Oct. 27, 1970 O. KALB ET AL 3,536,310

MOUNTING FOR A TILTABLE CONVERTER

Filed March 9, 1967 3 Sheets-Sheet 1

Fig. 1

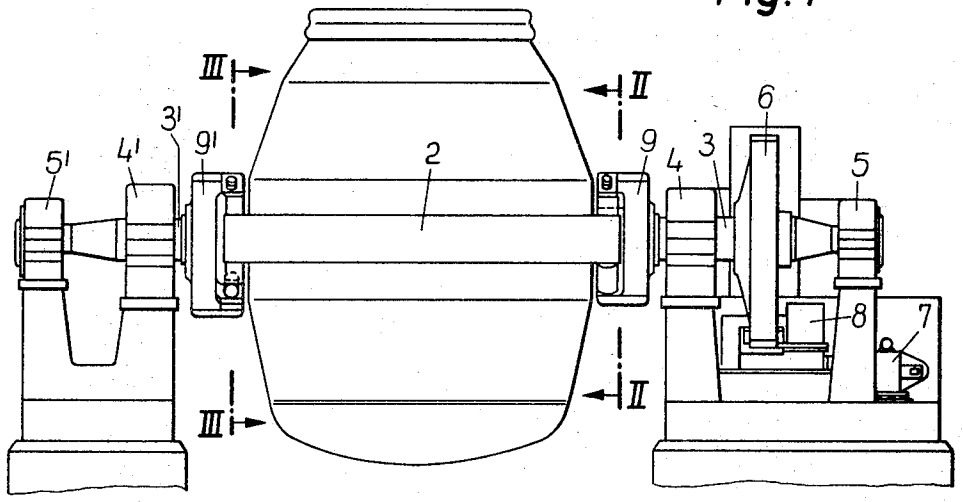

Fig. 2

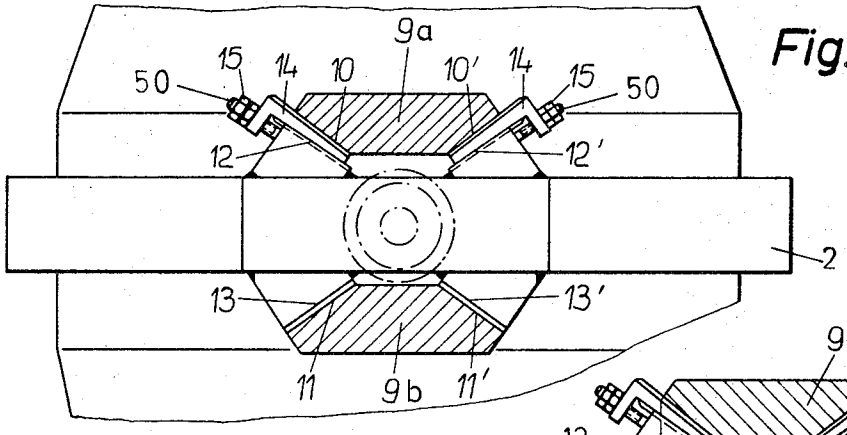

