June 5, 1956 W. J. RILEY 2,748,608

MECHANISM FOR THE OPERATION OF FREELY MOVABLE VIBRATING SCREENS

Filed July 15, 1954 2 Sheets-Sheet 1

Fig. 1.

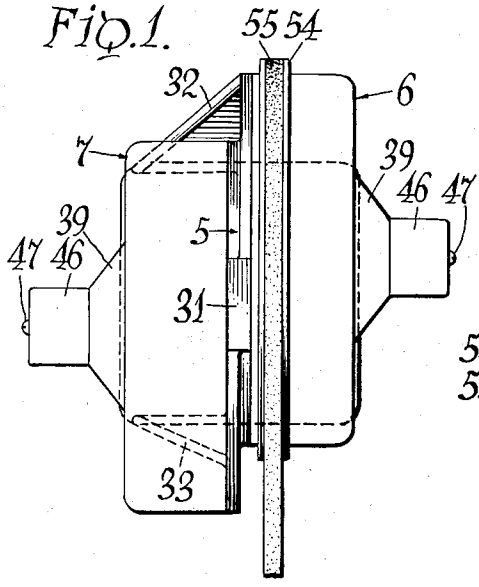


Fig. 2.

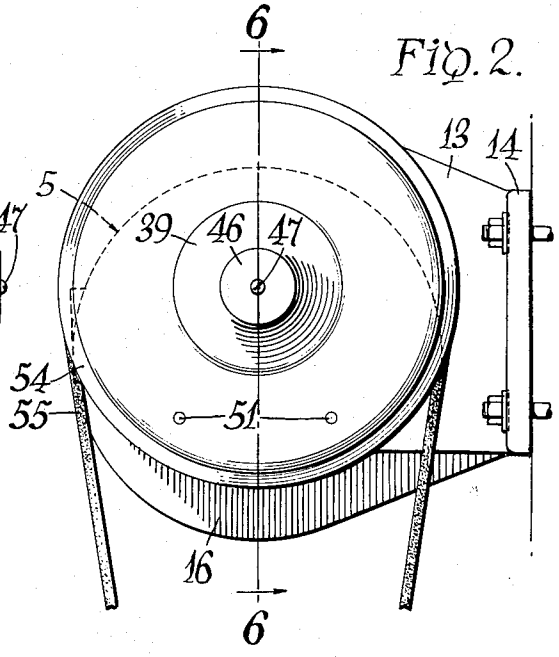


Fig. 3.

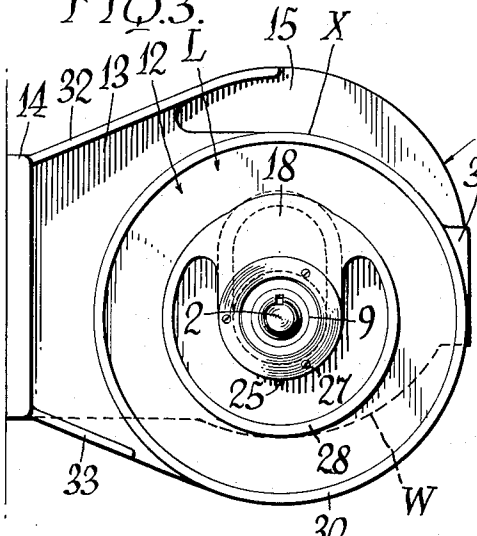


Fig. 4.

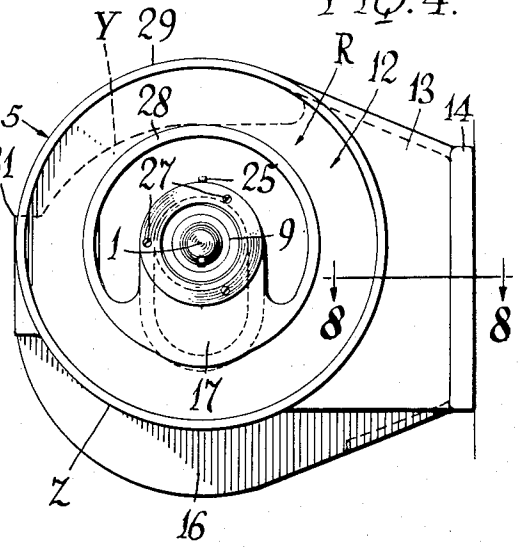
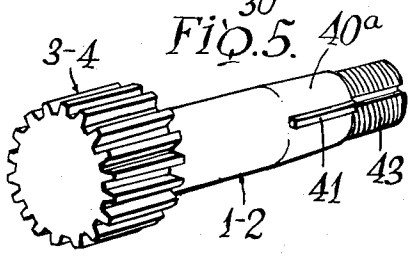


