

Nov. 6, 1962

H. W. FLEISCHER

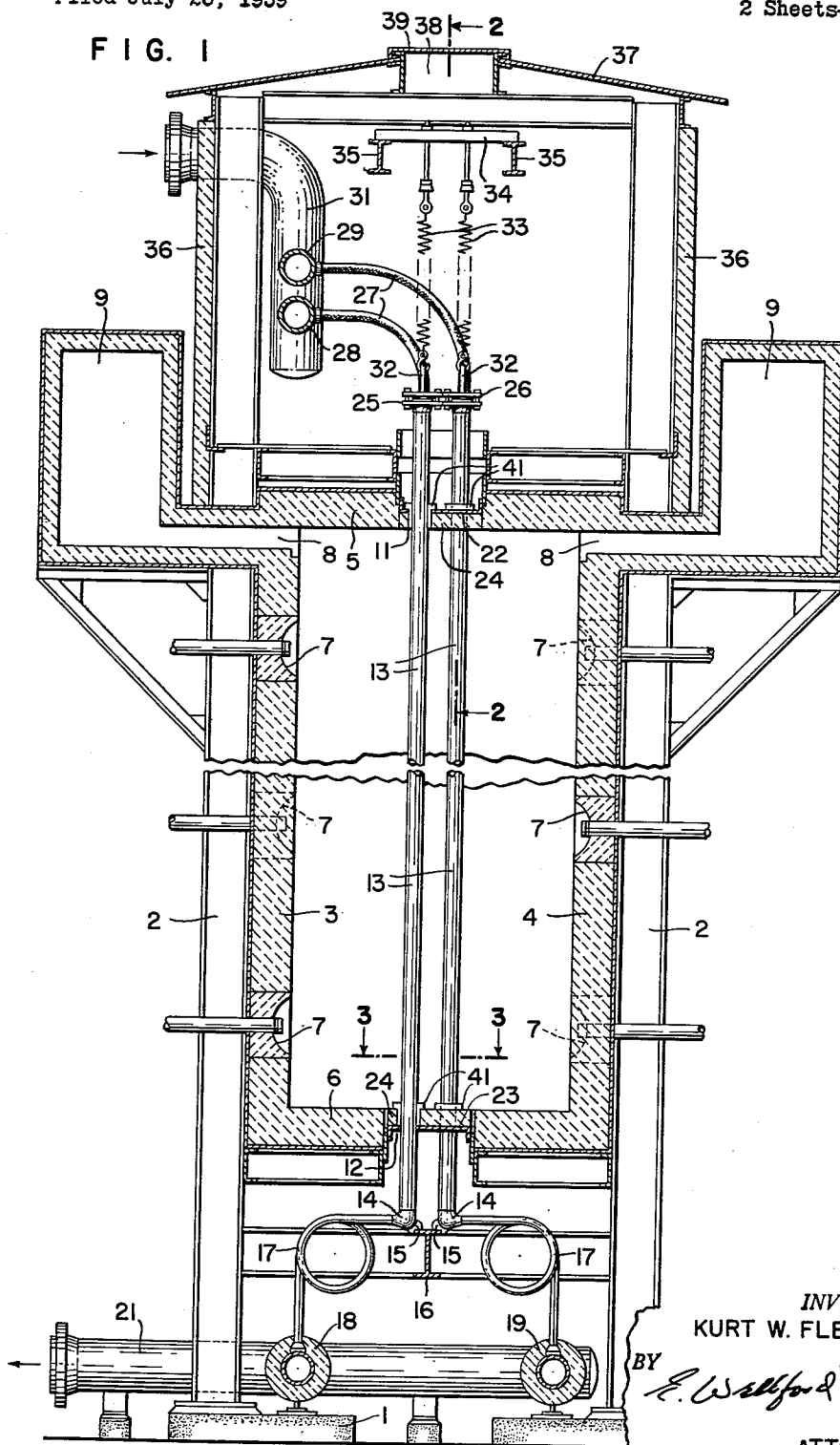
3,062,197

TUBE HEATER

Filed July 23, 1959

2 Sheets-Sheet 1

FIG. 1



INVENTOR.
KURT W. FLEISCHER

BY *E. W. Mason*

ATTORNEY.

