H. HECKER.

RECUPERATOR.

APPLICATION FILED APR. 12, 1920.

1,426,381.

Patented Aug. 22, 1922.

3 SHEETS—SHEET 1.

Fig. 1.

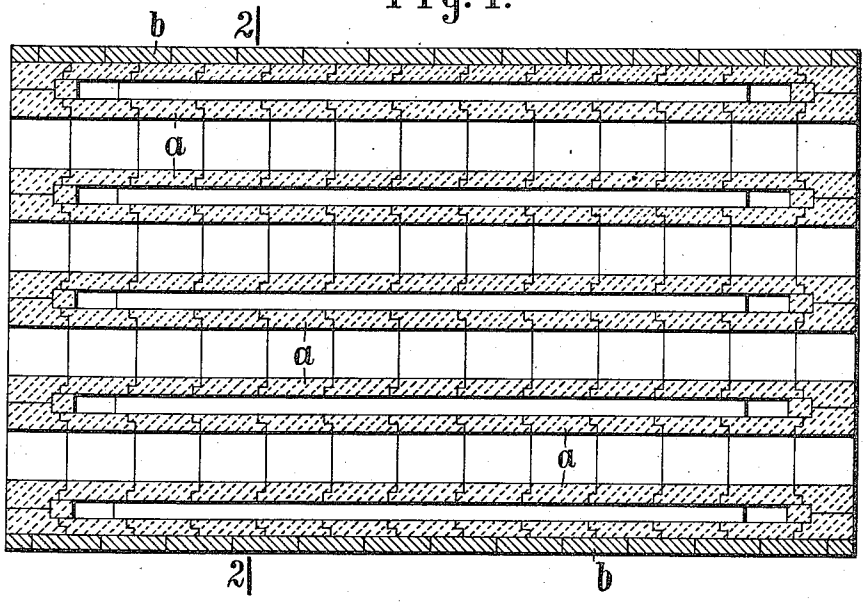
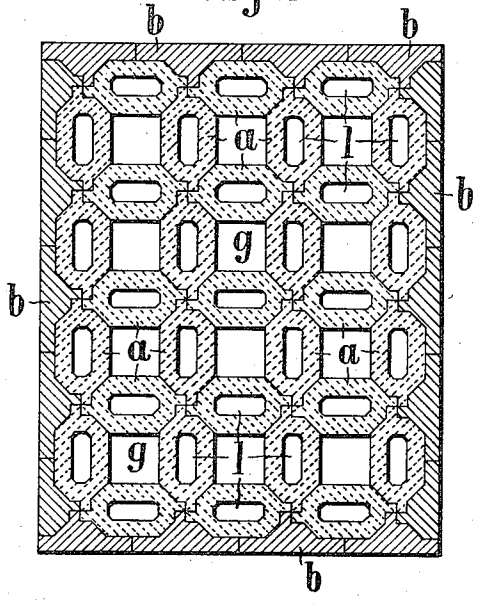


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

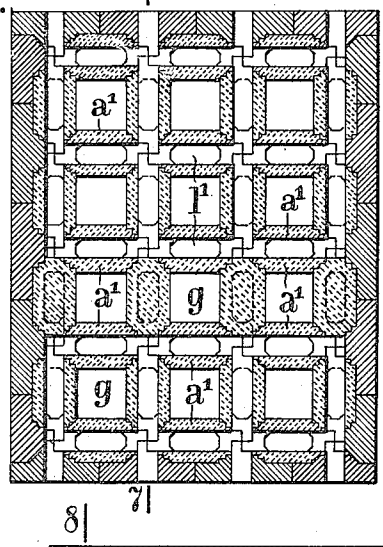


Fig. 4.

