

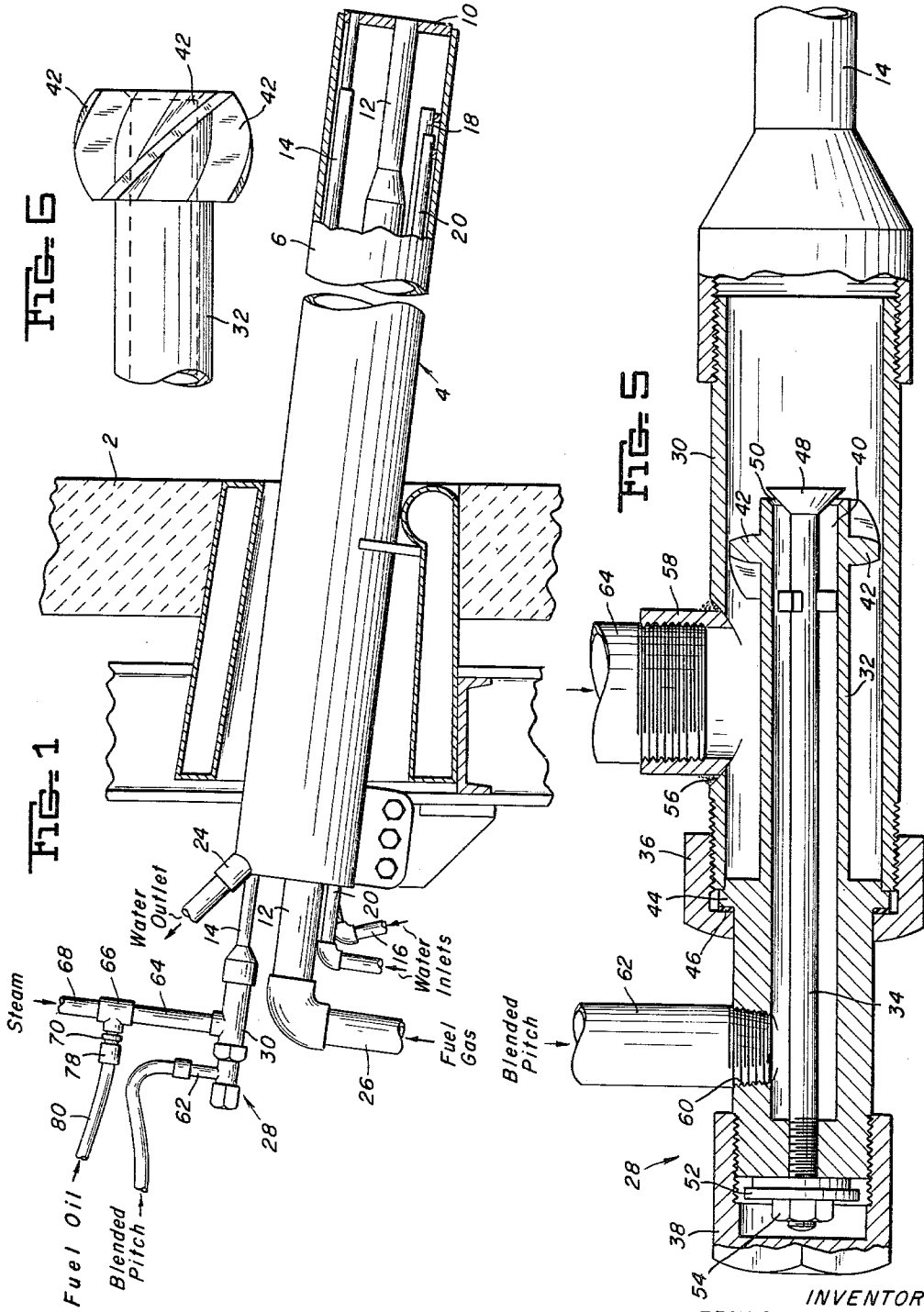
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METHOD AND APPARATUS FOR BURNING TWO INCOMPATIBLE
LIQUID HYDROCARBON FUELS