Fig. 3

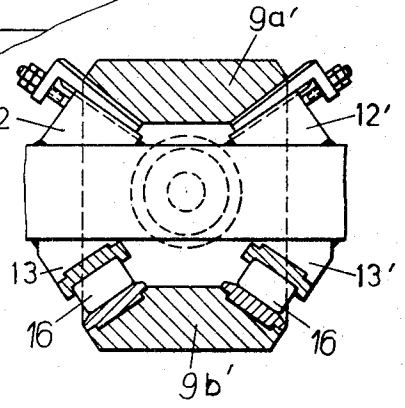

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Fig. 4

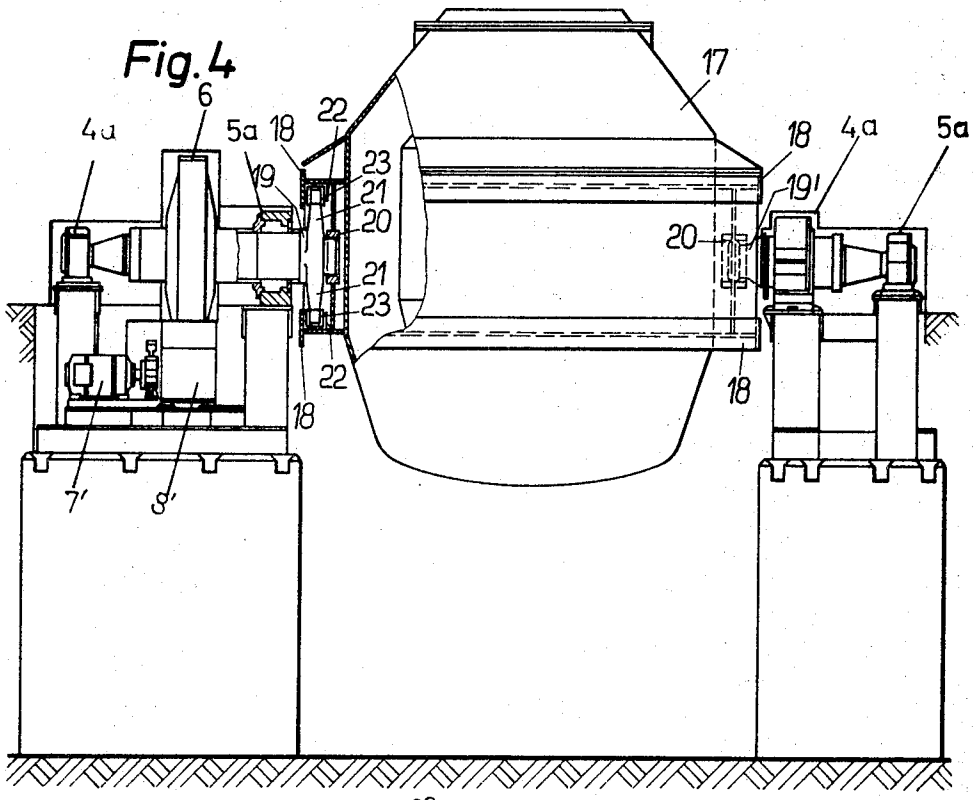
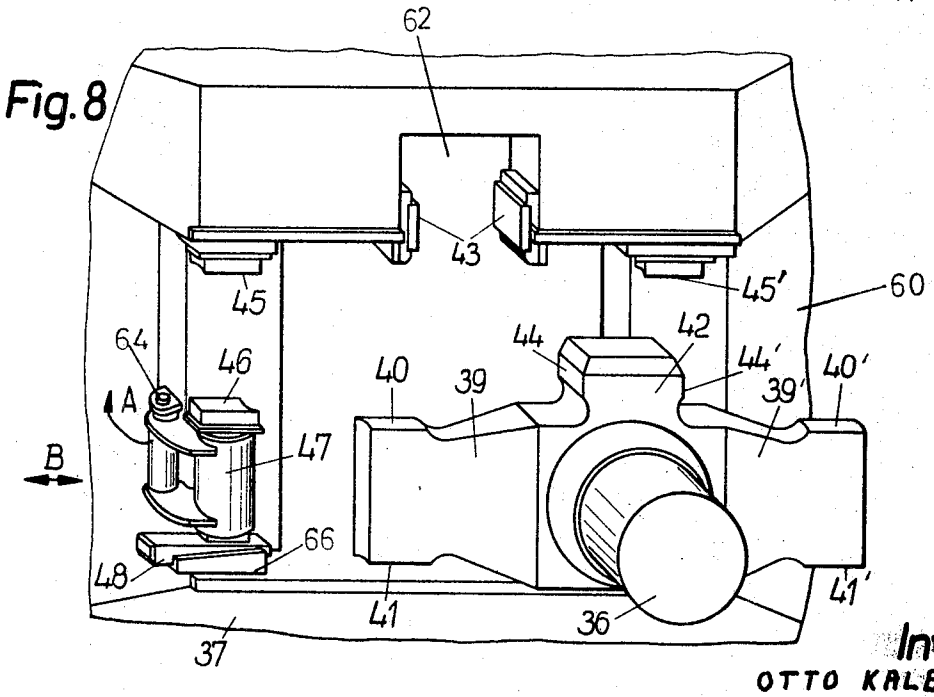


