

May 20, 1952

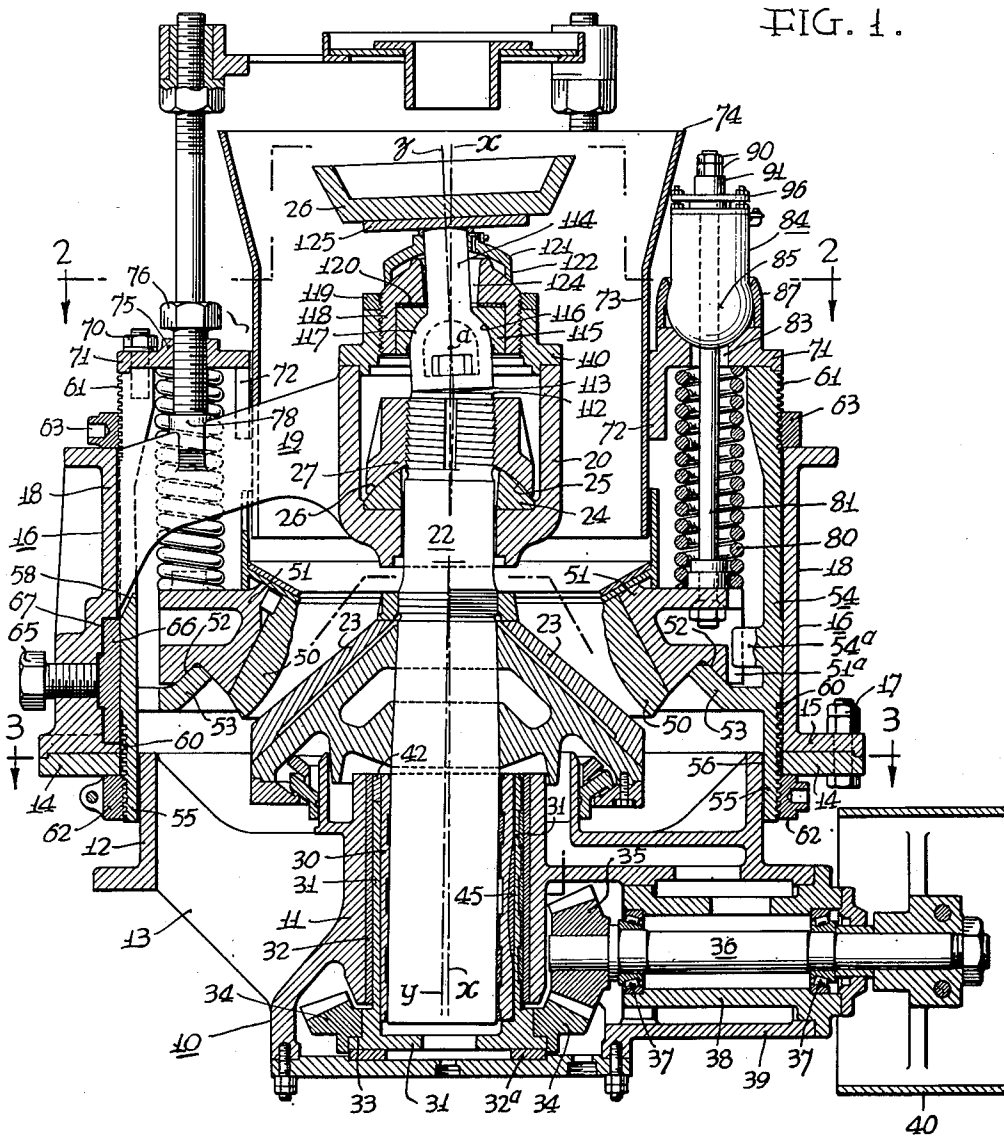
S. W. TRAYLOR, JR

2,597,548

FRAME STRUCTURE FOR GYRATORY CRUSHERS

Filed Feb. 10, 1948

10 Sheets-Sheet 1



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10 Sheets-Sheet 3

FIG. 4.

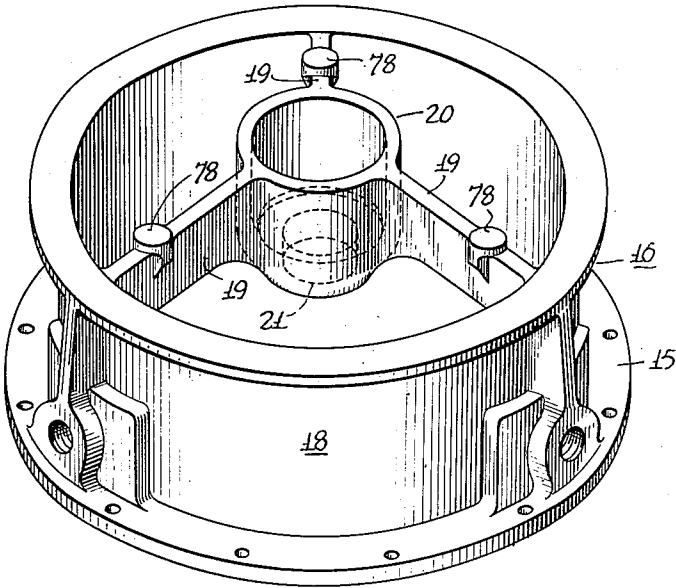
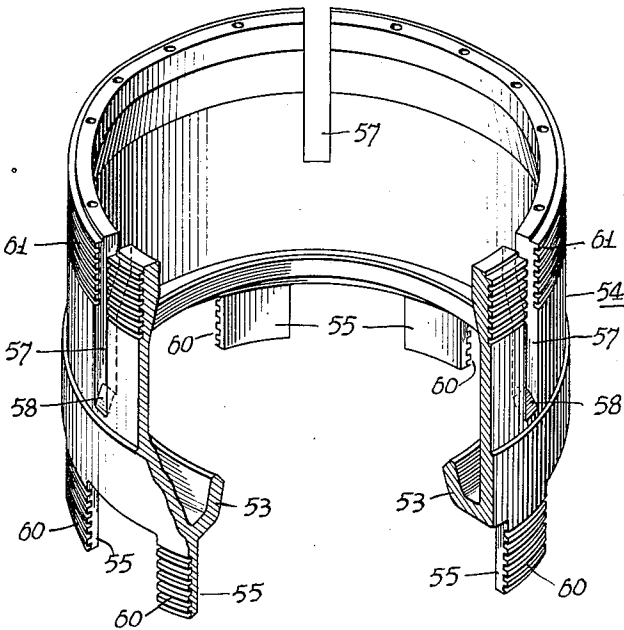


FIG. 5.



