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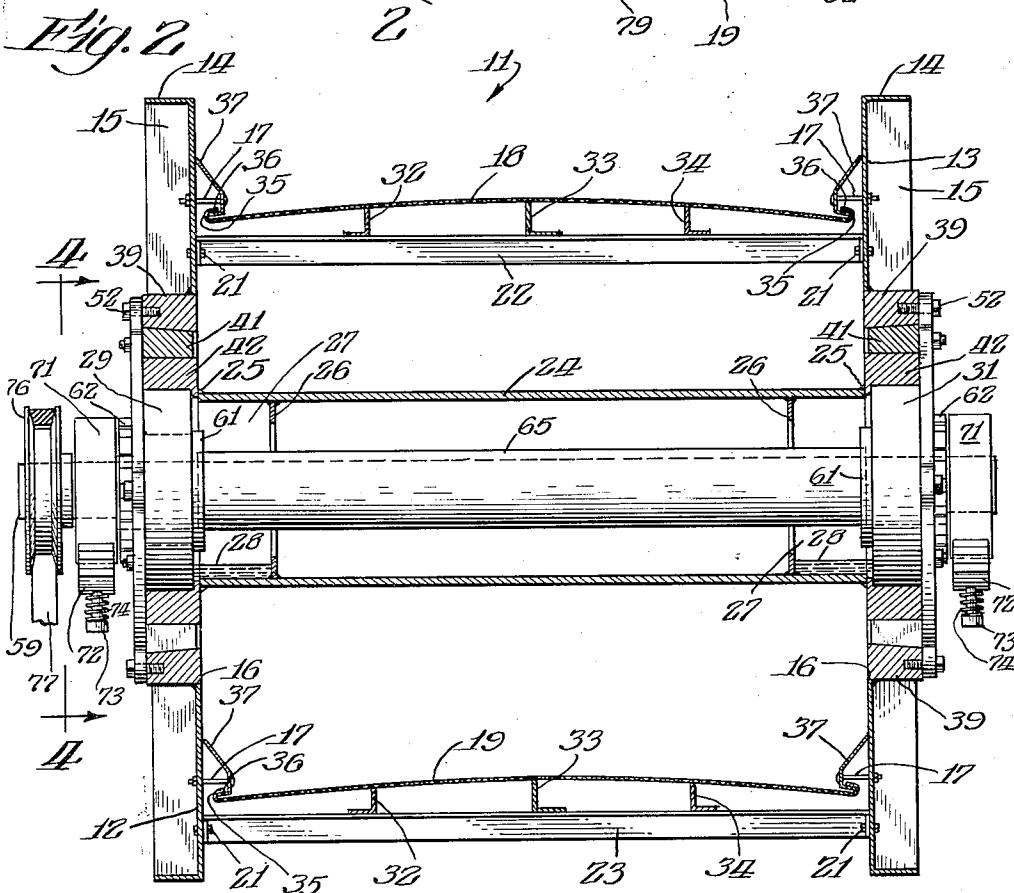
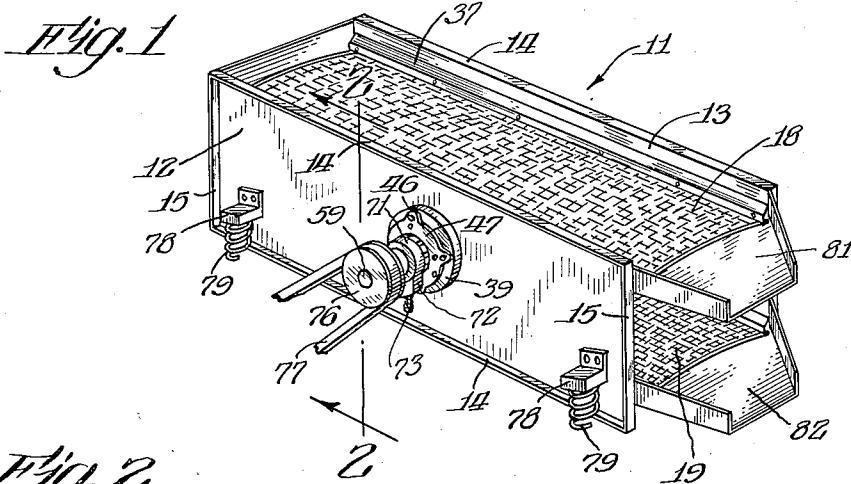
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2,964,186