Fig. 8



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MOUNTING FOR A TILTABLE CONVERTER

Filed March 9, 1967 3 Sheets-Sheet 3

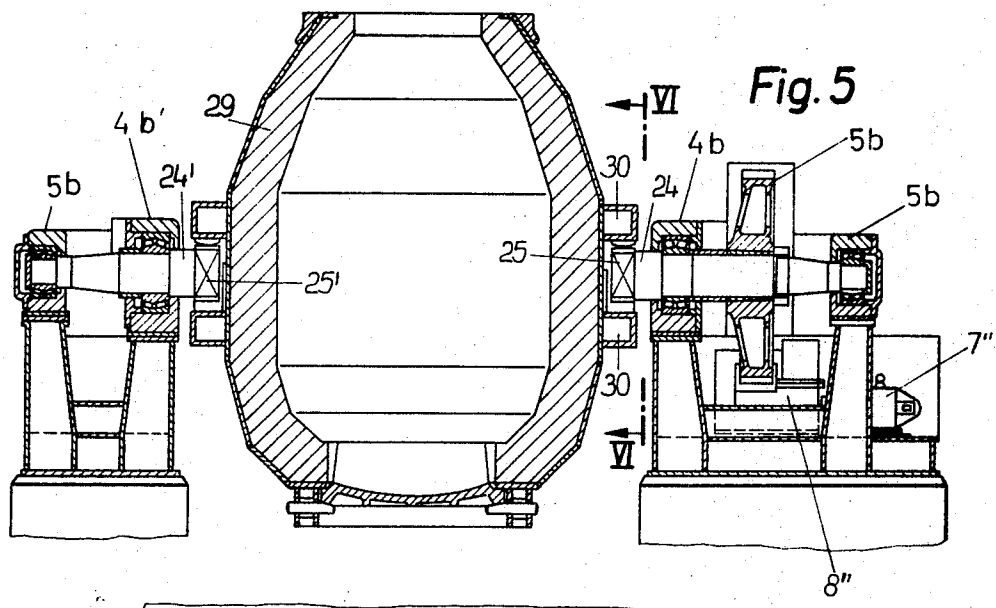

Fig. 5

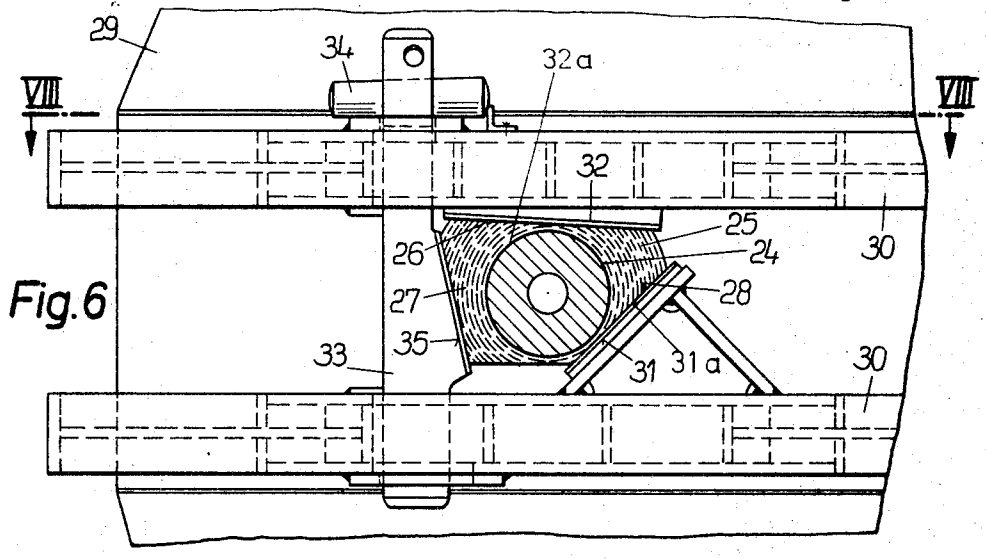

Fig. 6

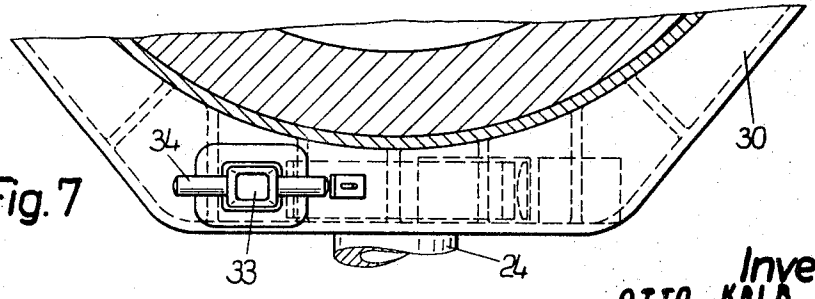

Fig. 7

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United States Patent Office 3,536,310 Patented Oct. 27, 1970

3,536,310

MOUNTING FOR A TILTABLE CONVERTER

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Filed Mar. 9, 1967, Ser. No. 621,914
Claims priority, application Germany, Mar. 9, 1966, P 38,942
Int. Cl. C21c 5/50
U.S. Cl. 266—36 5 Claims

ABSTRACT OF THE DISCLOSURE

Four separate embodiments of a mounting for a tiltable converter are described herein in respect to separate drawing showings for each. The converter is provided with one or more encircling support rings for supporting the converter for tilting movement about a horizontal axis which extends substantially through the center of the converter. The mounting apparatus includes two easily engageable and disengageable spaced apart journal shafts with engagement devices which permit the converter to be tightly secured and driven by means to effect its tilting movement.

In accordance with one embodiment, each shaft has engaging means permitting tight engagement with the converter at a location adjacent a single supporting ring. In the embodiment shown and described, the engaging member of the rotatable shafts comprises a substantially C-shaped part or claw which includes an upper part having bevelled side faces which are engageable with wedge-shaped elements carried above the converter supporting ring and a lower part having wedge-shaped side faces which are engageable with wedge formations projecting below the ring of the converter. Fastening wedges are inserted between the inclined surfaces of the upper journal part and the wedge member carried by the support ring of the converter in order to provide a tight interengaging fit to permit the driving rotation of the journal shaft and the converter to effect tilting of the converter. In a modified arrangement, roll elements are employed in the mounting of the lower portion of the journal shafts to the ring of the converter.

In another embodiment, the journal shaft elements include a squared bearing body which fits into a recess defined centrally between two ring supporting members of the converter. In addition, two oppositely extending engaging arms are provided on the journal shaft elements which extend into recesses defined underneath the upper ring and above the lower ring and which are held between abutments to facilitate the driving of the converter for tilting movement.

A further embodiment includes a journal shaft which has outwardly extending side journal arms on each side and an upwardly extending arm. This modification is employable with a converter having spaced supporting rings with the upper one including an upwardly extending journal recess having bearing elements for receiving the upper arm of the journal shaft member and side bearing blocks for receiving the side journal arms of the shaft member. The lower side or the journal arms are supported by bearing abutments pivotally carried between the converter supporting rings which may be swung out of position to permit easy removal of the converter from the journal shaft elements.

