July 11, 1950 E. E. DEISTER 2,514,538

VIBRATORY POWER MECHANISM

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FIG. 1

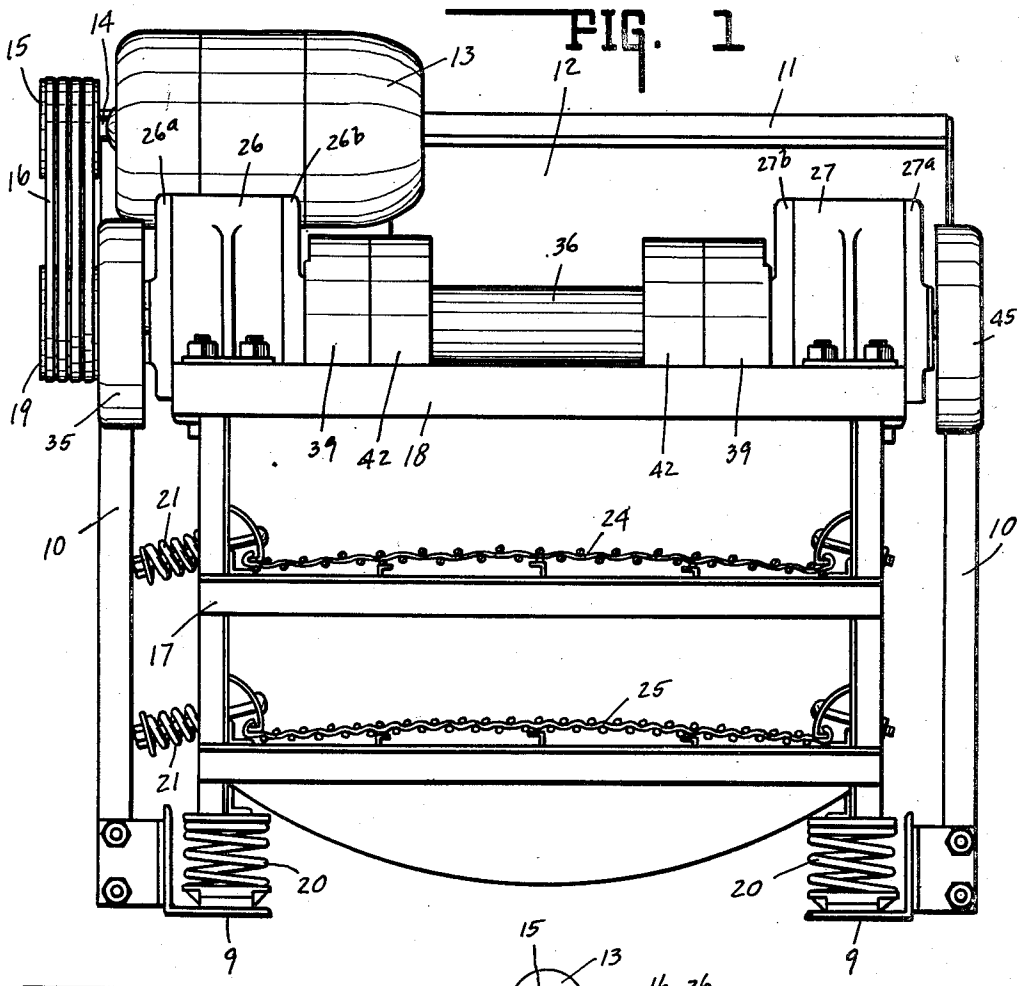
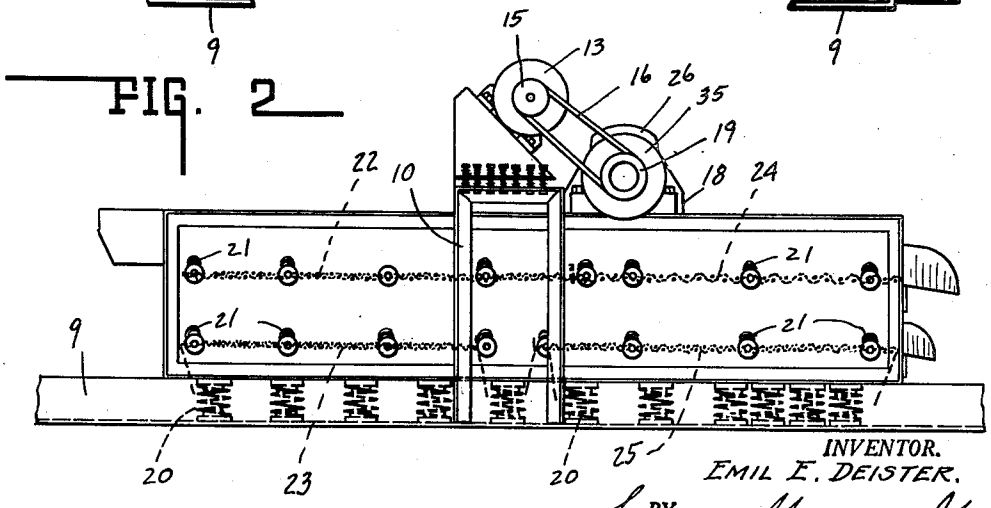


