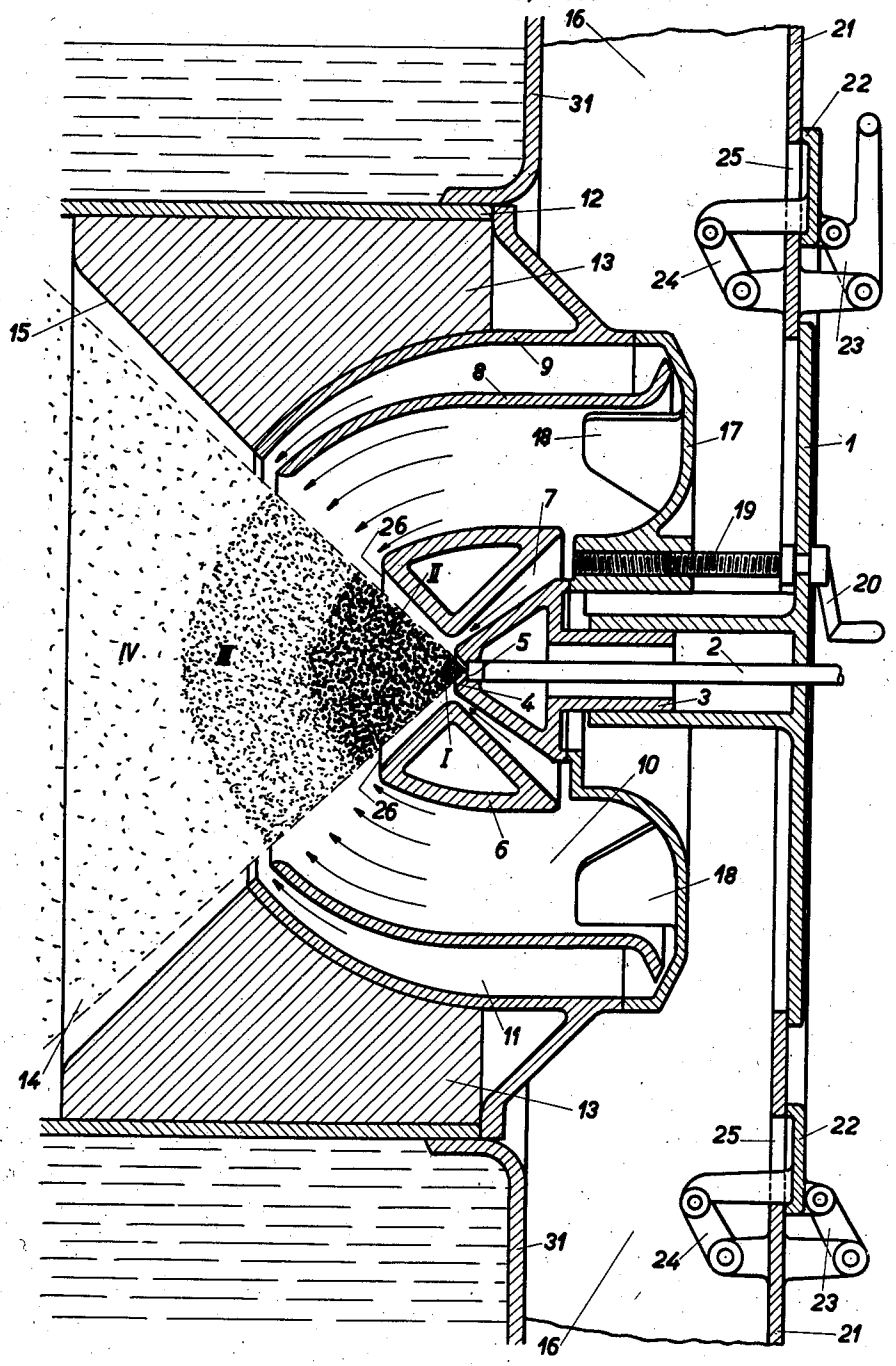
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FIRING EQUIPMENT FOR THE COMBUSTION OF LIQUID FUELS

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FIRING EQUIPMENT FOR THE COMBUSTION OF LIQUID FUELS

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This invention relates to firing equipment for the combustion of liquid and more particularly heavy liquid fuels. It is known in connection with firing equipment for this purpose to feed the combustion air to the fuel at a plurality of points disposed one behind the other, with a view to effecting more perfect combustion of the fuel. The known types of firing equipment of this description have been found to have certain drawbacks, more particularly when they are used for burning heavy oils. As a rule it is necessary to operate with a great excess of air, and in addition it frequently occurs, with these types of firing equipment, that the burner nozzle becomes clogged with coked oil. Smokeless combustion is also far from being achieved.