Fig. 5.



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Fig. 6.

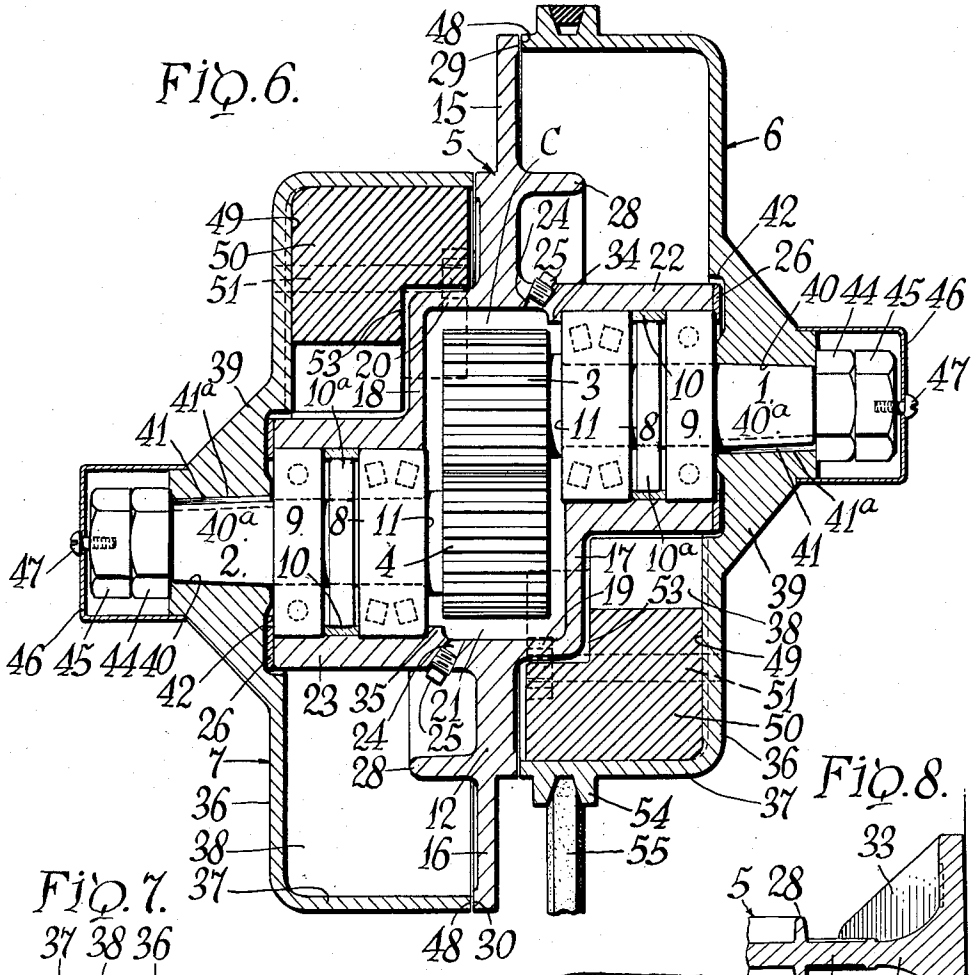
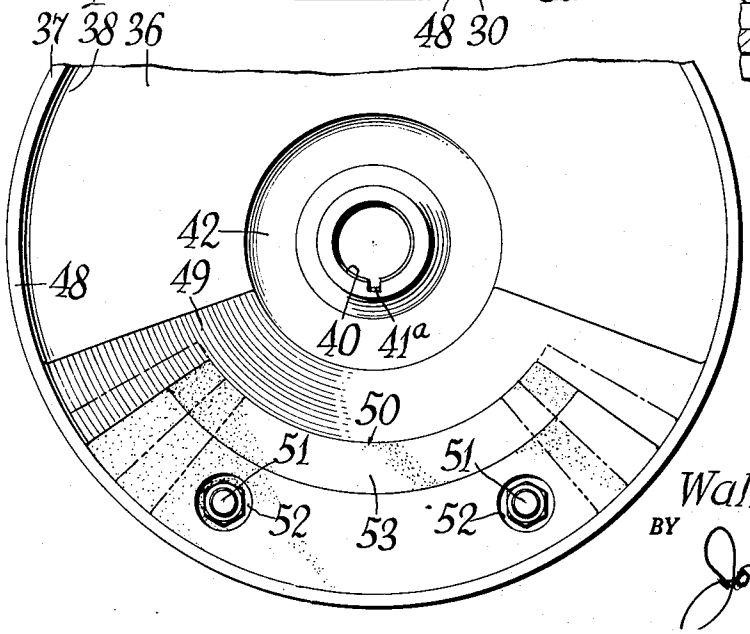


