

[54] **APPARATUS FOR SUPPORTING THE BODY OF THE CONVERTER**

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[51] Int. Cl..... C21c 5/50

[58] Field of Search..... 266/35, 36 P

[56] **References Cited**

FOREIGN PATENTS OR APPLICATIONS

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[57] **ABSTRACT**

An apparatus for supporting the body of a converter which is supported on a base stand and has a pair of trunnion shafts provided on a trunnion ring held between an upper bracket and a lower bracket fixed on the outside of the body, which comprises a plurality of upper supporting devices each having means freely movable therein and having one end of each supporting device set on the upper bracket and the other end set on a sliding base plate in a guiding groove provided on the upper surface of the trunnion ring and extending in the radial direction of the body, and a plurality of lower supporting devices having a gliding-in part of semi-circular cross-section allowing for a free gliding movement in the radial direction of the body and having one end set on the lower bracket and the other end set on the trunnion ring.

3 Claims, 14 Drawing Figures

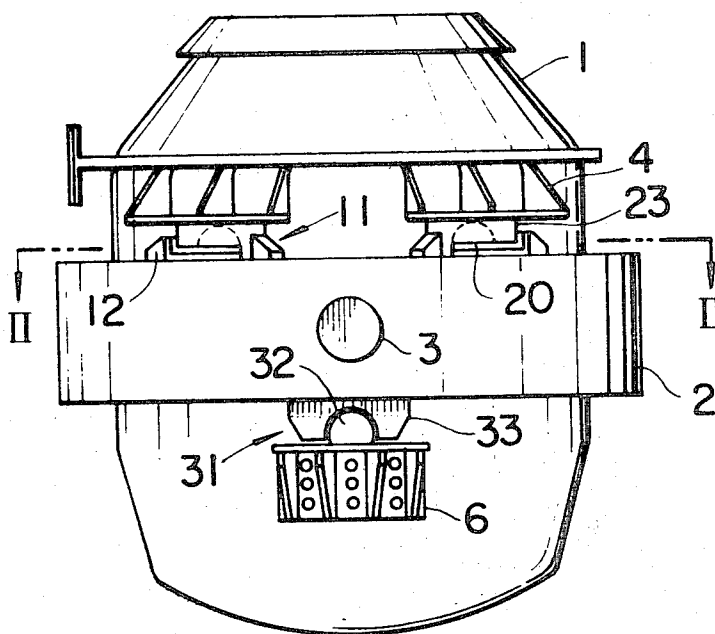


FIG. 1

