

Feb. 10, 1953

L. W. AUSTIN ET AL
REFRACTORY PRODUCT

2,628,088

Filed May 22, 1950

2 SHEETS—SHEET 1

Fig. 1.

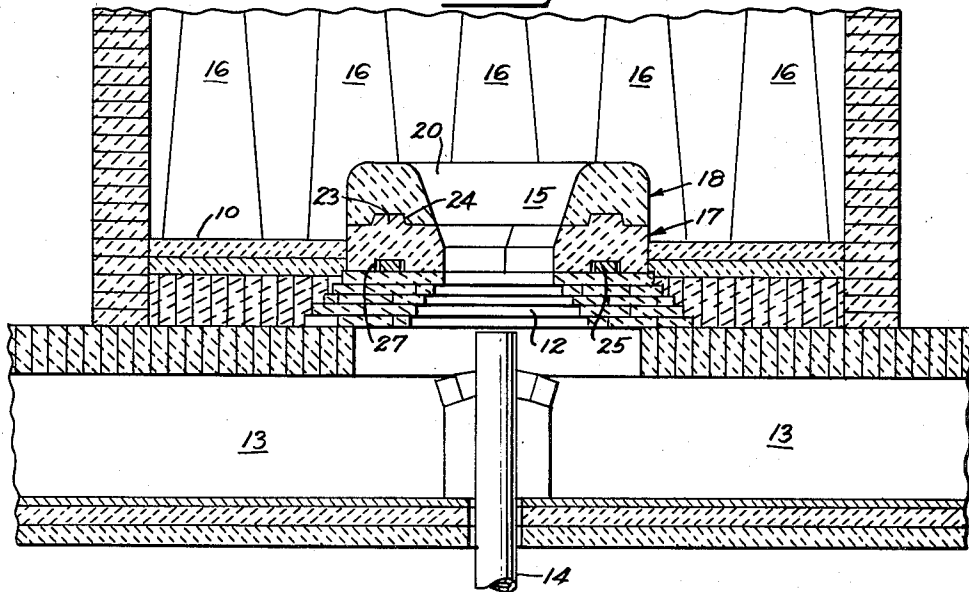


Fig. 2.

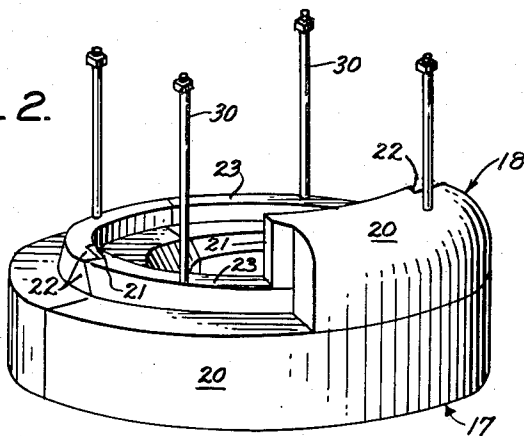
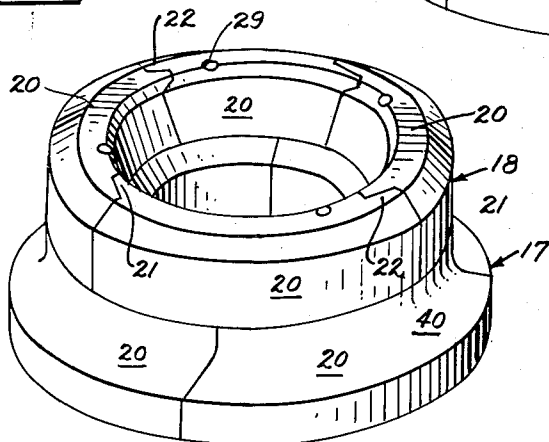



Fig. 3.



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2 SHEETS—SHEET 2

Fig. 4.