Nov. 6, 1962

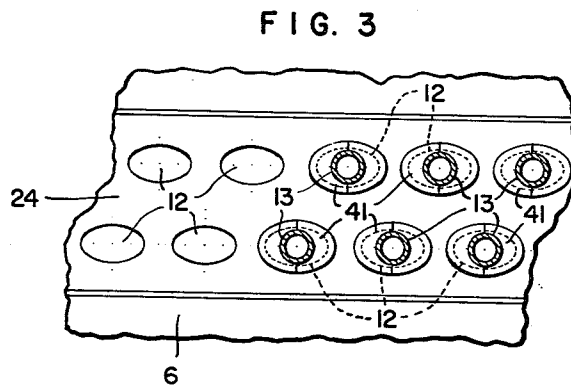
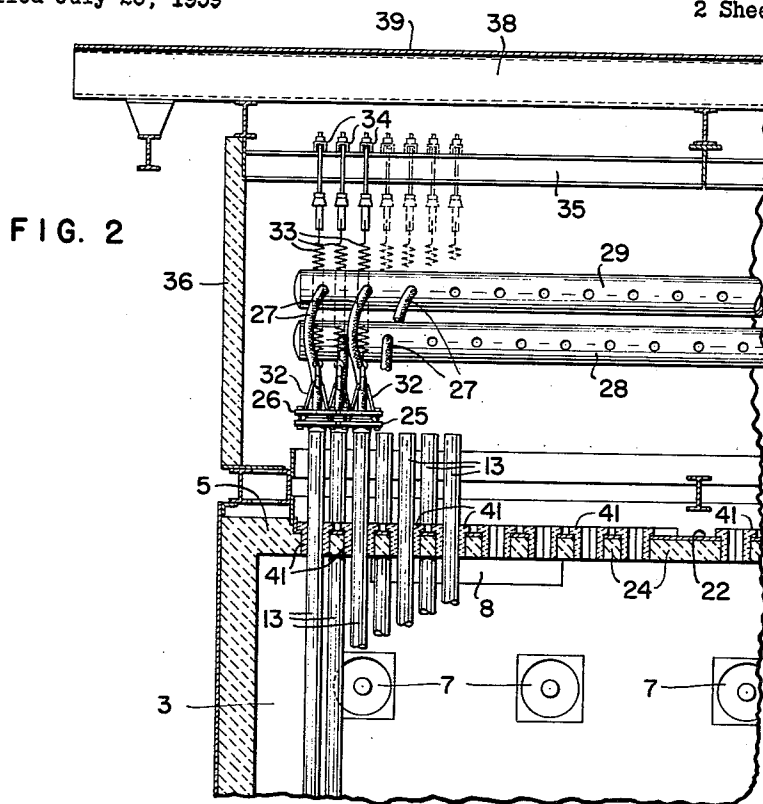
H. W. FLEISCHER

3,062,197

TUBE HEATER

Filed July 23, 1959

2 Sheets-Sheet 2



1

3,062,197

TUBE HEATER

Kurt W. Fleischer, Philadelphia, Pa., assignor to Selas Corporation of America, Dresher, Pa., a corporation of Pennsylvania

Filed July 23, 1959, Ser. No. 829,093

2 Claims. (Cl. 122—510)

The present invention relates to fluid heaters, and more particularly to a tube heater of the type in which the tubes extend vertically, and its construction.

In heaters of the type with which this invention is concerned it has always been a problem to support the tubes so that they will not warp or bend as a result of the thermal expansion produced as they are heated. It has also been a problem to mount the tubes in the furnace so that they can readily be removed for cleaning and repair when this is necessary.

It is an object of the invention to provide a fluid heater that overcomes the above mentioned problems. It is a further object of the invention to provide a fluid heater in which the tubes through which the fluid flows can be heated substantially uniformly from end to end. It is also an object of the invention to provide a fluid heater in which the tubes are at all times partially supported by resilient means such as a spring.

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 view through the furnace,

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

FIG. 3 is a view taken on line 3—3 of FIG. 1.

The furnace comprises structure forming a tall, narrow furnace chamber. This structure rests on foundations 1 and includes buckstays 2 that extend upwardly from the foundation. The furnace itself has a cross section as shown in the drawing, and includes side walls 3 and 4, ends, a top 5 and a floor 6. The side walls, ends, top and floor may be made in accordance with ordinary furnace construction including a sheet metal backing plate that is lined with suitable insulating and refractory material. Each of the side walls is provided with a plurality of vertical rows of burners 7 which may be of the type shown in Patent No. 2,671,507 issued to C. W. Morck. The view shown in FIG. 1 indicates that the furnace chamber is relatively narrow and that it is vertically elongated. The furnace may be of any desired length, in a direction perpendicular to the plane of the drawing, that is needed for the number of tubes required for a given installation. At spaced points along the upper ends of each of the side walls there are provided horizontally extending exhaust vents 8 that communicate with ducts 9, which in turn exhaust into a stack, not shown.

