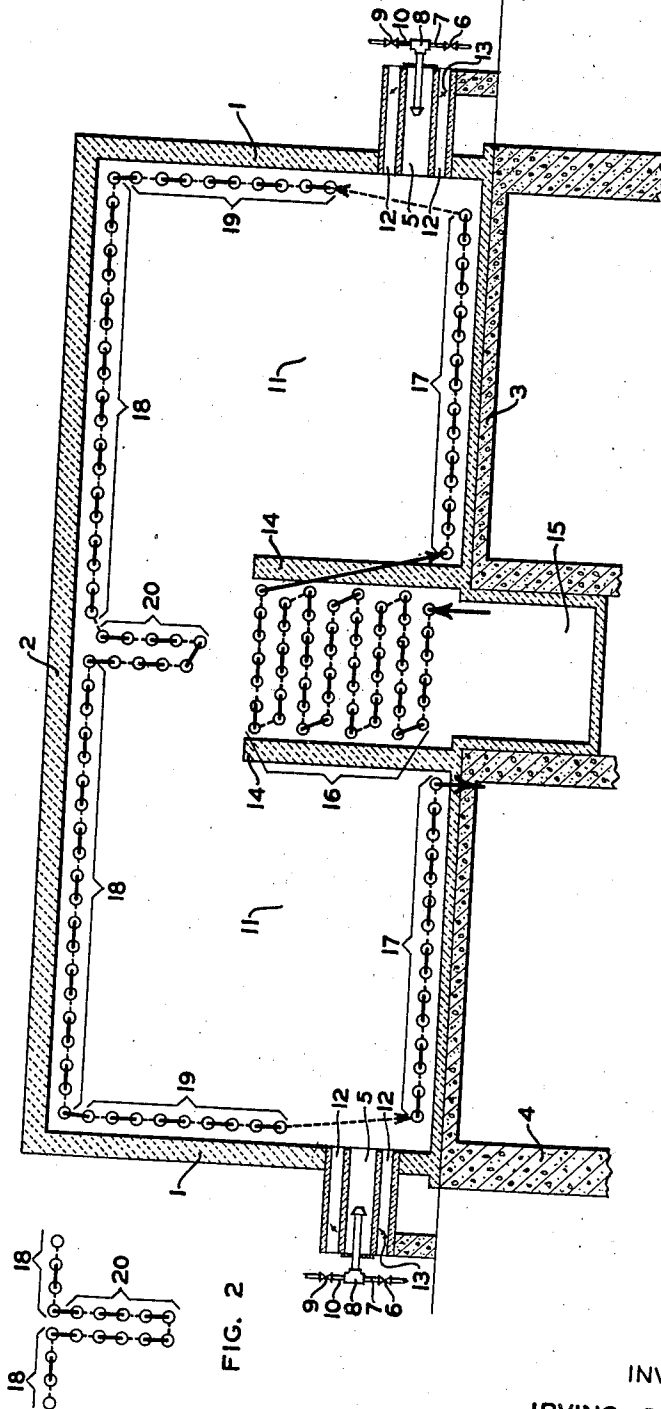


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I. OBERSTAD
HEATING OF FLUIDS

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HEATING OF FLUIDS

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This invention relates to the heating of fluids and more particularly to a means for increasing the heating capacity of heaters of the so-called "double end fired" type. The invention may be advantageously employed in the many existing heaters of this type as well as in new heater installations.

In the petroleum industry there are at present a great many heaters of the type above mentioned being employed in various processes for the refining and conversion of crude oil to produce marketable products such as gasoline, naphtha, fuel oil and various lubricants. It can readily be seen that any means for enlarging the output of these heaters will be beneficial to the industry.

The features of the present invention provide means for obtaining additional heating capacity without necessitating radical or expensive changes in existing heater structures. It is also possible in new heaters to employ this invention to provide higher heating capacities without increasing the overall size of the heater as compared to previously disclosed tube arrangements for this type of heater.

In heaters of the so-called "double end fired" type it has been the general practice to install rows of radiant heating tubes along the floor and roof of the heater. It has also been common practice to install rows of radiant heating tubes along the end walls above the burner ports. The cooler combustion gases are utilized to heat a bank of convection heating tubes which are generally disposed in a zone located between the two radiant heating zones of the heater.

In my invention I propose to install additional radiant heating tubes by suspending two substantially vertical rows of horizontally disposed tubes from the roof of the heater at a point immediately above the previously mentioned convection heating zone. In this way I add a substantial amount of heating surface without increasing the size of the furnace structure. In addition these supplementary tubes will have a higher heat input than the average of the other tubes of the heater since they are subject to superimposed radiant and convection heat. For this reason the increase in heating capacity realized will be more than proportional to the number of tubes added. This higher heat input to the additional tubes will also make it possible to receive the benefits of increased heating capacity without a proportional increase in pumping costs due to pressure drop through the heater.

In order to make the features and advantages

of the invention more apparent reference is made to the accompanying diagrammatic drawing and the following description thereof.

In the drawing,

Fig. 1 illustrates in sectional elevation a double-end-fired heater embodying one form of the invention.

In Fig. 2 an alternate arrangement of the invention is shown.