Fig. 8.

Fig. 7.



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United States Patent Office

2,748,608

Patented June 5, 1956

2,748,608

MECHANISM FOR THE OPERATION OF FREELY MOVABLE VIBRATING SCREENS

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Application July 15, 1954, Serial No. 443,514

7 Claims. (Cl. 74—61)

This invention relates to mechanism for the operation of freely movable vibrating screens. Such mechanism involves two oppositely rotatable individually unbalanced weighted elements which are cooperative to effect the vibratory motion of the screens, the weights of the two elements being balanced relatively to one another. The mechanism is attached to a wall of the vibrating screen in a relation in which the general plane of the centrifugal force is in the direction of vibration of the screen (as shown, for example, in the Coon patent, No. 2,510,741 of June 6, 1950). In such mechanism one of the elements is positively driven and drives the other, the relationship being such that when the weights are coincident in either "north" or "south" relation a corresponding reciprocatory movement of the screen will be effected. Generally speaking such mechanisms may be said to be operative upon the rotary kinetic imbalance principle.

Mechanism of the character described has been used for a generation or more, with certain specific advantages, for the operation of vibratory screens in particular fields of work, principally the processing of various cereal grains. In mechanism of this character the unbalanced weighted elements are individually concentrically mounted upon a rotatable shaft and the two shafts are parallel and in mutually offset relation; the weight carrying elements are operatively connected to cooperating gear wheels; and the shafts and gears are maintained in proper relative positions by a fixed casing feature. These characteristics are shown, for example, in the Roth Patent No. 1,517,587 of December 2, 1924 which also sets forth the ideals of having the weights of the gyrating elements operating in closely related parallel planes with the centrifugal forces of the weights acting within the transverse limits of the effective bearing surfaces.

In such mechanism as heretofore used the shafts have been mounted in separate supporting elements of cast iron which have been attached to a cast iron base in turn attached to a wall of the screen. Over a period of time the cast iron of the base and the supporting elements becomes warped with the results that the shafts and gears are relatively canted or cocked, a certain degree of binding action perforce develops in the bearings and the gears, and the mechanism fails to operate with desirable efficiency for its intended purposes (the speed of rotation of the unbalanced elements being of the order of five or six hundred R. P. M.).

In some of the prior constructions the unbalanced weighted elements are spaced from one another in sensible degree and the intervening space is not occluded. Two serious objections result. One is physical danger, that is to say the clothes or the fingers of workmen who happen to be close to the mechanism may be caught between the rapidly rotating weighted elements. The other is that there is no protection against the free access of dust into the weighted elements and dust, accumulating over a period of time, will work into the bearings with resultant impairment of the efficiency of operation. In other prior constructions the unbalanced weighted elements have been occluded, thereby eliminating the objections pointed out. However in such cases the structures have been unduly heavy and cumbersome and have entailed undue expense in the assembly of the parts.

