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Muckelrath

[11] **3,779,230**

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[54] **INDIRECT OR DIRECT FIRED HEATER**

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[73] Assignee: **Air Heaters, Inc.**, Tioga, N. Dak.

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[52] **U.S. Cl.** ..... **126/116 R**, 431/115, 432/222

[51] **Int. Cl.** **F24h 3/06**

[58] **Field of Search** ..... 126/116 R, 110 R, 126/110 B; 263/19 R, 19 A; 431/115, 174

[56] **References Cited**

UNITED STATES PATENTS

2,780,218	2/1957	Allen	263/19 A
3,147,795	9/1964	Livingston et al.	431/174
2,415,064	1/1947	McCollum	126/116 R

FOREIGN PATENTS OR APPLICATIONS

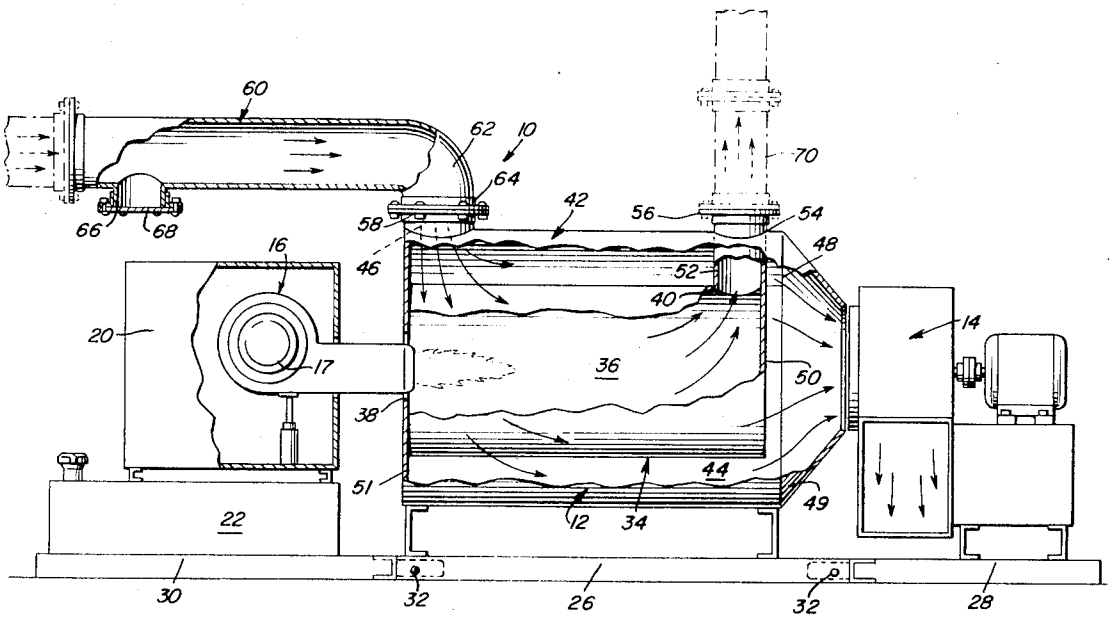
185,536	9/1922	Great Britain	431/115

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Attorney—Harvey B. Jacobson

[57] **ABSTRACT**

A selectively indirect and direct-fired air heater has a fire tube and sheel section, a blower section detachably connected to the fire tube and shell section and arranged for moving air therethrough, and a plurality of heating units selectively connectible to the fire tube and shell section for passing combustion gases to a fire tube thereof. Each heating unit is designed to burn a different type of fuel. The fire tube and shell section has a housing provided with a wall defining the fire tube. A shell is arranged in heat exchange relation with respect to the housing, and is provided with a wall arranged around the housing wall and defining a fluid or airflow passage having inlet and outlet openings. The fire tube has an outlet opening having a flanged duct surrounding same. A pipe in communication with the shell inlet opening is provided with a flange which is selectively joinable with the flanged duct for selectively connecting the fire tube outlet opening to the shell inlet opening for cycling combustion gases through the airflow passage. The firing is direct when the fire tube outlet is so connected, and indirect otherwise.