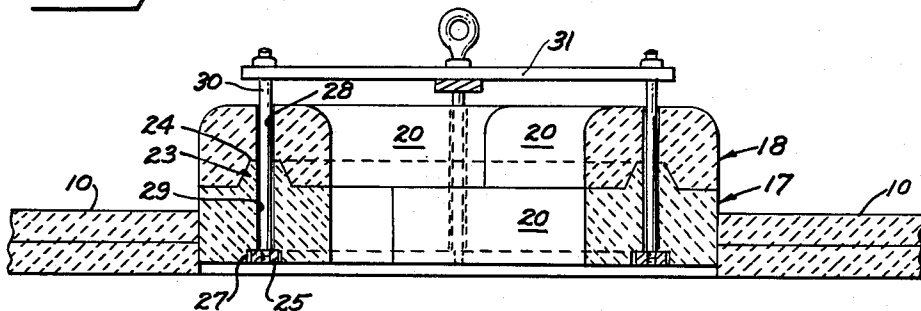


Fig. 5.

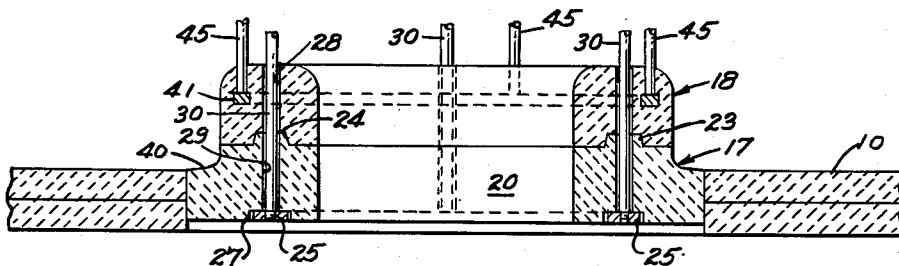
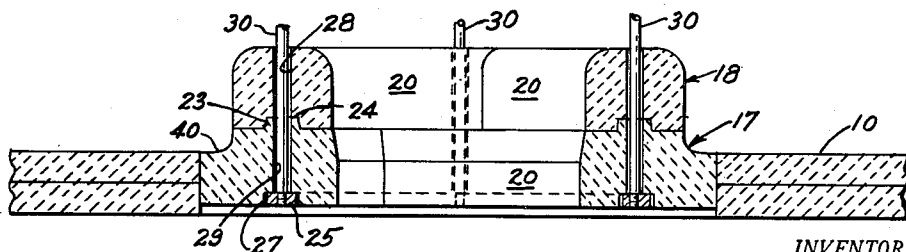


Fig. 6.



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REFRACTORY PRODUCT

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3 Claims. (Cl. 263—46)

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This invention relates to ports for metallurgical furnaces and more particularly to ports employed in metallurgical furnaces of the type generally referred to as soaking pits.

Soaking pits are employed for heating ferrous metal ingots and the like. They are usually comprised of a large box-like enclosure and can be fired in a variety of ways the most common being bottom and side firing.

In the former or bottom method of firing the pit is heated by means of a burner port located in a central portion of the hearth, through which the flame is introduced. Ingots to be heated are charged on the hearth surrounding the burner port and are there "soaked" or heated through, preparatory to their being rolled into plates or other shapes.

In the latter method the flame is introduced into the pit by a plurality of burner ports located in the several side walls of the pit and the exhaust gases are permitted to escape through an exhaust port positioned in a central portion of the hearth.

A very important feature of this port which is located in the central portion of the hearth, be it either in the form of an exhaust port for a side fired furnace or a burner port for a bottom fired furnace, is the fact that it projects upwardly somewhat above the level of the hearth and is thereby subjected to the intense heat of the furnace which causes spalling and other failures of the brick from which the port is built.

In addition, as the large billets or ingots, which are treated in the soaking pit, are charged and removed by a crane or other similar hoisting device they are prone to swing about considerably and often strike against this port subjecting it to considerable physical abuse.

In the past, because of its prior construction which has been usually in the form of a masonry ring, the port has been subject to early deterioration and destruction due to its many joints and the bumping of the ingots. The joints make the structure less compact, more subject to the spread of slag through to the flues below and less resistant to spalling and when this structure becomes loose it is easily broken by a slight bump from an ingot.

Finally because of the early deterioration in the prior types of ports they had to be replaced or repaired several times during the life of the remainder of the furnace lining. Replacement or repair of this hearth port is a costly operation due, principally, to the fact that it necessitates cooling or shutting down of the furnace,

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otherwise the temperature in the soaking pit would be too high for workmen to stay any length of time. When new bricks and mortar are used they must be allowed to set and dry, after which they must be cured by the gradual application of heat. All of these steps necessitate a prolonged shut down period during which the furnace is inoperative.

