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Vöcklinghaus

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[54] METHOD OF AND APPARATUS FOR THE HEATING OF A HEAT-TRANSFER MEDIUM

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** .... **122/250 R;** 110/1 K; 122/421

[51] **Int. Cl.**[2] **F22B 27/08**

[58] **Field of Search** .... 110/1 H, 1 S, 1 K; 122/4, 122/250 R, 356, 421

[56] **References Cited**

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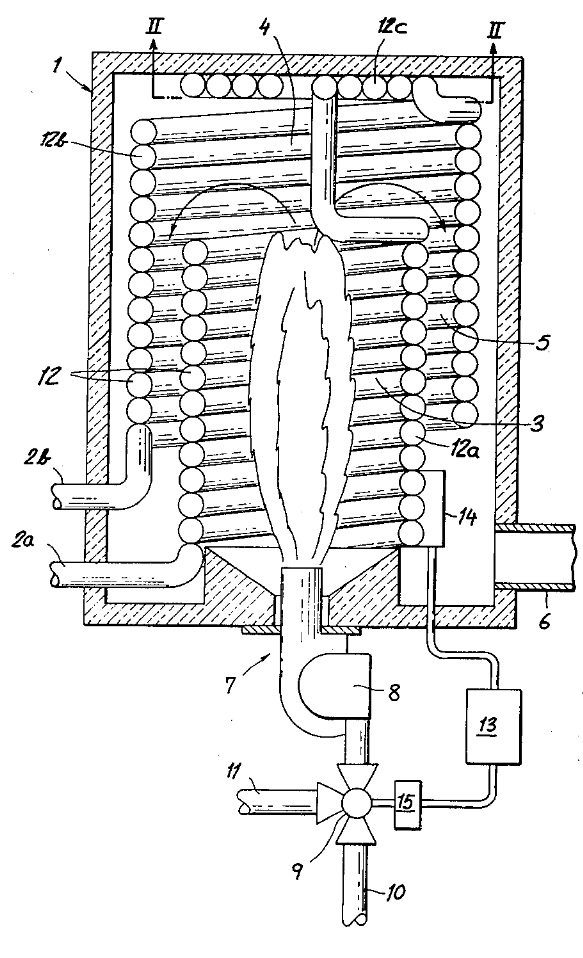
[57] **ABSTRACT**

A liquid medium having a high boiling point, e.g. oil, serves as a heat-transfer medium or a recirculating centrally heated system having a heat exchanger disposed in a combustion chamber. The medium is recirculated through the heat exchanger. At least one burner is provided for the combustion of a fuel composition producing large quantities of corrosive compounds and the system is operated such that the temperature of the combustion gases and the wall of the heat exchanger in contact therewith is always above the dewpoint of the corrosive components of the combustion gases. Preferably the system is operated so that the temperature of the heat-exchange medium is always above 200° C.

