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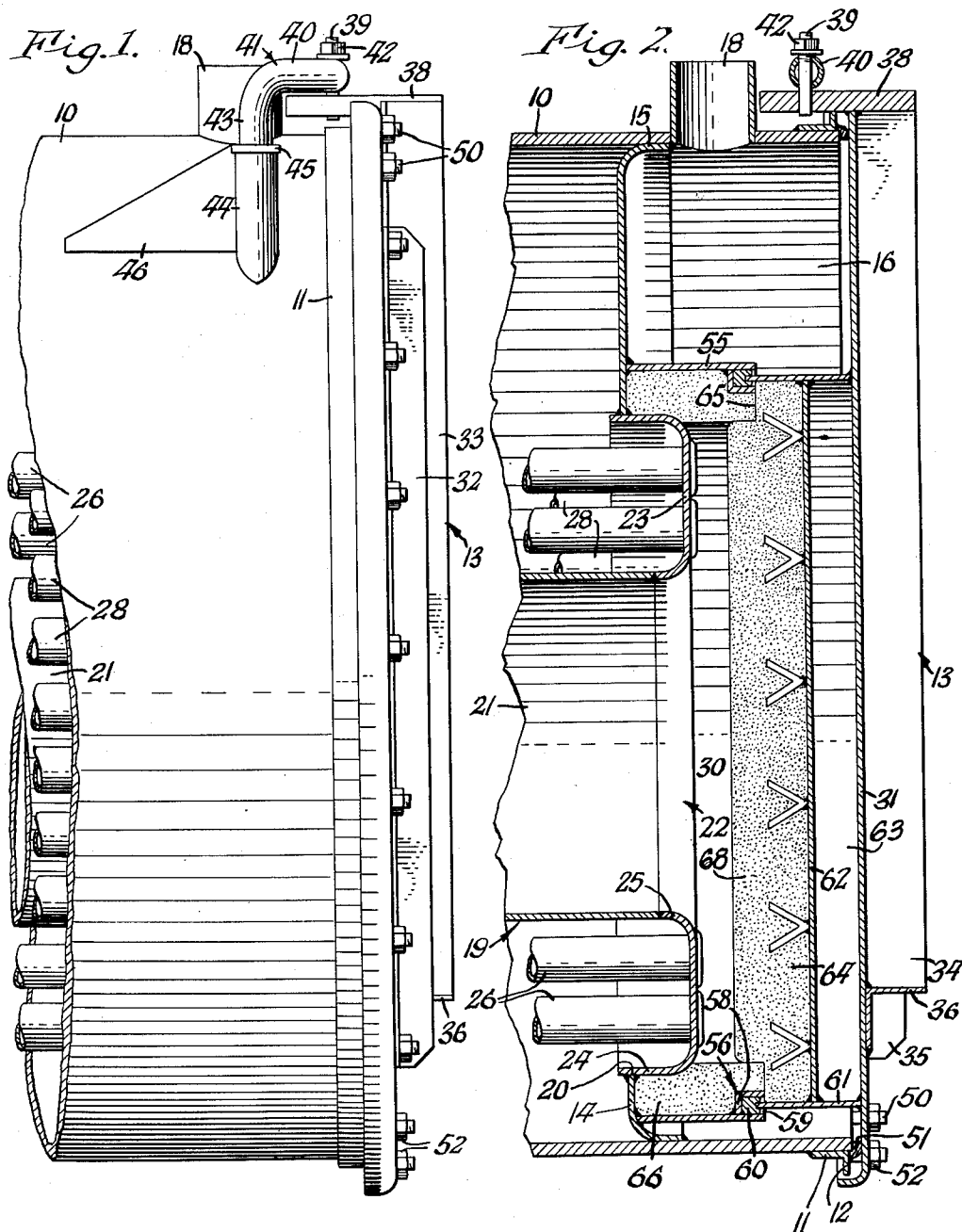
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FIRE TUBE BOILER HAVING REMOVABLE SMOKE BOX CLOSURE