To overcome these disadvantages it has heretofore been proposed to make a complete hearth port ring of a heavy cast steel or cast iron spider over which a plastic chrome material was rammed into place. This ring overcame the disadvantage of workmen having to spend longer periods in building up a brick ring. It also eliminated the joints but had the disadvantage of utilizing two different materials, one of which has a tendency to shrink and the other to expand. The metal spider not only tended to expand due to heat, but also derived expansion and growth due to oxidation together with scaling and a large volume increase. Since the plastic chrome was placed directly on this metal, expansion would cause cracks to open up in the plastic channel which would allow more oxidation and would hasten the destruction of the ring or rosette. Accordingly, this type of rosette has not proved entirely satisfactory.

It is the primary objective of the present invention to provide a ring or rosette for soaking pits or the like which will be an improvement over those used in the past which had inherent defects and faults because of their particular constructions.

Accordingly, in overcoming the aforesaid defects and objectionable features of prior rings or rosettes for the hearths of soaking pits or the like it is among the specific objects of the present invention to provide a rosette which will be more durable than those of the past and one which has longer life, thereby reducing the expense incurred in the operation of a soaking pit furnace.

A further object of the invention is to provide a prefabricated removable rosette which can be assembled outside the furnace and then hoisted into position within the furnace, so that a minimum amount of time will be lost in substituting a new ring for one which has become defective, and with the result that the overall length of time during which a soaking pit is inoperative will be reduced.

Another object of the invention is to provide a rosette for a soaking pit hearth or the like which is adapted to withstand considerable phys-

ical abuse and has high resistance to bumping by the ingots.

A further object of the invention is to provide a rosette for soaking pits which consists of a separate prefabricated, unitary structure for use with either a burner or exhaust opening and which may be entirely constructed outside the soaking pit at any time prior to the necessity for repairs and thereafter placed in operating position within the pit.

A still further object of the invention is to provide a rosette for a soaking pit hearth or the like wherein the refractory bricks comprising the ring or rosette are interlocked with one another so that their joints are compactly and effectively sealed to obviate the risk of slag spreading there-through to the flues below.

Another object of the invention is to provide a rosette for a soaking pit or the like having a high resistance to spalling.

These and other objects are achieved by providing a rosette for the port openings of soaking pit hearths comprised of a plurality of refractory rings mounted one upon the other, at least one of said rings being comprised of a plurality of refractory segments which have tongue and groove portions whereby the individual segments of the said ring can be joined together, each of said segments having upstanding portions which engage groove portions in the ring mounted directly above the said segments, each ring being further provided with vertical shafts which are in alignment with those of the ring mounted immediately therebelow and a metal annulus mounted in an annular groove in the underside portion of the lowermost refractory ring to which the lower extremities of tie rods thrust through said aligned vertical shafts may be threadedly connected in such a manner that when the upper extremities of the tie rods have been affixed to a yoke, the said rosette may be hoisted into position within said soaking pit.

Other objects and features of the invention will be apparent from a consideration of the following detailed description taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a central, vertical section of a metallurgical furnace or soaking pit wherein a burner port is located in the hearth and it further illustrates the general construction thereof and the application thereto of the rosette embodied in the present invention;

Figure 2 is a perspective view of the partially dismantled rosette shown in Figure 1.

Figure 3 is a perspective view of a modified form of the rosette, shown in Figure 1;

Figure 4 is another sectional view of the rosette shown in Figure 1 to which a yoke has been attached for the purpose of transporting the same into position within the soaking pit;

Figure 5 is a sectional view of another modified form of the rosette;

Figure 6 is a sectional view of the rosette shown in Figure 3.

With further reference to the drawings and particularly Figure 1, a metallurgical furnace or soaking pit is shown as comprising a hearth 10 surrounded by a vertical wall 11 and adapted to be closed at its top by a removable cover not shown. A port opening generally indicated at 12 is located centrally of the hearth and communicates with flues or ducts 13 through which a draft of preheated air is communicated to the interior of the soaking pit to support combustion of gas or other fuel entering through a pipe 14.

which is directed upwardly and centrally of the burner opening. A refractory rosette or ring 15 embraces the port opening and projects upwardly into the soaking pit to the most advantageous height. A plurality of ingots 16 are located about the port and its associated rosette.