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2 Sheets-Sheet 1



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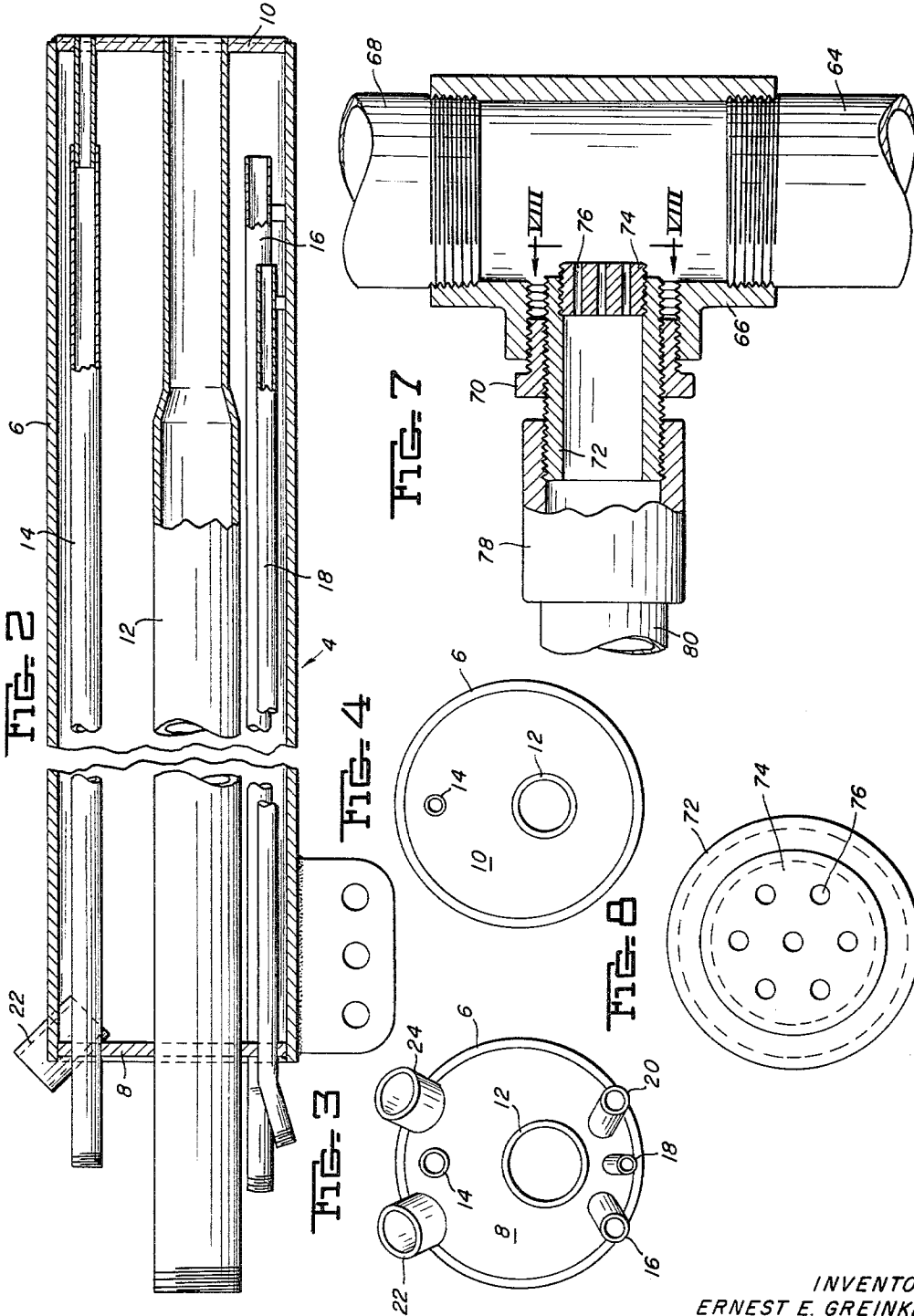
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1

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METHOD AND APPARATUS FOR BURNING TWO INCOMPATIBLE LIQUID HYDROCARBON FUELS

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This invention relates to a method and apparatus for burning two incompatible liquid hydrocarbon fuels and more particularly to burning such fuels in an open hearth furnace. Two fuels are incompatible with each other if they will precipitate or solidify in the presence of one another. Two such fuels are Bunker (C) fuel oil and blended pitch. Blended pitch is pitch obtained from coal tar and cut with creosote, blend oils or light tars in order to reduce its viscosity. In place of pitch, coal tar or other fuels having a relatively high carbon to hydrogen ratio may be used. Such fuels have carbon to hydrogen ratios of at least 15 to 1 or even higher although they will probably have a maximum ratio of 20 to 1. Other types of fuel oil may also be used. Such oils must have a relatively low carbon to hydrogen ratio. While this ratio may vary it should not exceed 10 to 1. In addition to being incompatible these two types of fuel have different characteristics insofar as the flame produced is concerned. During the operation of an open hearth furnace conditions vary so as to require different amounts of heat and to make it desirable to vary the flame characteristics. Prior to my invention it was not possible nor practical to utilize both types of fuel through a single nozzle. When using both fuels at the same time two burners with separate nozzles and separate atomizers were used. This was expensive and required a greater amount of space than when using a single burner.