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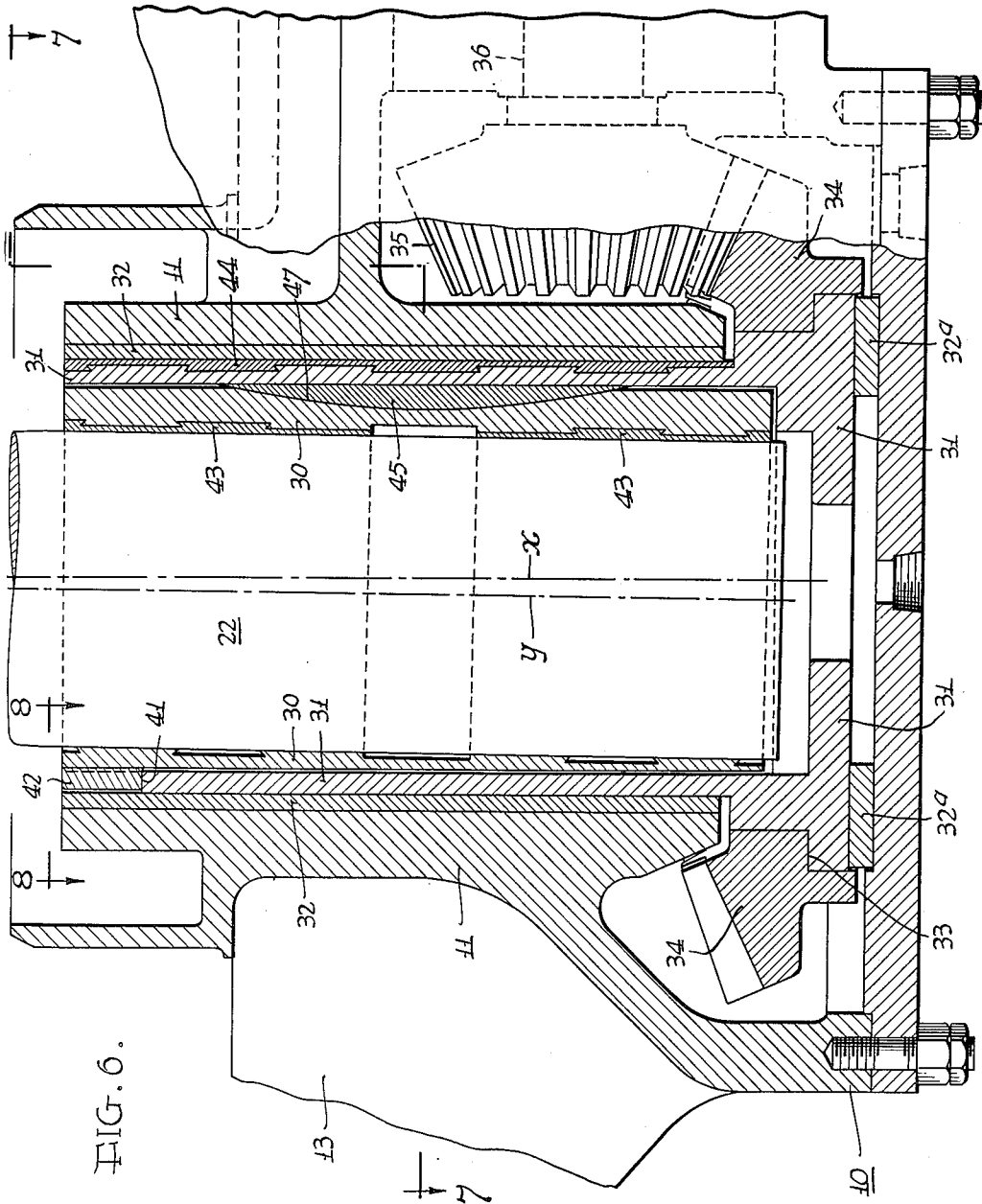
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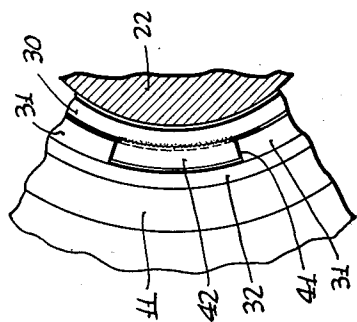
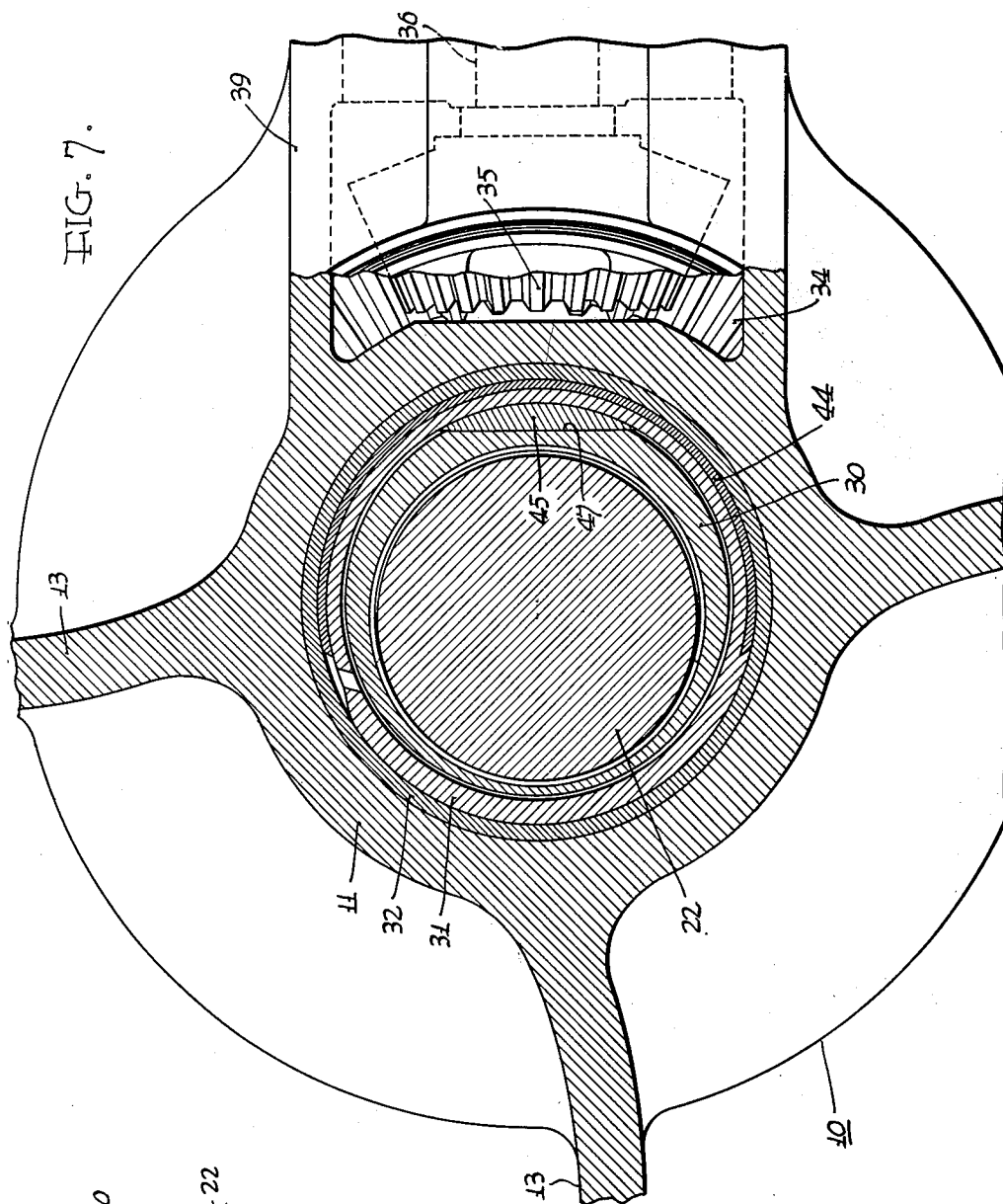
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10 Sheets-Sheet 5



