

July 1, 1930.

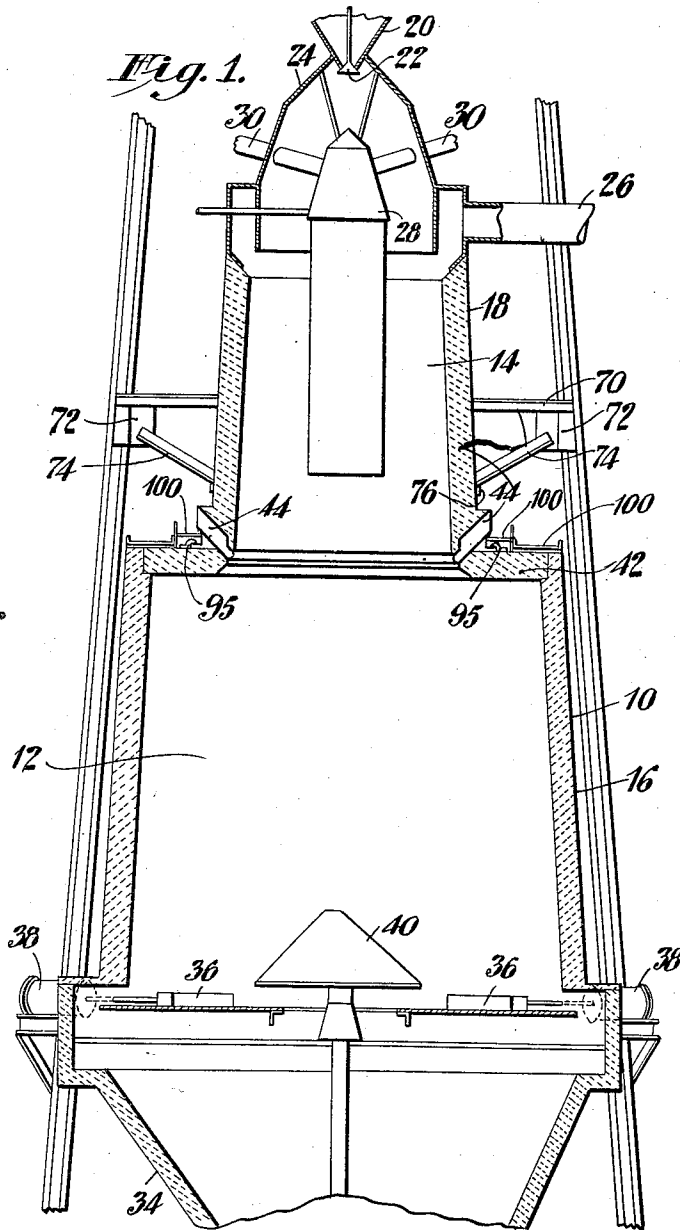
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1,769,894

FURNACE ARCH CONSTRUCTION

Filed June 18, 1926

2 Sheets-Sheet 1



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Fig. 2.

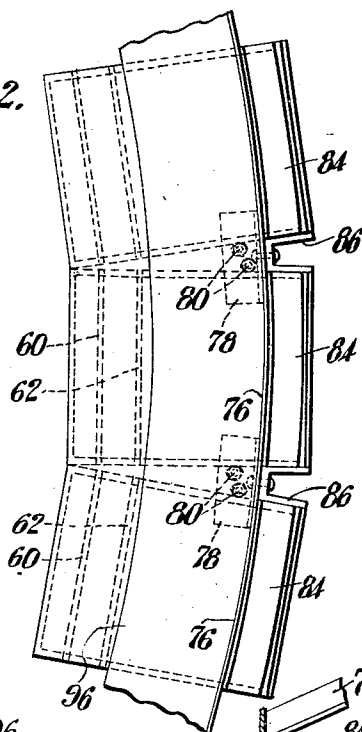


Fig. 3.