The top of the furnace and the bottom of the furnace are provided along their center with a staggered row of openings 11 and 12, respectively, through which tubes 13 extend to form a pair of parallel rows of tubes in staggered relation. The ends of these tubes project above the top and below the bottom of the furnace. The lower end of each tube has fastened to it, as by welding, an elbow 14 that has an abutment 15 projecting from the side opposite to the opening of the elbow. These abutments rest on a beam 16 that runs the length of the furnace chamber. Thus it will be seen that the weight of each of the tubes is supported on the beam 16 leav-

2

ing the upper ends of the tubes free to expand and contract as necessary due to the heat applied to the tubes by the burners.

The lower end of each of the left row of tubes is connected by a flexible tube 17 having a loop in it to an insulated manifold 18. The lower end of the right hand tubes are connected by a similar flexible tube 17 to an insulated manifold 19 extending the length of the furnace. The manifolds 18 and 19 are in turn connected to an outlet header 21.

The openings 11 and 12 in the top and bottom of the furnace respectively, are formed in a pair of metal plates 22 and 23 respectively, which extend the length of the furnace midway between the side walls. Each of these plates is protected on the furnace side by a slab of insulation 24 that has openings in it corresponding to the openings in the respective plates that they protect. It is noted that the space above plate 22 may be filled with a fibrous or granular insulating material if it is desired. In like manner the space below plate 23 may also be packed with a fibrous insulated material, preferably at least to the thickness of the floor of the furnace.

The upper end of each tube has a flange 25 welded to it, which flange is connected by bolts to a cap 26 closing the upper end of the tube. Fluid to be heated in the tube is introduced through a flexible tube 27, one end of which extends through and is fastened to the cap, and the other end of which communicates with a header 28 or 29, depending upon the row of tubes. These headers are connected to a supply header 31 that can be connected to any desirable source of fluid supply.

Due to the fact that the tubes extend in a vertical direction they will have a tendency to bow or sag as they are heated. In order to overcome this tendency, there is provided a means that is capable of supporting a portion of the weight of each tube and continually urge this weight in a vertically upward direction in order to insure that the tubes will remain straight as they expand and contract while being heated. To this end each of the caps 26 is provided with bail 32 to which the lower end of a spring 33 is fastened. The upper end of each spring is adjustably attached to a cross piece 34 whose ends rest on a pair of horizontally extending beams 35. If the tube, for example, weighs 1,000 pounds the spring would be tensioned so that it would exert an upward force of approximately 500 pounds, or approximately half the weight of the tube through a distance equal to the maximum tube expansion. Thus while the tube is supported by the abutment 15 on beams 16, a portion of its weight is supported by the spring 33. The force exerted by the spring 33 is substantially uniform and is sufficient to insure that the tubes will remain straight at all times as they are being heated and cooled.

The spring hangers and manifolds 28 and 29 are protected by means of a housing built above the top of the furnace. This housing includes side members 36 that are attached to buckstays 2, and a roof 37. The roof is provided with an opening 38 that extends the length of the furnace in a direction perpendicular to the plane of the drawing with the opening covered by a removable cover 39.

From time to time it may be desirable or necessary to remove one or more of the tubes for cleaning or replacement. This may easily be accomplished with the construction shown herein. To this end the openings 11 and 12 are made elliptical or oval in shape and slightly larger than the diameter of the tubes. When a tube 13 is to be removed the flexible tube 17 is cut or disconnected from the horizontal end of elbow 14 and cap 26 is disconnected from flange 25. When this is done the cross piece 34 and the spring carried thereby can be removed

from a position directly above the tube. Thereafter the tube is rotated through 90° so that the projecting end of elbow 14 and the abutment 15 are aligned with the long axis of openings 11 and 12. The tube can then be moved vertically from the furnace through opening 38 in the roof. With the construction shown herein the tubes can be removed individually even while the furnace is hot. It is noted that the space between the openings 11 and 12, and the tubes is closed by means of a split sleeve 41 of a refractory material. This sleeve, as shown in FIG. 3, is made so that its outer dimension will be received by the opening 12, for example, and its inner dimension will receive the tube. The sleeve is split so that parts thereof can be placed around the tube and dropped into the opening. A flange provided on the upper end of the sleeve parts will rest on plate 22 or insulation 23, as the case may be, to prevent the tubes from wobbling in the respective openings, and to close these openings to prevent a flow of air or furnace gases through them.

