April 11, 1950 W. J. MILLER 2,503,883

FLUID HEATER

Filed July 24, 1946

Fig. 1.

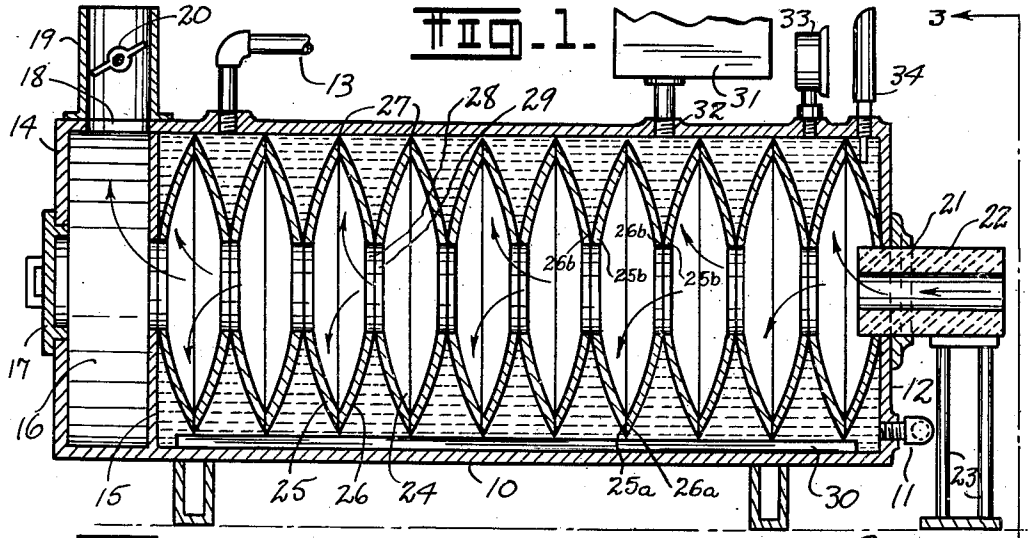


Fig. 2.

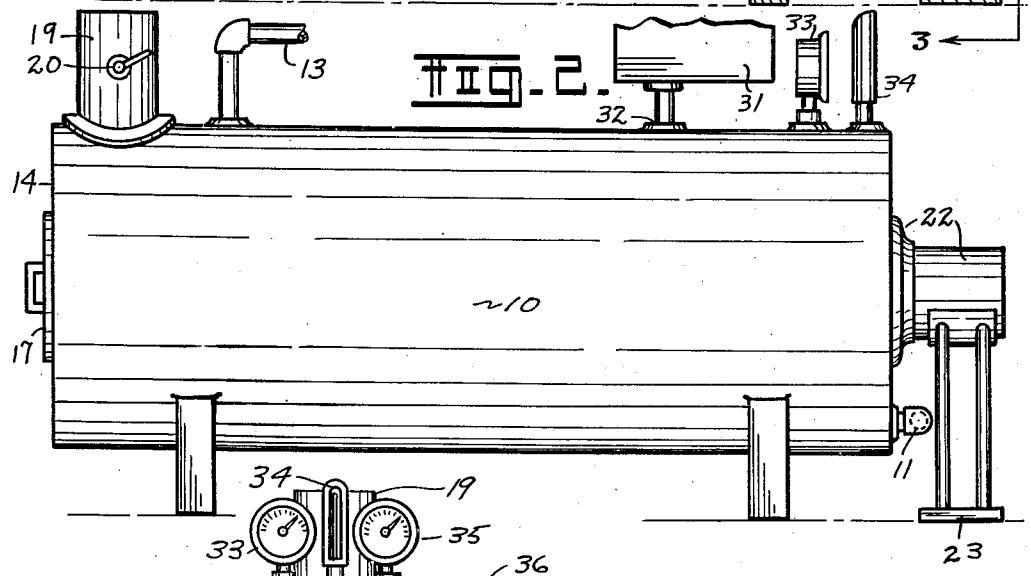
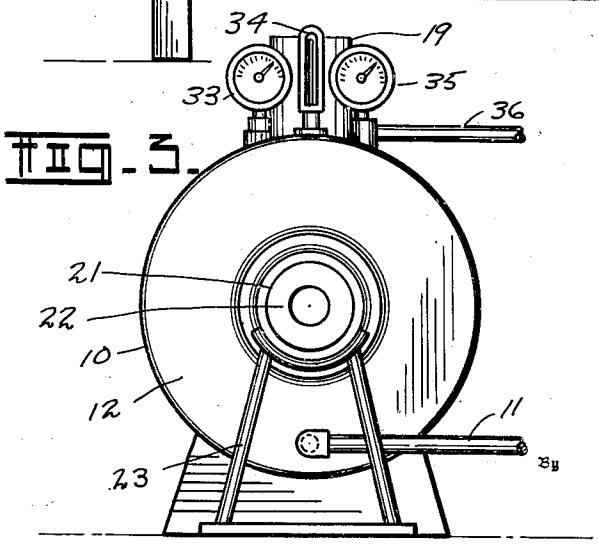


