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LIQUID FUEL NOZZLES

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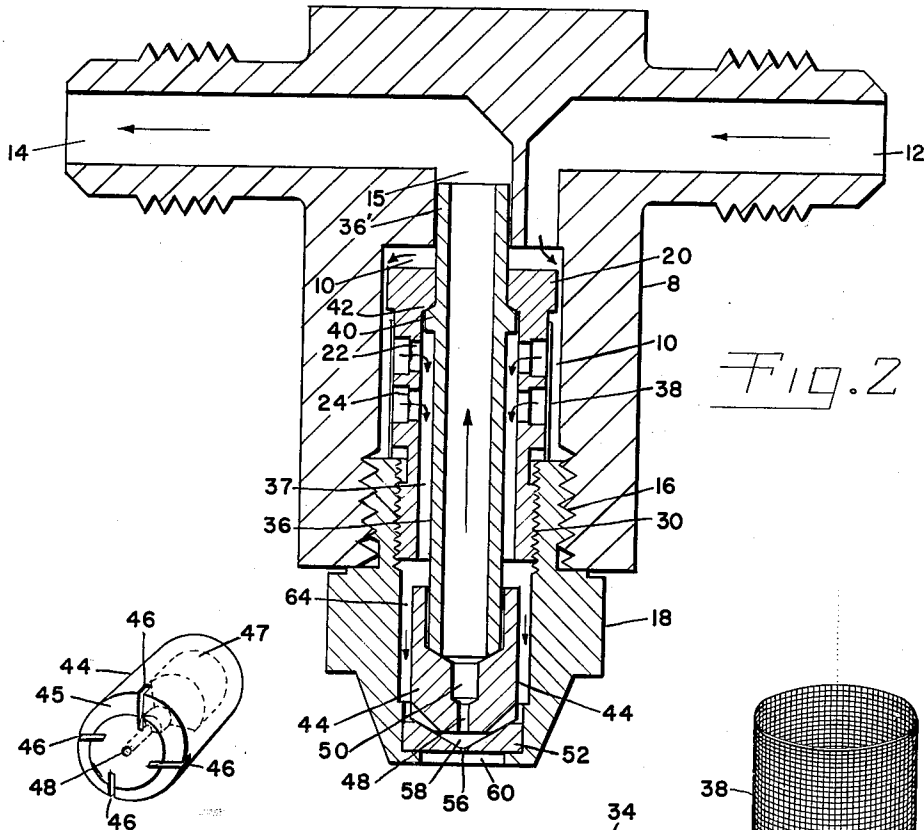


Fig. 2

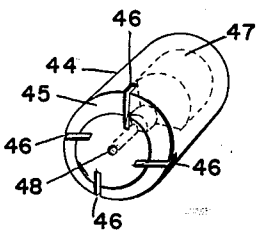


Fig. 5

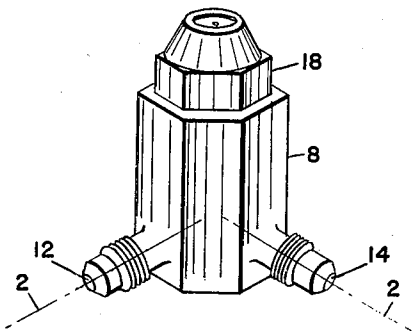


Fig. 1

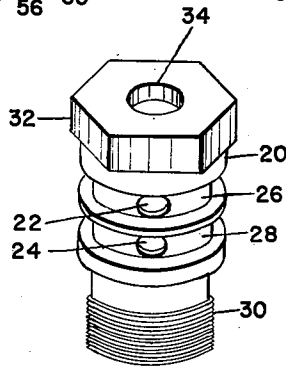


Fig. 3

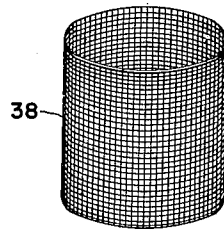


Fig. 4

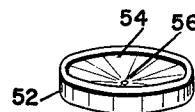


Fig. 6

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# UNITED STATES PATENT OFFICE

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## LIQUID FUEL NOZZLE

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1 Claim. (Cl. 299—120)

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This invention relates to improvements in liquid-fuel nozzles of the return-flow type.