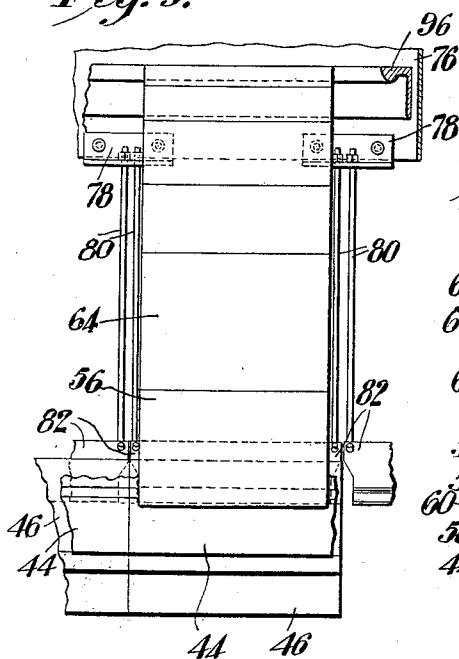
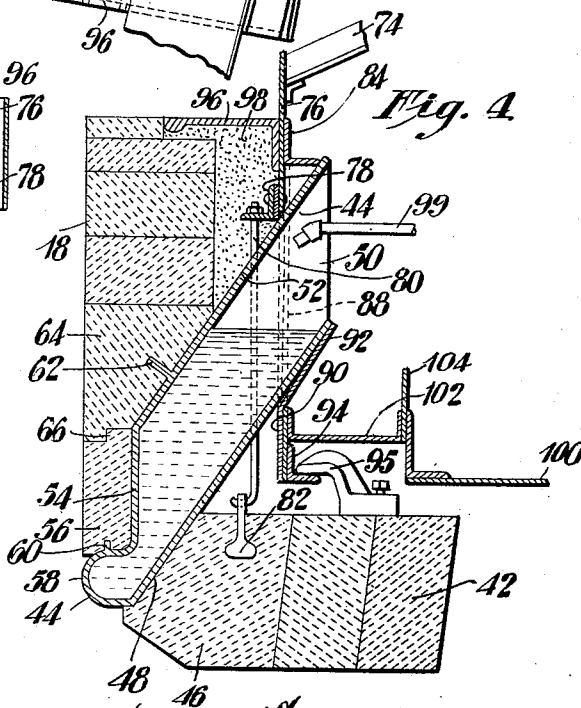


Fig. 4.



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FURNACE-ARCH CONSTRUCTION

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The present invention relates to the linings of a shaft type furnace or gas generator.

A type of shaft furnace or gas generator is known having vertical co-axial zones of different diameters one above the other, the zones of larger diameter being below those of smaller diameter or section, adjacent zones being connected by arches commonly made as flat as possible. In the operation of gas generators of the type just mentioned, a great deal of difficulty has been caused by the rapid deterioration of the materials at the corners of the flat arches and the lower face of the upper cylindrical sections of smaller diameter or horizontal cross-section.

One of the objects of the present invention is to avoid the difficulties and expenses flowing from the rapid deterioration of the lining adjacent a flat arch.

A second object of the present invention is to provide an arrangement whereby key blocks at the intersections of flat arches and cylindrical zone walls of gas generator or furnaces may be removed through the exterior of the structure and without taking down the cylindrical walls or the flat arches.

Another object of the present invention is to provide an arrangement whereby keying means at the intersections of flat arches and vertical zone walls may be made in sections and removable for replacement without stopping the gas generator or furnace.

Further objects and advantages of the present invention will be apparent to those skilled in the art from the following description taken in connection with the accompanying drawing in which

Fig. 1 is a central vertical section through a shaft furnace or gas generator having sections of different diameters one above the other, and illustrating an arch construction embodying the preferred form of the invention.

Fig. 2 is a detail in plan of a portion of a furnace or generator and showing several adjacent water cooled metal key blocks embodying the present invention as arranged in position for use, the brick-work being removed for purposes of illustration.

