Jan. 16, 1968 G. S. HALL 3,363,840

LIQUID FUEL BURNERS

Filed May 20, 1965 3 Sheets-Sheet 1

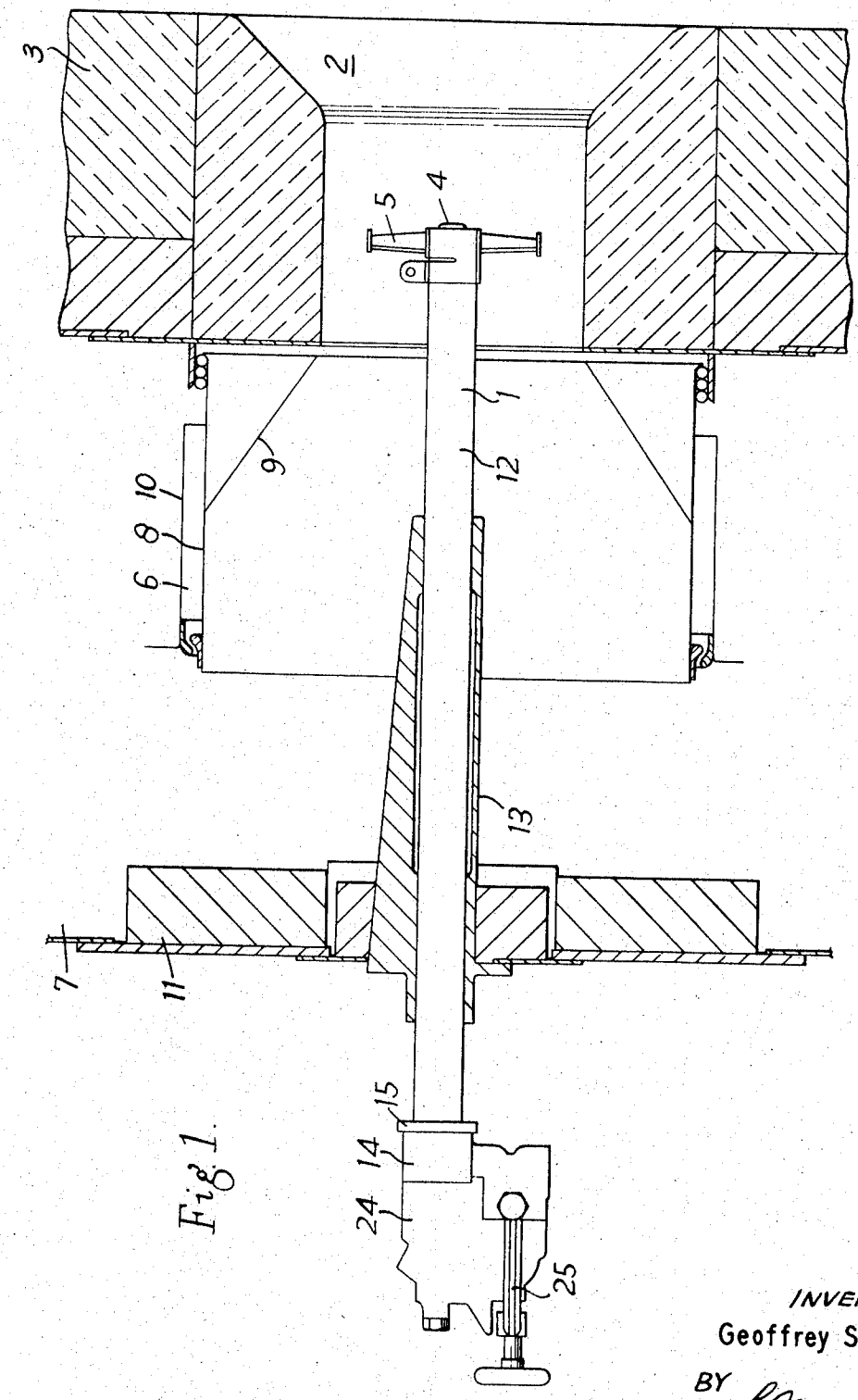

Fig. 1.

