May 16, 1939. S. L. MAMULA 2,158,943

BLAST FURNACE CONSTRUCTION

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Fig. 3.

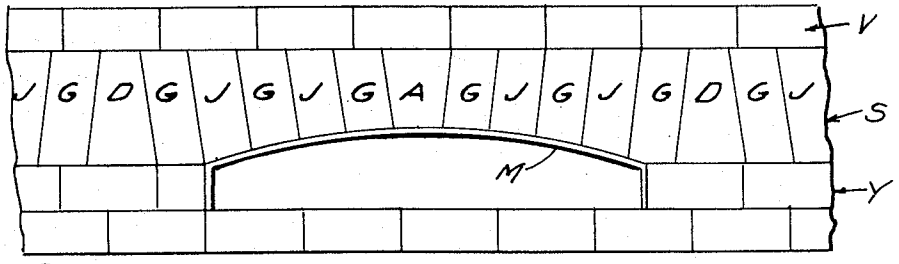



Fig. 2.

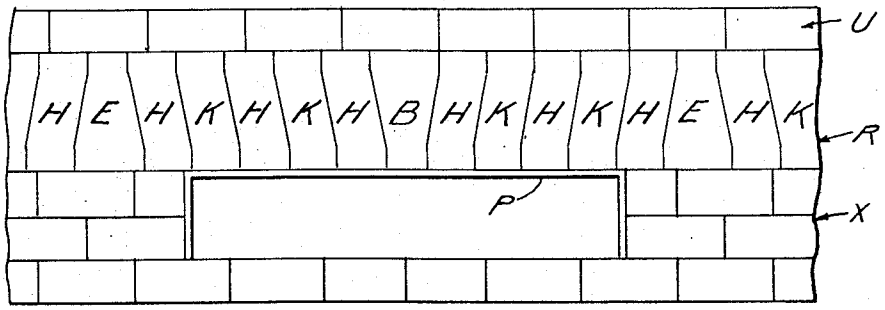



Fig. 1.

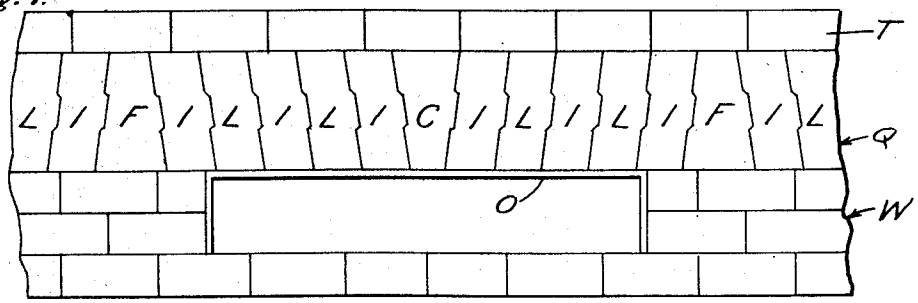
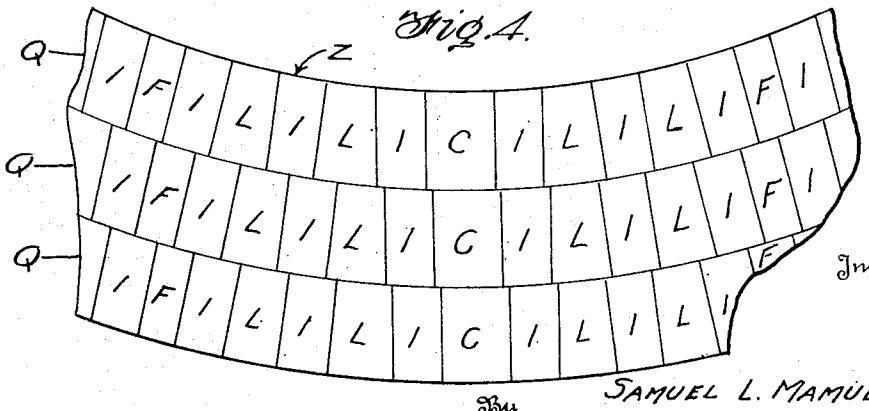



Fig. 4.




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BLAST FURNACE CONSTRUCTION

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Fig. 5.

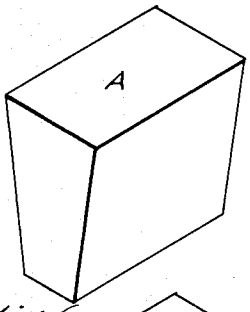



Fig. 9.

