March 31, 1931. F. A. FAHRENWALD 1,798,460

HEAT RESISTING SURFACE

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Fig. 1

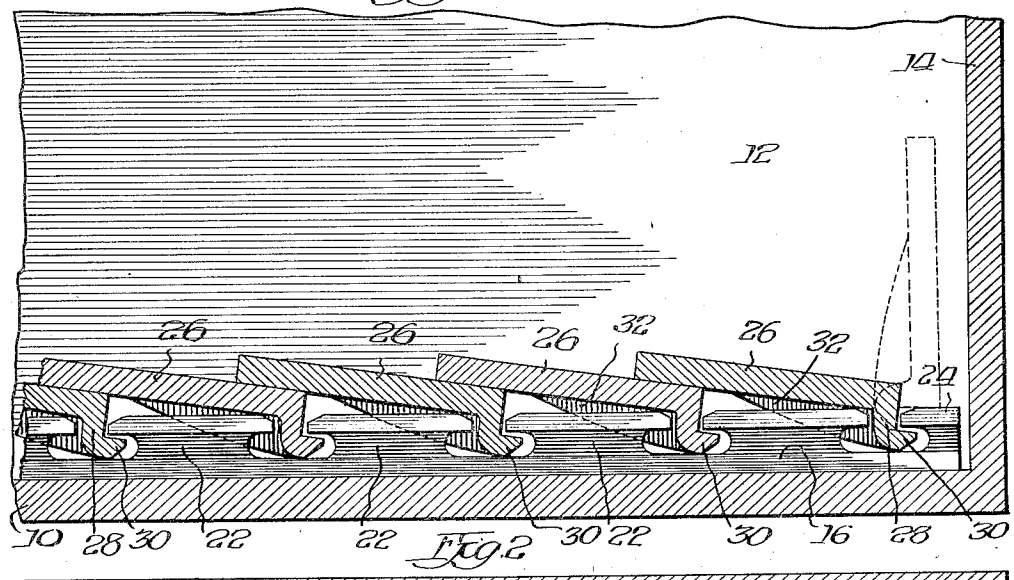
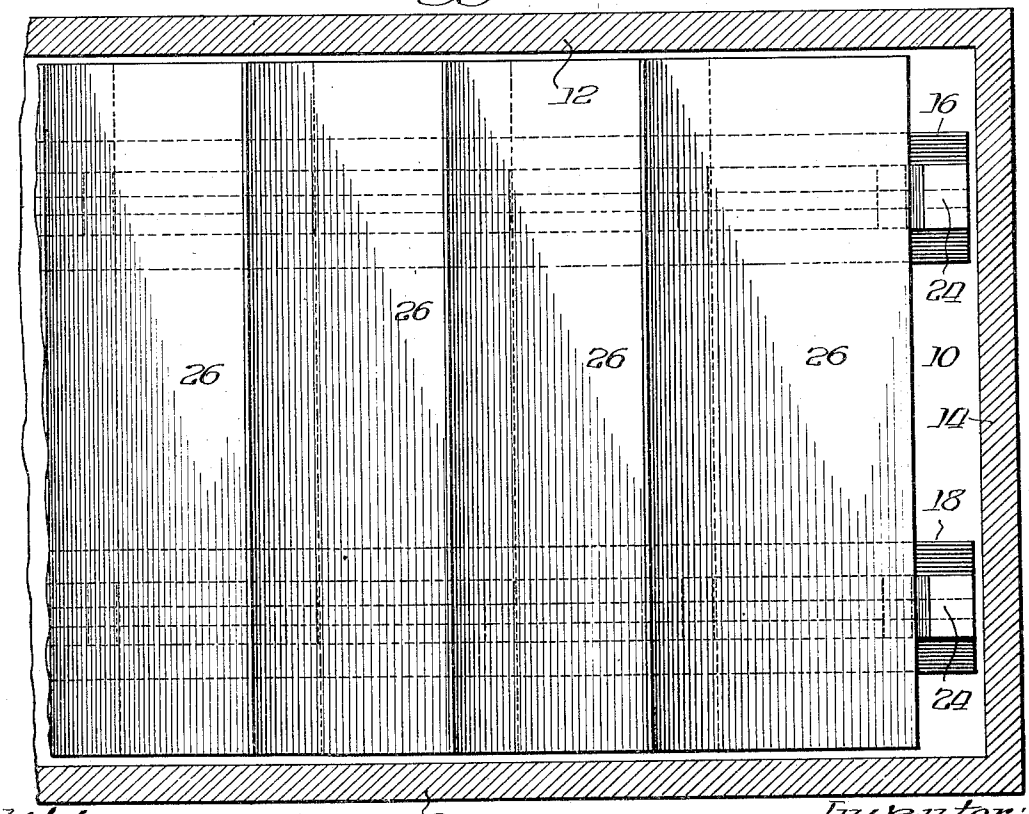


Fig. 2



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HEAT RESISTING SURFACE

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Fig. 3.

