July 9, 1968 K. EBERHART 3,391,919

CONVERTER VESSEL SUPPORT

Filed March 17, 1966 2 Sheets-Sheet 1

Fig. 2.

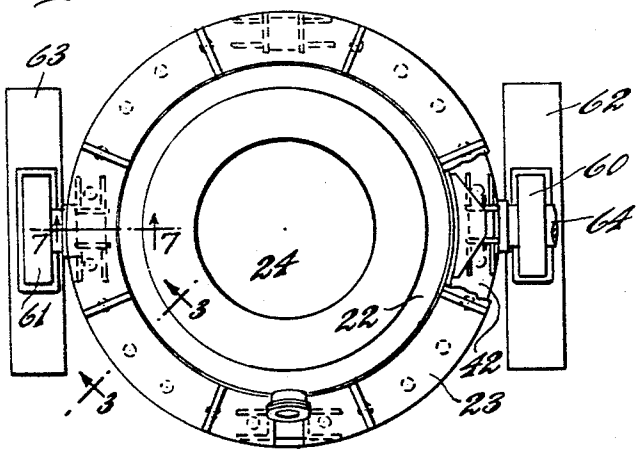


Fig. 3.

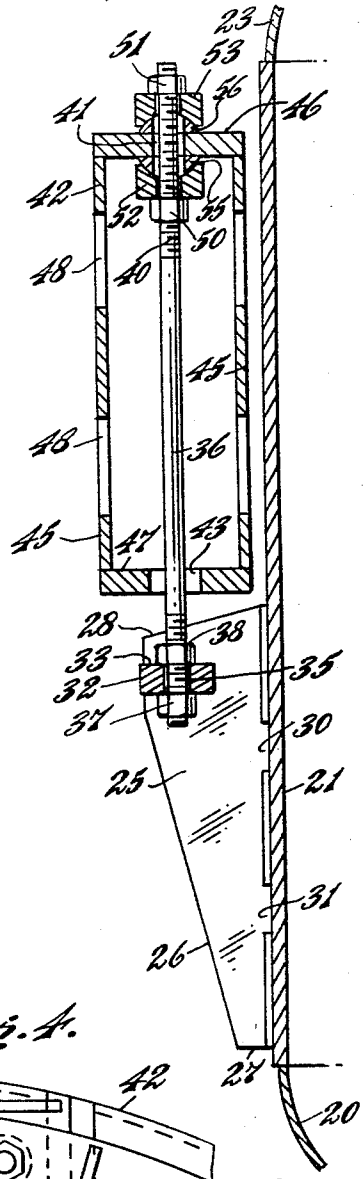


Fig. 1.

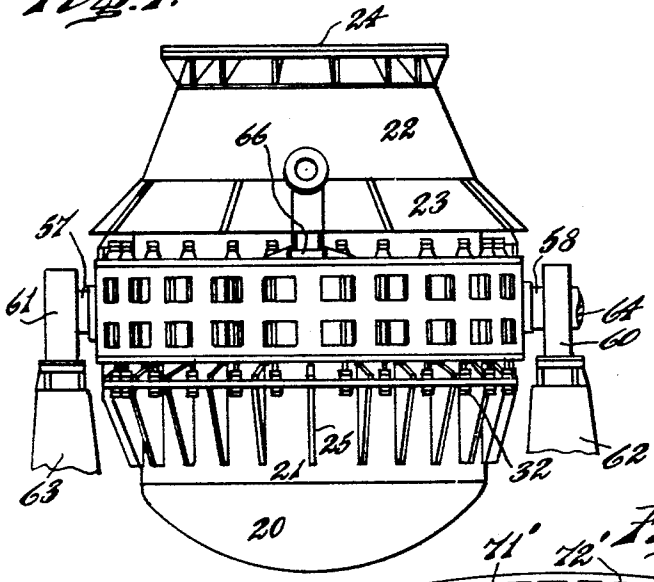
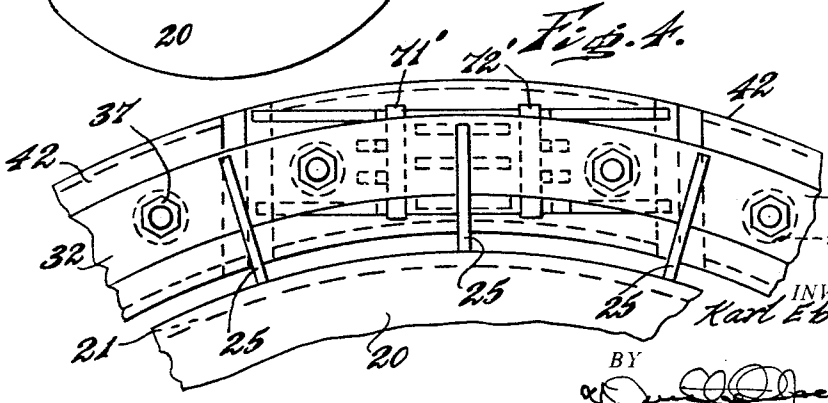