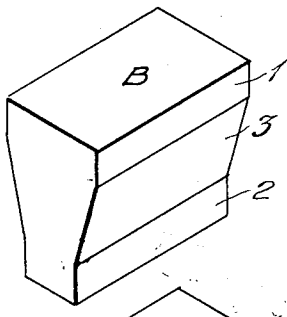



Fig. 13.

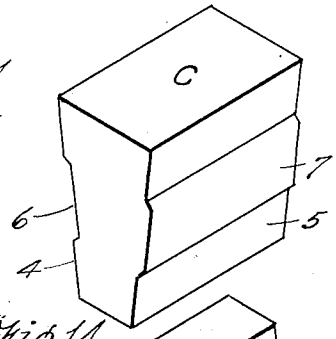



Fig. 6

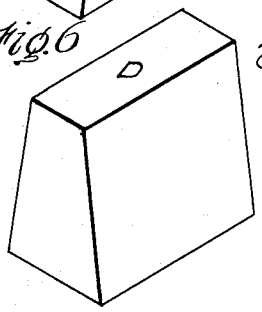



Fig. 10.

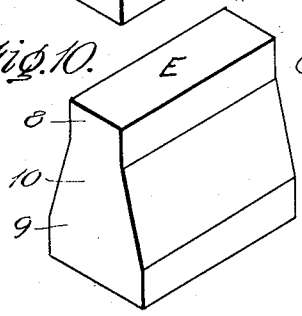



Fig. 14.

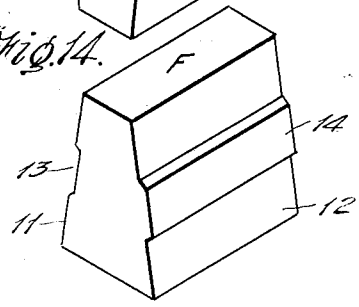
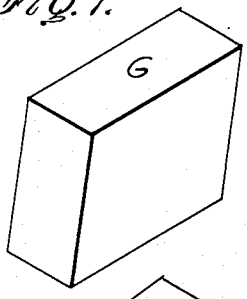
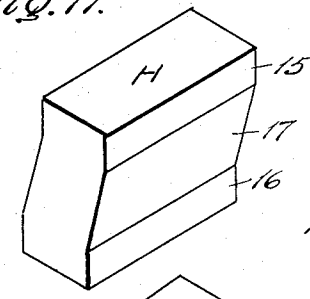


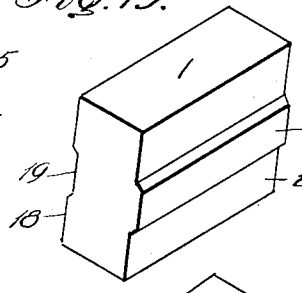

Fig. 7.

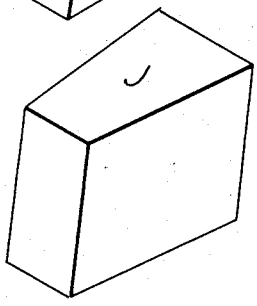
Fig. 11.

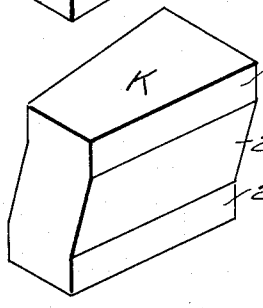
Fig. 15.



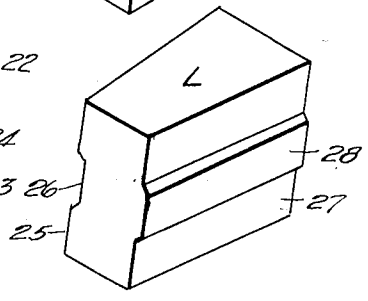




Fig. 8.

Fig. 12.

Fig. 16.

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# UNITED STATES PATENT OFFICE

2,158,943

## BLAST FURNACE CONSTRUCTION

Samuel L. Mamula, Cleveland, Ohio

Application September 14, 1937, Serial No. 163,871

2 Claims. (Cl. 72—55)

This invention relates to blast furnace construction, more particularly to a continuous circular wall structure formed with spaced arches disposed in relation with bosh cooling plates of flat or arcuate form.

The invention has for its object to provide, in a manner as hereinafter set forth, a continuous circular wall structure provided with spaced arches so formed as to permit of the removal therefrom of worn out bosh cooling plates and the substituting of new ones without in any manner removing and replacing any one or more of the elements of the structure from the position they were originally set when building the arch.

