April 12, 1927. 1,624,128

W. O. AMSLER

RECUPERATOR

Filed Sept. 27, 1922 2 Sheets-Sheet 1

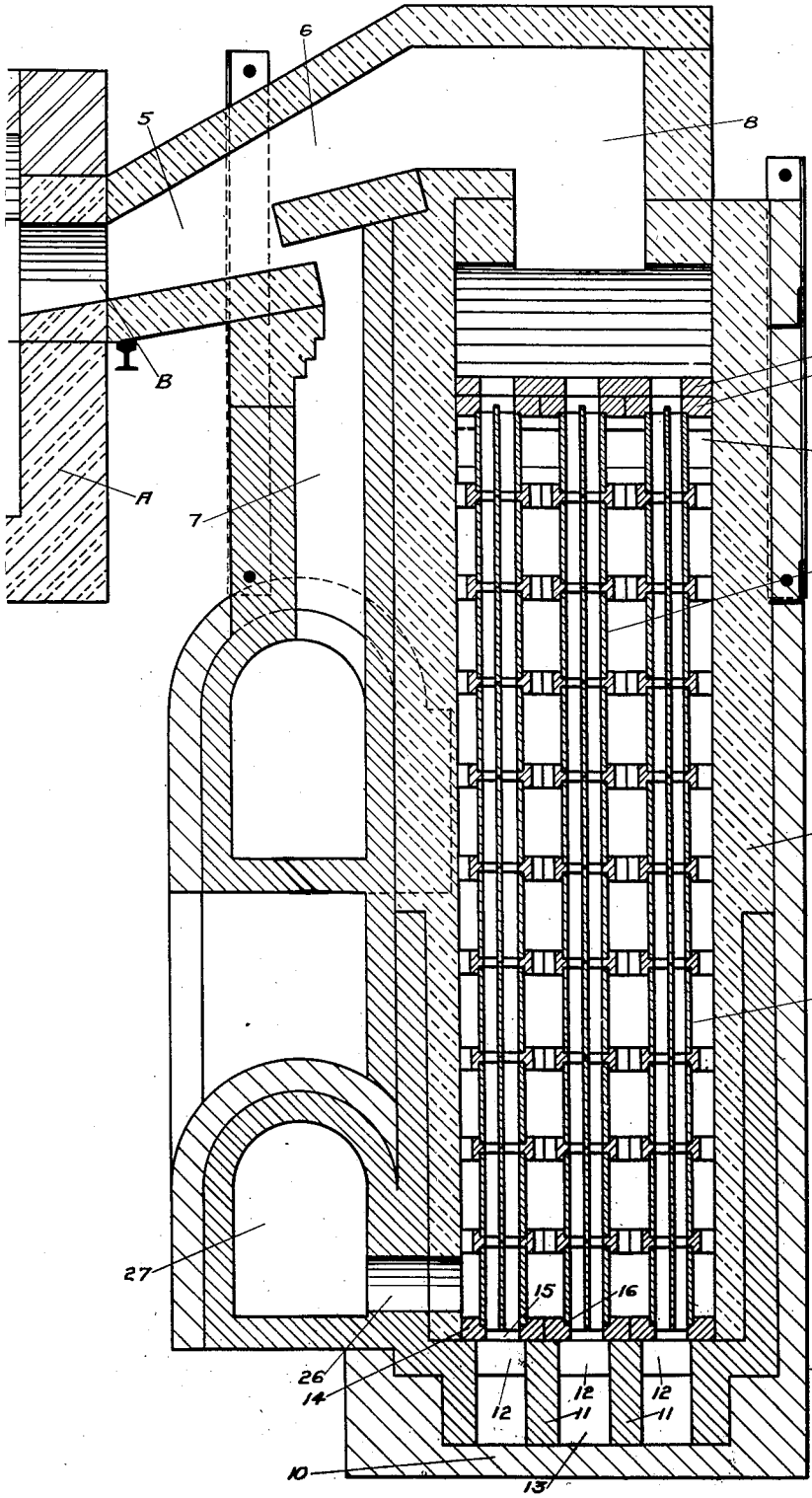


FIG. 1

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Filed Sept. 27, 1922 2 Sheets-Sheet 2