Fig. 4.



INVENTOR.
Karl Eberhart

BY

ATTORNEYS

July 9, 1968 K. EBERHART 3,391,919

CONVERTER VESSEL SUPPORT

Filed March 17, 1966 2 Sheets-Sheet 2

Fig. 5.

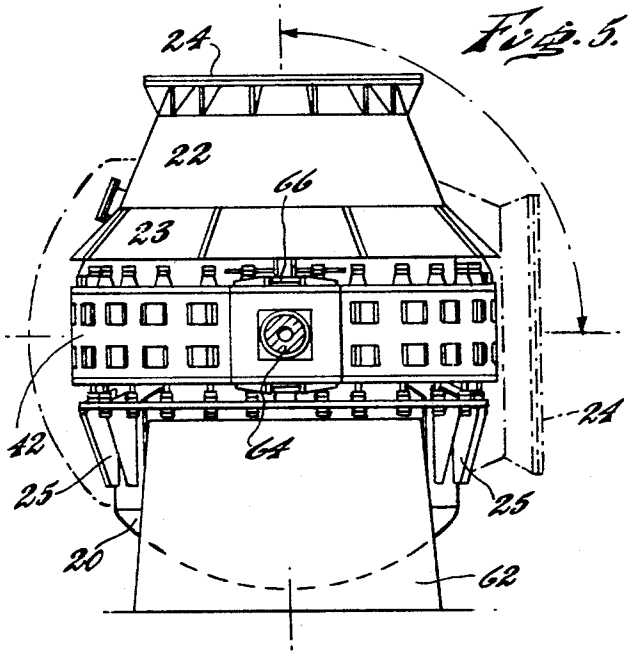


Fig. 7.

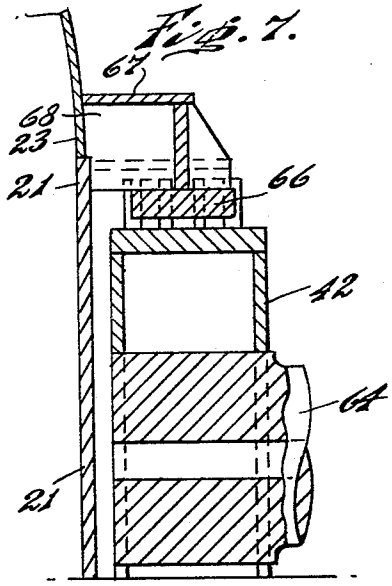
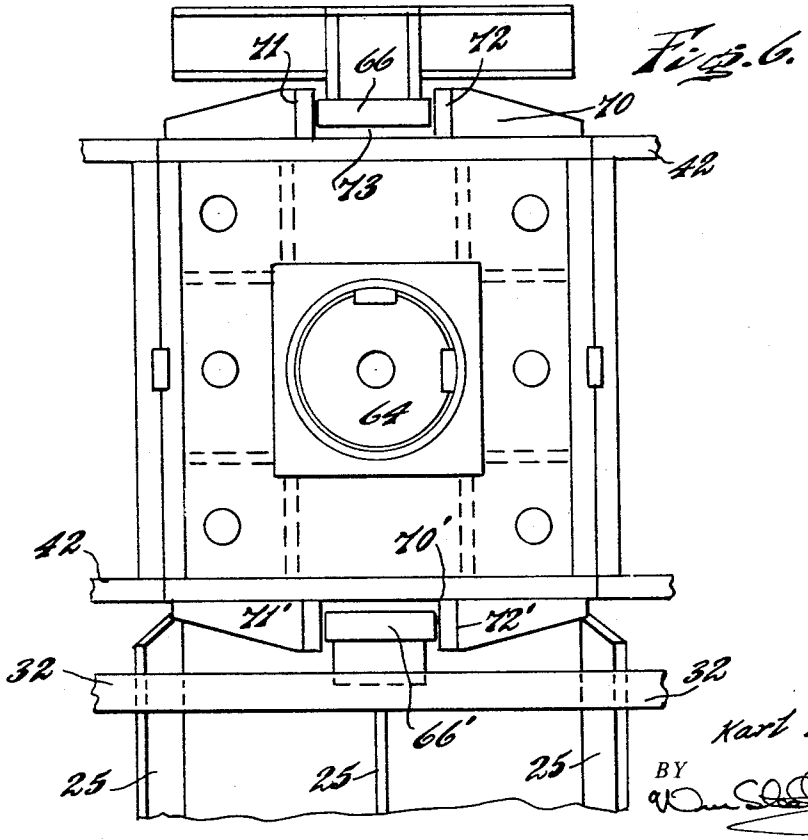


