Aug. 2, 1938. J. C. WOODSON 2,125,661

ANNEALING FURNACE

Filed Oct. 7, 1937 2 Sheets-Sheet 1

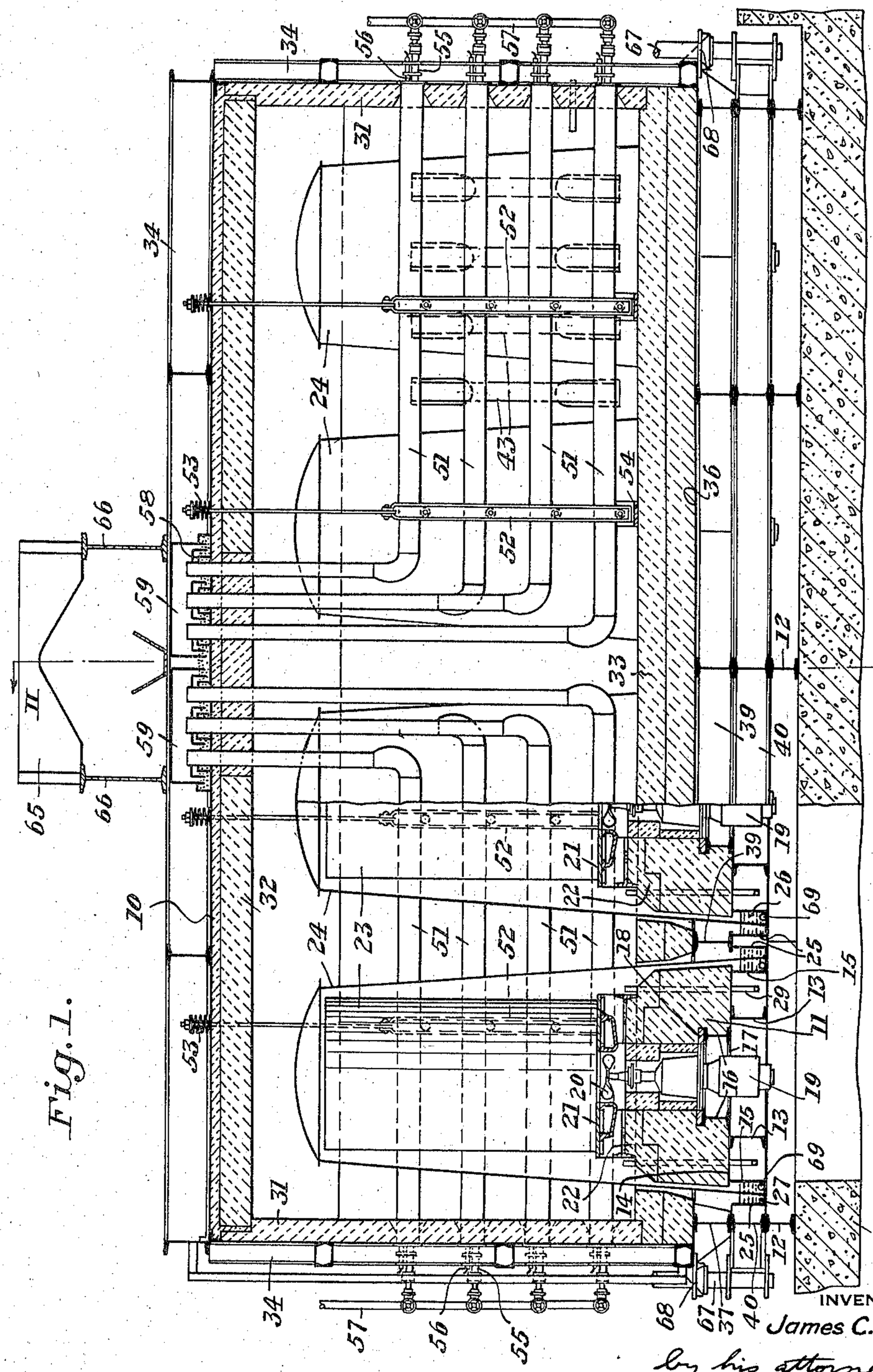

Fig. 1.