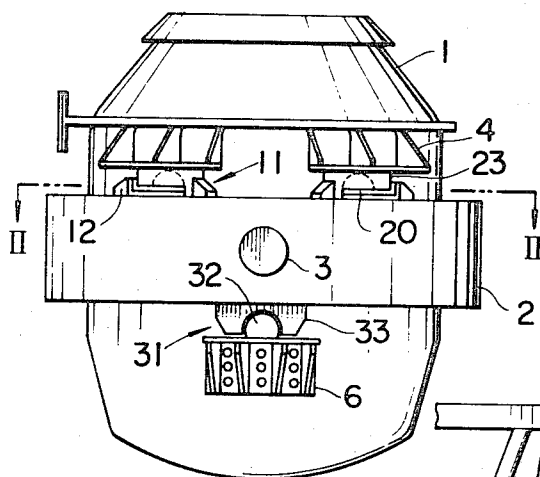


FIG. 3

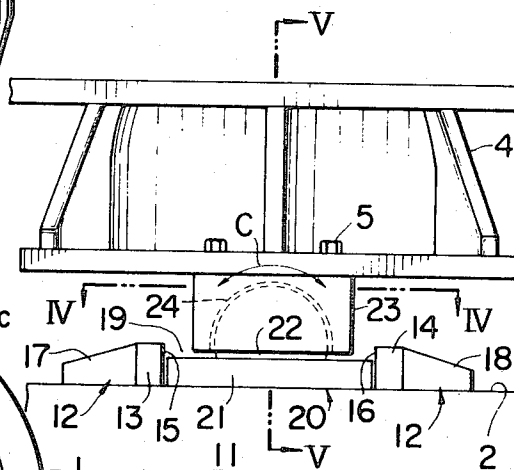


FIG. 2

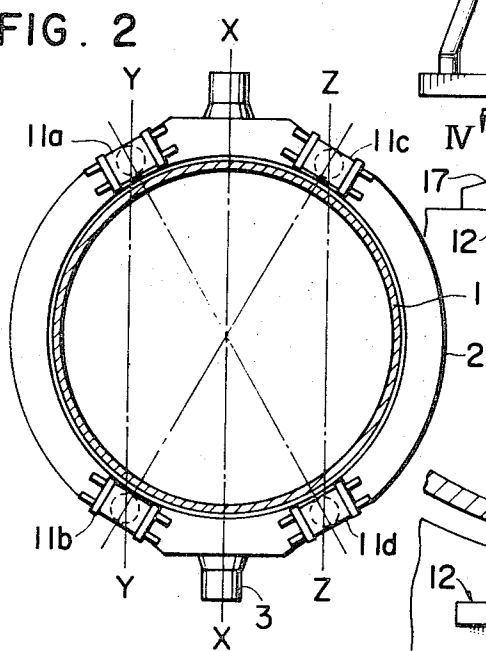


FIG. 4

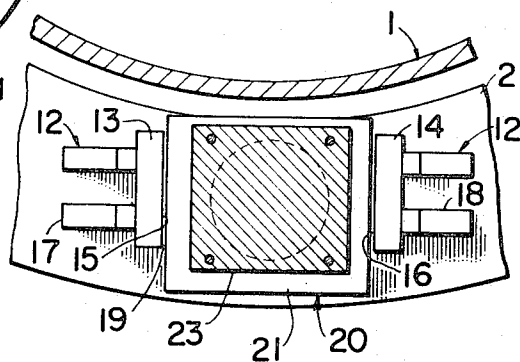


FIG. 5

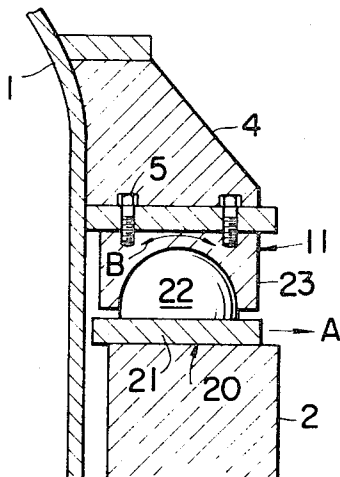


FIG. 6

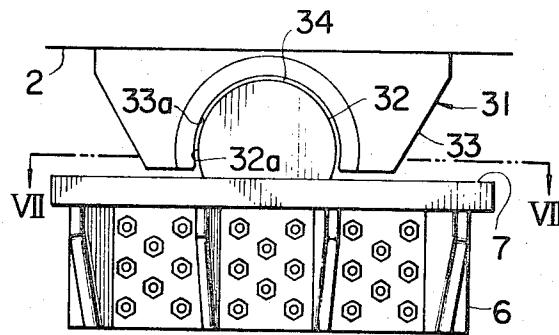


FIG. 7

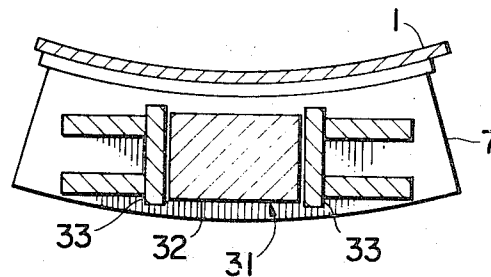


FIG. 8

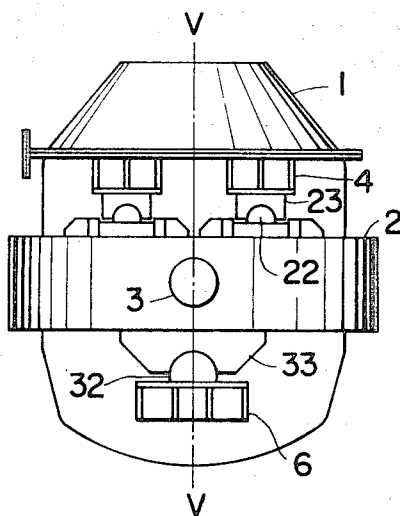
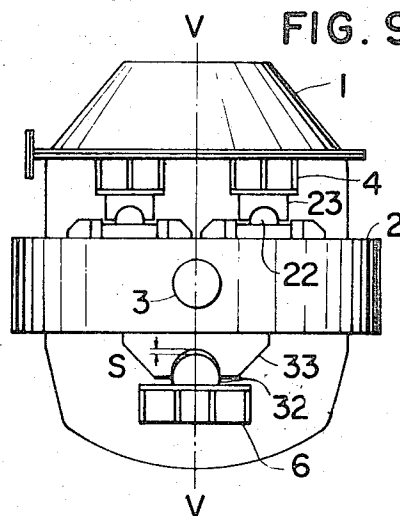
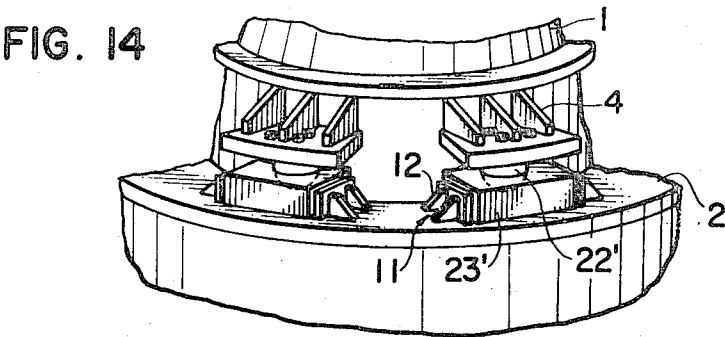
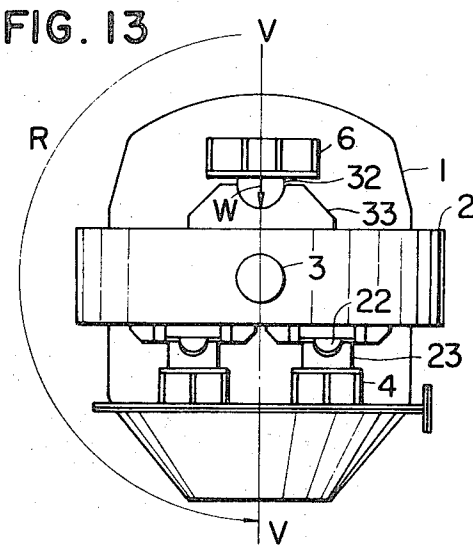
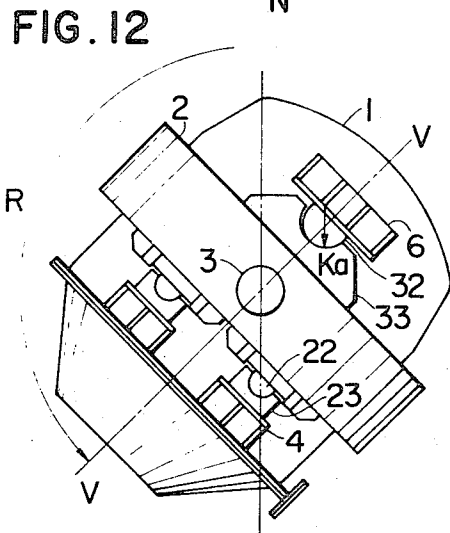
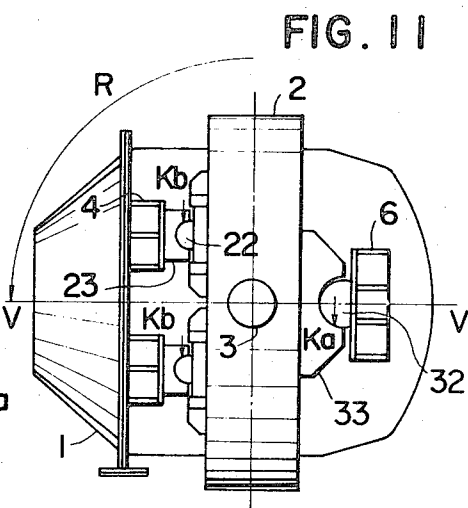
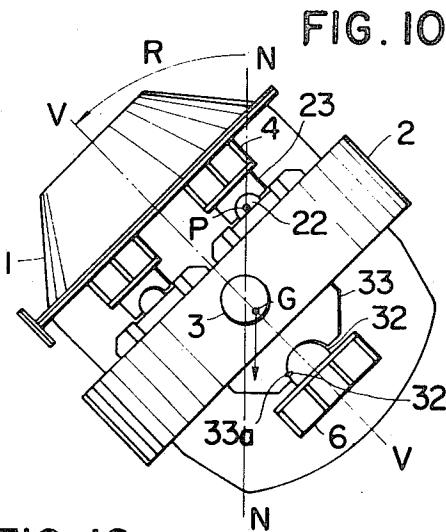