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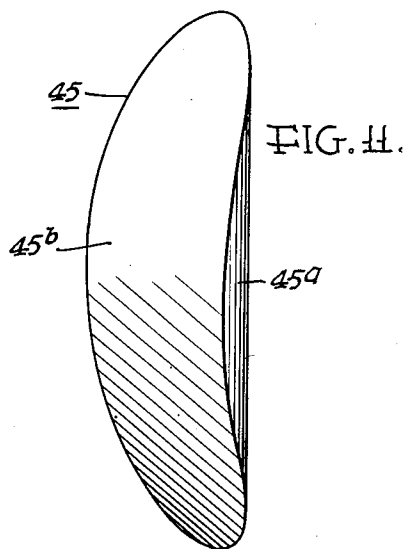
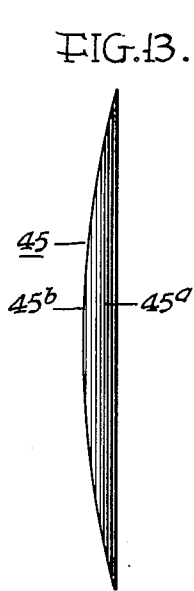
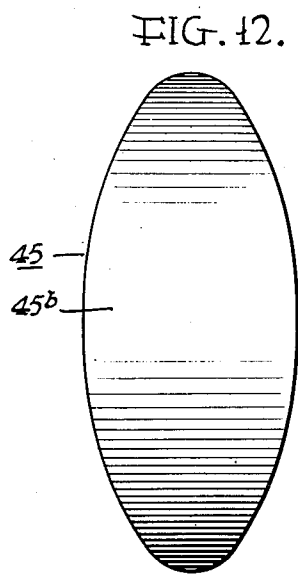
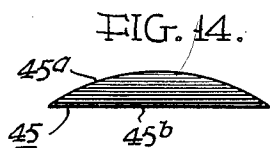
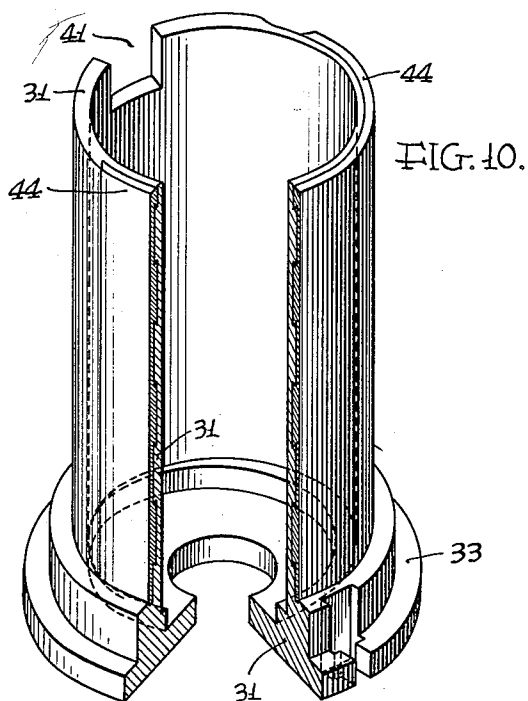
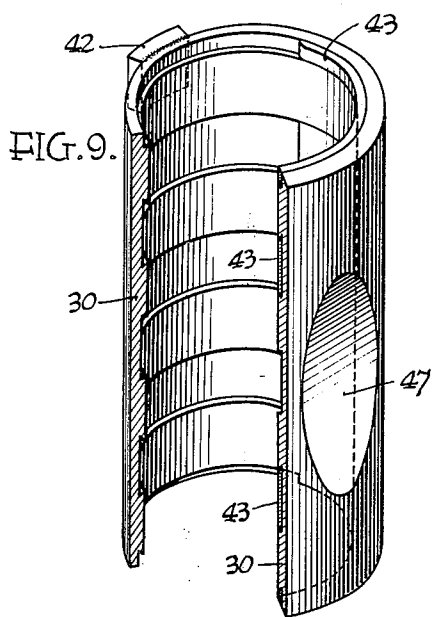
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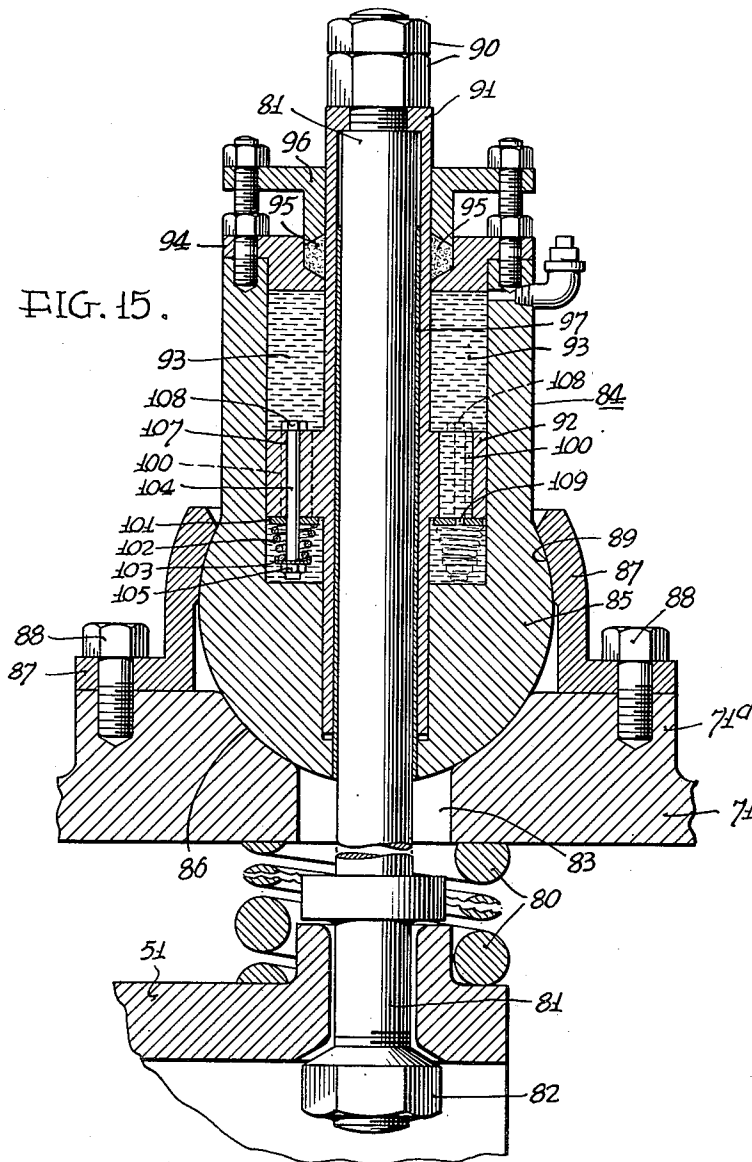
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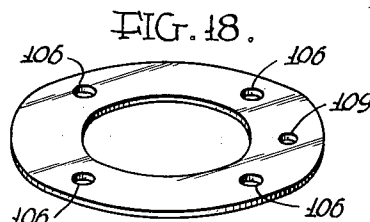
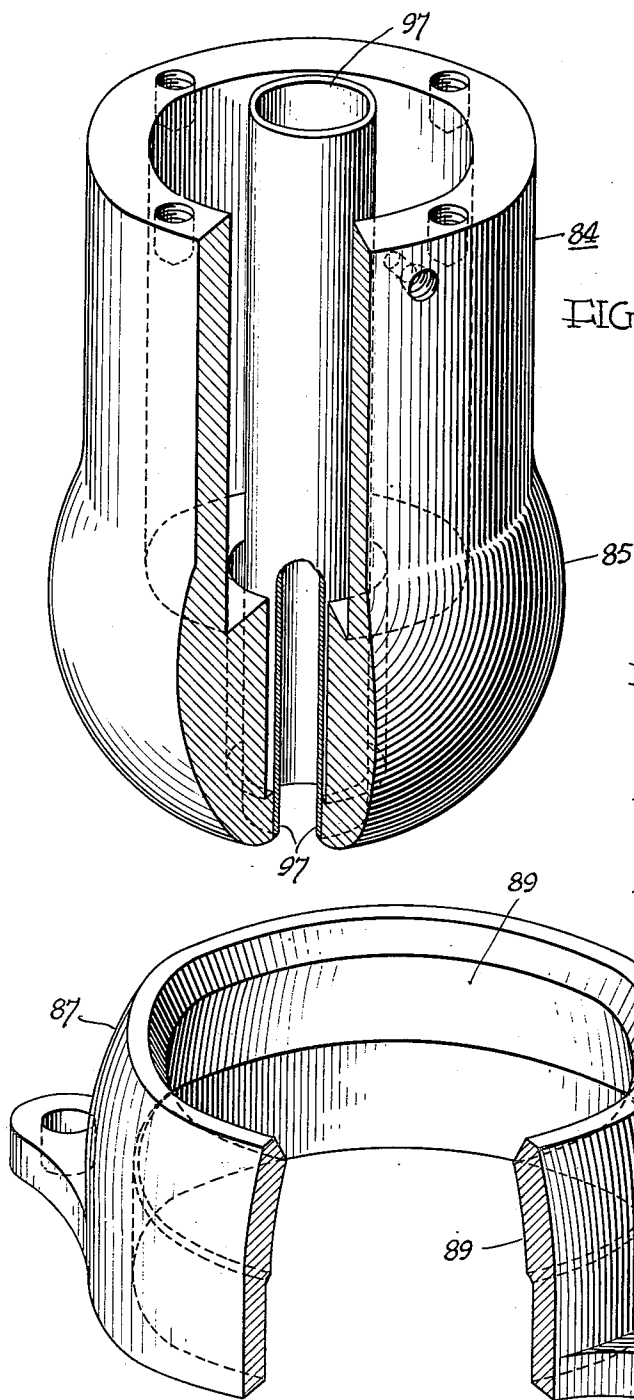


FIG. 16.

