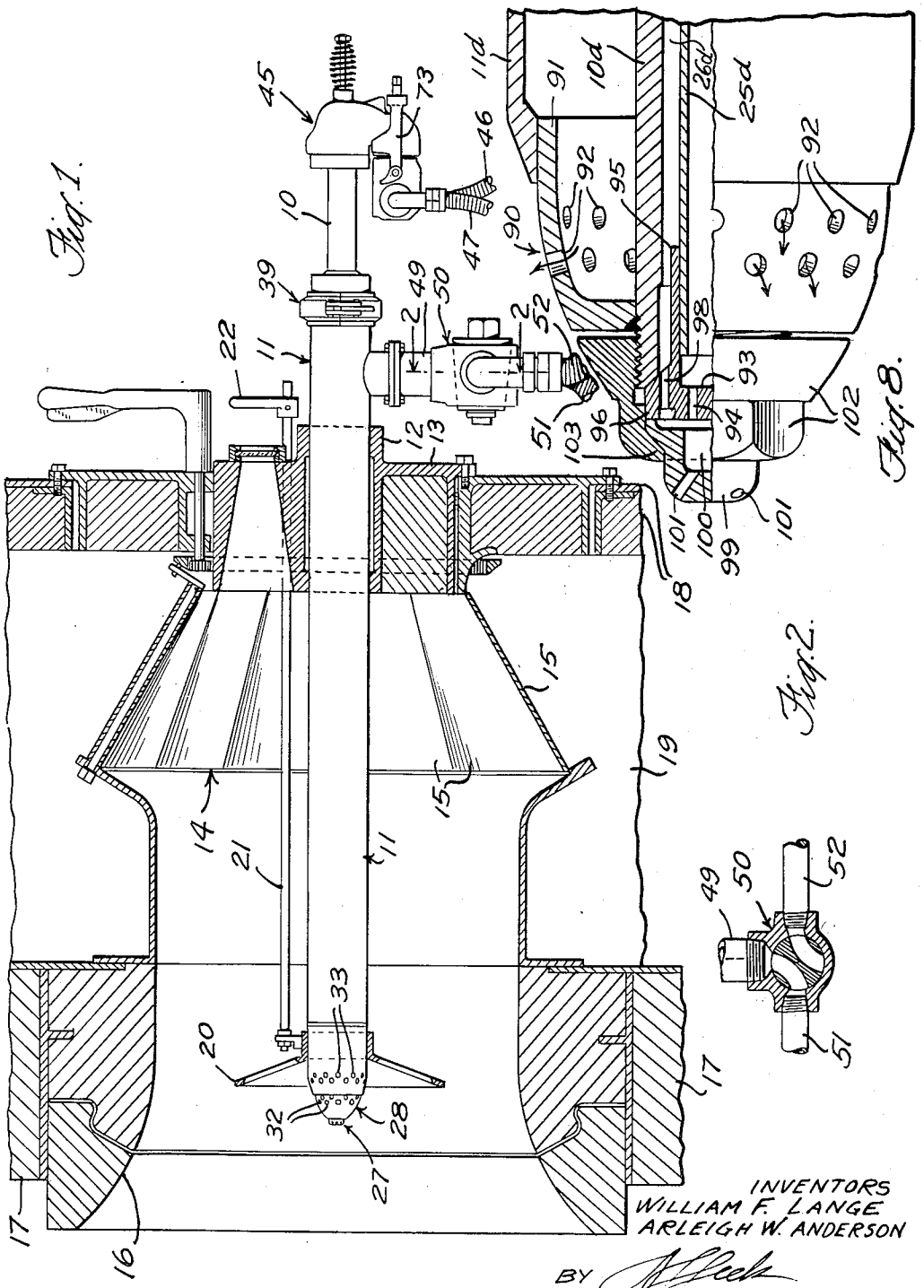
Dec. 20, 1960 W. F. LANGE ET AL 2,965,163