INVENTOR

James C. Woodson

by his attorneys

Stebbins, Blenko & Parmelee

Aug. 2, 1938. J. C. WOODSON 2,125,661

ANNEALING FURNACE

Filed Oct. 7, 1937 2 Sheets-Sheet 2

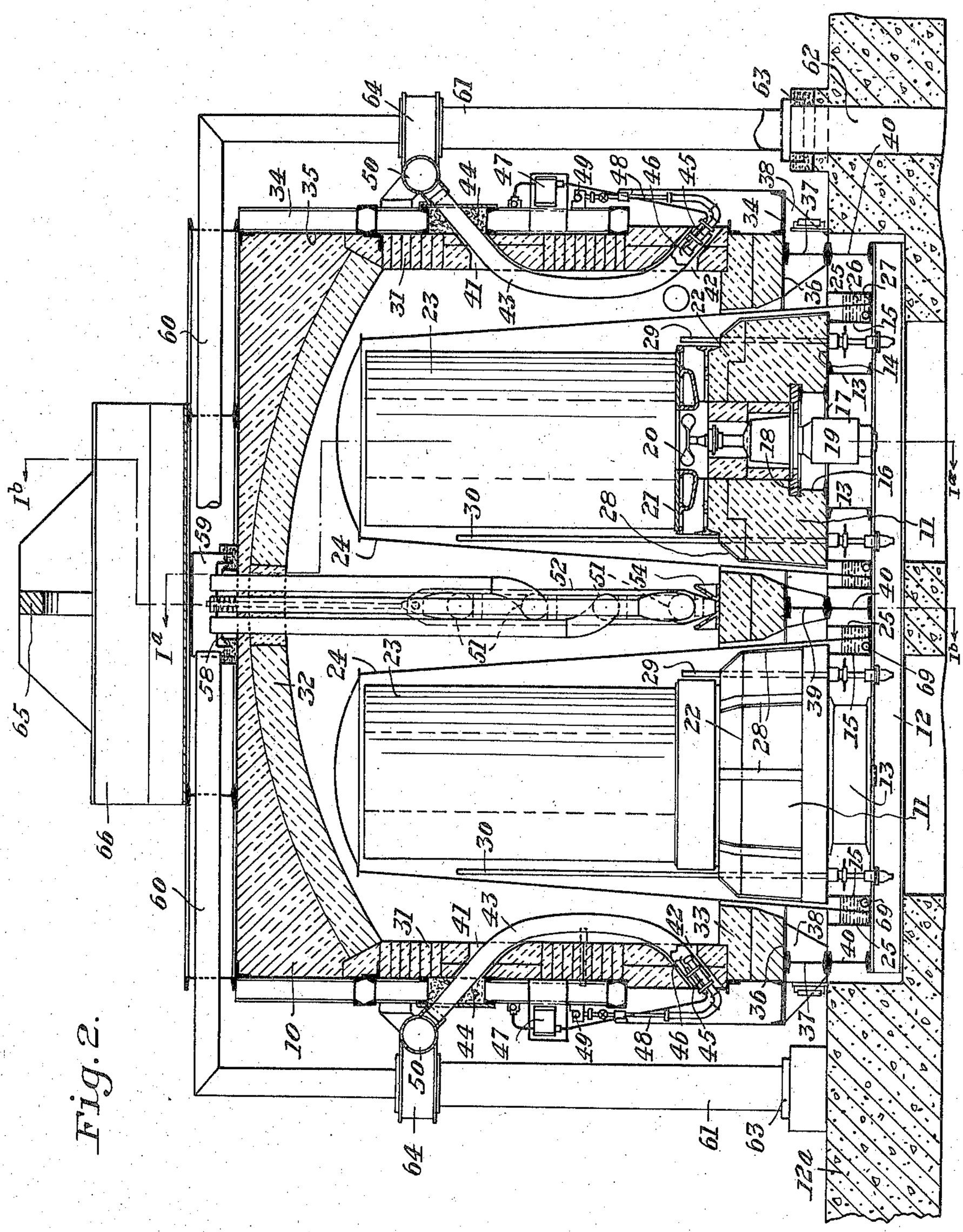

Fig. 2.

INVENTOR
James C. Woodson
by his attorneys
Stebbins, Blenko & Parmelee

Patented Aug. 2, 1938 2,125,661

UNITED STATES PATENT OFFICE

2,125,661

ANNEALING FURNACE

James C. Woodson, Cleveland, Ohio, assignor to Lee Wilson Sales Corporation, Cleveland, Ohio, a corporation of Ohio

Application October 7, 1937, Serial No. 167,721

3 Claims. (Cl. 263—42)

This invention relates to annealing apparatus, and in particular to an annealing furnace of the cover type, which is adapted to be lowered over the material to be annealed and lifted therefrom when the material has been heated to the desired temperature.

Cover type annealing furnaces as constructed heretofore have consisted of an open-bottomed refractory lined enclosure adapted to be lowered on a refractory covered base or hearth. Inner protective covers have been disposed over the material. These inner covers are also open-bottomed enclosures of light plate, and the lower edges thereof cooperate with sand seals formed in the base or hearth. Such seals permit a slight leakage of the special atmosphere supplied to the space inside the inner covers, but this leakage is not important ordinarily because of the relatively low cost of the deoxidizing atmosphere normally employed.

