

Dec. 25, 1962

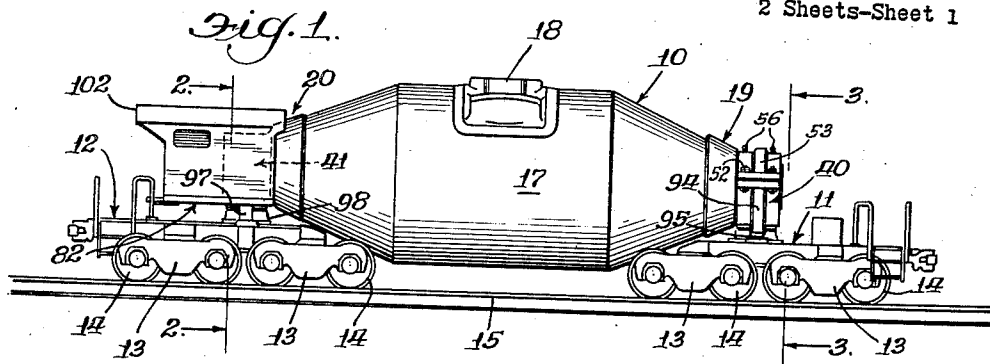
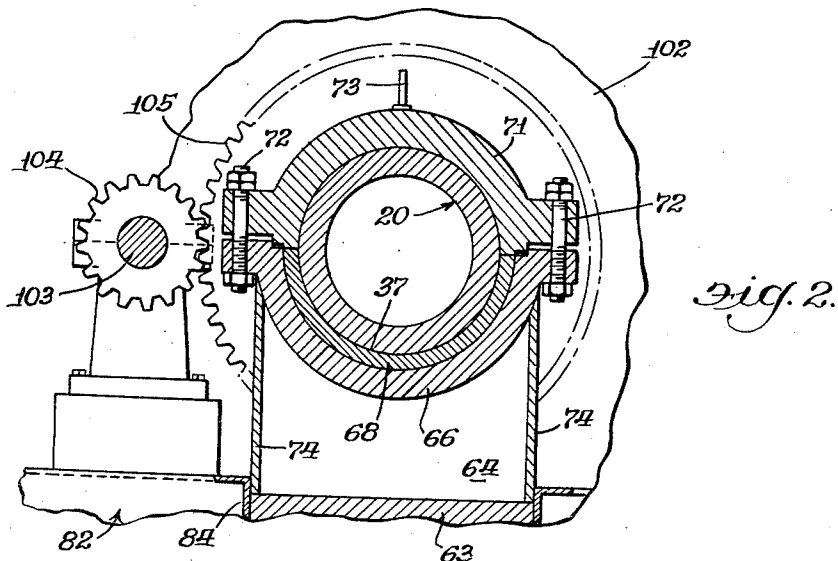
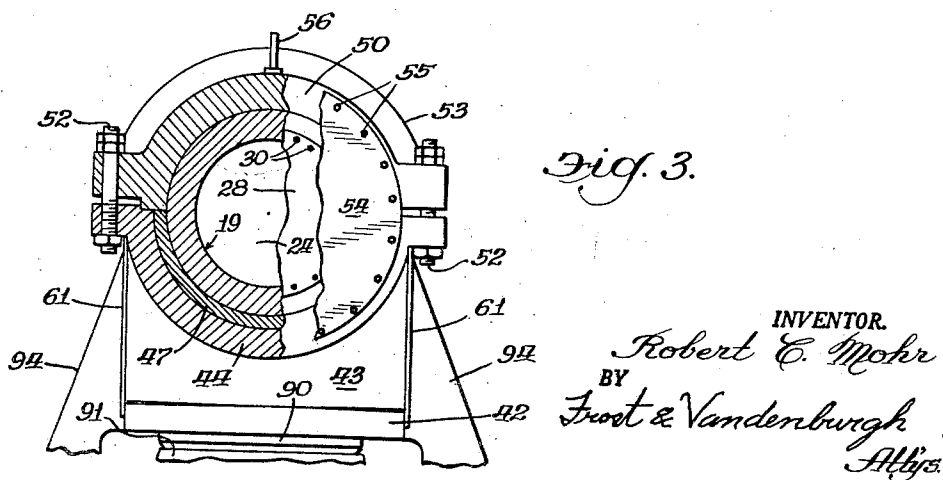
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HOT METAL MIXER CAR