It is desirable that the gears and bearings run in oil. In the prior constructions no satisfactory provision has been made for an effectively sealed oil chamber for the gears. In the absence of an effective seal the oil, under the centrifugal forces developed, will escape from the gear chamber. This entails not only a waste of the oil but also the liability of the escaping oil being thrown into the screen and contaminating the grains which are being processed.

The objects of the invention are: (1) to provide a mechanism in which the warping of the cast iron parts will not effect the alinement of the shafts or the gears, that is to say a mechanism which will always operate at 100% efficiency; (2) to provide a mechanism in which the weight carrying elements are occluded, thereby to eliminate the physical hazard of certain prior constructions and substantially to prevent the free access of dust into the weight carrying elements; (3) to provide a mechanism of extremely compact nature which has a minimum number of parts that may be assembled at a minimum of expense; (4) to provide a mechanism as above characterized which provides an oil chamber for the gears and is so constructed as to provide an effective seal against the escape of oil; and (5) to provide a mechanism as above characterized in which the parts are structurally independent in the sense that any part may, as occasion may require, be quickly replaced by a duplicate part.

The invention consists of elements of novel construction which are combined and related in a novel manner. According to the invention the shafts and the gears are carried by a single integral intermediate element which is integral with a single supporting stand or pedestal having integral with it an attachment base in the form of a plate to be bolted to the wall of the screen. The gears, their shafts and bearings are initially assembled in operative relation to one another and to the intermediate element. The weight carrying elements may be said to be bowl shaped and, following the initial assembly, are simply fitted in position upon the parts of the shafts which project beyond the bearings, the relation between the assembled weight carrying elements and the intermediate element being such that the interiors of the weight carrying elements are occluded for the purposes above stated. The above and other features of construction and relation which characterize the invention will be set forth in detail as the description proceeds.

In the accompanying drawings:

Figure 1 is a front elevation of the mechanism which constitutes the invention.

Figure 2 is a side elevation thereof, the side shown being that at the right of Figure 1.

Figure 3 is a side elevation of the intermediate element as viewed from the left, Figure 1 being considered.

Figure 4 is a side elevation of the intermediate element as viewed from the right, Figure 1 being considered.

Figure 5 is a perspective view of one of the gears and the shaft by which it is carried.

Figure 6 is a central vertical transverse section on the line 6—6 of Figure 2 looking in the direction of the arrows.

Figure 7 is a partial elevation of one of the weight carrying elements, looking at its inner face, the other weight carrying element being similar in construction.

Figure 8 is a detail horizontal sectional view on the line 8—8 of Figure 4 looking in the direction of the arrows.

The relationship of the gears and the shafts by which they are carried conforms to standard practice as exemplified by the mechanism shown in the Roth Patent No. 1,517,587 of December 2, 1924. The shafts are designated as **1** and **2** respectively. At its inner end the shaft **1** carries a spur gear **3** and the shaft **2** similarly carries a spur gear **4**, the two gears being in meshing relation. The shafts **1** and **2** have their major axes in parallel relation and are relatively positioned in laterally offset relation, the shaft **1** extending to the right (Figure 6 being considered) from the spur gear **3** and the shaft **2** extending to the left from the spur gear **4**.

The shafts **1** and **2**, the spur gears **3** and **4** and the bearings for the shafts are carried by a supporting element designated generally as **5** and arranged between the opposed weight carrying elements **6** and **7** which are mounted, respectively, upon the shafts **1** and **2**. The shafts **1** and **2** are each journalled in bearings **8** and **9**. By preference, and in accordance with standard industrial practice, the bearings **8** which are located adjacent the gears are roller bearings of standard construction and the bearings **9** are ball bearings, the bearings of each pair being held in proper relation to one another by a spacing ring **10**. The bearings **8**, as roller bearings, serve to resist end thrusts of the shafts **1** and **2** and in this capacity adjoin annular shoulders **11** formed on the shafts and located adjacent the spur gears. The bearings **9** are of the well known type in which is encased a supply of grease in which the balls operate, bearings of this type being constructed to seal the grease against escape. The space between the bearings **8** and **9** which is maintained by the ring **10** encloses an oil sealing element **10***a* of well known and conventional form which has a press fit within the ring **10** and prevents the escape of oil beyond the bearings **8** along the associated shafts **1** or **2**.

