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R. RUEGG
MULTIPLE TUBE GAS HEATING FURNACE WITH
MOVABLE TUBE SUSPENSION MEANS

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Filed Sept. 4, 1946

2 Sheets-Sheet 1

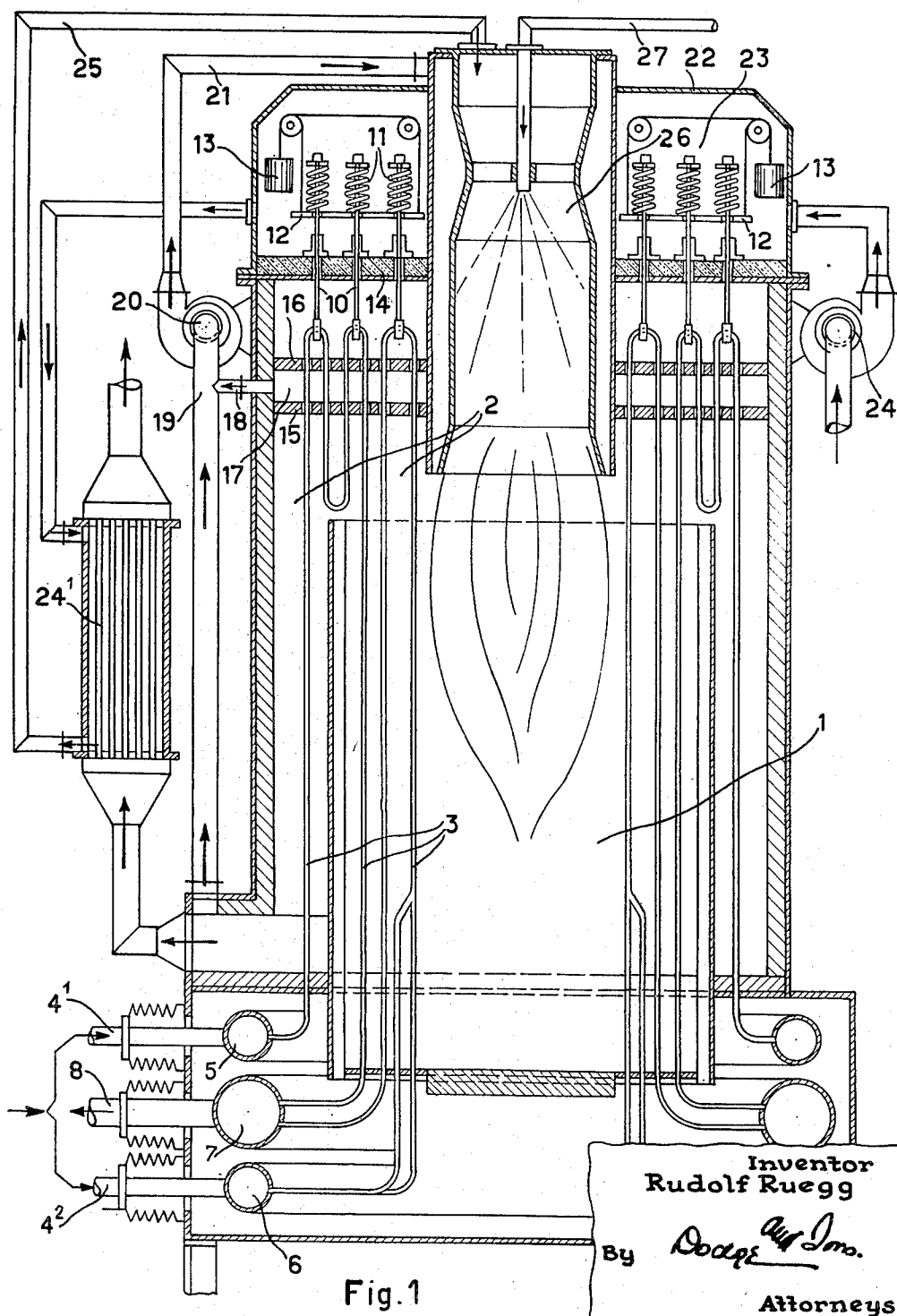


Fig. 1

Inventor
Rudolf Ruegg

By *Dodge & Co.*

Attorneys

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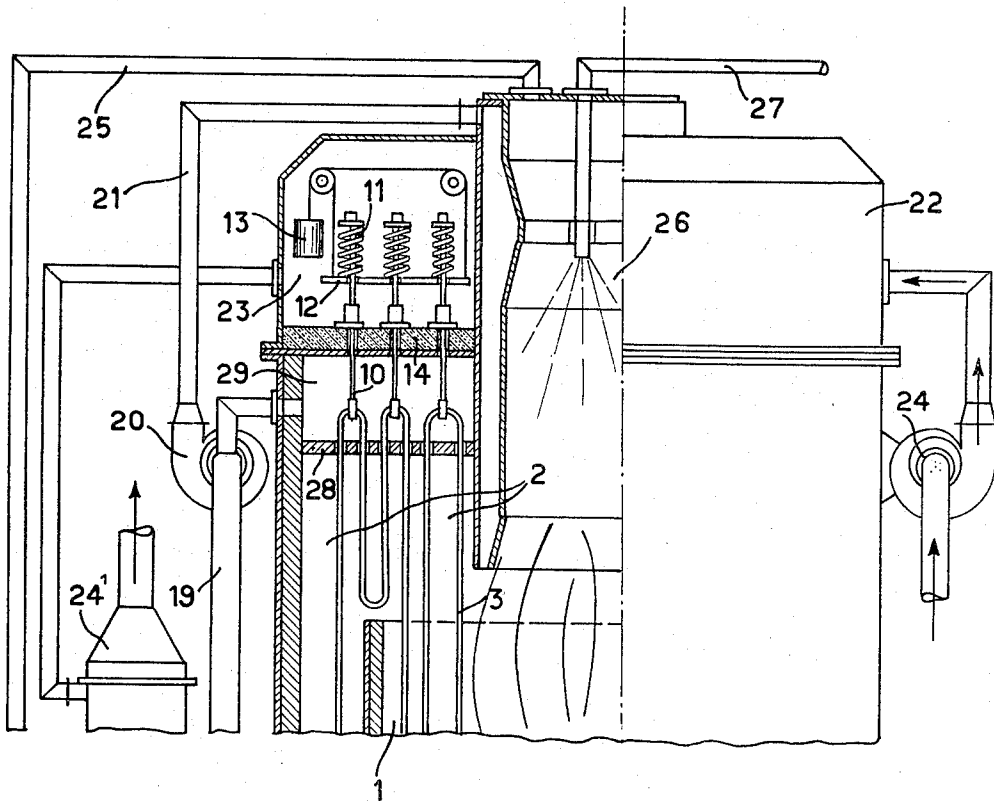


Fig. 2

Inventor
Rudolf Ruegg

By *Dodge & Inn*

Attorneys

UNITED STATES PATENT OFFICE

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MULTIPLE TUBE GAS HEATING FURNACE
WITH MOVABLE TUBE SUSPENSION
MEANS

Rudolf Ruegg, Zurich, Switzerland, assignor to
Aktiengesellschaft Fuer Technische Studien,
Zurich, Switzerland, a corporation of Switzer-
land

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10 Claims. (Cl. 126—109)

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This invention relates to a gas heater with tubes suspended at the top outside the furnace chamber in a manner permitting movement.

In gas heaters of this kind parts of the suspension device have usually to be passed with clearance through one of the walls which bound the chamber containing furnace and flue gases.

Such clearance is necessary in order to enable the tubes to expand longitudinally. Now if a pressure above atmospheric exists in the said chamber, there is risk that flue gases may escape through said clearances into the surrounding space, which, under certain circumstances may lead to injury to the health of the work-people in a short time. If on the other hand a pressure below atmospheric should exist in the space filled with furnace and flue gases, air can pass into this chamber through the said clearances from outside, whereby as is well known the degree of efficiency of gas heaters is very greatly reduced. The provision of packings in such cases is mostly not possible for the reason that stuffing boxes entail objectionable friction and bellows used to produce packless joints require too much space.

The object of the present invention is to provide a gas heater of the kind hereinbefore referred to in which, in connection with the suspension of the tubes, packings can be dispensed with and the above mentioned disadvantages do not occur notwithstanding. For this purpose we provide, between those parts of the heater which are filled with flue gases and a chamber which contains the suspension device for the heater tubes and which is traversed by air serving to cool this device, a further chamber, from which any flue gases which may pass into it and also any air which may tend to pass into said chamber and thus into the path of the flue gases, are drawn off.

