June 29, 1943. A. BARGEBOER 2,323,001

LIQUID SPRAYING DEVICE FOR LIQUID FUEL BURNERS

Filed June 8, 1939

FIG. 1.

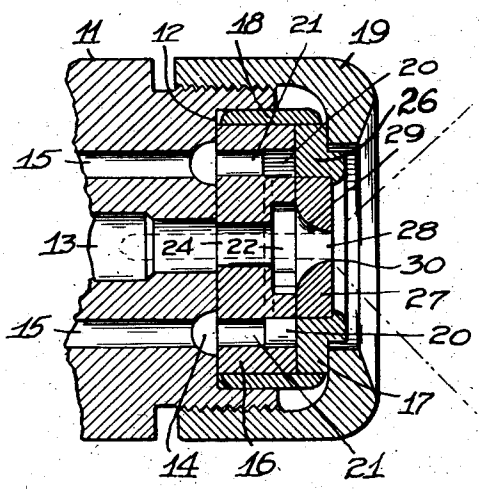
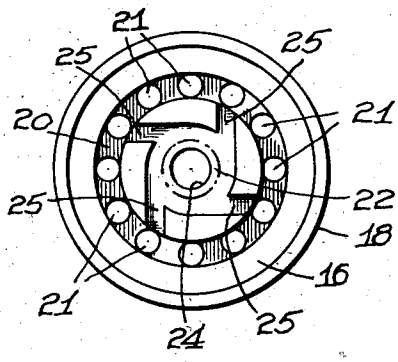


FIG. 2.



Adolf Bargeboer
INVENTOR
BY
his ATTORNEY.

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2,323,001

UNITED STATES PATENT OFFICE

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LIQUID SPRAYING DEVICE FOR LIQUID FUEL BURNERS

Adolf Bargeboer, The Hague, Netherlands; vested in the Alien Property Custodian

Application June 8, 1939, Serial No. 278,013

1 Claim. (Cl. 299—120)

My invention relates to a liquid spraying device for liquid fuel burners, and more particularly to a liquid spraying device of the type in which liquid is forced under pressure through channels which are tangential to a so-called whirling space in order to set up a rapid rotation of the fuel in said space.

One object of my invention is to improve the efficiency of the heretofore known spraying devices of this type and to provide an apparatus which produces a very fine and evenly distributed fuel mist composed of minute substantially uniform globules which are produced even when extremely heavy and crude fuels are used.

Another object of my invention is to provide a liquid spraying device of the type described which may be easily manufactured and which occupies very little space.

In my U. S. Patent No. 2,079,430, there is described a spraying device in which tangential channels lead to a whirling chamber or space and are arranged at an oblique angle to the axis of said chamber, the latter being provided with a small axial spray opening and a larger axial return opening to produce a central cavity in the liquid rotating in the whirling space, whereby the liquid emerges from said space as a rapidly rotating thin film which is broken up into a mist at the edge of the spray opening. In the embodiment described in my prior patent the inner surface of the rotating liquid assumes substantially the shape of a hollow double cone.

I have found that the results obtained in my prior constructions can be considerably improved if the tangential channels are disposed substantially at right angles to the axis of the whirling space and the spray orifice is beveled to a knife edge.

This arrangement produces a particularly fine dispersion of the liquid fuel, because the fuel is forced into the whirling space in a direction at right angles to the axis thereof without any axial component. Thus the highly accelerated spiral fuel flow which is set up occurs practically in a plane. The axial movement of the fuel liquid towards the spray orifice is brought about solely by the bevel of the latter. As a result, the rotating fuel film is forced outwardly against the knife edge of the spray orifice under a very high centrifugal force so that even very crude and viscous fuel particles are broken up into an extremely fine mist at this edge. In the device according to the present invenion the inner surface of the rotating liquid assumes substantially the shape of a hollow cylinder.

Other advantages of the new arrangement are that the spraying device can be easily manufactured and has a reduced axial length.

The invention is illustratively exemplified in the accompanying drawing, in which

Fig. 1 is an axial section through the tip of a spraying device according to the invention, and

Fig. 2 is a front elevational view of the element containing the tangential channels.

In the figures, the nozzle body 11 is provided at its tip with a central recess 12 and with an axial bore 13. In the bottom of the recess 12 there is a ring groove 14. A plurality of fuel supply channels 15 extending parallel to the axial bore 13 open into the groove 14.

The atomizing tip of the nozzle comprises an inner end part 16 and an outer end part 17. A sleeve 18 circumferentially embraces the two end parts 16 and 17 and holds them together. The whole aggregate 16, 17 and 18 is inserted into the recess 12 of the nozzle and is held in position by a nut 19 screwed onto a screw thread provided on the nozzle head.

The inner end part 16 comprises a circular metal disc provided with an annular groove 20 of approximately the same diameter as the annular groove 14 and communicating with the latter through a plurality of perforations 21. A cylindrical central whirling space 22 provided in the surface of the disc 16 communicates with the groove 20 through a plurality of channels 25 extending in a plane at substantially right angles to the longitudinal axis of the nozzle. The channels 25 are disposed tangentially to the whirling space 22, that is the productions of the inner channel walls extend tangentially to the imaginary cylinder bounding the whirling space. The whirling space communicates with the axial bore 13 of the nozzle by means of an axial bore 24 concentric with the whirling space 22 and having a diameter smaller than the diameter of the latter. The bore 24 constitutes the return opening of the whirling space.

The outer end part 17 of the atomizing tip comprises a metal ring element 26 having inserted therein and rigidly united therewith a metal carbide disc 27 of a diameter substantially equal to the inner diameter of the annular groove 20. The metal carbide disc 27 is provided with a central spray orifice 28 of outwardly decreasing diameter, the smallest diameter of said opening being substantially less than that of the return bore 24. The bevelled wall 29 of the orifice 28 is disposed at an angle of less than 90° relative to the front face of the disc 27 so

that the edge of the spray orifice 28 is formed as a knife edge 30.

The device operates as follows: Fuel is forced through the channels 15, 16 and 21 into the annular groove 20 forming the fuel supply chamber and from there through the tangential channels 25 into the whirling space 22. The fuel rotating in the whirling space is driven into a very rapid spiral motion practically free of any axial component. When the fuel film rotating in the whirling space 22 spreads into the orifice 28, the bevelled wall 29 of the latter gives an axial component to the movement of the fuel sufficient to eject the rotating film from the nozzle tip. However, owing to the high speed rotation of the fuel assumed in the whirling space 22 and to the fact that fuel is constantly forced into said space in a direction at right angles to the axis thereof, the fuel will arrive at the knife edge 30 of the spray orifice 28 with almost undiminished rotary speed and will thus be urged against said knife edge with a very high centrifugal force sufficient to break up and finely disperse the fuel into uniform minute globules. The rotating fuel assumes in the whirling space a shape in which its inner surface corresponds substantially to that of a hollow cylinder as indicated in dotted lines in Fig. 1.

I claim:

In a liquid spraying device for fuel burners, the combination of a nozzle having a whirl chamber, fuel supply channels projecting tangentially of said whirl chamber and in a plane at right angles to its axis, a wall extending at right angles to the axis of said whirl chamber and closing the same at the rear end thereof, said entire rear wall being plane except for a single central return orifice provided in said end wall, said return orifice having a diameter smaller than that of said whirl chamber, and a hollow conical portion forming the entire front wall of said whirl chamber and terminating at its tip in a bevelled knife edge spray orifice having a smaller diameter than said return orifice.

ADOLF BARGEBOER.