FIG. 9





APPARATUS FOR SUPPORTING THE BODY OF THE CONVERTER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to apparatus for supporting the body of a converter and more particularly to an apparatus for supporting the body of a converter by means of a plurality of devices each having a spherical projection provided thereon which freely glides along the inside of an associated receiver, thus providing a continuous transfer of the center of gravity of the body when rotated thereby preventing an impact from being produced on supporting parts of the converter at the time the converter is rotated to be emptied.

2. Description of the Prior Art

The conventional type of apparatus for supporting a large capacity converter consists of a device having a pair of trunnion shafts supported on a base stand through trunnion rings which are held between upper and lower brackets fixed on the shell of the body of said converter.

In view of the well known fact that when the temperature inside a conventional converter becomes extremely high during operation, thermal expansion of the body takes place in both the horizontal and vertical axes of the body, the body and the trunnion rings are kept apart. The problem caused by thermal expansion taking place particularly in the direction of the major axis of the body, that is, in a vertical direction, is that an undesirable play is produced between the trunnion ring and the body at the body supporting point because the expansion rate of the trunnion ring is smaller than that of the body. Another reason for undesirable play between various parts of the converter is the deformation of the body or its supporting apparatus due to aging. With such play produced at the body supporting point whether due to thermal expansion or to aging, when the converter is rotated for emptying beyond 90° and as far as 180°, this causes a drop of the body from the upper bracket toward the lower bracket, the drop being the distance of said play, producing an impact on the trunnion rings, the bearings for the trunnion shafts and other parts, which impact damages these parts of the body supporting apparatus.

According to prior art attempts to overcome this problem the weight of the body is supported by freely movable brackets fit over disc-shaped shaft heads fixed around the body. An alternative solution heretofore proposed is to construct the body supporting device such that a taper liner is used at the lower part of the device, thereby cancelling the bad effects of thermal expansion of the body.

These devices are fairly effective against troubles caused by expansion and contraction of the body, particularly in preventing troubles caused by impact produced due to undesirable play between parts of the apparatus, which have been caused by the expansion of the body in the direction of body axis although the present invention is an improvement thereover.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an apparatus for supporting the body of a converter, which produces no impact when the body is rotatably inverted regardless of the occurrence of undesirable

play caused by thermal expansion of the body or the body supporting members at the body supporting point, thus providing a smooth transference of the center of gravity of the body. Another object of the invention is to provide an apparatus for supporting the body of a converter, which is usable even when it undergoes some thermal deformation.

In order to attain the above objects, the present invention comprises an apparatus for supporting the body of the converter, which consists of an upper supporting device and a lower supporting device, the former having a spherical projection which allows for free gliding movement along the inside of its receiver and the latter having a semi-circular projection with a semi-circular cross-section thus also allowing for such gliding movement as mentioned above.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a side view of a converter equipped with the apparatus according to the present invention.

FIG. 2 shows the cross-sectional view of the converter of FIG. 1 along II — II.

FIG. 3 shows a front view of the upper body supporting device according to the present invention.

FIG. 4 shows the cross-sectional view of the device of FIG. 3 along IV — IV.

FIG. 5 shows the longitudinally-sectional view of the device of FIG. 3 along V — V.

FIG. 6 shows a front view of the lower body supporting device according to the present invention.

FIG. 7 shows the cross-sectional view of the device of FIG. 6 along VII — VII.

FIGS. 8 to 13 disclose the function of the apparatus according to the present invention.

FIG. 14 shows the obliquely view of another embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The apparatus for supporting the body of converter according to the present invention consists of an upper supporting device 11 and a lower supporting device 31.

An upper bracket 4 is attached at four points on the outside of the upper part of the body 1 above a trunnion ring 2.