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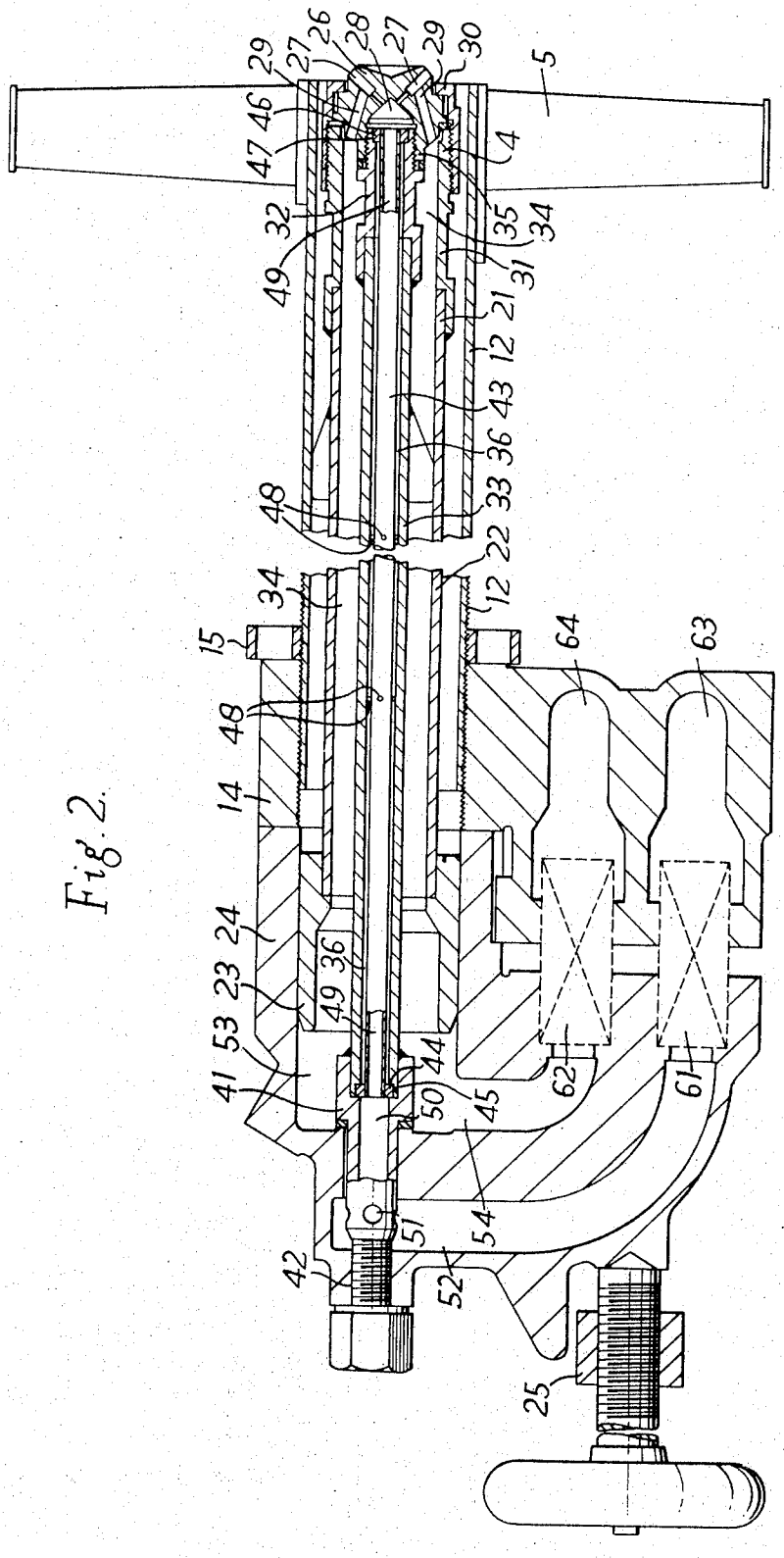

Fig. 2.

