Oct. 22, 1968 R. M. BRECKENRIDGE 3,406,804

TUBE HEATER WITH QUENCH

Filed Nov. 16, 1966

FIG. 1

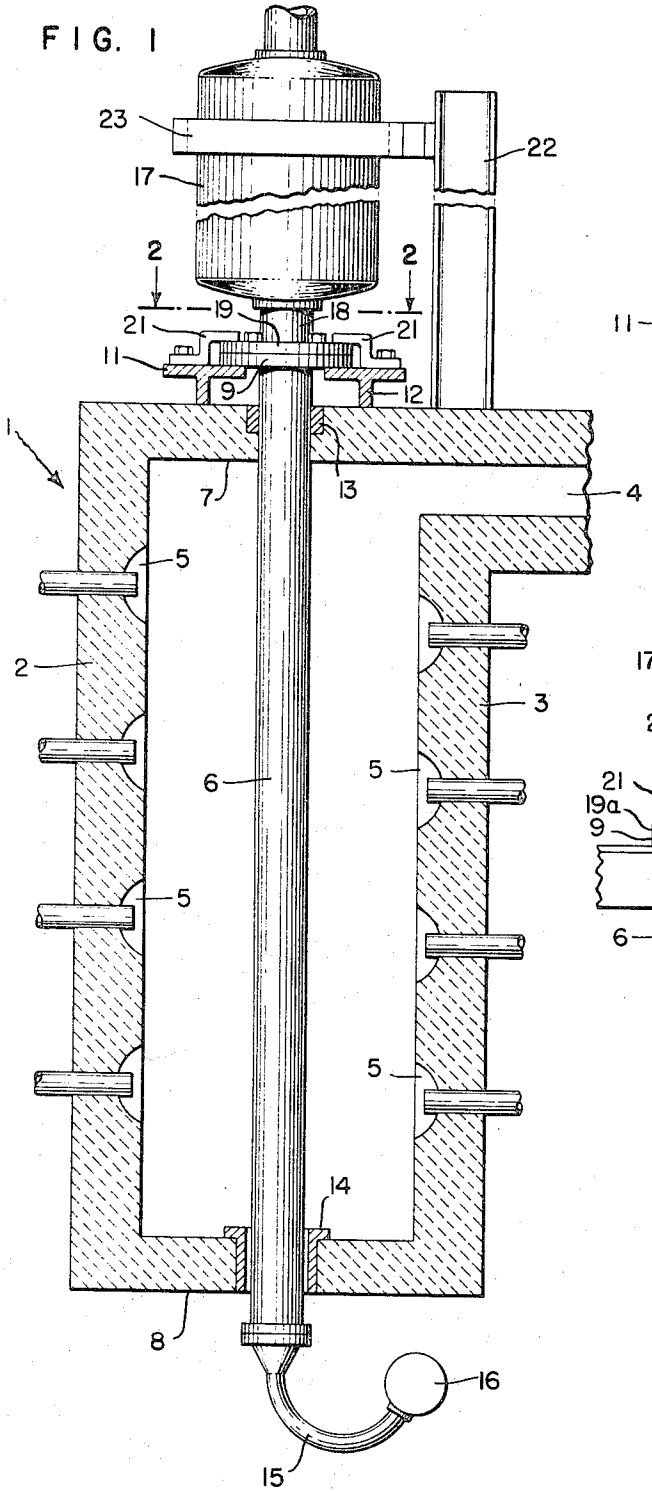


FIG. 2

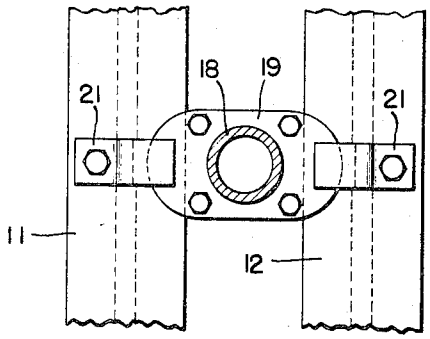
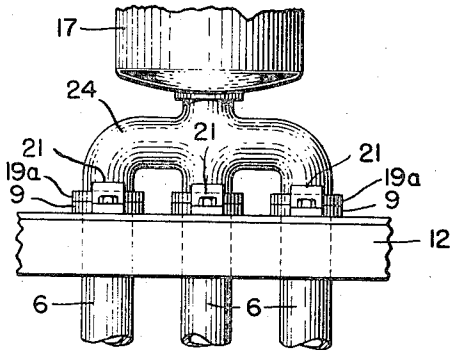


