Dec. 20, 1966 M. A. ZIMMERMAN 3,292,599

MULTICHAMBERED FIRED HEATER AND TUBE WALL CONSTRUCTION

Filed Dec. 14, 1964

Fig. 2

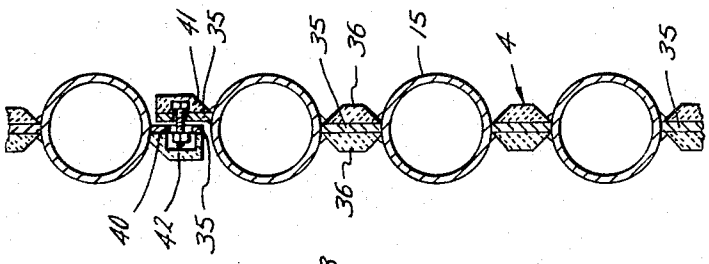
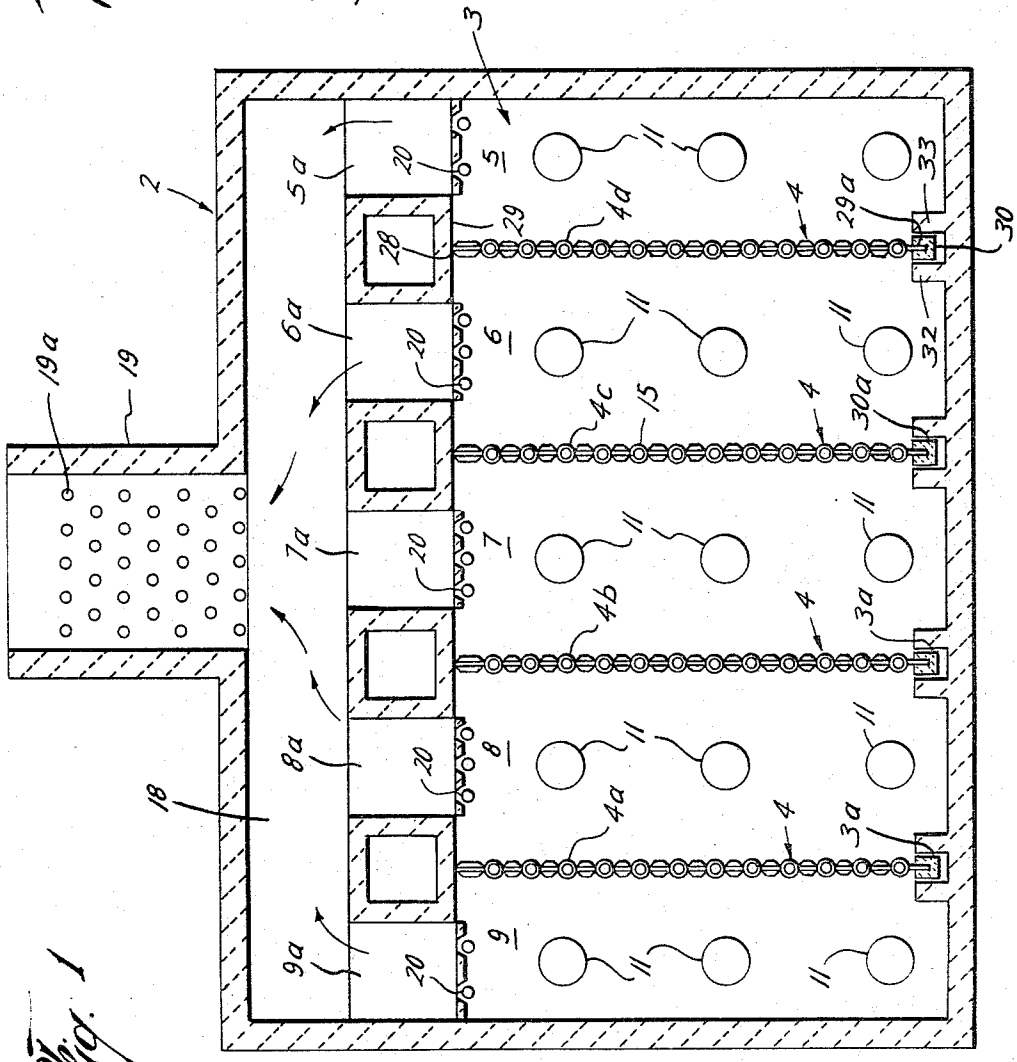


Fig. 1



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United States Patent Office 3,292,599
Patented Dec. 20, 1966

3,292,599

MULTICHAMBERED FIRED HEATER AND TUBE WALL CONSTRUCTION

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Filed Dec. 14, 1964, Ser. No. 418,225
4 Claims. (Cl. 122—510)

The present invention relates to a multichambered fired heater and to a tube wall construction therefor.

Various forms of fluid heaters have been heretofore proposed, such by way of example that as shown in United States Patent No. 2,396,200. The present invention may be considered an improvement of the tube arrangement and tube wall construction for heaters such as that illustrated in Letters Patent 2,396,200 as will be more fully described hereinafter.