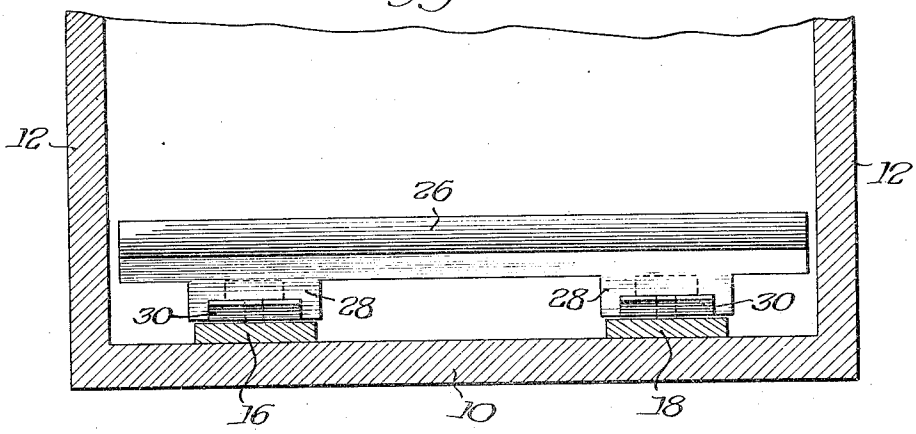


Fig. 4

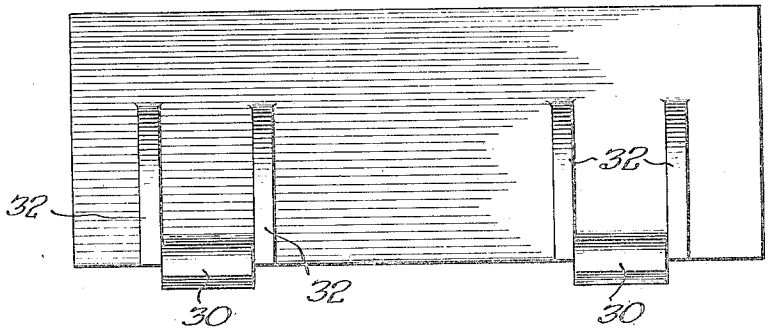
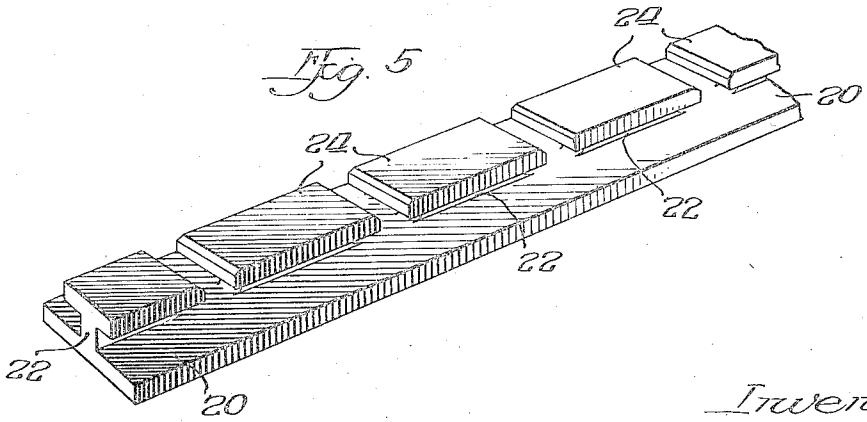


Fig. 5



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Patented Mar. 31, 1931

1,798,460

UNITED STATES PATENT OFFICE

FRANK A. FAHRENWALD, OF CHICAGO, ILLINOIS

HEAT-RESISTING SURFACE

Application filed September 27, 1928. Serial No. 308,627.

This invention relates to heat resisting metallic surfaces, such, for example, as furnace hearths, dampers, and the like, and is illustrated herein as embodied in a heat resisting surface of the same general construction as those disclosed in United States Letters Patent Nos. 1,629,689 and 1,643,766, granted May 24, 1927 and Sept. 27, 1927, respectively, upon applications filed in my name.