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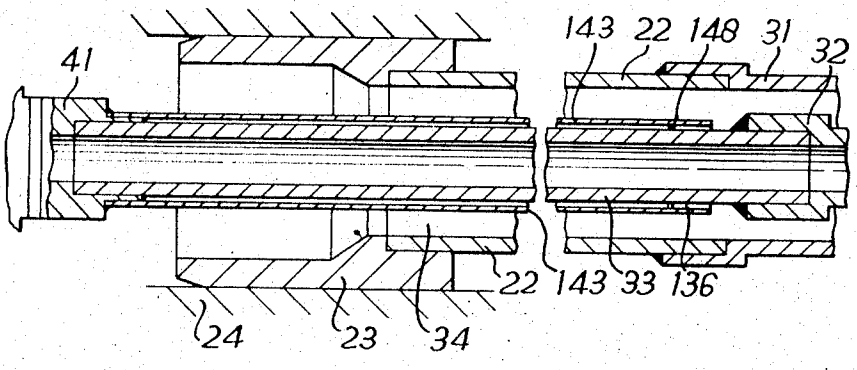
Fig. 3.



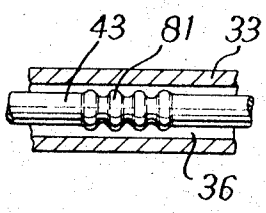


Fig. 4.

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LIQUID FUEL BURNERS

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1 Claim. (Cl. 239—397.5)

ABSTRACT OF THE DISCLOSURE

A liquid fuel atomizer having a stagnant space between the adjoining boundaries of the liquid fuel and atomizing steam passages. The stagnant space acts to inhibit the transmission of heat from the atomizing steam to the liquid fuel thereby preventing the vaporization of a volatile fuel whose boiling point is below the temperature of the atomizing steam. Vaporization of the fuel would cause fluctuations of fuel pressure within the atomizer passage and result in unstable burner operation.

This invention relates generally to liquid fuel burners, and more particularly to an improved liquid fuel atomizer of the type in which the liquid fuel is mixed with an elastic atomizing fluid at the discharge head of the atomizer and is discharged therefrom as an atomized spray of fuel droplets.

Fluid assist atomizers have been successfully used for some time. For example, United Kingdom patent specification No. 579,591 discloses a liquid fuel burner including an atomizer which comprises a barrel at the end of which is provided a sprayer plate. The sprayer plate has an imperforate central part and is formed with channels of circular cross-section diverging from an inner space adapted to be fed with elastic fluid and directed with their longitudinal axes lying on and spaced around a frustrum of a cone, and other channels also of circular cross-section respectively making junctures with the first channels at locations remote from the outlets thereof and extending from an outer space adapted to be fed with liquid fuel. The atomizer barrel is formed with a pair of co-axial tubular members forming a central passage for the supply of elastic fluid to the inner space of the sprayer plate and an outer concentric passage for the supply of liquid fuel to the outer space of the sprayer plate. The fuel channels converge from the outer space towards the longitudinal axis of the atomizer and meet the elastic fluid channels at an acute angle.

When a volatile fuel, such as naphtha or petroleum spirit, is supplied to the outer concentric passage of such an atomizer and steam is supplied to the central passage at a temperature greater than the initial boiling point of the volatile fuel, vaporization of the fuel may occur and thereby cause unstable operation due to fluctuations in the pressure in the fuel flow passages of the atomizer caused by the vaporization of fuel therein.

To overcome this problem, according to the present invention there is provided in a liquid fuel burner, an atomizing assembly including an atomizer head and a barrel formed with longitudinally extending separate passages arranging to supply streams of elastic atomizing fluid and liquid fuel to the atomizer head. To avoid the above mentioned variations in operation due to vaporization of the fuel in the atomizer assembly, means are provided between the fuel and atomizing fluid flow passages to inhibit the transmission of heat from the elastic fluid stream to the liquid fuel stream. Preferably this insulating means is wall means providing a substantially stagnant space between the adjoining boundaries of the fuel and atomizing fluid passages. Where the fuel and atomizing passages are defined by concentric tubes, the stagnant space is preferably defined by a tubular sleeve adjacent the inner tube of the barrel and preferably sealed thereto at least at one end.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

In the drawings:

FIG. 1 is a sectional side view of a liquid fuel burner according to the present invention;

FIG. 2 is an enlarged sectional elevation of the atomizer assembly of the present invention;

FIG. 3 is a sectional side view of modified portions of the atomizer assembly shown in FIG. 2; and

FIG. 4 is a sectional side view of portions of the atomizer assembly of FIG. 2 showing further modification thereof.