As shown in FIG. 1 to 5, the upper supporting device 11 consists of a guiding member 12, a sliding member 20 and a spherical member 23. The supporting device is arranged between said trunnion ring 2 and said upper bracket 4.

Each of the guiding members 12 has a pair of stoppers 13 and 14 standing on the upper surface of the trunnion ring 2 at intervals along the circumference of said trunnion ring 2. The parallel facing insides of the stoppers 13 and 14 are perpendicular to the upper surface of the trunnion ring 2. These insides function as guiding surfaces 15 and 16, in conjunction with the upper surface of the trunnion ring 2 and form a guiding groove 19 extending in the radial direction of the body 1. In case the body 1 is rotated, the stoppers 13 and 14 receive the weight of the body 1. Therefore, these stoppers have reinforcing members 17 and 18, respectively, behind them.

The sliding member 20 consists of a right-cubic, sliding base plate 21 and a semi-spherical head 22 hereinafter referred to as a hemi-spherical gliding head 22,

the latter projecting from the upper surface of said sliding base plate 21.

The sliding base plate 21 slides in said guiding groove 19 in the radial direction of the body 1.

The spherical receiver 23 is fixed on the upper bracket 4 with bolts 5 or by any appropriate means, and has a spherically shaped concave part facing said hemispherical gliding head, so that it may receive said hemispherical gliding head 22 thus allowing for a free gliding movement along its inside.

Four sets of the upper supporting devices 11 each of which is constructed as mentioned above, are arranged as shown in FIG. 2 on both sides of the axis line X—X of the trunnion shaft 3. These four sets 11a, 11b, 11c and 11d are symmetrically arranged respectively in lines Y—Y and Z—Z, which are parallel to the axis line X—X of said trunnion shaft.

Although in this embodiment, the number of sets of upper supporting devices 11 are limited to four, this may be changed according to the capacity, shape, etc., of the converter. However, whatever number of sets are used they should preferably be arranged as mentioned above.

As shown in FIGS. 6 and 7, a pair of lower brackets 6 are fixed on opposite outer sides of the body 1 below the trunnion shaft 3.

A lower supporting device 31 consists of a semi-circular gliding head 32 and a semi-circular receiver 33, and is arranged between said trunnion ring 2 and said lower bracket 6.

The semi-circular gliding head 32 has a semi-circular cross section and extends in the direction of the trunnion shaft axis 3 and is fixed on the upper base plate 7 of said lower bracket 6 in such manner that it arches upwardly.

The semi-circular receiver 33 has a concave part 34 having semi-circular cross section and extending in the direction of the trunnion shaft axis 3, and is fixed to the bottom surface of the trunnion ring 2 facing the lower bracket 6. Said concave part 34 receives said semi-circular gliding head 32 allowing for free gliding movement therein.

The arrangement as mentioned above of the lower supporting device 31 below and close to the trunnion shaft 3 provides for more stable support of the body 1 than otherwise attained.

The function of the above mentioned apparatus of the present invention is as follows:

Referring to FIGS. 1 and 6, if the body 1 expands due to heat any displacement of the lower supporting device in the horizontal radial direction of the body, will be cancelled by mutual movement of said semi-circular receiver 33 and said semi-circular gliding head 32 along the sliding surface of semi-circular cross-section extending in the direction of radius of the body.

As shown in FIG. 9, displacement due to thermal expansion of the body in the direction of the body axis V—V, that is, in the vertical direction produces a play S between said semi-circular receiver 33 and said semi-circular gliding head 32. In case the body 1 of a converter having such undesirable play, is rotated in the direction R, as shown in FIG. 10, in order to empty the contents therefrom the sides 32a and 33a respectively of said semi-circular gliding head 32 and said semi-circular receiver 33, of the lower support come into contact because of the moment of the body 1 produced by its pendulum movement with the center of sphere P

of said hemi-spherical gliding head 22 of said upper supporting device 11 on the right hand side as the center of such movement, while the center of gravity G of the body 1 moves from the left side to the right side of the perpendicular N—N which passes through said center of sphere P of said head 22 of said upper supporting device 11. In FIGS. 10 to 12, Ka and Kb denote respectively the lower and the upper supporting points of the load of said pendulum movement.

Even in case the body 1 is rotated 90° with its axis in a horizontal position, the upper part of the body is supported at the contact between the spherical receiver 23 and the semi-spherical gliding head 22; and the lower part is supported at the contact between the semi-circular receiver 33 and the semi-circular gliding head 32. Therefore, the play S does not cause the body to drop, hence no impact is produced.