Filed Feb. 8, 1961

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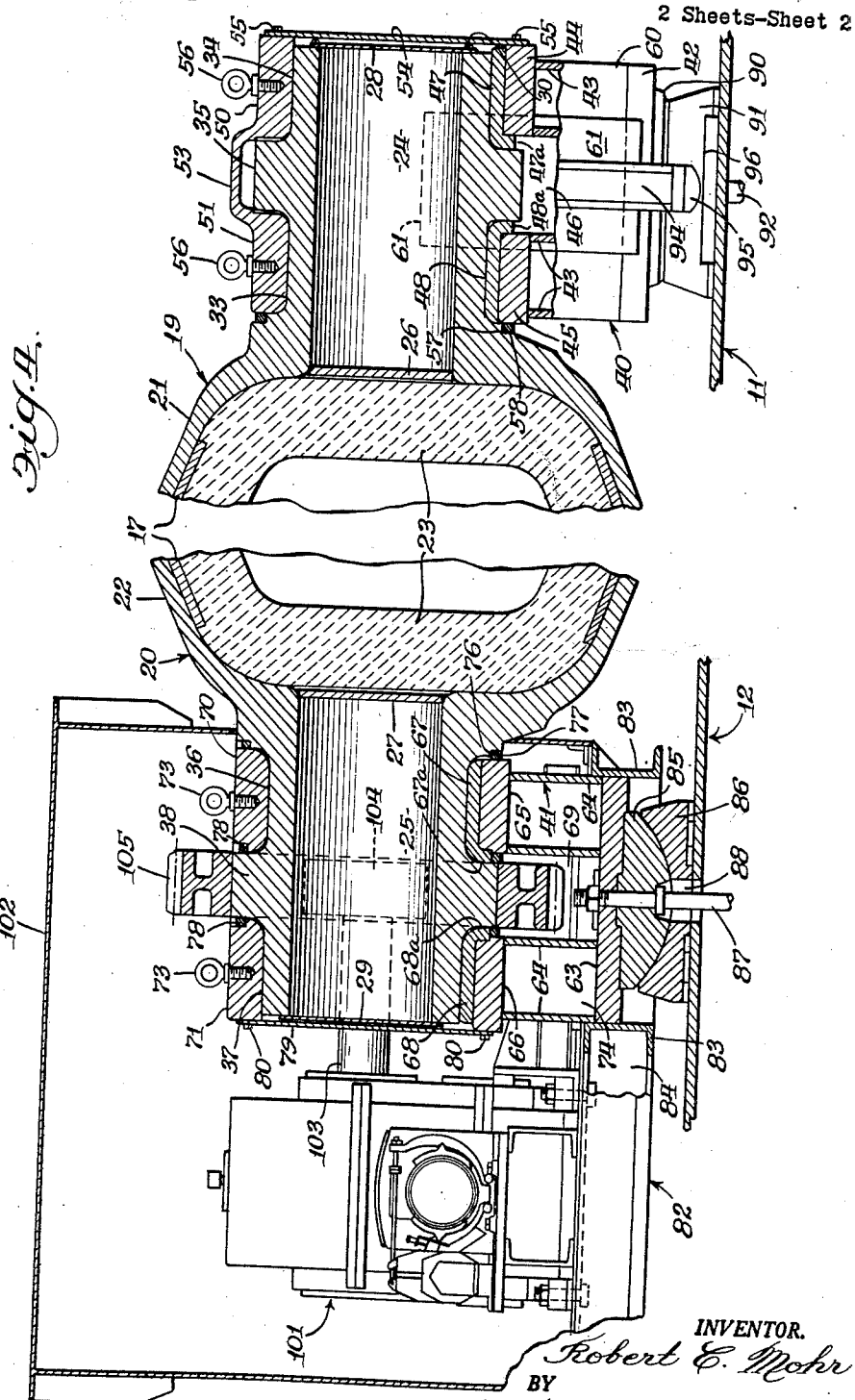
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1

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HOT METAL MIXER CAR

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The present invention relates to a hot metal mixer car for use by a steel mill or the like.