Filed Aug. 17, 1950

2 SHEETS—SHEET 1



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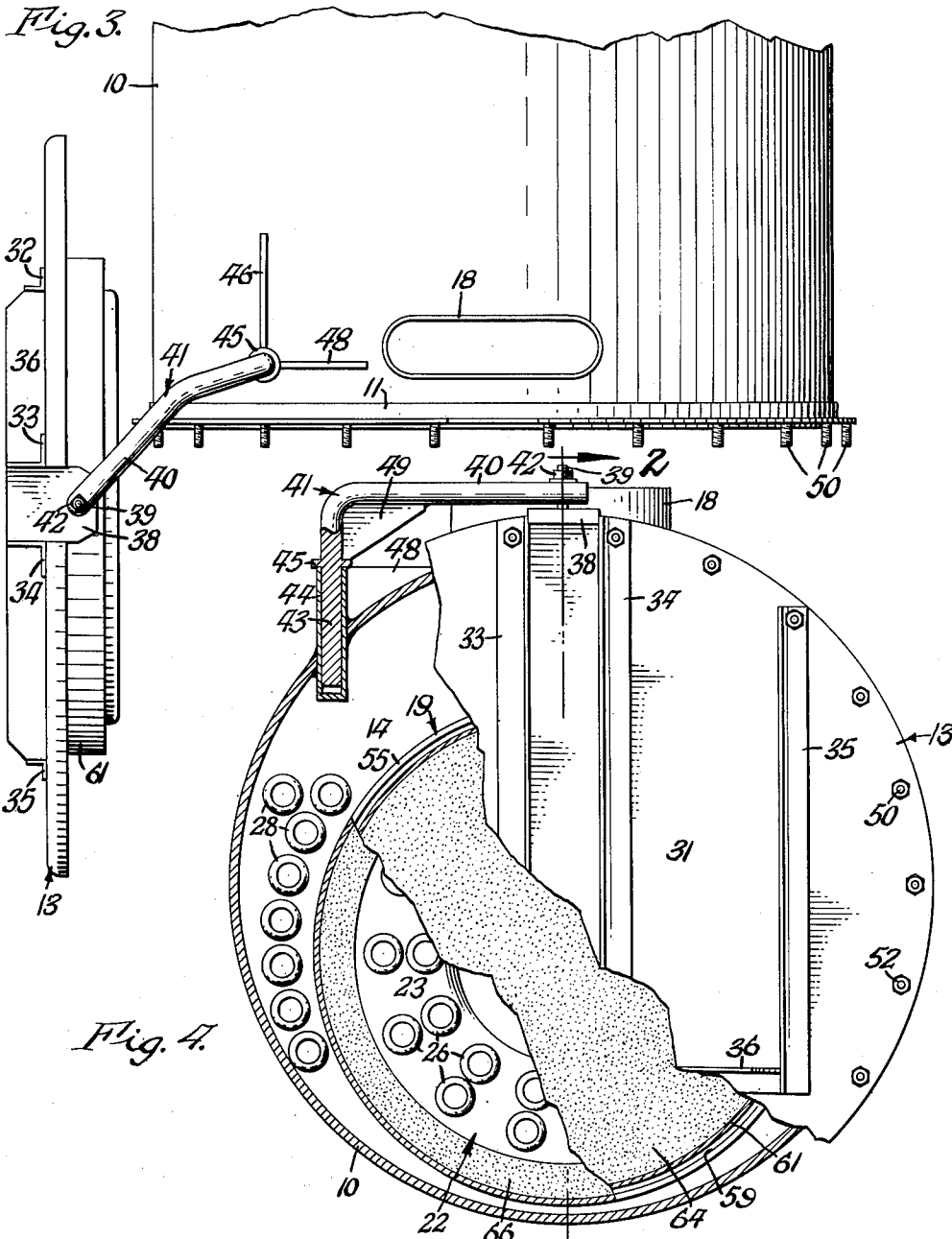
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UNITED STATES PATENT OFFICE

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FIRE TUBE BOILER HAVING REMOVABLE
SMOKE BOX CLOSURELouis John Henc, Titusville, Pa., assignor to
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Application August 17, 1950, Serial No. 179,931

3 Claims. (Cl. 122-149)

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This invention relates to a boiler construction for steam generators or the like and is more particularly shown in the horizontal fire tube type of boiler shown in my copending application Serial No. 172,116, filed July 5, 1950, for Boiler although features of the invention can be employed in horizontal fire tube boilers of other constructions.