Fig. 6.



INVENTOR.
Karl Eberhart
BY
ATTORNEYS

United States Patent Office 3,391,919 Patented July 9, 1968

3,391,919

CONVERTER VESSEL SUPPORT

Karl Eberhart, Sinking Spring, Pa., assignor to Birdsboro Corporation, Birdsboro, Pa., a corporation of Pennsylvania

Filed Mar. 17, 1966, Ser. No. 535,142
3 Claims. (Cl. 266—36)

ABSTRACT OF THE DISCLOSURE

The disclosure relates to a mounting for a converter from a trunnion ring in which the trunnion ring supports the converter vessel by a plurality of rods depending from the top of the trunnion ring, secured to the vessel below the trunnion ring, and having universal freedom, for example, by reason of ball and socket connection to the trunnion ring at the top. The load is applied centrally to the trunnion ring cross-section.

The present invention relates to metal converter vessels of a type suitable for top-blow operations and more particularly to an improved support construction for such converter vessels.

The object of this invention is to provide a new and improved converter or refining vessel supporting construction that is suitable for top-blow operations.

A further purpose is to provide a converter supporting construction mounting that will withstand the rough usage involved in an oxygen blow process vessel support.

A further purpose is to eliminate high skin stresses created by having a very thick flange welded continuously on the periphery of the vessel.

A further purpose is to eliminate brackets bolted to the outside of the vessel.

A further purpose is to provide an improved construction support between the vessel and trunnion ring and to increase, by means of the support, the life of the vessel, to facilitate the repair of the vessel and to assure an accurately loaded trunnion ring.

A further purpose is to minimize the wear, stresses and strains set up in a converter support construction.

A further purpose is to provide an improved construction support to annul any gap between supporting connection and trunnion ring resulting from expansion.

Further purposes appear in the specifications and the claims.

In the drawings, I have chosen to illustrate a few only of the numerous embodiments in which my invention may appear, selecting the forms shown from the standpoint of convenience and illustration, satisfactory operation and clear demonstration of the principles involved.

FIGURE 1 is a side elevational view showing a representative top-blow converter utilizing the mounting structure of the invention.

FIGURE 2 is a top plan view of the structure of FIGURE 1.

FIGURE 3 is an enlarged sectional detail of the connection-assembly or construction as taken along line 3—3 of FIGURE 2 of the drawings.

FIGURE 4 is a bottom plan view partially broken away showing the arrangement of the centroid of the trunnion ring, with flexible suspension rods in place.

FIGURE 5 is a vertical side view in elevation on the same scale as FIGURE 1, with full line showing the vessel in normal position and the dot and dash lines showing the vessel in a 90° discharge position, with the vessel held at the trunnion shafts.

FIGURE 6 is a partial vertical elevational view of the stop-brackets, particularly showing an absence of metal to metal support whereby the vessel is held securely without

substantial friction between brackets and trunnion rings.

FIGURE 7 is a fragmental section on an enlarged scale taken on line 7—7 of FIGURE 2.

Describing in illustration but not in limitation, and referring to the drawings:

Converter vessels of the so-called Bessemer type, and particularly one of the top-blown oxygen blow type, present difficult and exacting requirements in their construction and utilization compared to the conventional converters of the so-called side blown types. The principal problem is rotatably supporting the converter. The vessel is subjected periodically to an intense heat of the reaction at extremely high temperatures, for instance, of 3500° F. This results in expansion and contraction of the vessel which in turn creates extremely high stresses on the mounting structures, resulting in failures which require replacement of parts and constant and expensive maintenance.