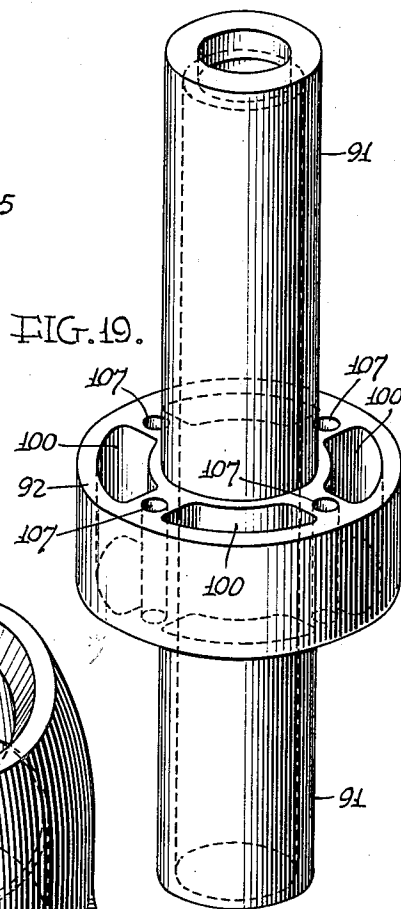


FIG. 19.

FIG. 17.

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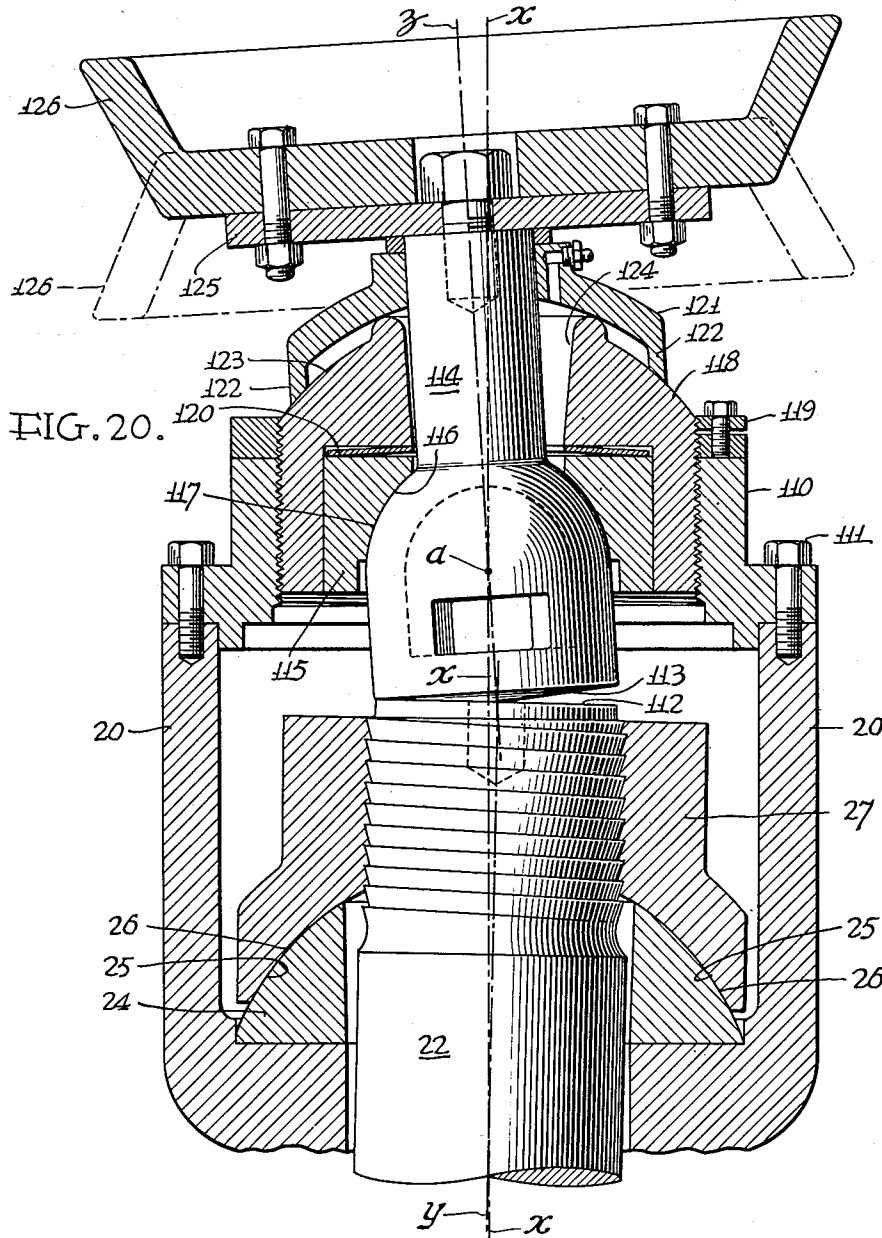
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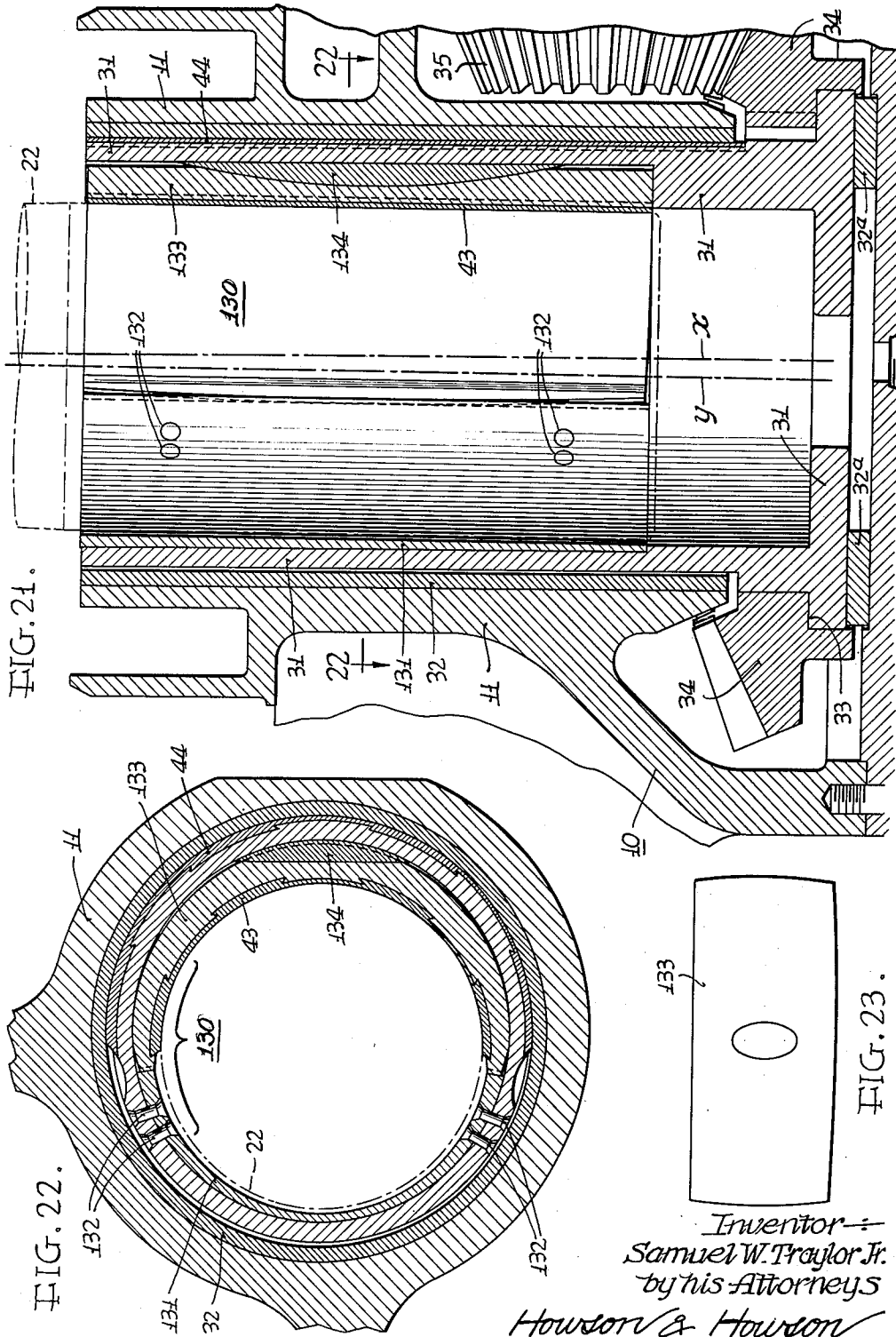
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UNITED STATES PATENT OFFICE

2,597,548

FRAME STRUCTURE FOR GYRATORY CRUSHERS

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Application February 10, 1948, Serial No. 7,353

3 Claims. (Cl. 241—290)

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This invention relates to new and useful improvements in crushers, and more particularly to improvements in crushers of the gyratory type.