FIG. 2

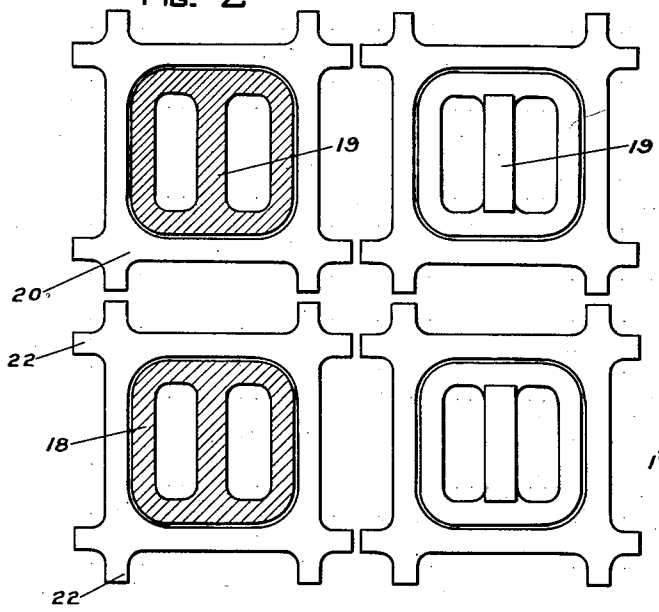


FIG. 4

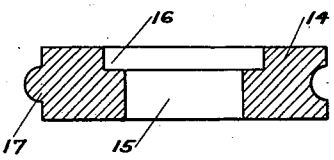


FIG. 5

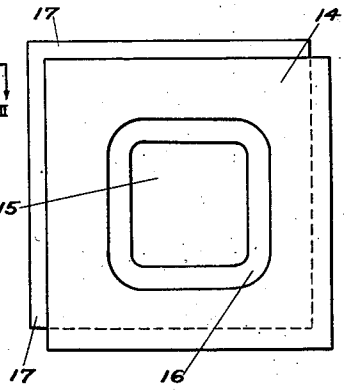
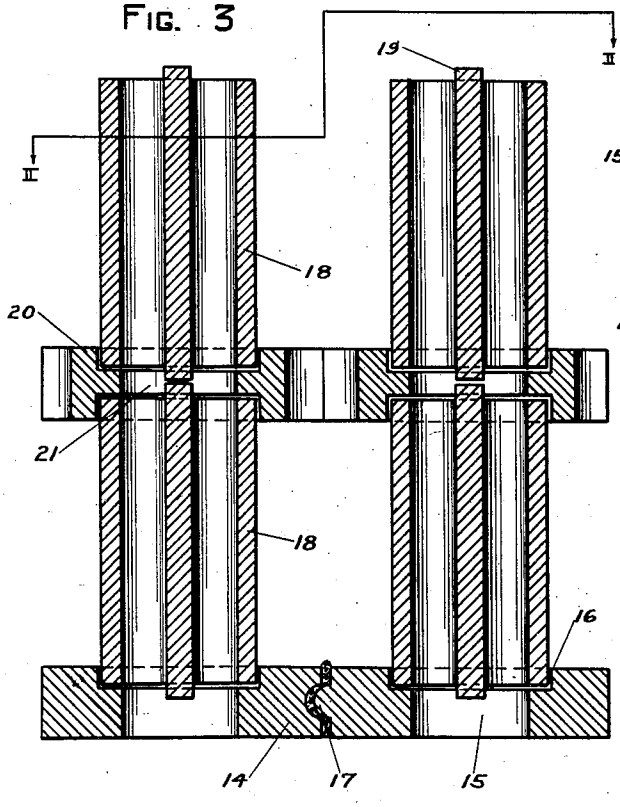


FIG. 3



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UNITED STATES PATENT OFFICE.