It is therefore an object of my invention to provide a method of burning two incompatible liquid hydrocarbon fuels through a single burner and nozzle.

Another object is to provide such a method which will deliver the mixture to the furnace with sufficient velocity to avoid depositing it along the burner lines.

A further object is to provide such a method wherein the characteristics of the flame may be varied.

Still another object is to provide apparatus for burning two incompatible fuels through a single nozzle in which precipitation of minute particles will occur in the emulsion which enters the furnace so as to increase the radiating energy in the flame produced.

A still further object is to provide such apparatus which will enable the furnace operator to more advantageously utilize the characteristics of the fuels by varying the ratio of the fuels during various stages of the furnace operation.

These and other objects will be more apparent after referring to the following specification and attached drawings, in which:

FIGURE 1 is an elevational view, partly in section, showing the apparatus of my invention in place on a furnace wall;

FIGURE 2 is an enlarged view, partly in section, showing a burner used in my invention;

FIGURE 3 is a view of the entry end of the burner of FIGURE 2;

FIGURE 4 is a view of the exit end of the burner of FIGURE 2;

FIGURE 5 is an enlarged sectional view of an atomizer used in my invention;

FIGURE 6 is a view showing a detail of the atomizer of FIGURE 5;

FIGURE 7 is an enlarged view, partly in section, of a detail of my invention; and

2

FIGURE 8 is a view taken on the line VIII—VIII of FIGURE 7.

Referring more particularly to the drawings reference numeral 2 indicates a wall of a furnace such as one end of a steel producing open hearth furnace. A burner 4 is inserted through the wall 2 into the furnace. As shown the burner 4 includes a large diameter tube 6 having end closure plates 8 and 10. A tube 12 extends through the tube 6 from the outlet closure plate 10 to the inlet closure plate 8. A tube 14 located above the tube 12 likewise passes from the outlet closure plate 10 through the inlet closure plate 8. Water inlet pipes 16, 18 and 20 pass through the closure plate 8 into tube 6 at the bottom portion thereof and terminate short of the plate 10. Water outlet pipes 22 and 24 are attached to the plate 8 adjacent the top thereof. All the joints between the tubes and the plates are made water tight by means of welding. The parts so far described are conventional and form no part of the present invention.

The tube 12 is connected to a fuel gas supply pipe 26 at its entry end and gaseous fuel, such as coke oven gas, is supplied thereto. If desired the tube 12 may be omitted and the burner furnished solely with liquid fuels as described hereinafter. An atomizer 28 is attached to the inlet end of tube 14. As shown in FIGURE 5 the atomizer 28 includes a pipe 30, an atomizer core 32, a nozzle rod 34, a lock nut 36 and a cap 38. The atomizer core 32 has an axial opening 40 therethrough and four spiral ribs 42 on its outer surface at the discharge end thereof. The core 32 passes through the entry end of tube 30 and has a collar 44 thereon which bears against the entry end of tube 30 and is held in place by means of lock nut 36, a gasket 46 being provided to insure tightness of the joint. The nozzle rod 34 passes through the atomizer core opening 40 and has a beveled plate 48 at its discharge end so as to provide a peripheral opening 50 from the atomizer core 32. The nozzle rod 34 is threaded through the entry end wall of the atomizer core 32 and is locked in place by means of washer 52 and nut 54. The cap 38 is threaded on the outside of the entry end of atomizer core 32. A hole 56 is provided through the wall of tube 30 on the entry side of ribs 42, a coupling 58 being welded to the wall of the tube at the opening 56. A threaded opening 60 is provided through the wall of atomizer core 32 on the entry side of lock nut 36. The atomizer itself is not new and other types of atomizers may be substituted for that shown.

A tube 62 is threaded into opening 60 and a liquid fuel, such as blended pitch or other hydrocarbon having a relatively high carbon to hydrogen ratio, is introduced through the tube 62 into the atomizer 28. A pipe 64 is threaded into the coupling 58 and is connected to a T 66. A pipe 68 threaded into the T 66 is connected to a source of atomizing fluid. This fluid should have a temperature of at least 200° F. and preferably is steam at a temperature of at least 350° F. and at a pressure greater than that of the liquid fuels. As shown in FIGURE 7 a bushing 70 is threaded into the side outlet of T 66 and receives a nipple 72 having an orifice plate 74 in the end thereof projecting into the main run of T 66. A plurality of small orifice holes 76 are provided through the plate 74. A coupling 78 is threaded on the outer end of nipple 72 and receives a tube 80 which is connected to a source of liquid fuel, preferably Bunker (C) fuel oil which has a relatively low carbon to hydrogen ratio. It will be understood that the steam may be first mixed with the pitch rather than with the fuel oil. Also, the mixture of steam and fuel may be introduced into the atomizer at a position further from its discharge end as compared to the other liquid fuel rather than as shown.

