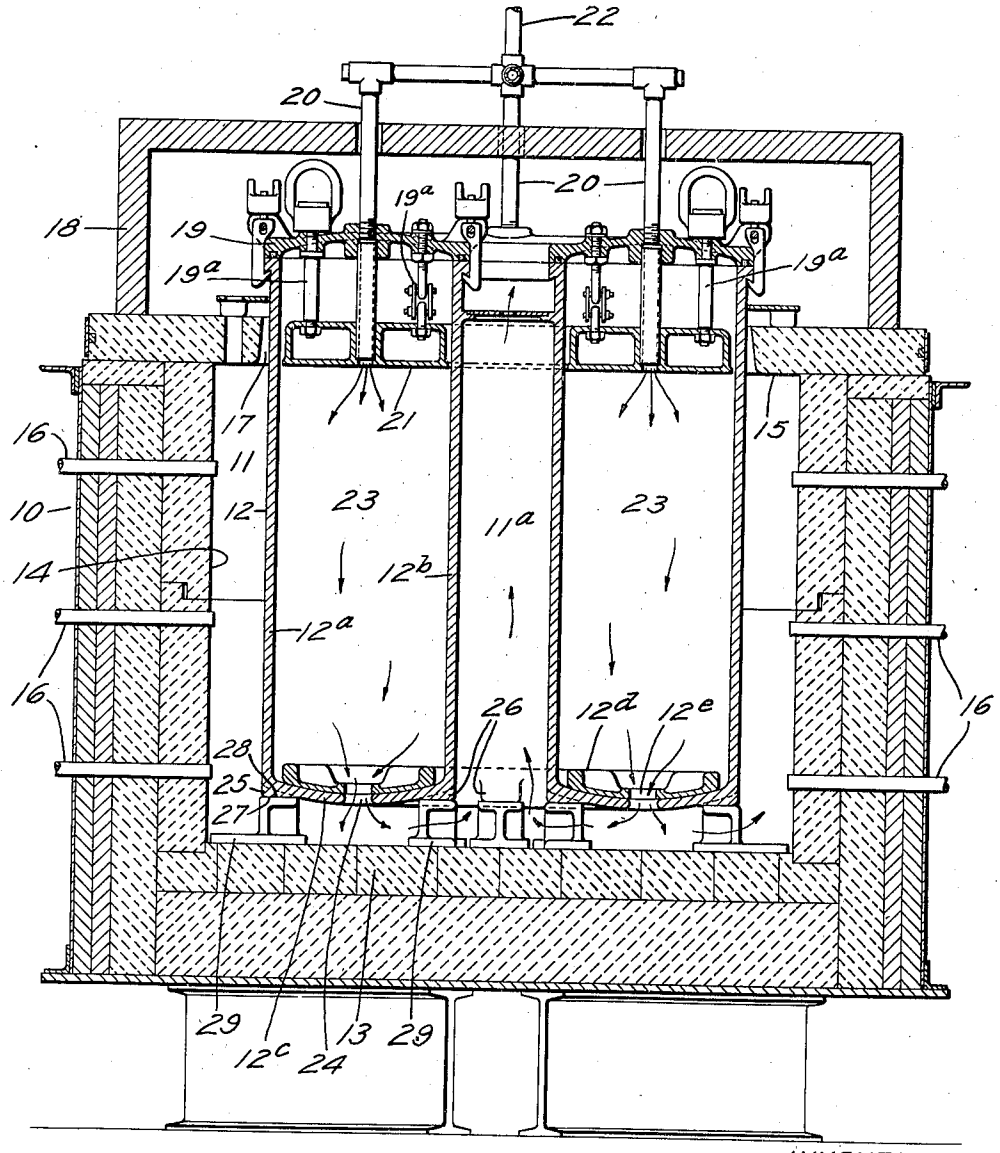
Nov. 18, 1941. P. C. OSTERMAN 2,262,960

RETORT AND SUPPORT THEREFOR

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FIG. 1



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FIG. 2

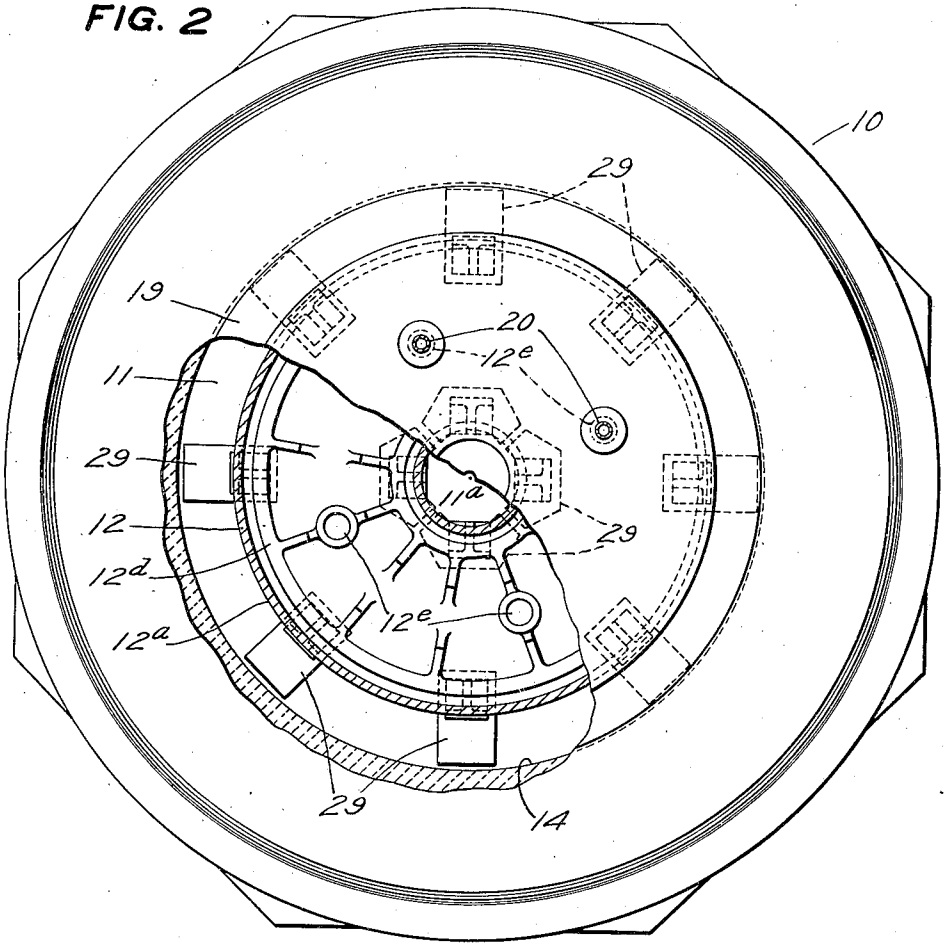


FIG. 4

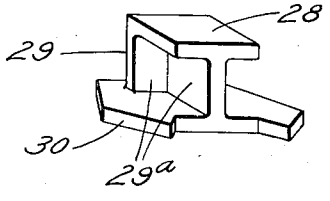
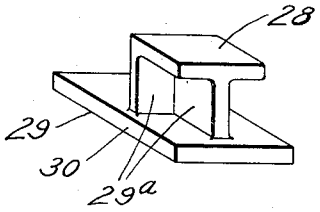


FIG. 3



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2,262,960

RETORT AND SUPPORT THEREFOR

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Application August 2, 1940, Serial No. 349,920

3 Claims. (Cl. 266—5)

The present invention relates to heat treating apparatus and concerns more particularly improvements in the design, construction, and mode of use of work enclosing retorts of the larger sizes.

The trend of industry today is toward larger and larger machinery, parts, and accessories, many elements of which require the application of one or more heat treating processes before being completed and placed in service. This current growth in the size and weight of workpieces requiring treatment, as well as the recent advances made in design and construction of machine elements, have necessitated larger and larger heat treating apparatus, including large work receiving retorts often of complex design, and still larger furnaces to heat them.