In the heating of fluids such as hydrocarbon oils and the like, it is desirable to accomplish the heating of the fluids in a manner to avoid undesirable effects thereon. To accomplish this, it is desirable that the heating of the fluids be substantially uniform and not occur in local areas on the tubes through which the fluid is conducted which localized heating causes "hot spots" which may cause deleterious effects on the fluid being heated.

Also, it is desirable to accomplish heating of the fluids while simultaneously avoiding flame impingement upon the tubes through which the fluid is flowing to reduce the possibility of forming "hot spots," and to conduct the combustion or heating gases adjacent the tubes and through the heater in a manner to efficiently and properly accomplish the heating of the fluids.

An object of the present invention is to provide a multichambered fired heater in which several streams of fluid may be heated under controlled temperature conditions simultaneously and to heat the tubes from both sides in a manner to produce a very uniform heat transfer rate of greater intensity than that commonly allowable when the tubes are heated from one side only or from both sides. Such construction provides superior heating characteristics and at the same time permits a substantial savings in costs through the reduction in the number of tubes and the saving in heater construction costs.

Another object is to form a multichambered fired heater with rows of tubes which inhibit the passage of heating gases through the rows of tubes and thereby reduces the possibility of flame impingement directly on the tubes.

Another object of the present invention is to provide a construction and arrangement of tubes in a heater to form a wall and thereby divide the heater into multichambers with burners therein to heat each side of the tubes uniformly.

Still another object of the invention is a tube wall construction to divide a heater into a number of chambers, each chamber having a plurality of burners therein for heating the tubes, and the tubes being connected together to inhibit combustion gases passing between the tubes and thereby avoid flame impingement upon the tubes.

Another object of the present invention is to connect a plurality of tubes together to form a dividing wall in a fired heater in a manner to heat the tubes to produce a uniform heat transfer rate.

Other objects and advantages of the present invention will become more readily apparent from consideration of the following description and drawings wherein:

FIG. 1 is a schematic representation of a heater embodying the present invention; and

FIG. 2 is an enlarged sectional view showing one form of the tube wall of the present invention.

Attention is first directed to FIG. 1 of the drawings wherein a structure is referred to generally by the numeral 2. The structure 2 forms a suitable enclosure to accomplish the purposes of the present invention, such structure being formed of suitable refractory material such as fire brick or the like. The construction of the structure 2 is not critical to the present invention and any suitable well-known and standard practice of forming the structure 2 may be employed.

The structure 2, by reason of its closed end, bottom, top, and side walls, as will be described in greater detail, forms a space referred to generally by the numeral 3. It will be noted that a plurality of spaced rows of tubes illustrated at 4 are provided in the space 3 to divide the space 3 into separate chambers 5, 6, 7, 8 and 9. Of course, the tubes in each row are joined at their ends to form a continuous fluid conducting path in that row.

Burners 11 are mounted in each of the chambers 5, 6, 7, 8, and 9 as illustrated for heating the spaced rows 4 of tubes on each side thereof.

It can be appreciated that the rows of tubes 4 are formed by tubes 15 which are connected together, as will be described in greater detail hereinafter, to form continuous divider walls between the chambers 5, 6, 7, 8, and 9, and the tubes 15 also serve to conduct fluid therethrough which fluid is heated by the burners 11 in the various chambers. Flues 5*a*, 6*a*, 7*a*, 8*a* and 9*a* are formed in the structure 2 which communicate with the chambers 5, 6, 7, 8 and 9, respectively, at their upper ends and also communicate with the common discharge 18 which is connected to the stack 19 for discharge of the combustion gases from the structure 2.

If desired, fluid conducting tubes may also be provided as illustrated at 20 adjacent the flues 5*a*, 6*a*, 7*a*, 8*a* and 9*a* so that as the combustion gases from the burners 3 are conducted to the flues 5*a*, 6*a*, 7*a*, 8*a* and 9*a*, heating of the tubes 20 and the fluid flowing therethrough may be effected.

A convection tube section 19*a* is arranged below the stack 19 as illustrated in the drawings, FIG. 1 for heating of fluid therein by the stack gases. It can be appreciated that the convection tube section 19*a*, tubes 20 as well as the tubes 15 are mounted in the structure 2 so that fluid is conducted therethrough in a well-known manner for heating thereof. If desired, the convection section 19*a*, the tubes 20 and the tubes 15 may be connected in series, so that the fluid is first pre-heated in convection section 19*a* and tubes 20 and then conducted to tubes 15 for final heat. In some instances, convection section 19*a* may serve as a preheater for a fluid stream which is then conducted to tubes 20 for final heat. The spaced rows of tubes 4 may be also connected to receive and heat separate fluid streams. For example tube row 4*a* may be connected to receive one fluid stream, tube rows 4*b* and 4*c* may be connected in series to receive a second fluid stream, and tube row 4*d* may be connected to still a third fluid stream for heating thereof. In this event, the burners 11 in chambers 8 and 9 will be provided with suitable controls by means well known in the art to maintain the desired temperature in chambers 8 and 9 so as to heat the fluid in tube row 4*a* to the desired temperature. Similarly, the burners in chambers 5 and 6 heat tube wall 4*d* and the burners in chambers 6, 7 and 8 heat tube walls 4*b* and 4*c*.