A further object of the invention resides in constructing a flat arch, of fire bricks so formed as to overcome the necessity for the cutting of the bricks by the bricklayers, as is now required when building the arch and fitting it to the bosh plate.

A further object of the invention is to provide an arch of a course of fire bricks for positioning over the bosh plate and including a key brick, skew-back bricks, filler bricks and course shaping bricks, and with the bricks constituting the arch having their tops, as well as their bottoms disposed in horizontal alignment.

A further object of the invention is to provide, in a manner as hereinafter set forth, an arch for the purpose referred to formed of key, skew-back, filler and course shaping bricks having their tops disposed in horizontal alignment, the key brick and skew-back bricks are of like form, the key brick is oppositely disposed with respect to the skew-back bricks, and the key and skew-back bricks are of a different shape from the shape of any one of the other bricks. The filler bricks are of a different shape from the shape of any one of the other bricks, and the course shaping bricks are of a different shape from the shape of any one of the other of the bricks.

Further objects of the invention are to provide, in a manner as hereinafter set forth, a continuous circular wall structure formed with arches for the purpose referred to which is simple in its construction and arrangement, strong, durable, thoroughly efficient in its use, constructed at a saving in expense, time and labor with respect to the arched wall structures now generally employed, and of a form to permit of the readily removing therefrom of a damaged bosh cooling plate and the expeditiously replacing of a new plate therein when occasion requires.

To the above ends essentially and to others which may hereinafter appear, the invention consists of the novel construction, combination and arrangement of parts as will be more specifically referred to and as illustrated in the accompanying drawings wherein is shown embodiments of the invention, but it is to be understood that changes, variations and modifications may be resorted to which fall within the scope of the invention as claimed.

In the drawings:

Figure 1 is a fragmentary view in elevation looking towards one face of the continuous circular wall structure provided with an arch in accordance with this invention,

Figure 2 is a view similar to Figure 1 of a modified form of construction,

Figure 3 is a view similar to Figure 1 of still another modified form of arch construction,

Figure 4 is a fragmentary view in top plan of the continuous circular arched wall structure in accordance with this invention,

Figures 5, 6, 7 and 8 are perspective views respectively of one form of key brick, skew-back brick, filler brick and course shaping brick employed in the arch structure,

Figures 9, 10, 11, and 12 are perspective views respectively of another form of key brick, skew brick, filler brick and course shaping brick employed in the arch structure, and

Figures 13, 14, 15 and 16 are perspective views respectively of still another form of key brick, skew brick, filler brick and course shaping brick employed in the arch structure.

With reference to the drawings there is illustrated three forms of key bricks indicated at A, B, C; three forms of skew-back bricks designated D, E, F; three forms of filler bricks indicated at G, H, I; and three forms of course shaping bricks designated J, K, L. When setting up the continuous circular wall structure with an arch, in accordance with this invention, the arch will be formed of bricks A, D, G and J; or bricks B, E, H and K; or bricks C, F, I and L used together.

With reference to Figure 1, by way of example, the flat arch shown thereby, will consist of a key brick C, skew-back bricks F, filler bricks I and course shaping bricks L arranged in the manner as shown. With reference to Figure 2, by way of example, the flat arch shown thereby will consist of a key brick B, skew-back bricks E, filler bricks H and course shaping bricks K arranged in the manner as shown. With reference to Figure 3 and by way of example the curved arch shown thereby will consist of a key brick A, skew-back bricks D, filler bricks G and course shaping bricks J arranged in the manner as shown.

The brick C, bricks I, bricks L and bricks F

when forming the flat arch have their upper and lower surfaces (top and bottom edges) respectively arranged in horizontal alignment. This statement applies to the bricks B, H, K and E when forming the flat arch. The statement relative to the bricks C, I, L, F applies to the bricks A, G, J, D when these latter are arranged to form a flat arch, but when forming a curved arch the lower ends of bricks A and J and the lower ends of the bricks G with the exception of one brick G are cut away to conform to the curvature of the top of the bosh cooling plate M shown in Figure 3. The bosh cooling plates shown in Figures 1 and 2 are designated respectively at O, P, and have flat tops.

With reference to Figures 1, 2 and 3 the circular courses in which are arranged the arches are designated Q, R, S respectively, the brick superstructure on the courses Q, R, S at T, U, V respectively and the brick courses below the courses Q, R, S at W, X, Y respectively.