VIBRATORY SCREEN APPARATUS

Filed March 3, 1958

2 Sheets-Sheet 1



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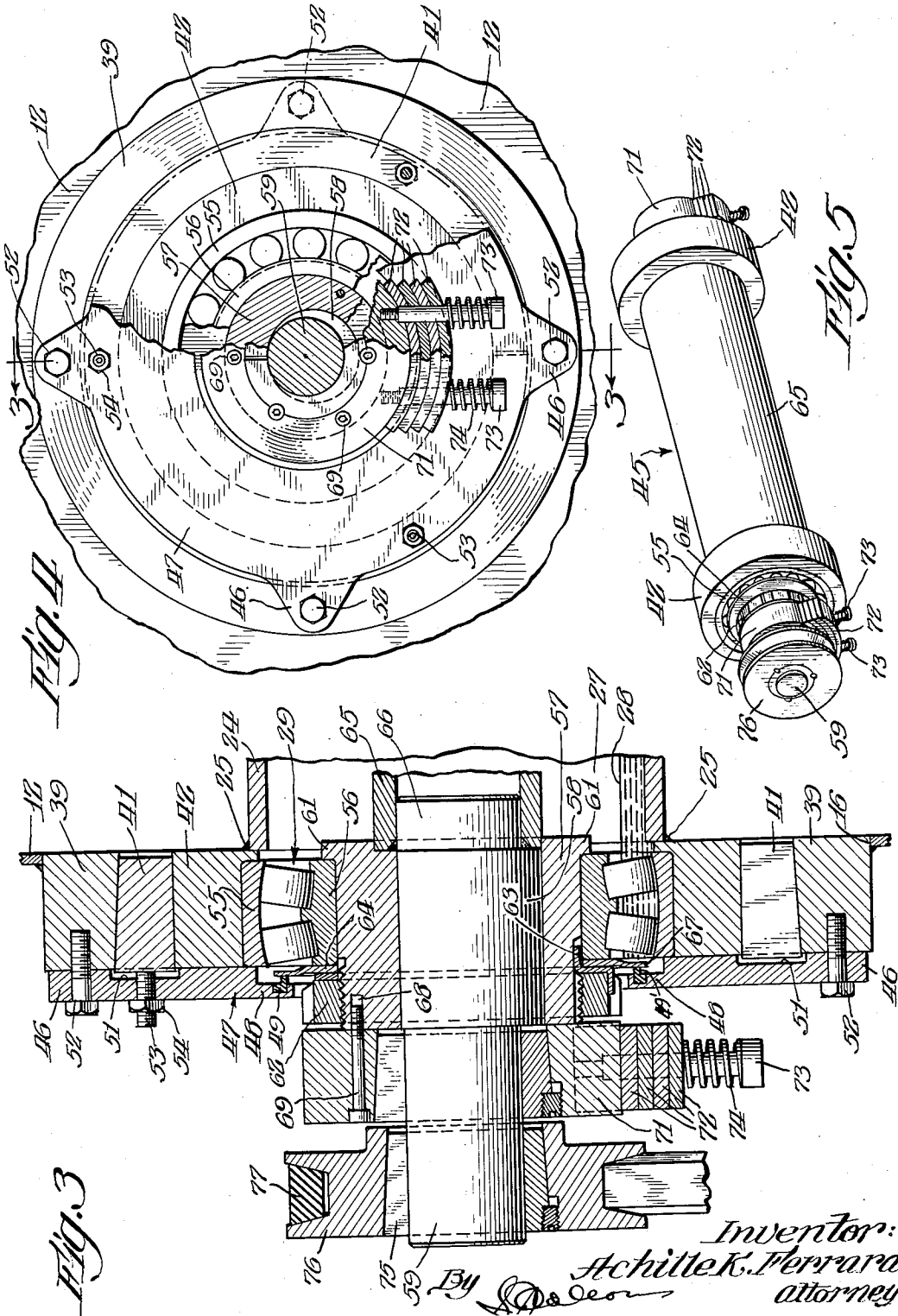
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VIBRATORY SCREEN APPARATUS

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The present invention relates to improvements in vibratory screens, such as are used industrially and commercially to effect segregation of mass materials, and concerns itself more particularly with motion stimulating mechanism for such screens characterized by facile removability and interchangeability in unitary form.