One of the principal objects of the present invention is to provide a boiler having a removable rear cover or end closure, preferably carried by a davit, which, when open, exposes the entire gas outlet chamber; interior of the tubular internal furnace shell or main combustion tube; rear face of the rear main transverse end head or tube sheet; rear face of any projecting subhead between the main combustion tube and the rear tube sheet; rear ends of any forward pass boiler tubes through the projecting subhead; and rear ends of the rearward pass boiler tubes connected with the rear main transverse end head or tube sheet.

Another object is to provide such a removable rear cover or end closure which, when closed, provides a gas transition chamber at the rear of the projecting subhead and also provides an adequate seal between this gas transition chamber and the gas outlet chamber at the rear of the boiler.

A further object is to provide such a sealed separator between the gas transition chamber and gas outlet chamber of a projecting subhead boiler which is composed of parts carried by the rear main transverse end head or tube sheet and the cover or rear closure, respectively, of the boiler and in which each part is provided with an adequate refractory lining.

Another object is to provide such a boiler closure which includes a dead air space between its rear plate and its refractory lining to further insure against destructive heat transfer.

Other objects and advantages will appear from the following description and drawings in which:

Fig. 1 represents a fragmentary side elevation of the rear end of a boiler embodying the present invention.

Fig. 2 is a fragmentary vertical longitudinal section therethrough, this section being taken generally on line 2-2 of Fig. 4.

Fig. 3 is a fragmentary top plan view of the rear end of the boiler shown in Figs. 1 and 2 and showing the rear closure in its open position.

Fig. 4 is a rear elevational view of the boiler, partly in section.

The invention is shown as embodied in the rear

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end of a horizontal fire tube type of boiler having a cylindrical boiler shell 10, having a rear end ring 11 provided with an outwardly projecting flange 12.

The invention is concerned only with the rear end of the boiler and for a more complete showing of the entire boiler reference is made to my said co-pending application for Boiler, Serial No. 172,116, filed July 5, 1950.

The rear end of the boiler shell 10 is closed by a circular rear cover or rear boiler closure indicated generally at 13 and a rear main transverse end head of tube sheet 14 is welded inside the rear end of the boiler shell, this main transverse end head being shown as having a rearwardly projecting peripheral flange 15 welded to the inside of the boiler shell in spaced relation to the rear cover or boiler closure 13 so as to provide a last gas or gas outlet chamber 16 at the rear end of the boiler. This gas outlet chamber is provided with a gas discharge outlet flue 18. The rear main transverse end head or tube sheet 14 forms part of a rear tube sheet structure indicated generally at 19 and is provided with a circular opening 20 which is concentric with the internal furnace shell or combustion tube 21 of the boiler but is of considerably larger diameter than this combustion tube.

The boiler is shown as including a projecting subhead indicated generally at 22 and which is disposed in the opening 20 through the rear tube sheet or transverse end head 14. This projected subhead is in the form of an annular shell which is U-shaped in cross section, having a vertical annular rear wall 23, an outer flange 24 which projects axially forwardly through the opening 20 in the rear tube sheet or transverse end head 14 and an inner annular flange 25 which projects axially forwardly into engagement with the rear edge of the internal furnace shell or combustion tube 21. The abutting edges of the combustion tube 21 and the inner flange 25 of the subhead 22 are butt welded, and the edge of the opening 20 in the rear main transverse end head of tube sheet 14 can be welded to the outer flange 24 of this subhead. The subhead 22 thereby is in the form of a rearwardly extending protuberance from the combustion tube 21 and rear tube sheet 14 of the boiler.