It was soon found, however, that this new and larger class of work could not be handled with apparatus of the same type that was used heretofore for customary run of small workpieces, and one of the difficulties encountered was the cracking of the large retorts at or in the regions of their legs. Cracks in a retort as well as broken legs rendered the retort unfit for further use, for the reasons that the workpieces could no longer be isolated from the harmful external atmosphere and one or more broken legs promoted unsteadiness and tipping tendencies either during the heating stage or during the cooling stage.

Furthermore, as the sizes of workpieces increased, so did the difficulties of the foundryman in molding large work receptacles increase, notwithstanding the exercise of great care and skill in an effort to produce satisfactory castings. Factors such as shrinkage, warpage, unequalized cooling of different portions of the hollow receptacles became quite serious and more difficult to cope with as the receptacles increased in size, and rendered the initial cost thereof expensive and almost prohibitive.

A primary aim of this invention is to render a retort construction available that may be conveniently and relatively inexpensively made in the largest of sizes as may be demanded, and which when put to use will be capable of withstanding repeated heating and cooling operations without danger of cracking or fracturing or otherwise being rendered unfit for use in a relatively short time.

Still another objective of this invention is to overcome and eliminate certain latent defects that heretofore has been encountered in the use of large retorts, chief among which has been a weakness developing at and about their bases and the leg regions after the retort had been subjected to relatively few heatings and coolings.

The adding of extra material to reinforce regions that later proved to be weak did not solve the problems, for such heavier regions of the retort made the foundryman's task of molding more difficult, and the retort so reinforced, did not, moreover, stand up well in service. The concentrations of metal were found to take longer to heat and held the heat longer than other regions, thus causing non-uniformity in the heating and cooling of workpieces and the setting up of severe and unequal stresses in the retort walls which also promoted fracturing.

While it is known that considerable expansion and contraction occurs incident to wide changes in temperature of the metal, reliance has heretofore been placed, in the case of small light weight retorts, upon the ability of the retort to creep on the brick floor of the furnace while expanding or contracting. This practice was feasible only because the total amount of expanding or contracting movement, in the case of the small retort, was not appreciably great and the bending stress was well within the strength and elasticity of the retort walls to overcome. But where, however, as in the case of large retorts of 30, 40 or 50 inches in diameter, the amount of expansion and contracting movement approaches a distance of one inch, ($\frac{3}{16}$''–¼''/foot), the bending stresses are considerably greater and the large retort structure, because of its great weight, was found to have a resistance to movement on the furnace floor greater than the strength of the legs. Consequently, cracks soon developed in the retort sides and one or more of the legs soon became broken.

The present invention undertakes to provide a commercially satisfactory solution to the retort cracking and leg breaking problem, and proposes a retort construction in which the receptacle and its supporting legs form an assembly having a sliding anti-friction joint or connection between the parts. With this construction the retort standards rest upon the furnace floor, but by virtue of the sliding connection between the standards and retort proper, relative movement between parts of the assembly may take place repeatedly without placing any section or portion thereof under a breaking stress.

The present invention is particularly adaptable to the torus or ring shaped retort construction wherein the direction of expanding and

contracting movement is generally radially but, at the same time may be a little one-sided in its action, depending upon the movement and intensity of the heat applied about the retort, and in such cases the provision of means to permit of relative movement, in any direction, to occur between elements of the assembly, has been found to offer the solution to a problem of long standing.

In attaining the objectives of this invention it is now proposed to construct the bottom of the retort with a series of relatively smooth bearing areas spaced thereabout. These areas may assume the form of relatively small horizontal pads, each of which projects slightly beyond the plane of the area of the bottom immediately adjacent thereto, so that it may be finished relatively smooth and to a uniform height. A series of leg supports are also constructed preferably of the same material as the retort proper, e. g., nickel chromium alloy, and each of which has a metallic top bearing surface also finished in size and shape complementary to the bearing areas on the retort bottom. The portions of the legs supports, below their finished tops, progressively increase in size so as to afford a relatively large area of contact with the floor of the furnace.

Upon assembling and use of the unit, the finished metallic surfaces of the retort and leg supports are brought into juxtaposition, and being constituted of the same high quality and high heat resisting material, form a metal-on-metal sliding connection that affords the necessary freedom of retort movement thereon notwithstanding that the lower and enlarged footing area of each of the legs is prevented from moving along the somewhat uneven and roughened refractory floor of the furnace.