Fig. 3 is a detail elevation of a metal key

block construction of Fig. 1 looking outward from inside the generator; and

Fig. 4 is a central vertical section through the flat arch construction illustrated in Fig. 3.

In the drawing, 10 indicates as a whole a gas generator of the shaft type having a lower section or heat zone 12 of relatively large diameter or horizontal cross-section and an upper section or carbonizing zone 14 of relatively small diameter or cross-section. The zones 12 and 14 are surrounded by outer masonry walls or shells 16 and 18 respectively which may be of cylindrical form as illustrated, but the construction of which in general forms no part of the present invention. As illustrated, moreover, the generator 10 is provided at the upper end of the zone 14 with a hollow inlet cone 20 for feeding the coal or other fuel into the generator, the lower end of the cone 20 being controlled by a valve 22 or the like so as to cut off or admit to the generator 10 coal or other fuel coming down through the hollow cone. A hollow hood 24 is mounted at the upper end of the zone 14 which is provided with an outlet pipe 26 through which gas may be taken off. Within the hood 24, moreover, is suspended a smaller auxiliary gas discharging hood 28 reaching down within the body to the zone 14 and having gas discharging pipes 30, connected therinto near its upper end.

At the lower end of zone 12 is a hollow discharging cone 34 through which ashes or coke may pass downwardly out of the apparatus. At the upper end of the cone 34 adjacent its connection with the section 16 are placed power operated rams or pushers 36, 36, operated by cylinders 38, as well as a rotating agitation cone 40 located near the central vertical axis of the apparatus for maintaining coke or similar material in a somewhat loosened condition whereby the operation of the pushers 36, 36, in urging the coke or other substances into the discharge cone 34 is facilitated. The above described relates only to a typical structure in which the present invention may be embodied.

The junction between the upper end of wall 16 and the lower end of wall 18 is formed largely by a flat arch 42 which ex-

tends inwardly from the upper edge of wall 16 to the lower end or edge of wall 18. The flat arch 42 and wall 18 meet along a conical surface lying substantially at an angle of 45° to the horizontal.

While it has been attempted to operate shells or gas generators of the type above described having flat arches contacting directly with the lower ends of the walls of superimposed smaller zones of the generator, it has been found that deterioration of the refractory at the angle formed between an arch and the wall immediately above it has been rapid and that the expense of maintaining such structures has been very high. Moreover, the time taken out of the operation of the generator for repairs on account of the trouble just mentioned has been relatively high.

According to the present invention there are placed between the flat arch 42 and the upper wall 18, a course or series of hollow water cooled metal key blocks 44, 44. The bricks or blocks 46, 46, forming the inner course of the flat arch 42, Fig. 4, are bevelled so that when in place their upper faces form a conical surface 48 inclined to the horizontal preferably at an angle of about 45° while the lower sides of blocks 44 contact with bricks 46 along the surface 48. The blocks 44 are hollow, opening to the atmosphere when in place through mouths 50 having edges lying in vertical planes. The upper surface or side 52 of blocks 44 lies parallel to the surface 48, the wall 52 being mounted in the furnace lining at substantially 45° to the horizontal. When the blocks 44 are in place they extend downwardly and inwardly from the outside of shell 18 to a point not far removed from the inner surface of the wall 18 at its lower end. Wall 52 of each block 44 connects with a vertical wall 54 the lower end of which is approximately on the same level with the lower edge of the bricks 56 forming the lower course of the wall 18. Each of the blocks 44 has a hollow half round projection or bulb 58, which connects with the lower edges of the wall 54. Each of the hollow key blocks 44 is provided with two outwardly projecting fins 60 and 62 respectively. Fins 60 are fixed to bulbs 58 in a substantially vertical position and are arranged to enter recesses formed in bricks 56 in the lower course of the wall 18. Similarly the fins 62 project outwardly from the surface of the wall 52 and into complementary recesses in the bricks 64 forming the next to the lowest course of the wall 18. The fins 62 project at right angles to the walls 52 on which they are fixed lying at an angle of about 30° to the horizontal. They prevent any tendency of bricks 64 to move inwardly into the interior of the furnace or generator 10 and also resist the tendency of the bricks 64 to slide downwardly along the inclined outer faces of