MULTIPLE FUEL BURNER

Filed May 1, 1957 3 Sheets-Sheet 1



INVENTORS
WILLIAM F. LANGE
ARLEIGH W. ANDERSON

BY

ATTORNEY

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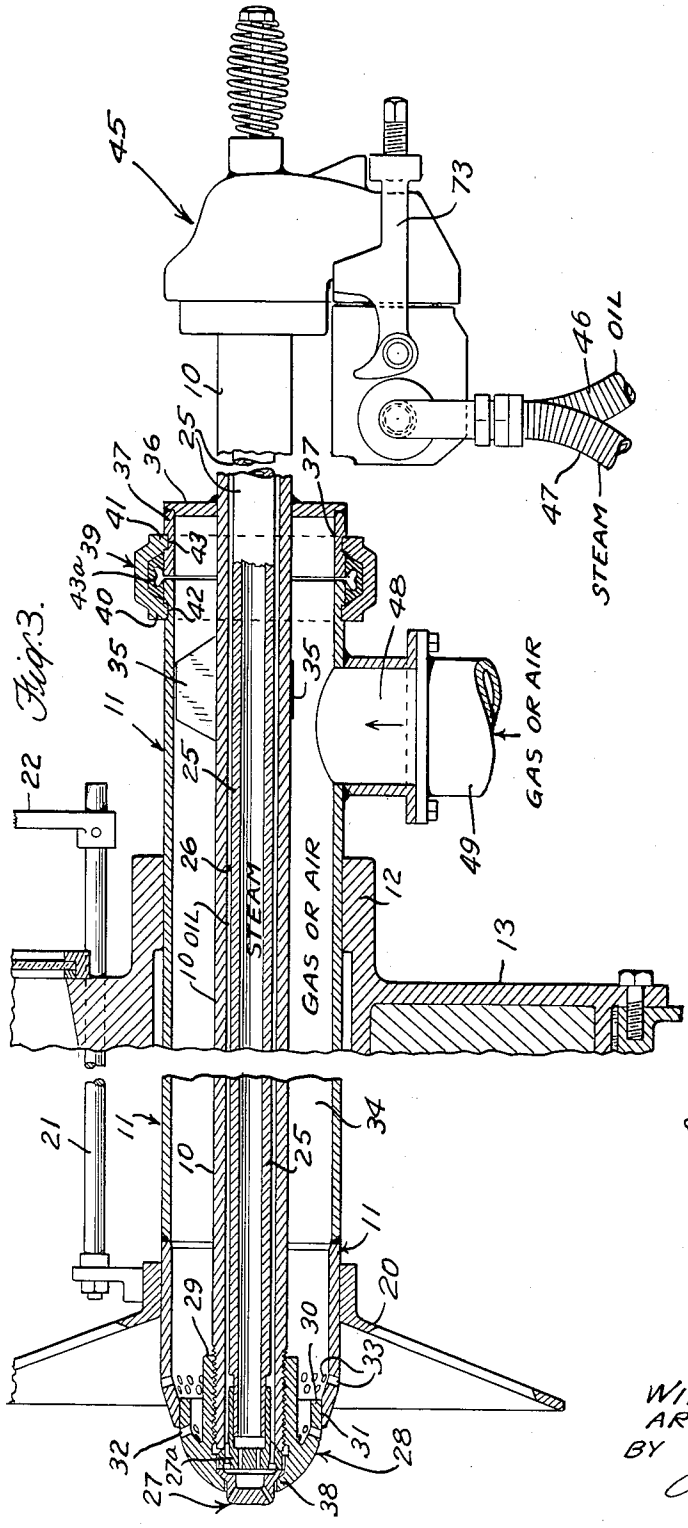

Fig. 3.

