April 22, 1969 M. SCHUCH 3,439,666

DOUBLE SHELL TANK FLUID HEATER

Filed Dec. 13, 1967

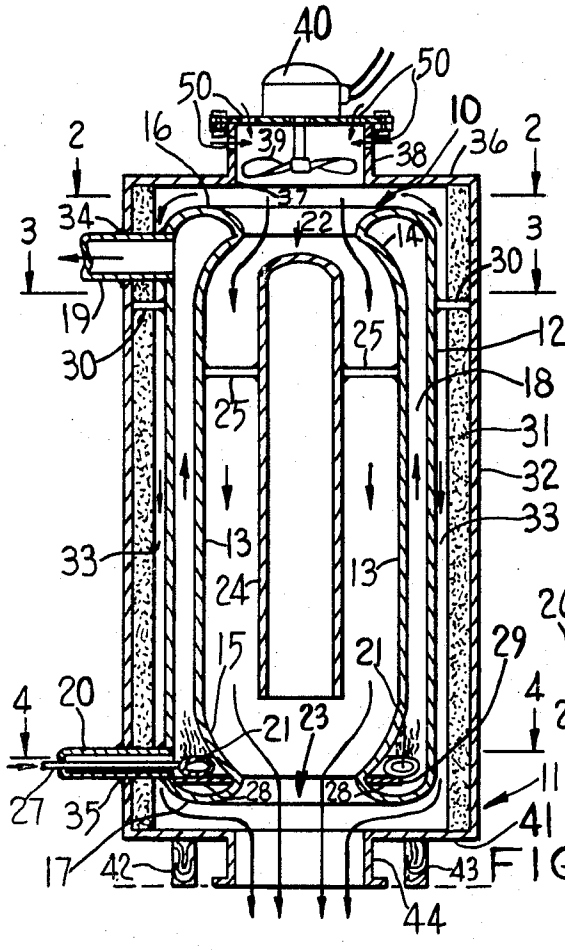


FIG. 1

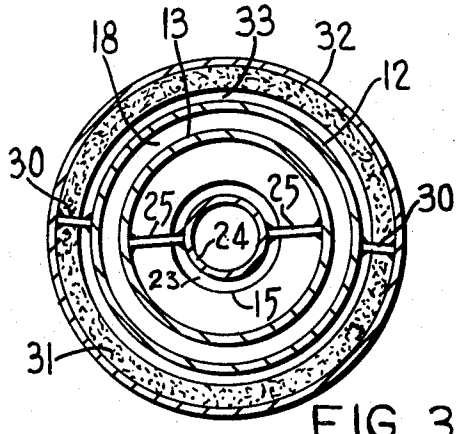


FIG. 3

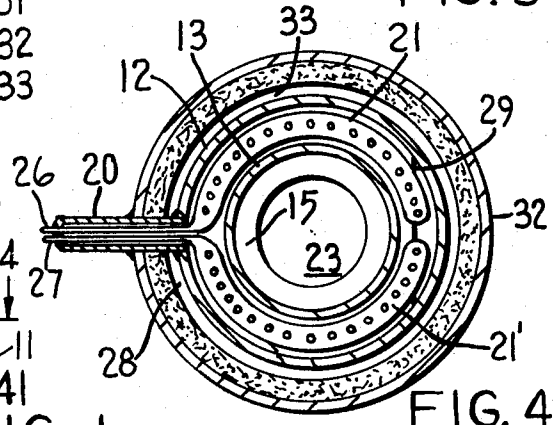


FIG. 4

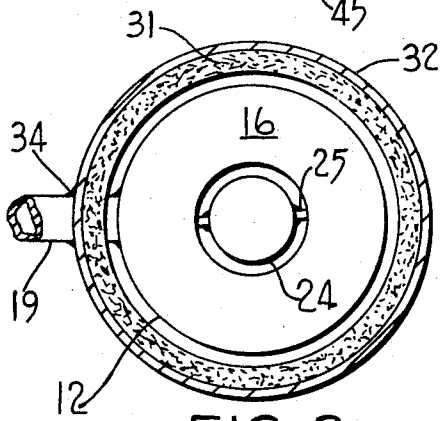


FIG. 2

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DOUBLE SHELL TANK FLUID HEATER

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ABSTRACT OF THE DISCLOSURE

A fluid heater is described having a hollow cylindrical outer shell and a hollow cylindrical inner shell annularly disposed so as to provide a narrow gas flow space between the two shells. The inner shell has inwardly-converging top and bottom portions which are connected with the corresponding outer shell portions by shell rings, which provide an upper inlet and lower outlet for fluid passing through the inner shell.