Prior to the provision of the inventions disclosed in the said Letters Patents, furnace hearths and the like comprised generally, a single large piece of alloy having a flat upper surface, or a relatively small number of large pieces of alloy that combined to present a surface of the desired area. In charging such furnaces as those of the open hearth type, it is customary simply to throw in or otherwise deliver, cold castings, forgings, etc., to the large metallic hearth surface while maintaining the latter at a high temperature, and, owing to the fact that metals and alloys of the class generally known as heat resisting, possess a rate of expansion considerably higher than is possessed by most refractory materials, it will be appreciated that in the use of hearths of the old, single piece type, the introduction of the cold metallic castings or forgings onto isolated areas of the large hearth caused those areas to chill and to contract. As a result of this action, hearths composed of fairly thick metal would flow under tension or compression and eventually crack. On the other hand, if the metal of the hearth was relatively thin and flexible, it would warp completely out of shape in accommodating its surface contour to internal dimensional changes brought about by the fluctuations in temperature of its different portions. Thus, one of the heavier and thicker hearths would not tend to warp as much as one of the relatively thin types, but it would tend to flow and become of uneven thickness which, of course, was about equally undesirable.

In view of this tendency on the part of hearths generally in use prior to the inventions disclosed in my above mentioned Letters Patents, and still being used in some quarters, it was proposed by me in the said patents to reduce warping and cracking by forming the hearth of a large number of small castings laid edge to edge and connected together by means of interengaging portions. Thus, in the practice of my former inventions, the plates are small and of a sufficient thickness that if a change in temperature is imparted to one portion of a plate, conduction currents will be set up and before being warped or otherwise damaged, the small plate will assume a uniform temperature throughout, which will result in a uniform expansion or contraction being imparted to the plate.

While the inventions set forth in the Letters Patents mentioned are very satisfactory in operation and constitute marked advances over the prior art, it has been found desirable, and is accordingly an important object of the present invention, to provide a heat resisting surface which permits unlimited expansion of the plates without tending to bend or buckle them. It will be appreciated that a surface composed of a plurality of small heat resisting plates closely laid in edge to edge relation with one another cannot expand unlimitedly in the direction of the plane of the plates, and if a high degree of expansion is imparted, the plates may engage one another in some fashion and buckle, or the plates may become unduly separated whereby the spaces between the edges of adjacent plates will become widened; a result which may not be desired.

It is accordingly an important feature of the invention, which is conducive to the accomplishment of the recited object, to provide a heat resisting surface composed of a number of heat resisting plates arranged to present an unbroken work engaging surface irrespective of expansion or contraction imparted to the plates. As illustrated, the plates are disposed with their adjacent edges loosely overlapping one another, whereby the plates may undergo dimensional changes without opposition and without destroying the unbroken continuity of the heat resisting, work engaging surface.

Another feature of the invention which aims towards the accomplishment of the re-

cited object consists in the elimination of fasteners or fastening elements extending between the small heat resisting plates, whereby each plate is free to change dimensionally without exerting any tendency to change dimensionally the remaining plates. The plates are, as hereinbefore pointed out, arranged to overlap, and they are held in assembled relation with one another by reason of being attached to supporting members, and not through joining adjacent plates by means of interengaging parts. Thus each plate member may expand or contact, or, in the event that such should occur, warp or bend, freely independently of the remaining plates.

Still another feature of the invention consists in the provision of a novel connection between the member or members comprising the heat resisting surface, and the member, or members, which support the heat resisting surface. As illustrated, the connection disclosed herein permits ready removal of the heat resisting plates when the latter are manually moved into a particular position, and prevents removal of the plates in all other positions. Furthermore, the connections are arranged to permit unrestricted expansion of the plates in all directions and, as shown, they comprise broadly a plurality of parts carried by the supporting members and a plurality of interfitting parts carried by the heat resisting plates, in such a manner that the connection may be rendered effective or ineffective merely by interfitting the parts without the use of any separate securing or fastening means whatsoever. Such a provision simplifies and improves not only the construction of the heat resisting surface but likewise its assemblage and disassemblage.

Other objects and features of the invention will become apparent from a reading of the following specification in the light of the accompanying drawings, in which—

Figure 1 is a view in elevation in section of a furnace having a hearth of the improved type mounted therein;

Figure 2 is a plan view of the furnace and hearth that are shown in Figure 1;

Figure 3 is a view in side elevation in section of the furnace and hearth that are shown in Figures 1 and 2;

Figure 4 is a lower plan view of one of a series of heat resisting plates which comprise the hearth shown in the preceding figures; and

Figure 5 is a perspective view showing a supporting member or element which is adapted to rest upon the floor of the furnace and to support the hearth.