A further embodiment of the device includes a journal shaft member which is formed with upper and lower inclined wedge-like surfaces which are adapted to be positioned to seat against complementary surfaces held by an

upper and lower supporting ring of a converter, respectively. In addition, the journal mounting includes a wedge member which is supported between the rings and which may be positioned upwardly to cause a wedge surface to engage with an inclined side surface of the journal shaft member to provide the tight driving fit. The wedge member may be dropped downwardly out of position to permit removal of the converter laterally out of the supporting journal shafts.

SUMMARY OF THE INVENTION

This invention relates in general to the construction of pivotal mounting elements for a vessel and, in particular, to a new and useful mounting for a metallurgical furnace such as a converter which permits easy connection and disconnection of the converter for mounting on supporting axles to provide a driving axle for tilting the converter.

In the known converters, the converter vessel is surrounded by a supporting ring on which the supporting or tilting journals are usually securely fastened. A principal difficulty in the construction and operation of tiltable converters is that the high temperatures to which they are subjected result in deformation of the converter vessel which must be considered in designing the mounting arrangements therefor. Unless this deformation is compensated by one of the known relatively expensive constructions wherein the vessel is suspended in a loose supporting ring in which it can expand in an unhindered manner, disturbances will result in the faulty operation of the tilting drives. With converters with fixed supporting rings, a deformation of the supporting structure which includes the supporting journals or axles will take place even with the use of supporting journal suspensions. In order to obtain the necessary safety of operation of the tilting drives, therefore, riding devices or riding countershafts are used in which the effects of the vessel deformation are to be absorbed. These riding drives require a large number of parts and are apt to be more subject to trouble than the normally used simple tilting drives and they are considerably more costly. In addition, when using riding drives or countershafts, the permissible deformation of the vessel or of the supporting structure is limited to a relatively narrow range because at greater deformations disturbances in the journal suspension will occur.

In accordance with the present invention, there is provided a mounting arrangement constructed in a manner such as to avoid harmful effects of deformations of the supporting structure of the converter vessel and of the resultant sag of the supporting journals on the journal suspension and on the tilting drive. The apparatus includes separated supporting pedestals for rotatably supporting journal shafts having ends facing each other in a position for receiving and mounting centrally therebetween the converter vessel. Each of the journal shafts is provided with wedge-like clamping elements which are adapted to be secured around one or more supporting rings of the converter. In the event that any deformations of the converter take place, the rigidly mounted supporting journals maintain their horizontal position exactly so that the driving gears for rotating one of the journal shafts is not unduly stressed. For this purpose, the ends of the shafts are provided with clamping elements which engage around or within the respective supporting ring or rings of the converter and they include arm portions which support the ring in a manner such that bending and torsional stresses are minimal. Any stresses which are apt to be caused by static forces and temperature rises and which may normally produce permanent deformation of the supporting ring are largely eliminated. The journal shafts are advantageously supported on a double radial bearing suspension or on a single bearing taking up radial forces as well

as moments and, in particular, a vertically set ball race. When two radial bearings are provided for the rigid suspension of the supporting journals, the fact that any additional load due to the deformation of the vessel is kept away from these bearings results in a sturdy especially safe design. The suspension of the supporting journals in a vertically set ball face which is rendered possible by the structural separation of the journal shaft elements from the converter vessel permits short supporting journals and thus results in an advantageous reduction of the space requirements in the zone of the supporting journals and the tilting drive. Because the journal shafts are supported separately from the converter, they are not unduly subjected to the temperature stresses of the converter and they may be made relatively short to provide for the advantageous reduction of space in the zone of the journals and adjacent the drive for the journal shafts.

In accordance with a feature of the invention, each journal shaft construction is provided with engageable parts which may be easily engaged with the supporting ring of the converter vessel and they are arranged such that engagement or disengagement may be made from one side so that the converter may be easily moved out off the journal supports.

Accordingly, it is an object of the invention to provide an improved pivotal mounting for a tiltable converter which includes supporting pedestals for rotatably supporting individual journal shafts on each side of the converter, the journal shafts including means which are engageable with the converter for tiltably supporting the converter and for driving the converter for tilting movement.