In operation, the fuel oil passing through the orifice

holes 76 is broken up into a multiplicity of relatively small streams so as to provide thorough mixing of the steam and fuel oil. This mixture or emulsion then travels through tube 64 into the atomizer 28 where it is atomized along with the blended pitch which is introduced through tube 62. This final emulsion or mixture of steam, fuel oil and blended pitch then passes through tube 14 of water cooled burner 4 and is burned as it enters the furnace. When coke oven or natural gas is used it will pass through the tube 12 and will be burned in the usual manner.

I have found that by maintaining the velocity of the mixture through the tube 14 at a minimum of 1,000 ft. per second no deposition of the fuels will occur. Also, minute particles, mainly carbon, will precipitate in the emulsion which enters the furnace, thus increasing the radiating energy in the flame. I also find it desirable to vary the ratio of the pitch and fuel oil in order to change the characteristics of the flame. The ratio between the fuels used must never exceed 20 to 1 and it is preferred that it not exceed a ratio of 4 to 1. In some instances when using gas, especially coke oven gas, the gas may be shut off while there is a heat in the furnace. When using a standard burner this results in more liquid fuel being required to furnish the necessary heat in an efficient manner whereas, when using the present burner, adjustments in fuel ratios can be made so as to more closely approximate the characteristics of the flame formed when using gas in combination with the liquid fuel.

While one embodiment of my invention has been shown and described, it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. Apparatus for burning two incompatible liquid fuels comprising an elongated tubular burner having entry and outlet ends, elongated means for atomizing liquid fuels connected to the entry end of said burner, said means having two inlets spaced apart along the length thereof, means connecting a source of one liquid fuel to the inlet of said atomizing means remote from said burner, a conduit connected to the other of said inlets, a side inlet connection to said conduit, an orifice plate having a plurality of openings therethrough connected in said side inlet, means connecting a source of the other liquid fuel to the side inlet connection, and means connecting a source of atomizing fluid to said conduit on the entry side of said inlet connection.

2. Apparatus according to claim 1 including a fuel gas tube extending longitudinally through said burner.

3. The method of burning two incompatible liquid hydrocarbon fuels the first having a relatively low carbon to hydrogen ratio of not more than 10 to 1 and the second having a carbon to hydrogen ratio of at least 15 to 1, which comprises mixing the first fuel with an atomizing fluid having a temperature of at least approximately 200°

F. to obtain a non-combusted liquid mixture, then atomizing the second fuel with said non-combusted mixture in liquid atomized state to obtain an atomized liquid mixture, delivering the atomized liquid mixture to a burner, and then burning the atomized liquid mixture after it leaves the burner.

4. The method of claim 3 in which the atomized liquid mixture passes through the burner at a minimum velocity of approximately 1,000 ft. per second.

5. The method of claim 3 in which the first fuel is fuel oil and the second fuel is a fuel of the class consisting of blended pitch and tar.

6. The method of burning two incompatible liquid hydrocarbon fuels in an open hearth furnace, the first fuel having a relatively low carbon to hydrogen ratio of not more than 10 to 1 and the second having a carbon to hydrogen ratio of at least 15 to 1, which comprises mixing the first fuel with an atomizing fluid having a temperature of at least approximately 200° F. to obtain a non-combusted liquid mixture, then atomizing the second fuel with said non-combusted mixture in liquid atomized state to obtain an atomized liquid mixture, delivering the atomized liquid mixture to a burner, then burning the liquid atomized mixture in said furnace, and varying the proportions of the fuels during various stages of a heat in said furnace.

7. Apparatus for burning two incompatible liquid fuels comprising an elongated tubular burner having entry and outlet ends, tubular means connected to the entry end of said burner, a side conduit connected to said tubular means, a side inlet connection to said conduit, an orifice plate having a plurality of openings therethrough connected in said side inlet, means connecting a source of one of the liquid fuels to the side inlet connection, means connecting a source of heated atomizing fluid to said conduit on the entry side of said inlet connection, a tube arranged coaxially in said tubular means and extending from the end remote from said burner to a position on the burner side of said side conduit, means connecting a source of the other liquid fuel to said tube, and means for directing said last named fuel outwardly from said tube into said tubular means.

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