the walls 52. It will be seen moreover that the lower edges of bricks 64 and the upper edges of bricks 56 are rabbeted together as indicated at 66, the inner edge of the bricks 64 coming below the outer edge of the bricks 56 along the line 66 whereby bricks 64 hold the upper ends of bricks 56 in position on the inner face of the blocks 44 along the walls 54.

The generator or shell 10 is surrounded by a steel frame-work 70 one purpose of which is to support a charging platform from which fuel may be introduced into the cone 20. However, according to the present invention, the frame-work 70, Fig. 1, is employed to assist in the support of the blocks 44 and certain courses of the arch 42 thereby assisting in the support of the section 18. The frame-work 70 moreover comprises means resisting lateral displacement of certain of the bricks in the section 18 thereby further assisting the masonry of the generator 10 to retain its position when in use. The connections between the generator 10 and the frame-work 70 just referred to includes brackets 72, to which are secured the outer and upper ends of inwardly and downwardly inclined steel beams or struts 74, 74 the lower and inner ends of which are secured to a circular metal band 76, Figs. 3 and 4, surrounding the lower portion of shell 18 adjacent the upper and outer ends of the blocks 44. The lower edge of band 76 has fixed thereto several short angle plates 78, 78, the horizontal flanges of which project inwardly from the band 76. Connected to and running downwardly from the horizontal flanges of the plates 78 are hooks 80, 80, the lower ends of which hook into the vertical webs of inverted T-shaped metal blocks 82, 82, inserted in complementary recesses in the bricks 46. The bricks 46 are, therefore, suspended during the course of the erection of the shell of the generator or shaft furnace 10 and also are assisted to maintain their positions during the use of the generator by connection to the steel frame-work 70. It will be seen that the hooks 80 just referred to pass downwardly from the angle irons or plates 78 between the blocks 44. In order to permit this arrangement, the blocks 44 are made rectangular in plan instead of wedge shaped, blocks 44 contacting only near their inner and lower ends, as illustrated in Fig. 2.

As appears further from Figs. 2 and 4, angle plates 84 are fixed to the outer face of band 76, the horizontal flanges of angle plates 84 lying between the upper ends of the blocks 44 and the band 76 and bearing against the outside of the blocks to assist in holding them in place. Preferably the outer flange of the angle 84 is welded to the upper edge of the wall 52 of the blocks 44. The lower edge of the band 76, moreover, is fixed close to the blocks 44 while intermediate the blocks 44 band 76 has riveted thereto U-shaped pieces

86, Fig. 2 wedging the outer ends of blocks 44 firmly in place. Furthermore, running downwardly from the band 76 are straps 88, the lower ends of which are fixed to and support pieces 90 having upwardly and outwardly inclined portions 92 contacting with the lower surfaces of the blocks 44 and assisting in holding them in place during erection as well as during use of the apparatus. Preferably the portions 92 and the lower edges of blocks 44 are welded together.

It is desired also, according to the present invention, to partially support other courses of the flat arch 42 in addition to the inner course of this arch. For this purpose, the pieces 90 previously referred to may have attached thereto angle plates 94, the horizontal webs or flanges of which extend beneath and assist to support the ends of metal fingers 95 secured to the brick or bricks in one or more of the courses of the arch 42 outside of the bricks 46. The band 76 also has secured to its inner face bulb angle plates 96, plates 96 having horizontal flanges extending inwardly and assisting in supporting the wall 18. The space intermediate the outer surface of the shell 18 and the plates 76 and 96 and blocks 44 is preferably filled with insulating material 98. Plate 96 not only assists in supporting the wall 18 when the apparatus is in normal use, but also supports wall 18 and insulation 98 when one or more of blocks 44 have been removed for replacement or repair. Moreover, the plates 90 have secured thereto a frame-work 100 extending outwardly above the arch 42 and resting on the upper edge of shell 16 or connected to the frame 70 or both.