Vibratory screens are predominantly used under environments which are harmful or injurious to their operating mechanism, effecting rapid wear and degeneration of bearings through infiltration of air borne abrasive particles despite the most carefully designed means to seal these members against this hazard. In order to make any standard type of operating mechanism suitable to vibratory screen stimulation for a wide variety of industrial uses it must include the characteristic of adjustability respecting stroke or amplitude, hence, to be economically efficient and commercially competitive a powering mechanism requires to have such adjustability reliable and abundantly gradient. Frequently, such screens are employed as part of a production line and located in limited quarters. Consequently, upon failure, costly time may be lost while making repairs through holdup of production, or even when repairs or replaceability have been made practical respecting the screen body with its operating mechanism, extraction under limited space facilities can involve adjacent machines and their removal.

Accordingly, a primary object of the present invention is to provide a vibratory screen and associated gyrating mechanism thereof which possesses abundant adjustability of stroke amplitude as well as compensatory adjustability of counterweights in close placement to the load sustaining planes, whereby to subject the principal rotary power shaft to but small torque strains.

Another object of the invention is to provide such a screen with an associated powering unit which comprises an easily severable combination, requiring but few and readily available field tools for both removal and reinstallation, and having the equally important characteristics of allowing the powering unit to be removed from either side of the screen body, following disconnection, or permitting such unit to be extracted from between the body side walls if extraction space should be limited on both sides of an installation.

Yet another object of the invention is to provide a vibratory screen apparatus in which the coupling connection between the gyrating mechanism is wholly self centering and independent of rivets, bolts or other shearable means of securement.

A further object of the invention is to provide a powering unit for vibratory screens which is rapidly removable and insertable as a complete unit including within contained bearings and oil reservoir, in respect to its screen supporting body, so that field service and repairing may thereby be obviated and so that upon first signs of mechanical disorder, a replacement unit may be installed reducing total as well as repair time materially and allowing corrective measures to be made by the suppliers without holding up the customers production line.

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The foregoing and other objects and purposes of the present invention will become more intimately described and explained during the course of the following complete description taken in conjunction with the accompanying drawings, in both of which like reference numerals designate corresponding parts throughout, and in which

Fig. 1 is a fragmentary perspective view on a diminutive scale of a typical vibratory screen with rapidly severable powering mechanism for producing gyratory motion, constructed in accordance with the present invention,

Fig. 2 is a transverse sectional view, on an enlarged scale of the same assembly taken approximately on line 2—2 of Fig. 1,

Fig. 3 is a transverse detail sectional view, on a further enlarged scale of one end of the operating unit housing and shaft, and may be identified by line 3—3 on Fig. 4,

Fig. 4 is a fragmentary side elevational view with portions broken away to reveal posterior details of the operating unit, and may be identified by line 4—4 on Fig. 2, and

Fig. 5 is a detail perspective view of the operating unit alone, constructed in accordance with the present invention.

In the accompanying illustrations a vibrating screen body 11 is shown built up of two substantially identical side plates 12 and 13 made by perimetrically upsetting the edge portions 14 and 15 of similar sheets of steel that have had their centers identically aperture as at 16, Figs. 2 and 3. The shop techniques of forming these side plates and cutting of their apertures 16 at the precise centers and in matching relationship are susceptible of being held to very close tolerance by the use of aligning fixtures so that when the body is assembled, side for side balance is achieved with but small endeavor. This facility is correspondingly true respecting the location and execution of other matching attributes, such as the making of the bolt holes through which are to pass the tautness adjusting bolts 17 of the screens 18 and 19 and the rivet holes through which are to pass the securements 21, by which the cross-members 22 and 23 are made fast to the side plates.

