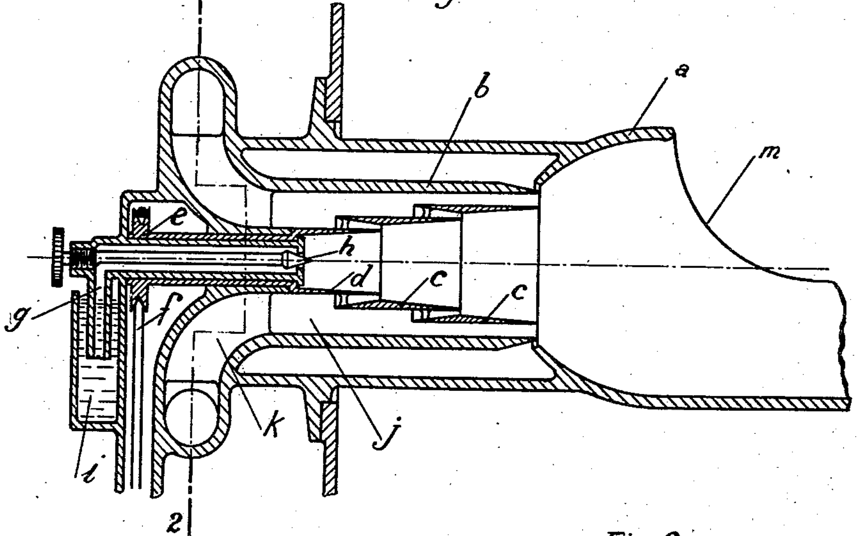



Fig. 2

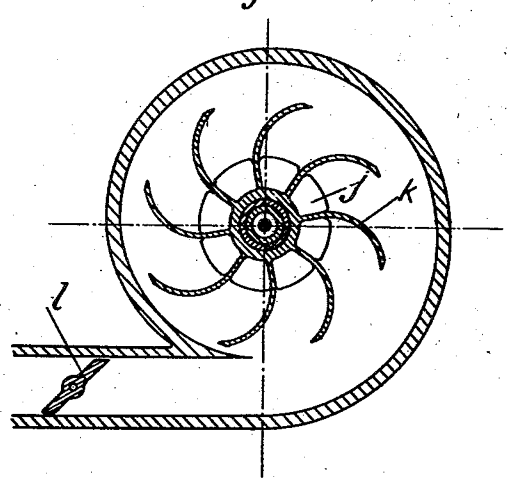
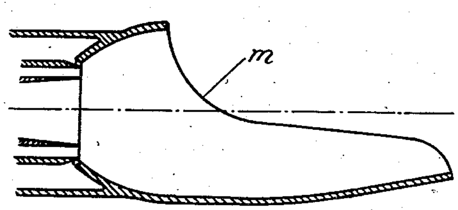



Fig. 3

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# UNITED STATES PATENT OFFICE

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## LIQUID FUEL BURNER

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3 Claims. (Cl. 158—77)

This invention relates to an improved device for atomizing liquid fuel and assuring intimate mixture thereof, in a constant proportion, with the air necessary to support combustion.

To this end and in accordance with this invention, a liquid fuel burner is provided with a fixed nozzle inside which rotate a series of concentric jets constituting a vacuum intensifier. These jets, which may be integral with a rotary tube, are rotatable about a fixed tube which is maintained in communication with a tank containing the liquid fuel at a constant level which is slightly lower than the axis of said fixed tube.

By means of this arrangement the air passing into the fixed nozzle and the rotary jets, carries along an amount of liquid which is constantly proportional to said air.

Moreover, the centrifugal effect due to the rotary jets supplements the transporting effect due to the passage of the air, so as to produce perfect atomization at all speeds.

The accompanying drawing illustrates, by way of example, an embodiment of a triple-action device although the rotary jets may vary in number. Figure 1 is an axial section of the atomizer mounted at the intake of the burner. Figure 2 is a cross section on the line 2—2 Figure 1, showing a detail of the apparatus, and Figure 3 is an axial section on a vertical plane of the burner proper, on a smaller scale.

Disposed at the intake of the actual burner *a* are a fixed nozzle *b* and a series of rotary jets *c*, integral with a rotary tube *d* and arranged in such a manner that the inner extremity of the rotary tube *d* opens into the neck of the first jet *c*, the inner extremity of the first jet *c* opening into the neck of the second jet *c*, and so on . . . the inner extremity of the last jet *c* corresponding with the inner extremity of the fixed nozzle *b*. This unit (jets and rotary tubes) is rotated by a pulley *e* and belt *f* or any other suitable means. Inside the rotary tube and serving as a bearing therefor is situated one branch of a fuel feed pipe *g* the terminal orifice of which may be controlled by a needle valve *h*. The liquid is drawn into the other branch of the pipe *g* from a constant level tank *i* open to the atmosphere.