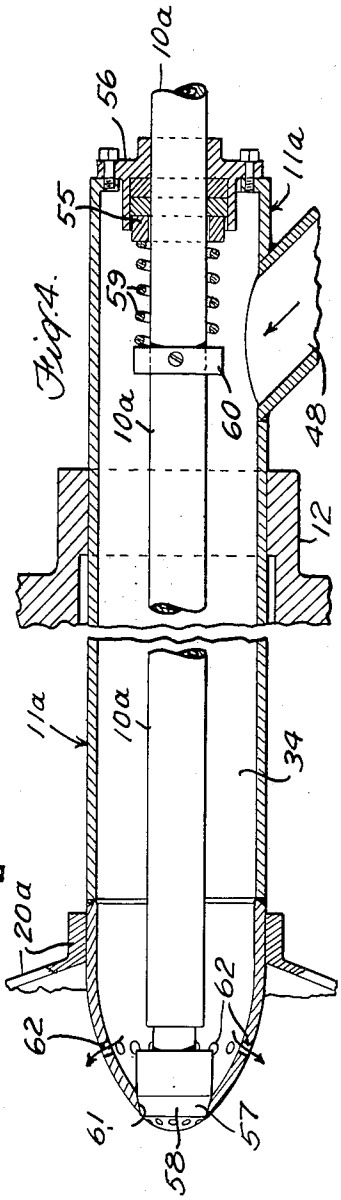

Fig. 4.

INVENTORS
WILLIAM F. LANGE
ARLEIGH W. ANDERSON
BY
ATTORNEY

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Fig. 5.

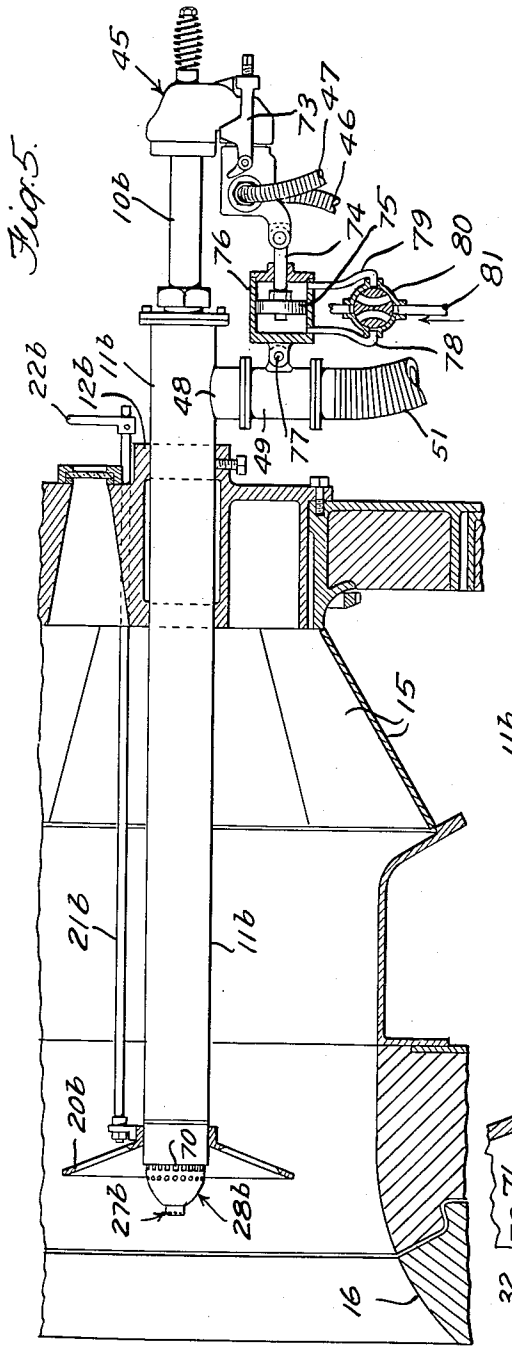


Fig. 7.