One of the difficulties and objections encountered in prior crushers of the gyratory type has been the inability to provide an eccentric that will give long life under high loads. As is well known, a film of oil must be maintained between relatively rotating parts. Many eccentrics in this type of crusher fail to have a self-aligning feature in the eccentric with the result that the clearances between the moving parts have to be so great to allow for inaccuracies in machining and deflections that a proper oil film cannot be maintained, with the result that worn and burned out bearings occur more frequently than they should and both loss of time and added expense are entailed by operating shutdowns plus the cost of repairs and replacement parts. Another difficulty is presented by the provisions for effecting adjustment of the crushing surfaces as the result of wear or to change the fineness of the crushing operation. In many cases, and particularly in gyratory crushers of the so-called "spider" type, adjustment of the crushing surfaces is effected by vertical adjustment of the crusher shaft and head. In such cases the construction of the eccentric mounting of the shaft is made unduly complicated in order to provide for axial movement of the shaft, and feeding devices for the material to be crushed likewise become more complex and expensive.

Furthermore, gyratory crushers of the spider type characteristically have a comparatively small head motion and although these crushers ordinarily do not require a feeding device for the material to be crushed, there are many instances, such as, for example, in crushing stone to a fineness of less than about one-half inch, where either a feeder device for the material must be employed or a smaller throw eccentric provided for the crusher shaft. A change of eccentrics entails considerable loss of time and expense so that the provision of an adequate feed device for crushers of this type is desirable. Furthermore, it is necessary in these crushers to provide for the displacement of the concave to permit discharge of uncrushable objects, for example, tramp iron, such as a sledge hammer head, drill bit, dipper tooth or the like, without damage to the elements of the machine, and it is desirable also to retard or delay the return of the displaced concave in order to facilitate the discharge of such objects from the crusher. This is so, for if the return of the concave is not retarded or delayed, tramp iron which is larger than the open setting of the crusher will not be discharged but will stay within the crushing cavity and cause the concave to be forced up and down until the crusher is stopped and the iron

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or other object removed manually by burning with a torch. By retarding or delaying the return of the concave to its normal working position, the entrained tramp iron or other object is permitted to work its way readily through the crusher and be discharged therefrom. In addition, the delayed or retarded return of the concave to its normal working position cushions the shock or impact of this return action and prevents, or at least minimizes, the danger of injury or damage to the machine.

With the foregoing in mind, one of the important objects of the present invention is to provide a novel eccentric bearing and mounting construction for the shaft of a gyratory crusher wherein the eccentric bearing is supported for limited rocking movement so that it is self-aligning with the shaft according to fluctuations thereof.

Another object of the invention is to provide a novel eccentric bearing and mounting construction for gyratory crushers wherein the eccentric bearing member is rotatable relative to the crusher shaft.

Another object of the invention is to provide a novel eccentric bearing and mounting construction as set forth wherein it is entirely possible at all times to maintain adequate and proper lubrication of the assembly.

Another important object of the invention is to provide in a gyratory crusher of the present type, novel means for effecting vertical adjustment of the crushing surfaces relative to each other.

Another object of the invention is to provide novel means for adjusting the crushing surfaces of a gyratory crusher relative to each other through vertical adjustment of the concaves as distinguished from adjustment of the crusher shaft and head.

Another object of the invention is to provide a novel construction and arrangement of parts for effecting vertical adjustment of the crusher concaves which is relatively simplified and which can be manipulated to effect an adjustment of the crushing surfaces without disturbing the crusher shaft and its mountings or any other component mechanism of the machine.

Another important object of the present invention is to provide a novel feed device for gyratory crushers of the spider type.

Another object of the invention is to provide a feed device as set forth which is automatically operated by the motion of the crusher head shaft and which embodies novel features of construction and arrangement whereby a relatively large movement is imparted to the feed device by a comparatively small movement of the head shaft.

Another object of the invention is to provide a novel feed device for gyratory crushers having

the features and characteristics set forth which is quite simplified in construction and is entirely effective and efficient in operation and use.

A further important object of the present invention is to provide, in a gyratory crusher having yielding means permitting displacement of the crushing bowl or concave when an uncrushable object is encountered, novel means for retarding and cushioning the return of the concave to its normal operating position, whereby discharge of the uncrushable object from between the crushing surfaces is effected and reseating of the parts with substantial impact and shock is prevented or minimized.

These and other objects of the invention, and the various features and details of the construction and operation thereof, are hereinafter fully set forth and described with reference to the accompanying drawings, in which:

Fig. 1 is a sectional view vertically through a gyratory crusher embodying the present invention taken on line 1—1, Fig. 2;

Fig. 2 is a sectional view taken on line 2—2, Fig. 1;

Fig. 3 is a sectional view taken on line 3—3, Fig. 1;

Fig. 4 is a detached view in perspective of an upper frame and spider member of the crusher;

Fig. 5 is a perspective view partially in section of a sleeve or ring member which is supported by the frame of the crusher and mounted for adjustment vertically with respect thereto;

Fig. 6 is an enlarged sectional view of the eccentric mounting of the crusher shaft;

Fig. 7 is a sectional view taken on line 7—7, Fig. 6;

Fig. 8 is a fragmentary view from line 8—8, Fig. 6;

Fig. 9 is a perspective view partially in section of a novel bearing construction embodied in the eccentric mounting for the crusher shaft;

Fig. 10 is a perspective view partially in section of a housing member which receives the bearing of Fig. 9;

Fig. 11 is a view in perspective of a rocker member which is provided in association with the bearing of Fig. 9 to effect self-aligning thereof.

Figs. 12, 13 and 14 are elevational and plan views, respectively, of a rocker member which is provided in the bearing of Fig. 9 and operates to effect self-alignment of the bearing according to movements of the crusher shaft;

Fig. 15 is an enlarged detached view in section showing details of construction and arrangement of parts embodied in novel means provided for retarding return to operative position of the crushing concaves following the release thereof to permit foreign material, such as tramp iron, to pass through the apparatus;

Figs. 16, 17, 18 and 19, respectively, are detached perspective views showing the construction and arrangement of certain of the component parts of the retarding mechanism of Fig. 15;

Fig. 20 is an enlarged fragmentary sectional view of the upper end of the crusher shaft showing the support therefor and novel means for feeding material to the crusher;

Fig. 21 is a view similar to Fig. 6 showing a modified eccentric bearing construction;

Fig. 22 is a slightly reduced sectional view on line 22—22, Fig. 21; and

Fig. 23 is a developed view, in reduced scale, of

the bearing member embodied in the construction of Fig. 21.

Referring now to the drawings and more particularly to Fig. 1 thereof, a crusher of gyratory type made according to the present invention may comprise a lower or base frame section generally designated 10, including a central sleeve or hub portion 11 and an outer ring portion 12 integrally joined together, for example, by means of a plurality of circumferentially spaced legs 13 arranged, for example, as shown in Fig. 3. The ring portion 12 of the lower frame 10 is provided at its upper edge with a laterally projecting continuous flange portion 14 on which is seated the lower flange portion 15 of an upper frame and spider section which is generally designated 16, and constructed, for example, as shown in Fig. 4 of the drawings. Preferably, the upper frame spider section 16 is bolted to the lower frame section 10 as indicated at 17.

Extending radially inward from the annular wall portion 18 of the upper frame section 16, at predetermined spaced intervals thereabout, is a plurality of spider legs 19 which terminate at their inner ends in a centrally disposed housing portion 20 of generally cup-shape having an opening 21 in its bottom portion for the upper end of a crusher shaft 22, which carries the usual crusher head 23. Seated within the housing 20, and surrounding the upper end of the shaft 22, is an annular member 24 having a spherical upper surface portion 25 on which rests the corresponding spherical surface 26 of a member or nut 27 that is threaded upon the upper end of the crusher shaft 22 as shown. By this construction it is to be observed that the entire weight of the shaft 22 and the crusher head 23 is carried by and suspended from the upper frame section and the nut 27 may be adjusted to predeterminedly set the position of the crusher head 23.

The lower end of the crusher shaft 22 is eccentrically supported in the central hub portion 11 of the lower frame section 10 and a gyratory motion is imparted to the shaft 22 in the well-known manner. As previously stated, the conventional type eccentric mountings heretofore utilized for the shafts of gyratory crushers have been objectionable due to the fact that the amount of clearance that was required for the flexure of the shaft and inaccuracies of machining, usually made it impossible to maintain an oil film between the relatively moving parts of the eccentric assembly and hence these mountings were not properly lubricated. In addition, in conventional type eccentrics as used heretofore, the alignment of the inner and outer bearings is fixed so that the inner bearing cannot adjust itself to the slight misalignments of the shaft when the crusher is under load.