A hot metal mixer car is a large, heavy vehicle normally constructed for operation on railroad tracks. Usually it has a capacity of 200 or more tons of molten metal. This molten metal is carried in a large refractory-lined container, the empty weight of which usually will be in excess of about 150 tons. Because of the container size and the clearance, etc., requirements of the area in which the hot metal mixer car is used, the general practice is to mount the container on a pair of spaced trucks, with the container itself forming the only connection between the trucks.

The container has one or more fill and pour openings located in a side thereof intermediate the trucks. The container is mounted on the trucks in such a manner that it may be rotated about a horizontal axis. This permits the side openings to be positioned upwardly for the filling of the container, or to be positioned downwardly for the emptying of the container. In view of the tremendous weight of the container, particularly when it is loaded with molten metal, serious problems are created with respect to the bearings in which the container is journaled for rotation about the horizontal axis.

Obviously, the bearings must be capable of adequately supporting the loads involved while permitting the rotation of the container about the horizontal axis without undue frictional forces. The fact that these cars are operated in a steel mill area where the air is apt to be laden with abrasive dusts and corrosive chemicals adds to the difficulties in providing suitable bearings. Because of the weight, abrasive dust, etc., the bearings are likely to have a relatively short operating life. Replacement of the worn parts is complicated by the very size and weight of the car structure. Furthermore, because of the capital investment it represents, it is most uneconomical to have a car out of service for the repair and rehabilitation of worn parts.

Providing a suitable bearing structure for a hot metal mixer car is further complicated by the fact that the bearings must be capable of withstanding substantial axial loads on the shafts journaled in the bearings. Since the only connection between the trucks on which the container is supported is through the container itself, the draw bar pull applied to the truck at one end of the car, as for example by a locomotive, is transmitted to the truck at the other end of the car only through the bearings and the container itself. If several such cars are connected in series with an engine at one end, the draw bar pull to move each succeeding car is represented by a force applied to the bearing structures of the preceding car. Such forces are not wholly confined to an evenly applied draw bar pull, but will also include the shock forces of bumps, coupling, and uncoupling, etc.

The principal object of the present invention is to provide a hot metal mixer car having the container mounted in bearings over each of the trucks, with the bearings being particularly capable of standing up under the deleterious effect of the previously described conditions so that the car will have a relatively long operating life before repair or replacement of parts is required.

In devices of the type with which the present invention deals, power means are provided at one end of the car to rotate the container about the horizontal axis, as

2

previously described. Because of the problems attendant the connection of the power means to the container, it usually has been deemed to be necessary to utilize a different bearing structure at the end at which the power means is located (hereinafter referred to as the live end) from that which could be utilized at the end of the car where there was no necessity for a power connection (hereinafter referred to as the dead end). The bearing structure I have devised is, in contradistinction, basically identical for the bearings at both the live and dead ends. This not only simplifies and reduces the cost of manufacture, but aids the user of the car. The stock of replacement parts that the user must keep on hand is reduced since, in the main, the parts are interchangeable, and can be used either for the rehabilitation of the bearing at the live end or the rehabilitation of the bearing at the dead end.

Further objects and advantages will be apparent from the following description taken in conjunction with the drawings, in which:

FIGURE 1 is an elevational view of a hot metal mixer car embodying my invention;

FIGURE 2 is a partial section as viewed at line 2—2 of FIGURE 1;

FIGURE 3 is a partial view as seen at line 3—3 of FIGURE 1 with portions broken away; and

FIGURE 4 is a partial elevational section of the car as view in FIGURE 1.

As best seen in FIGURE 1, the hot metal mixer car comprises an elongated, generally cylindrical container generally 10. One end of container 10 is supported on a main truck generally 11. The other end of container 10 is mounted on a main truck generally 12. Each of the main trucks 11 and 12 are mounted on two subtrucks 13. Each subtruck 13 includes four wheels 14 to carry the car on railroad rails 15. The details of the subtrucks 13 and the mounting of the main trucks 11 and 12 thereon do not form a part of the present invention. Preferably such mounting is that illustrated and claimed in application Serial No. 763,135, filed September 24, 1958, the disclosure of which is incorporated herein by reference.