This rosette combines with the burner opening to produce the desired shape in the port opening for inducing the proper flow of gas and air into the furnace and obtaining efficient admixture and combustion thereof.

It is evident therefore that this member or rosette must be so constructed that it will be able to withstand intense heat and the severe physical abuse resulting from charging the furnace with the ingots.

In the preferred embodiment of the invention this rosette is comprised of two refractory rings 17 and 18, one of which is superposed upon the other. Each of these rings in turn may be comprised of a plurality of premolded, interfitting, arcuate, refractory segments 20, having tongue and groove ends or sections 21 and 22, respectively, whereby the aforesaid refractory segments in each individual ring may be securely joined together to form a single compact ring.

The refractory segments of the bottom ring 17 are also provided with an upstanding portion 23 located in substantially the central portion of the top surface of each segment, which serves as a tongue engaging the hollowed out or grooved portions 24 on the underside of each refractory segment which make up the upper ring or rosette 18, thereby providing means for locking the upper ring 18 to the lower ring 17.

By utilizing the aforesaid tongue and groove joints for the ends of the refractory segments in each ring, as well as between the rings themselves all the various elements of the rosette are securely locked together to form a single compact and unitary whole.

In order that provision may be made for hoisting this unit into the pit a metal annulus 25, may be positioned within an annular groove formed by the hollowed out portions 27 on the underside of each refractory brick of the lower ring 17, which hollowed out portions are in open communication with one another when the segments of this ring are assembled together.

By providing vertical shafts 28, in the upper ring 18 which are in open communication with similar shafts 29 in the lower ring 17, means are provided, whereby tie rods 30 may be thrust therethrough and threadedly secured at their lower extremities to the annulus 25. A yoke unit 31 may then be fastened to the upper extremities of the tie rods for hoisting the entire ring into the soaking pit.

Once the rosette has been moved into position in the port opening 12 the tie rods 30 may be unscrewed from steel annulus 25, and then lifted completely out of the rosette by means of the yoke. If this is done the only metal remaining in the rosette then is the metal annulus 25. Since this ring is relatively small in comparison with the rosette as a whole and, since it is mounted within the lower ring 17 in such a way that it has sufficient room for expansion, any expansion or oxidation thereof will cause little or no pressure upon the refractory ring 17.

In the event facilities are not available for assembling the rosette as a unit outside the soaking pit, the various refractory segments having preformed tongue and groove portions may be individually lowered into the soaking pit, where

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they can be simply joined together to form a rosette by masons working in the pits. Since preformed tongue and groove segments are used the working time of the masons in the pit will obviously be reduced.

As shown in Figures 3, 5 and 6, the lower refractory ring 17 may be provided with an upper set back portion 40 along that part of its outer periphery which projects above the hearth 10. The purpose of this is to reduce the outer circumference of that part of the rosette which projects above the hearth, thereby providing more room within the soaking pit for the ingots so that their danger of striking the rosette is lessened. The upper ring 18 is accordingly also constructed with a smaller outer periphery to coincide with the reduced periphery of ring 17.

The inner peripheries of rings 17 and 18, however, remain constant so that the inner contour of the rosette as a whole will be uniform and the most favorable for evenly distributing the flame from the burner port into the soaking pit.

Since that portion of the rosette which projects above the level of the hearth is the part of the rosette, which is most subject to deterioration and destruction by contact with the ingots, it may be reinforced by a metal ring 41 as shown in Figure 5. When such a reinforcing metal ring is used in conjunction with the upper refractory ring 18, ring 18 is made in the form of a single, non-sectionalized refractory piece with the reinforcing ring cast therein.

Another advantage of utilizing a reinforcing metal ring in the upper refractory ring 18 lies in the fact that when the upper portion or upper ring of the rosette present within the soaking pit has become damaged it will be a simple matter to replace it without moving or destroying the still good and useful lowermost refractory ring 17. This is brought about by the fact that tie rods 45 can be either welded or threadedly fastened to ring 41 and a yoke unit affixed to the tie rods 45 for hoisting the new ring 18 into position over ring 17. In this way a completely new upper unit or ring can then be quickly lowered into the soaking pit to replace the damaged or destroyed upper ring. Alternatively, metal ring 41, and also tie rods 45 when the latter are welded on, are wrapped or coated with a material which is combustible or volatile when heated under the conditions of use, such as cloth, paper, tar, wax, etc. The removal or destruction of the wrapping or coating material in use has the advantageous effect of providing a free space which will permit oxidation or expansion of the metal ring, and rods, in use without causing disruption of the refractory piece. Metal ring 41 can also be constructed as a ring broken, or open, at one place whereby the ends can expand toward or past each other.