According to the present invention there is provided a novel eccentric mounting for the lower end of the crusher shaft 22 which is not subject to the foregoing objections and difficulties and which has the distinct advantage of being self-aligning. Thus, with reference to Figs. 6 to 13, inclusive, of the drawings, the lower end of the crusher shaft 22 is journaled in an eccentric bearing 30 which is in turn received within a housing 31 that is rotatably mounted in a suitable concentric journal 32 mounted internally of the central hub portion 11 of the lower frame section 10 of the crusher. The lower end of the housing 31 rests upon a flat bearing 32a and is shouldered as indicated at 33. Secured upon this shoulder 33 of the housing is a bevel ring gear

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34 which is driven from another bevel gear 35 that is fixed on the inner end of a radially extending shaft 36. The shaft 36 is rotatably journaled in bearings 37 supported in a sleeve 38 disposed within a housing portion 39 of the lower main frame section 10. The shaft 36 extends outwardly of the crusher and has a pulley or the like 40 for a drive belt secured on its extremity.

The housing 31 is rotationally driven at a preselected speed from the pulley 40 through the described gearing, and it is to be noted that the upper end of the housing 31 is provided with a slot 41 in which is engaged a projection or lug 42 on the eccentric bearing 30 (Fig. 9) so that the latter rotates with the housing 31 and relative to the crusher shaft 22. The bearing 30 is internally babbitted as indicated at 43 at the load receiving side thereof, and the housing 31 likewise is exteriorly babbitted in a corresponding area as indicated at 44.

In order that the eccentric bearing 30 will be selfaligning with respect to the shaft 22 and permit limited rocking movement of the bearing within and relative to the housing 31, there is interposed between the bearing 30 and the housing 31, at the load or thrust side of said shaft, a rocker member 45 constructed and configured as shown in Figs. 11, 12, 13 and 14 of the drawings. As shown in the drawings, the rocker member 45 has an outer surface 45a which is curved to conform to the inner wall surface of the housing 31 and has an inner surface 45b which is longitudinally convex and transversely flat. The inner surface 45b of the rocker 45 seats against a correspondingly configured surface 47 provided on the eccentric bearing 30, and the thickness of the rocker member 45 is such that its outer surface 45a projects beyond the external surface of the bearing 30 and engages the adjacent inner surface of the housing 31 in a manner to maintain a small clearance between the housing 31 and the eccentric bearing 30 so that the only contact of the bearing at this point with the housing is through the rocker member 45. By this construction the eccentric bearing member 30 is free to tilt vertically and slide horizontally upon the inner surface 45b of the rocker member 45 and ample clearance is provided between the housing and bearing to provide for limited displacement of the latter according to any misalignment of the shaft 22.

According to the present invention the crushing bowl or concaves 50 which cooperate with the head 23 are carried by an annular backing member or ring 51 having the cross-sectional shape and configuration shown in Fig. 1 of the drawings. As shown, this backing ring 51 is provided in its undersurface with a triangular recess or groove 52 arranged for seating engagement upon an inwardly inclined continuous annular flange portion 53 formed internally of an annular flange portion 53 formed internally of an annular sleeve or wall member 54, the said backing ring being held against rotation relative to the member 54 by a projection 54a on the latter which engages a slot 51a in said ring. The member 54 is mounted in association with the crusher main frame sections 10 and 16, respectively, and is adapted to be adjustable vertically with respect thereto for the purpose of adjusting the crushing bowl or concaves 50 relative to the head 23.

The construction and arrangement of the sleeve or wall member 54 is best shown in Fig. 5 of the drawings. Projecting vertically downward

from the lower edge of the member 54 at equally spaced intervals circumferentially thereof is a plurality of lugs 55 which are received in slots 56 (see Figs. 1 and 3) of corresponding size and shape arranged circumferentially of the lower frame section 10 in the flange portion 14 thereof outwardly of the wall portion 12 thereof. In addition, vertical slots 57 corresponding in number and spacing to the spider legs 19 of the upper frame section 16 are provided in the member 54 for reception of the said spider legs 19, and these vertical slots 57 extend downwardly from the upper edge of the member 54 and have their lower ends beveled or inclined as indicated at 58 in correspondence with the shaping of the extremities of the spider legs 19.

As previously stated herein the member 54 is adapted to be adjusted vertically with respect to the main frame sections 10 and 16 of the crusher to effect an adjustment of the concaves 50 relative to the head 23. To this end the outwardly facing surfaces of the depending lugs 55 of the member 54 are threaded as indicated at 60 and the upper end portion of the said member likewise is similarly threaded as indicated at 61. In engagement with the threads 60 of the depending lugs 55 of member 54 is a split ring nut 62 which is arranged at the underside of the flange portion 14 of the lower main frame section 10, for example, as shown in Fig. 1 of the drawings, and similarly engaged with the threads 61 provided on the upper edge portion of the member 54 is a ring nut 63 which is adapted to abut upon the flanged upper edge of the frame section 16.

By this construction and arrangement it will be apparent that through adjustment of the ring nuts 62 and 63, respectively, the position of the member 54 vertically with respect to the main frame sections 10 and 16 can be varied, thus making it possible to effect adjustment of the crushing bowl or concaves 50 relative to the crusher head 23 without the necessity of vertically adjusting the crusher shaft and head assembly. When the member 54 has been properly positioned vertically with respect to the main frame sections 10 and 16 as described, any relative lateral play or other movement between the member 54 and upper frame section 16 is eliminated by tightening a plurality of bolts 65 provided radially in the frame section 16 at predetermined intervals circumferentially thereof and arranged to engage against pressure plates 66 which are seated in recesses 67 in the frame 16 and contact the outer surface of the member 54.

Secured upon the upper end of the member 54, for example, by suitable bolts 70, is an annular top plate 71 having at its inner circumferential edge a depending flange portion 72 arranged concentrically of the spider housing portion 20 and providing lateral support for the skirt portion 73 of a feed hopper 74. Threaded vertically in suitable bosses 75 provided circumferentially of the top plate 71, corresponding to the spacing of the upper frame section spider legs 19, are bolts 76 which are arranged to engage downwardly into tight engagement upon suitable seat portions 78 provided on the upper edges of the aforesaid legs 19 thereby providing additional hold-down of the upper frame section 16.

According to the present invention, the backing ring member 51 which carries the concave or crusher bowl 50 normally is held in firm seating engagement upon the inwardly inclined flange portion 53 of the member 54 by means of a plurality of relatively stiff coil springs 80 that are

interposed and react between the aforesaid ring 51 and the undersurface of the top plate 71.

As is well understood in the art, during the operation of a crusher of the type with which the present invention is concerned the head 23 is given a gyratory movement around the axis x as indicated by line y with the result that the surface of the head approaches toward and retreats from the working surface of the concave 50 along a circular pattern. In the event that non-crushable objects of greater size than the minimum opening at which the crusher is set enters between the crushing surfaces, excessive crushing strains normally would be transmitted from the head 23 to the concave 50 but, in accordance with the present invention, these strains are relieved by the yielding of springs 80 above the portion of such an object with the result that the concave 50 and the backing member 51 tilt upwardly above the diametrically opposite point as a pivot until the object has worked its way through the crushing zone whereupon the springs 80 reseal the backing ring 51 upon the inwardly inclined flange portion 53 of the vertically adjustable member.

In order to facilitate the passage of non-crushable material between the crushing surfaces and also to prevent reseating of the parts described above with substantial impact or shock which might damage or injure certain elements of the machine, there is associated with certain of said springs 80 a mechanism or means for retarding the return of the concave 50 and its backing 51 to their normal working position upon the flange 53 of the member 54.

With reference more particularly to Figs. 15 to 19, inclusive, of the drawings, a rod 81 extends coaxially within each of the coil springs 80 and has its lower end loosely secured to the backing ring 51, for example, by means of a nut 82 threaded on the lower end of said rod as shown. Each of the rods 81 extends vertically upward through an opening 83 in the top plate 71 and into an hydraulic cylinder 84. The lower end of the cylinder 84 is provided with a spherical portion 85 which is supported in a corresponding recess or seat 86 provided in the bossed portion 71a of the annular top plate 71. The spherical portion 85 of the cylinder 84 is retained in seating engagement with the recess 86 by means of a retaining ring or the like 87 secured to the top plate 71, for example, by bolts 88 and provided with internal surface portions 89 of spherical section arranged to engage the cylinder spherical surface 85. By this construction and arrangement of parts it will be observed that the cylinder 84 is afforded substantially a universal mounting with respect to annular top plate 71.