Container 10 comprises a metal shell 17, which may be fabricated of steel plate, as by means of welding. On one side of shell 17 is a suitable opening generally 18 for the loading of molten metal into the container and the pouring of the molten metal therefrom. At each end of shell 17 is a shaft assembly generally 19 and 20, respectively. Shell 17 extends into cups 21 and 22 of shaft assemblies 19 and 20, respectively, and is suitably secured thereto as by means of welding or riveting. The interior of the shell and cups is provided with a refractory lining 23. Shaft assemblies 19 and 20 have axial bores 24 and 25 therethrough. At the container end, bores 24 and 25 are closed by plates 26 and 27 welded to the shaft assemblies 19 and 20. Covers 28 and 29 are secured to the opposite ends of the bores as by means of bolts 30 (FIGURE 3).

Shaft assembly 19 has two journal sections 33 and 34 separated by an annular boss 35. Similarly, shaft assembly 20 has a pair of journal sections 36 and 37 separated by an annular boss 38. From FIGURE 4 it will be noted that, for all practical purposes, shaft assembly 19 is identical to shaft assembly 20, and the two may be used interchangeably. The journal sections of each assembly, e.g. journal sections 33 and 34 and 36 and 37, are of approximately equal length as measured axially of the shafts.

Shaft assembly 19 is mounted in a supporting member generally 40 while shaft assembly 20 is mounted in a supporting member generally 41. While supporting mem-

bers 40 and 41 may be formed entirely from castings, in the illustrated embodiment substantial portions thereof are formed by cutting and welding metal plates and sections. Supporting member 40 includes a base plate 42 on which are a plurality of uprights 43. On supporting members 43 are a pair of pillow blocks 44 and 45, which define a space 46 therebetween. On each pillow block is a bearing insert 47 and 48, respectively. Insert 47 has a flange 47a which extends into the space 46 and abuts one side of the annular boss 35. Similarly, insert 48 has a flange 48a which abuts the opposite side of boss 35. As is best seen in FIGURE 3, the two bearing inserts 47 and 48 extend only approximately about the bottom half of the journal sections 33 and 34.

A pair of caps 50 and 51 extend about the top half of the journal sections and are secured to pillow blocks 44 and 45 by bolts 52. A cover 53 extends about boss 35 between caps 50 and 51. In the illustrated embodiment, caps 50, 51 and cover 53 are formed integrally, but it is obvious to those skilled in the art that these could be formed in three pieces suitably fastened together. A cover 54 is received about the outer end of pillow block 44 and cap 50 and is fixed in place by bolts 55. Lifting rings 56 are threaded into caps 50 and 51. An annular recess 57 extends about shaft assembly 19 to receive a packing ring or seal 58 between the shaft assembly 19 and cap 51 and pillow block 45.

Support member 40 has side plates 60. In the illustrated embodiment, support member 40 was constructed identical to support member 41 for all practical purposes and, for reasons that will hereinafter become apparent, side plates 60 did not cover the space 46. For this reason, covers 61 are placed over the opposite sides of the space 46. In other embodiments the side plates 60 could completely cover each side of the support member 40, in which case the cover plate 61 would not be needed.

Support member 41 comprises a base plate 63, uprights 64 and pillow blocks 65 and 66, which carry bearing inserts 67 and 68. A space 69 exists between pillow blocks 65 and 66. Into this space extends boss 38 with flanges 67a and 68a of bearing inserts 67 and 68 abutting opposite sides of boss 38. Caps 70 and 71 are secured to pillow blocks 65 and 66 by bolts 72. Lifting rings 73 are threaded into caps 70 and 71. Except for the space 69, side plates 74 are secured to uprights 64 to form part of the supporting structure for the pillow blocks 65 and 66.

A groove 76 extends about the periphery of shaft assembly 20 to receive a packing ring 77 between the shaft assembly and pillow block 65 and cap 70. Packing rings 78 extend about each side of boss 38 with one side of each packing ring bearing against the boss and the opposite sides bearing against the caps 70 and 71 and the pillow blocks 65 and 66. A cover plate 79 is positioned over the outstanding end of the support member 41 and is held in place by bolts 80.