Flat arcuate pancake-type gas burners are placed in and on the lower juncture of the two shells, and an insulated cover is provided around the unit, there being a narrow annular air space between the inner surface of the cover and the outer shell. The cover extends beyond the upper juncture of the two shells, and a top connects the upper edges of the cover. A central opening in the top houses a fluid blower which blows fluid, such as air, through the inner shell and through the annular space around the outer shell.

A cylindrical deflector having a diameter less than the inner shell inlet opening, is attached within and to the inner surface of the inner shell.

A flue connected to the upper portion of the outer shell and passing through the cover serves to discharge flue gas, while a duct connected to the lower portion of the outer shell serves to allow entry of the burners as well as the secondary air required. A circular plate is placed under the burners and in and over the lower junction of the shells to direct flow of secondary air from the duct to portions of the burner remote from the duct.

The cover is desirably extended below the lower junction of the shells, and a bottom is joined to the extending edges. A central opening in the bottom permits heated fluid to pass out into a plenum chamber, for example, for heating purposes.

Background of the invention

A large number of fluid heaters have been described and have appeared on the market. Most of them suffer from the fact that, if they are simple in construction, they are highly inefficient. And, if they are efficient, they are quite complicated to make and consequently, are expensive.

In Patent 3,029,803, a double shell heater is disclosed. However the unit has a separate heating pot, and the air is blown at the side into the outer annular space only. The separate pot arrangement incurs the danger of mixing flue gas with the air, while the air feed method incurs considerable loss of heat due to the resistance involved.

The same is true of Patent No. 2,172,399, wherein air is blown from the side into an annular space. Both patents employ series flow of air, whereas a parallel flow of two air streams reduces considerably the resistance to flow.

There has been need for some time for a fluid heater which is simple to manufacture, and yet is efficient in heat output.

Summary of the invention

According to the present invention, a highly efficient unit is offered which is relatively simple to manufacture. It involves the use of two annularly-placed hollow shells, the inner shell having its ends inwardly converged, and both shells being connected at top and bottom by shell rings which provide an inlet opening on top and an outlet opening at the bottom for the fluid being heated.

The gas burner is laid on a circular plate on and within the lower juncture of the two shells. The outer shell is provided with a flue on top and air duct at the bottom, the latter serving as the entry means for the gas burners. An outer insulated cover surrounds the outer shell in spaced relation, and a blower above the entry opening blows fluid through the inner shell. Also, a parallel air stream flows through the annular space between the cover and the outer shell, and the two heated air streams are united and led to the space to be heated. A baffle in the inner shell deflects the air toward the shell wall and thus improves heat transfer efficiency.

Such a unit is relatively simple to manufacture, yet it possesses extremely high efficiency.

Brief description of the drawings

The invention will be more readily understood by reference to the accompanying drawing in which a preferred embodiment is described, and in which:

FIGURE 1 depicts a cross-sectional vertical elevational view of a preferred embodiment.

FIGURE 2 presents a cross-sectional horizontal view taken along the plane of line 2—2 in FIGURE 1.

FIGURE 3 illustrates a similar view taken along the plane of line 3—3 in FIGURE 1, and

FIGURE 4 shows a similar view taken along the plane of line 4—4 in FIGURE 1.

The same numerals represent similar parts in the various figures.

Description of the preferred embodiment

Referring to the drawing, numeral **10** represents generally the heater portion, while numeral **11** designates generally the insulated cover portion. The heater portion consists of a cylindrical outer metal shell **12**. Disposed inside shell **12**, in annular relation, is metal inner shell **13** which has its upper portion **14** and lower portion **15** turned inwardly. Both shells are connected at the top with a ring section **16**, and at the bottom with a ring section **17**. Between shells **12** and **13** is a narrow annular space **18** through which flue gases are designed to pass, discharging into flue **19**, which is connected to the upper part of shell **12**.

It will be noted that the connections for the two shells provide an upper entrance opening **22**, and a lower discharge opening **23** for air or other fluid forced through the center of shell **13**. A cylindrical baffle **24** also is inserted inside shell **13**, and is attached thereto by struts **25**, and it serves to deflect the air stream toward the heated wall of shell **13**.

