April 24, 1945. J. E. JOHANSSON 2,374,290

ADJUSTABLE LIQUID FUEL BURNER

Filed Jan. 13, 1943

FIG. 1

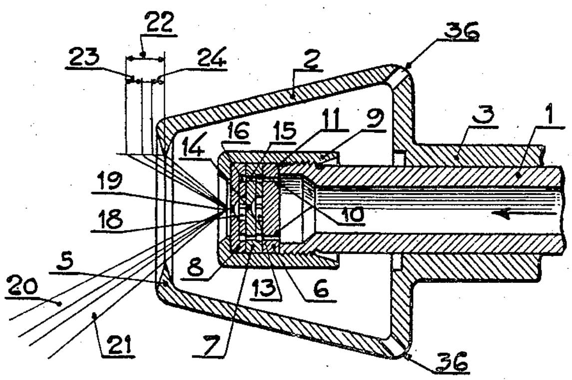


FIG. 4

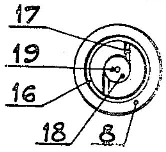


FIG. 3

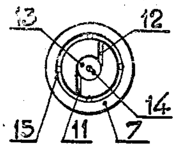


FIG. 2

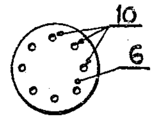
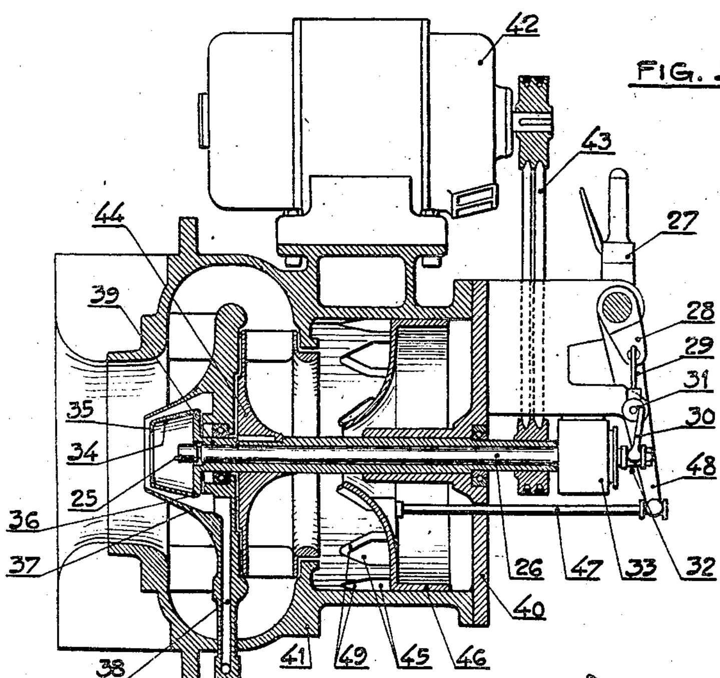


FIG. 5



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ADJUSTABLE LIQUID FUEL BURNER

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In Sweden February 12, 1942

1 Claim. (Cl. 299—120)

This invention relates to improvements in adjustable liquid fuel burners for boilers, hot water heaters or other heating plants. In a type of such burners, the control of the fuel quantity delivered to the combustion zone is effected by means of a shield which catches a variable quantity of the fuel sprayed by an atomizer. Control of the fuel quantity caught by said shield is effected by varying the spraying angle of the fuel jet or by varying the relative position of the atomizer and the shield. However, in conventional liquid fuel burners which are at present available the fuel flows out of the atomizer in the shape of a thin layer limited by two conical surfaces having a common apex. The difference between the apex or top angles of said surfaces is very small and, therefore, it is very difficult to bring about a continuous control of the fuel quantity delivered to the combustion zone.

The principal object of the present invention is to provide means to render possible a very exact continuous control of the fuel quantity supplied by an oil burner to a combustion zone.