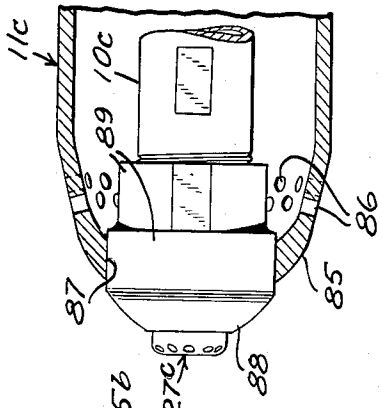
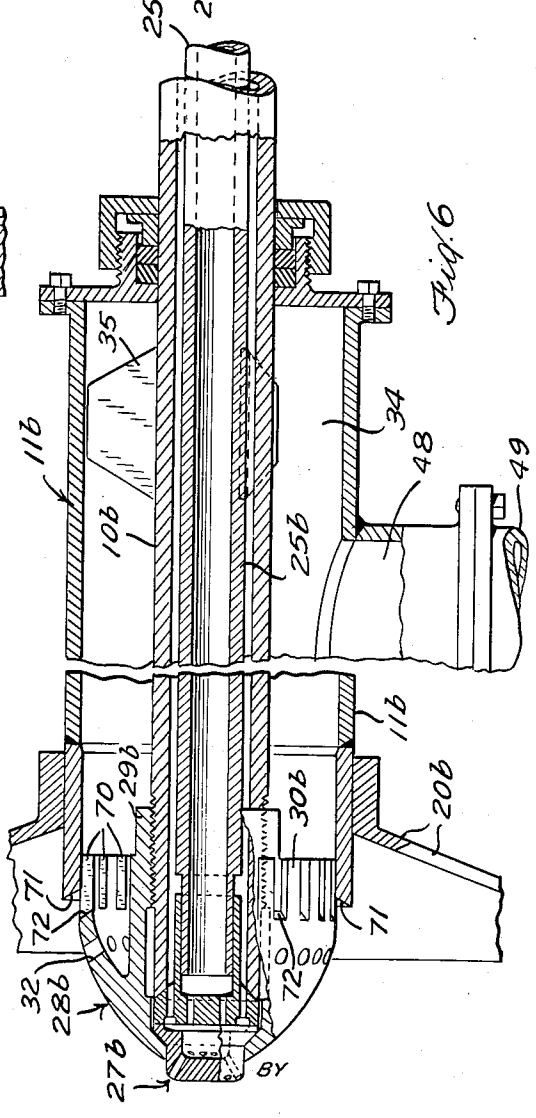


Fig. 6



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MULTIPLE FUEL BURNER

William F. Lange, Springdale, Conn., and Arleigh W. Anderson, Pasadena, Calif., assignors to Peabody Engineering Corporation, New York, N.Y., a corporation of New York

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5 Claims. (Cl. 158—11)

This invention relates to fuel burners and more particularly to a combination multiple fuel burner.

An object is to provide a burner of the above type having novel and improved characteristics.

Another object is to provide a combination burner of the above type having improved cooling means.

Another object is to provide a burner having a pair of concentric fuel barrels so constructed and arranged that either or both fuel barrels may be used as desired without readjustment or retraction of either barrel.

Another object is to provide a burner construction wherein one fuel barrel is cooled by the flow of fuel through the other barrel whereby the unused barrel need not be retracted or removed when the other barrel is in use.

Various other features of the invention will be apparent from the following disclosure.

The nature of the invention will be better understood by referring to the following description taken in connection with the accompanying drawings in which certain specific embodiments have been set forth for purposes of illustration.

In the drawings:

Fig. 1 is a longitudinal section through a burner embodying the invention with parts in elevation;

Fig. 2 is a section taken on the line 2—2 of Fig. 1 showing the construction of the gas and air valve;

Fig. 3 is a broken section similar to Fig. 1 but on a larger scale;

Fig. 4 is a broken section similar to Fig. 3 but with the oil barrel in elevation, illustrating a further embodiment of the invention;

Fig. 5 is a sectional view similar to Fig. 1 illustrating an embodiment wherein the gas ports are adjustable;

Fig. 6 is a broken section of the embodiment of Fig. 5 but on a larger scale;

Fig. 7 is a detail view of a burner head wherein the gas ports are disposed entirely within the end of the gas barrel; and

Fig. 8 is an enlarged detail view partly in section of a type illustrating a further embodiment of the invention.