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RECUPERATOR.

Application filed September 27, 1922. Serial No. 590,980.

This invention is for a recuperative furnace, and relates particularly to an improved recuperator and tiles for use in the same.

In recuperative furnaces, the waste gases are passed from the furnace around pipes, through which air being supplied to the burner passes, whereby the air is heated prior to combustion. It is customary in recuperators to provide passages around the air pipes through which the waste gases pass, so that the gases follow a given path, rather than circulate around those pipes which most need the heat. The air pipes are generally disposed vertically and the waste gas passages are horizontal, with vertical connections to provide a somewhat sinuous path of travel for the gases.

With such an arrangement, some of the pipes are heated a great deal more intensely than others. The most highly heated pipes induce the greatest flow of air. As a greater flow of air means a higher velocity, the air is less thoroughly heated, but the cooling effect is great, so that heat is absorbed as rapidly as it is supplied, and less heat reaches the other pipes.

The present invention has for one of its objects the provision of a recuperator in which the gases have a more or less free circulation around the pipes. With this arrangement, if one pipe tends to become hotter than the others, laws of convection divert their flow to cooler parts of the chamber through which they pass. Consequently, other pipes become heated, while that which was receiving most heat is cooled by the greater volume of air induced through it. I therefore obtain a stabilized condition, which maintains a substantially constant flow through each pipe, with a corresponding even distribution of heat, resulting in an even heating of the air with a maximum absorption of heat from the waste gases.

Further objects of my invention are to provide an improved tile structure forming the interior of the recuperator.

The invention may be readily understood by reference to the accompanying drawings, in which:

Fig. 1 represents a vertical section through a recuperator embodying my invention and a portion of a furnace;

Fig. 2 is a transverse section across a portion of the recuperator, the tiles being shown on a larger scale and slightly separated, for purposes of illustration, the section being taken in the plane of line II—II of Fig. 3;

Fig. 3 is a vertical section, on a larger scale, of a portion of the recuperator;

Fig. 4 is a transverse section across one of the bottom tiles; and

Fig. 5 is a top view of one of the bottom tiles.

In the drawings, A indicates a furnace into which burner B communicates. The burner is of any well known or preferred construction, and includes a mixer passage 5 into which air passage 6 and gas passage 7 lead.

The air passage 6 leads to a chamber 8 in the top of a recuperator structure C. This structure includes refractory vertical walls 9 enclosing a chamber of suitable dimensions, and having a bottom wall 10. The bottom part of the chamber enclosed by these walls is divided by partitions 11, between which are air passages 12 leading from a conduit 13.

At the top of vertical walls 11, and partially supported thereby, is a horizontal partition comprised of suitable blocks or tiles 14, preferably square, of refractory material, as shown in Figs. 4 and 5. Each block 14 has a central opening 15 which is preferably substantially square, and around the hole in the top face of the block is a recessed shoulder 16. The blocks preferably have a rib or tongue 17 on two sides thereof, and a correspondingly shaped groove on the other two sides thereof. The tongue on one block extends into the groove of an adjacent one, to provide a seal. The hole 15 of each block is positioned over an air passage 12.

Set on the recessed shoulder 16 of each block, is a relatively short length of hollow pipe, block, or tile 18 of refractory material, having a cross sectional shape similar to that of the shoulder, and adapted to fit snugly in the recess, as clearly shown in Fig. 3. If desired, refractory cement may be used to insure a tight joint. Each block 18 preferably has a transverse web 19 extending throughout the length thereof, and which is preferably a little longer than the pipe.

Resting on the top of each block or pipe 18, is a horizontal spacing and joining block or tile 20. Each block 20 has an opening 21

therethrough, of the same size as the opening in blocks 14 and the passage in pipes 18. In each face of the tiles 20, concentric with the opening, is a recess, into which the ends of tiles 18 snugly fit to form a tight joint, pipes 18 also being placed above and supported on blocks 20.