The supporting element **5** is a casting having a body portion **12** of plate-like form. The body portion **12** is integral with a coplanar pedestal **13** having an integrally connected and terminally related supporting base **14** in the form of a plate, the major plane of which is normal to the major plane of the body portion **12**. The body portion **12** and the pedestal **13** are of uniform thickness and conjointly constitute a single part, the outline of which is shown in Figures 3 and 4, Figure 3 showing the left face L of the element **5** (Figure 1 being considered) and Figure 4 showing the right face R of the element **5**. The outline of this single part is shown in Figures 3 and 4, viewed in combined relation, by the broken lines W and Y of Figures 3 and 4 respectively and by the solid lines X and Z of the same figures. In Figure 3 the curved broken line W meets the similarly and reversely curved opposing solid line X, these two lines delimiting the body portion **12** at one side of the element **5**. In Figure 4 the curved broken line Y (opposed in position to the broken line W) in like manner meets the similarly and reversely curved opposing solid line Z, these two lines delimiting the body portion **12** at the opposite side of the element **5**.

The supporting element also includes oppositely located flanges **15** and **16** integral with the body portion **12** and having their faces in planes parallel to the central plane of the body portion **12**, the flanges preferably being of reduced thickness and offset relatively to one another.

The body portion **12** is formed to provide a casing C which encloses the gears **3** and **4** and supports the bearings **8** and **9**. The casing includes spaced vertical walls **17** and **18** in parallel planes which are also parallel to the central plane of the body portion **12**. The walls **17** and **18** are located at opposite sides of the body portion **12** to which they are connected by transverse walls **19** and **20**. The casing thus constituted delimits a chamber **21** in which the gears **3** and **4** are arranged. As shown in Figure 6 the wall **17** is located at the right of the body portion **12** and the wall **18** is located at the left. The wall **17** is formed adjacent its upper end with

a laterally projecting open ended cylindrical extension **22** and the wall **18** is formed adjacent its lower end with a similar extension **23**, the extensions **22** and **23** being in mutually offset relation and concentric to the respective shafts **1** and **2**. The extensions **22** and **23** accommodate and support the bearings **8** and **9**, the bearings **9** having their outer lateral faces substantially coplanar with the outer edge faces of the extensions. The chamber **21** preferably contains a suitable volume of lubricating oil in which the gears **3** and **4** and the bearings **8** operate, the oil being admitted to or drained from the chamber **21** through passages **24** in the transverse walls **19** and **20**, these passages being normally closed by removable plugs **25**. In order to secure the bearing assemblies **8**, **9**, **10** and **10***a* upon the shafts **1** and **2** in proper relation to the shoulders **11** rings **26** which overlie the outer sides of the outer race of the ball bearings **9** are carried by the extensions **22** and **23**, being secured to the annular end faces of these extensions by screws **27** (Figures 3 and 4). The body portion **5** at each side thereof is provided with circularly curved reinforcing flanges **28** which are in spaced concentric relation to the extensions **22** and **23** and are integrally connected to the transverse walls **19** and **20** and also, as shown in Figures 3 and 4, to the vertical walls **17** and **18**.

The supporting element **5** is formed at its right side R with an annular flange **29** which projects laterally to a slight extent, is spaced from the flange **28** at the same side, and is concentric to the extension **22**. The supporting element **5** is formed at its left side L with an annular flange **30** which projects laterally to a slight extent, is spaced from the flange **28** at the same side and is concentric to the extension **23**, the flange **30** being of the same diameter as the flange **29**. The flange **29** extends along the body portion **12** and also along the margin of the flange **15**. The flange **30** in like manner extends along the body portion **12** and also along the margin of the flange **16**. The flanges **29** and **30** are mutually offset in planes parallel to one another and to the plane of the body portion **12**. The broken line W shown in Figure 3 represents the curvature of the flange **29** shown in Figure 4 and the broken line Y shown in Figure 4 represents the curvature of the flange **30** shown in Figure 3. At their outer sides the flanges **29** and **30** are formed with enlarged portions **31** as shown in Figures 3 and 4, the enlargements **31** being also integrally connected to the respective flanges **15** and **16** and serving as gussets for reinforcing the flanges. At its side L (Figure 3) the supporting element **5** is formed with upper and lower reinforcing gussets **32** and **33** which extend from points along the margins of the flanges **15** and **16** and along the margins of the pedestal **13** to the base **14**.