FIG. 2



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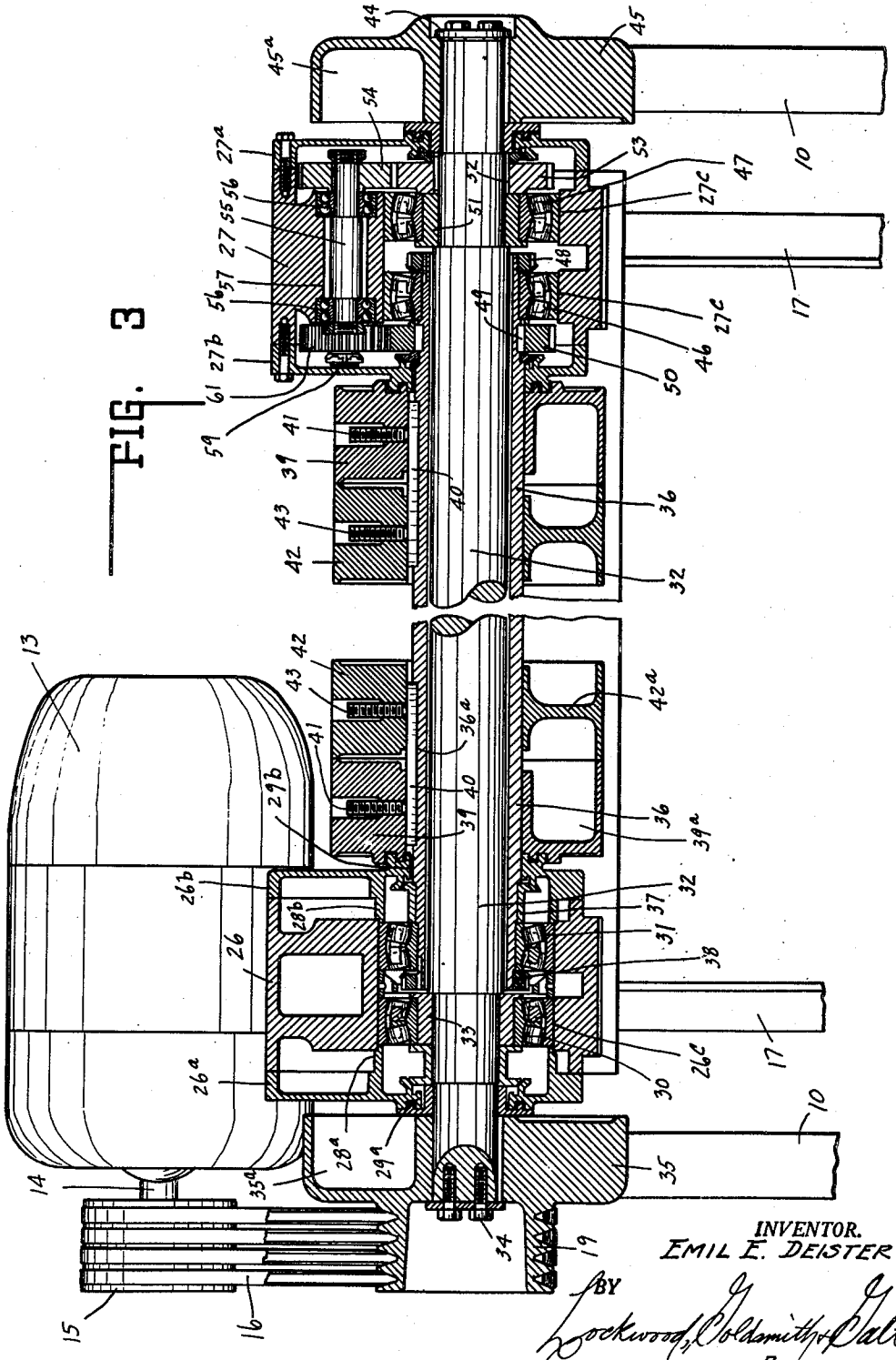
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VIBRATORY POWER MECHANISM