The general object of the invention is to provide a liquid-fuel nozzle of the return-flow type which is simple in construction, efficient and reliable in operation, easily cleaned, and capable of supplying strained liquid-fuel at low and accurately controllable rates. The nozzle hereinafter described is especially intended for supplying liquid fuel at rates ranging from only about one-quarter ( $\frac{1}{4}$ ) gallon to about one and three quarters ( $1\frac{3}{4}$ ) gallons per hour, for combustion in house-heating, water-heating and other kinds of apparatus requiring only a small amount of liquid-fuel. The liquid-fuel may be supplied to the nozzle at the customary pressure of about 100 pounds per square inch, and the return-flow may be controlled by any suitable valve, for example, by the pressure regulating device described in my copending application Ser. No. 70,773, filed January 13, 1949. Thus the quantity of liquid-fuel per hour which is emitted by the nozzle may be regulated.

The invention will be understood from the following description, taken in connection with the accompanying drawings in which a preferred embodiment of the invention is illustrated. Fig. 1 is a perspective view of the liquid-fuel nozzle; Fig. 2 is an inverted sectional elevation, on an enlarged scale, on the planes 2—2 of Fig. 1; Fig. 3 is a perspective view of the perforated bushing; Fig. 4 is a perspective view of the cylindrical screen which (when used) cooperates with the outside of said bushing; Fig. 5 is a perspective view of the liquid-fuel distributor looking at the end which is provided with tangential grooves and with a return passage; and Fig. 6 is a perspective view of the orifice nib which cooperates with the grooved end of the fuel distributor.

From Figs. 1 and 2 it will be apparent that the liquid-fuel nozzle has a base member 8 having a cavity 10 provided with an inlet passage 12, and a return passage 14 which communicates at 15 with the center of the bottom of the cavity 10. The mouth of the cavity 10 is shown internally threaded as indicated at 16, so as to receive the externally threaded end of the nozzle tip 18 within which are assembled certain parts about to be described; but the nozzle tip 18 may be secured to the base member 8 in any other suitable way. This assemblage of parts within the tip 18 includes a hollow bushing or strainer body 20, shown in Fig. 3, which is provided with holes 22 and 24 located in the bottoms of grooves 26 and 28. The bushing 20 has an

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outside diameter considerably less than the diameter of the cavity 10, so that said bushing is spaced-apart relative to said cavity as will be apparent from Fig. 2. At one end, the bushing 20 is externally threaded, as shown at 30 in Fig. 3, so as to receive the internally threaded end of the nozzle tip 18; and at its other end the bushing 20 is provided with a head 32 (shown as hexagonal) which is provided with a centrally located hole 34 adapted to receive the return tube 36 which will be later described. A fine-mesh screen 38, shown in perspective in Fig. 4, having a diameter such that it cooperates with the outside of the perforated portion of the bushing 20, may be included in the assemblage of parts, as shown in Fig. 2. The return tube 36, shown in longitudinal cross-section in Fig. 2, is adapted to pass through the bushing 20 and is provided with a cylindrical end 36' which slidably and closely fits into the central portion 15 of the return passage 14 in the base member 8, as is shown in Fig. 2. It will also be apparent from Fig. 2 that the return tube 36 is provided with an external flange 40 which cooperates with an internal flange 42 in the bushing 20. It will be noted that the cooperating faces of the flanges 40 and 42 are inclined to the axis of the return tube 36, so that these faces tightly abut, thus closing at one end the annular space 37 between the tube 36 and the bushing 20. Cooperating with the end of said return tube 36 is a fuel distributor 44, the form of which will be evident from Figs. 2 and 5. It will be noted from Fig. 5, that one end of the fuel distributor 44 has a frusto-conical surface 45 and is provided with tangential slots 46 located therein as shown. The other end of the fuel distributor 44 is provided with a cylindrical cavity 47 adapted to receive the end of the return tube 36; and the fuel distributor 44 is also provided with an axial passage 48 communicating with a larger axial hole 50 which communicates with the cavity 47 and with the passage through the return tube 36 when that tube and the fuel distributor 44 are assembled. It will be noted that the end of the tube 36 and the bottom of the cavity 47 in the fuel distributor 44 are provided with cooperating inclined surfaces, thereby insuring a tight connection between the tube 36 and the fuel distributor 44, this being facilitated by a slight clearance between the tube 36 and the distributor 44, as shown in Fig. 2. The orifice nib 52, shown in perspective in Fig. 6 and in section in Fig. 2, is provided with a conical cavity 54 adapted to cooperate with the conical surface 45 on the end of the fuel distributor 44; and said nib 52 is pro-

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vided at its center with an orifice 56 which is considerably smaller than the axial hole 48 in the fuel distributor 44. As will be apparent from Fig. 2, the fuel distributor 44 and the nib 52 define between them a conical whirling-space 58, hereinafter referred to. It will also be apparent from Fig. 2 that the nib 52 is nested within the end of the nozzle tip 18 which is provided at its end with an axial opening 60.