Fig. 3.



Inventor

William J. Miller.

W. B. Harpman

Attorney

Patented Apr. 11, 1950

2,503,883

UNITED STATES PATENT OFFICE

2,503,883

FLUID HEATER

William J. Miller, Youngstown, Ohio

Application July 24, 1946, Serial No. 685,985

2 Claims. (Cl. 122—136)

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This invention relates to a fluid heater and more particularly to a heater unit designed for heating a fluid hydrocarbon or similar liquid.

The principal object of the invention is the provision of a heater unit for efficiently effecting heat transfer from a heat source to a fluid agent.

A further object of the invention is the provision of a heater unit incorporating a heat transferring structure capable of resisting distortion created therein by heat introduced thereinto.

A still further object of the invention is the provision of a heater unit particularly adapted for heating a fluid oil which in turn may be used for heating tar, asphalt and various bituminous products which must be heated to liquefaction to facilitate transfer thereof from one point to another.

A still further object of the invention is the provision of an oil heater incorporating novel radiator structure into which flame and products of combustion are introduced and presents an unusually wide radiating area to the fluid oil in the heater.

The fluid heater shown and described herein has been designed primarily for use in heating a fluid such as oil which is in turn pumped through coils in a container of tar, asphalt or bituminous material to convey the heat thereto for the liquefaction thereof. The heater units heretofore developed for this purpose have generally had serious faults in operation and relatively short lives in use. The introduction of flame, usually from an oil burner burning a hydrocarbon into the heater units heretofore known, resulted in a partial coking of the fluid oil to be heated on the surfaces of the radiating structures heretofore used, particularly in the portions of the radiator adjacent the section thereof into which the flame is introduced. The present invention contemplates a structure which minimizes this effect as the flames introduced into the heater unit have a relatively large area to expand into with the result that more uniform temperatures are obtained throughout the radiator portion of the heater unit.

Further difficulty heretofore encountered in fluid oil heaters has been the rupture of the radiator structure usually immersed in the oil to be heated and the subsequent inoperation of the device. The rupture usually occurs because of the inability of the structure to withstand the distortion in the radiator structure due to the expansion caused by the introduction of flame and the products of combustion thereinto. The present heater unit structure avoids this difficulty by providing a radiator section of a design and configuration which enables it to automatically compensate for such expansion and distortion as occurs without effecting the integral structure of the radiator section itself.

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With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed can be made within the scope of what is claimed without departing from the spirit of the invention.

The invention is illustrated in the accompanying drawing, wherein—

Figure 1 is a longitudinal section of the fluid heater with parts in elevation and parts broken away.

Figure 2 is a side elevation of the fluid heater with parts broken away.

Figure 3 is an end elevation of the fluid heater taken on line 3—3 of Figure 1.