Expansion and contraction of the vessel involves distortion of the vessel. This becomes particularly serious when securing the converter vessel in any of the multiple positions while charging, blowing, and tapping of the refined metal. The problem of distortion becomes especially critical at the joint between the vessel and the trunnion ring.

I have found that the solution to the problem discussed above is to provide a support which allows the vessel to expand in all directions. This minimizes distortion of the vessel and greatly reduces the stresses imparted to the supporting structure. In accordance with my invention, I provide a multiple connection between the vessel and a trunnion ring by a plurality of flexible suspended rods which are self-aligning. The rods are individually connected at one end to a ring which is secured to, but spaced from, the vessel shell, and at the other end to a trunnion ring which surrounds, but is separate from, the vessel shell. The trunnion ring is supported on trunnions. The connecting rods are self-centering within the ring.

Considering the forms shown in the drawings, the converter vessel comprises a bottom **20** which preferably is of a semi-sphere or arcuate type to sufficiently withstand the pressure imparted by the refractory and the molten metal. The vessel has a cylindrical side surface **21** which comprises the right circular cylinder as seen in FIGURES 1 and 2 particularly, and as shown in cross-section in FIGURE 3 in the form of a steel jacket. It should be understood, of course, that the refractory lining and design of the converter, or vessel, are conventional and of the prior art type. The vessel has the top section **22**, including sloping sides **23** and a mouth section **24**.

The vessel is supported from a support arrangement which constitutes the present invention. The support arrangement includes a series of vertically extending circumferentially spaced gusset plates **25** which are welded to the lower end of the side **21**. The gusset plates **25**, as seen, for instance, in FIGURES 1 and 3, are preferably of a triangular-like section, including a tapered portion **26**, a bottom portion **27**, and a top portion **28**. The gusset plates are skip-welded at **30** and **31** to the side wall **21** of the converter in a skip-weld fashion in order to allow for vertical expansion under heat stress of the plate with respect to the wall. The place of the plate **25** extends radially with respect to the vessel and are secured to the vessel wall **21** completely circumferentially around the wall.

A circumferentially extending ring **32** is supported from the gusset plates and extends into a slot in the plates at **33**. The ring **32** is welded to the gusset plates and preferably the ring is rectangular in cross-section. Hence, the gusset plates and ring **32** form a secure arrangement with respect to the vessel wall **21**.

The ring **32** has extending therethrough a plurality of openings **35** which receive the ends of rods **36**, as best seen in FIGURE 3. The holes are formed at spaced positions between the gusset plates, as shown diagrammatically in the figures, particularly FIGURE 1. The rod **36** is held to the ring **32** by lock nuts **37** and **38**, which are threadedly engaged with the rod **36**. The rod **36** has a threaded portion **40** at its upper end which extends through an opening **41** at the top of a heavy trunnion ring **42**. The rod extends at its lower end through opening **43** in the trunnion ring and is clear of any contact with the trunnion ring.

The trunnion ring **42** extends circumferentially in spaced relationship about the wall **21** of the vessel and comprises side walls **45**, top wall **46**, and bottom wall **47**. The ring **42** is rectangular in cross-section and has openings **48** extending therethrough to provide for free air circulation within and without the trunnion ring **42**. The rod **36** has at its upper end threaded nuts **50** and **51** which engage a self-centering bearing arrangement comprising nuts **50** and **51** which bear against spherical washers **52** and **53** which, in turn, seat against aligning washers **55** and **56**.

The trunnion ring **42** has fixed at diametrically opposite points trunnions **57** and **58** which are secured to the trunnion ring by riveting, bolting, welding, or the like. The trunnions are journaled in bearing-pillow blocks **60** and **61** which, in turn, are fixed on bases **62** and **63**. The trunnion extends at **64** to a drive rotating mechanism of any conventional type (not shown) to tilt the converter or vessel to a horizontal position as shown in FIGURE 5.

The vessel sides **21** has secured thereto at **65**, **66**, **67** and **68**, a series of stops, as best seen in FIGURE 7. The stop **66** is supported from a bracket **67** which is welded at **68** to the wall **21** and the top **23** of the vessel.