13 Claims, 3 Drawing Figures



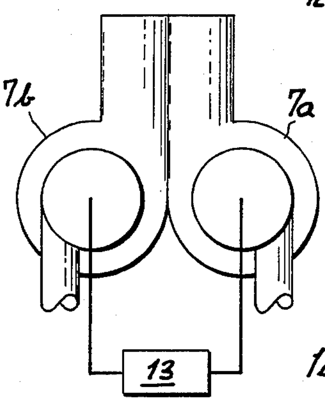


FIG. 3

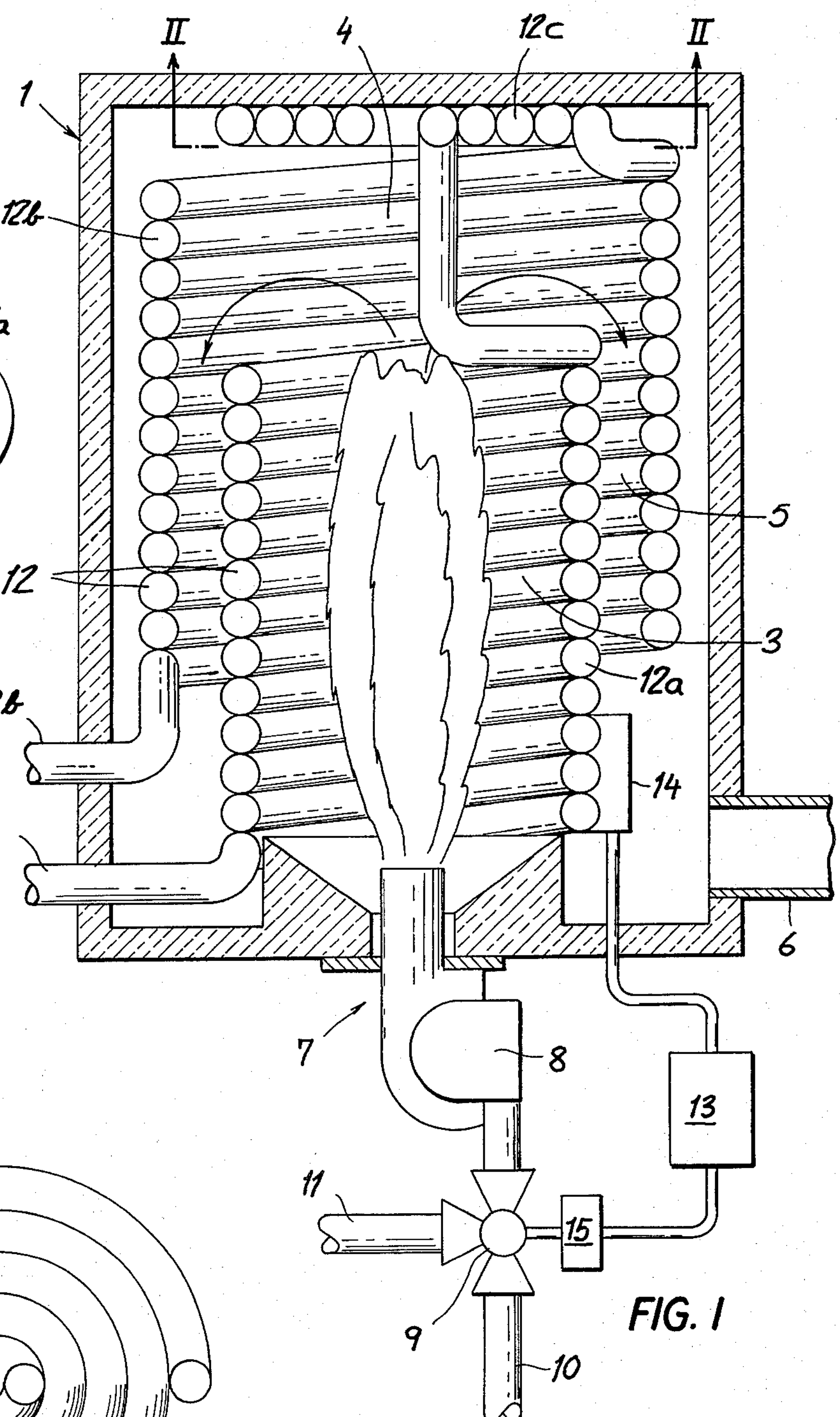


FIG. 1

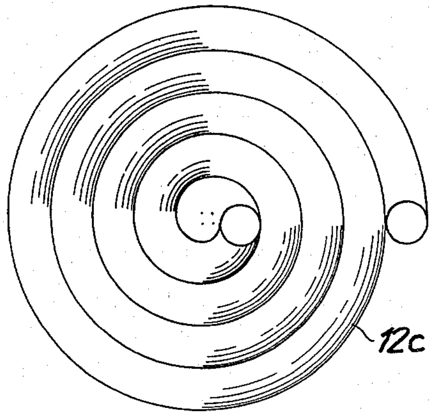


FIG. 2

METHOD OF AND APPARATUS FOR THE HEATING OF A HEAT-TRANSFER MEDIUM

FIELD OF THE INVENTION

The present invention relates to a method of and an apparatus for the combustion of fuel compositions containing sulfur and chlorine compounds and giving rise to gaseous components which normally are corrosive to the walls of a heat exchanger and, more particularly, to a system for heating a heat-transfer fluid displaced in a circulating path through a heat exchanger.

BACKGROUND OF THE INVENTION

If is, of course, known to provide a heating cycle in which a heat-transfer fluid, e.g. a liquid, is recirculated along a closed path and is heated at a central-heating plant or station at one location along this path and dissipates heat to another medium, to a load, etc. at a further location spaced from the heating apparatus. Such systems may be used for the generation of electric power in which the heat-transfer medium is vaporized or used to heat a vaporizable fluid, in central heating systems for buildings and industrial plants or any place at which remote utilization of the thermal energy carried by the heat-transfer fluid is possible.

The heating of such fluids is normally carried out in a boiler or heat exchanger fired by one or more burners using as fuel conventional fuel oil, consumer gas, natural gas or coal.

It has been proposed heretofore (see *Brennstoff-Wärme-Kraft*, Band, **16, 1964,** No. **8,** pages **397–399**) to use as fuel components or compositions, used oil, aqueous and toxic sludges, phenol-containing water and the like so as to destroy these liquids which are environmental pollutants and are hazardous to the health. These components can have their heating value increased by the addition of fuel oil or can be burnt together with fuel oil, the heat being recovered in waste-heat boilers or the like.