This and further objects are attained by mechanism illustrated in the accompanying drawing, in which—

Fig. 1 is a longitudinal section of a burner constructed in accordance with the invention;

Figs. 2, 3 and 4 illustrate various details of the burner; and

Fig. 5 is a longitudinal section of a complete burner assembly.

The burner according to Figs. 1–4 comprises a pipe 1 for supplying liquid fuel to the atomizer proper. Said pipe is movable in longitudinal direction of the pipe relatively to a catching shield which consists of a drum 2 in the shape of a truncated cone. At the base of the cone the drum is provided or connected with a hollow stem 3 in which the pipe 1 is movable. The drum 2 which may be rotatable is provided near the base portion with bores 36 for withdrawing fuel caught by the shield from the drum. At the small open end of the drum through which the fuel is thrown by the atomizer, the drum is provided with a sharp circular flange 5 limiting the fuel outlet of the burner. At the end of the pipe 1 extending into the drum 2, there is fixed an atomizer consisting of three diaphragms 6, 7 and 8 disposed co-axially to and behind one another. These diaphragms are shown in Figs. 2–4 in the same order as they are disposed in the atomizer from the right to the left in Fig. 1, that is, in the direction of flow of the fuel. A collar 9 screw-threaded onto the end of the pipe 1 encloses the three diaphragms 6, 7, 8 and holds the diaphragms together by pressing them against the end of the pipe 1. The diaphragm 6 is a distribution diaphragm provided with a number of longitudinally disposed bores 10 for distribution of the liquid fuel supplied by the pipe 1 to slots provided in the subsequent diaphragms 7 and 8. In the embodiment shown, there are eight bores in the diaphragm 6, but the number of the bores may obviously be varied. The bores 10 conduct the fuel to an annular groove 11 provided in that side of the next following diaphragm 7, which faces the diaphragm 6. The annular groove 11 is through tangentially disposed ducts 12 connected with a central whirling chamber 13 from which a central outlet duct or nozzle 14 extends through the diaphragm in a direction towards the opening of the burner. The diaphragm 7 is further provided with four axial bores 15 connecting the groove 11 with a similar annular groove 16 in the diaphragm 8. Tangentially disposed ducts 17 extend from the annular groove 16 to a central whirling chamber 18 in the diaphragm 8, into which chamber also the nozzle 14 opens. A central duct or nozzle 19 having a larger cross-sectional area than the nozzle 14 extends through the diaphragm 8 and constitutes an outlet for the fuel from the atomizer.

Due to the illustrated arrangement of two nozzles 14 and 19 disposed co-axially one behind the other, the fuel jets obtain the shape of two hollow concentric cones 20 and 21. By suitably adapting the dimensions of the grooves and bores in the diaphragms 7 and 8, it is possible to bring about that the jet cones 20 and 21 nearly continuously adjoin each other and form a single hollow cone limited by two conical surfaces having considerably different top or apex angles. However, practically there is never any interspace between the two cones, as is shown in Fig. 1, due to the fact that the fuel particles of the inner cone, which have a greater rotational velocity than the particles of the outer cone, will withdraw particles from the latter so that the cones will continuously adjoin each other. The length 22 of the section line between the hollow jet cones 20, 21 and the limiting edge 5 of the shield indicates the principal range in which a displacement of the shield and the atomizer relatively to one another effects a variation of the fuel quantity delivered to the combustion zone. In the embodiment illustrated in Fig. 1, this length 22 is about half an inch at a diameter of the opening in the shield of about two inches. Thus, the displacement of the atomizer and the shield relatively to each other can be limited to this value. In the position of the atomizer and the shield illustrated in the drawing, evidently the maximum quantity of fuel is delivered to the combustion zone. When the pipe 1 is displaced to the right in Fig. 1 relatively to the drum 2 the quantity of fuel delivered to the combustion zone is continuously reduced. After the atomizer has been displaced the length 22 the main portion of the fuel flowing out of the atomizer is caught by the flange 5 and will return through the bores 36 to the fuel tank. It is evident that by using an atomizer producing a single hollow jet cone it would be necessary to have the entire control of the fuel quantity from maximum to minimum be effected by a displacement over a range 23 or 24, the length of which, however, is very small, namely, about a quarter of an inch only, so that an exact control of the fuel quantity would be rendered very difficult.