The stop **66** extends into a bearing arrangement **70** as best seen in FIGURE 6. Bearing arrangement **70** includes abutments **70** and **72** affixed to the trunnion ring **42** which form a groove **73** about the stop **66**. A slight clearance extends between the stop **66** and the guides or abutments **70** and **71** in order to allow any expansion or contraction differences between the trunnion ring and the support vessel, or converter vessel. A similar arrangement is created directly below at stop' where abutments **71'** and **72'** extend from the trunnion ring **42** along the sides of the stop **66'**.

As best seen in FIGURE 1, the stops are placed at 90° spacing circumferentially of the vessel.

When the vessel is rotated into a horizontal position, as shown in FIGURE 5, the vessel is kept positioned and concentrically spaced within the trunnion ring by means of the stops **66** and **66'** and the bearing arrangements **70** and **70'**, as well as by the rods **36**.

In operation, the vessel is charged in the conventional manner through the top opening—when the vessel is in an upright position. The charge is then reacted, as for instance, by feeding oxygen through a lance when the vessel is an oxygen top-blow converter, and the metal refined. During this interval, the vessel is free to expand either symmetrically or otherwise, with no appreciable interference from any support structure, including the trunnions. Any radial circumferential or horizontal movement, expansion or contraction of the vessel proceeds freely with the flexible suspended rods compensating readily by movement at their lower ends. The self-aligning feature—at the rods upper ends—permits the load of the vessel to be transmitted to the trunnion ring **42** with no restraint imparted to the vessel by the trunnion ring **42**.

When the trunnion shaft **64** is rotated by a suitable drive, the trunnion ring **42** is likewise rotated about the

trunnion shaft **64** axis. The rods **36**, with their slef-aligning feature, can only support the vessel vertically, and hence there is a small initial rotational movement of the trunnion ring **42** with no corresponding rotational movement of the vessel. After this small last movement of the vessel, relative to the trunnion, ring stops **66** and **66'**, respectively, come into contact with bearing arrangements **70** and **70'**. Abutments **71** and **72**, with respect to stops **66**, and abutments **71'** and **72'** with respect to stops **66'**, selectively come into bearing contact, depending on the direction of tilt, with the stops causing the vessel to be tilted with, and remain concentrically suspended within, trunnion ring **70**. The stops **66** and **66'** are in sliding contact with the abutments, so the vessel continues to be free to expand and contract without restraint from the trunnion ring. The flexible suspended rods **36** continue to bear a tension load longitudinally of the vessel.

After the pour or tapping is complete, the trunnion drive returns the vessel to an upright position, wherein the vessel assumes a position with respect to the trunnion ring described above.

In the event any of the suspended flexible rods **36** are damaged, they can be readily replaced individually without any necessity of tearing down the entire converter. It is merely necessary to remove the nuts securing the rod to ring **32** and the trunnion ring **42** and insert a new rod.

In view of my invention and disclosures, variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art to obtain all or part of the benefits of our invention without copying the structure shown, and I, therefore, claim all such insofar as they fall within the reasonable spirit and scope of my claims.

I claim:

1. In a converter having a vessel adapted to be rotated on trunnions, a vessel support comprising a trunnion ring surrounding the vessel and spaced therefrom, there being a plurality of circumferentially spaced generally vertical openings through the trunnion ring intermediate between the sides, bearing means on the trunnion ring at the tops of the openings, attachment means on the vessel located beneath each of the openings, and a plurality of rods connected to the bearing means at the top, extending downward through the openings and secured to the attachment means below the trunnion ring, the openings in the trunnion ring near the lower portion thereof being of substantially greater diameter than the rods, thereby providing freedom for self-alignment of the rods about the bearing means.

2. A converter support of claim **1**, wherein the bearing means comprises self-aligning, ball and socket connections between each of the rods and the trunnion ring.

3. A converter support of claim **2**, wherein the attachment means comprises an attachment ring extending around the vessel and gusset plates securing the attachment ring to the vessel.

References Cited

UNITED STATES PATENTS

2,823,028	2/1958	MacGregor et al.	266—39
2,826,405	3/1958	McFeaters	266—36
3,000,621	9/1961	Puxkandl	266—36
3,146,983	9/1964	Johnson	266—39
3,201,108	8/1965	Kramer	266—36

J. SPENCER OVERHOLSER, *Primary Examiner.*

R. D. BALDWIN, *Assistant Examiner.*