Nov. 18, 1930. A. F. HALL 1,781,780

REFRACTORY STRUCTURE

Original Filed Sept. 27, 1928

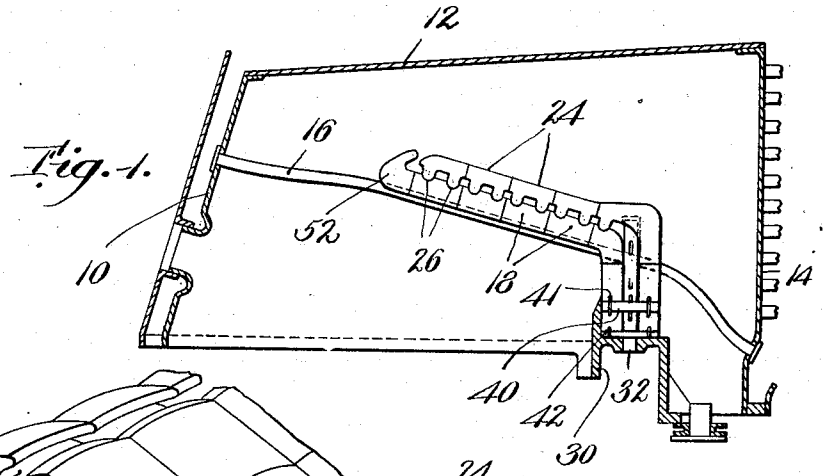


Fig. 1.

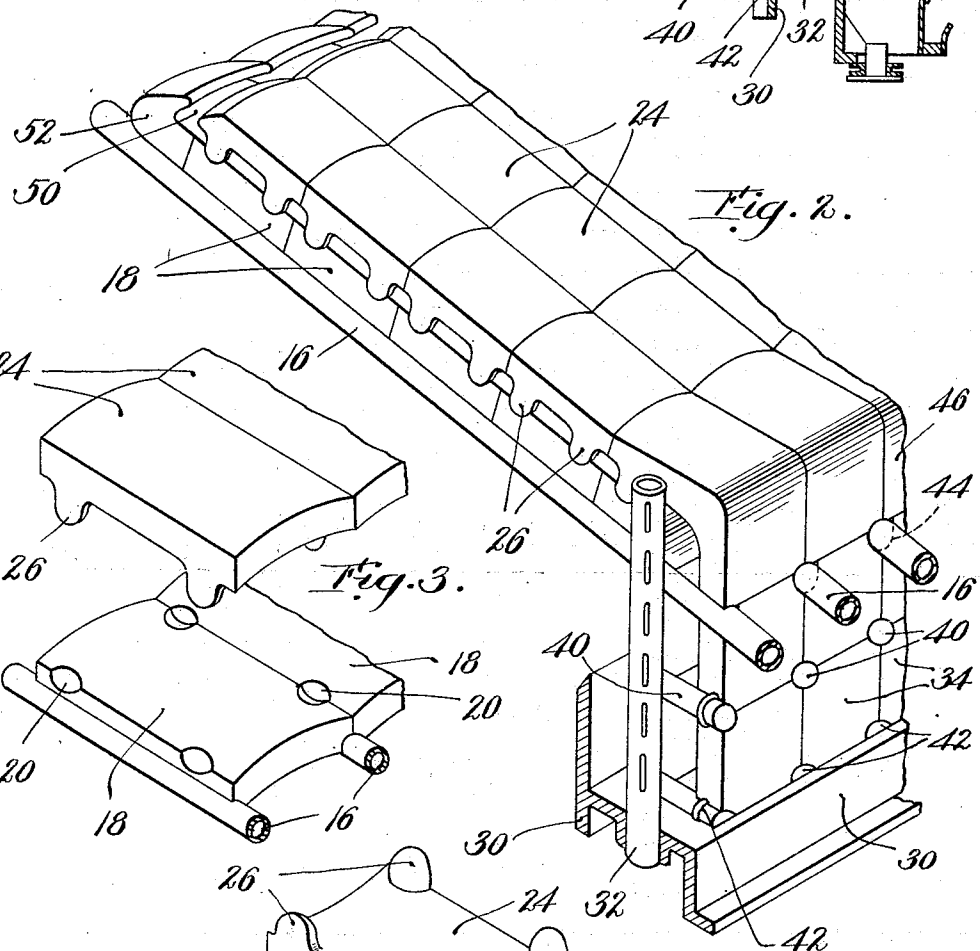


Fig. 2.