The present invention relates to firing equipment for liquid fuels which makes it possible to operate with a very slight excess of air even when heavy fuels are used and the combustion is very nearly perfect and therefore smokeless, and the danger of the burner nozzle becoming clogged with coke residue of combustion is eliminated. In accordance with the invention the fuel is ignited inside a conical member which forms, jointly with a hollow body surrounding the burner nozzle, a passage or conduit for the air required for ignition. This hollow body surrounding the burner nozzle extends beyond the orifice of the burner nozzle, so that the igniting air only encounters the fuel supplied from the burner nozzle at a certain distance from the orifice of this nozzle, and consequently in the immediate vicinity of this orifice the fuel is still present in a non-ignited state.

The passage for the priming or igniting air and also the conduits supplying the air for the later stages of combustion are so disposed and shaped that they discharge in one or more conical surfaces substantially parallel to the surface of the fuel cone, and are so shaped, as to the part thereof nearest the orifice, that the air is delivered substantially at right angles to the surface of the fuel cone.

In the accompanying drawing there is shown, by way of example, a longitudinal section of a form of construction of burner installation according to the invention, designed for use, for example, in the furnace of a marine boiler. A fire-door is represented at 1 and the burner nozzle 2 passes therethrough into the combustion chamber. This burner nozzle 2 is surrounded by a hollow body 3 the forward end 4 of which extends for a certain distance into the fire-box beyond the orifice 5 of the burner nozzle 2. The hollow body 3 is in its turn surrounded by an ignition head 6 of double conical shape so that between these two parts 3 and 6 there is formed an air passage 7 which is hereinafter referred to as the igniting air passage, and to which atmospheric air or compressed air may be supplied in a manner to be described in due course. By means of a double walled annulus 8, 9, which is preferably tapered towards the front, there are formed two air conduits 10 and 11 of which the conduit 10 is bounded by the annulus 8 and the outer surface of the ignition head 6, while the conduit 11 is formed between the two annuli 8 and 9. Between the annulus 9 and the fire tube 12 of the boiler there is provided a ring or lining 13 of fire-clay or the like. All the air-ways 7, 10 and 11 discharge substantially along a conical surface defined by the inner surface of the ignition head 6, and which is disposed approximately parallel to the surface of the fuel cone 14 issuing from the nozzle 2. At the same time, as may be seen from the drawing, the shape of the conduits 7, 10, and 11 is such that the air is discharged therefrom approximately at right angles to the surface of the fuel cone 14. In this manner the air is caused not only to surround the fuel cone but to a great extent to penetrate into and to permeate the same, with the result that thorough intermingling of the fuel and air is insured.

Approximately in the same conical surface as the orifices of the air conduits 7, 10, and 11 there is also disposed one wall 15 of the fire-brick ring 13. If the orifices of the conduits 7, 10, and 11 are not all disposed in one and the same conical surface it is advisable to shape the inner surface 15 of the ring 13 so that it forms a continuation of the conical surface at which the last air conduit 11 discharges.

In order that no oil coke shall become deposited on the end portion of the hollow body 4, the ignition head 6, the double annulus 8, 9 and the fire-brick ring 13 as a result of combustion of the fuel the shape of the cone of atomized oil and its dimensions are arranged to be such that a sufficiently wide air gap is left between this cone and the above-mentioned parts of the firing equipment.

Air is supplied, past a common regulating member 17, from an antechamber 16 to the conduits 7, 10, and 11. This common regulating member 17, which is provided with a twist-imparting means in the form of obliquely set blades 18, may be opened to a greater or less extent by means of an adjusting device taking the form

in the present instance of a screw 19 provided with a crank 20, and in this manner the rate of air supply to the burner can be adjusted to suit the need at any one time. Air may be supplied to the antichamber 16 either from a compressed air container or from the outside atmosphere. In the latter case there is provided on the firedoor frame 21 an annular plate 22 which may be moved parallel to itself by means of an arrangement of links 23 and 24 so as to open and close an annular aperture 25 in the firedoor frame 21.