It will be noted that the single intermediate element **5** constitutes the sole support for the shafts **1** and **2**, their bearings **8** and **9**, and the gears **3** and **4**, these parts being assembled relatively to the element **5** prior to the assembly of the weight carrying elements **6** and **7**. The shaft **1** with its bearings **8** and **9** fitted upon it and the spacing ring **10** and oil sealing element **10***a* arranged between the bearings is inserted through the extension **22**, the gear **3** thereby being positioned in the chamber **21**. The shaft **1** is moved inwardly until its movement is arrested by the engagement of an inwardly projecting lug **34** provided at the inner end and upper side of the extension **22** with the inner lateral face of the bearing **8**. The extension **23** is provided at its inner end and its lower side with an inwardly projecting lug **35** similar in all respects to the lug **34**. The shaft **2**, with its bearings **8** and **9**, is similarly inserted through the extension **23**, the gear **4** thereby being positioned in the chamber **1** in mesh with the gear **3**. The lug **35** directly engages the inner lateral face of the bearing **8** on the shaft **2**, thereby to limit the inward movement of the shaft **2**. It is to be noted that the assembly of the shafts **1** and **2**, their bearings **8** and **9** and the gears **3** and **4** relatively to

the element 5 may be effected in a minute or so of time and that it is immaterial whether the shaft 1 or the shaft 2 be assembled in the first instance. It will also be noted that the described assembly of the shafts 1 and 2, their bearings and the gear wheels relatively to the element 5 does not require the use of any fastening devices other than the rings 26.

When the shafts 1 and 2 and their associated parts have been assembled relatively to the element 5 portions of each shaft will project outwardly beyond the corresponding bearing 9. The weight carrying elements 6 and 7 are mounted upon the outwardly projecting portions of the respective shafts 1 and 2. The weight carrying elements are similar in construction and in diametrical and lateral dimensions. Each weight carrying element includes a disc shaped vertical base wall 36 and an annular wall 37 projecting inwardly from the periphery of the base wall. The base wall 36 and the annular wall 37 provide an element which may be conveniently characterized as bowl shaped, the wall 37 delimiting an internal space 38. The wall 36 is formed with a central hub 39 of increased thickness and which has a tapering central opening 40 to fit over the projecting portion 40*a* of the corresponding shaft. The projecting part of each shaft is provided with a longitudinal key 41 and the opening 40 is provided with a longitudinal keyway 41*a* in which the key 41 fits. The keyway 41*a* is preferably located in an extension of the central transverse plane of the casing C, i. e., the plane 6—6 of Figure 2. Such location of the keyway insures the accurate positioning of the weight carrying elements upon the respective shafts 1 and 2.

Each hub 39 has on its inner face an annular recess 42 to accommodate the securing rings 26. In assembling the weight carrying elements the hubs 39 are fitted upon the projecting portions of the shafts 1 and 2 and the weight carrying elements are moved inward. The shafts 1 and 2 have threaded terminal extensions 43 (Figure 5) which project axially from portions 40*a*, these having a slight taper which conforms to the taper of the openings 40 in which they fit. The inward movement of the weight carrying elements is limited by the taper of the shaft portions 40*a*, that is to say by the bottoming of these shaft portions in the tapering openings 40. When the inward movement of each weight carrying element has been completed the inner face of its hub 39 will be very slightly spaced from the adjacent securing ring 26 and from the outer side of the inner race of the bearing 9. When the weight carrying elements have been moved inwardly upon the projecting portions of the shafts 1 and 2 to the extent permitted nuts 44 and 45 are applied to the shaft extensions 43 and tightened, the inner nuts 44 being brought into engagement with the outer end faces of the hubs 39 and the outer nuts 45 serving as lock nuts. Such tightening of the nuts 44 and 45 will result in the driving fit of the tapering portions 40*a* in the openings 40. Dust caps 46 are preferably fitted over the nuts 44 and 45 and secured in each instance by a screw 47 tapped into the outer end of the corresponding shaft. The marginal portion of the annular walls of each dust cap have a somewhat close fit upon an annular face provided on the corresponding hub 39.