Fig. 3.

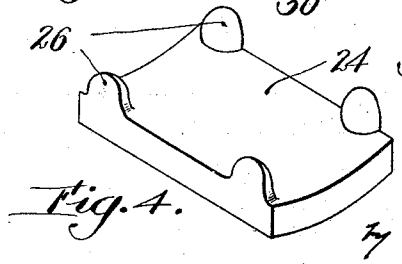


Fig. 4.

Inventor.

Arthur F. Hall.

by H. W. Kenway Atty

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UNITED STATES PATENT OFFICE

ARTHUR F. HALL, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO HALL ARCH COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF DELAWARE

REFRACTORY STRUCTURE

Application filed September 27, 1928, Serial No. 308,607. Renewed April 10, 1930.

This invention relates to refractory structures for use in furnaces. In one aspect it consists in an improved sectional furnace wall of the type wherein an air space is provided for the double purpose of preheating air for combustion and cooling the inner or fire wall section. As such, the invention may be applied with advantage to furnaces of all different types. In another aspect, the invention consists in an improved refractory wall and arch for use particularly in locomotive furnaces.

In my prior application Serial No. 298,835, filed August 10, 1928, I have disclosed a refractory furnace wall, the sections whereof are connected by spacer bars having ribbed ends which are interlocked with the wall sections. In still another aspect, the present invention consists in a carrying forward or further development of that construction by which certain additional advantages are secured.

In my prior application above identified, I have disclosed an arch of which the sections are separated by a plurality of spacer struts or bars formed distinct from the block units of the arch and assembled so as to support the upper tier or section of the arch. In accordance with the present invention, I contemplate incorporating the spacer members as integral parts of the block units, thereby eliminating spacer struts as separate elements of the combination. To this end, an important feature of the invention consists in a sectional arch in which one tier has a plurality of integral spacer lugs and the other tier has a correspondingly arranged plurality of sockets which receive the free end of the spacer lugs and anchor them in position. As herein shown, the spacer lugs constitute an integral part of the block units of the upper tier of the arch. These are preferably arranged at the edge of the block unit and of complementary shape so that when two block units are assembled they form between them a complete spacer lug of curved cross section. Similarly, the block units of the lower tier or section are provided in their upper edges with recesses which register in the assembled structure and form curved sockets of the proper shape and in the proper location to receive the ends of the spacer lugs projecting from the block units of the upper section.

My invention also includes within its scope individual block units having the novel characteristics of those herein shown as forming the component parts of the sectional arch.

The use of integral spacer lugs has not heretofore been attempted in a locomotive arch and such construction possesses decided advantages from the standpoint of convenience in handling and assembling the block units in constructing the arch. Moreover, locating the spacer lugs at the edges of the block units and making them of complementary shape permits the lugs to be designed in dimensions most favorable from the manufacturing standpoint.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof, selected for purposes of illustration and shown in the accompanying drawings, in which

Fig. 1 is a view in longitudinal section of a locomotive furnace equipped with the refractory structure of my invention;

Fig. 2 is a view in perspective, partly in section, of the arch and arch wall;

Fig. 3 is a view in perspective, on an enlarged scale, of a portion of the arch; and

Fig. 4 is a view in perspective of one of the units of the upper arch section in inverted position.