The upper end of the rod 81 extends entirely through the cylinder 84 and secured upon its upper end, for example, by means of nuts 90, is the sleeve portion 91 of a piston member 92 which is slidably disposed within a chamber 93 provided internally of the cylinder 84. The cylinder chamber 93 is closed at its upper end by a cylinder head 94 and the joint between the latter and the piston sleeve 91 is prevented from leaking by packing 95 secured in place and retained by a gland 96 that is secured endwise of the cylinder head 94 as shown. Interposed between the piston sleeve 91 and the rod 81 is a thin tube 97 which extends from the extreme lower end of the cylinder 84 upwardly to a point above the cylinder head 94 so that oil or other liquid within the cylinder chamber 93 will not

leak downwardly along the rod 81 and out of the cylinder 84.

As shown in Fig. 19 of the drawings, the piston 92 is provided with openings or passages 100 therethrough of substantial area arranged circumferentially of the piston. These openings 100 are normally closed against the passage of oil from one side of the piston 92 to the other by means of a valve ring 101 disposed beneath the piston and normally retained in closing relation with respect to the passages 100 by means of coil springs or the like 102 acting between the underside of the valve ring 101 and a washer 103 retained on the lower end of a stem 104 by a nut or the like 105, the said stem 104 extending vertically upward through openings 106 and 107 in the valve ring and piston, respectively, and having a head portion 108 at its upper end which rests upon the upper face of the piston 92. The valve ring 101, in addition to the openings 106 for the stems 104, is provided with a bleed opening 109 disposed in register with one of the relatively large piston passages 100 and operable to permit oil or other liquid to bleed therethrough from the lower side of the piston 92 to the upper side thereof under certain operating conditions of the piston.

Suppose now that a piece of uncrushable material, such as a piece of tramp iron, is encountered between the crushing surfaces and is too large to pass through the crusher in the ordinary operation of the apparatus. As the crusher head 23 moves toward the piece of tramp iron the concave ring 50 and its packing member 51 are forced upwardly from its seat on the inclined flange 53 and against the downward pressure provided by the springs 80. This upward movement of the concave ring and its backing member causes the rod 81 likewise to be forced upwardly through the tube 97 and relative to the cylinder 84 carrying with it the piston 92. As the piston 92 moves upwardly, oil or other liquid which is contained in the cylinder chamber 93 is forced downwardly through the large ports 100 with sufficient force to open the valve ring 101 against its springs 102 thereby causing a relatively free and rapid flow of oil or other liquid from the upper side of piston 92 to the lower side thereof.

When the piece of tramp iron or other uncrushable material has been passed through the crusher, and the concave ring 50 and its backing member 51 are thus free to reseal upon the flange 53, downward movement of the piston 92 in the cylinder 84 is retarded by the oil therein and, since the valve plate 101 will be moved into closing relation with the large piston passages 100 by virtue of both the valve springs 102 and the upward pressure of the oil in the cylinder, the only passage of oil that can take place from the lower side of the piston 92 to the upper side thereof is through the small bleed port 109 that is provided in the valve plate 101. Hence downward movement of the piston 92 and the rod 81 is materially retarded so that the backing member 51 is precluded from reseating upon the inwardly inclined flange portion 53 of the member 54 with sufficient impact or shock to cause damage or injury to the machine.

The type of gyratory crusher with which the present invention is concerned has comparatively small head motion and although it does not ordinarily require a feeder for the stone to be crushed, in order to make the finer sizes of stone, say of a size about one-half inch and less, either

a still smaller throw of the head 23 is required or a feeder device must be employed to feed just enough stone to the crusher so that it will not become choked or overloaded. Accordingly, the present invention contemplates the provision, in gyrotory crushers of the type described, of a feeder device which is operable automatically by the gyrotory oscillations of the crusher head shaft 22.

With reference more particularly to Fig. 20 of the drawings, an annular sleeve or collar 110 is secured, for example, by bolts 111, to the upper edge of the housing 20 of the upper main frame section 16 from which the crusher shaft 22 and head assembly 23 is suspended, in the manner previously described. The upper end face 112 of the crusher shaft 22 is a flat plane surface which lies perpendicular to the true longitudinal axis of the said shaft, and has its center displaced or offset laterally from the vertical axis x of the machine. Seated upon this plane end face 112 of the shaft 22 is the conical end face 113 of a feeder shaft 114 which likewise has its center or apex offset from the axis x and coincident with the center of the shaft face 112. The feeder shaft 114 is supported in operative position upon the flat face 112 of the crusher shaft 22 by means of an annular wearing ring 115, of bronze or other suitable metal, having an internal spherical surface portion 116 disposed in bearing contact with a corresponding spherical surface provided on the enlarged end portion 117 of said feeder shaft 114. The wearing ring 115 is retained in its proper relation with respect to the feeder shaft 114 by means of a cap 118 which is threaded internally of the annular collar 110 and locked in its proper adjusted position therein with respect to the wear ring 115 by means of a lock ring 119 threaded externally on the cap 118 into abutting engagement with the upper face of the annular collar or flange 110. A flat spring 120, for example, of the well-known Bellfield type, is interposed between the wearing ring 115 and the cap 118 and provides a certain degree of resiliency between these members.

Secured upon the feeder shaft 114 adjacent the upper end thereof is a cap or ring 121 of generally spherical configuration having a depending peripheral flange portion 122 which slidably seats upon the upper spherical surface 123 of the cap 118 and thereby precludes dust from entering interiorly of the feeder mechanism through the feeder shaft opening 124 in said cap. The space lying inwardly of the cap flange 122 between the cap 121 and the top spherical surface of the cap 118 preferably is filled with grease to provide lubrication for the moving contact surfaces of said members. Secured upon the upper end of the feeder shaft 114 is a plate 125 to which is bolted a feed table or the like 126.

It is to be noted, with reference to Fig. 20 of the drawings, since the lower end surface of the feeder shaft 114 is of conical configuration, that the feeder shaft 114 engages the shaft 22 of the crusher at an angle and the contact between the ends of the crusher shaft 22 and said feeder shaft is a straight line which lies radially from the apex of the conical end surface 113 of the feeder shaft. Thus the center of the oscillatory motion of the feeder mechanism will be at a point designated a at the intersection of the true vertical axis x of the machine and the angularly displaced axis z of the feeder shaft 114. By reason of the construction and arrangement described, and since the contacting end faces of the shafts

22 and 114 have their centers laterally offset or displaced with respect to the machine axis x as set forth, it will be apparent when the shaft 22 is caused to gyrate about said axis x as indicated by line y , that gyrotory movement of the shaft 22 will impart a gyrotory movement to the feeder shaft 114 whereby the latter is caused to move about the axis x as indicated by line z .

With respect to the center of gyration a of the feeder shaft 114, it will be observed that the distance between the center of the upper end face 112 of the crusher shaft 22 and the feeder shaft gyration center a will govern the extent or degree of gyration of the feeder shaft, and by varying the construction of the feeder shaft 114 to provide a spherical surface portion having its center closer to the upper end face of the crusher shaft 22, the gyrotory motion of the feeder shaft 114 will be magnified or increased, whereas by constructing the feeder shaft so that its center of gyration is spaced at a greater distance from the end face of the crusher shaft 22, the extent of gyration of the feeder shaft 114 may be decreased. Furthermore, it is pointed out that the center of gyration of the feeder shaft 114 may be arranged below the crusher shaft end face 112 in which event the same degree of gyrotory movement of the feeder shaft 114 would take place but in an opposite angular relation with respect to the shaft 22 from that shown in Fig. 17 of the drawings. The feed table 126 is shown in the drawings in the position desirable for feeding relatively coarse material to the crusher and for feeding relatively finely divided materials to the crusher this table may be secured to the plate 125 in the inverted position shown in dotted lines in said Fig. 20.