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FIG. 3



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VIBRATORY POWER MECHANISM

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FIG. 4

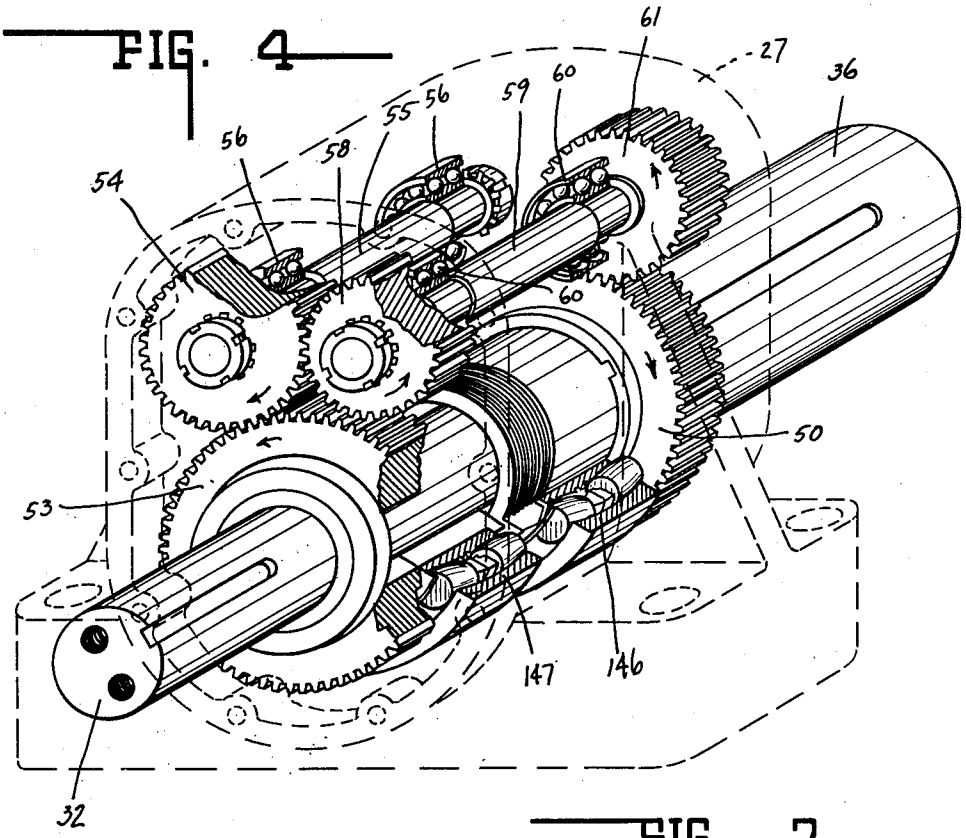


FIG. 7

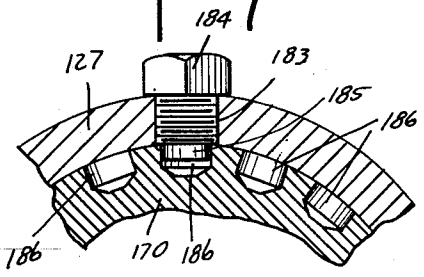
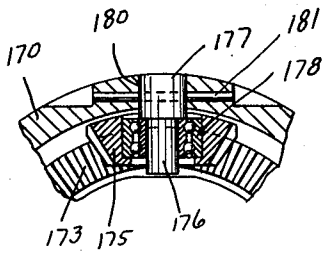