Referring more specifically to Figs. 1 to 3, the invention is shown as embodied in a gas and oil burner having an oil barrel 10 and a concentric gas barrel 11 mounted as a unit with the gas barrel 11 extending through the hub 12 of the front plate 13 of an air register 14 of standard construction having peripheral air doors 15 and communicating with a burner opening 16 in a furnace wall 17. The front plate 13 is attached to a wall 18 spaced from the furnace wall 17 to form a plenum chamber 19, through which air for combustion is supplied to the air register 14. The usual diffuser plate 20 is disposed to slide on the gas barrel 11 and may be adjusted in position by a rod 21 extending through the plate 13 adjacent to the hub 12 and provided with an adjusting handle 22.

The oil gun may be of the mechanical atomizing type

or of the steam or air atomizing type. In the form shown the oil gun comprises an outer oil barrel 10 and an inner steam tube 25, concentric with the oil barrel 10 and spaced therefrom to provide an annular oil passage 26. The oil gun terminates in a tip or head 27 of the usual construction.

A gas tip or cap 28 is provided with a hub 29 which is threaded onto the oil barrel 10, with a lip 38 which clamps the oil tip 27 in place on tip plug 27*a* and the oil barrel 10 and with a flared skirt 30, the peripheral portion of which fits within the end of the gas barrel 11 to form a slip joint 31 for allowing relative movement of the parts in response to differences in expansion. Oil tip 27 and gas tip 28 may be combined in one piece.

The skirt 30 is provided with one or more rings of gas ports 32 and the gas barrel is formed with an additional row or rows of gas ports 33 communicating with the annular gas passage 34 between the oil barrel 10 and the gas barrel 11.

The oil tip 27 and the gas tip 28 may be streamlined to avoid eddy currents in the combustion air passing over the tips.

At the fire room (rearward) end the oil barrel 10 is centered and supported in the gas barrel 11 by fins 35. The rearward end of the gas passage 34 is closed by a cap 36 which is attached to the oil barrel 10 and is formed with a skirt 37 which registers with the end of the gas barrel 11. The cap 36 is secured in place and sealed to gas barrel 11 by a quick detachable coupling comprising a split ring 39 having peripheral flanges 40 and 41 which seat in corresponding grooves 42 and 43 in the gas barrel 11 and in the cap skirt 37 respectively. The quick detachable coupling embodies a flexible sealing ring 43*a*.

The oil barrel 10 and steam tube 25 are attached to the usual atomizer coupling 45 having connections to an oil pipe 46 and steam pipe 47 through yoke coupling 73. The gas passage 34 communicates through a port 48 with a supply pipe 49 connected through a two-way valve 50 to gas supply pipe 51 and air supply pipe 52.

In the operation of the combination oil and gas burner shown in Figs. 1 to 3 oil is supplied to oil barrel 10 from the oil pipe 46 and gas for combustion is supplied to the gas barrel 11 from the gas pipe 51 through the valve 50. The oil is atomized by the oil tip 27 in the usual manner. In the embodiment shown the oil gun is of the steam atomizing type and steam is supplied by the feed pipe 47. It is to be understood, however, that other types of oil guns may be used and the oil gun may for example be of the wide range mechanical atomizing type involving oil supply and return in which case the steam supply is omitted and oil return line is used. The gas which passes through the gas barrel 11 flows through the rings of ports 32 and 33.

A feature of the invention is the arrangement of the parts so that the gas for combustion in the gas barrel 11 flows over and in contact with the outer surface of the oil barrel 10 in its passage from the gas port 48 to the discharge ports 32 and 33 in the gas tip 28, and in the barrel 11, respectively. This gas is capable of effectively cooling the oil barrel and the oil tip by direct heat transfer, particularly when the gas is very cold as is often the case. This cooling action of the gas eliminates the necessity for additional cooling means for the oil barrel and also permits the oil barrel to remain in place when gas alone is being fired.

The oil barrel is also cooled by the flow of fluids therethrough. When oil only is being burned alternate cooling may be effected by alternately supplying cooling air through the gas barrel from the air pipe 52 by suitable adjustment of the valve 50. This cooling air enters the

furnace at the burner tip and constitutes additional combustion air.