The accompanying drawings show by way of example and in a simplified mode of representation two embodiments of the subject matter of the invention. In these drawings in which like reference numerals are used to indicate similar parts:

Fig. 1 is a view of a gas heater chiefly in vertical axial section, but with parts shown in elevation.

Fig. 2 shows a modification of a detail.

In the figures, 1 denotes the furnace chamber of an air heater and 2 denotes those parts of the heater which are filled with flue gases. The heater contains a large number of tubes 3 bent into the shape of a U, and suspended outside the furnace chamber movably at the top in a

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manner to be more fully described hereinafter. The air to be heated flows in through pipes 4¹, 4², arranged parallel with each other, into two distributors 5 and 6 respectively which are arranged at the bottom of the heater. Some of the tubes 3 are connected to the distributor 5 and the remainder of them to the distributor 6, and all these tubes 3 are also connected to a common header 7 for the air heated in these tubes 3. Said header 7 is likewise arranged at the bottom of the heater. The air then passes into a pipe 8 to the place (not shown) where such hot air is to be used. In the type of construction herein described, the longitudinal expansion of the two substantially parallel branches of the U-shaped tubes 3 is practically equalised. The distributors 5, 6 and the header 7 are not therefore subjected to any movements in a vertical direction and consequently only expansions in a horizontal direction have to be taken into account, which, regarded from a constructive standpoint, is to be valued as a great advantage. Owing to the arrangement of the distributors 5, 6 and of the header 7 at the bottom of the heater the tubes 3 must be suspended movably at the top and the suspending means must be yieldably supported. For this purpose we provide in conjunction with each tube 3 a suspension rod 10 and a spring 11 which tends to draw said rod upwards. The various springs 11 are supported by a plate 12, which counterweights 13 tend to draw upwards. The rods 10 are passed with clearance through the cover 14 of the heater which consists at least in part of some heat insulating material. Above the parts 2 of the heater which are filled with flue gases, are arranged two plates 15, 16 through which all the tubes 3 suspended by the rods 10 are passed with clearance. These plates 15, 16 enclose a space 17 which is connected by a pipe 18 to a pipe 19. Through this latter a fan 20 draws flue gases off from the lower part of the heater and delivers them again into the furnace chamber 1 through a pipe 21 at the top for cooling purposes. The greater part of the suspension and counterbalancing device 10, 11, 12, 13 for the heater tubes 3 is housed in a chamber 23 closed at the top and sides by a box-like casing 22 and at the bottom by the cover 14. Fresh air under pressure is delivered to this chamber 23 by a fan 24 for cooling purposes, and after leaving the chamber 23 said air is heated up further in a heat exchanger 24¹ by waste gases, after which it flows through a pipe 25 to the burner 26 as air for the support of combustion. Fuel flows also to the burner 26 through a pipe 27.

In the type of construction described a pressure above atmospheric exists in the chamber 23 filled with fresh air, and in the parts 2 which are filled with flue gases, exists according as the plant is a normal one with an exhaust fan or has a charged combustion chamber, either a slight pressure below atmospheric pressure or a pressure above atmospheric pressure, the latter being however smaller than that which exists in the chamber 23. Notwithstanding the movable suspension of the tubes 3 no fresh air under pressure can pass out of the chamber 23 to the parts 2, because any air which might pass through the clearance in the cover 14 and in the upper plate 16 into the space 17 will be exhausted from said space 17 by the fan 20 before it can pass through the clearances in the plate 15 to the parts 2.

If a pressure above atmospheric and greater than that in the chamber 23 exists at the parts 2, no flue gases can escape into the surrounding neighborhood, because the flue gases which get as far as the exhaust space 17 are drawn off therefrom by the fan 20, so that they cannot get even into the space between the plate 16 and the cover 14.

As shown in Fig. 2, in some circumstances a single plate 28 between the parts 2 which are filled with flue gases, and the cover 14, will be sufficient. In such case the exhaust space 29 between the plate 28 and the cover 14 must be connected up to the fan 20. When this is done it is advisable to make the partition 14 between the exhaust space 29 and the chamber 23 which contains the suspension and equalising device 11, 12, 13 for the heater tubes and through which the suspension rods 10 for the heater tubes 3 are passed, likewise at least partially of heat insulating material.

