April 23, 1940. W. LINDER 2,198,054

REGENERATIVE GAS HEATER OR STOVE

Filed Jan. 11, 1938 2 Sheets-Sheet 1

Fig. 1

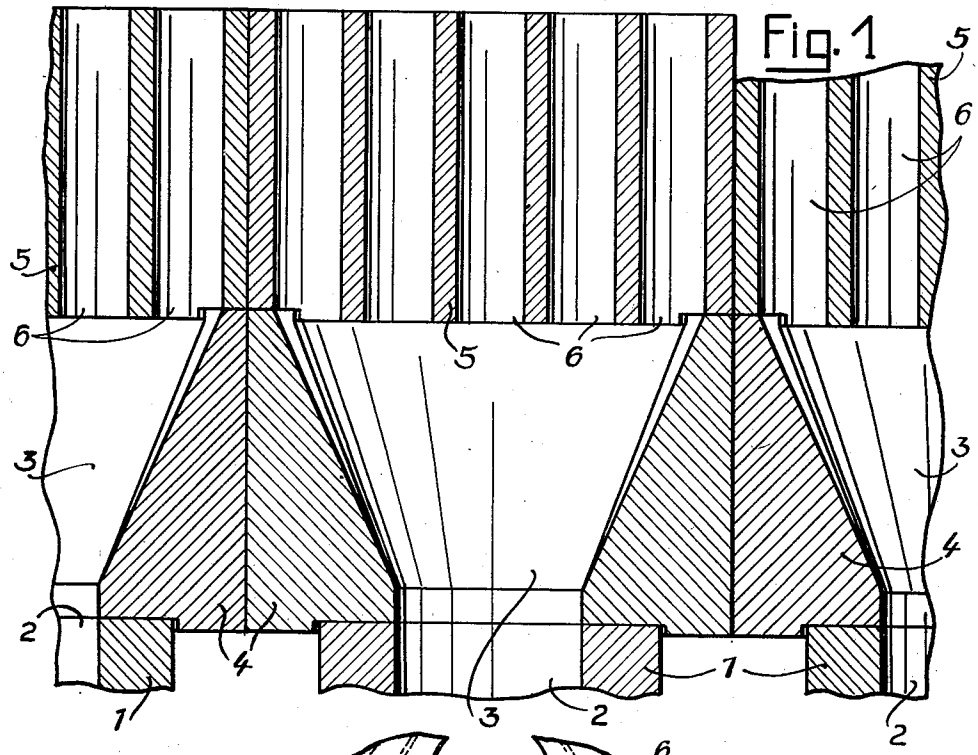
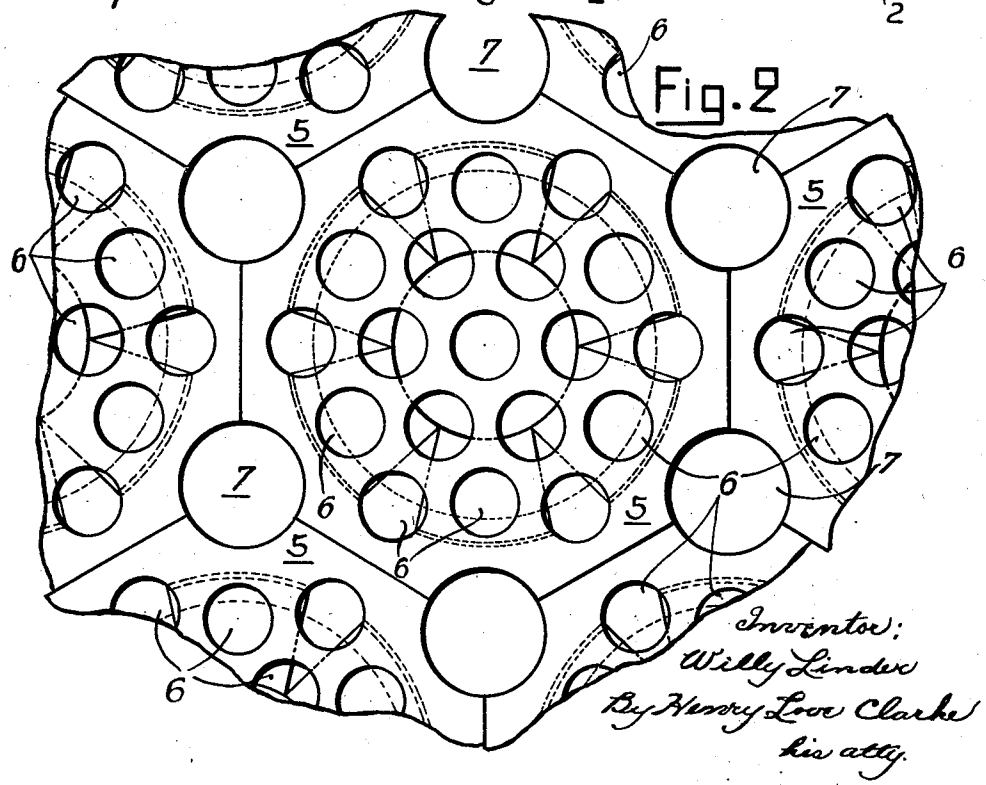