These cross-members 22 and 23 are arranged in two rows or more, depending upon whether more than two qualities of segregation are to be performed. They may be made of angle metal weldments but should be of precisely identical length so that the side plates of the body assembly may be assured of parallelism. Transversely of each horizontal row of struts 22 or 23, there may be secured, as by riveting or welding, a series of bridge rails 32, 33 and 34. These elements usually have different heights respecting their vertical components, whereby to afford to the overlying screens 18 or 19, a slight curvature or transverse bow, best seen in Fig. 2. The ends or side edges of the screens are equipped with relatively rigid trim coverings which coverings are doubled over to form the plicatures 35. Within the plicature foldover space there may be received the sidewise extending flanges 36 of beveled flange molding strips 37. The latter serve two purposes, confining the flow of worked material and by adjustment of their bolts 17, to exert a slack take-up upon the screens, when required.

Within each one of the apertures 16 there is secured, as by seam welding, a steel circular ring 39 preferably having an internal conical bore. When provided with such conical bore, its larger diameter should be toward the outside of the assembly, see Figs. 2 and 3, so that when entered by the metal split anchor ring 41, there may be effected a clamping and circumferentially true constriction upon its related flange ring 42. While the anchor rings 41 have been shown as being made of metal, they may of course comprise any other suitable material which is non-compressible and transmits vibratory waves without damping the same. In order to assure the accurate placement of the two side plate rings 39, it is suggested that an

alignment fixture be used for supporting the said rings 39 while they are welded to the side plates, and in this way there may be assured with least probability of error, that the total assembly, including the side plates 12 and 13, together with their attached components 22, 23, and others, will be balanced and in true perpendicularity to the gyration axis.

Flange rings 42 are integrated, as by seam welding 25 to the opposite ends of a tubular shroud 24. During this construction, it is recommended that a suitable alignment fixture be utilized for holding the rings accurately in axial conformity as well as in parallelism with each other. Within the shroud tube 24, there may first be secured, by weldment, a pair of barrier rings 26, each nearest its related end of the shroud tube, as seen in Fig. 2. Such barrier rings will serve to confine reservoir quantities of lubricating oil within the spaces 27, the oil 28 being available to the bearing assemblies 29 and 31 which undergo rotation during the gyration of the body unit.

It is to be observed that before introduction of the anchor rings 41 between the body attached steel rings 39 and the stimulating mechanism attached flange rings 42, there is sufficient clearance thereat to permit the stimulating unit 45 together with its flange rings 42 to be inserted or withdrawn freely from either side of the assembled body, or even to enable the unit 45 to be lifted out diagonally one end first from between the body side plates 12 and 13. Through this versatility there is afforded an important advantage over previously known devices favoring limited space conditions such as exist where assembly lines are planned in close proximity to a wall or to other plant installations. Equally important, is the notable facility with which the placement and removal of the anchor rings 41 may be executed, as will now be explained.

To the outer face of each steel body ring 39, there is bolted, Fig. 4, a circular alignment of equally spaced ear portions 46 of a disc ring 47, of radial width sufficient to include an internal skirt flange 48, Fig. 3, whose interior face is provided with an annular groove 49 for seating therewithin an oil seal ring of elastic wear resistant characteristics. In addition, the disc rings 47 are provided with a secondary circular alignment of bolt holes (three in the instant illustration) through which may pass as many adjustable pressure exerting bolts, each threadably engaging the disc ring 47 and having their ends designed to impinge against the outer surface of their related anchor rings 41. The inner surfaces of the disc rings 47 are undercut as at 51 in order to allow thereat sufficient room for the projection of the anchor rings 41 before they are pressed into ultimate wedge-tight condition. In practice, the disc rings 47 will be applied in position after the anchor rings 41 have been loosely inserted and the ear bolts 52 then tightened up. This will draw the anchor rings inward, if they protrude that far, and thereafter the adjustable bolts 53 will be turned until a full wedge-stop condition is achieved. Finally, the locknuts 54 will be turned down until frozen and the wedge tight adjustment may thereby be made stable.