FIG. 6



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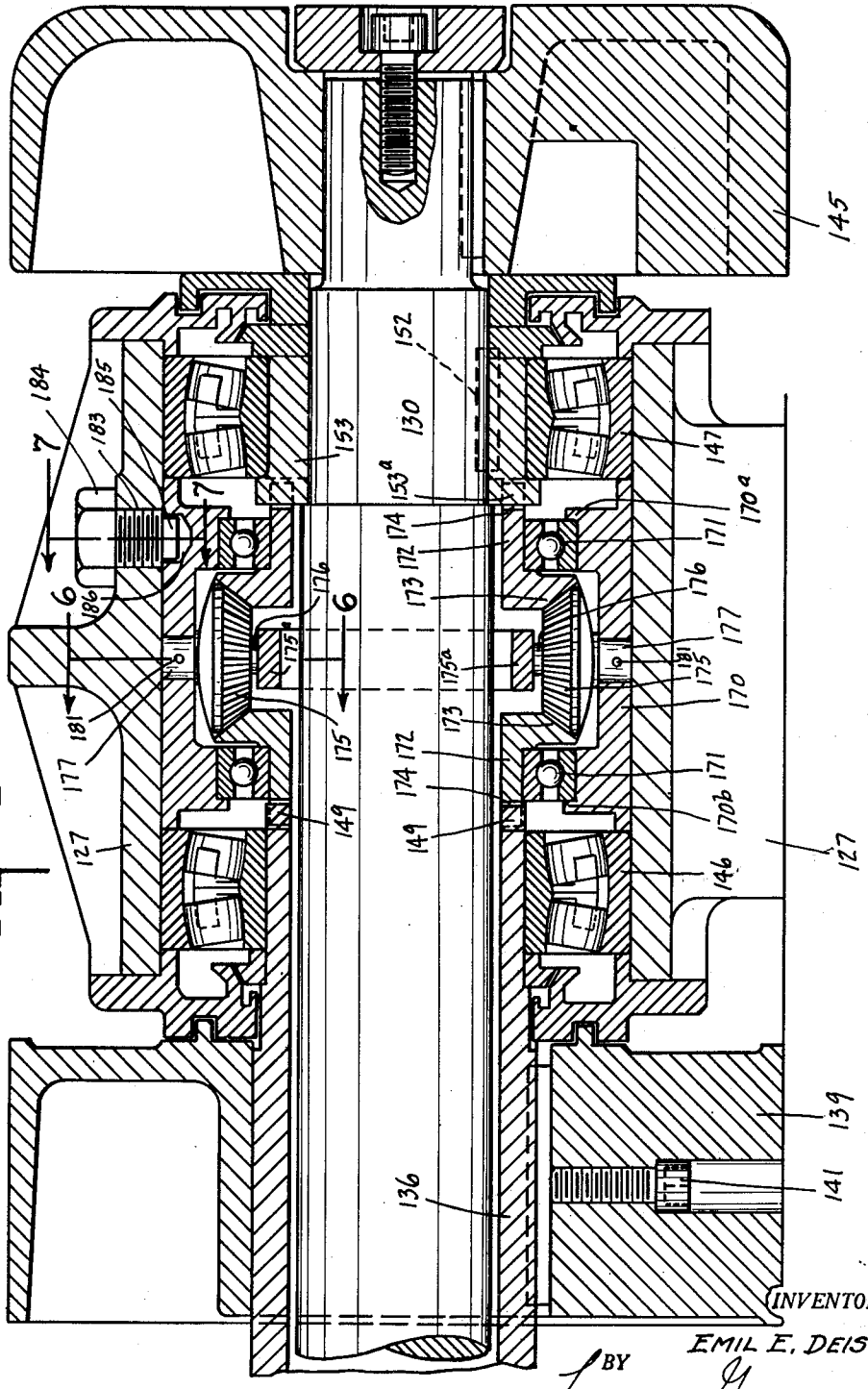


FIG. 5

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UNITED STATES PATENT OFFICE

2,514,538

VIBRATORY POWER MECHANISM

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Application August 9, 1946, Serial No. 689,604

3 Claims. (Cl. 74—87)

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This invention relates to a vibratory power mechanism.

The chief object of this invention is to provide mechanism utilizing rotary power and transforming same to reciprocatory power through the use of rotary unbalanced weights, the rotational axes of which are coincident so that the relative arcuate angularity between weights can be readily adjusted tooth-by-tooth over a wide range so that the general direction of reciprocation can similarly be adjusted over a comparatively wide range, all without requiring any adjustments of other mechanism to be vibrated by said first mentioned mechanism.

The aforesaid permits a shaking screen structure of this general type to be utilized for the segregation of different size solids of different materials, that is, materials of different specific gravities, such as gravel to be sized, broken coal to be sized, ballast to be sized, etc.