Fig. 5 is a longitudinal section of a complete burner assembly according to the invention. The atomizer 25 is of the same type as the atomizer illustrated in Figs. 1–4 and is mounted on a tubular shaft 26 movable in longitudinal direction by means of a hand lever 27 and levers 28, 29, 30. The levers 29 and 30 are journalled on a pivot 31 and the rounded end of the lever 30 is guided in an annular groove 32 at the right hand end of the shaft 26. Liquid fuel is conducted to the atomizer through the tubular shaft 26 by means of a pump mounted in a housing 33. The atomizer is surrounded by a rotating drum 34 having a limiting flange 35 which forms the shield proper for catching a portion of the hollow jet cone from the atomizer. The drum 35 has the shape of a truncated cone and is provided at its base with bores 36 through which fuel caught by the drum flows into a housing 37 enclosing the drum. From said housing 37 fuel in excess is drained off through a pipe 38. The drum 34 is mounted on a tubular shaft 39 enclosing the shaft 26 and rotating on the latter. The shaft 39 is journalled in the housing 37 and also in the rear wall 40 of the housing 41 for the burner assembly. On the housing 41 is mounted an electrical motor 42 which by means of wedge-shaped belts 43 drives the tubular shaft 39 to which the fuel pump is connected. A fan or blower 44 secured on the shaft 39 draws in combustion air through openings 45 in the cylindrical rear portion of the housing 41 and blows said air into the combustion zone. A slide 46 for controlling the quantity of combustion air is disposed in the cylindrical portion of the housing and can be adjusted in longitudinal direction by means of a rod 47 and a lever 48 operable by the hand lever 27. The slide consists of a body of revolution disposed co-axially with respect to the fan 44 in front of the inlet of the latter. The openings 45 taper towards their ends 49 turned to the fan so that by displacement of the slide to the left in Fig. 5 from the position illustrated in the drawing the inlet area for the air will at first be relatively slowly reduced but towards the end of the displacement in said direction relatively more rapidly. By suitably forming the openings 45 and by interconnecting the fuel controlling means and the means for controlling the quantity of air delivered to the combustion zone, a proper relation between fuel and air quantity can be obtained at varying loads. The device described for controlling the air quantity may obviously be used in combination with burners of other construction than that illustrated in Fig. 5.

The embodiments of the invention described above and illustrated in the drawing should only be considered as examples, and the details thereof may obviously be modified in various ways within the scope of the following claim.

More than two nozzles may for instance be mounted behind one another in the atomizer so that more than two coaxially disposed hollow jet cones are obtained and, consequently, the range of control is further increased. Atomizers may also be used, in which different groups of tangentially directed grooves are adapted to supply fuel to a whirling chamber, so as to obtain concentrically disposed layers of fuel whirling with different velocities. Thus, when such layers of fuel are flowing out of a central nozzle, they give rise to different jet cones coaxially disposed to each other. The displacement of the atomizer relatively to the shield can naturally be effected in different ways. The shield may, for instance, be movable and the atomizer stationary. The means for controlling the fuel and air quantities delivered to the combustion zone may be automatically adjustable by means of a thermostatic device varying the adjustment of said means in response to the temperature in a boiler, the air in a room or the like impulse.

What I claim is:

In a liquid fuel burner, a fuel atomizer, means in said atomizer for spraying fuel supplied to said atomizer in at least two hollow jet cones disposed concentrically to each other, fuel catching means disposed adjacent to the path of the fuel jet delivered by the atomizer and adapted to catch portions of said fuel jet and to prevent caught fuel from entering the combustion zone of the burner, and means to effect a displacement of said fuel catching means and said atomizer relatively to each other a length corresponding to the distance from the section line between said fuel catching means and the exterior envelope of the largest one of said jet cones to the section line between said fuel catching means and the interior envelope of the smallest one of said jet cones.

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