June 20, 1939. W. LINDER 2,163,149

REGENERATIVE GAS HEATER WITH COMBUSTION SHAFT ARRANGED OUTSIDE THE HEATER CASING

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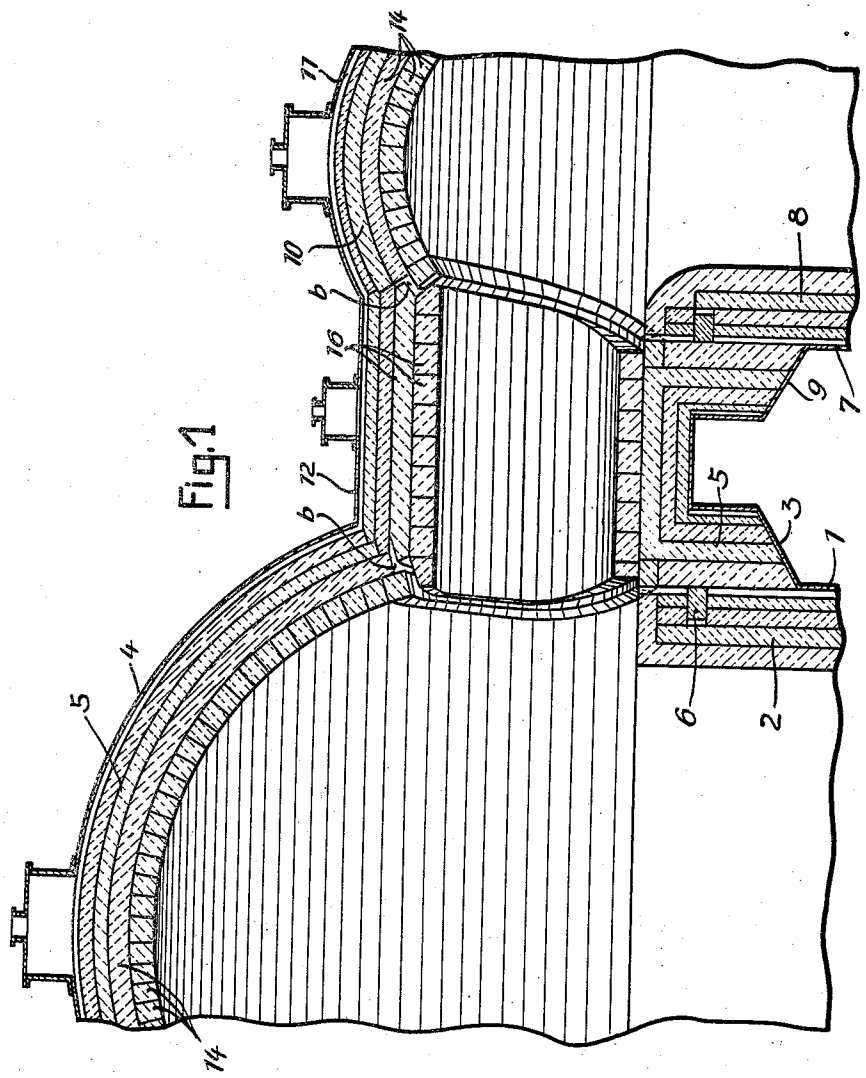
Fig.1