The embodiment of Fig. 4 is generally similar to that shown and described in connection with Figs. 1 to 3. In Fig. 4 however the rearward end of the oil barrel **10***a* is slidably mounted in a bushing **55** in an end plate **56** which closes the end of the gas barrel **11***a*. The oil barrel **10***a* is provided with an oil atomizing tip **57** having a tapered surface **58** which seats in a correspondingly tapered surface in the end of the gas barrel **11***a*. The surface **58** is held seated in the end of the gas barrel **11***a* by means of a spring **59** which is disposed on the rearward end of the oil barrel **10***a* between a bushing **55** and a collar **60** which is secured to the oil barrel **10***a*.

In this embodiment the forward (furnace) end of the gas barrel **11***a* is made conical as at **61** and is provided with a ring of gas ports **62** to form the gas tip. No relative movement between the gas tip and the gas barrel is required since the differences in expansion are taken up by spring **59** and by the movement of the rearward end of the oil barrel **10***a* in the bushing **55**.

The embodiment shown in Figs. 5 and 6 is generally similar to that of Figs. 1 to 3 except that adjustable gas ports are provided in the gas tip. In this embodiment the peripheral portion of the skirt **30***b* of the gas tip **28***b* is provided with a ring of elongated slots **70** which overlap the end of the gas barrel **11***b*. The peripheral portion of the skirt **30***b* is adapted to slide within the gas barrel **11***b* so as to vary the exposed areas of the slots **70**. The end of the gas barrel **11***b* is tapered as shown at **71**, and wall **72**, which forms the forward ends of the slots **70**, may be similarly inclined for directing the gas forwardly and outwardly in the usual cone of fuel. Gas ports may be arranged to discharge fuel at any desired angle with respect to the axis.

The rearward end of the oil barrel **10***b* is attached to a yoke coupling **73** which is connected by a piston rod **74** to a piston **75** operating in a cylinder **76**. The cylinder **76** is attached by a pin **77** to the rearward end of the gas barrel **11***b*. The two ends of the cylinder **76** are connected by pipes **78** and **79** to a control valve **80** to which fluid under pressure is supplied from the line **81**. The arrangement is such that by suitable adjustment of the control valve **80** fluid pressure is applied to one end or the other of the cylinder **76** so as to shift the piston **75** and with the piston the oil barrel **10***b* and the tip **28***b* with respect to the gas barrel **11***b* so as to adjust the exposed area of the slots **70**.

In this embodiment the size of the gas ports may be adjusted during operation so as to vary the quantity of gas burned in accordance with variations in load. The control of valve **80** may be made automatic for example in response to variation in load or variation in steam pressure or the like so as to automatically adjust the quantity of gas burned to the optimum conditions. By varying the size of the gas ports over the range, the gas pressure behind the ports may be kept substantially constant and the exit velocity from the ports maintained more nearly constant. This tends to result in better mixture at reduced loads.

In the embodiment of Fig. 7 the forward end of the gas barrel **11***c* is tapered inwardly to form the gas tip **85** which is provided with a ring or rings of gas ports **86**. The tip **85** terminates in the cylindrical surface **87** in which the enlargement of hub **89** slides. The oil tip **88** is attached to the oil barrel **11***c* by a hub **89** as in the previous embodiments.

In this form all of the gas ports are carried in the gas tip which is attached to the gas barrel itself and provision is made for relative expansion of the parts by means of the sliding fit between the cylindrical surface **87** of the gas tip and the surface of the enlarged section of hub **89**.

In the embodiment of Fig. 8 the gas tip **90** is welded or otherwise permanently secured to the outer surface of the oil barrel **10***d* and is provided with a skirt **91** having a sliding fit with the inside of the gas barrel **11***d*. The gas tip **90** is provided with rows of gas orifices **92** as above described. A cap **93** having steam ports **94** is provided with a skirt or shank **95** which fits over the outer surface of the steam tube **25***d* and is formed with a flange **96** which engages the end of the oil barrel **10***d* and closes the end of the annular oil passage **26***d*. The flange **96** is provided with oil ports **98**. An oil tip **99** provided with the usual oil discharge ports **101** is seated over the end of the oil barrel **10***d* and is spaced from the cap **93** to provide a mixing chamber **100** in which the steam impinges upon and atomizes the oil for discharge through the ports **101**. A retaining ring **102** is threaded on to the outer surface of the oil barrel **10***d* and is provided with a lip **103** which clamps the oil tip **99** and the cap **93** in place against the end of the oil barrel **10***d*.