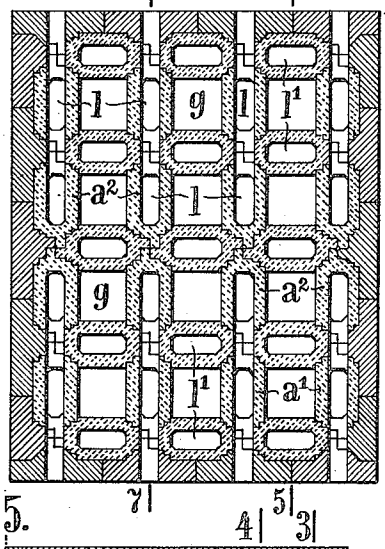


Fig. 5.

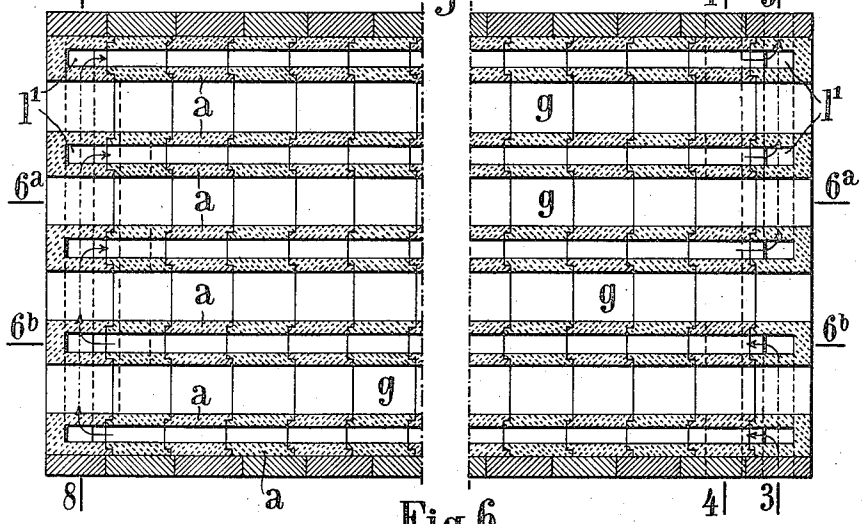
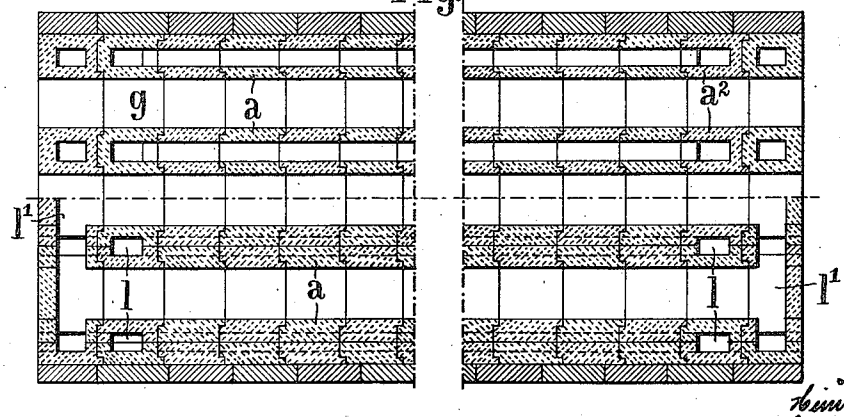


Fig. 6.



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3 SHEETS—SHEET 3.

Fig. 7.