FIG. 3



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TUBE HEATER WITH QUENCH

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ABSTRACT OF THE DISCLOSURE

A hydrocarbon pyrolysis furnace in which the upper end of a tube or tubes is rigidly and directly attached to a quench for the heated fluid which, in turn, is rigidly mounted on the upper part of the furnace.

The present invention relates to heaters for use in the pyrolysis of hydrocarbons, and more particularly to a means for mounting the heating tubes and their associated quenches on the heater to reduce thermal expansion strains on the various parts as the heater is operated.

In heaters of the present type, the tubes through which the material being heated flows may be forty feet in length. The tubes will expand several inches in length between cold and working temperature and means must be provided to permit this expansion to take place. At times the material being heated in one or more adjacent pipes is discharged directly into a quench. This quench also varies in size as its temperature changes under operating conditions. Many suggestions have been made of ways to overcome the effects of expansion of thsee parts, all of which are relatively complicated.

It is an object of the invention to provide a simple and inexpensive means for mounting tubes and quench with respect to a tube heating furnace so that expansion of these parts can take place with no effect on other parts of the equipment.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages and specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

In the drawings:

FIG. 1 is a section through a furnace showing a mounting for a tube and quench;

FIG. 2 is a view taken on line 2—2 of FIG. 1, and

FIG. 3 is a view from the right of FIG. 1 showing a modified form of the invention.

Referring to FIG. 1, there is shown a tube heating furnace of the type disclosed more in detail in Fleischer Patent 3,062,197. A furnace of this type includes structure forming a furnace chamber having opposed parallel walls **2** and **3**, the upper portion of one of the walls being provided with an exhaust opening **4**. The furnace is heated by a plurality of rows of burners **5**. These burners are placed in vertically displaced horizontal rows in the side walls of the furnace facing toward the center thereof. Extending through the chamber and between these burners is a row of vertically extending reactor tubes **6**, one of which is shown in the drawing. The upper end of this tube extends through the roof **7** while the lower end extends through the floor **8**. The tube is supported with its upper end in a fixed position by means of a flange **9** projecting radially therefrom. The flange rests on a pair of structural beams **11** and **12** that can be part of the furnace supporting structure or can be separate, rigidly mounted beams. It is noted that the portion of tube **6** extending through roof **7** has a snug fit in the opening

provided in the roof with packing **13** extending around the tube in order to obtain a substantially gas-proof seal between the two so that products of combustion cannot escape at this point. The lower end of tube **6** extends through a sleeve **14** that is received in an opening of floor **8**. This sleeve is slightly larger in diameter than the tube so that the tube can slide freely in the sleeve as it expands and contracts due to temperature changes. The sleeve should be close enough in size to the diameter of the tube, however, so that there is as little leakage as possible of air into the furnace chamber. The lower end of the tube is connected through separable flanges to a flexible connection **15** and by this connection to a supply manifold **16** through which fluid to be heated is supplied to the tube.

In carrying out a process of hydrocarbon pyrolysis, it is required for some types of pyrolysis that the heated fluid be quenched immediately after it has passed through the furnace. To this end there is provided a quench **17** having an inlet **18** located immediately above the upper end of the tube **6**. The inlet is provided with a radially extending flange **19** corresponding in size to flange **9** and resting thereon. The two flanges are bolted together with suitable gaskets so that the heated fluid will pass directly from the tube to the quench and from there to a point of use through a suitable flexible connection. The lower end of the quench and the upper end of the tube are held rigidly in position above the furnace chamber and adjacent thereto by means of clamps **21** which engage the top of flange **19** and are bolted rigidly to the supporting beams **11** and **12**. Since the quench may be several feet in height and since it also varies in temperature, the quench will expand and contract during operation of the system. For this reason it may be desirable to guide the upper end of the quench in its movements. Therefore, there is provided an upwardly extending support **22** which can form a part of the furnace reinforcing structure. A ring **23** loosely surrounding the quench is bolted to support **22** thereby serving as a guide for the quench as it changes in length. A suitable flexible connection is attached to the upper end of the quench through which the product is discharged.