Of course, any suitable number of chambers and tube rows may be provided, depending upon the size of the heater.

The structure 2 includes end and side walls and a bottom and top of any suitable construction well known. The combustion or heating draft gases are generated by the burners 11 and then flow through the chambers to accomplish their heating function and are then discharged out the upper end of each chamber and into common discharge 18 to be discharged from the structure through

stack **19**. As shown, the tube walls are formed by horizontal tubes which are vertically aligned, but they may extend vertically and be aligned horizontally if desired as will be described shortly.

The spaced rows **4** of tubes **15** may be supported at their upper end **28** in any suitable manner such as by bolting or the like to the structure **2** at **29**. They are then permitted to hang downwardly and a receptacle **30** formed by the guide walls **32** and **33** receives an extension **30***a* formed on the lower end of the rows **4** so that the spaced rows **11** upon heating may extend downwardly towards the receptacle **30**.

A form of the tube wall is shown in FIG. 2 of the drawings and is shown as including tubes **15** which are provided with fins **35** formed on each side thereof and connected therewith. The fins **35** connect adjacent tubes **15** together thereby forming a continuous wall to inhibit the passage of heating gases from burners **11**. The fins **35** are provided with suitable refractory material **36** on their surfaces between the tubes **15** as shown in FIG. 2 of the drawings to inhibit overheating of the tubes **15** at the point where the fins **35** are connected with the tubes.

It can be appreciated that the construction as well as the arrangement of the tube wall **4** in the heater **2** substantially prevents communication or passage of heating gases from one chamber to the next in the structure such as described with regard to FIG. 1 of the drawings. Thus, the combustion or heating gases from the burners **11** are communicated upwardly in the chamber rather than around the tubes and the flow of heating gases effected by the construction of the tube wall **4**, as well as its arrangement in the structure **2** in relation to the flue of each respective chamber and the stack **19** tends to more evenly and properly distribute the draft gases adjacent the tubes **15** and thereby uniformly heat the tubes at a greater intensity than heretofore possible. Also, the continuous tube wall **4** substantially, if not completely, eliminates passage of the heating gases between the tubes **15** in the tube wall from one chamber to the next and thereby prevents the flame from the burner **11** from coming into direct contact with the tubes **15**. By preventing flame impingement upon tubes **15**, improper heating and overheating of the tubes **15** is inhibited and a more even heat distribution is attained.

In effect, the tube walls **4** form a radiant heating surface for a process heater which is impervious to the flow of heating gases from one chamber to the next.

Under some circumstances, it may be desirable to provide an expansion joint which is formed in the divider wall **14** formed by the tubes **15** and their interconnecting fins **35**, and this may be accomplished by forming a slot **40** in one or more of the fins **35** and securing a pin **41** in an adjacent overlapping fin. An enlarged end **42** may

be formed on the pin **41** after it has been positioned in the slot **40** and the refractory material then formed to accommodate free longitudinal movement of the pin **41** relative to the slot **40**, it being noted that the diameter of the pin **41** is less than the length of the slot **40** to accomodate relative movement therebetween. Upon expansion or extension of the wall **4** by reason of heating, the overlapping fins **35** may move relative to each other and thereby accommodate extension of the tube wall **4** without rupturing or deforming the wall **4**. The tube wall **4** is constructed so that the axes of the tubes **15** are substantially in alignment, or substantially in a common plane.

Broadly, the present invention relates to a multichambered fired heater and to a tube wall construction therefor.

What is claimed is:

1. A tube wall partition for a multichambered fired heater comprising:

(a) a plurality of hollow tubes having their axes lying substantially in a common plane;

(b) unitary metallic fins extending outwardly from said tubes;

(c) means interconnecting adjacent tubes together by said fins to form a substantially vertical wall;

(d) refractory material secured on each side of said fins between said tubes to inhibit overheating of said tubes where joined with said fins;

(e) means for supporting the uppermost tube from inside of the heater;

(f) said fins between said tubes supporting and suspending said tubes below the uppermost tube.

2. The structure as set forth in claim **1** including an expansion joint formed by said fins to accommodate longitudinal expansion of the tube wall.

3. The structure as set forth in claim **2** wherein said expansion joint is formed by providing slot means in one of said fins, and pin means connected with an adjacent overlapping fin, said pin means fitting in said slot means and having a diameter less than the length of said slot to accommodate longitudinal movement of said tube wall.

4. The structure as set forth in claim **1** including means with the lowermost tube and the heater to serve as a guide for the downward expansion of said tubes.

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