Inner or forward pass boiler tubes 26 connect the projecting subhead 22 with the front main transverse end head or tube sheet (not shown). These boiler tubes are shown as arranged in two annular rows around the internal furnace shell or combustion tube 21 and are immersed in the

body of water surrounding this combustion tube and contained within the boiler shell 10. The rear ends of these forward pass boiler tubes 25 extend through and are secured to the vertical annular rear wall 23 of the projecting subhead 22 and the front ends of these boiler tubes extend through and are secured to the front tube sheet (not shown). Accordingly the products of combustion leaving the rear end of the tubular internal furnace shell or combustion tube 21 travel radially outward around the projecting subhead 22 and enter the inner or forward pass boiler tubes 26 and are conducted to the front end of the boiler. From the front end of the boiler the products of combustion are conducted rearwardly through outer or rearward pass boiler tubes 28 which connect the front tube sheet (not shown) with the rear main transverse end head or tube sheet 14 and discharge the products of combustion into the gas outlet chamber 16.

It will be seen that the body of water within the boiler shell 10 contacts and hence water cools the boiler shell 10; main transverse rear end head or tube sheet 14; main combustion tube 21; the two series of boiler tubes 26 and 28; and also the projecting subhead 22.

The invention is primarily concerned with the construction of the rear cover or rear boiler closure 13 and the manner in which it provides a gas transition chamber 30 at the rear end of the projecting subhead 22 and the manner in which it provides a seal between this gas transition chamber 30 and the gas outlet chamber 16. This rear cover or rear boiler closure is shown as comprising a circular, flat sheet metal plate 31 having welded to its rear face a series of spaced, vertically extending reinforcing angle bars 32, 33, 34, 35. The lower ends of these angle bars can be joined by a horizontal angle bar 36 also welded to the plate 31 and between the central pair 33 and 34 of these vertical reinforcing angle bars a metal block 38 is secured, this metal block being arranged at the top of the rear cover or boiler closure 13 and being suitably welded to the reinforcing bars 33 and 34. This block 38 projects forwardly from the circular flat sheet metal plate 31 and at its forward end has welded thereto a pin 39 the threaded upper end of which projects upwardly through the horizontal arm 40 of a davit 41 and is held thereon by a nut 42. The davit arm 40 is continued to form a vertical post 43 which is journaled in a sleeve 44 extending through and welded to the boiler shell 10, this post 41 having a collar 45 supporting the post on the sleeve 44. The upper end of the sleeve 44 can be reinforced by a suitable number of vertical, triangular plates 46 and 48 and the horizontal arm 40 of the davit 41 is also preferably reinforced by a triangular plate 49.

To secure the rear cover or boiler closure 13 in position, the flanged ring 11 at the rear of the boiler shell 10 is provided with an annular series of stud bolts 50 secured thereto and projecting through holes provided in the margin of the circular flat sheet metal plate 31. The usual sealing gasket 51 is interposed between this circular flat metal plate 31 and the flange 12 of the ring 11 and the gasket is compressed by nuts 52 applied to the stud bolts 50.

A cylindrical sheet metal extension 55 is welded at its forward edge to the rear face of the rear main transverse end head or tube sheet 14 in concentric relation with the projecting subhead 22, this cylindrical extension preferably being of substantially greater diameter than this project-

ing subhead and extending beyond the subhead and part way toward the circular flat sheet metal plate 31 of the rear cover or closure 13 for the boiler. Within its outer end a ring 56 is welded to this cylindrical projection, this ring being L-shaped in cross section and having an inner radially outwardly projecting flange 58 fitted in and welded to the cylindrical projection 55 so as to form an annular groove or channel 59 around and inside the rear rim of the cylindrical projection 55. In this groove 59 is placed a ring or gasket 60 of a suitable sealing compound, this gasket or ring of sealing compound being engaged and compressed by the forward rim of a metal tubular member or cylinder 61 which is secured to its rear edge, as by welding, to the forward face of the circular flat sheet metal plate 31 of the rear cover or boiler closure 13.

Within the metal cylinder 61 there is welded a sheet metal disk 62, this sheet metal disk being in spaced relation to the circular flat sheet metal plate 31 so as to form a circular dead air chamber 63. To the forward face of this sheet metal disk or partition 62 is welded, at their apexes, a series of V-shaped wires, these wires serving as an anchorage for a body 64 of refractory material with which the forward end of the metal cylinder 61 is lined.