The air reaches the nozzle by way of an annular passage *j* which may be provided with guide vanes *k* adapted to direct the streams of air parallel with the axis.

In this device the final section of the rotary tube *d* is exposed to the vacuum obtaining in the neck of the first jet *c*, the other end of said tube being subjected to atmospheric pressure. Consequently an outflow of the liquid occurs, the amount of which increases when the vacuum increases, whilst the vacuum in the neck, itself, increases when the delivery of air increases.

The laws of deliveries in relation to pressures being the same for the two fluids, air and liquid, calculation reveals that, if the level of the liquid coincides with the axis, the relation of fuel to air is substantially constant. In practice, a gap of several millimetres is left between the liquid level and the axis, to prevent siphoning on stopping, and this will not appreciably modify the ratio of fuel to air.

In this manner, automatic proportionality is established between the air and the fuel within the two limits that have been fixed for the working of the burner.

In order to obtain correct atomization by the action of the air alone, it would be necessary that, with the burner operating at its lowest rate, the velocity of the air at the neck of the first jet *c* should already be considerable, with the result that a very high pressure would be required for operating the burner at its maximum rate, it being known that the pressure increases as the square of the delivery rate.

The rotary device of this invention, however, intended to obviate this serious inconvenience which causes noise and a waste of energy, ensures atomization at low speeds, a low air velocity being sufficient to carry the atomized liquid towards the burner proper.

On the other hand, the effect of the centrifugal action on the liquid diminishes with increased delivery rate and for a given angular velocity of the tube *d* and rotary jets *c*, because as the quantity of liquid increases, a greater portion of liquid slides in relation to the rotary jets and the liquid is but partly set in rotation. The result is a slower specific velocity of the liquid and a progressively less effective atomization. Consequently, the rotary device by itself is favourable for small deliveries, but its action diminishes when the delivery increases.

However, so far as the effect of the air, by itself, is concerned, the atomization obeys a converse law and is the more complete as the air delivery increases.

The superimposition of these two opposed phenomena gives, as the resultant, a constant effect, that is to say, perfect atomization at all rates, without necessitating a high air pressure.

It should also be remarked that, even at high operating rates, the part played by the rotary device is always highly advantageous, for, if it no longer atomizes directly, it assists the work of the air in distributing the liquid to the necks of the several jets. Moreover, at all operating rates, since the liquid presents itself in the form of thin films at right angles to the direction of the air, the latter is compelled, in order to pass, to cut these several successive layers, with the result that the mixture is rendered strictly homogeneous.

The proportioning of the mixture is obtained, once for all, by means of the needle valve *h* so that, by means of a single control, a throttle *l* or the like, the device enables the power of the burner to be modified whilst maintaining the fuel-air ratio constant. This also does away with micrometric orifices.

With the object of lessening the noise due to the combustion, and also to facilitate the latter at low rates, the upper part of the burner proper *a* is considerably cut away as at *m* (Figures 1 and 3), thus giving the burner the form of a scoop, in order to destroy the acoustic effect which occurs when the combustion takes place inside a tube which is open only at the end. A second advantage is to allow the flame to spread when operating at low rates, thereby increasing the activity of radiation.

What I claim is:

1. In a liquid fuel burner, an atomizer which comprises in combination with a combustion chamber, at least two coaxial annular elements rigidly held together, one of said elements extending a slight distance within the other one with a certain radial clearance between them, means for revolving said elements about their common axis, a sleeve coaxial with said elements and surrounding them opening into the combustion chamber, means for feeding air to said sleeve, a fuel tank in which the liquid level is located below said axis, and conduit means dipping into said tank and opening into the annular element of smallest diameter for feeding fuel from said tank to said element.

2. In a liquid fuel burner, an atomizer which comprises in combination with a combustion chamber, a plurality of coaxial annular elements rigidly held together, each element extending a slight distance within the next one with a certain radial clearance between them, means for revolving said elements about their common axis, a sleeve coaxial with said elements and surrounding them opening into the combustion chamber, means for feeding air to said sleeve, a fuel tank in which the liquid level is located below said axis, and conduit means dipping into said tank and opening into the annular element of the smallest diameter for conveying fuel from said tank to said element.

3. In a liquid fuel burner, an atomizer which comprises in combination with a combustion chamber, a plurality of coaxial annular elements rigidly held together, each element extending a slght distance wthin the next one with a certain radial clearance between them, a revolving tube integral with said elements, a pulley keyed on said tube for revolving said tube and said elements about their common axis, a fuel tank in which the liquid level is located below said axis, a stationary tube within said revolving tube, a pipe connected with one end of said stationary tube and dipping into said tank, a nozzle at the other end of said stationary tube, a sleeve coaxially surrounding said annular elements opening into the combustion chamber, and means for feeding air to said sleeve.

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