By referring to the drawings and Figures 1 and 2 in particular, it will be seen that the fluid heater comprises a tank-like structure 10 having an inlet connection 11 on the lower front end 12 thereof and an outlet connection 13 on the upper surface thereof and near the back end 14 thereof. Positioned vertically within the tank-like structure 10 and forming a fluid-tight partition with respect to the interior thereof, there is a partition 15 which forms a smoke box 16 in conjunction with the back end 14. A cleanout door is provided opening into the smoke box 16 and is indicated by the numeral 17. An opening to permit the escape products of combustion introduced into the smoke box 16 is provided and is indicated by the numeral 18. A relatively short smoke stack 19 is positioned over the opening 18 and serves to direct the products of combustion upwardly and away from the heater unit. A damper 20 is positioned in the smoke stack 19.

At the opposite end of the heater unit and in the front end 12 thereof, there is a relatively large opening 21 which partially supports a tube 22 of refractory material by means of which flame and the products of combustion are introduced into the interior of the heater unit. A supporting stand 23 is positioned beneath the tube 22. An oil burner (not shown) or similar device is intended to be positioned with the flame delivery orifice thereof in registry with the passageway in the tube 22 of refractory material. Positioned within the tank 10 of the heater unit, there is a

radiatior structure, generally indicated by the numeral **24**, and consisting of a plurality of sections each comprising a pair of concave, partly-spherical, circular discs **25, 26**. Each of the discs **25, 26** is beveled at its periphery to form an annular flat face designated respectively **25a** and **26a** disposed at right angles to the longitudinal axis of the radiator structure, the pair of discs of each section being arranged in opposed relation with their concave sides facing each other, and with their peripheral flat faces **25a** and **26a** fitting against and welded to each other.

The chambers formed from each of the pairs of concave discs **25** and **26** are interconnected to one anotoher by welding and communicate with one another by reason of registering orifices **28** and **29**, the pairs of discs of each of the sections having at their outer sides inner flat annular marginal face portions designated respectively **25b** and **26b**, the inner flat marginal face portions **25b, 26b** of the discs of one section fitting against the inner flat marginal face portions of the discs of adjacent sections and joined thereto in a plane at right angles to the longitudinal axis of the radiator structure.

The radiator portion **24** of the heater unit thus consists of a plurality of bellows-like units integrally formed as by we'ding the pairs of concave discs **25** and **26** in opposed relation at their peripheries **27** and around the edges of the orifices **28** and **29** which are centrally located with respect to each of the disc sections **25** and **26**. The radiator structure **24** thus formed forms a bellows-like device which easily adjusts its over-all size and shape depending upon the degree of distortion in the element occasioned by expansion due to the heat introduced thereinto.

It will be obvious to those skilled in the art of radiator constructions that the novel radiator structure disclosed herein can be carried integrally through the device being fixed only at its extreme outermost ends and preferably supported as by a supporting member **30** positioned in the bottom of the tank **10** and upon which the bottom edges of the bellows-like sections of the radiator unit **24** rest. The formation of each of the bellows-like units of the radiator section **24** from the concave discs **25** and **26** enable the expansion occurring in the metal structure to cause slight distortion of the edge of the bellows-like units without adversely affecting or stressing the welded seams at the peripheries **27** of the elements or the seams about the orifices **28** and **29** of the elements, through which seams the assemblies are interconnected.

It will thus be seen that when flame or other products of combustion are introduced into the tube **22** of refractory material at the front end of the fluid heater, the flame and hot gases will be directed inwardly in axial alignment with the plurality of registering orifices **28** and **29**. The hot gases may also circulate through each of the hollow chambers formed by the opposed concave discs **25** and **26** thereby providing a uniform heating of the entire radiator unit and thus a uniform heating of the fluid oil circulating the unit and in the tank **10**. The hot gases, after having imparted a majority of their heat to the radiator unit **24**, pass into the smoke box **16** and upwardly out of the smoke stack **19**, the return of the flow of the gases being determined by the positioning of the damper **20** in the stack **19** and by the quantity of hot gases, flame and products of combustion introduced into the radiator through the tube **22** of refractory material.