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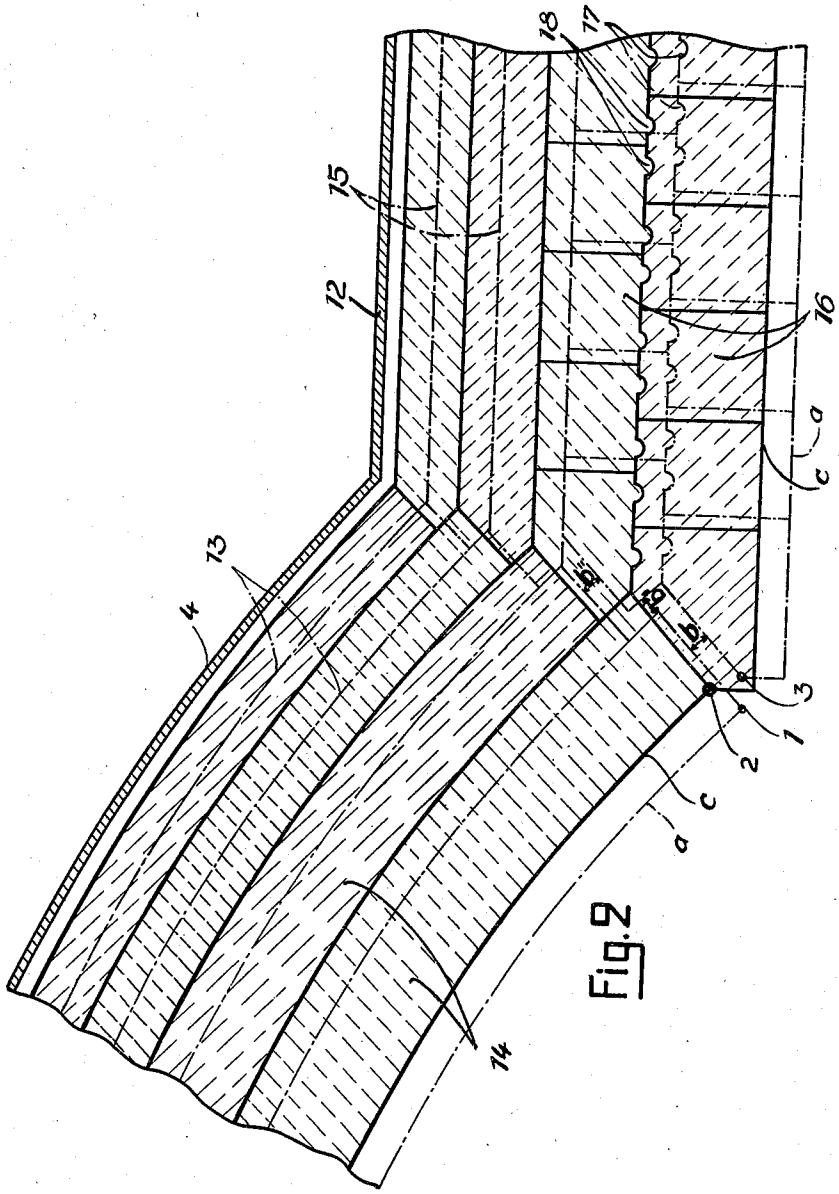

Fig. 2

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REGENERATIVE GAS HEATER WITH COMBUSTION SHAFT ARRANGED OUTSIDE THE HEATER CASING

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4 Claims. (Cl. 263—19)

The present invention relates to those regenerative tower-like gas heaters (system Cowper) for heating-up gases or the like in which the combustion shaft is arranged outside the gas heater itself, and the dome of the gas heater is connected with the dome of the combustion shaft by means of a bricklined channel.

The object of my invention is to provide such improvements in said gas heaters which will ensure a perfect assemblage of the bricklining, arranged inside the channel connecting the gas heater proper with the combustion shaft situated outside thereof, as well as a perfect assemblage of the bricklining of both the gas heater dome and combustion shaft dome adjacent to said connecting channel, when working at normal temperatures.

The invention mainly consists in arranging the inner refractory bricklining of the dome of the gas heater and of the combustion shaft, as well as the bricklining of the connecting channel, in such a manner that the individual parts of the brickwork, in cold condition, show a definite distance from one another, so that the end faces of the bricklining of the channel and of the dome fit against each other, in hot condition, without causing a considerable pressure.

Another important feature of the present invention is that the individual bricks of the refractory lining of the connecting channel are staggered and their tongues and grooves fit into each other in such a manner that the various bricks of the bricklining are connected with one another immovably relatively to each other.

Other important objects and features of my present invention will be made apparent to those skilled in the art from the following disclosure and especially from the description of a preferred embodiment of my invention hereinafter disclosed.