The flanges 29 and 30 are of the same diameter as the walls 37 of the weight carrying elements 6 and 7 and correspond in relative location to the relative location of the walls 37 of the two weight carrying elements. Therefore the vertical faces of the flanges 29 and 30 confront the vertical edge faces 48 of the walls 37. The confronting vertical faces of the flanges 29 and 30 and of the walls 37 are machined and just sufficiently spaced to avoid contact between them, the spacing being quite minute, that is to say of the order of one thousandth of an inch. Thereby the internal spaces 38 delimited by the walls 36 and 37 are in effect completely occluded, that is to say occluded to an extent such that the liability of the passage of particles of dust through the space between the confronting machined faces is negligible. It will be noted that the body 12 and flange 15 provide a complete closure for the internal space 38 of the element 6 and that the body 12 and flange 16 provide a complete closure for the internal space 38 of the element 7. The construction in any event is such that any dust particles which perchance may enter the spaces 38 cannot have access to the bearings.

The base walls 36 of the weight carrying elements preferably have thickened portions which extend through approximately 120°. On the inner faces of the base walls 36 the thickened portions provide raised pads 49, the faces of which are machined. The weight bodies 50 may be composed of lead and are attached by bolts 51 to the base walls 36, these bolts being located symmetrically with respect to the keyway 41*a*. The weight bodies are mounted upon the pads 49 and have countersunk openings 52 (Figure 7) to accommodate the heads of the bolts 51. The bodies 50 of the elements 6 and 7 are of course of equal weight and of the same dimensions. As secured by the bolts 51 the weight bodies bear uniformly upon the pads 49 and also upon the inner faces of the walls 37 and are positioned with their centers of mass in planes which pass between the transverse limits of the bearings for the associated shaft (using the word "transverse" with reference to the positions of the parts shown in Figure 6 which is a central vertical transverse section). The construction achieves maximum compactness while at the same time enabling the bodies 50 to be of the maximum degree of weight which may be required by a particular screen. The bodies 50 are therefore preferably of the cross sectional outline shown in Figure 6, this outline involving an annular recess 53 whereby parts of the bodies 50 will be located behind the walls 17 and 18 and other parts will overhang the flanges 28 and the curved end walls of the gear casing. Bodies 50 of varying degrees of weight may be interchangeably used. This capacity is sufficiently indicated in Figure 7 wherein the radially extending broken lines are indicative both of bodies of less weight than the body shown in full lines and of bodies of greater weight. In order that the weight bodies may be ideally mutually balanced and the maximum benefits of the specific weights realized each weight body in the initial assembly of the driving mechanism is in a position in which it will be bisected by extensions of the central transverse plane of the gear casing C. It will of course be understood that for a given speed of rotation the amplitude of vibratory throw will be increased with heavier weights and decreased with lighter weights. The machining of the faces of the pads 49 insures accuracy in the symmetrical positioning of the weights, that is to say in the positioning of the weights in accurately balanced relation to one another.

It will be noted from the foregoing description that a minimum number of machining operations will be required. These operations are limited to the inner circumferential faces of the extensions 22 and 23, the edge faces 48 of the walls 37, the vertical faces of the flanges 29 and 30, the faces of the pads 49, and the vertical end faces of the hubs 39.

Whenever for any reason, such, for example, as the substitution of weight bodies, it may be desired to remove the weight carrying elements, all that is required is to disconnect the nuts 44 and 45 from the shafts and thereupon pull the weight carrying elements 6 and 7 away from the shafts. This may be done in a few minutes and at such time complete access is readily had to all parts.