11 Claims, 2 Drawing Figures



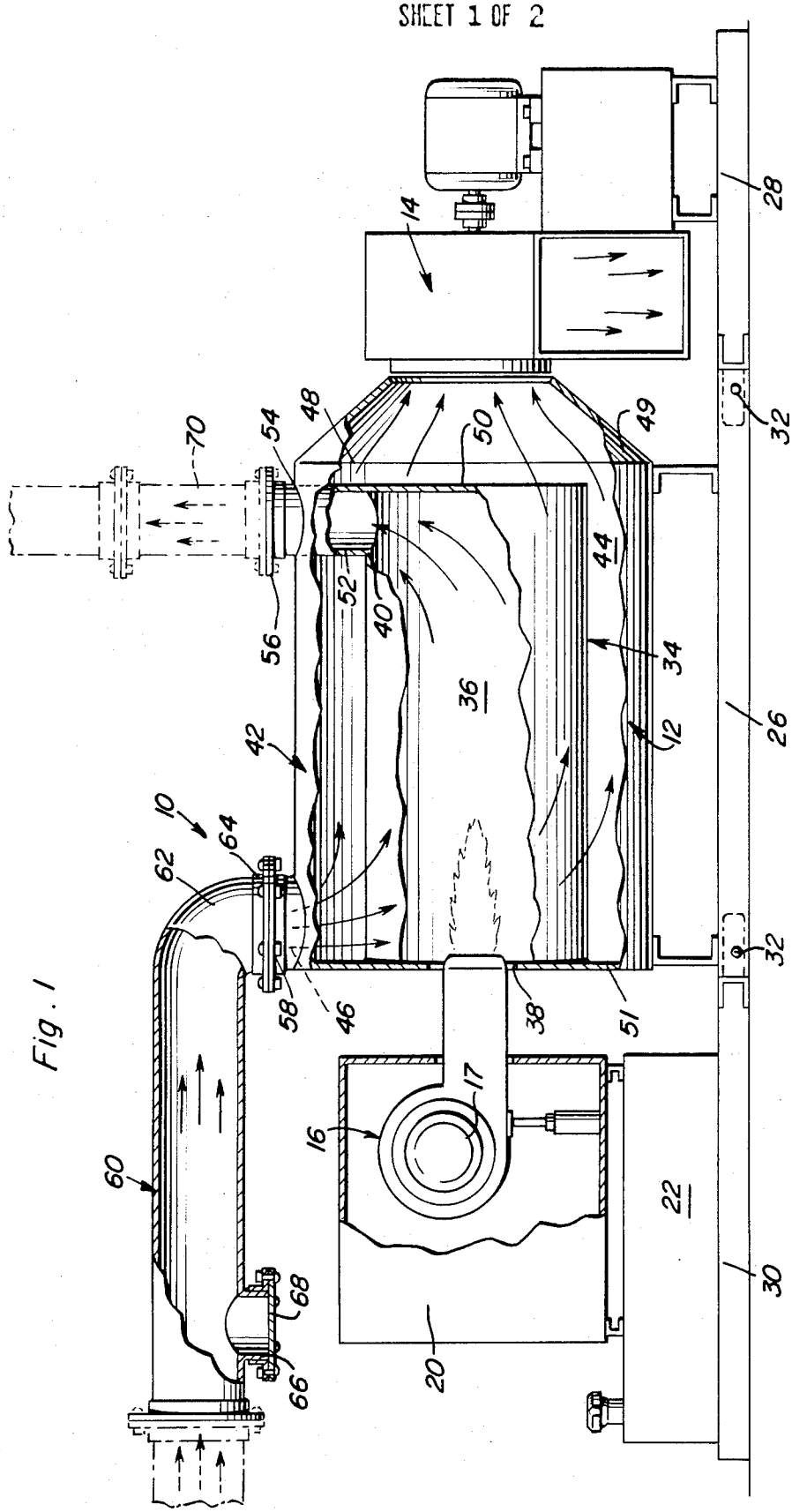

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Fig. 1

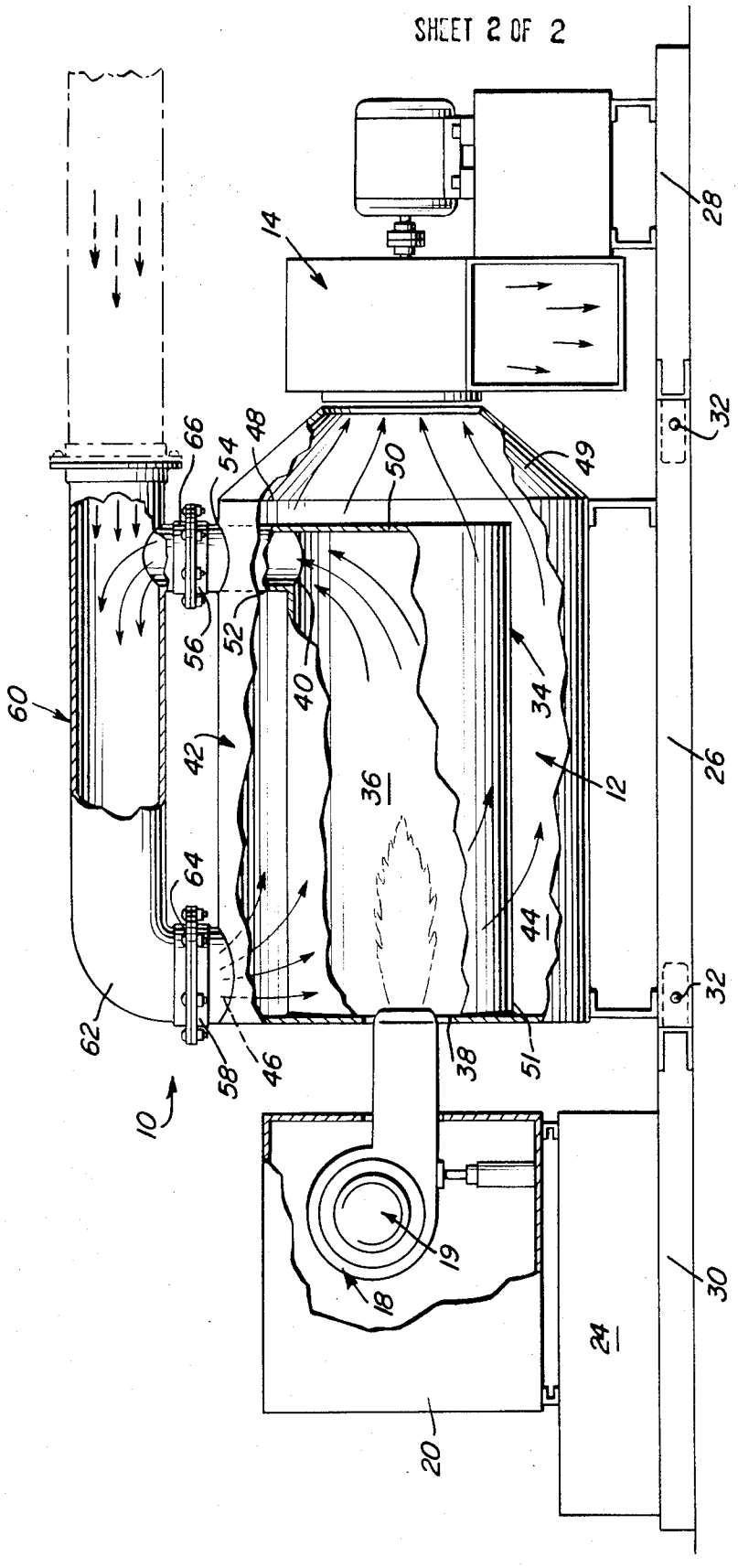

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Fig. 2

INDIRECT OR DIRECT FIRED HEATER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to a fluid heater, particularly an air heater, and specifically to such a heater which may be selectively arranged in indirect and direct fired heating modes and burn different type fuels.

2. Description of the Prior Art

Heaters are known which put out a large volume of constant temperature heated air for heating exterior work areas such as encountered in construction and the like. These heaters enable work to be performed even under extremely cold weather conditions.

These heaters are basically classified as indirect and direct-fired, and by the type of fuel burned. U. S. Pat. No. 3,388,697 discloses an example of an indirect-fired heater. By indirect-fired is meant that the air being heated is not contacted directly by the combustion gases heating same.

The prior art air heaters are basically designed and constructed as either an indirect or direct-fired heater, and are further intended to burn only a designated type of fuel, which is usually either a fuel oil or gas.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an air heater capable of a high heat output and that may be selectively arranged in either an indirect or a direct-fired mode.

It is a further object of the present invention to provide an air heater which is capable of being set up to burn selectively any suitable, known fuel.

These and other objects are achieved according to the present invention by providing a selectively indirect and direct-fired fluid heater having a housing provided with a wall defining a fire tube having an inlet and an outlet for permitting combustion gases to pass through the fire tube. A shell is provided having a wall arranged in heat exchange relation with respect to the housing wall so as to define a fluid flow passage having inlet and outlet openings. Means are mounted on the housing and shell for selectively connecting the fire tube outlet opening to the shell inlet opening for cycling combustion gases through the fluid flow passage. The firing being in the direct-fired mode when the fire tube outlet is so connected, and in the indirect-fired mode otherwise.