A further object of the invention is to provide journal shafts for pivotally supporting a converter which shafts include upper and lower engagement members having inclined faces which are engageable over inclined faces of wedge members carried on a supporting arm of the converter.

In accordance with a further object of the invention, there are provided journal shaft elements having a journal bearing portion which fits into a multi-sided recess defined between spaced supporting rings of a converter and with an arm portion extending outwardly in each direction for engagement in recesses defined adjacent the respective supporting rings for drivingly connecting the converter for tilting movement.

A further object of the invention is to provide a journal shaft for pivotally supporting a converter which includes an end portion having arms extending outwardly in each direction and an upwardly extending arm for engaging in corresponding journal recesses defined in a converter side wall and wherein the arm portions may be removed from the converter by shifting a bearing support carried on the converter member.

A further object of the invention is to provide a journal shaft support for a converter which includes an engagement element having inclined surfaces which engage similarly inclined surfaces defined between supporting rings of a converter and with a third oblique surface defined on a side of the journal shaft which may be anchored for driving movement by a wedge member which may be movably positioned in respect to supporting rings of the converter.

A further object of the invention is to provide a converter which is simple in design, rugged in construction and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side elevational view of a converter mounting stand constructed in accordance with the invention;

FIG. 2 is an enlarged sectional view taken along the lines II—II of FIG. 1;

FIG. 3 is a section taken along the line III—III of FIG. 1;

FIG. 4 is a side elevational view, partly in section, of another embodiment of converter tilt mount;

FIG. 5 is an axial sectional view of still another embodiment of tilt mount for a converter;

FIG. 6 is a section taken on the line VI—VI of FIG. 5;

FIG. 7 is a section taken on the line VII—VII of FIG. 6; and

FIG. 8 is an enlarged side perspective view of another embodiment of supporting journal attachment for the converter tilt mounting.

DETAILED DESCRIPTION

Referring to the drawings, in particular, the invention embodied therein in FIGS. 1–3 comprises a tilt mounting for a converter generally designated **1** having a single annular supporting ring **2**. The converter **1** is supported by the ring **2** which is carried at each end of rotatable journal shafts **3** and **3'**. The journal shafts **3** and **3'** are rotatably supported on two axially spaced journal elements **4** and **5** and **4'** and **5'**, respectively. Each element advantageously carries suitable bearing supports. The journal shaft **3** carries a gear **6** which is affixed thereto for rotation therewith and which is driven through gearing **8** by a motor **7**.

In accordance with the invention, each journal shaft **3** and **3'** extends outwardly from its associated bearing support **4** and **4'**, respectively, and they carry opposed securing claws or clamps **9** and **9'**, respectively, which may be engaged over the supporting ring **2** to tiltably support the converter **1**. For this purpose, as best indicated in FIG. 2, the clamps **9** and **9'** include an upper part **9*a*** and a lower part **9*b*** each having oblique or wedge-shaped side faces **10**, **10'** and **11**, **11'** which are adapted to engage on inclined faces of wedge elements **12**, **12'** and **13**, **13'** carried on respective top and bottom sides of the supporting ring **2**. The upper parts **9*a*** of each shaft **3** and **3'** are held in position by fastening wedges **14** which are secured by means of nuts **15** which are tightened over bolt members **50** which are threaded into the wedge members **12** and **12'**. This easily effected securing of the supporting shafts **3** and **3'** to the supporting ring **2** of the converter **1** is such that it effectively prevents transmission of deformation of converter vessel **1** to the rigidly mounted supporting journals and the construction absorbs the tilting moments particularly well. The claws **9'**, as indicated in FIG. 3, include rollers **16** disposed between the lower clamp part **9*b'*** and the wedges **13** and **13'**, and these permit better flexibility of the attachment.