Support member 41 is mounted on a movable frame generally 82, which includes cross channels 83 and longitudinal channels 84. A bearing member 85 of semispherical convex configuration is mounted on the bottom of plate 63 with its spherical axis extending vertically through the center of boss 38. Bearing member 85 is carried in a semispherical concave cavity of saddle 86. Saddle 86 is mounted on the top of main truck 12. A bolt 87 extends through bearing member 85 and longitudinally elongated opening 88 in saddle 86 to limit the movement of bearing member 85 in saddle 86. With such a structure, the bearing member 85 is free to rotate about the axis of bolt 87 with respect to saddle 86. Relatively free movement of bearing 85 and saddle 86 is permitted in the plane of the view of FIGURE 4, the movement being more than sufficient to permit truck 12 to accommodate itself to track irregularities. Relatively limited movement of the bearing member 85 in saddle 86 is permitted in the plane normal to the view of FIG-

URE 4 because of the relatively narrow width of opening 88 and the outriggers subsequently described. Such mounting structure is illustrated and described in greater detail in pending application Serial No. 763,135, filed September 24, 1958.

The mounting of support member 40 on truck 11 is substantially identical to that of support member 41 on truck 12. A semispherical convex bearing member 90 is secured to the bottom of plate 42. The bearing member 90 rides in a semispherical concave saddle 91 which is mounted on the top of truck 11. A bolt 92 extends through the two, as does bolt 87 on truck 12. Saddles 91 and 86 are located on the main trucks 11 and 12 midway between the points on those trucks at which the main trucks are supported on the subtrucks 13.

A pair of outriggers 94 extend out from opposite sides of support member 40 and have shoes 95 at the bottom end thereof. Shoes 95 are positioned only a short distance above wear plates 96 on the top of truck 11. Similarly, a pair of shoes 97 (FIGURE 1) are fixed to and extend downwardly from opposite sides of movable frame 82. Shoes 97 are positioned just slightly above wear plates 98 on the top of truck 12. The shoes in cooperation with the wear plates serve to additionally limit the extent to which the mounting members 40 and 41 will tip sideways with respect to trucks 11 and 12.

The power means 101 for rotating container 10 is mounted on movable frame 82 within cab 102. Power means 101 drives a shaft 103, the axis of which is parallel to the axis of shaft assembly 20. Affixed to shaft 103 is a spur gear or pinion 104 which engages a ring gear 105 surrounding and affixed to boss 38. Power means 101 may be electrically powered (as illustrated) or may be powered by a suitable internal combustion engine.

From the foregoing description, it will be apparent to those skilled in the art that the structure of my invention is ideally suited to withstand the rigors and abuses of the conditions to which a hot metal mixer car will be subjected. The journal and bearing surfaces are protected against the entrance of abrasive materials. The shafts at each end of the container are securely held in large bearings of a nature particularly adapted to stand up under the tremendous loads and the damaging blows to which they will be subjected, as for example during the coupling of cars or the movement of a hot metal mixer car by a locomotive. The bearing inserts upon which the weight of the container and its contents are carried may be made of a material particularly suited to lower the frictional drag when the container 10 is rotated.

After wear has occurred, the caps on the support members may be removed and with the shaft assemblies raised just sufficiently to remove their weight from the bearing inserts, the bearing inserts may be removed from the pillow blocks (by rotating the inserts in the pillow blocks) and replaced with new inserts. All of the inserts are interchangeable, so that a stock of various types of bearings need not be maintained. The load applied to shaft assembly 20 by power means 101 in the rotating of container 10 is centered between the two pillow blocks 65 and 66 to provide the most efficient, trouble-free operation. It is not an overhanging drive or a drive spaced some distance from one or both of the bearings, such as is the case in the prior art devices.

The foregoing description of a specific embodiment is for the purposes of complying with 35 U.S.C. 112 and should not be construed as imposing unnecessary limitations upon the appended claims inasmuch as modifications and variations thereof will become apparent to those skilled in the art from the foregoing description.