In utilizing the fluid heater, the space between the tank **10** and the radiator structure **24** is filled completely with the circulating fluid to be heated which is usually a heat conducting oil, and a surge tank **31** is placed in communication with an orifice **32** in the upper portion of the tank **10**. A pressure gauge **33** is positioned on the heater unit and is in communication with the interior thereof and provides an indicator of the working pressure within the heating unit. A thermometer **34** is also placed on the upper surface of the heater unit and extends into the fluid oil in the heater unit to enable the temperature thereof to be readily determined.

By referring now to Figure 3 of the drawings in which a front end elevation of the fluid heater is shown, it will be seen that a secondary pressure gauge is positioned on the uppermost portion of the tank **10** and is connected with a pipe **36** which, in operation, leads to a point on the pipe line used in conjunction with the heater unit for circulating the hot oil therefrom through a tank of material to be heated. Thus, the operator of the unit has before him the working pressure of the heater unit as given on the gauge **33**, the working pressure of the heated material passing through the ultimate material to be heated and the temperature of the heated oil in the heater unit. These are useful in regulating the amount of heat introduced into the heater unit as by an oil burner (not shown) commonly employed.

In using the heater unit, the inlet **11** and the outlet **13** are connected by pipes or tubes to a coil located in the tank of the material to be heated such as, for example, a heating coil in a railway tank car. A circulating pump (not shown) is connected into the fluid circuit thus established and the heater unit is then fired by the introduction of flame and products of combustion into the radiator **24** thereof with the result that the fluid oil therein is heated readily and efficiently. The heated oil is then pumped out of the pipe **13** and through the coil in the tank of the tar, asphalt or bituminous material to be heated, and returned to the inlet **11** of the heater unit. In actual operation, the device is found to be very efficient and it will be obvious that its compact construction makes it possible to mount it on a truck or trailer chassis, its portability thereby enabling it to be moved when desired.

It will thus be seen that an efficient fluid heater has been disclosed which will effectively and efficiently heat a fluid medium, such as a hydrocarbon, rapidly and economically and which fluid e'ement may then be circulated through various materials to be heated, thereby achieving the several objects of the invention.

Having thus described my invention, what I claim is:

1. In a fluid heater, a radiator structure of bellows-like construction consisting of a plurality of sections each comprising a pair of separately formed concave partly-spherical circular discs, each disc having an opening centrally therethrough and being beveled at its periphery to form an annular flat face disposed at right angles to the longitudinal axis of the radiator structure, the pair of discs of each section being arranged in opposed relation with their concave sides facing each other and with their peripheral flat faces fitting against and joined to each other, and the discs of each section having at their convex outer sides, inner marginal, substantially flat face portions, the inner marginal substantially flat face portions of one section fitting against the inner

marginal substantially flat face portions of adjacent sections and joined thereto in planes at right angles to the longitudinal axis of the radiator structure.

2. A fluid heater comprising a tank-like structure having a radiator unit positioned therein and establishing an axially extending passageway into which flame and products of combustion may be introduced, the chamber within the tank-like structure about the radiator unit containing a fluid to be heated and the radiator unit being of bellows-like construction consisting of a plurality of sections each comprising a pair of separately formed concave, partly-spherical circular discs, each disc having an opening centrally therethrough and being beveled at its periphery to form an annular flat face disposed at right angles to the longitudinal axis of the radiator structure, the pair of discs of each section being arranged in opposed relation with their concave sides facing each other and with their peripheral flat faces fitting against and joined to each other, and the discs of each section having at their con-

vex outer sides, inner marginal, substantially flat face portions fitting against the inner marginal substantially flat face portions of adjacent sections and joined thereto in planes at right angles to the longitudinal axis of the radiator structure.

WILLIAM J. MILLER.

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