When the apparatus herein described is in operation, the blocks 44 are maintained substantially full of water and are found to be durable under the conditions of high temperature existing in the furnace adjacent the flat arch. Steam formed from water within blocks 44 readily escapes from the open mouths 50 of these blocks. Water to replenish that evaporated from the blocks 44 is supplied through pipes, one of which is illustrated at 99 (Fig. 4). It is preferred to supply sufficient water to blocks 44 through pipes 99 not only to off-set that lost by evaporation, but to cause an overflow from the mouths of the blocks. Water overflowing from blocks 44 is caught in a trough 102 extending around the generator or furnace and conducted away. In order that the trough 102 may conduct away the overflow water, it is set beneath the mouths of blocks 44 so that water overflowing from the mouth of the blocks falls directly into trough 102. A splash plate 104 is provided running along the outer edge of trough 100 and extending sufficient to prevent water falling into the trough from splashing out. No special means need be provided for maintaining a

circulation within the blocks 44, their shape and position being such that when in use the convection currents provide all the circulation necessary. Preferably, blocks 44 are made of cast iron.

It will be apparent from the foregoing to those skilled in the art that water cooled key blocks made and arranged according to the present invention not only are durable under the conditions imposed upon them in use, but reduce the temperature and so prolong the life of the adjacent brick-work. Moreover, the water-cooled blocks 44 may be removed individually while the generator is in operation and a new block or blocks substituted without shutting down the generator.

While a given embodiment of the present invention has been illustrated and described herein in detail it will be understood that the present invention is not limited to the details of the foregoing description or to those illustrated in the drawing, it being the intention to obtain protection for the invention disclosed herein as broadly as the state of the prior art will permit.

In particular, it will be understood that the arch construction disclosed herein, while described in connection with a gas generator may be used with any shaft type furnace or combustion chamber.

Having thus described my invention I claim:

1. A combustion chamber having walls defining adjacent zones of different cross sectional areas and arranged one above the other, a substantially flat brickwork arch extending inwardly from the upper end of the wall defining the lower of said zones and a plurality of water cooled metal key blocks interposed side by side joining the lower edge of the wall defining the upper of said zones and the inner edge of said arch.

2. A combustion chamber having walls defining adjacent zones of differing cross-sectional areas and arranged one above the other, a substantially flat brick-work arch extending inwardly from the upper end of the wall defining the lower of said zones and a plurality of water cooled metal key blocks interposed side by side joining the lower edge of the wall defining the upper of said zones and the inner edge of said arch, each of said water cooled blocks having one side opening to the atmosphere on the outside of the generator.

3. A combustion chamber having walls defining adjacent sections of differing cross-sectional areas and arranged one above the other, a substantially flat brick-work arch extending inwardly on the upper end of the wall defining the lower of said sections and water cooled metal key blocks interposed between the lower edge of the wall defining the upper of said sections and the inner edge of said arch, said blocks being structurally in-

dependent of each other, said generator and blocks having means whereby an individual key block may be removed from the generator while the remainder of said blocks are in place in the generator.

4. A combustion chamber having walls defining adjacent sections of differing cross-sectional areas and arranged one above the other, a substantially flat brick-work arch extending inwardly from the upper end of the wall defining the lower of said sections, and water-cooled metal key blocks interposed between the lower edge of the wall defining the upper of said sections and the inner edge of said arch, said blocks having means whereby refractory bricks may be secured thereto.

5. A combustion chamber having walls defining adjacent sections of differing cross-sectional areas and arranged one above the other, a substantially flat brick-work arch extending inwardly from the upper end of the wall defining the lower of said sections, and hollow water cooled blocks interposed between the lower edge of the wall defining the upper of said sections and the inner edge of said arch, said blocks transmitting the downward thrust of the upper sections to the inner edge of said arch.