The present invention is an improvement on the previous construction of cover type furnaces, whereby fluid seals are provided for cooperation with the inner covers. The invention makes it economical to employ more costly deoxidizing gases than have been used heretofore with the more desirable results accruing therefrom.

In accordance with the invention, I provide a charge support or a plurality thereof for cooperation with a cover which has a bottom wall, as well as the usual side walls and roof. The bottom wall is provided with openings adapted to admit the charge supports with a slight clearance. Sealing channels are disposed around the charge supports at a level below that of the bottom wall of the cover when the latter is disposed in cooperative relation with the charge supports. An inner protective cover has its lower edge seated in the sealing channel, the lower portion of its side wall being disposed in the clearance space between the bottom wall of the furnace cover and the charge support. Since the sealing channel is outside the enclosure defined by the furnace cover and charge support, it is protected from the intense heat within the enclosure. Fluid sealing material may be thus employed. I also provide means for cooling the fluid sealing material in the channel.

A complete understanding of the invention may be obtained from the following detailed description thereof which refers to the accompanying drawings illustrating a present preferred embodiment. In the drawings:

Figure 1 is a longitudinal sectional view showing the parts in elevation; and

Figure 2 is a transverse sectional view taken along the line II—II of Figure 1. Lines I^a—I^a and I^b—I^b indicate, respectively, the planes on which the sections at the left and right-hand sides of Figure 1 are taken.

Referring now in detail to the drawings, the apparatus of my invention comprises, generally, a cover 10 and one or more charge supports 11. In the example shown, there are eight charge supports arranged in two parallel rows, as clearly shown in the drawings. These supports are carried on beams 12, disposed on a suitable foundation 12^a. Channels 13, extending between adjacent beams 12, support a bottom plate 14. An inner channel wall 15 extends around the bottom plate and is spaced slightly inward of the edge of the latter, thereby cooperating with the channel 13 to support it. A central annular wall 16 extends around a central opening 17 in the bottom plate 14. The wall 16 may be conveniently formed of a beam or other shape bent to the proper curvature. A bearing plate 18 rests on the wall 16 and supports a motor 19 for driving a fan 20, mounted on a shaft journaled in bearings suitably disposed on the plate 18. A charge support proper, shown at 21, rests on a pier 22 of refractory material built up on plate 14. The charge support 21 is adapted to receive a coil of strip indicated at 23.

An inner protective cover 24 is adapted to be disposed over the charge 23. An outer sealing channel wall 25 extends around the inner wall 15 and is spaced outwardly therefrom to provide a sealing channel containing sealing fluid indicated at 26. As shown, the lower edge of the inner cover is seated in the channel formed by the walls 15 and 25 and an annular bottom plate 27. The pier 22 is provided with guards 28 in the form of straps extending down over the lateral faces thereof in circumferentially spaced relation. Inlet and exhaust pipes 29 and 30 for deoxidizing gas extend upwardly through the beam 22.

The cover 10 includes side walls 31, a roof 32, and a bottom wall 33. The side walls and roof are formed of refractory brick assembled within a shell composed of frame members 34 and sheathing plates 35. A bottom wall 33 is similarly composed of refractory brick laid on a plate 36. Beams 37 extend along the lower edges of the cover below the plate 36 and are secured to frame members 34 by gusset plates 38. In addition to the beams 37, extending along the sides and ends of the cover, intermediate beams 39 form therewith a lattice for supporting the bottom plate 14 of the cover. When the cover is disposed over

the charges and their supports, the beams 37 and 39 rest on beams 40 extending transversely of the beams 12.

Opposite side walls 31 (preferably the longer ones) are provided with ports 41 and 42 through which heat exchange tubes 43 extend into and out of the space within the cover. Sealing channels 44 extend along the side walls 31 and embrace the upper ends of the heat exchange tubes 43 where they emerge from the side walls. A burner 45 extends into the lower end of each of the tubes 43 and is provided with an ignition electrode 46. The latter is connected to a transformer 47, whereby a spark gap between the electrode and the burner may be created to ignite combustible gas issuing from the burner. Combustion of such gas occurs by the aid of atmospheric air induced into the lower ends of the tubes. The tubes 43 are preferably spaced uniformly along substantially the full length of the side walls 31, although only a few such tubes are indicated in Figure 1. Fuel gas is supplied to the burners through valved connections 48 from manifolds 49. Exhaust gases are discharged from the upper ends of the tubes 43 into manifolds 50.

In addition to the heat exchange tubes 43, carried by the side walls 31, I provide heat exchange tubes 51, extending inwardly from the shorter side walls 31 and upwardly through the roof 32 at a point substantially centrally thereof. The heat exchange tubes 51 are suspended by stirrups 52, depending from the roof and carried on springs 53. The lower ends of the stirrups fit into guide and supporting blocks 54.

