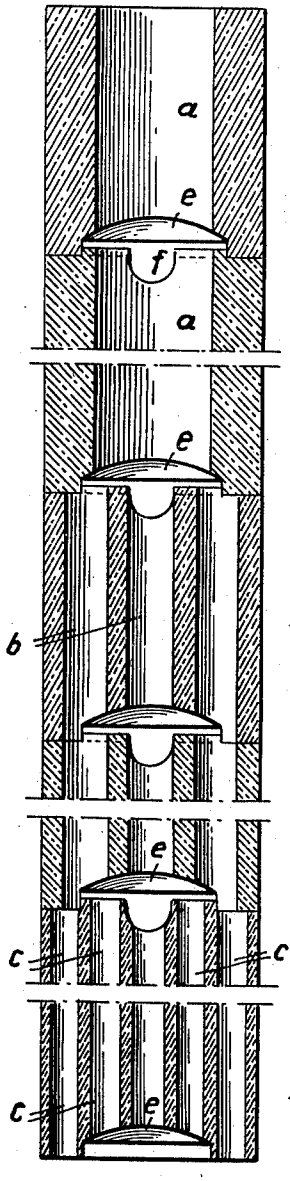
Aug. 7, 1928. 1,679,993

O. STRACK

HEAT EXCHANGING STRUCTURE FOR AIR HEATERS AND THE LIKE

Filed March 21, 1927

Fig. 1.



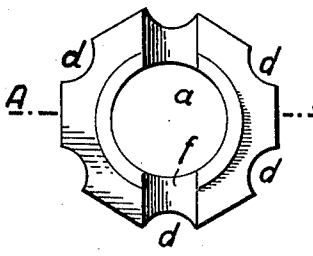


Fig. 2.

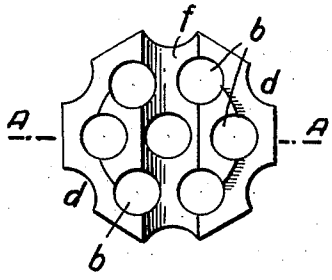


Fig. 3.

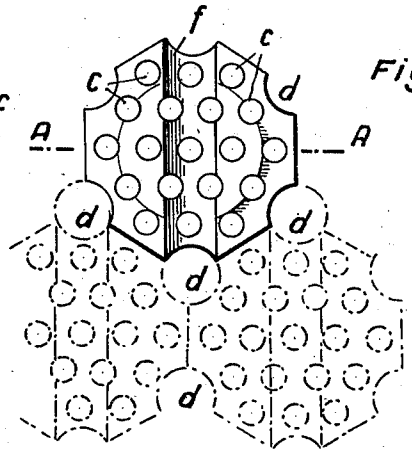


Fig. 4.

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Patented Aug. 7, 1928. 1,679,993

UNITED STATES PATENT OFFICE.

OTTO STRACK, OF AUERBACH, HESSE, GERMANY, ASSIGNOR OF ONE-HALF TO THE FIRM PFÄLZISCHE CHAMOTTE- UND THONWERKE SCHIFFER & KIRCHER AKTIEN-GESELLSCHAFT, OF GRUNSTADT, GERMANY.

HEAT-EXCHANGING STRUCTURE FOR AIR HEATERS AND THE LIKE.

Application filed March 21, 1927, Serial No. 177,182, and in Germany March 23, 1926.

This invention relates to a heat-exchanging structure for abstracting heat from furnace or fire gases, accumulating it, and transmitting it later on to air in order to heat the same intensely. More especially, the invention relates to refractory blocks intended to be built into air-heaters or the like in a certain manner, as fully described hereinafter, and these blocks which are all of the same exterior shape are characterized by the number and the diameter of vertical passages provided in them, as well as by the thickness of the refractory material present between these passages or channels, also as fully described hereinafter.

Concerning, for instance, an air-heater for use in iron works or the like, the hot gases, the heat of which is to be abstracted by, and accumulated in, the refractory blocks mentioned, enter into the space enclosing said blocks at the hood and pass downwards through the passages left between, and provided in, the blocks. Supposing, the heat of said gases amounts to about 1200° C., this high temperature will be reduced by and by to what is called the waste-gas temperature. The temperature is, therefore, very different in the various heights of the air-heater. This is the case also afterwards when no more hot gases flow through the heater in a downward direction, but air flows through it in an upward direction in order to be heated by the heated blocks. These are consequently cooled down correspondingly.