It will be evident from Fig. 2 that the perforated bushing 20 carrying (if desired) the screen 38, the return tube 36, the fuel distributor 44 and the orifice nib 52 are easily assembled; and that they are held in tight assembled relationship by the engagement of the external threads 30 on the end of the bushing 20 with the internal threads in the nozzle tip 18. When these parts have been so assembled, the external flange 40 on the tube 36 cooperates with the internal flange 42 in the bushing 20; one end of the return tube 36 cooperates with the bottom of the cavity 47 in the distributing member 44; and the orifice nib 52 cooperates with the end of the fuel distributor 44 as has been described. This assemblage of parts may then be inserted in the cavity 10 in base member 8, with the end of the tube 36 in the return passage 15, and may be secured in the base member 8 by the engagement of the internally threaded portion 16 of the base member 8 with the externally threaded portion of the nozzle tip 18, as will be obvious from Fig. 2.

When the fuel nozzle is in use, the liquid-fuel entering through the inlet passage 12 flows into the cavity 10, through the screen 38 (if it is used), and through the holes 22 and 24 in the bushing 20 into the annular space 37 between the bushing 20 and the return tube 36, as indicated by the arrows in Fig. 2. From this annular space 37 the liquid-fuel flows into the annular space 64 between the fuel distributor 44 and the nozzle tip 18, and through the slots 46 into the whirling-space 58. From the whirling-space 58, some of the whirling liquid-fuel flows through the axial passages 48 and 50 and into the return tube 36 through which the fuel flows to the return passage 14; and the remainder of the liquid-fuel escapes from the central hole 56 in the orifice nib 52 in the form of a spray for combustion purposes. To facilitate insertion of the tube 36 in the passage 15 a slight clearance between these parts is provided; but this clearance should be as small as practicable to minimize the passage of liquid fuel through this clearance.

From the foregoing description, it will be evident that the various parts of the liquid-fuel nozzle may be easily and accurately fabricated and may be readily assembled and disassembled for cleaning. The various parts may be made of any suitable material. For example, the fuel distributor 44 and the orifice nib 52 may advantageously be made of stainless steel which is capable of being accurately machined and pol-

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ished; and the other parts of the fuel nozzle may be made of brass. In the liquid-fuel nozzle illustrated and described, the return tube 36 and fuel distributor 44 are separate and separable cooperating parts which is considered desirable. It will be understood, however, that these parts may be made integral or permanently connected. It will also be understood that the orifice nib 52 and nozzle tip 18, instead of being separate and separable, may be integral or permanently connected. Such modifications in construction may be made without departing from the invention.

What is claimed is:

A liquid fuel nozzle of the return-flow type comprising a base member having a cavity provided with an inlet passage and in the center of its bottom with a return passage, the mouth of said cavity being internally threaded, and an assemblage of parts adapted to cooperate with said base member and comprising a hollow perforated bushing receivable within said cavity in spaced-apart relation thereto and having an externally threaded end, a return tube which passes through said bushing and is provided with a cylindrical end which slidably and closely fits into said return passage in the center of said base member, said bushing and tube being provided with cooperating flanges which substantially close the annular space between said bushing and tube near one end, a fuel distributor having a cavity cooperating with the end of said return tube and provided with an axial passage communicating with said tube, the end face of said fuel distributor being provided with tangential grooves, a nib having an axial orifice and cooperating with the grooved end of said fuel distributor and a nozzle tip having an axial aperture and cooperating with said nib and provided with an internally threaded opening cooperating with the externally threaded end of said bushing and provided with an externally threaded portion cooperating with the internally threaded mouth of said base member, whereby said perforated bushing, return pipe and fuel distributor, nib and nozzle tip may be secured together in assembled relationship and then may be secured in said base member with the end of said return tube closely fitting into the return passage in the center of said base member.

CALVIN D. MACCRACKEN.

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