In other words, only relative arcuate adjustment of the coaxial weights is required to adapt the present invention for the separation of any one of the materials so that the shaking screen operates at maximum efficiency for each such material and also without screen clogging.

The chief feature of the present invention resides in the coaxial mounting of the weights and the arcuate adjustment thereof for the purposes set forth.

Other objects and features of the invention will be set forth more fully hereinafter.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

In the drawings Fig. 1 is an end view of a multiple screen structure of the shaking type and embodying the invention.

Fig. 2 is a diagrammatic view of such a screen device.

Fig. 3 is a central sectional view of the agitator portion of the device.

Fig. 4 is a perspective view of the interdrive between the coaxial shafts shown in Fig. 3.

Fig. 5 is a central sectional view of a modified form of the invention and the portion illustrated corresponds to the right hand portion of Fig. 3.

Fig. 6 is a transverse sectional view taken on line 6—6 of Fig. 5 and in the direction of the arrows.

Fig. 7 is a transverse sectional view taken on line 7—7 of Fig. 5 and in the direction of the arrows.

In the drawings, see Figs. 1 and 2, there is illustrated an outer frame 9 comprised of spaced

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angles suitably connected together and from which rise supports 10. An overhead frame 11 is adjustably supported by these supports and its biased face 12 has secured to it a motor 13 having shaft 14 mounting pulleys 15 driving belts 16.

Within the frame is the shaker structure represented by a frame 17 to which in overhead relation is secured an overhead base 18 mounting the agitator device to be more fully described. The agitator device includes the pulleys 19 driven by belts 16.

The shaker frame 17 is cushioned upon the outer frame 9 throughout the shaker frame length by supporting springs 20, see Fig. 1. The shaker frame is slightly less than the outer frame as to length and narrower. It is of less height than uprights 10. The screen material is tensioned upon the shaker frame by adjustable yielding catches or connections 21.

Fig. 2 illustrates a diagrammatic representation of the screen structure. Herein screen 22 receives all the material to be sized. Assume the same passes 5/8 inch or smaller material. This falls through to lower screen 23 that passes only 1/4 inch or smaller material. The material trapped by screen 22 is caused to travel to and across screen 24 which passes 1 1/4 inch or smaller material. The lateral discharge from screen 24 obviously is greater than 1 1/4 inch.

Such material as passes through screen 24 obviously is 1 1/4 or less and greater than 5/8 inch. Screen 25 below screen 24 passes 3/4 inch or smaller size. Thus the material passed through screen 25 is no greater than 3/4 inch nor less than 5/8 inch.

The overrun obviously is sized between 3/4 inch and 1 1/4 inches. The overrun (centrally disposed) from screen 23 is less than 5/8 and greater than 1/4 inch. Thus material supplied to the screen structure at the upper left hand end, see Fig. 2, will produce five sizes thereof.

It is well known that substantially horizontally disposed screens, such as indicated at 22, 23, 24 and 25 will function properly and efficiently, without clogging, if the general direction of agitation is that required for the specific material to be separated.

Herein such adjustment is readily effected in the agitator device proper, to which attention will now more specifically be directed. Same is shown more fully in Figs. 3 and 4.

In Figs. 1 and 3 it will be observed that there is suitably secured the main housing members 26 and 27. Housing member 26 includes two end

plates 26a and 26b and these provide certain inwardly directed stop shoulders 28a and 28b which confront each other and central apertures 29a and 29b.

The main housing portion includes the central bore 26c and mounted therein are the anti-friction elements 30 and 31. Shaft 32 is rotatably supported by the bushing structure 33 within the bearing 30 and is suitably retained therein as indicated.

The end of this shaft, which projects beyond the housing 26, has secured to it as at 34 the multiple pulley structure 19 aforesaid and a weight 35, the latter being of cylindrical type with the chamber portion 35a formed therein.

The shaft 32 aforesaid is enveloped by a sleeve 36 which is operatively associated with the oil flinger spacing sleeve 37 and the anti-friction element 31, the latter being retained in position by the lock ring structure 38.

The sleeve shaft or tube 36 is provided with a key way 36a, and a cylindrical weight 39 having the chamber 39a therein is keyed as at 40 to said sleeve and secured by means of the lock screw 41 which may be of the headless type.

Herein a second weight, generally similar to the previously mentioned weight, is provided, and the same is indicated by the numeral 42 keyed by the element 40 and locked by the screw 43, but this particular weight, instead of being chambered as at 39a, has an I section as indicated at 42a.