In the operation of a tube heater of this type the furnace is first constructed and the tubes are placed in it one by one by lowering them through opening 38 of the roof, openings 11 and 12, and then rotating them until the abutment 15 rests on beam 16. The elbows 14 are then connected to the flexible tube 17 and caps 26 bolted to flanges 25. Thereafter cross pieces 34 are placed in position and springs attached to the cross pieces and balls 32. Fluid can then be introduced through header 31 to be distributed by the manifolds through the various tubes. As the fluid is heated it is collected by manifolds 18 and 19 to be discharged through header 21. The burners are of the type that can be adjusted so that the tubes are heated from opposite sides and evenly from end to end thus giving a constant temperature to the fluid flowing through the tubes from the time it enters until the time it leaves the furnace chamber. If desired, however, one or more of the burners at the upper or lower portion of the furnace chamber can be turned off so that the tube is heated to a higher temperature at its upper end than at its lower end, for example, depending upon the type of heat cycle which is required for the fluid that is being heated.

While the furnace is particularly designed for individual tubes, it will be apparent that suitable return bends could be attached to the upper and lower ends of adjacent tubes to form a continuous, elongated path of fluid flow. In such a case the lower return bends would rest on beam 16, and the upper return bends would be attached to springs 33.

From the above description it will be seen that I have provided a tube furnace for heating fluids in which provision is made to take up thermal expansion of the tubes and simultaneously to insure that the tubes will remain straight regardless of the heating that is taking place. There is also provided by this construction a means whereby the tubes may easily be inserted and removed from the furnace even while the furnace is in operation. The arrangement includes means to insure that the tubes will be held rigid in their supports, but will nevertheless permit axial expansion thereof.

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 a tube heater, structure forming a vertically elongated furnace chamber having a top, a floor and oppositely disposed side and end walls, a plurality of vertically and horizontally displaced burners in said opposite side walls, said burners radiating heat toward the center of the furnace chamber, a plurality of vertically extending tubes through which fluid to be treated flows forming a row with each tube substantially midway between said side walls and adapted to be heated on opposite sides by said burners, each burner heating predominantly that portion of the tube in front of it, the ends of said tubes projecting through said top and floor, means in said top and floor to hold each tube individually in a vertical position in said chamber, means outside of said furnace separately to support one end of each tube in a fixed position, a first manifold, a flexible connection between said one end of each tube and said first manifold, means outside of said furnace to apply an axially directed force to the opposite end of each tube sufficient to maintain the tube substantially straight as it changes in length due to thermal expansion, said holding means permitting said opposite end of each tube to move axially therein, a second manifold, and a flexible connection extending between said opposite end of each tube and said second manifold.

2. In a tube heater, structure forming narrow furnace chamber having a top, floor and parallel side and end walls, each of said top and floor having a row of aligned openings extending lengthwise of the chamber substantially midway between said side walls, a plurality of rows of burners in each of said side walls, a plurality of uncovered tubes through which fluid to be treated flows, each tube extending through a pair of aligned openings in said top and floor, means in said openings individually to hold said tubes in vertical position, means to support separately one end of each tube in a fixed position, first manifold, an individual flexible connection extending between the supported end of each tube and said first manifold, means to apply to each tube at its other end an axially applied force sufficient to maintain said tube substantially straight as it expands and contracts due to heating, a second manifold, a flexible connection between said other end of each tube and said second manifold, said tubes forming a row extending along said furnace chamber between said rows of burners, each tube adapted to be directly heated by the burners adjacent thereto in opposite sides of the furnace, and means to circulate fluid through said tubes from one manifold to the other.

References Cited in the file of this patent

UNITED STATES PATENTS

1,786,909	Jackson et al.	Dec. 30, 1930
1,989,612	Florez	Jan. 29, 1935
2,043,456	Watrons	June 9, 1936
2,173,984	Shapleigh	Sept. 26, 1939
2,267,864	Hosbein	Dec. 30, 1941
2,292,354	Artsay	Aug. 11, 1942
2,615,362	Churchman	Oct. 28, 1952
2,716,968	Hess et al.	Sept. 6, 1955
2,788,266	Stirnmann	Apr. 9, 1957
2,849,991	Kallam	Sept. 2, 1958