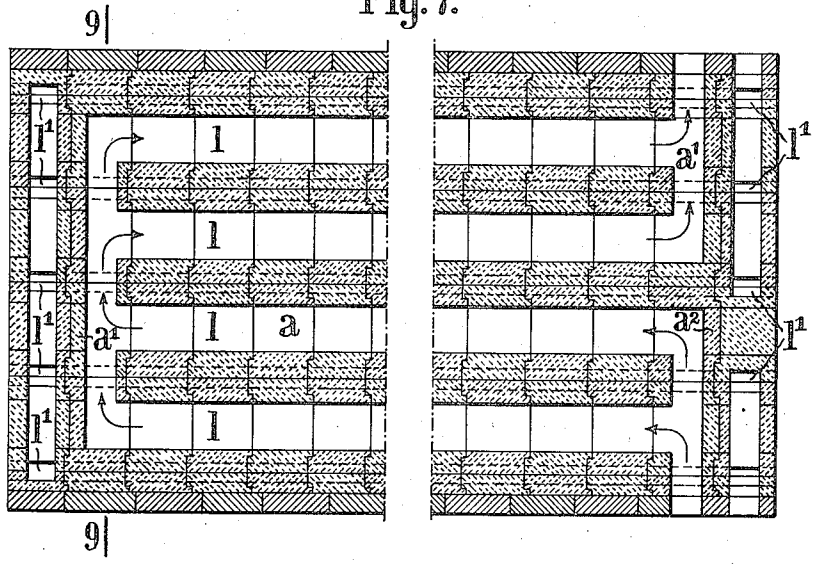


Fig. 8.

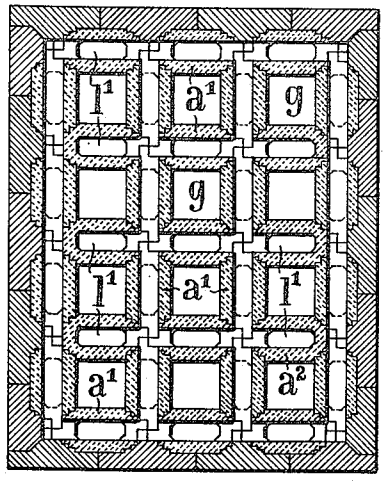
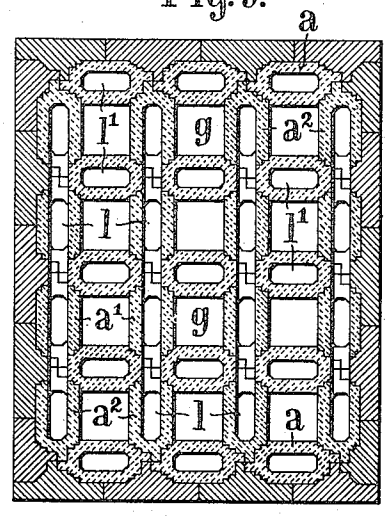


Fig. 9.



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UNITED STATES PATENT OFFICE.

HEINRICH HECKER, OF HAGEN, GERMANY

RECUPERATOR.

1,426,381. Specification of Letters Patent. Patented Aug. 22, 1922.

Application filed April 12, 1920. Serial No. 373,463.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, HEINRICH HECKER, citizen of the German Republic, residing at Hagen, in Westphalia, Germany, have invented certain new and useful Improvements in Recuperators (for which I have filed applications in Germany May 2, 1918, Patent No. 319,667, and September 10, 1918), of which the following is a specification.

It is already known to construct recuperators with the air ducts disposed parallel with the waste gas ducts by employing channel bricks, of which the channels, registering with each other serve as gas ducts, whilst the air ducts are formed by the outer sides of four such channel bricks. Although this mode of construction represents a simplification, compared to recuperators constructed of slabs, the use of brick channels as gas ducts entails certain drawbacks; owing to the danger of their being choked by grit, these gas ducts must be made very large, and therefore channel bricks of very large dimensions have to be employed, so that these bricks are heavy and not easily handled by the bricklayer, and are, besides, owing to the tensions appearing in their walls, apt to crack and burst. If, for the purpose of meeting this last mentioned danger, the walls are made thicker, the weight will be still further increased, as the area of the channel cannot be reduced, and the outside dimensions must therefore become larger. Above all the exchange of temperature across the thick walls is much impaired. When channel bricks are employed as gas ducts, it will only be possible to meet the stipulation of disposing for the purpose of a better utilization of the heat, small air ducts beside large gas ducts, by employing between the channel bricks special intermediate bricks of a different size. This will, however, require much attention and care of the bricklayer, and delays the erection, beside raising the cost thereof, the same as the use of special molded slabs for the same purpose. With such molded slabs, furthermore, the large number of joints, and the therefrom resulting tendency towards leakages in the channels should be considered.