The igniting and combusting of the fuel issuing under pressure from the burner nozzle 2 is effected in a plurality of zones. First of all the fuel passes into zone I through which it passes in a finely atomized state without yet being ignited. This, as already mentioned, is due to the fact that the hollow body 3 surrounding the end of the burner nozzle 2 extends with its forward end 4 a certain distance, and at least 5 mm, beyond the orifice 5 of the nozzle 2, so that the air fed through the igniting air passage 7 does not encounter the fuel until the latter has passed through the zone I. Thus, in the zone I immediately adjoining the orifice of the burner nozzle no ignition of the fuel takes place and no oil coke can become formed and lodged at the orifice of the nozzle. The igniting air passage 7 is so dimensioned that at the most 10% of the total quantity of air required can pass therethrough. This relatively small quantity of air issuing from the passage 7 mixes with the fuel cone in zone II where the fuel is ignited by the heat radiated from the ignition head 6. The thus ignited and partially vapourized fuel then passes into zone III where it is supplied with air from the conduit 10. This air, which has become preheated in passing along the ignition head, effects very extensive combustion of the fuel at this stage. Finally, in zone IV lying substantially within the fire-brick ring 13 there is effected combustion of any remaining fuel with the aid of the air supplied through the conduit 11 after having become pre-heated to a high temperature by the fire-brick ring 13.

In order that the combustion process may proceed perfectly certain relations between the cross-sectional areas of the orifices of the igniting air passage 7 and of the ignition head 6, and between the depth of the ignition head and the diameter of the orifice of the ignition head, should not be exceeded. The total cross-sectional area of the orifice of the igniting air passage 7 should have a ratio to the cross-sectional area of the orifice 26 of the ignition head 6 in the order of 1:4 and at the most 1:12, while the ratio of the depth of the ignition head (measured from the orifice thereof to its narrowest point in the direction of the generatrices) to the diameter of the orifices of the ignition head should be 1:1.5, and at the most 1:2.5.

I claim:

1. In a burner for heavy liquid fuels, a fuel nozzle, a body surrounding the nozzle and extending beyond the end of the nozzle, said body having an opening therein flaring outwardly from the end of the nozzle, and said body having a conical shaped outer surface with the smaller end thereof adjacent the end of the nozzle, an ignition head surrounding said body in a spaced relation with respect to said conical surface providing an annular passage for supplying air to the fuel after the fuel has passed beyond the flared opening in said body, said ignition head having a surface portion flaring outwardly from points adjacent the smaller end of said body, a double wall annular member surrounding said ignition head in a spaced relation providing an annular air conduit between the ignition head and the annular member and a second annular air conduit between the walls of the annular member, and said double wall annular member being shaped to direct the air passing from the conduits provided thereby substantially at right angles to the surface of the fuel issuing from the nozzle.

2. In a burner for heavy liquid fuels, a fuel nozzle, a body surrounding the nozzle and extending beyond the end of the nozzle, said body having an opening therein and a conical shaped outer surface with the smaller end thereof adjacent the end of the nozzle, an ignition head surrounding said body in a spaced relation with respect to said conical surface providing an annular passage for supplying air to the fuel after the fuel has passed beyond the opening in said body, said ignition head having a surface portion flaring outwardly from points adjacent the smaller end of said body, and an annular member surrounding said ignition head in a spaced relation providing an annular air conduit between the ignition head and the annular member.

3. In a burner for heavy liquid fuels, a fuel nozzle, a body surrounding the nozzle and extending beyond the end of the nozzle, said body having an opening therein flaring outwardly from the end of the nozzle, and said body having a conical shaped outer surface with the smaller end thereof adjacent the end of the nozzle, an ignition head surrounding said body in a spaced relation with respect to said conical surface providing an annular passage for supplying air to the fuel after the fuel has passed beyond the opening in said body, said ignition head having a surface portion flaring outwardly from points adjacent the smaller end of said body, and an annular member surrounding said ignition head in a spaced relation providing an annular air conduit between the ignition head and the annular member.

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