One of the weight carrying elements is positively driven and serves to drive the other. In the construction shown the element 6 is positively driven and for this purpose carries a circumscribing sheave 54 for cooperation with a drive belt 55 which is trained over a sheave (not shown) on the shaft of an electric motor. The gear 3 rotates with the element 6 and by its engagement with the gear 4

effects the rotation of the element **7** in a direction opposite to the direction of rotation of the element **6**, the unbalanced weights of the two elements cooperating in the usual manner to effect the vibration of the screen.

It will be noted that the weights are located in concentric relation to the extensions **22** and **23** and within the transverse limits of the bearings. The weights are operative in closely related parallel planes, their transverse mutual spacing being limited only by the transverse dimensions of the body **12** as combined with the flanges **29** and **30**. Because of these facts the drive does not develop any unbalanced forces which adversely affect the bearings.

I claim:

1. A mechanism operative upon the rotary kinetic imbalance principle for effecting the operation of freely movable vibrating screens which comprises, in combination: a single integral supporting element having a body portion of plate-like form, a single pedestal co-planar with, projecting from and integral with the body portion, the pedestal having an attachment base, a gear casing integral with the body portion and having walls located at opposite sides of the body portion in parallel planes which are also parallel to the plane of the body portion and transverse walls connecting the parallel walls to the body portion, the parallel and transverse walls defining a gear chamber, each of the parallel walls being formed with a laterally outwardly projecting open ended cylindrical extension, the extensions being in mutually offset relation, a shaft arranged within each extension and having a portion projecting beyond it, the shafts having their axes in parallel relation and the extensions being each concentric to the associated shaft, a spur gear carried by each shaft, the spur gears being positioned in meshing relation in the gear chamber, bearings for the shafts fitted in and supported by the respective extensions, and two weight elements positioned at opposite sides of the supporting element, and respectively mounted on the shafts for rotation therewith, one of the shafts being power driven and serving through the spur gears to drive the other, the supporting element being positioned between the weight elements and the weight elements each having its center of mass in a plane which passes between the transverse limits of the bearings for the associated shaft.

2. A mechanism as set forth in claim 1 wherein the supporting element includes oppositely located flanges projecting from the body portion and having their faces in planes parallel to the central plane of the body portion, the weight elements include a base wall of disc-like form and an annular wall carried by the base wall and projecting inwardly from its periphery toward the supporting element, the base wall and annular wall delimiting an internal space, the annular walls enclosing and being concentric with the respective extensions, the body portion and one of the flanges occluding the internal space of one of the weight elements and the body portion and the other flange occluding the internal space of the second weight element.

3. A mechanism as set forth in claim 2 wherein the base walls of the weight element are each provided on their inner face with a raised arcuate pad having an extent of approximately 120° and having a machined face and each weight element includes a weight body removably mounted in symmetrical relation upon the pad of its base wall.

4. A mechanism as set forth in claim 1 wherein the bearings are provided as a pair for each shaft and in each pair are arranged in inner and outer relation, a spacing ring is provided to hold the bearings of each pair in mutually spaced relation, and each extension is formed with an inwardly projecting lug to engage the inner of the corresponding pair of bearings, the lugs being located adjacent the upper and lower ends of the gear chamber.

5. A mechanism as set forth in claim 1 wherein the bearings are provided as a pair for each shaft and in each pair are arranged in inner and outer relation, a spacing ring is provided to hold the bearings of each pair in mutually spaced relation, each extension is formed with an inwardly projecting lug to engage the inner of the corresponding bearings, the lugs being located adjacent the upper and lower ends of the gear chamber, and a securing ring is attached to the outer edge face of each extension and overlies the outer lateral face of the outer bearing of the corresponding pair.

6. A mechanism as set forth in claim 1 wherein the body portion is formed at each side with a laterally and outwardly projecting arcuate reinforcing flange, the flanges being concentric to the extensions and integrally connected to the walls which define the gear chamber.

7. A mechanism as set forth in claim 1 wherein each weight body is secured by bolts to a wall of the corresponding weight carrying element and the weight bodies overhang the end walls of the gear chamber and extend inwardly beyond the vertical walls of the gear chamber.

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