It will be noted that in the construction of Fig. 8 any oil which may leak around the end of the oil barrel and past the screw threads on which the ring **102** is seated is prevented by the sealed joint between the gas tip **90** and the oil barrel **10***d* from entering the gas passage and interfering with the discharge and combustion of the gaseous fuel.

It is to be understood of course that the features disclosed in the various embodiments are interchangeable and may be used in accordance with the characteristics which are required in a particular installation. All of these embodiments are characterized by the direct passage of the gas over and in contact with the outer surface of the oil barrel regardless of whether or not oil is being fired. The gas accordingly cools the oil barrel by direct heat transfer and cools the tips due to the heat conduction from the tips to the barrels and thence by heat transfer from the barrels to the gas stream.

A particular advantage of this construction is that the oil tip and gas tip remain in place at all times even though a single fuel only is being burned so that they are instantly available for use when required. Hence the fuel may be shifted from oil to gas or vice versa without adjusting the position of the tips and without retracting or advancing either of the barrels. Other improved operating characteristics will be apparent to a person skilled in the art.

In the above description a combination gas and oil burner has been described for convenience. It is to be understood however that the burner may be used with various combinations of fluid fuels. For example for burning two different types of gaseous fuels or two different grades of oil fuel, either simultaneously or alternately, or three grades of gaseous fuels can be burned by introducing a third gaseous fuel through the pipe **47**.

What is claimed is:

1. A multiple fuel burner comprising an inner barrel having an axial tube therein spaced from said barrel to form therewith separate and concentric passages for fuel oil and an atomizing fluid respectively, an atomizing tip assembly at the forward end of said barrel and having forward and rear walls forming a mixing chamber, said rear wall having passages therein communicating with both of said concentric passages to supply oil and atomizing fluid to said mixing chamber, said front wall having a plurality of peripheral openings for discharge of an atomized spray of oil for combustion, means securing said atomizing tip assembly to said barrel, said rear wall having a sleeve extending axially therefrom to make a sliding fit with said tube for permitting relative axial movement of said tube and barrel in response to differential expansion thereof, an outer gas barrel concentric with said inner barrel and spaced to form therewith an annular gas passage and a gas tip comprising an annular member having a multiplicity of separated openings for the discharge of gas for combustion, means securing said gas tip to said inner barrel in heat transfer relationship therewith, said gas tip having an outer skirt portion making a sliding fit with said gas barrel for per-

mitting relative axial movement of said barrels due to differential expansion thereof.

2. A multiple fuel burner as set forth in claim 1 in which said skirt of said gas tip is provided with elongated ports around its periphery overlapping the end of said outer barrel and means is provided for shifting said inner barrel and said gas tip axially for adjusting the flow area of said ports.

3. A multiple fuel burner as set forth in claim 2 in which the adjusting means comprises a cylinder and piston arranged to cause relative sliding movement of the respective barrels and connections are provided for supplying fuel to the respective barrels and other connections are provided for supplying fluid pressure to the respective ends of said cylinder for adjusting the position of said piston therein.

4. A multiple fuel burner as set forth in claim 1 in which said securing means is embodied in said gas tip and includes means to clamp said atomizing fuel tip assembly to said inner barrel.

5. A multiple fuel burner as set forth in claim 1 in which a quick detachable coupling is provided to connect said outer barrel to said inner barrel.

References Cited in the file of this patent

UNITED STATES PATENTS

1,009,678	Mavrogordato	Nov. 21, 1911
1,636,597	Fischer	July 19, 1927
1,887,407	Forney	Nov. 8, 1932
2,418,712	Heymann	Apr. 8, 1947
2,562,460	Hopkins	July 31, 1951
2,579,215	Nuyl	Dec. 18, 1951
2,803,296	Young	Aug. 20, 1957