I claim:

1. In a hot metal mixer car having a pair of spaced truck means connected only by a hot metal container supported on said trucks, the improvement comprising: shafts extending from opposite ends of said container,

5

each shaft having a pair of journal sections separated by an annular boss of greater diameter than that of said journal sections; support members mounted on each of said trucks, each support member comprising a pair of pillow blocks spaced apart a distance greater than the length of said boss, a pair of bearings, one for each pillow block, each bearing having an annular flange extending outwardly about the side of the pillow block adjacent the mating pillow block, said bearings being received about the journal sections of the respective shaft with said flanges abutting said boss and the sides of the pillow blocks, and a cap fitting over each journal section and secured to the respective pillow block, whereby each shaft is rotatably mounted in a support member with the boss being held between the bearing flanges of each pillow block to restrain the shaft against axial movement; means to seal each support member against the entry of foreign material into the bearing surfaces; rotatable means centered under each support member and mounting the support members on said truck; a ring gear surrounding and fixed to one of said bosses; and power means to rotate said container including a pinion gear engaging said ring gear.

2. In a hot metal mixer car having a pair of spaced truck means connected only by a hot metal container supported on said trucks, the improvement comprising: shafts extending from opposite ends of said container, each shaft having a pair of journal sections of approximately equal axial length with an annular boss of greater diameter than that of said journal sections separating said journal sections; a pair of unitary support members positioned at opposite ends of said container below said shafts, each support member including a pair of pillow blocks spaced from each other axially of said shaft with the space therebetween being a little greater than the axial length of said boss, a pair of bearings, one for each pillow block, each bearing having an annular flange extending outwardly about the side of the pillow block adjacent the mating pillow block, said bearings being received about the journal sections of the respective shaft with said flanges abutting said boss, and a cap fitting over each journal section and secured to the respective pillow block whereby each shaft is rotatably mounted in a support member with the boss being held between the bearing flanges of each pillow block to restrain the shaft against axial movement; means to seal each support member against the entry of foreign material into the bearing surfaces, said means including covers on one of said support members covering the space between said pillow blocks and between said caps; rotatable means centered under the space between the pillow blocks of each support member and mounting the support members on said trucks; a ring gear surrounding and fixed to the boss received within the other of the support members, said ring gear being received in the space between the pillow blocks and extending outwardly of the support member on one side thereof; power means positioned adjacent said other support member and supported from the respective truck by the rotatable means supporting said other support means on the respective truck, said power means including a drive shaft parallel to said container shafts and a pinion gear on said drive shaft with the pinion gear engaging said ring gear.

3. In a hot metal mixer car having a pair of spaced truck means connected only by a hot metal container

6

supported on said trucks, the improvement comprising: shafts extending from opposite ends of said container, each shaft having a pair of journal sections of approximately equal axial length with an annular boss of greater diameter than that of said journal sections separating said journal sections; a pair of unitary support members positioned at opposite ends of said container below said shaft, each support member including a pair of pillow blocks spaced from each other axially of said shaft with the space therebetween being a little greater than the axial length of said boss, a pair of half bearings, one for each pillow block, each bearing having a semi-annular flange extending outwardly about the side of the pillow block adjacent the mating pillow block, said bearings being received about the bottom half of the journal sections of the respective shaft with said flanges abutting said boss, and a cap fitting over each journal section and secured to the respective pillow block whereby each shaft is rotatably mounted in a support member with the boss being held between the bearing flanges of each pillow block to restrain the shaft against axial movement; means to seal each support member against the entry of foreign material into the bearing surfaces, said means including covers on one of said support members covering the space between said pillow blocks and between said caps, sealing rings between said shafts and the end of each support member adjacent said container, and sealing rings between the other support member and each side of said boss; a semispherical convex bearing affixed to the bottom of said one support member and centered between the axial ends of said support member; a semispherical concave saddle mating with said convex bearing and supporting the same, said saddle being mounted on one of said trucks approximately centered between the wheels thereof; a second semispherical convex bearing affixed to the bottom of said other support member and centered between the axial ends thereof; a second semispherical concave saddle mating with said second convex bearing and supporting the same, said second saddle being mounted on the other of said trucks approximately centered between the wheels thereof; means associated with said bearings and saddles to limit the movement of each bearing in its saddle about an axis parallel to the axis of said shafts, while permitting movement of the bearings in the saddles about a generally vertical axis through the same; power means mounted on said second convex bearing and connected to the boss within the other support member to rotate the container, said power means including a generally annular driven member positioned in the space between the pillow blocks of the other support member and affixed to the boss between said pillow blocks, and a shaft and a driving member at one side of said other support member, said driven member being operatively connected to said driving member.

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