In the embodiment indicated in FIG. 4, a converter vessel **17** carries an upper supporting ring **18** and a lower supporting ring **18'** spaced from the upper ring. Journal shaft members **19** and **19'** are suitably supported in spaced bearings **4*a*** and **5*a*** and **4*a'*** and **5*a'*** as in the other embodiment. The converter **17** is tilted by the action of a driving motor **7'** driving through gears **8'** and a gear **6'** affixed to the journal shaft **19** as in the other embodiment. A bearing recess or bearing body **20** is defined between the rings **18** and **18'** and they receive the crowned ends of the supporting journals **19** and **19'**, respectively. The driven supporting journal **19** is provided with two engaging arms **21**, **21'** which engage against sliding guides **22** carried above the lower support ring **18'** and below the upper support ring **18**. The free ends of the supporting arms **21** and **21'** are provided with abutments **23** which engage in the sliding guides **22**. When the supporting rings **18** and **18'** are arranged at a shorter dis-

tance from each other, the supporting journal ends of the arms **21** and **21'** are designed as ball or socket elements to permit engagement in similar counter elements carried on the associated supporting rings. For this purpose the receiving journal carried on the rings may be arranged on the exterior of the journals to permit quick connection and disconnection of the driving engagement of the converter **17**.

An essential advantage of the supporting journals engaging between two supporting rings **18** and **18'** is that they can be constructed by relatively simple means so that when the converter is in a vertical position, the attachments of the journal ends may be easily unfastened by a slight lifting of the converter and the converter may be removed horizontally. In this way, the converter may be easily exchanged such as for relining purposes.

In the embodiment indicated in FIGS. 5–7, there are provided spaced supporting journal shafts **24** and **24'** which are mounted on spaced roller bearing sets **4***b*, **5***b* and **4***b'* and **5***b'*, respectively, which include roller bearings designed to absorb axial as well as radial thrust. A drive gear **56** is secured to the shaft **24** and is rotated by means of a motor **7''** driving through gearing **8''**. In this embodiment, the converter **29** carries an upper supporting ring **30** and a lower supporting ring **30'**. The supporting journal shafts **24** and **24'** have opposed converter engagement heads **25** and **25'** of polygonal configuration. Each head includes an inclined or wedge-shaped upper surface **26**, a downwardly inclined or wedge-shaped lower surface **28**, and an oblique or side wedging surface **27**. The upper ring **30** carries a wedge member **32** having an inclined surface or seat **32***a* which is engageable with the surface **26**. The lower ring **30'** carries a wedge member **31** having an inclined surface or seat **31***a* which is engageable with the surface **28**. The engaging faces and the seat faces provided by the wedge members **31** and **32** are crowned so that a compensating relative movement can occur to prevent any effects of the deformation of the vessel during operation while it is supported on the journals **24** and **24'**. A feature of this construction is that the converter **29** may be moved laterally to cause engagement of the inclined surfaces **26** and **28** on the seat surfaces **32***a* and **31***a*. Thereafter, the journals **24** and **24'** are locked into engagement with the converter by means of a wedge member **33** or wedge element which is raised upwardly through a suitable opening in the lower ring **30'** in order to present a blocking surface **35** in engagement with the surface **27**. When this is done, the wedge **33** is held in position by a cross wedge or securing member **34** which is directed through an opening and the upper end of wedge **33** above the ring **30**.

With the converter of the type indicated in FIGS. 5–7, it is very easy to engage and disengage the converter from the journal supporting shafts **24** and **24'**. The inclination of the side face **35** of the wedge **33** is such that after removal of the cross wedge **34**, the lock wedge **33** can be let down through the opening in the ring **30'**. After removal of the lockwedge **33**, the converter **29** can be lifted somewhat so that it can be driven out laterally between the journal shafts **24** and **24'** and replaced by a newly lined vessel, for example. Thus, for the replacement of vessel or converter **29** it is only necessary to remove a wedge member **33** on each journal shaft **24** and **24'** and to replace it after a new converter is positioned in place.