The heat exchange tubes 51 and their manner of mounting in the furnace cover are the subject of my copending application Ser. No. 166,052, filed September 28, 1937, for Annealing furnace and method.

The outer ends of the tubes 51 are provided with burners 55 and ignition electrodes 56. The burners are supplied from manifolds 57. The upper ends of the tubes 51 are provided with seals 58 and discharge into collector boxes 59. Exhaust ducts 60 lead from the boxes 59 to downcomers 61. The latter communicate with the exhaust passages 62, but are separable therefrom. A seal 63 closes the joint between the downcomers and the passages. The manifolds 50, furthermore, communicate with the downcomers 61 by connections 64.

When the apparatus described above is to be used for the annealing of material, the cover 10 is raised from its supporting beams 40 by any convenient means, such as a crane. For this purpose, a yoke 65 extends between beams 66 secured to the beams of the framework 34, which extends longitudinally of the roof. When the cover 10 has been raised, charges, such as the coils 23, are placed on the supports 21 and inner covers 24 disposed thereover, as shown in the drawings. Deoxidizing gas is then supplied to the space inside the inner covers by the pipes 29 and 30. The cover 10 is then lowered over the charges. Guide pins 67 on the base, cooperating with eyes 68 on the cover, facilitate this operation. When the cover 10 is in position, the burners in the heat exchange tubes are ignited and heat is radiated from the tubes to the covers 24 and thence to the coils 23. The fans 20 facilitate the delivery of heat from the walls of the covers 24 to the coils 23.

Since the channels for the sealing fluid 25 are below the level of the bottom wall 37 of the furnace cover, they are protected to a great extent from the intense heat developed within the furnace cover. The clearance between the piers 22 and the holes in the bottom wall 33 is hardly more than sufficient to accommodate the side walls of the inner covers so that practically the only heat which can reach the sealing fluid is that conducted thereto through the walls of the inner covers. To absorb this heat, I provide cooling coils 69 in the fluid seals which prevent overheating of the fluid. The bottom wall 33 protects the fluid seals and the supporting structural framework from substantially all direct radiation from the interior of the furnace cover, despite the holes in the bottom wall, as the latter are largely filled, when the cover is in position, by the piers 22.

It will be apparent from the foregoing description that the invention provides more effective sealing of the space within the inner covers than was attainable with the sand seals used heretofore. As a result, it becomes economical to use more costly deoxidizing gases than have been employed in the past. This is desirable for the metallurgical effect upon the material being annealed. It will be understood that the bottom plates 14 are welded to the inner channel walls 15 and that the bearing plates 18 are gas-tight and are welded to the annular wall 16, whereby the space under each inner cover is proof against leakage of the gas contained therein when the cover is in place with its bottom edge in the sealing channel.

While I have illustrated the invention as applied to a furnace adapted to accommodate a plurality of charges, it may also be embodied in a furnace adapted to receive a single charge. The latter modification is described and claimed in my copending application Ser. No. 162,132, filed September 2, 1937, for Coil annealing furnace.

Although I have illustrated and described but a preferred embodiment of the invention, it will be understood that changes therein may be made without departing from the spirit thereof or the scope of the appended claims.

I claim:

1. In apparatus for annealing a plurality of charges, the combination with a plurality of spaced, aligned bases each adapted to receive and support a charge thereon, of a cover adapted to be lowered over said bases to enclose said charges, said cover including a bottom wall, side walls and a roof, said bottom wall being provided with spaced, aligned holes shaped and dimensioned to admit said bases.

2. In annealing apparatus, the combination with a plurality of spaced bases each adapted to receive and support a charge to be annealed, of a heating cover disposable over said bases and charges thereon, said cover having a bottom wall, side walls and a roof, said bottom wall having openings therein shaped and dimensioned to admit said bases with clearance therearound, a sealing channel extending around each base, and an open-bottomed protective cover disposed over each base and extending downwardly through said clearance into said channel out of contact with said base and heating cover, and a fixed support for said heating cover extending a substantial distance upwardly above said channel.

3. An annealing furnace comprising a bottom wall, side walls and a roof, said furnace being disposable over a plurality of spaced bases each adapted to support a charge of material to be

annealed, said bottom wall having openings therein shaped and dimensioned to admit said bases with a slight clearance extending around each base, and certain of said side walls being provided with heat-radiating means, a sealing channel extending around each base at a level substantially below the top thereof, and an inner protective cover overlying each base, extending through said clearance out of contact with said base and furnace and having its lower edge seated in one of said channels.

JAMES C. WOODSON.