For constructing a recuperator with compartively small and easily heated air ducts running parallel to the roomy gas ducts, and for simplifying the construction of the same so that a single small type of brick may be employed, the present invention provides that the channels of the said bricks shall not be used as gas ducts but as air ducts. For this purpose channel bricks with a rectangular channel are employed, which, on their outside have a flat hexagonal shape, having two opposite long sides and four shorter, equal sides. Four such bricks are placed together, bearing against each other with one each of their shorter sides, so that with their long sides they enclose a gas duct of large area whilst their comparatively small channels surround as air ducts the gas ducts on all four sides. The channel bricks may, in this case, be made with thin walls and ensure a good exchange of temperature. Besides they are of small dimensions and of a moderate weight, and above all, of a uniform type, so that the erection of the recuperator is simplified and easy. The stipulation for a sufficient tightness of the joints is, at the same time, met by the overlap of the bricks in the joint, not extending, as with the known channel brick types or slab constructions, to the thickness of one wall only, and the depth of the joint being at the least equal the thickness of channel brick, i. e. the thickness of two walls plus the shorter width of the intervening channel. Owing to the truncated ends of the brick, the joint will be still longer and of a tortuous line. Furthermore the coped ends of the hexagonal bricks to be joined in the joint have at both ends alternated rectangular lugs disposed in the longitudinal axis of the brick, so that the joints form a zig-zag line. These rectangular lugs, besides have the advantage, of affording a horizontal bearing surface and thereby simplifying the laying of the bricks, whereas the oblique surfaces would cause a lateral pressing away of the bricks standing on edge by those placed over and across them.

In building recuperators of the kind described, the joints in the air ducts between the individual bricks and between such bricks and the branching off bricks cause much difficulty. A large number of shaped bricks of essentially different outside dimensions are required, which it is difficult to embody in the structure. The building of this part of the recuperator requires a most careful supervision. The necessity of transporting and assorting the numerous bricks increases the danger of breakage.

One missing brick may considerably delay the erection. Also here the present invention will facilitate the building of the recuperator, as the tops of the recuperators are constructed of channel bricks of the same cross section as the ducts, with the only difference that these bricks, in order to make a straight run of the gas flues possible, for connecting the air ducts to the leading in and leading out conduits or for connecting them the one to the other, are closed at one end and are formed with recesses either on one or both sides at the ends intended for bonding. Thus for the construction of the ends of the recuperators, apart from the outer covering which may be carried out in any manner, only two kinds of bricks are required, all of which, however, have the same external shape as the channel bricks of the flues. A direct advantage of this construction lies in the simplified manufacture of the recuperator bricks, as the number of the shapes is reduced to a minimum. Furthermore the construction of the ends is carried out in a much shorter time than was possible heretofore. Especially all intermediate bricks required heretofore are dispensed with, which were required in groups for dividing the air flues. The connection of the air flues is thus no longer effected by leaving away intermediate bricks but solely by exclusively air duct bricks being employed of the same outline as the other bricks, only with the difference that the former have recesses at given points.

The drawing shows a constructional form of the recuperator according to the present invention by way of example. Fig. 1 is a longitudinal section. Fig. 2 is a cross section according to line 2—2 in Fig. 1. Figs. 3—9 show the construction for connecting the air ducts. Fig. 3 being a cross section on the line 3—3 in Fig. 5, Fig. 4 a cross section on the line 4—4 in Fig. 5, and Fig. 5 a vertical section on the line 5—5 in Fig. 4. Fig. 6 is a horizontal section on the lines 6^a—6^a, 6^b—6^b in Fig. 5, Fig. 7 vertical section on the line 7—7 in Fig. 3, and 4, respectively, Fig. 8 is a section on the line 8—8 in Fig. 5 and Fig. 9 is a section on the line 9—9 in Fig. 7.