Turning now to the drawings, the reference numeral 10 indicates the bottom of a furnace that is provided with side walls 12, 12 and an end wall 14. The furnace, of course, may be of any desired type for it is to be appreciated that the invention is capable of application to furnaces of practically every type, and may be employed in a number of other usages in which it is desired to provide a metallic heat resisting surface. Usages comprise linings for furnaces, dampers, grates, baffles, flues, etc. It is for the purpose of illustration only, that the invention is shown herein as embodied in a furnace hearth.

A plurality of supporting elements, or members, 16 and 18 are disposed longitudinally of the furnace, and comprise metallic rails, or bars, spaced apart and disposed parallel to one another. As shown more clearly in Figures 1 and 5, each of the supporting members 16 and 18 comprises a base 20 having a plurality of upwardly extending flanges or ribs 22 formed integrally with the central, longitudinal portion of the base, and with outwardly flared lug engaging portions 24. As shown in Figure 2, the lug engaging portions are narrower than the base portion 20 of the supporting members, and as shown in Figure 1, the lug engaging portions are flared out to provide a series of equally spaced recesses or pockets having restricted openings. The supporting members are so formed and placed within the furnace that each opening in one of the members has a corresponding opening in the other member located directly opposite the first opening.

The hearth itself is composed of a plurality of heat resisting plates 26, 26 which, as shown in Figures 1, 3 and 4, are provided with a plurality of connecting portions, each of which comprises a downwardly extending forward wall or projection 28, a lug portion 30 extending forwardly from the lower extremity of the wall 28 and having an upper face substantially parallel to the upper face of plate 26 and a plurality of side walls 32, 32 extending rearwardly and upwardly from the opposite sides of the forward wall 30. The arrangement just described is in the form of a pocket with a lug projecting from the forward side thereof, and as illustrated each of the heat resisting plates 26 is provided, as shown in Figure 4, with a plurality of these pockets, it being understood that the number of pockets provided will correspond to the number of supporting members 16 and 18. The lugs 30 of the plates are arranged to fit within the recesses formed between the lug engaging portions of the supporting elements, as shown in the dotted lines at the right of Figure 1. In this view, a heat resisting plate disposed vertically, with the lug pointing downwardly, has been moved into such a position that the lug projects through the opening formed between adjacent lug engaging portions, and is now free to be swung downwardly to the left as viewed in the said figure to assume the position shown in solid lines. When so positioned the side walls 32 and 32 of a pocket engage the sides of the flared-out portions 24 and 24 of the

supporting members thereby preventing lateral displacement of a plate relatively to the members; the rear face of the forward wall 28 of the plate engages an edge of an adjacent flared-out portion and the front face of the forward wall engages an edge of another adjacent flared-out portion whereby horizontal displacement of the plate longitudinally of the hearth is prevented; and the upper face of the lug 30 engages the underside of an adjacent flared-out portion of the supporting rail thereby preventing vertical bodily displacement of the plate 26. Thus, it will be seen that by the provision of this hinge-like connection, the plates are prevented from becoming accidentally displaced, but, if it is desired to replace a warped, broken, or bent plate, this may be done merely by swinging it to a vertical position lifting it out and inserting in its place an undamaged plate. It is also to be observed that the fit between the interconnecting parts of the plate and the supporting members is very loose whereby the plates may move limitedly relative to the supporting elements in order to expand freely and without binding.

As will be observed from Figure 1, the rear edges of the plates overlap one another, and it is contemplated that this overlapping shall take place in the direction of the discharge end of the hearth, for, in instances where a continuous feeding operating across the hearth takes place, a smooth and uninterrupted surface will be afforded as contrasted with a rough work engaging surface which would occur if the work were fed across the hearth in the direction of the exposed rear edges of the heat resisting plates. In this latter event, the work might catch on the plates and displace them by swinging them into a vertical position, or, if the castings in the furnace are extremely heavy they might bend the hot plates or otherwise damage the hearth. Owing to the fact that by far the greater amount of material in the heat resisting plates is disposed in the rectangular bodies of the plates, as compared with the pockets of the plates, it will be appreciated that upon heat being applied, the greatest amount of expansion will be imparted to the flat, rectangular bodies, and not to the pockets and hence, with this in view the parts of the pocket are mounted for expansion within wide limits and each body portion is mounted for unlimited expansion independently of the remaining plates, which it will be observed are free to expand unlimitedly without exerting any influence upon the adjacent sheets.

There are many additional features of this invention which are not at once apparent to a person to whom the invention is disclosed, and these include, among other things, the provision of lug receiving openings having symmetrical side walls disposed to permit the heat resisting plates to be inserted in the manner shown in Fgure 1, or reversed to run in the opposite direction; and the idea of mounting the connecting members on the under side of the work engaging heat resisting plates whereby metal carried through the furnace may pass easily from each overlapping plate to its underlying neighbor.