What is claimed is:

1. The combination of means enclosing a combustion chamber, at least one wall of said enclosing means being provided with a plurality of apertures for the passage of corresponding tube-suspending means; a burner for causing combustion of fuel in said combustion chamber; yielding tube-suspending means external to said enclosing means, associated with said apertured wall, and having tube-engaging extensions which pass and are movable longitudinally through respective apertures; a housing enclosing said tube-suspending means; means for circulating a gaseous cooling medium through said housing; at least one partition disposed within said enclosing means and defining therein a combustion chamber proper and an intervening chamber between said wall and said partition, said partition also being provided with a plurality of apertures, the disposition of the apertures in said partition being a function of the disposition of the apertures in said wall; a plurality of tubes having straight portions which extend through the apertures in said partition and are formed with bent portions which engage said tube-engaging extensions within said intervening chamber, each tube and each tube-engaging extension nearly filling the aperture through which it passes; and circulating means operatively connected to said intervening chamber and to said combustion chamber to withdraw gases directly from said intervening chamber and deliver them to said combustion chamber at a rate such as to maintain in the intervening chamber a pressure which is lower than the lowest pressure concurrently ex-

isting in the combustion chamber and in said housing.

2. The combination defined in claim 1 in which the straight portions of the tubes are substantially vertical and are suspended at their upper ends from said tube-engaging extensions.

3. The combination defined in claim 1 in which the tubes have parallel vertical straight portions connected within said intervening chamber by a bend, forming an inverted U, and said tube-engaging extensions engage respective bends.

4. The combination defined in claim 1 in which the tubes have parallel vertical straight portions connected within said intervening chamber by a bend, forming an inverted U, and said tube-engaging extensions engage the bend, and the lower ends of said straight portions are connected to fixed manifolds.

5. The combination defined in claim 1 in which there are two similarly apertured partitions spaced apart and both traversed by the tubes; namely, a first partition adjacent the combustion chamber, and a second partition between the first partition and the apertured wall; and the circulating means is operatively connected to the space between the first and second partitions so as to draw gases directly from said space and indirectly from the space between the second partition and the apertured wall, in which space the tube-engaging extensions engage the tubes.

6. A gas heater comprising in combination means enclosing a combustion chamber and an offtake passage for products of combustion leading from said chamber, one wall of said enclosing means having a plurality of spaced apertures for the passage of corresponding tube-suspending means; a burner arranged to cause combustion of fuel within said chamber; a plurality of yielding suspending means supported outside said combustion chamber and each having tube-engaging extensions which pass and are movable longitudinally through corresponding ones of said apertures; a housing enclosing said yielding suspending means; means for circulating a gaseous cooling medium through said housing; at least one partition interposed between the interior of the combustion chamber and said apertured wall and serving to define between said wall and partition an intervening chamber, said partition also being provided with a plurality of apertures, the disposition of the apertures in said partition being a function of the disposition of the apertures in said wall; tubes arranged for the passage therethrough of gas to be heated, said tubes being so located within the combustion chamber as to be swept by combustion and flue gases flowing from said burner to said off-take passage, said tubes passing through apertures in said partition, and entering within said intervening chamber into engagement with said tube-engaging extensions; and circulating means operatively connected to said intervening chamber and to said combustion chamber so as to withdraw both flue gases and cooling medium from said intervening chamber and for discharging the same into said combustion chamber.

7. The combination defined in claim 6 in which the tubes are vertical, the apertured wall of the combustion chamber is at the top and the tubes have fixed connections at their lower ends.

8. The combination defined in claim 6 in which the tubes are vertical, the apertured wall of the combustion chamber is at the top, the tubes have fixed connections at their lower ends, and said yielding suspending means comprise suspender

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rods which serve as the tube-engaging extensions, a counter-weighted platform and a plurality of springs one reacting between the platform and each of said rods.

9. The combination defined in claim 6 in which a heat exchanger is interposed in said offtake to recover heat from products of combustion, the cooling medium circulated through the housing is air and connections are provided to direct said medium from the housing to and through the exchanger and from the exchanger to the combustion burner where it is used as combustion air.

10. The combination defined in claim 6 in which the circulating means which withdraws

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gases from the intervening chamber includes an inlet connection leading from the offtake, whereby the circulating means delivers a mixture of flue gases and cooling medium to said combustion chamber.

RUDOLF RUEGG.

REFERENCES CITED

The following references are of record in the file of this patent:

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