By this invention heavy concentrations of metal at the leg regions of retorts has been eliminated thereby greatly facilitating the problem and expense of manufacture, and with resulting improved performance in operation.

The substantially uniformity in wall thickness, made possible by this invention, has further tended to relieve the retort of unequalized stresses during use, and this together with the provision made for free movement in any direction, has rendered available an economical to use and economical to make, retort having a usable life far exceeding the life of prior structures.

Other objects and advantages will be in part indicated in the following description and in part rendered apparent therefrom in connection with the annexed drawings.

To enable others skilled in the art so fully to apprehend the underlying features hereof that they may embody the same in the various ways contemplated by this invention, drawings depicting a preferred typical construction have been annexed as a part of this disclosure and, in such drawings, like characters of reference denote corresponding parts throughout all the views, of which—

Figure 1 is a vertical sectional view of a portable retort unit embodying this invention.

Fig. 2 is a plan view partly broken away of the assembly illustrated in Fig. 1.

Figs. 3 and 4 are perspective views of inner and outer leg standards.

Referring more particularly to Fig. 1 of the drawings the furnace proper is indicated at **10** and has a chamber **11** therein within which a workpiece container or retort **12** is positioned. The floor **13**, side walls **14**, and ceiling **15** of the furnace **10** is constructed of heat resisting refractory material, and the chamber **11** therein is heated in any well known manner, such as by the burners **16**.

In the embodiment illustrated, the ceiling **15** of the furnace is provided with an opening **17** through which the upper portions of the work receiving retort **12** projects, and the whole is surmounted by a cover **18** which helps to confine the heat about the retort and serves as a collector for used gases which are carried away.

The retort herein illustrated is constructed of nickel chromium alloy and is adapted primarily for the carrying out of carburization processes. A nickel chromium alloy has been selected for retort construction for it will stand a higher heat and will not carbonize like the ordinary iron or steels, and is constructed to receive large circular workpieces which are to be carburized on their inner peripheral surfaces as well as their outer peripheral surfaces. To attain uniformity in temperature throughout, the retort and work therein to be treated, is heated from the inside as well as from the outside and to that end the work container **12** is made ringlike in character, being somewhat in the form of a double U in vertical section. The outer vertical wall **12a** defines the outer periphery of the ring and the tubular inner wall **12b** defines the inner periphery, both walls being formed integral with a connecting annular bottom wall **12c**.

When in use, an annular cover member **19** closes and is clamped over the annular opening at the top of the torus shaped container, and is provided with one or more conduits **20** through which a treating gas may be injected into the receptacle **12** and envelope the work therein. Such treating gas is confined to the regions of the container directly housing the work, and which are subjected to the more extreme treating temperature of the furnace, by means of an insulated annular cover **21** hung by the rods **19a** from the cover **19** at a point approximately even with the ceiling wall **15** of the furnace. At least one set of the rods **19a** is so constructed as to provide for lateral movement of the cover **21** relative to the cover **19** to allow compensation for the differences in expansion of elements whose temperatures are different.

The gas conduits **20** may, if desired, communicate with a common source of supply **22**, as illustrated, and serve as a means for conducting the treating gas to the work chamber **23** underlying the annular cover **21**. The treating gas or gas mixtures fill the interior of the container and are discharged through apertures **24** in the depressed bottom wall thereof. The bottom surface **12c** of the retort is outwardly crowned for increased strength and to avoid corners and dead areas and the exhaust apertures **24** are formed in the lowermost parts thereof. A sectional grill **12d**, having corresponding openings **12e** therein, rest upon the crowned lower wall **12c** of the retort to afford level support for the workpiece.

A retort of the character described cannot be placed directly on the brick floor of the furnace for such placing would prevent retort movement and also prevent the heat of the furnace from circulating thereunder to the inner chamber **11a** as well as close off the exhaust gas outlets **24**. Heretofore it has been customary to mount the retort on legs formed integral with the walls of the retort. However, and par-

ticularly in the case of large diametered retorts, the subjecting of the retort to a wide range of temperatures, from cold to a carburizing temperature of 1650 to 1750° F., causes a considerable movement in the retort walls, with the prior constructions, cracks soon developed and legs were broken. Accidents of such character were usually attended by serious damage to the furnace and resulted in spoilage of work and were due primarily to the fact that the larger retorts, which range up to 50 inches in diameter, were so heavy and the total movement of the sides so great, that the legs would effectively resist creeping upon the refractory floor of the furnace and intense breaking stresses developed.