At its rim, this lining or body of refractory material 64, as indicated at 65, fits against the rear face of an annular body 66 of refractory material with which the cylindrical extension 55 of the rear main transverse end head or tube sheet 14 is lined. This annular refractory lining 66 fills the space between the outer flange 24 of the projecting subhead 22 and the cylindrical extension 55 and also encloses the corresponding sides of the ring 56 which provides the channel 59 at the rearward end of this cylindrical extension 55. Preferably the body of refractory lining 64 carried by the rear main cover or closure 13 fits within the annular refractory lining 66 carried by the main transverse end head or tube sheet 14, and for this purpose is provided with a central forwardly protruding portion 68.

It will be seen that when the rear cover or closure 13 of the boiler is swung open, as indicated in Fig. 3, it exposes the entire gas outlet chamber 16; the full interior of the tubular internal furnace shell or main combustion tube 21; the entire rear face of the rear main transverse end head or tube sheet 14, together with the interiors of the rearward pass boiler tubes 28 extending through this tube sheet; and the entire rear face of the projecting subhead 22, together with the interiors of the forward pass boiler tubes 26 extending through and connected to this projecting subhead. Accordingly it will be seen that swinging open the rear cover or closure 13 of the boiler exposes the entire rear end of the boiler so as to make inspection, cleaning and repairs very convenient.

To close the rear cover or boiler closure 13 it is merely necessary to swing it on the davit 41 so as to align the stud bolts 50 with the holes through the rim of the circular flat sheet metal plate 31 of the rear cover, following which the nuts 52 can be applied to tighten the rear closure or cover 13 against the sealing gasket 51 between this rim and the circular ring 11 at the rear end of the boiler shell 10. In so tightening these nuts the forward rim of the metal cylinder 61 secured to the forward face of the circular flat sheet metal plate 31 engages and displaces the ring 60

of sealing material contained within the annular channel 59 provided by the ring 56 within the cylindrical extension 55 of the rear main transverse end head or tube sheet 14.

At the same time, the rim of the refractory lining 64 of the rear cover or closure 13 is drawn against the rear face of the refractory ring 66 lining the rearward cylindrical extension 55 of the main transverse end head or tube sheet 14. Also in closing the cover the forward protuberance 68 of the refractory lining 64 for the rear cover or closure 13 of the boiler enters the ring 66 of refractory material so as to further inhibit the escape of gases from the gas transition chamber 30 to the gas outlet chamber 16. In order to escape from this gas transition chamber 30 to the gas outlet chamber 16 it is necessary for these gases to first make the right angle turn provided by the contiguously opposing faces of the refractory linings 64 and 66 and then to escape past the ring 60 of sealing compound. Even if this ring of sealing compound should leak or even become badly burned out there is still no danger of a destructive blow torch action of these escaping gases because the velocity of the escaping gases is reduced by the labyrinthian path through which the gases are compelled to pass in so escaping.

From the foregoing it will be seen that the present invention provides a boiler in which the entire interior rear end is rendered fully accessible by the simple expedient of opening the rear cover or closure and in which closing this rear cover or closure automatically provides a fully sealed separator between a gas transition chamber at the rear end of the main combustion chamber and the gas outlet chamber.

I claim:

1. A boiler comprising a boiler shell, a combustion tube within said shell, a rear transverse tube sheet across the rear end of said shell in forward spaced relation to the rear end thereof to provide a rear chamber in said shell, said tube sheet having an opening of larger size than said combustion tube and registering therewith, an annular subhead having its inner part secured to the corresponding end of said combustion tube and extending radially outwardly therefrom, an outer annular flange on said subhead projecting axially away from said one end of said shell toward said tube sheet and joined thereto around said opening whereby said subhead provides an annular protuberance projecting axially from said tube sheet toward said one end of said shell, a series of forward pass boiler tubes adjacent said combustion tube and connected with said projecting subhead, a series of rearward pass boiler tubes remote from said combustion tube and connected with said tube sheet, a removable closure member for the rear end of said shell, a gas outlet flue from said rear chamber, a metal tubular member interposed between said projecting subhead and said rearward pass boiler tubes and secured to said tube sheet to project rearwardly therefrom part way across said rear chamber and thus to provide an annular channel formed by said tube sheet, projecting subhead and metal tubular member, a tubular refractory lining for said metal tubular member and fitted in said channel and engaging said projecting subhead and tube sheet, a second metal tubular member secured to said closure member to project forwardly therefrom and generally registering with said first tubular metal member, and a disk-like refractory lining for said second metal tubular

member and arranged to mate with the rear end of said first refractory lining.