A modified form of the eccentric bearing construction for the lower end of the crusher shaft 22 is shown in Figs. 21, 22 and 23 of the drawings. As in the case of the eccentric bearing construction previously described herein, this bearing assembly comprises the housing 31, which is rotationally journaled in a bearing 32 mounted in the central hub portion 11 of the lower main frame section 10, arranged to receive therein an eccentric bearing generally designated 130 which receives the lower end of the crusher shaft 22 in the manner previously described.

In accordance with this modified construction of the eccentric bearing assembly, the bearing 130 comprises a fixed generally semi-circular filler section 131 which is secured internally of the housing 31, for example, by rivets 132, and a movable section 133 which embodies novel features of construction and arrangement whereby said section is afforded limited rocking movement about both horizontal and vertical axes in order that it may align itself with the shaft 22 according to slight fluctuations and misalignments thereof.

The section 133 of the bearing 130 is arranged at the load side of the shaft 22 and rocking movement of this section relative to its housing 31 is afforded by a rocker member or insert 134 constructed as shown and described with reference to Figs. 11, 12, 13 and 14 of the drawings, and also by slightly rounded or convex opposite end and bottom faces provided on the rocker section 133 as shown in the developed view of said section illustrated in Fig. 23 of the drawings. These rounded or concave end and bottom faces of the bearing section 133 allow the said section limited rocking movement upon the rocker member 134 so that the bearing is free to align itself with the shaft 22.

It is to be noted, as in the case of the bearing

construction of Fig. 6, that the eccentric bearing 130 is adapted to rotate relative to the shaft 22 and is keyed or secured to the housing 31 for rotation therewith by means of the aforesaid rivets or securing means 132, the housing 31 being rotationally driven in the manner previously described through its associated gear 34 and the gear 35.

While certain embodiments of the present invention have been illustrated and described herein, it is not intended to limit the invention to such disclosures, and changes and modifications may be made therein and thereto within the scope of the following claims.

I claim:

1. In a gyratory crusher, upper and lower frame sections, a concave disposed for coaction with a crushing head, a wall member associated with the upper frame section and having depending lugs at its lower edge engaging through correspondingly positioned slots in the lower frame section, means on said wall member to support said concave in its normal working position, and means threaded on said depending lugs and the upper edge portion of the wall member respectively and arranged to engage vertically spaced portions of said upper and lower frame sections for predetermined positioning the wall member vertically with respect to said frame sections and thereby the position of said concave relative to the crushing head.

2. In a gyratory crusher, upper and lower frame sections, a concave disposed for coaction with a crushing head, a wall member associated with the upper frame section and having depending lugs at its lower edge engaging through correspondingly positioned slots in the lower frame section, an inwardly directed flange internally of said wall member on which said concave is supported in its normal working position, an inwardly projecting lug internally of said wall member engaging a slot in said concave to secure the latter against rotation relative to the wall member and frame sections, and locking means threaded on said depending lugs and the upper edge portion of the wall member respectively and arranged to engage vertically spaced portions of said upper and lower frame sections for predetermined positioning the wall member vertically with respect to said frame sections and thereby the position of said concave relative to the crushing head.

3. In a gyratory crusher, a lower frame section having a central hub portion, an upper frame and spider section secured upon said lower frame section and having a central housing portion, a crusher shaft having its upper end adjustably supported in suspended relation from the housing and its lower end disposed in said lower frame hub portion, means for imparting a gyratory motion to said shaft, a crushing head carried by said shaft, a concave disposed for coaction with the crushing head, a wall member associated with the upper frame section and having depending lugs at its lower edge engaging through correspondingly positioned slots in the lower frame section, means on said wall member on which said concave is adapted to seat in the normal working position thereof, means on said wall member engaging said concave to secure the latter against rotation relative to the wall member and frame sections, and means cooperable with said depending lugs and the upper edge portion of the wall member respectively and arranged to engage vertically spaced portions of said upper and lower frame

sections for predetermined positioning the wall member vertically with respect to said frame sections and thereby the position of said concave relative to the crushing head on said shaft.

4. In a gyratory crusher, a lower frame section having a central hub portion, an upper frame and spider section secured upon said lower frame section and having a central housing portion, a crusher shaft having its upper end adjustably supported in suspended relation from the housing and its lower end disposed in said lower frame hub portion, means for imparting a gyratory motion to said shaft, a crushing head carried by said shaft, a concave disposed for coaction with the crushing head, a backing ring for said concave, a wall member associated with the upper frame section and having depending threaded lugs at its lower edge engaging through correspondingly positioned slots in the lower frame section, an inwardly directed flange internally of said wall member on which said backing ring is adapted to seat in the normal working position of the concave, and means threaded on said depending lugs and on the upper edge portion of the wall member respectively and arranged to engage vertically spaced portions of said upper and lower frame sections for predetermined positioning the wall member vertically with respect to said frame sections and thereby vary the position of said concave relative to the crushing head on said shaft.

5. In a gyratory crusher, a concave disposed for coaction with a crushing head, means supporting said concave in the normal working position thereof, a plurality of springs normally urging the concave into said normal working position and yieldable under predetermined stresses to effect displacement of the concave from the crushing head by the passage of uncrushable material therebetween, a plurality of cylinders each having a limited universal mounting in a fixed part of the crusher, a rod extending coaxially through each cylinder and connected at one end to said concave, a piston secured on said rod and operable in said cylinder, hydraulic fluid in said cylinder opposing movement of the piston therein, and valve means associated with said piston providing relatively free passage of said fluid relative to the piston in the direction of movement corresponding to displacement of said concave and relatively restricted passage of said fluid in the other direction of travel of the piston so that the return of the concave to working position is substantially retarded.

6. In a gyratory crusher, a concave disposed for coaction with a crushing head, means supporting said concave in the normal working position thereof, a plurality of springs normally urging the concave into its normal working position and yieldable under predetermined stresses to effect displacement of the concave from the crushing head by the passage of uncrushable material therebetween, a plurality of cylinders each having a spherical base portion disposed in a spherical seat provided in a fixed part of the crusher, a member retaining the cylinder on said seat while providing limited universal movement of the cylinder relative to its seat, a rod extending through each cylinder and connected at one end to said concave, a piston secured on said rod and operable in said cylinder, hydraulic fluid means in said cylinder opposing movement of the piston therein, and valve means associated with said piston providing relatively free passage of said fluid relative to the piston in the direction of movement corresponding to displacement of the concave and

relatively restricted passage of said fluid in the other direction of travel of the piston so that return of the concave to working position is substantially retarded.

7. In a gyratory crusher, a lower frame section 5 having a central hub portion, an upper frame and spider section secured upon said lower frame section and having a central housing portion, a crusher shaft having its upper end adjustably supported in suspended relation from the housing 10 and its lower end disposed in said lower frame hub portion, means for imparting a gyratory motion to said shaft, a crushing head carried by said shaft, a concave disposed for coaction with the crushing head, means supporting said concave 15 comprising a member on which said concave is adapted to seat in the normal working position thereof, a plurality of springs normally urging the concave into its normal working position and yieldable under predetermined stresses to effect 20 displacement of the concave from the crushing head by the passage of uncrushable material therebetween, a plurality of cylinders each having a limited universal mounting with respect to the upper frame section, a rod extending through 25 each cylinder and connected at one end to said concave, a piston secured on said rod and operable in said cylinder, hydraulic fluid means in said cylinder opposing movement of the piston therein, and valve means associated with said piston providing relatively free passage of said fluid relative to the piston in the direction of movement corresponding to displacement of said concave and relatively restricted passage of said fluid in 30 the other direction of travel of the piston so that return of the concave to working position is substantially retarded.

8. In a gyratory crusher, a lower frame section 35 having a central hub portion, an upper frame and spider section secured upon said lower frame section and having a central housing portion, a crusher shaft having its upper end adjustably supported in suspended relation from the housing 40 and its lower end disposed in said lower frame hub portion, means for imparting a gyratory motion to said shaft, a crushing head carried by said shaft, a concave disposed for coaction with the

crushing head, means supporting said concave comprising a backing ring and a member associated with the upper frame section and on which said ring is adapted to seat in the normal working position of the concave, adjustable means arranged to engage said sections for predeterminedly positioning the member vertically with respect thereto and thereby the position of said concave relative to the crushing head on said shaft, a plurality of springs arranged circumferentially of the concave backing ring and normally urging the same into seating engagement upon the wall member, said springs being yieldable under predetermined stresses to effect displacement of the concave from the crushing head by the passage of uncrushable material therebetween, and substantially universally mounted means operable upon displacement of the concave to retard return thereof to its normal working position.

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