It will be appreciated from so much of the descripton as has already been given that one of the small heat resisting plates may be of extremely high temperature while an adjacent plate may be relatively cool without the expansion of the hot plate being of damaging influence upon that plate, or upon the adjacent cool plate. It will further be realized that when all of the plates are heated the supporting rails or members may likewise become heated and tend to warp or buckle and, in order to prevent this, it is contemplated attaching the supporting members to the furnace only at one end of each member so that it may contract and expand freely towards and away from the opposite end of the furnace. Either end of the furnace may be employed as an anchorage for the ends of the supporting members.

It is to be understood that in many aspects, the invention may be changed and modified to depart from the illustrated embodiment thereof, and that parts may be eliminated or other parts provided, without departing from the true nature and scope of the invention as endeavored to be pointed out by the foregoing description and the appended claims. For example, the overlapping character of the plates may even be dispensed with and interengaging fingers provided along adjacent sides whereby all of the plates will be disposed within a single plane free to contract and expand while at the same time presenting a satisfactory work engaging surface; or, for example, the supporting elements may be eliminated from the combination in some instances and replaced by openings formed directly in the furnace bottom or in other walls, etc. in connection with which the invention may be employed.

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

1. As an improved article of manufacture, a heat resisting plate comprising a flat upper surface that is adapted to be exposed when the plate is mounted in an operative position, and a lower surface provided with a projection having thereon a lug adapted to interlock with a cooperating supporting member in securing the plate in an operative position.

2. As an improved article of manufacture, a heat resisting plate comprising a flat upper surface that is adapted to be exposed when the plate is mounted in an operative position, and a lower surface provided with a

lug adapted to interlock with a cooperating supporting member in securing the plate in an operative position, said lug having a face nearly parallel with the plate.

3. As an improved article of manufacture, a solid monolithic plate of heat resisting material having a lug offset therefrom near one end thereof and extending nearly parallel therewith in the general direction of an extension of said end, said lug being adapted to engage a socket to hold said plate in place.

4. An assemblage of the character described comprising, in combination, a plurality of overlapping heat resisting members mounted for free sliding engagement with one another, and means associated with the members for maintaining them in assembled relationship, said means comprising an elongated member provided at spaced intervals with plate securing portions.

5. An assemblage of the character described comprising, in combination, a support having an opening formed therein, and a heat resisting member adapted to be carried by the support and provided with a projection for interfittingly engaging within the opening.

6. An assemblage of the character described comprising, in combination, a support having a plurality of lug engaging portions formed thereon, and a plurality of heat resisting members mounted upon the support, each of said heat resisting members being provided with a lug for interfitting engagement with the lug engaging portions.

7. An assemblage of the character described comprising in combination, an elongated supporting element, and a plurality of heat resisting plates hingedly connected to the supporting element, said plates and said supporting element having interfitting parts so constructed and arranged that any substantial displacement of the plates horizontally relatively to the supporting element is prevented and displacement of the plate in other directions relatively to the supporting element is permitted only upon the plate being pivotally moved into a vertically extending position.

8. An assemblage of the character described comprising, in combination, a plurality of elongated supporting members spaced apart and extending parallel to one another, the supporting members being correspondingly provided with a plurality of equally spaced, lug engaging openings, and a plurality of overlapping heat resisting plates carried by the supporting members, each of the heat resisting plates being formed with a plurality of downwardly extending walls terminating in forwardly extending lugs adapted to engage within corresponding openings formed in the supporting members substantially to prevent forward and rearward movement of the plate, and with a plurality of walls extending rearwardly from the downwardly extending walls and adapted to engage the sides of the supporting members substantially to prevent lateral movements of the plate relatively to the supporting members.

9. A heat resisting furnace hearth comprising a plurality of supporting members adapted to extend lengthwise of the hearth, the members being provided with equally and correspondingly spaced openings, and a plurality of heat resisting plates overlapping in the direction of the discharge end of the hearth, the plates being provided with projects for engaging within the openings in the supporting members to prevent accidental displacement of the plates.

10. As an improved article of manufacture, a solid monolithic plate of heat resisting material having a lug offset therefrom near one end thereof and extending nearly parallel therewith in the general direction of an extension of said end, said lug being adapted to engage a socket to hold said plate in place except when said plate has been pivoted substantially 90° about said lug.

Signed at Chicago, Illinois, this 19 day of September, 1928.

FRANK A. FAHRENWALD.