Such techniques have been found to be economically feasible as long as the combustion gases, e.g. the hot gases formed on combustion (referred to as exhaust gases after heat has been extracted therefrom) contain practically no corrosive compounds. When corrosive compounds are present, however, the use of the process is rendered impractical since the heat-exchanger surfaces deteriorate rapidly.

OBJECTS OF THE INVENTION

It is the principal object of the present invention to provide a method of and an apparatus for the heating of a recirculating heat-transfer fluid whereby the aforementioned disadvantages are obviated.

It is another object of the invention to provide a method of burning fuel compositions which produce large quantities of corrosive gaseous components whereby the system can nevertheless be economicalay utilized for the heating of a heat-transfer medium.

It is a further object of the invention to provide an improved apparatus for carrying out the last-mentioned method.

SUMMARY OF THE INVENTION

The present invention is based upon my discovery that fuel compositions containing toxic, poisonous and like compounds can be burnt effectively, in spite of the fact that they give rise to corrosive components in the

vapor state, and the heat generated by such compositions can be utilized, when the temperature along the surfaces of the heat exchanger traversed by the recirculating heat-transfer medium, and the combustion gases is maintained above the dewpoint of the corrosive components in the combustion gases and preferably above **200**°C.

More particularly, I have found that it is possible to provide a process for the combustion fuel compositions consisting at least in large part of compounds producing large quantities of gaseous corrosive compounds or such compositions in combination with conventional fuels, without any of the disadvantages enumarated above.

For the present purposes, fuel compositions are intended to means compositions containing liquid or gaseous fuels or combinations thereof which have a heat value of at least **4000** kcal/gh and exclusively or partially give rise to liquid or gaseous combustion or decomposition products with a high water content (**10** to **50**% by weight) and contain chlorine, sulfur and like corrosive agents.

According to the method aspect of the invention, the combustion gases are generated by the burning of large quantities of liquid or gaseous fuel compositions producing large quantities of gaseous corrosive compounds, only at a temperature above the dewpoint of the corrosive compounds in the combustion gases. According to a preferred technique, the heat exchange is carried out at a temperature of the heat-transfer medium of at least **200**° C. Surprisingly, the corrosive effect only is found when the temperature of combustion, in the combustion chamber or the wall of the heat exchanger in contact with the combustion gases, takes place at or below the dewpoint temperature of the gaseous corrosive compounds.

According to the apparatus aspects of the present invention, a system for the heating of a recirculated heat-transfer medium comprises a central heating system having a combustion chamber in which at least one burner arrangement opens, and a heat exchanger disposed between the burner and the exhaust gas outlet. According to the invention, means is provided for the selective combustion of liquid or gaseous fuel compositions capable of generating large quantities of gaseous corrosive compounds and for the combustion of conventional or gaseous fuels having minimal corrosive combustion products, the selection or control means responding to a temperature sensor on the heat exchanger surface proximal to the exhaust gas outlet. When the temperature sensor indicates a decrease in the heat-exchanger surface temperature to substantially the dewpoint (preferably to substantially **200**° C) a signal is supplied to the switchover means which operates the latter to preferentially burn the fuel with the higher heat value, namely, the normal fuel with low corrosive characteristics, either by metering more of this fuel into the composition or by operating a separate burner for this fuel for a greater duration than the burner operating with the composition rich in corrosive combustion products.

BRIEF DESCRIPTION OF THE DRAWING

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a vertical section through a central heating plant for a recirculating heat-transfer medium;

FIG. 2 is a section taken along line II——II of FIG. 1; and

FIG. 3 is a view of a double-burner arrangement which can be substituted for the burner of FIG. 1.

SPECIFIC DESCRIPTION

In the drawing, I show a central heating station **1** for the heating of a heat-transfer medium, especially oil having a boiling point above **200°** C, which is recirculated through a system represented generally at **2** and having an inlet **2***a* to the heat exchangers of the central heating station and an outlet **2***b* returning to a heat-consuming load.

The central heating station comprises a combustion chamber **3** which is defined by a first cylindrical heat exchanger **12***a* communicating with the inlet **2***a* and coaxially surrounding a burner **7**.

The combustion chamber **3** communicates, at its axial end remote from the burner **7**, with a flow-reversing chamber **4** which lies transversely to the axis of the combustion chamber and communicates with an exhaust-gas outlet chamber **5** opening at **6** into a stack or flue.

Chamber **5** is defined by a cylindrical heat exchanger **12***b* coaxial with heat exchanger **12***a* and spacedly surrounding same. The flow-direction changing chamber **4** is defined in part by a spiral-tube heat exchanger **12***c* spaced from the end of heat exchanger **12***a*. As illustrated, the heat exchangers **12***a* —**12***c* are connected in series to permit the oil to flow therethrough.