Slabs or bricks of refractory material can not be used as retort supports, for they too, are rough, uneven and offer undue resistance to movement, and fracturing of the retort soon develops. Moreover, bricks were not always available and could not be positioned to provide proper circulation of the heat under the retort or to yield correct or uniform elevation or support to a given retort.

This invention aims to eliminate the dangers and difficulties encountered with the prior designs, proposes a retort leg construction exceedingly simple in design, but which, by virtue of its simplicity insures, at all times, ample and proper support for large heavy retorts with the added advantages of insuring proper circulation of heating atmosphere and of providing for lateral movement in any direction of the retort sides in response to changes in temperature.

Figure 1 of the drawings illustrates a preferred embodiment of the invention, and which includes the provision of a series of bearing areas or pads 25 formed about the outer periphery of the retort and a second series of bearing places 26 about the inner periphery. The areas 25 are of a thickness such as not to involve any appreciable concentration of retort metal for the reasons above mentioned, and all lie substantially in the same horizontal plane.

The under surface 27 of the pads are finished to a uniform height and relatively smooth, and are adapted to seat upon complementary shaped and finished metal surfaces 28 of individual leg standards 29. In the operative position shown, the receptacle 12 and standards 29, constitute a complete assembly, the receptacle part of which is portable in nature.

The lower portion 30 of each leg standard 29 is expanded in area and is adapted to rest upon the refractory surface of the furnace floor, transmitting over a large area thereto, the gross weight of the retort and its contents. As a further consequence of this construction the floor of the furnace is not worn away or become pitted in spots by the frequent removal of the retort as is occasioned with the prior designs having smaller integral legs. Moreover, with the present design of retort assembly, the abutting flat surfaces 27 and 28, provide a metal to metal sliding joint or connection between each standard 29 and the main body of the retort. Notwithstanding that different portions of the retort may move in different directions and at different rates or times, the portions thereof adjacent each standard is free to move relative to the standard, in response to the magnitude of the stress at that region. Each standard has, in effect, a universally operating connection with the retort proper and, in the aggregate, form a sturdy non-tipping support for the retort and one which allows free flow of heating or other gases thereunder and therebetween.

Figures 3 and 4 of the drawings illustrate preferred forms of outer and inner leg standards respectively, each of which is provided with a relatively large and flat supporting area 28 adequately reinforced and braced by the ribs 29a. The supporting ribs 29a merge into the enlarged base portions 30, which may, in the form illustrated in Fig. 3, be rectangular in shape, or as illustrated in Fig. 4, be polygonal in shape to facilitate their spacing and positioning within the furnace. When positioned as illustrated in Figs. 1 and 2, the bases of the outer ring of standards may lie close to or even touch the vertical wall 14 of the furnace and be definitely positioned thereby, whereas the inner ring of standards, by virtue of their polygonal bases, are self spaced and located.

The sectional plan view, Fig. 2, illustrates eight anti-friction bearing areas in the outer ring of standards and four of such areas in the inner ring, and the standards in each ring are, it will be seen, spaced apart to afford uniformly distributed support to the retort as well as ample spaces therebetween for the circulation of heat under substantially the whole area of the bottom of the retort.

By this invention difficult problems incident to casting large torus shaped containers have, in the first instance, been eliminated for it is now possible to cast the elements of the assembly as separate units with relative ease, and which when assembled within the furnace, provide the necessary freedom of movement therebetween essential to avoid retort fracture.

Moreover, retorts constructed in accordance with this invention, may have their side and bottom walls substantially uniform thickness, i. e., devoid of all unduly heavy concentrations of metal, thereby to achieve not only greater uniformity in texture, size and shape of the cast retort during the steps of its manufacture, but a greater degree of uniformity in the rate of heating and cooling during use with corresponding improved heat treating effects upon the workpieces undergoing treatment therein.