From the above it will be seen that the tube and the quench are both rigidly supported at one end and at a location immediately adjacent to the point where the heated fluid leaves the furnace chamber. As tube **6** expands and contracts, its lower end will move freely in an opening in the floor of the furnace and this expansion is taken up by flexible connection **15** extending between the lower and coolest end of the tube and the supply pipe. In like manner, as the quench expands and contracts due to temperature changes encountered in the operation of the system, the lower end of the quench will be held rigid and the upper and cooler end can expand freely while it is guided by the ring **23**. Thus the vital connection between the quench and the tube is held rigidly togther while the relatively cold ends of these are free to expand and contract. This is particularly advantageous when the flexible connection **15** is at the colder end of the tube since it can be much more easily fabricated if it is not required to withstand high temperatures.

The embodiment disclosed above contemplates the use of a separate, relatively small quench in connection with each tube **6**. In some places this may not be practical because of costs. In such case it will be necessary to connect several tubes to a single quench. A construction of the type is shown in FIG. 3 of the drawing wherein the inlet **24** of quench **17** is shown as having three branches each of which is provided with a flange **19***a* cooperating with the flange on the upper end of a tube. The quench inlets and the tubes are held together and are held in position by clamps **21** in the manner described in connection with the embodiment of FIGS. 1 and 2. It will be

obvious that any number of inlets may be provided for a single quench. The main precaution to be taken when a plurality of tubes are connected to a single quench is to prevent the distance between the upper end of the tube and the bottom of the quench itself from varying too much between several tubes.

An additional advantage of both embodiments is the ease with which the quench and tubes can be decoked. It is only necessary to brake the flanged connection between the lower end of the tube and flexible connection **15**. The quench and tube can be simultaneously back-flushed without disturbing the connection between them, and the removed material will be collected in a sump beneath the tube.

While in accordance with the provisions of the Statutes I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit and scope of the invention set forth in the appended claims, and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

What is claimed is:

1. In combination, structure for the pyrolysis of hydrocarbons forming a heater having a vertically extending chamber enclosed by a pair of opposed side walls, a roof and a floor, and a plurality of vertically displaced rows of burners in said side walls, a vertical tube in said chamber between said rows of burners through which fluid to be heated passes, the ends of said tube extending, respectively, through said roof and floor, a quench for the heated fluid having an inlet extending from the lower portion thereof, means to fasten the upper end of said tube to the inlet of said quench and to mount said quench and the upper end of said tube in a fixed position above said roof and adjacent thereto, a supply pipe for fluid to be heated located below said floor, and a flexible connection between said supply pipe and the lower end of said tube.

2. The combination of claim **1** in which means is provided to close the space between said tube and roof where the tube passes through said roof, and means in said floor loosely encircling said tube where said tube passes through said floor whereby as said tube expands its lower end will move with respect to said floor.

3. The combination of claim **1** in which there are a plurality of parallel tubes extending through said chamber and said quench has a plurality of inlets, said means to fasten fastening the upper end of each tube to an inlet.

4. The combination of claim **1** in which the portion of said quench above said inlet is free to expand and contract, and means to guide said portion of said quench.

5. In combination, structure for the pyrolysis of hydrocarbons forming a heater having a vertically extending chamber enclosed by a pair of opposed side walls, a roof and a floor, a plurality of vertically displaced rows of burners in said side walls, a vertical tube in said chamber between said rows of burners and through which fluid to be heated passes, said tube having an inlet end and an outlet end one of which projects out of said chamber, a quench for the heated fluid having an inlet and an outlet extending therefrom, means to fasten the outlet end of said tube rigidly to the inlet of said quench and to mount said outlet end of said tube and the inlet to said quench in a fixed position adjacent to the location where said outlet end of said tube projects from said chamber, a supply pipe for the fluid to be heated, and means to connect said supply pipe to the inlet end of said tube.

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