The exhaust-gas outlet **6** may be connected with an exhaust-gas cleaning apparatus not shown.

The burner arrangement **7** comprises an atomizing burner **8** designed to burn high-water fuel compositions to which conventional fuels may be added. A valve **9** communicates selectively between two supply lines **10** and **11**, respectively delivering conventional fuel oil and a waste liquid containing large quantities of water, chlorine and sulfur compounds producing corrosive components upon combustion. Respective pumps and reservoirs for the two liquids may be provided.

The valve **9** may also be constituted as a mixing valve, when the heat valve of the fuel falls, thereby indicating a reduction in the combustion gas temperature at contact with the heat exchanger **12** close to the outlet **6**, such that as the dewpoint is approached, the temperature sensor **14** provides a signal for the controller **13** which actuates the valve operator **15**.

At startup, the oil serving as the heat-transfer medium is recirculated in the cycle **2** through the heat exchanger and may have a temperature below **200°** C or, say, room temperature as detected by the sensor **14**. The controller **13** actuates the valve operator **15** so that the valve **9** delivers only pure fuel oil to the burner **7**, **8**, whereby combustion gases of low corrosivity and high temperature are produced.

Once the temperature of the recirculating oil is heated to **200°C** or above, the temperature sensor through controller **15** meters quantities of the high corrosion fuel composition to the burner. Should the temperature detected by sensor **14** drop, the quantity of this high-corrosion fuel composition is reduced or terminated so that the temperature at the surface of the heat exchanger at least at the outlet and the temperature of the combustion gases within the heat exchanger is at all times maintained above **200°C** and, therefore, above the dewpoint of the corrosive components of the combustion gases.

Any solids produced by the combustion process may be collected on the floor of the combustion chamber and removed by conventional scraping or conveying devices.

The arrangement shown in FIG. **3** comprises a pair of burners *7a* and *7b*, the first for the combustion of pure fuel oil and the other for combustion of the fuel composition of high corrosivity which may be operated jointly or independently by the controller **13** to accomplish the same results.

I claim:

1. A method of centrally heating a heat-transfer fluid comprising the steps of:

circulating said fluid through a heat exchanger;

generating a hot combustion gas contacting said heat exchanger by combustion of at least one fuel composition generating large quantities of gaseous corrosive components upon combustion; and

controlling said combustion by selectively burning a fuel and said composition so that said combustion gas contacts said heat exchanger only at a temperature above the dewpoint of said corrosive components in the combustion gas.

2. The method defined in claim **1** wherein said combustion gas contacts said heat exchanger always at a temperature of said fluid of at least **200°** C.

3. The method defined in claim **1** wherein said fluid is oil.

4. The method defined in claim **1** wherein said fuel and said fuel composition are mixed before combustion.

5. The method defined in claim **1** wherein said fuel and said fuel composition are independently burnt in a common combustion chamber.

6. The method defined in claim **1** wherein the temperature at a surface of said heat exchanger is detected and used to control the proportions of said fuel and said fuel composition which are burnt.

7. An apparatus for the heating of a recirculated heat-transfer fluid in a central heating station comprising:

means defining a combustion chamber;

at least one heat exchanger traversed by said fluid in said combustion chamber;

at least one burner opening into said combustion chamber for generating combustion gases therein passing into contact with said heat exchanger;

means forming a combustion gas outlet from said chamber; and

control means for maintaining the temperature at which said combustion gas contacts said heat exchanger at least in the region of said outlet above the dewpoint of corrosive components of the combustion gas, said control means including means for the selective combustion of a fuel and of a fuel composition producing large quantities of corrosive components upon combustion.

8. The apparatus defined in claim **7** wherein said control means includes a temperature sensor on said heat exchanger, a controller connected to said temperature sensor, and a switchover device for selecting between combustion of fuel and said fuel composition.

9. The apparatus defined in claim **8** wherein two burners are provided for selective operation by said switchover means, one of said burners burning said fuel and the other burner burning said composition.

10. The apparatus defined in claim **8** wherein a single burner is provided with inlets for said fuel and said composition, said switchover means selectively communicating between said inlets and said burner.

11. The apparatus defined in claim **8** wherein said fluid is oil.

12. The apparatus defined in claim **8** wherein said temperature sensor is disposed on said heat exchanger adjacent said outlet.

13. The apparatus defined in claim **8** wherein said heat exchanger defines a combustion chamber coaxial with said burner, a flow-direction-changing chamber ahead of said burner, and a combustion gas discharge chamber coaxial with said combustion chamber and communicating with said outlet.

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