The sleeve shaft 36 adjacent its opposite end mounts similar weights 42 and 39 in reversed relation, and same are keyed and locked to the sleeve, as previously described. The housing 27 includes the end plate 27a and the opposite end plate 27b.

The shaft 32 is extended beyond the housing 27 and mounts on the end thereof as at 44 the cylindrical weight 45 chambered as at 45a, same corresponding to the similar weight 35 chambered at 35a. If desired, the pulley structure 19, shown integral in Fig. 3, may be detachably connected by the same means 34 that the weight 35 is secured to said shaft. This then would only require slightly longer bolts and would permit utilization of identical end weights, and for purposes herein these weights may be considered identical although actually for production purposes the two weights as aforesaid are only similar.

It will be noted that the central portion of the housing 27 includes the central bore portions 27c and seated therein are the anti-friction structures 46 and 47. The anti-friction structure 46 supports the right hand end of the sleeve shaft 36 and the same are locked together by the lock ring 48 as shown. Splined to the sleeve shaft as at 49 is a gear 50.

Between the weight 45 and the adjacent end of the sleeve shaft is the bearing 51 operatively associated with the anti-friction structure 47 for rotatably supporting, within the bore 27c of the housing 27, the end of said shaft.

Splined or keyed to that shaft 32, between that bearing and the weight 45, as at 52, is a gear 53. This gear 53 meshes with a gear 54 mounted on one end of a jack shaft 55 antifrictionally supported as at 56 in a bore 57 parallel to the central bore 27c in the main housing portion.

Meshing with the gear 54 is another gear 58 mounted on another shaft 59, not shown in Fig. 3 but shown in Fig. 4. This shaft is anti-frictionally supported in a parallel bore as indicated

at 60. The shaft 59 carries at its other end a gear 61 which meshes with the gear 50 carried by the sleeve shaft 36.

Rotational power is transmitted by shaft 32 through gear 53, gear 54, shaft 59, gear 61 and gear 50 to the sleeve shaft 36 to rotate the last named in a direction opposite to the direction of rotation of the central shaft 32 and at a rate proportional thereto.

It will be noted that the gears are detachably mounted, although having spline connection, on the ends of the jack shafts 55 and 59. It will also be noted that the cover plates 27a and 27b are detachably mounted upon the main housing structure 27.

Thus whenever it is desired to adjust the relative angular displacement of the shaft 32 with respect to the sleeve shaft 36 the adjacent pulley 45 may be removed, the cap plate 27a removed, and the gear 54 removed and the sleeve shaft 36 rotated an arcuate distance of one or more teeth and then the gear 54 replaced and the other parts replaced in the reverse order.

Whenever it is not expedient to make the adjustment from the rear end, the end plate 27b is removed after the locking screws have been retracted from the weights and the same have been shifted axially toward the other end of the structure and the cover plate has similarly been shifted.

When sufficiently shifted, the gear 61 may be removed from its shaft 59 and the weights turned in the advance or retrograde direction an arcuate distance equal to one or more teeth.

Then the gear 61 is reapplied, cover 27b reapplied, and the weights 39 and 42 shown in the right hand portion of Fig. 3 are also repositioned axially and locked as aforesaid. The result is that the sleeve weights will be arcuately adjusted relative to the shaft weights.

It will also be obvious that the sleeve shaft and central shaft are concentric and are coaxially mounted. The weights are mounted so their axes of rotation are coaxial and the weights are generally mounted in opposition the degree or extent thereof being variable and further that such variation is readily accomplished, as previously set forth.

By way of further explanation it is to be noted that as the two shafts are rotated centrifugal force is equally effective on the weights carried by the respective shafts so that through the gearing illustrated at some intervals in the rotation the centrifugal force of all weights is effective in the same diametric direction, and at another period the same is effective in that same general direction but in an opposite sense.

Thus maximum centrifugal force incident to the summation of centrifugal forces produces a reciprocatory force, as it were, for effecting screen reciprocation since this force is only dissipated through the housings 26 and 27 which are carried by the base portion 18, in turn secured to the shaker screen frame structure 17.

Now when the weights of the two shafts are in direct opposition and they are substantially of equal force and effect, reference being had to the relative velocities as well, the base 18 is not subject to agitation or reciprocation and therefore in a cycle of agitation the force from the maximum recedes to a minimum and then increases to the maximum and obviously the number of oscillations or reciprocations of the screen structure depends on the speed imparted to the vibratory device by the motor 13.