Without further analysis, the foregoing will so fully reveal the gist of this invention that others can, by applying current knowledge, readily adapt it for various utilizations by retaining one or more of the features that, from the standpoint of the prior art, fairly constitute essential characteristics of either the generic or specific aspects of this invention and, therefore, such adaptations should be, and are intended to be, comprehended within the meaning and range of equivalency of the following claims.

Having thus revealed this invention I claim as new and desire to secure the following combinations and elements, or equivalents thereof, by Letters Patent of the United States:

1. An apparatus for carburizing metal articles combining a furnace having a heating chamber provided with a brick floor therein, a portable hollow container for receiving workpieces for heat treatment insertable in said chamber, said container being adapted to be subjected to high heat during the treating process and to change in size in response to changes in temperature and comprising a normally closed metal container having inner and outer cylindrical walls integrally connected about their lower edges by a ring-like bottom wall, said bottom wall being outwardly curved in cross-section and having a

plurality of apertures at the lowest portions thereof for the passage of a treating gas therethrough, means for slidingly supporting the ring-like container in the heating chamber in spaced relation with the brick floor of the furnace comprising a plurality of individual standard elements on the floor of said heating chamber, said standards being circumferentially spaced from each other as to form an inner circle and an outer circle of approximately the diameters of the said inner and outer walls of the container, each of said standards having a flat, metal bearing surface horizontally disposed along the top thereof, and a series of horizontally disposed flat bearing surfaces on the curved ring-like bottom of the container spaced about the outer periphery of said bottom and a second series of horizontally disposed flat bearing surfaces on the container bottom spaced about the inner periphery thereof, said horizontal bearing surfaces on the standards and on the container bottom being juxtaposed and affording a plurality of flat metal-on-metal regions of supporting engagement between the container and said standards operative to support the container and the gas apertures in the bottom thereof spaced from the brick floor of the furnace and to afford a minimum of resistance to lateral movement of the container in any direction on and relative to the said standards in response to changes in the temperature of the container.

2. In the art of heat treating workpieces, a furnace having a brick floored heating chamber therein, a portable normally closed metal container insertable in said chamber and adapted to be subjected to high furnace heat for holding and enclosing the work during the heating stages and which container changes in size in accordance with changes in the temperature thereof; said container having side walls and a bottom wall integrally united, relatively stationary metal supporting means for supporting said container above the brick floor of the heating chamber of the furnace comprising a plurality of individual metal standards adapted to be positioned about the floor of the heating chamber and under the bottom wall of said container, each of said standards having a relatively smooth bearing surface on the top thereof on which the metal container slidingly seats, and each of said standards also having a foot portion of an area larger than its said bearing surface adapted nonslidingly to engage the brick floor of the heating chamber, a plurality of bearing pads on the underside of the bottom wall of the container, each pad being machined flat to provide a bearing surface complementary to the bearing surfaces formed upon the metal standards, said flat bearing surfaces on the container bottom and the metal standards cooperating to support the container in spaced relation with the floor of the heating chamber and affording laterally yieldable joints facilitating relative movement of the container on and relative to the said standards in response to changes in the temperature of the container occurring as an incident to the heat treating process.

3. A retort and leg assembly for heat treating workpieces in a furnace comprising a portable metal container member having a bottom wall and integral side walls adapted to receive workpieces for heat treatment, a cover member therefore, means for supporting said container in spaced relation with the floor of a heating chamber of the furnace including a plurality of spaced pads on the bottom of the container, each providing a horizontally disposed metallic bearing surface on and integral with the bottom of said container member, a plurality of metal supporting standards, each standard having a horizontally disposed bearing surface thereon adapted to coact respectively with the metal bearing surfaces on said container, said standards being positioned about the floor of the heating chamber in underlying abutting relation to the bearing surfaces on the container for supporting the container in said spaced relation with the floor of the heating chamber, said horizontal bearing surfaces providing a metal-on-metal sliding connection between the container and the standards capable of affording minimum resistance to container movement on and relative to the standards in any lateral direction in response to the changes in temperature of the container during the treating process.

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