With the use of the gas heater of the before mentioned design, it has been found that the refractory bricklining of the connecting channel, and of the adjacent dome of the gas heater, and the combustion shaft, expand quite differently when they are heated to high temperatures. If, in the bricklining of the connecting channel, only the usual expansion joints between the individual bricks are provided, and if the end bricks of the channel bricklining rest against the dome bricklining, then a high pressure is exerted upon the bricks of the dome lining adjacent to the said channel bricklining. This pressure results from the heat expansion of the individual bricks during the heating-up of the brickwork. It has been found that the pressure necessary for closing the expansion joints in the channel bricklining is considerably greater than the pressure which the dome bricklining is able to withstand. Consequently, it easily happens that when heating-up such gas heaters, the dome bricklining becomes loosened in the zones adjacent to the mouth of the connecting channel which connects the dome of the gas heater proper with the dome of the combustion shaft. There is, therefore, the danger that the assemblage of the dome bricklining is released, and that finally the dome bricklining will break-down. According to my present invention, this difficulty is overcome by arranging the end bricks of the lining of the channel in such a manner that, at normal temperature, they have a certain distance from the end bricks of the dome bricklining, this distance being such that at working temperature, the spaces between the end bricks of the said bricklining will close on account of the heat expansion of the refractory materials, and the end bricks of the channel lining fit against the bricks of the dome lining without building-up a dangerous pressure.

If the bricks of the channel lining are interconnected in such a manner that they can not be displaced relatively to each other, there results the further advantage that, when cooling-down the gas heater, the end bricks of the channel lining are removed from the mouth of the dome bricklining, and the space between the channel bricklining and the dome lining is thus restored after the bricklining is cooled-down to normal temperatures. In this way, it is possible to design the lining of the gas heater in such manner that even with repeated starting-ups and shutting-downs of the gas heater, the assemblage of the bricklining in the connecting channel, in the dome of the gas heater, and in the dome of the combustion shaft, is maintained.

With the above and other objects of my invention in view, I will now describe a preferred embodiment of my invention on the lines of the accompanying drawings, in which

Figure 1 shows a vertical section through a part of the gas heater constructed according to my present invention.

Figure 2 shows on an enlarged scale the arrangement of the bricklining at the connecting point between the gas heater dome and the channel bricklining.

In Figure 1 of the drawings, the cylindrical main casing of the gas heater has been marked 1, said casing being provided with a usual refrac-

tory bricklining 2. At the upper end of the heater casing, there is an inclined projection 3 to which is affixed the casing 4 of the gas heater dome. The base of the dome bricklining 5 is supported upon the inclined projection 3 of the heater casing. The gas-tight connection between the bricklining 2 of the heater and the dome bricklining 5 is effected by a suitable packing 6. The lining 2 of the heater casing 1 is therefore able to expand towards the top independently of the heater dome.

Near the heater 1 casing is situated the casing 7 for the combustion shaft which, similar to the heater 1, is fitted with a refractory lining 8. Also the combustion shaft casing has an inclined projection 9 on which is supported independently the bricklining 8 of the combustion shaft, the bricklining 10 of the dome 11.

The casing 4 of the gas heater dome and the casing 11 of the combustion shaft dome are connected with one another by an essentially cylindrical pipe 12 which is lined by refractory bricks.

In the construction shown in Figure 2 of the drawings, the projection of the gas heater dome 4 consists preferably of the porous, i. e., slightly elastic outer layers 13 and highly refractory inner layers 14. Similarly, also, the casing 12 of the connecting channel is lined with porous outer layers 15 and highly refractory inner layers 16. The refractory layers 14 and 16 are now laid in cold condition in such a manner that they have a certain distance from one another at the point where the bricklining 16 of the connecting channel touches the dome bricklining 14.

In Figure 2, the dotted lines "*a*" indicate the relative positions of the layers of the bricklinings of the dome 4 and casing 12 in cold condition. In this condition, the end bricks of the lining layers 16 and of the layers 14 are a definite distance from one another, marked in Figure 2 with *b*, *b'* and *b''*.

The dimensions of the spacings of the bricks 14 and 16 from one another are chosen in such a manner that, on the one hand, the dome bricklining 14 may raise and expand corresponding to the heat expansion of the dome brickwork and, on the other hand, also the bricklining 16 of the connecting channel may raise and expand in longitudinal direction. In hot condition, the dome bricklining takes, therefore, the position indicated by the full lines "*c*" (Figure 2). It will be realized that in hot condition, the spaces *b*, between the end bricks of the bricklining 14 and 16, disappear, and that the end bricks of the bricklining 14 and 16 fit against one another without a dangerous pressure. This means that, corresponding to the operating condition it is possible to close completely the intermediate spaces *b*, i. e., so that the bricks of layers 14 and 16 fit against one another with a definite yet harmless pressure, although decreasing the intermediate spaces *b* to such an extent that an injurious gas circulation in the remaining intermediate spaces, and thus an undesired heat-penetration to the outer layers of the brickwork, is rendered impossible. Of course, the exact design of the bricklining depends on the operating conditions to be met with in each individual case.