When the structure wall forming body Z is set up it will include a plurality of concentrically arranged circular continuous courses Q or R or S and as shown by way of example at Figure 4, the structural wall forming body Z consists of three concentrically arranged circular continuous courses Q. The arches of one course are to align with the arches of the other courses. When an arch forming course is set up there are suitably arranged between the skew back bricks of one arch forming portion of the course and the skew bricks of adjacent arch forming portions of the course, filler bricks and course shaping bricks to complete the course. It is to be understood that any suitable fire resisting cement is employed for securing the bricks of a course together, and that the bricks are formed from any suitable fire resisting material.

The bricks A, B, C, D, E, F, G, H and I are substantially of oblong-quadrangular contour. The bricks J, K, L are of substantially frusto-tapered in plan. The front and rear ends of the bricks A, B, C are substantially of inverted frusto-tapered contour the smaller portion being lowest. The front and rear ends of the bricks D, E, F are substantially of frusto-tapered contour. The front and rear ends of the bricks G, H, I, J, K, L are substantially of oblong-quadrangular contour. The bricks when used are disposed on their lower lengthwise surfaces. In the following description the nearest narrow surfaces on the drawings are understood to be the front ends and the rear ends are oppositely disposed thereto.

The brick A has its top of greater width, but of the same length as its bottom. The sides of brick A incline outwardly in opposite directions from its bottom to its top. The brick A in vertical section at any point throughout its length is of inverted frusto-tapered contour.

The brick B is formed of an upper rectangular portion 1, a lower rectangular portion 2 of less width than the portion 1 and an inverted frusto-tapered intermediate portion 3 of greater height than the portions 1, 2. These latter are of the same height. The shape of the intermediate portion 3 of brick B forms the intermediate portions of its sides with surfaces inclining outwardly from the upper end of portion 2 to the lower end of portion 1. The portions 1, 2 form each side of brick B with upper and lower flat vertical surfaces and with the lower surfaces inset with respect to said upper surfaces. The brick B in vertical section at any point of its length is of substantially inverted frusto-tapered contour being smallest below.

The brick C has its top of greater width, but of the same length as its bottom. The brick C has its sides inclined outwardly in opposite directions from its bottom to its top. One side of brick C is indicated at 4 and its other side at 5. Extending lengthwise from end to end of side 4 and disposed centrally thereof is a groove 6 having oppositely bevelled side walls. Extending from one end to the other end of the side 5 and disposed centrally thereof is a laterally directed tongue 7 having its sides oppositely bevelled. The tongue 7 aligns with the groove 6. The brick C in vertical section at any point of its length is of substantially inverted frusto-tapered contour.

The brick D has its top of less width, but of the same length as its bottom. The brick D has its sides incline inwardly in opposite directions from its bottom to its top. The brick D in vertical section at any point throughout its length is of frusto-tapered contour. This is the same form as brick A inverted.

The brick E is formed of an upper rectangular portion 8, a lower rectangular portion 9 of greater width than the portion 1 and a frusto-tapered intermediate portion 10 of greater height than the portions 8, 9. These latter are of the same height. The shape of the intermediate portion 10 forms the intermediate portion of the sides of brick E with surfaces inclining inwardly from the upper end of portion 9 to the lower end of portion 8. The portions 8, 9 form each side of brick E with upper and lower flat vertical surfaces and with the upper surface inset with respect to the said lower surface. The brick E in vertical section at any point of its length is of substantially frusto-tapered contour. This is the same as brick B inverted.

The brick F has its top of less width, but of the same length as its bottom. The sides of brick F incline inwardly from its bottom to its top. One side of brick F is indicated at 11 and its other side at 12. Extending lengthwise from end to end of side 11 and disposed centrally thereof is a groove 13 having oppositely bevelled side walls. Extending from one end to the other end of the side 12 and disposed centrally thereof is a laterally directed tongue 14 having its sides oppositely bevelled. The tongue 14 aligns with the groove 13. The brick F in vertical section at any point of its length is of substantially frusto-tapered contour. This is the same as brick C inverted endwise.

The brick G is of uniform thickness throughout and in plan it is of oblong-rectangular contour. The brick G has its sides inclined in parallel planes, with respect to the vertical, such as shown in Figure 3. As the sides of the brick G are disposed in inclined parallel planes the top of the brick is slightly offset with respect to the bottom of the brick. The front and rear of the brick G are vertical and disposed parallel. The top and bottom of brick G are horizontal and disposed in parallel relation.