The lower part of shell **12** is connected with duct **20**, through which the gas lines **26** and **27** enter to supply gas to curved pancake type gas burners **21** and **21'**. The duct also serves as the entry for secondary air for the burners. A circular plate **28** laid over shell juncture **17** serves as a base for burners **21–21'**. The rear portion **29** of plate **28** is cut off to allow entry of secondary air from beneath plate **28** for the rear portions of the burners.

Attached to the outside of shell **12**, in spaced relation therewith, by struts **30** is insulating cover **11**, which consists of a layer **31** of magnesia, or other type of insulation, attached to metal shell **32**. It will be observed that a narrow space **33** is thus provided between cover **11** and outer heater shell **12**. Flue **19** and duct **20** project through cover shell **32**, and the joints are sealed at **34** and **35**, respectively.

Cover shell **32** is extended above the line of shell juncture **16**, and a plate top **36** is connected to the upper edge of shell **32**. Top **36** is provided with central opening **37**,

and a collar **38** attached to said opening. Fan **39**, driven by motor **40**, is mounted in collar **38**.

Cover shell **32** is extended below the line of shell juncture **17**, and a plate **41** is connected to the lower edge of shell **32**, to provide a bottom, which can rest on floor joists **42–43**, for example. A flanged collar **44** can be provided to connect with an opening in a floor plenum chamber **45**, for example, or other suitable duct for transferring heated air.

The heater is used as follows:

If the unit is to be used as an air heater, gas burners **21–21'** are ignited. This causes secondary air to flow through duct **20**, and into the space between shells **12** and **13** and under plate **28**. Enough air flows under plate **28** and through opening **29** to provide adequate secondary air for the portions of the burners farthest away from duct **20**. The flue gases pass through annular space **18** and discharge through flue **19**. This causes the heating up of shells **12** and **13**.

Air blower **39** is started. This causes room air to be sucked through openings, as shown by the arrows, and to be blown through opening **22** where it is deflected by cylinder **24**, so that it impinges on the inner surface of shell **13**, and is discharged through opening **23** and out into plenum **45**, or other space to be heated. The fan also blows air through annular space **33**. This stream of air is heated by shell **12**, and the thus-heated stream then joins the other heated stream, as they issue through collar **44**.

It will be noted that the heater has an exceptionally high efficiency in view of the fact that both shell walls are employed for the heating operation, and a high velocity fluid flow provides an excellent film heat transfer coefficient.

The unit may be employed to heat water, or other fluid, if desired, by making the necessary changes familiar to those skilled in the art.

I claim:

1. A fluid heater, of the type described, comprising:

a hollow cylindrical outer shell,

a hollow cylindrical inner shell disposed annularly within said outer shell in a manner so as to provide a narrow annular gas flow space therebetween, said inner shell having an inwardly-converging top portion and an inwardly-converging bottom portion,

a shell ring connecting member connecting the upper portions of said inner and outer shells, whereby a central inlet opening is provided for said inner shell,

a shell ring connecting member connecting the lower portions of said inner and outer shells whereby a central discharge opening is provided for said inner shell, and serving as a repository for gas burners disposable thereon,

an insulated cover disposed in spaced relation over said outer shell and extending above said upper connected portions and below said lower connected portions,

a flue connected to the upper portion of said outer shell wall, and extending through said cover, and serving to discharge flue gases,

a duct connected to the lower portion of said outer shell wall, and extending through said cover, and serving as an entrance for fuel feed lines to said gas burners, and as an inlet for secondary air for said gas burners,

a top attached to the upper edges of said cover, and having means providing a central opening therein, and

fluid blowing means connected in said top opening and designed to blow fluid through said inner shell and around the outside of said outer shell in the annular space therearound.

2. A fluid heater, according to claim **1**, in which a cylindrical gas deflector is disposed within and attached to the inner wall of said inner shell, said deflector having an external size smaller than said inner shell inlet opening.

3. A fluid heater, according to claim **1**, in which a bottom is attached to the lower edges of said cover, and means are provided for a central opening therein for discharge of heated fluid.

4. A fluid heater, according to claim **1**, in which a flat circular plate is disposed within and on said lower junction of the inner and outer shells and under said burners and designed to direct a flow of secondary air from said duct to the burner portions remotely distanct from said duct.

References Cited

UNITED STATES PATENTS

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JAMES W. WESTHAVER, *Primary Examiner.*

U.S. Cl. X.R.

126—71, 90; 122—161