The locomotive furnace shown in Fig. 1 may be of any commercial type and comprises the rear sheet 10, the crown sheet 12 and the flue sheet 14 which, with the grate, define the fire box of the locomotive. A series of arch supporting tubes 16 extend forwardly at a downward inclination from the rear sheet 10 to the flue sheet 14. The arch tubes are shown as bent to enter the rear sheet and the flue sheet at substantially right angles. Water flows from the front to the rear water leg of the boiler through the arch tubes and thus protects them from burning. The arch extends from one side to the other of the furnace, resting on the tubes 16, and

in the construction shown rests at its rear end upon a vertical arch wall. At the forward end of the grate is a transverse supporting channel beam 30 disposed in inverted position and constituting a support for the arch wall. Securely set in the web of the beam 30 is a series of vertical pipes 32 which are arranged in spaced relation and constitute anchoring means for the arch wall. As shown in Fig. 2, the pipes open freely through the beam 30 and their lower ends thus form inlet openings for air which is discharged through holes in the walls of the pipes into the air space of the arch wall and into the air passage of the arch, as will presently appear.

The arch wall is constructed of block units 34 which are generally rectangular in shape but provided at each corner with a recess of curved contour and substantially quadrant-shaped. In the assembled structure, therefore, the recesses form circular sockets with cylindrical walls. Except in the upper tier of block units, each recess is provided with a circumferential groove which, in the assembled structure, forms with adjacent block units an annular ring in the socket.

The inner and outer sections of the arch wall are laid in tiers of block units 34 disposed at either side of the anchor pipes 32 and as each tier is laid it is connected to the corresponding tier of the other section by interlocking spacer bars 40 and 42. The spacer bars 42 are semi-cylindrical in shape and are placed with their flat side upon the surface of the channel bar 30. They, therefore, fill the semi-cylindrical sockets formed at the lower adjacent corners of the block units 34 with their projecting ribs seated in the grooves of the sockets. The spacer bars 40 are circular in cross section and provided with projecting ribs 41. These fill the cylindrical sockets formed at the corners of four adjacent block units 34 with their projecting ribs 41 interlocked in the grooves of the sockets.

The second tier of block units 34 is provided with slightly larger curved recesses 44 which, in the assembled wall, constitute passages for the supporting tubes 16. The unit blocks 46 of the uppermost tier of the arch wall are angular in shape, having a vertical portion which completes the vertical wall and an inclined portion which merges into the arch itself. The lower corners of the block units 46 are provided with a shallow grooved notch to fit the upper side of the supporting tubes. The individual block units of the wall are locked together by a tongue and groove connection, as shown in Fig. 2.

As a general thing, the block units 34 forming the sections of the arch wall will be made of a high grade fire clay although any highly refractory material, such as carborundum or alundum, may be used if desired or the fire clay may be provided with a facing of such material. The spacer bars may be of the same material as the block units or of different material; for example, satisfactory results have been secured by employing block units of fire clay and spacer bars of alundum.

The block units of the two wall sections are similar in shape and size although it may be desirable in some cases to reduce the thickness of the block units of the fire wall section if alundum or carborundum is used in this location. The dimensions of the block units are determined with particular reference to the type of installation and the size of the furnace for which the block units are intended.

The lower section of the arch is formed by block units 18, best shown in Fig. 3. These are slightly curved or arched and have plane faces except for the shallow recesses 20 which are formed in each of the upper longitudinal edges of the block unit. The lower longitudinal edges are given a concave bevel for the purpose of fitting the supporting tubes 16. The block units 18 of the lower arch section are assembled upon the arch tubes 16, extending from one side of the furnace to the other, and abut directly at their adjoining edges. The recesses 20 are substantially semi-circular in cross section and have a concave bottom. They are spaced a short distance from the end of the block unit and when two units are assembled in the arch the recesses register and form sockets of circular contour and having a concave bottom.