The brick H in plan is of oblong-rectangular contour and it includes an upper rectangular portion 15, a lower rectangular portion 16 and an intermediate portion 17 of greater height than the portions 15, 16. The portion 16 is disposed throughout at an inclination with respect to the vertical whereby the upper portion 15 is offset with respect to the lower portion 16. The inclined intermediate portion 15 of the brick H forms the sides of the latter with inclined surfaces extend-

ing in parallel planes, with respect to the vertical from the lower portion 16 to the upper portion 15 of brick H. The portions 15, 16 are of the same height. The top and bottom of the brick H are of the same area. The front and rear of the brick H includes upper and lower straight surfaces connected together in offset relation by an intermediate surface inclined with respect to the vertical.

The brick I is substantially of oblong-rectangular contour in plan. The top and bottom of brick I are of the same area. The front and rear of the brick I are of the same area. The sides of brick I extend in parallel inclined planes with respect to the vertical. The side 18 of brick I is formed with a groove 19 corresponding in form and arrangement to that of the grooves 6 and 13. The side 20 of the brick I is formed with a tongue 21 corresponding in contour and arrangement to that of the tongues 7, 14.

The brick J in top plan is of frusto-tapered contour. The top of brick J is the same area as its bottom. The brick J has its front of the same height as, but of materially less width than the rear thereof. The sides of brick J are disposed at an inclination with respect to the vertical and to each other. The brick J in vertical section, at any point throughout its length is of substantially quadrangular contour. The front and rear of brick J are of oblong-quadrangular contour.

The brick K in top plan is of frusto-tapered contour. The brick K includes an upper frusto-tapered portion 22, a frusto-tapered lower portion 23 and a frusto-tapered intermediate portion 24 which is inclined to the vertical, of greater height than the portions 22, 23, extends from the portion 23 to the portion 22 and the inclination is such whereby the portion 22 is offset with respect to portion 23. The sides of the brick K are disposed at an inclination with respect to the vertical and to each other. The front of the brick K is of the same height but of materially less width from the rear thereof. The top and bottom of brick K are of the same area.

The brick L in top plan is frusto-tapered contour and has its sides disposed at an inclination with respect to the vertical and to each other. The latter is of materially greater area than the front. The side 25 of brick L is formed with a groove 26 of the same form and arrangement as the grooves 6 and 13. The side 27 of the brick L is formed with a tongue 28 of the same form and arrangement as the tongues 7 and 14.

The arch will consist of a key brick A, B, or C, a pair of skew-back bricks D, E, F, of like form two sets of filler bricks, G, H, I, and a series of arch-shaping bricks J, K, L, of like form. The filler bricks of each of said sets are of like form. The filler bricks of one set are oppositely disposed with respect to the filler bricks of the other set. The key brick is arranged between and having its sides opposing the inner sides of inner filler bricks of said sets. The arch-shaping bricks being arranged between and having their sides opposing sides of filler bricks of said sets, and each skew-back brick has its inner side opposing the outer side of the outer filler brick of a set.

In Figure 1 the bricks on the left of key brick C are the same as on the right reversed in position, except brick L which must be made inclined in the opposite direction.

The arch is built over the bosh plate in a manner to provide a packing space between the plate and bottom of the arch.

What I claim is:

1. In a furnace arch structure a key brick having the configuration in end elevation of a truncated V, one inclined side of said brick having a longitudinally extending keyway therein provided with inwardly convergent side walls, the other side of said brick having an outwardly extending longitudinal key provided with outwardly convergent longitudinal faces, and filler bricks on opposite sides of said key brick, said filler bricks having a parallelogram configuration in end elevation, each of said filler bricks having a longitudinal keyway in one side thereof provided with inwardly convergent opposite walls, and a longitudinal key on the opposite side of each filler brick having outwardly convergent faces for engagement in a keyway of an adjacent brick, that portion of each face of a brick on one side of a key or keyway being disposed in the same plane as the remaining face of the brick on the opposite side of the key or keyway.

2. In a blast furnace construction, a continuous circular wall structure provided with an arch for a bosh cooling plate, said arch consisting of a wedge-shaped key member and a plurality of filler bricks extending from opposite sides thereof, said key member having a longitudinally extending keyway inwardly tapered in one side thereof and a longitudinally extending tapered key on the opposite side thereof, said filler bricks having a longitudinally extending keyway in one side thereof and a longitudinally extending tapered key on the opposite side thereof, the key of one filler brick engaging in the keyway of an adjacent brick, that portion of each face of a brick on one side of a key or keyway being disposed in the same plane as the remaining face of the brick on the opposite side of the key or keyway.

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