2. A boiler comprising a boiler shell, a combustion tube within said shell, a rear transverse tube sheet across the rear end of said shell in forward spaced relation to the rear end thereof to provide a rear chamber in said shell, said tube sheet having an opening of larger size than said combustion tube and registering therewith, an annular subhead having its inner part secured to the corresponding end of said combustion tube and extending radially outwardly therefrom, an outer annular flange on said subhead projecting axially away from said one end of said shell toward said tube sheet and joined thereto around said opening whereby said subhead provides an annular protuberance projecting axially from said tube sheet toward said one end of said shell, a series of forward pass boiler tubes adjacent said combustion tube and connected with said projecting subhead, a series of rearward pass boiler tubes remote from said combustion tube and connected with said tube sheet, a removable closure member for the rear end of said shell, a gas outlet flue from said rear chamber, a metal tubular member interposed between said projecting subhead and said rearward pass boiler tubes and secured to said tube sheet to project rearwardly therefrom part way across said rear chamber and to provide an annular channel formed by said tube sheet, projecting subhead and metal tubular member, a tubular refractory lining for said metal tubular member and fitted in said channel and engaging said projecting subhead and tube sheet, a second metal tubular member secured to said closure member to project forwardly therefrom and generally registering with said first tubular metal member, and a disk-like refractory lining for said second metal tubular member and arranged to mate with the rear end of said first refractory lining, a central part of one of said refractory linings protruding into a central recess in the other of said refractory linings to provide an annular labyrinthian crevice therebetween thereby to inhibit the escape of gas between said refractory linings.

3. A boiler comprising a boiler shell, a combustion tube within said shell, a rear transverse tube sheet across the rear end of said shell in forward spaced relation to the rear end thereof to provide a rear chamber in said shell, said tube sheet having an opening of larger size than said combustion tube and registering therewith, an annular subhead having its inner part secured to the corresponding end of said combustion tube and extending radially outwardly therefrom, an outer annular flange on said subhead projecting axially away from said one end of said shell toward said tube sheet and joined thereto around said opening whereby said subhead provides an annular protuberance projecting axially from said tube sheet toward said one end of said shell, a series of forward pass boiler tubes adjacent said combustion tube and connected with said projecting subhead, a series of rearward pass boiler tubes remote from said combustion tube and connected with said tube sheet, a removable closure member for the rear end of said shell, a gas outlet flue from said rear chamber, a metal tubular member interposed between said projecting subhead and said rearward pass boiler tubes and secured to said tube sheet to project rearwardly therefrom part way across said rear chamber and to provide an annular channel formed by said tube sheet, projecting subhead

and metal tubular member, a tubular refractory lining for said metal tubular member and fitted in said channel and engaging said projecting sub-head and tube sheet, a second metal tubular member secured to said closure member to project forwardly therefrom and generally registering with said first tubular metal member, a disk-like refractory lining for said second metal tubular member and arranged to mate with the rear end of said first refractory lining, a central part of one of said refractory linings protruding into a central recess in the other of said refractory linings to provide an annular labyrinthian crevice therebetween thereby to inhibit the escape of gas between said refractory linings, a metal ring of angular form in cross section secured to one of said tubular metal members ad-

acent the outboard edge thereof and providing an axially opening annular channel receiving the outboard edge of the other tubular metal member and a sealing gasket in said last channel.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,940,973	Sharp	Dec. 26, 1933
1,950,756	Sharp	Mar. 13, 1934
2,126,417	Sharp	Aug. 9, 1938
2,464,701	Lyke	Mar. 15, 1949