The construction as illustrated in Figure 1 of the drawings represents the cold condition of the bricklining, from which those skilled in the art will clearly recognize the spacings "*b*" (of Fig. 2) between the end bricks of the channel bricklining 16 and the inner layer 14 of the dome bricklining.

Figure 2 further shows a special connection of the inner layers 16 of the channel bricklining with each other. The bricks of the inner layer 16 of the dome bricklining are fitted with grooves 17 in which engage the corresponding tongues 18 of the bricks of the second or outer layer 16 of the bricklining which bricks are also arranged in staggered position relatively to the bricks of the inner layer. By this arrangement, the bricks of the inner layer 16 of the channel bricklining are connected with one another and also with the bricks of the second lining layer. This offers the advantage that the layers 16 of the channel lining may expand and contract again as one unit, and the essential distance "*b*" between the end bricks of the bricklining 14 and of the lining 16, when cooling down the gas heater, is restored anew, i. e., any dangerous pressure upon the bricklining of the two dome-like casings is thus avoided.

If necessary, further layers of suitable combustible material may be provided between the layers 16 of the channel lining and the outer layers 15. The layers of such combustible material will burn out when the refractory lining is heated-up to working temperature. After said combustible layers have disappeared, the layers 16 may move easily relatively to the outer insulating layers 15. Furthermore, it is now possible to arrange expansion joints in the bricklining of the connecting channel, for instance in the centre, which is of advantage if the connecting channel 12 is very long.

Various changes may be made in the details of construction of the apparatus described in the foregoing specification without departing from the invention and the advantages thereof, since the invention may be variously embodied within the scope of the following claims.

I claim:

1. A regenerative heating system comprising a regenerator tower-like metal casing inner-lined with refractory brickwork and having a metal-encased dome inner-lined with refractory brickwork; a combustion shaft therefor arranged outside the same and constituted of a tower-like metal-casing inner-lined with refractory brickwork and having a metal-encased dome inner-lined with refractory brickwork; and a connecting channel constituted of a metal-casing inner-lined with refractory brickwork connecting the regenerator dome with the combustion shaft dome; and in which the ends of the end bricks of the inner refractory lining of one of the domes and the ends of the end bricks of the inner lining of the connecting channel, that are adjacent each other, are disposed relative to each other so as to be so spaced from each other, in cold condition, that the end faces of the channel bricklining will fit in gas tight relation against the end faces of the dome bricklining, without exerting dangerous pressure of expansion on each other, when expanded under heat in operation.

2. A regenerative heating system as claimed in claim 1, and in which the bricks of the refractory lining of the connecting channel are arranged in superimposed annular layers with the bricks in adjacent layers staggered and interconnected by means of tongue and groove joints.

3. A regenerative heating system comprising a regenerator tower-like metal casing inner-lined with refractory brickwork and having a metal-encased dome inner-lined with refractory brickwork; a combustion shaft therefor arranged outside the same and constituted of a tower-like metal-casing inner-lined with refractory brick-

work; and a connecting channel constituted of a metal-casing inner-lined with refractory brickwork connecting the regenerator dome with the combustion shaft dome; and in which the ends of the end bricks of the inner lining of the regenerator dome and the ends of the end bricks of the lining of the connecting channel, that are adjacent each other, are disposed relative to each other so as to be so spaced from each other, in cold condition, that the end faces of the lining of the connecting channel will fit in gas tight relation against the end faces of the dome bricklining, without exerting dangerous pressure of expansion on each other, when expanded under heat in operation.

4. A regenerative heating system as claimed in claim 3, and in which the end of the bricklining of the dome of the combustion shaft is also arranged so as to be disposed, in cold condition, with a definite spaced distance from the adjacent end faces of the bricklining of the connecting channel, said spacing being of such width from the end faces of the bricklining, provided in the connecting channel, that the end bricks of the channel-lining, at hot working temperature, also will fit closely in gas tight relation against the adjacent ends of the bricklining of the combustion-shaft dome.

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