The blocks 20 are provided with lateral projections 22, preferably extending outwardly from each corner of the block. The projections abut against one another and against the side walls of the recuperator, to keep the pipes in proper spaced relation.

The interior of the chamber is thus built up of sections of pipe 18, held in position in spacing blocks 20 until the pipes are of sufficient length. At the upper part of enclosure is a partition 24 formed of blocks 14 similar to those at the bottom of the pipes, and above this is a brick wall 25, to ensure sufficient strength and sealing of the gases. This partition separates the recuperator chamber from chamber 8, with which the vertical air pipes communicate.

The projections 22 on blocks 20 keep the blocks spaced apart so that gases are free to circulate around the pipes and through the chamber, following no specified path of travel. An important advantage of this construction is that the exterior of the pipes are exposed to heat on all sides. The central web 19 in each pipe, being longer than the pipe, contacts at each end with the web of the pipe above and below it to assume the weight of the pipe, and thereby relieve the heated outer walls of the pipe of much of this load.

In operation, hot waste gases are drawn from the furnace through passages not shown, but in a manner well understood in the art, and introduced into the recuperator through a passage 28 just below partition 24. The hot gases pass downwardly around pipes 18 and between blocks 20 to the lower part of the recuperator, where they escape through passage 26 into chimney flue 27.

As the gases have a relatively open chamber in which to circulate around the pipes, and are not confined to a definite limited path, they are free to always flow toward the coolest part of the recuperator. Consequently, if one part of the chamber tends to become hotter than the other, inducing an unequal flow of air upwardly through the pipes, the gases will naturally flow toward the cooler part of the chamber, thereby assuring an even distribution of heat and an even heating of the air.

The shape of the tiles is such that they can be easily and cheaply molded and easily installed. The tiles might be used in other air heating devices than recuperators and are adapted for different constructions of furnaces other than that specifically illustrated.

I claim as my invention:

1. A recuperator comprising a vertical chamber having a plurality of vertical refractory pipes extending therethrough, means for introducing hot gases at the top of the chamber, means for withdrawing gases from the bottom thereof, said chamber being relatively open whereby the gases may freely circulate about the pipes and flow down through the chamber to effect an even distribution of heat.

2. A recuperator comprising a chamber enclosed in vertical walls, a pluraity of pipes extending longitudinally through the chamber and comprised of relatively short sections of hollow tile, transversely disposed centrally apertured blocks interposed between ends of each section having recesses therein into which the pipe sections fit, and spacing means on some of the blocks for holding them in position and providing intervening openings to allow gases to circulate between the blocks.

3. A recuperator comprising a chamber enclosed in vertical walls, a plurality of pipes extending longitudinally through the chamber and comprised of reatively short sections of hollow tile, blocks interposed between ends of each section having openings therethrough in alinement with the openings through the hollow tiles, said blocks serving to keep the pipe sections spaced on all sides from one another, and means on some of the blocks providing passageways for allowing gases to circulate longitudinally through the chamber around the pipes and between the blocks.

4. A recuperator comprising a chamber, a plurality of pipes extending longitudinally therethrough, said pipes being comprised of a plurality of relatively short lengths of hollow tile placed end to end, blocks having openings therethrough in alinement with the passages through the hollow tiles interposed between the ends of the hollow blocks, and providing a series of transverse spacing walls for maintaining the pipes in spaced relation on all sides from adjacent pipes, means on said blocks whereby passages are formed in the transverse walls to allow the free circulation of gases longitudinally therethrough, and inlet and outlet means through which hot waste gases may be introduced and removed.

5. In a recuperator, a chamber, a plurality of longitudinally extending refractory pipes for air disposed in the chamber, means for introducing heating gases to and discharging same from the chamber, said chamber being relatively open to permit a free circulation of the gases in a longitudinal direction throughout the chamber and around said pipes.

In testimony whereof I affix my signature.

WALTER O. AMSLER.