Ring 18 with its reinforcing metal ring or band 41 also has an annular depression on its underside, which serves as a groove into which tongues 23 on refractory ring 17 fit. As in the case of tie rods 30 once the new ring 18 has been lowered into place the tie rods 45 may then be removed.

The rosette of the instant invention has been described only with reference to a soaking pit which is bottom fired. However, it is obvious that it could be also utilized in a soaking pit which is side fired since in the latter case there would be no change in the structure of the rosette. The only change would be that the burner port shown in Figure 1 would serve as an exhaust opening and further openings would be

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provided in the vertical wall 11 for firing the furnace. In this case the refractory ring would serve as a port for an exhaust opening instead of a port for a burner opening.

By using individual, arcuate, tongue and grooved refractories for building a unitary rosette and by joining the refractories comprising the lower ring by tongue and groove joints not in alignment with the joints in the upper ring or by utilizing a sectionalized lower ring and a solid upper ring or vice versa, through joints in the rosette are eliminated together with the risk of having slag seep therethrough to the flues below.

Furthermore by utilizing tongue and groove joints as the means for strengthening and solidifying the rosette instead of other means the proper inner contour of the rosette can be maintained for spreading the flame and for obtaining maximum radiation to the ingots, when it is used as a burner port.

Other arrangements of tongue and groove joints may be used as well as those described and shown in the drawings and it is also within the contemplation of the invention to construct the rosette in the form of a single ring made up of a plurality of refractory segments united together by means of tongue and groove joints.

In the claims the word "ring" includes not only refractory layers made in the form of a circle, but also those which may be made in the form of a rectangle, square, triangle, etc.

Various changes and modifications may be made in the invention without departing from the spirit and scope thereof and accordingly it is not to be limited except by the appended claims.

What is claimed is:

1. The improvement in rosettes for the port opening of a soaking pit hearth comprising the combination of a plurality of refractory rings, placed one upon the other, each of said rings being comprised of a plurality of refractory segments, each one of which has tongue and groove portions, whereby the individual segments and the rings formed by said segments can be joined together as a removable unit, certain of said segments in one ring being further provided with vertical shafts, which are in alignment with similar shafts located in the ring immediately therebelow, and a metal annulus mounted in an annular groove in the underside portion of the lowermost refractory ring to which the lower extremities of tie rods thrust through said aligned vertical shafts may be threadedly connected in such a manner that when the upper extremities of the tie rods have been affixed to a yoke, the said rosette may be hoisted into position within said soaking pit.

2. The improvement in rosettes for soaking pit hearths comprising the combination of a plurality of refractory rings mounted one upon the other, the lowermost ring being comprised of a plurality of refractory segments which have tongue and groove portions whereby the individual segments of said ring can be joined together, said segments also having upstanding portions engaging groove portions in the refractory ring mounted directly above the said segments, a reinforcing metal ring located within said uppermost refractory ring, each refractory ring being further provided with vertical shafts which are in alignment with those of the ring mounted immediately therebelow and a metal annulus mounted in an annular groove in the underside portion of the lowermost refractory ring to which the lower extremi-

ties of tie rods thrust through said aligned vertical shafts may be threadedly connected in such a manner that when the upper extremities of said tie rods have been affixed to a yoke, the said rosette may be hoisted into position within said soaking pit.

3. The improvement in rosettes for soaking pit hearths comprising the combination of a plurality of refractory rings mounted one upon the other, at least one of said rings being comprised of a plurality of refractory segments which have tongue and groove portions whereby the individual segments of the said ring can be joined together, said segments also having upstanding portions which engage groove portions in the ring mounted directly above the said segments, a metal ring located within the uppermost refractory ring, means for affixing said metal ring in said uppermost refractory ring to a hoisting unit, and means for affixing the entire plurality of refractory rings comprising said rosette to a second hoisting unit, said metal ring and said means for affixing said

metal ring to a hoisting unit being coated with a material removable by heat.

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