Referring to the drawing the heater comprises the end walls 1, side walls not shown, the roof 2, and the floor 3 which may be constructed of a suitable refractory material such as fire clay, silica or high-alumina brick or tile. The refractory walls and roof may be of any desired type of construction and the whole structure may be supported upon a concrete foundation 4.

Burner ports 5 are provided in opposite ends of the heater for the introduction of suitable fuels and regulated quantities of air. In the case here shown each burner 8 is adapted for use with liquid fuel. The fuel is admitted to each burner through a valve 6 and conduit 7 and steam or air for atomization of the fuel is admitted through the valve 9 and conduit 10. In the burner, passages are so arranged that when steam is used it first heats the oil and then atomizes it so that it is readily ignited when mixed with the air introduced through the ports 12. Dampers 13, are provided in the ports 12, for regulating the quantity of air admitted to the heater.

Spaced from the end walls 1 are two bridge walls 14 which extend from the floor upward for a substantial distance and are spaced apart to provide a fluid heating zone therebetween through which combustion gases from zones 11 pass before entering the flue 15. Within the zone defined between the bridge walls are disposed a bank 16 of heating tubes which, because they will be exposed to principally convection or fluid heat, will have a relatively low rate of heat input and therefore are usually employed as preheating or initial heating tubes.

Adjacent to the floor of the heater in combustion and radiant heating zones 11 a plurality of heating tubes 17, are placed. Other radiant heating tubes 18 and 19 are disposed in zones 11 adjacent the roof 2, and wall 1, respectively. Since these tubes are subject to direct radiant heat on one side and reflected radiant heat on the other side they have a much higher heat input than the tubes of bank 16. It is, however, well within the scope of the invention to omit the tubes 19 when desired.

In many existing heaters tubes have already

been arranged as above described. By employing my invention two rows of tubes 20 are disposed as shown above the previously mentioned fluid heating tubes 16.

In the preferred form of the invention the tubes 20 are disposed in a staggered arrangement in order that they may be exposed to radiant heat on both sides. In the alternate arrangement as shown in Fig. 2 the tubes are not staggered and therefore do not absorb as much heat as the tubes in the preferred arrangement but this is more or less equalized by the additional tubes it is possible to include when employing this method of disposition.

In Fig. 1 the various banks of tubes are shown connected for series flow therethrough, but it is also well within the scope of the invention to employ various other methods of flow. For example the incoming fluid stream may be split into two portions each one of which may be passed in series through half of the tubes 16 and thereafter in series through the tubes 17 along the floor of one of the combustion zones 11, the tubes 19, along the wall of one of the combustion zones and the roof tubes 18, disposed in the same combustion zone, thence through one row of the tubes 20, after which the two streams may be joined together and transferred to any additional equipment desired depending upon the process in which the heater is being employed.

In another variation of the invention two individual streams of fluid may be passed in a parallel flow arrangement through the heater, the heating conditions of each stream being regulated as desired by manipulation of the firing conditions in the separate combustion zones.

As an illustration of its utility a comparison between the capacity of a heater without the invention and a heater employing the invention follows.

In the heater shown in Fig. 1 a total of 52 fluid heating tubes is employed along with a total of 88 radiant heating tubes when the tubes 20 are not used. The fluid heating tubes have a rate of heat input of approximately 4500 B. t. u. per square foot of surface or for the 52 fluid heating tubes a total of 234,000 B. t. u. per unit of heater width. The radiant heating tubes will have a heat input rate of about 11,000 B. t. u. per square foot of heating surface or a

total for the 88 radiant heating tubes of 968,000 B. t. u. per unit of heater width. The combined heating capacity will be 1,202,000 B. t. u. per unit of heater width.

In this particular heater, when utilizing the invention, an additional heating capacity of 96,000 B. t. u. per unit of heater width will be realized or an increase of about 8%. This increase may be obtained with a heating surface increase of approximately 5.7%.

The phrase "unit of heater width" as used in this specification refers to a heater width which will give one square foot of heating surface per tube where all tubes are the same size.

I claim as my invention:

1. In a heater of the class described having a pair of independently fired combustion zones and a centrally disposed convection zone receiving combustion gases from both combustion zones, a plurality of heating tubes disposed within said convection zone, heating tubes disposed adjacent the floor of said combustion zones and heating tubes disposed adjacent the roof of said combustion zones; two substantially vertical rows of horizontally disposed tubes disposed above said convection zone, each of said rows being positioned in the direct path of hot combustion gases from at least one of said combustion zones.

2. In a heater of the class described having a pair of independently fired combustion zones and a centrally disposed convection zone receiving combustion gases from both combustion zones, a plurality of heating tubes disposed within said convection zone and heating tubes disposed adjacent the floor, roof and one wall of each of said combustion zones; two substantially vertical rows of horizontally arranged tubes disposed in vertical alignment with said convection zone, each of said rows being positioned in the direct path of hot combustion gases from at least one of said combustion zones.

3. A heater as described in claim 1, further characterized in that said two substantially vertical rows of tubes are arranged in staggered formation.

4. A heater as described in claim 2 further characterized in that said two substantially vertical rows of tubes are arranged in staggered formation.

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