As the rotation of the body 1 progresses from 90° toward 180°, the body 1 is supported by the abovementioned supporting points, with the load of the body put increasingly on the semi-circular receiver 33 and the semi-circular gliding head 32, as shown in FIG. 12. Finally, when as shown in FIG. 13, the body 1 is set on end (180° rotation), its entire weight is placed on said lower supporting point; that is, the body 1 is supported solely by said lower supporting point.

On the other hand, thermal expansion of the upper supporting device in the radial direction of the body is cancelled by the sliding of the sliding member 20 along the guiding groove 19 formed in the radial direction of the body, as shown by the arrow A of FIG. 5.

It is well known that when the body 1 deforms due to welding or aging or for any other reasons, the upper brackets 4 receive three different forms of loading. They include the rotation B in the horizontal radial direction in the body; the rotation C in a direction perpendicular to the direction of rotation B and sliding A also in the abovementioned direction. Such complicated action of the body responding to its thermal deformation can be easily cancelled out by using the method of the present invention, in the following manner.

Displacements due to the abovementioned rotation B in the horizontal radial direction of the body and the abovementioned rotation C in a direction perpendicular to the radius of the body can be absorbed or alleviated by the gliding in the spherical receiver 23 of the hemi-spherical gliding head 22; and the displacement due to the projection A in the direction of radius of the body can easily be cancelled as mentioned above.

As mentioned above, the simple spherical gliding part which is provided in the structure for supporting the body of a converter according to the present invention is effective in cancelling any impact produced at the time of the rotation of the body by smoothly transferring the center of gravity of the body even under complicated thermal deformation of the same or its supporting device, thereby not only preventing damage to said supporting device but also extending its life in that said supporting device is made usable even when it undergoes thermal deformation so far as these can be cancelled in the abovementioned manner.

FIG. 14 shows another embodiment of the present invention. Element 22' denotes a hemi-spherical gliding head; 23' denotes a spherical receiver; and the spherical gliding part of the upper supporting device is provided in a reversed manner from the abovementioned

tioned embodiment. As a further embodiment, a spherical gliding part may be reversely provided in the lower supporting device; or various assembling methods may be provided for the spherical gliding part of both or either of the upper and the lower supporting devices.

We claim:

1. An apparatus for supporting the body of a converter wherein a base stand supports a pair of trunnion shafts provided on a trunnion ring, said trunnion ring being supported between an upper bracket and a lower bracket fixed on the outside of the body, which comprises: a plurality of upper supporting devices each allowing for free gliding therein having one end set on the upper bracket and the other end set on a sliding base plate in a guiding groove provided on the upper surface of the trunnion ring and extending in the radial direction of the body, wherein each of said upper supporting devices consists of a guiding member fixed on the upper surface of the trunnion ring, a sliding member having a hemi-spherical gliding head, and a spherical receiver having a hemi-spherical concave part receiving said hemi-spherical gliding head for free gliding movement along its inside, one of said hemi-spherical gliding head or said hemi-spherical concave part being provided on said upper bracket and the other being provided on said sliding base plate inserted for free sliding along said guiding groove; and a plurality of lower

supporting devices having a part of a semi-circular cross-section allowing for free gliding movement in the radial direction of the body having one end set on the lower bracket and the other end set on the trunnion ring; wherein each lower supporting device consists of a semi-circular gliding head which allows for free gliding movement along its inside extending in the direction of axis of the trunnion shaft and either said semi-circular gliding head or said semi-circular receiver being fixed on the bottom surface of said trunnion ring and the other being fixed on the upper surface of the lower bracket.

2. The apparatus claimed in claim 1, wherein a plurality of upper supporting device are arranged symmetrically on straight lines on the upper surface of the trunnion shaft in parallel therewith and a pair of lower supporting devices are arranged on the opposite sides of the body below the trunnion shaft.

3. The apparatus claimed in claim 1, wherein said guiding member has a plurality of stoppers standing on the trunnion ring at intervals in the direction of circumference of the trunnion ring and the vertical parallel surfaces facing each other, respectively, of said stoppers form a guiding groove with the upper surface of the trunnion ring for guiding said sliding base plate.

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