6. A combustion chamber having walls defining adjacent sections of differing cross-sectional areas and arranged one above the other, a substantially flat brick-work arch extending inwardly from the upper end of the wall defining the lower of said sections and water cooled metal key blocks interposed between the lower edge of the wall defining the upper of said sections and the inner edge of said arch, said blocks having inner ends exposed to gases within the generator.

7. A combustion chamber having walls defining the adjacent sections of differing cross-sectional areas and arranged one above the other, a substantially flat brick-work arch extending inwardly from the upper end of the wall defining the lower of said zones and water-cooled metal key blocks interposed between the lower edge of the wall defining the upper of said sections and the inner edge of said arch, said key blocks being inclined to the horizontal and having horizontal bulbs at their lower and inner ends supporting in part the walls of the upper of said sections.

8. A combustion chamber having walls defining adjacent zones of differing cross-sectional areas and arranged one above the other, a substantially flat arch extending inwardly from the upper end of the walls defining the lower of said zones, the walls of said zones including brick-work, water-cooled key blocks joining the lower edge of the wall defining the upper of said zones and the inner edge of said arch, and means whereby said key blocks are interlocked with

bricks in one of the courses in the wall of the upper of said zones.

9. A combustion chamber having walls defining adjacent zones of differing cross-sectional areas and arranged one above the other, a substantially flat brick-work arch extending inwardly from the upper end of the wall defining the lower of said zones, the walls of said zones including brick-work, water-cooled metal key blocks interposed between the lower edge of the wall defining the upper of said zones and the inner edge of said arch, said key blocks being inclined to the horizontal and having projecting bulbs at their inner and lower ends, the lower course of brick in the wall of the upper of said zones resting on said bulbs and the second course of brick in the upper zone wall resting partly on said lower course and partly on said key blocks, the bricks of said lower and said second courses being rabbeted together, and means whereby the bricks in said two courses are interlocked with said key blocks.

10. A combustion chamber having walls defining adjacent zones of differing cross-sectional areas and arranged one above the other, a substantially flat arch extending inwardly from the upper end of the wall defining the lower of said zones, removable key blocks interposed between the lower edge of the wall defining the upper of said zones and the inner edge of said arch, a steel framework surrounding the chamber and reinforcing the walls in said upper zone, and supporting means connecting the brick at the inner edge of said flat arch and in contact with said key blocks to said framework.

11. A combustion chamber having walls defining adjacent zones arranged one above the other, said zones being of circular cross section but of different cross sectional areas, a substantially annular flat brick-work arch extending inwardly from the upper end of the wall defining the lower of said zones, and a plurality of independently removable water-cooled metal key blocks interposed side by side between the lower edge of the wall defining the upper of said zones and the inner edge of said arch.

12. A combustion chamber having walls defining adjacent zones of differing cross-sectional areas and arranged one above the other, a substantially flat arch extending inwardly from the upper end of the wall defining the lower of said zones, the walls of said zones including brick-work, and water cooled key blocks interposed between the lower edge of the wall defining the upper of said zones and the inner edge of said arch, said key blocks having projecting fins thereon, and the bricks at the lower end of the upper of said sections having recesses in which said fins are seated whereby said key

blocks are interlocked with the bricks in the wall of the upper of said zones.

13. A metal key block for flat arches having a water chamber and two parallel sides, a side substantially at 45° to one of said parallel sides and connected thereto, and a nose piece connecting said last mentioned side and the other of said parallel sides.

14. A key block as set forth in claim 13 and in which the nose piece extends substantially at right angles to the side last mentioned in claim 13.

15. A key block as set forth in claim 13 and in which the upper of the parallel sides has a rib extending outwardly therefrom.

16. A key block as set forth in claim 13 and in which a nose piece has a rib extending upwardly therefrom.

In testimony whereof I affix my signature.

HARVEY H. WONNING.