The inner surface of the two flange rings 42 of the motion stimulating unit 45 should be nicely lapped to receive by push-fit the outer race 55 of its bearing assembly 29, so that the effect of the wedge ring 41 may also serve to tighten the hold of flange ring 42 thereover. The inner race 56, Fig. 3, of each bearing assembly 29 may be drive fitted over the outer surface of an eccentric bushing 57, see also Fig. 4, whose inner bore is adapted to have wiper fitting reception for an eccentric swell 58 formed in a stud shaft 59. As illustrated in Figs. 3 and 4, the apices of eccentricity respecting bushing 57 and swell 58 oppose each other, achieving thereby the condition of minimum, and in most frequently used instances zero total effect. When, however, bushing 57 is rotated to any other position with respect to swell 58, up to maximum total eccentricity where both apices coincide angularly, a con-

dition is achieved whereat the center of stud shaft 59 differs from the resulting center of flange ring 42 and consequently upon rotation of shaft 59 a gyration thereof will be produced.

At the outset of rotation, the gyration will be on the part of shaft 59 and its carried parts about the true center of flange ring 42, but when a speed is reached corresponding to the resonance frequency of the body assembly, the gyration will become transferred to the latter, while the shafts 59 and their parts will then take on simple rotation. Bushings 57 are each provided with a limit collar 61 for seating the bearing inner races 56 and opposite thereto a threaded sleeve portion for receiving a spanner type nut 62, behind a lock washer 63 and seal disc 64. A tubular shaft extension 65 is adapted to connect together the facing stubs 66 of both shafts 59, integrating them into a single operative unit. It is to be noted that sealing disc 64 includes an offset section, Fig. 3, designated 67, having sufficient width to be engaged by the sidewardly extending annular rib of the oil seal ring 49' regardless of the degree of total eccentricity contemplated by adjustment.

Any adjusted quantity of eccentricity affecting bushing 57 and shaft swells 58 may be securably maintained by providing in the frontal faces of bushing 57 a series of threaded holes 68 into which may be threadably engaged the end of a securing bolt 69 that passes through a hole in a concentric counterweight 71. The latter is a wedge ring secured member to shaft 59 and is provided with a plurality of weight laminations 72 on its side opposite the one where resultant apex of eccentricity occurs however the bushing 57 is adjusted angularly in respect to its swell 58. The number and mass of the several weight laminations 72 may be adjusted to suit the mass of the body unit which it opposes, and such weights may be strung upon two or more off-radial bolts 73, shouldered to carry measured-compression springs 74. In this way the mass center of the counterweight laminations will move radially outward as the speed of rotation increases so that the afore described gyration transcience from the driven shafts 59 to the body occurs earlier during the speed acceleration.

At the end of one of the shafts 59 there is secured, preferably by means of concentricity assuring wedge rings 75, a V-belt pulley wheel 76, around which there is adapted to thread one end loop of an endless belt 77, driven by a suitable motor (not shown). As the motor comes up to speed, the gyration transcience takes place and ultimately the screen body begins to describe the gyration cycle carried out throughout all of its parts. This motion is permitted to take place freely by having the body resiliently supported, either from suspension or by means of rest pads 78, nested upon coils 79, Fig. 1.

Material to be segregated is dropped flowingly at the upstroke side of the body top screen 18 and at once begins to travel toward the downstroke end of the screen, meanwhile undergoing a continual bouncing of its load to augment the separation of its particles that are small enough to pass through the top screen mesh onto the next lower screen 19. When the two streams of material reach the discharge end of the screens, both are directed over funnel chutes 81 and 82 to be deposited onto conveyors or other receptacles.

While the present invention has been explained and described in contemplation of certain embodiments, it is not intended that such as illustrated in the accompanying drawings or as particularized in the foregoing description shall limit the spirit or scope thereof, but instead that a latitude of equivalent attainment shall be construed within the meaning of the annexed claims.