Fig. 2



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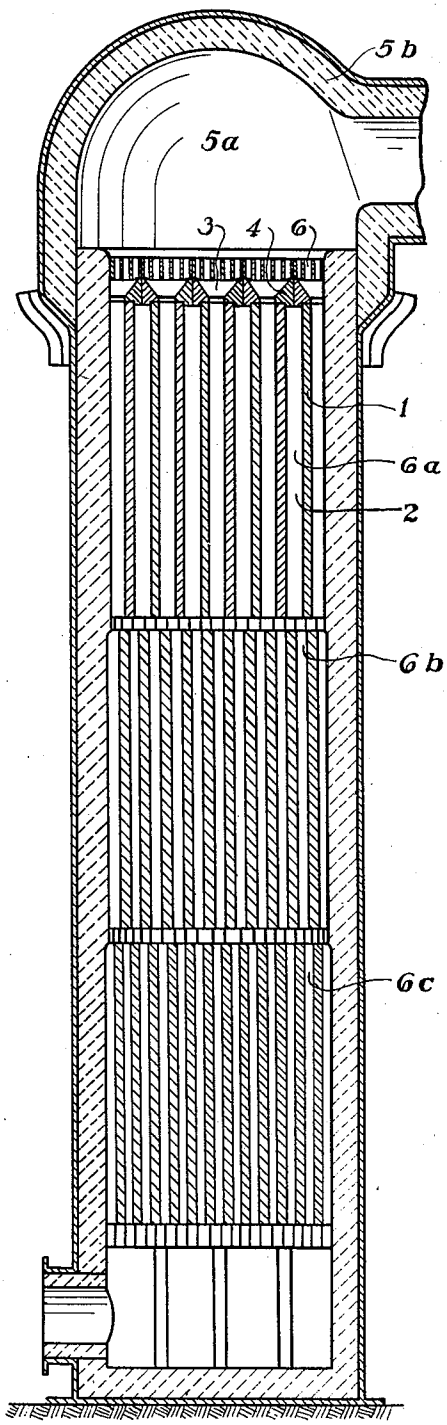

Fig. 3.

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UNITED STATES PATENT OFFICE

2,198,054

REGENERATIVE GAS HEATER OR STOVE

Willy Linder, Essen-Bredeney, Germany, assignor, by mesne assignments, to Koppers Company, Pittsburgh, Pa., a corporation of Delaware

Application January 11, 1938, Serial No. 184,389
In Germany January 12, 1937

1 Claim. (Cl. 263—19)

The invention relates to regenerative gas heaters or stoves and more particularly to the so-called Cowper stoves, comprising a tower-like casing equipped with a refractory chequer brickwork serving as heat exchanging medium, said chequerwork being provided with vertical channels through which the cold gases to be heated-up and the hot combustion products pass alternately.

It has been suggested to arrange the vertical channels in the chequerwork of a stove or gas heater in such a manner that the free section of said channels decreases gradually or continuously from the top downwards corresponding to the quantity of heat which the chequerwork in the various zones of the stove is able to absorb without any disadvantageous overheating of the refractory material. The reason for this arrangement is that the heat within a defined heating period penetrates the body of the heat exchanger bricks only to a certain depth, the extent of which depends upon the actual temperature difference between brick and heating media. As this difference is much higher near the top of the chequerwork than at the lower part thereof, it is of advantage to form the bricks of the upper part of the chequerwork with thicker walls than the bricks in the lower part of the stove. Consequently, the inner width of the gas channels in the chequerwork has to be made greater in the upper part than in the lower part.

It rather often occurs that the comparatively narrow channels provided in the lower part of the chequer brickwork are blocked-up, for instance by broken lumps of bricks spalling off from the dome-like roof of the heater. Such brick lumps fall through the upper wide gas channels of the chequerwork downwards until they are held-up by the narrow bottom channels of the chequer-brickwork. It is understood that it is practically impossible to remove the brick lumps from the lower part of the chequer brickwork without dismantling the brickwork in the upper zones of the stove. Consequently, considerable difficulties in operation are met with in the known Cowper stoves of the multiple zone design, as the flow of the gases through the chequerwork is disturbed. The efficiency of the stove depends, however, on a uniform distribution of the gaseous media through the whole area of the chequerwork.