The upper section of the arch comprises the block units 24 which are similar in size and shape to those of the lower section and are provided with downwardly projecting spacer members. These comprise integral lugs 26 located at the longitudinal edges of the block unit and spaced in from either end thereof. The lugs 26 are semi-cylindrical in cross section and their flat outer face is flush with the longitudinal edge face of the block unit. The outer ends of the lugs 26 are curved convexly so as to fit the concave bottom of the recesses 20. It will be seen that the lugs 26 are complementary in shape and that when adjacent block units are assembled, the flat faces of the lugs register and each pair of lugs thereupon forms spacer members of circular section and with a convexly curved end. In the assembled arch, the spacer lugs 26 support the upper tier or section of the arch, leaving an air space between it and the lower section. The block units 24 abut directly at their adjacent edges and may be covered or not, as desired, by a thin coating of cement.

At the rear end of the arch is provided an elongated outlet opening 50 by which air which is passed into the pipes 32 and through

the arch is delivered into the combustion space of the furnace. To this end, the lower section of the arch is provided with a terminal row of special block units 52 which extend beyond the block units 24 of the upper section and are provided with a curved upwardly-extending flange. This serves to direct the air upwardly and forwardly so that hot fresh air is supplied at a point in the combustion space where a deficiency of oxygen usually exists.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A refractory furnace structure comprising a flat support, a plurality of semi-cylindrical spacer bars arranged flat side down upon said support and having a rib near each end, and inner and outer wall sections having curved recesses in their lower surfaces with grooves to fit the ribs of the spacer bars.

2. A locomotive arch wall comprising inner and outer sections of rectangular block units, certain block units having circular recesses at their adjacent corners for the reception of supporting tubes, and a plurality of cylindrical spacer bars having circumferential ribs at either end which are interlocked with said sections.

3. In a locomotive furnace, a sectional arch comprising a tier of supported block units and a tier separated by an air space therefrom, one of said tiers comprising block units having integral projecting lugs each having a flat side and a curved side and being assembled so that the lugs register with their flat sides in contact, and the other tier comprising block units each having a recess in its face at the edge thereof and being assembled so that the recesses register and form sockets to receive the lugs.

4. In a locomotive furnace, a sectional arch comprising a tier of supported block units each having semicircular recesses in its edges and being assembled so that said recesses form circular sockets, and a second tier of block units each having integral semicircular spacing lugs and being assembled so that said lugs are oppositely disposed and form curved members to fit in said circular sockets.

5. In a locomotive furnace, a sectional arch comprising a tier of supported block units each having in its upper edges semi-circular recesses and being assembled so that said recesses form circular sockets spaced throughout the area of the tier, and a second tier of block units each having integral downwardly extending spacing lugs of complementary shape and being assembled so that said lugs register and fit in said circular sockets.

6. In a locomotive furnace, a sectional arch block unit of rectangular shape having curved tube supporting grooves in its lower longitudinal edges and semi-circular recesses with concave bottoms in its upper longitudinal edges spaced from each end of the block unit.

7. In a locomotive furnace, a block unit for a sectional arch, having a substantially rectangular body with semi-circular recesses in its upper longitudinal edges, each recess having a concave bottom and being spaced from the end of the block unit.

8. In a locomotive furnace, a block unit for a sectional arch, having a substantially rectangular body with integral semi-circular spacing lugs projecting from its lower longitudinal edges, each lug having a convex end and being spaced within the ends of the block unit.

9. A block unit for use in a sectional locomotive arch, having a substantially rectangular body portion with lugs of convex cross section projecting from its lower surface at opposite sides thereof, each lug having its outer face plane and flush with the edge of the block unit and its inner face curved, whereby two block units may be assembled with oppositely disposed lugs registering to form complete curved spacing lugs between them.

10. In a locomotive furnace, a sectional arch comprising a tier of supported block units and a second tier of block units spaced above the first, each of the block units in one tier having curved recesses in its edges and being assembled in the tier with others so that adjacent recesses register and form circular sockets, and each of the block units in the other tier having integral projecting lugs substantially semi-circular in cross section and being assembled in the tier with others so that adjacent lugs register and form curved spacing members shaped to fit in said circular sockets, thereby locating one block unit above the other.

ARTHUR F. HALL.