The invention for which Letters Patent hereon is requested is defined by the following claims.

I claim:

1. In a vibratory screen apparatus including a body to be vibrated having a pair of spaced apart side plates, a

plurality of strut elements secured at their ends to said side plates, and a screen element supported in longitudinal horizontal position between said side plates; a unitary body gyrating mechanism comprising, a tubular housing of length to correspond with the space between said body side plates, a pair of relatively small diameter flange rings each integral with a related end of said tubular housing, a pair of relatively large diameter flange rings each integral with one of said body side plates, and means for anchoring each of said small diameter flange rings concentrically within a related one of said large diameter flange rings to thereby secure said gyrating mechanism to said body, which comprises a split annulus conically tapered non-compressible ring dimensioned to enter snugly the space between said large and small diameter rings from one side, and a disc ring removably attached to each of said large diameter flange rings having adjustable bolts for exerting pressure to wedge said split annulus taper rings into its said space.

2. In a vibratory screen apparatus including a body for mounting a plurality of screen decks having a pair of side plates formed with registering apertures; a vibratory shaft assembly comprising an outermost clamp ring welded in each of said apertures, a tubular housing, an innermost clamp ring welded to each end of said tubular housing in planar registration with said outermost clamp rings, a disc ring removably secured to each of said outermost clamp rings having a plurality of circumferentially spaced adjustment bolts, and a non-compressible wedge ring conically convergent and insertable into the space between each planar registration of said outermost and innermost clamp rings, said adjustment bolts being adapted to force said wedge ring into tight fitting conditions between said registering clamp rings.

3. The vibratory shaft assembly set forth in claim 2 which includes journal bearing assemblies which comprise inner and outer race rings of which said outer race rings are receivable in push-fit relationship within interiorly finished cylindrical recesses of said innermost clamp rings whereby constriction thereof effected by the action of said wedge rings, serves to clamp retentively said bearing assembly outer race rings.

4. The vibratory shaft assembly set forth in claim 2 in which said disc rings each includes a skirt flange provided with an inwardly facing annular groove, a sealing ring of pliable material having a portion seating in said annular groove and a portion projecting perpendicularly therefrom, in combination with a seal disc carried adjacent each of said innermost clamp rings to be continuously engaged by said perpendicular projecting portion of said sealing ring for the purpose of retaining reserves of lubricating oil interiorly of said shaft assembly.

5. In a vibratory screen apparatus including a body for supporting screen decks and having a pair of side plates

having therethrough aligned openings, a gyrating mechanism comprising, flange rings welded to said plates at said openings, a removable tubular housing having endmost flange rings small enough in diameter to pass freely through the side plate's openings and their welded flange rings, means for adjustably wedging said gyrating mechanism flange rings within said body side plate flange rings, eccentric bushings journaled to rotate within said mechanism flange rings, stud shafts having eccentric swells adapted to be adjustably secured within said bushings to effect resultant degrees of eccentric variance to generate correspondingly different amplitudes of gyration, and counterweight rings secureable to said stud shafts in abutting relation to their said bushings for thereby limiting to a minimum the longitudinal torsional effects impressed during gyration upon said stud shafts.

6. The gyrating mechanism set forth in claim 5 including disc rings having internal skirt flange portions and bolted to said flange rings and in which said bushings comprise elements having stop shoulders at one end for axially locating journal bearing assembly inner race elements thereat, and briefly extending threaded portions at their opposite ends, nut elements and seal discs, clamped between said nut elements and said inner race elements and having seal portions engaging said internal skirt flange portions for thereby providing an integral sealing surface for retaining reserves of lubricating oil.

7. The gyrating mechanism set forth in claim 5 in which said counterweight rings are provided with a circumferential series of securing bolt holes, and said bushings provided with registering threaded holes on their end faces, whereby securing bolts may be therethrough applied under different axial dispositions respecting said counterweight rings and said bushings so that the weight preponderance of said rings may be adjusted to diametrically oppose the resultant eccentricity for different adjustments of said bushing and stud shaft swells relative to one another.

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