Referring to FIG. 1 of the drawings, the oil burner 1 is arranged to fire through a port 2 in a furnace wall 3. The oil burner includes an oil atomizing assembly having a sprayer head 4 at its distal end, which end is encircled by a swirler or impeller 5 positioned in the throat of the burner port. A windbox 7, to which superatmospheric air is supplied, is defined between the furnace wall 3 and the windbox wall 11. Disposed within the windbox 7 is an air register 6 for controlling the admission of combustion air to the burner port 2 from the windbox 7. The air register 6 includes a fixed cylindrical barrel 8 having within it a guide 9 which converges frusto-conically toward the burner port. A cylindrical sleeve 10 is axially slidably mounted over the outside of the barrel 8 so that the air flow from the windbox to the burner port 2 can be controlled.

The swirler 5 is carried by a tubular distance piece 12 which extends forwardly through the windbox wall 11 and is supported thereby in a suitable supporting hub 13. The outer or rearward end of the distance tube is threadably secured to a coupling 14 to which it is locked by a locking member 15.

Referring now to FIG. 2, the spraying or atomizer head 4 of the atomizer assembly is supplied with oil and steam through a tubular atomizer barrel assembly 21 which lies concentrically within and extends rearwardly beyond the end of the distance piece 12. The barrel assembly 21 includes an outer tube 22 connected at its rearward end to an outer terminal member 23, which lies slidably within an atomizer body portion 24 secured by a coupling yoke 25 to the coupling 14. The atomizing head 4 includes a sprayer plate 26 which has an imperforate central part and which is formed with channels or orifices 27 of circular cross-section diverging from an inner space 28 and directed with their longitudinal axes lying on and spaced around the frustrum of a cone. Other channels or orifices 29, also of circular cross-section are provided in the sprayer plate 25 and intersect with the channels 27. The sprayer plate 26 is secured by means of a cap nut 30 to a forward terminal member 31 welded to the barrel outer tube 22. An inner tube 33, co-axially arranged within the outer tube 22, is connected by welding at its forward end with a terminal member 32, which member is threadably engaged with the tubular end portion 35 of the sprayer plate 26. The orifices 29 in the sprayer plate 26 converge from and communicate at their inlet ends with an annular space 34 formed between the outer tube 22 and its terminal member 31 and the inner tube 33 and its terminal member 32.

The rearward end of the inner tube 33 is welded to a socket member 41 positioned within the atomizer body portion 24. The rearwardmost end of the socket member 41 is formed with a threaded connection which screws into a bore 42 in the outer wall of the body portion 24.

A tubular sleeve 43 is positioned substantially concentrically within the inner tube 33 with a radial clearance of approximately 1/32 of an inch so as to form an annular insulating space 36. The sleeve 43 extends throughout the length of the inner tube 33 and its forward terminal member 32. At its rearward end, the sleeve 43 is spaced from the inner tube 33 by a spacing ring 44 positioned in a recess 45 formed in the inner tube 33, and at its forward end, the sleeve 43 is spaced from the terminal member 32 by a spacing ring 46 positioned in a recess 47 formed in the terminal member 32. Between its ends, the sleeve 43 is spaced from the inner tube 33 by spacing means such as radially outwardly projecting pins or studs 48 projecting from the sleeve wall at spaced locations along its length. The sleeve 43 is seal welded at its rearward end to the spacing ring 45, and the ring 45 is seal welded to the inner tube 33.

The space 49 within the sleeve 43 communicates at its forwardmost end with the inner space 28 of the sprayer plate 26, and at its rearward end with a space 50 formed in the socket member 51. The space 50 communicates through apertures 51 in the socket member 41 with a steam passage 52 in the atomizer body portion 24. The annular space 34 within the barrel outer tube 21 communicates through the rearward terminal member 23 with an oil space 53 in the body portion 24 to which leads an oil passage 54 in the body portion 24. When the atomizer body portion 24 is, as shown, secured by the coupling yoke 25 to the coupling 14, the steam and oil passages 52 and 54 communicate through respective shut-off valves 62 and 61 in the coupling 14 with respective steam and oil passages 63 and 64 in the coupling 14, which passages respectively receive steam and oil through suitable supply conduits (not shown) connected with the coupling 14.