In a preferred embodiment of the present invention, the selectively connecting means has a duct mounted on the housing wall surrounding the outlet opening thereof. This duct extends through a hole provided in the shell wall, and is provided with a flange on an end thereof spaced from the housing wall. An additional flange is mounted on the shell wall surrounding the inlet opening thereof. The selectively connecting means further has a pipe having at an end thereof an elbow provided with a flange which joins with the flange mounted on the shell wall. The pipe is also provided with a flange which is selectively joinable with the duct flange for creating the direct-fired mode.

In an advantageous feature of the present invention, the fire tube and shell form a fire tube and shell section. A blower section is detachably connected to the fire tube and shell section, and is arranged for moving fluid therethrough. A plurality of heating units are provided.

Each heating unit is designed to burn a different type fuel, and is selectively connectible to the fire tube and shell section for passing combustion gases to a fire tube of the fire tube and shell section.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic, side elevational view, partly cut away and in section, showing a heater according to the present invention arranged in an indirect-fired mode.

FIG. 2 is a schematic, side elevational view, partly cut away and in section, similar to FIG. 1 but showing a heater according to the present invention arranged in a direct-fired mode.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now more specifically to the drawings, a selectively indirect and direct-fired air heater **10** according to the present invention has a fire tube and shell section **12.** A blower section **14,** which may be a conventional scroll-type centrifugal blower as illustrated, is detachably connected to section **12,** and is arranged for moving air therethrough.

A plurality of heating units **16** (FIG. **1**) and **18** (FIG. **2**) are provided. Each unit **16, 18** has a burner **17, 19,** respectively, designed to burn a different type fuel, and to be selectively connectible to section **12** for passing combustion gases to the fire tube thereof. Each burner **17, 19** is arranged in an enclosure **20,** which may also enclose the controls (not shown) for the particular unit **16, 18.** Burners **17, 19** and the controls therefor are of a conventional nature, and, therefore, they will not be discussed in detail herein. Unit **16** may be, for example, a fuel oil burning unit, and receive its fuel from a fuel oil tank **22** (FIG. **1**). Unit **18** may be, for example, a gas burning unit, and receive a liquefied gas such as propane from one or more liquefied gas bottles (not shown) placed in a, for example, liquefied gas bottle enclosure **24** (FIG. **2**).

Section **12** of heater **10** further has a base member **26** connected thereto for supporting same. In a similar manner, sections **14** and **16** have base members **28** and **30,** respectively. These base members **26, 28,** and **30** have interfingering portions with mating holes running transversely through them for receiving pins **32** for detachably attaching section **14** and one of units **16, 18** to section **12** to form a heater **10.** Further this construction permits heater **10** to be disassembled into three sections for easier shipment.

Section **12** of heater **10** has a housing **34** provided with a substantially cylindrical wall **36** defining a fire tube having an inlet opening **38** and an outlet opening **40** for permitting combustion gases from the burner **17, 19** of heating unit **16, 18** to pass through the fire tube. Wall **36** may be constructed from, for example, a stainless steel. A shell **42** is provided with a substantially cylindrical wall **44** arranged around wall **36.** Walls **36** and **44** define a substantially annular fluid flow passage having an inlet opening **46** and an outlet opening **48.** Advantageously, a cone-shaped diffuser **49** is connected

to outlet opening **48** to lead the heated air into blower section **14.**

As is clearly shown in the drawings, housing **34** and shell **42** are arranged coaxially, outlet opening **38** and inlet opening **46** are arranged in a respective wall **36, 44** co-directionally from the common axis of housing **34** and shell **42,** and lie in a common radial plane. The end of housing **34** adjacent outlet opening **40** is covered by a plate **50,** and the end of shell **42** adjacent inlet opening **46** has a cover **51** arranged thereon and provided with inlet opening **38.**

A means mounted on housing **34** and shell **42** for selectively connecting outlet opening **40** to inlet opening **46** for cycling combustion gases through the fluid flow passage will now be described. A duct **52** is mounted on wall **36** surrounding outlet opening **40.** This duct **52** extends through a hole **54** provided in wall **44,** and is provided with a flange **56** on the end thereof spaced from wall **36.** A flange **58** is mounted on wall **44** and arranged surrounding inlet opening **46.**

A pipe **60** is provided for bringing air into the annular fluid flow passage. This pipe **60** has at an end thereof an elbow **62** provided with a flange **64** which joins with flange **58** to form a flange coupling. Pipe **60** is also provided with a flange **66** at a point thereon spaced from flange **64** the same distance as flange **58** is spaced from flange **56.** Flange **66** is selectively joinable with flange **56,** as shown in FIG. **2** of the drawings, for cycling combustion gases through the fluid flow passage and creating a direct-fired mode. When heater **10** is arranged in the indirect-fired mode, as shown in FIG. **1** of the drawings, a plate **68** may be arranged on flange **66** in a known manner for covering same.