In the embodiment of FIG. 8, the supporting journal **36** which is partially indicated is designed to engage between securing portions defined by an upper ring **38** and a lower ring **37** on a converter **60**. The shaft **36** carries two oppositely extending laterally extending first and second arms **39** and **39'** having their ends designed as crowned seats **40** and **40'** and **41** and **41'**. These seats are shaped to absorb the weight of the converter vessel **60**. A short upwardly directed engaging arm **42** extends perpendicular to the supporting arms **39** and **39'** and is adapted to engage in a recess **62** defined in the upper ring **38**. In the recess **62**, there are employed counter bearing elements or blocks **43** between which the lateral faces **44**, **44'** are engaged. The engagement permits a locking of the shaft **36** with the converter to effect rotary movement but also permits a sliding movement of these parts. The upper ring **38** also carries bearing supports or shells **45**, **45'** which are engageable with the upper surfaces **40** and **40'** of the supporting arms **39** and **39'**. As counterbearings for the lower seats **41** and **41'** there are provided bearing blocks or shells **46** which are mounted on props **47** which are pivotal in the direction of the arrow A of FIG. 8 about a pivot **64**. The bearing shells **46** are advantageously located such that they may be wedged against the surfaces **21** by means of a wedging member or wedge element **48** which is directed between the prop **47** and a fixed support **66** on the ring **37**. By this arrangement, the pivoting of the props **47** is possible, without lifting the converter vessel, by removing of the wedges **48**. The three-armed engaging teeth formed at the end of the driven shaft **36** may thus easily be engaged with or disengaged from the converter. For a change of converters **60**, the lower seats **41** and **46** are relieved by setting the converter vessel **60** in a vertical orientation, the wedges **48** are then removed and the props **47** are pivoted by hand in the direction of the arrow A. Thereupon, the converter vessel is lifted to the extent that the engaging arm **42** slides out of its counter bearing **43** and the vessel may be moved out between the supporting journals horizontally in the direction of the arrow B. The wear of the joint parts is extremely low, even at continual change of vessels because movement of expansion and contraction of the vessel will occur only very slowly. If necessary, all parts can be readjusted or exchanged in a simple manner.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the invention principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A mounting for a tiltable converter comprising, a converter having a central exterior potrion with at least one supporting ring extending therearound, first and second journal shafts arranged at respective opposite sides of said converter and having ends adjacent said converter with engagement means for engaging against the top and bottom of said converter supporting ring without play for driving tilting movement and for disengaging said converter supporting ring to permit removal of said converter, first and second bearing means respectively rotatably supporting said first and second journal shafts exteriorly of said ends with said engagement means, drive means connected to said first journal shaft for rotating said first journal shaft to tilt said converter, said engagement means comprising a claw having an upper part extending over said supporting ring and a lower part extending below said supporting ring, said supporting ring having relatively closely spaced wedge members with oppositely sloping seat surfaces projecting from the top and the bottom of said ring, said upper and lower portions of said claw having ends with surfaces sloping complementary to the seat surfaces of said wedge members of said supporting ring for engagement therewith.

2. A mounting according to claim **1**, including a fastening wedge directed between said claw upper portion surfaces and the seat surfaces of said wedge members, and threaded bolt means in each of said wedges for engaging said fastening wedge for tightening said fastening wedge to lock said claw to said supporting ring.

3. A mounting according to claim **1**, including rollers between at least one of said upper and lower portions of said claw.

4. A mounting for a tiltable converter comprising at least one supporting ring adapted to extend around the converter, first and second journal shafts arranged at respective opposite sides of the converter and having ends

with engagement means for engaging the converter without play including an upper wedge part engaged over said ring and a lower wedge part engaged under said ring for driving tilting movement and for disengaging the converter to permit removal of said converter, and bearing means respectively rotatably supporting said first and second journal shafts exteriorly of said ends with said engagement means.

5. A mounting, according to claim 4, wherein said bearing means includes two axially-spaced roller support bearings engaged around said respective first and second journal shafts.

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