In operation, steam flows through the passage 63, the valve 61, the passage 52, the apertures 51, the space 50 in the socket member 41, the space 49 within the sleeve 43 to the inner space 28 of the sprayer plate 26, whence it is discharged through the orifices 27. Oil, or liquid fuel, flows through the passage 64, the valve 61, the passage 54, the oil space 53, and the annular space 34 in the barrel to the orifices 29, which lead the oil into the streams of steam in the orifices 27. The annular insulating space 36 between the sleeve 43 and the inner tube 33 contains air and/or steam which may have penetrated thereinto past the unsealed ring 46. Thus since there is substantially no fluid flow within the insulating space 36, the substantially stagnant pocket of gaseous fuel therein serves to inhibit the transmission of heat between the atomizing fluid and the volatile liquid fuel so that vaporization of the fuel on its way to the sprayer plate 26 is substantially avoided.

In the alternate embodiments of FIGS. 3 and 4, parts similar to those shown in FIGS. 1 and 2 are provided with the same reference numerals.

Referring to FIG. 3, a sleeve 143 is disposed coaxial with an externally of the inner tube 33 with a radial clearance of approximately 1/32 of an inch so as to form the narrow annular space 136. The sleeve 143 is seal welded to the socket member 41 at the rearward end of

the atomizer and extends throughout most of the length of the inner tube 33 to a location short of and adjacent the terminal member 32. Spacing means 148, in the form of studs or pins, are welded to the outer surface of the inner tube 33 at spaced locations along the length thereof to maintain the clearance between the sleeve 143 and the tube 33. In operation, a substantially stagnant pocket of fluid (fuel in this embodiment) is present in the annular space 136, and serves to inhibit the transmission of heat from the steam passing through the inner tube 33 to the liquid fuel passing through the annular fuel passage 34 enclosed by the outer tube 22.

In another modification, the sleeve 43 (see FIG. 2) may be seal welded at its rearward end to the ring 44 which is seal welded to the inner tube 33, and at its forward end to the ring 46 which is seal welded to the terminal member 32. Where both ends of the sleeve 43 are thus sealed and rigidly connected to the inner tube 33, linear differential expansion between the inner tube 33 and the sleeve 43 may be accommodated by expansion means such as the circumferentially extending corrugations 81 as shown in FIG. 4. The annular space 36 may be filled with air, or alternatively, small openings (not shown) may be provided in the sleeve 43 to allow steam to enter the annular space 36. In either event, a pocket of stagnant air and/or steam in the annular space 36 serves to inhibit heat transmission from the steam stream in the sleeve 43 to the fuel stream in the annular space 34 enclosed by the outer tube 22.

While in accordance with the provisions of the statutes there is illustrated and described herein a specific embodiment of the invention, those skilled in the art will understand that changes may be made in the form of the invention covered by the claim, and that certain features of the invention may sometimes be used to advantage without a corresponding use of the other features.

What is claimed is:

1. A liquid fuel atomizing assembly comprising a tubular barrel, an inner tube disposed substantially concentrically within said barrel to form therebetween an annular flow passage, a tubular sleeve member disposed substantially concentrically within said barrel and spaced close to said inner tube to form therebetween an annular space, means for supplying the liquid fuel to be atomized to said annular flow passage, means for supplying an elastic atomizing fluid to said sleeve for flow therethrough, an atomizer head connected in flow receiving relationship with the distal ends of said barrel and said inner tube and arranged to mix said atomizing fluid with said liquid fuel for the atomization thereof, said sleeve being sealingly connected with said inner tube at both ends thereof to isolate said space from fluid flow therethrough so as to inhibit the transmission of heat between said sleeve and annular flow passage, and said sleeve is formed with corrugations extending therearound for accommodating differential lineal expansion between said inner tube and said sleeve.

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EVERETT W. KIRBY, *Primary Examiner.*