When heater **10** is arranged in the indirect-fired mode (FIG. **1**) a stack **70** may be arranged on flange **56** in a known manner for carrying away the combustion gases.

The flow of the air and the combustion gases is designated in the drawings by the flow arrows. WIth a heater **10** according to the present invention, a heating unit can be set up from a standard set of components which is optimum for a particular location and easily movable thereto. A heating unit **16, 18** may be selected that burns a fuel that is most desirable for a particular heating situation. Blower section **14** will draw air through pipe **60** and the fluid flow passage to be fired either indirectly or directly and heated by combustion gases from the heating unit. If contamination of the air by the combustion gases is permissible, the direct-fired mode shown in FIG. **2** of the drawings may be employed with a resulting increase in efficiency of operation of the heater **10.**

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A selectively indirect and direct-fired fluid heater, comprising, in combination:

a. a housing provided with a wall defining a fire tube having an inlet opening and an outlet opening for permitting combustion gases from a burner means to pass through the fire tube;

b. a shell provided with a wall arranged in heat exchange relation with respect to the housing wall and defining therewith a fluid flow passage having inlet and outlet openings; and

c. means for arranging the heater in one of a direct firing mode and an indirect firing mode, and including means mounted on said housing and shell for selectively connecting the fire tube outlet opening to the shell inlet opening and cycling combustion gases through the fluid flow passage and arranging the heater in the direct firing mode, the heater being arranged in the indirect firing mode when the firing tube outlet opening is disconnected from the shell inlet openings.

2. A structure as defined in claim **1,** further including base means connected to said shell for supporting same, and means provided on said base means for selectively attaching heating units burning different type fuels to the base means, and arranging the heating units for passing combustion gases through the fire tube inlet opening.

3. A structure as defined in claim **2,** wherein said base means is further provided with means for detachably attaching a blower unit to the base means for moving heated fluid through the shell outlet opening.

4. A structure as defined in claim **3,** wherein said housing and shell are substantially cylindrical and are arranged coaxially, with the fluid flow passage being annular and the fire tube outlet opening and the shell inlet opening arranged in a respective wall co-directionally from the common axis of said housing and shell and in a common radial plane, an end of the housing adjacent the fire tube outlet opening being covered and an end of the shell adjacent the shell inlet opening having a cover provided with the fire tube inlet opening.

5. A structure as defined in claim **4,** wherein the means for arranging includes a duct mounted on the housing wall and surrounding the outlet opening thereof, said duct extending through a hole provided in the shell wall and being provided with a flange on an end thereof spaced from the housing wall.

6. A structure as defined in claim **5,** wherein a flange is mounted on the shell wall surrounding the inlet opening thereof, and the selectively connecting means further includes a pipe having at an end thereof an elbow provided with a flange joined with the flange mounted on the shell wall, said pipe also provided with a flange which is selectively joinable wih the duct flange for creating a direct-fired mode.

7. A structure as defined in claim **1,** wherein said housing and shell are substantially cylindrical, with the fluid flow passage being annular and the fire tube outlet opening and the shell inlet opening arranged in a respective wall co-directionally from the common axis of said housing and shell and in a common radial plane, an end of the housing adjacent the fire tube outlet opening being covered and an end of the shell adjacent the shell inlet opening having a cover provided with the fire tube inlet opening.

8. A structure as defined in claim **7,** wherein the means for arranging includes a duct mounted on the housing wall and surrounding the outlet opening thereof, said duct extending through a hole provided in the shell wall and being provided with a flange on an end thereof spaced from the housing wall.

9. A structure as defined in claim **8**, wherein a flange is mounted on the shell wall surrounding the inlet opening thereof, and the selectively connecting means further includes a pipe having at an end thereof an elbow provided with a flange joined with the flange mounted on the shell wall, said pipe also provided with a flange which is selectively joinable with the duct flange for creating a direct-fired mode.

10. A structure as defined in claim **1**, wherein the means for arranging includes a duct mounted on the housing wall surrounding the outlet opening thereof, said duct extending through a hole provided in the shell wall and being provided with a flange on an end thereof spaced from the housing wall.

11. A structure as defined in claim **10**, wherein a flange is mounted on the shell wall surrounding the inlet opening thereof, and the selectively connecting means further includes a pipe having at an end thereof an elbow provided with a flange which joins with the flange mounted on the shell wall, said pipe also provided with a flange which is selectively joinable with the duct flange for creating a direct-fired mode.

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