Owing to the great differences between the temperatures in the several heights of the heater the heat-accumulating and air-heating blocks are subjected to correspondingly different strains, and their heat-conducting capacity, their capacity to stand the strong changes of temperatures, and their strength when they have been heated very highly, changes also correspondingly. Now, the improved refractory blocks forming the subject-matter of this invention do not suffer from the drawbacks adhering to the known ones. They are so superposed as to form columns, a large number of these columns standing closely side by side, and each being built up of refractory blocks of equal external shape, each body having vertical passages, the number of which increases from the uppermost bodies to the lowermost ones, and the thickness of the refractory material surrounding said passages decreasing correspondingly, and the free total sectional area of the passages in any of said bodies being approximately the same in all bodies. The uppermost bodies need have only one passage in each body, and where there are two and more passages in a body as in the bodies below the uppermost ones, they are distributed regularly over the section of the respective bodies. The bodies forming a column are coupled with each other by end projections and end recesses, as usual, the arrangement of these projections and recesses being such that no lateral displacement of the superposed bodies can take place.

The amount of the refractory material is approximately the same in all bodies or refractory members, but the thickness of the walls between the passages is different by reason of the different number of the passages and the different diameter of the same, as already described.

The invention is illustrated diagrammatically and by way of example on the accompanying drawing, on which Figure 1 is a vertical section in the plane A—A of Figs. 2, 3 and 4 through a column of refractory heat-accumulating and air-heating blocks designed according to this invention, it being understood that the air-heater or the like is filled with a large number of such columns, all standing closely side by side, as indicated in the plan Fig. 4; Figure 2 is a plan of the second upper body of the column, Figure 3 a plan of a body in a lower layer, and Figure 4 a plan of a body in the lowermost layers, together with two neighbouring bodies drawn only in dotted lines.

The bodies shown by way of example are all of hexagonal shape, but the six vertical edges are cut away and hollowed out so as to be transformed into grooves *d* having circularly curved walls. Three neighbouring grooves of neighbouring blocks form a passage of circular section, as shown in Fig. 4. The upper blocks have each only one large passage *a*, the blocks therebelow have each 7 regularly distributed passages *b*, and the lower blocks have each 19 regularly distributed passages *c*. I prefer to interconnect all passages of any block with all passages of the next upper and next lower block and for this purpose every block is provided at one or the other end face with

a cavity *e*, and at the opposite end face with a horizontal groove *f*. The blocks are placed one upon the other in such a position that the consecutive grooves *f* extend at angles of 60 degress with respect to each other.

The refractory heat-accumulating and air-heating blocks designed and arranged as described present great advantages. The thickness of the walls of the passages is determined first of all with consideration to the strain to which the blocks are subjected by the heat of the gases, and the decreasing width of the passages is determinated with consideration to the decreasing heat of the gases. Where the hot gases with the highest heat enter into the passages, in the uppermost block-layers, the walls of the passages are thick so that the walls can not be softened. In the lower layers of the blocks where the temperature of the gases is lower, the walls of the passages may be thinner. There the larger number of the passages the free sectional areas of which are smaller, divides the current of the gas into thinner parts and the heating surface is at the same time greatly increased. Owing hereto, the exchange of the heat is very much promoted.

The total free sectional area of all passages for the heating gases and the air is approximately the same in all layers, the gases and the air can pass freely through the consecutive passages. Also the amount of the refractory material in all layers is approximately the same, all blocks being of the same external shape and approximately of the same weight.

The cavities *e*, as well as the grooves *f*, are also very useful for the exchange of the heat in that they give rise to the formation of eddies whereby the gases are more uniformly distributed; the cavities *e* and the grooves *f* prove useful also if any one of the passages should from any reason have become obstructed in that the gases in the block or blocks above the partly obstructed one can nevertheless flow further along in the respective column.

As the thickness of the walls of the blocks in the same layer of all columns filling the heater is practically the same, the entire bulk of the blocks is subjected to uniform strain during the heat-accumulating period, as well as during the air-heating period, and the entire refractory material in all the layers is utilized for the exchange of the heat.

I claim:

1. A heat-exchanging structure for air-heaters and the like, comprising sets of superposed refractory bodies of equal external shape, having vertical passages, the number of which passages increases from the uppermost bodies to the lowermost ones, the amount of the refractory material and the free total sectional area of the passages being approximately the same in every body substantially as described.

2. A heat-exchanging structure for air-heaters and the like, comprising sets of superposed refractory bodies of equal external shape, having vertical passages, the number of which passages increases from the uppermost bodies to the lowermost ones and which are regularly distributed in each body having more than one passage, the thickness of the refractory material surrounding said passages decreasing correspondingly and the free total sectional area of the passages in any of said bodies being approximately the same in all bodies substantially as described.

3. A heat-exchanging structure for air-heaters and the like, comprising sets of superposed refractory bodies of equal external shape, having vertical passages, the number of which passages increases from the uppermost bodies to the lowermost ones in several sections of body-layers in such a manner, that all bodies in the layers of the second section have more passages than the bodies in the layer or layers of the uppermost section, and that the bodies in the layers of the third section have more passages than the bodies in the second section, and so on, the amount of the refractory material and the free total sectional area of the passages being approximately the same in every body as described.

In testimony whereof I affix my signature.

OTTO STRACK.