As particularly shown in Fig. 2, the whole recuperator is built up out of the air channel bricks a, so that the gas ducts g are formed by laying and standing the bricks. A specially formed brick b has the object of completing the bottoms, tops and sides of the recuperator so as to form plane surface. It may be seen from the longitudinal section Fig. 1, that the whole of the recuperator can be built up out of the air channel bricks a. If it should appear preferable to give the gas ducts g a rectangular section instead of a square one, two different kinds of air duct bricks of different height are employed. The gas ducts g and the air ducts l may, of course be equally well disposed vertically as horizontally.

In the exemplification shown in Figs. 3–9 the air ducts l, l' surrounding the gas ducts are at their heads joined in such a manner, that only the horizontal ducts l' and the vertical ducts l, respectively, communicate with each other, as may be particularly seen from Figs. 6 and 7. Such differentiation may, however, also be dispensed with. For building the connections containing the respective communications for the air ducts l and l' specially formed bricks a' and a^2 are used, which have the same cross section as the duct bricks a, employed for building the horizontal and vertical air ducts l and l' respectively. In other words the bricks a' and a^2 have likewise bevel bonding joint surfaces, and thereon supporting lugs. The difference between the bricks a' between each other and compared to the bricks a consists therein that the bricks a' have besides a front side, recesses on both sides at the pointed ends, where the oblique joints and lugs are, so that the air in the leading in and the leading out conduits, and at the other end of the recuperator at the places where the air is reversed can distribute itself over all the air ducts l and l', respectively, grouped in clusters.

The channel bricks a' are used both for connecting the vertical air flues l and the horizontal air flues l', as may be seen from Figs. 3 and 4. At the places, where one cluster of flues is to be closed against the other, bricks a^2 are used, which are recessed only at one of their pointed ends. Both kinds of bricks a' and a^2 are closed at one front end, so that the necessary closing relatively to the waste gas ducts and of the flues l and l', relative to one another is obtained. At the places where the connecting ducts are carried through it is necessary to build in bricks a, which are similar to those forming the flues and in which the lugs are recessed. This, however, does not necessitate any special shapes of bricks.

For obtaining a greater tightness of the diagonal joints these are preferably made stepped, as may be seen from the drawing.

I claim:

1. A recuperator with air ducts, running parallel to the gas ducts, built up of bricks with a flattened rectangular channel, said bricks having a cross section of hexagonal shape with two opposite and parallel longer sides and four equal shorter sides, the said bricks forming with their longer sides the gas ducts, each of which being surrounded on all four sides by the channels in said bricks, which form with their shorter sides of the hexagonal cross section pointed ends,

that four of such bricks may be placed together to form the brick work structure.

2. A recuperator with air ducts, running parallel to the gas ducts, built up of bricks with a flattened rectangular channel, said bricks having a cross section of hexagonal shape with two opposite and parallel longer sides and four equal shorter sides, the said bricks forming with their longer sides the gas ducts, each of which being surrounded on all four sides by the channels in said bricks, which form with their shorter sides of the hexagonal cross section pointed ends, that four of such bricks may be placed together to form the brick work structure, said bricks being provided on their pointed ends with four cornered lugs disposed sideways to the longitudinal axis and alternating relatively to each other.

3. A recuperator with air ducts, running parallel to the gas ducts, built up of bricks with a flattened rectangular channel, said bricks having a cross section of hexagonal shape with two opposite and parallel longer sides and four equal shorter sides, the said bricks forming with their longer sides the gas ducts, each of which being surrounded on all four sides by the channels in said bricks, which form with their shorter sides of the hexagonal cross section pointed ends, that four of such bricks may be placed together to form the brick work structure, said bricks being provided on their pointed ends with four cornered lugs disposed sideways to the longitudinal axis and alternating relatively to each other, the heads of the recuperator being composed of channel bricks of the same cross section as those forming the air ducts, but closed at one end, and the connection of the air ducts between each other and to the leading in and leading out conduits being produced by recesses on the sides of the bonding of said bricks.

In testimony whereof I affix my signature in presence of two witnesses.

HEINRICH HECKER.

Witnesses:
EUGEN GODFREY,
ALBERT ZUSSE.