In order to maintain the efficiency of the Cowper stove of the multiple zone design, a frequent reconstruction of the chequerwork is necessary.

Now the principal object of my present invention is to provide such improvements in the chequerwork of the said gas heater or stoves that the difficulties arising from blocking-up the gas channels in the chequerwork by any broken bricks or other solids may be safely overcome.

My invention consists essentially in that on the top of the chequer brickwork, there is arranged a layer of refractory perforated bricks having holes of smaller section than the smallest section of the chequerwork channels in the lower part of the regenerator and that the total free section of the channels in the perforated brick layer is made equal or even larger than the free section of the adjacent chequerwork channels at the top of the regenerator.

The arrangement of such a layer of perforated bricks prevents any brick lumps or other matters from falling into the chequerwork channels, which lumps are larger than the narrowest chequerwork channels and which may deposit or stick to any point of the chequerwork. Any brick lumps which may pass the protection layer consisting of perforated bricks according to my invention, will pass even the narrowest channel of the chequer brickwork, finally accumulating in the free space underneath the chequer brickwork, where they are harmless and from where they can be removed without any trouble.

The arrangement of the protection layer consisting of perforated bricks acting as a sieve on the chequerwork is preferably combined with the use of highly refractory materials, which also in the less thick walls offer a sufficient resistance against the high temperatures existing in the dome of the Cowper stoves. According to my invention, the perforated bricks of the protection layer are made preferably from "Sillimanite."

Still further objects and features of my present invention may be taken from the following description of a preferred embodiment of my invention, and from the accompanying drawings, in which

Figure 1 shows a vertical section through a part of the Cowper chequerwork according to my invention and

Figure 2 a top-view of the chequerwork of Fig. 1.

Figure 3 is a vertical cross-sectional view of the Cowper stove as a whole.

The top layer of the chequerwork is marked 1 on the drawing. Said layer possesses comparatively wide channels 2. On the layer 1 of the multiple zones of regenerator channels of decreasing area of the heat exchanger chequerwork adjoins a brick layer 4 provided with coni-

cal openings 3. On this layer is arranged a protecting layer of perforated bricks 5 which are fitted with narrow channels 6. Above the bricks 5 is the usual free space 5*a*, covered by the dome 5*b* of the stove and from where are distributed the heating gases to the chequerwork and where are collected the media to be heated-up.

As illustrated in Figure 3, the free sections of each of the channels of zone 6*b* are less than those of zone 6*a*, and the free sections of each of the channels of zone 6*c* are less than those of zones 6*a* and 6*b*, thus providing a multiple zone design of channels which taper or decrease in area gradually from the top of the regenerator downwardly to its bottom.

The cross sections of the channels 6 are chosen in such a manner that they are each smaller than the smallest cross section of the channels of multiple zones like 6*a*, 6*b*, 6*c*, of the chequer brickwork especially of the chequerwork channels in the lower zones 6*b* and 6*c* of the stove.

It is advisable to arrange such a number of holes in the protecting layer of bricks 5 that the free cross section of all the gas ways, if compared with the gas ways in the top layer 1 of the chequerwork, is not considerably less so that a disadvantageous gas resistance is avoided in the protecting layer.

As may be seen from Figure 2, the protection bricks 5 are suitably made with a hexagonal section whereby if necessary, the brick edge corners are furthermore equipped with recesses 7 which together with the respective recesses of the adjacent bricks after putting together the brick layer, will result in additional channels for the passage of gases. The radius of the edge recesses 7 is, of course, to be selected in such a manner that the total cross section of the gas channel formed by the cuttings 7 of the adjacent bricks is smaller than that of the channels of the chequer brickwork.

I have now described above the present invention on the lines of a preferred embodiment thereof, but my invention is not limited in all its aspects to the mode of carrying it out as described and shown, since the invention may be variously embodied within the scope of the following claim.

I claim:

In a regenerative gas heater or stove comprising a tower-like casing with a dome top; and refractory checkerwork arranged therein, with the checkerwork constituting multiple superposed zones of vertical channels the width of which decreases from the top of the checkerwork downwardly: a sieve for retaining brick lumps that may fall from the dome towards the narrower channels, said sieve comprising a layer of perforated refractory bricks arranged over the top of the checkerwork of the upper zone between the same and the dome chamber, the holes in said perforated bricks communicably connecting with said vertical channels beneath the same, on the one hand, and with the free space in the dome chamber above the checkerwork, on the other hand, and the effective cross-sectional area of the respective holes in the sieve being of smaller width than the narrowest of the vertical channels of the multiple zones of channels, but the total free section of all of the holes in the sieve aggregated as a whole being at least equal to the total free section of all of the larger channels aggregated as a whole in the top layer of the subadjacent checkerwork.

WILLY LINDER.