It furthermore will be quite clear that the only result of shifting the relative arcuate spacing of the weights, as it were, is to shift the relative general direction of the maximum reciprocatory force. Thus it is possible to obtain agitation along lines or directions from close to horizontal to 45 or more degrees therefrom as required by the character of the material to be handled, for reasons assigned aforesaid.

Generally the range of adjustment is between 20 and 60 degrees so that the component of the force that is transverse to the plane of the screens insures the material dropping through them if of lesser size than the screen capacity, and the horizontal component of the force insures horizontal travel of the material not passed by the screen toward the discharge or overrun edge thereof, such as is found at the right hand end of screen **23**, **25** and **24** and where screen **22** passes material to screen **24**.

Obviously the general direction of agitation, insofar as the screen shown in Fig. 2 is concerned, should be upwardly and to the right. This means that the material is agitated so that smaller material freely passes through the screens and the other material not so passed is caused to advance horizontally and also upwardly so as not to clog the screens.

It is to be understood that the diagrammatic representation shown in Fig. 2 is merely given by way of example and that the specific mounting of the screen structure within the main frame is also given by way of example only and that the invention is primarily directed to a method of vibrating shaking screen means through coaxially mounted unbalanced weights rotating in opposite directions, the coaxial mounting resulting in the attainment of maximum vibratory action without the generation of inherent opposing actions such as occur with oppositely rotating unbalanced weights having parallel shafts of rotation.

Reference will now be had to Fig. 5 wherein a modified form of drive between the driving shaft and the driven tubular shaft or sleeve is illustrated.

In Fig. 5 numerals of the **100** series indicate parts similar to or like parts in the previous figures and designated by the respective primary numerals. In this figure it will be observed that the sleeve **153** is keyed as at **152** to the shaft **130**.

This sleeve is provided with a facial spline structure **153***a* and the shaft is suitably supported by the housing or main structure **127** through a bearing structure **147**.

Within the housing is a similar bearing structure **146** and at the opposite end thereof, and the same rotatably supports the sleeve shaft **136** to which is suitably secured the sleeve weight or weights **139**, same being keyed to the sleeve shaft, as shown, and set screw locked together, as indicated at **141**.

The sleeve shaft extends into the housing **127** and through the bearing **146** and is provided on its end with a toothed arrangement **149** that confronts the toothed arrangement **153** although the two are logitudinally spaced apart.

The general similarity of the two structures to the extent the second embodiment has been thus described will be obvious. The driving connection and the adjustability, however, of the second embodiment does differ considerably from that shown in the first embodiment; hence, entirely new numerals designate these parts.

Interposed between the two bearings **146** and **147** is a rotatable sleeve **170** and the same is provided with inwardly drected flanges **170***a* and **170***b* between which are mounted the bearing structures designated generally by the numerals **171**.

Rotatably supported within each is another sleeve structure **172** and the latter includes a crowned gear formation **173** at one end and at its opposite end is provided with a spline formation **174**. One splined arrangement is associated with the splined structure **153***a* and the other splined arrangement **174** is associated with the splined structure **149** on the end of the tubular shaft. Both of these sleeves **172** mesh with a plurality of beveled pinions **175**.

Herein two of the same are illustrated and more may be provided if desired. The two illustrated are diametrically arranged and a ring **175***a* includes radially directed shaft portion **176** that rotatably support said beveled gears.

The shafts **176** terminate in head structures **177** and, if desired, see Fig. 6, there may be interposed between the beveled gear and the shaft an anti-friction structure **178**. The adjusting ring **170** mounts the heads **177** as at **180** and a pin or lock **181** may secure the same in assembled relation.

From the foregoing, therefore, it will be understood that if the central shaft is rotated the sleeve **153** is rotated and by reason of the spline connection the beveled pinions **175** will be rotated upon their axes when the outer sleeve **170** is fixed to the housing **127**.

As a result the other beveled gear **173** will be rotated, and by reason of the spline connection **174**—**149** the sleeve shaft concentric and coaxial with the central shaft will also be rotated at the same rate as the central shaft but oppositely.

Rotational power is transmitted by central shaft **130**—**132** to clutch member **151**, keyed at **152**, clutched at **153***a*—**147** to crown gear **173** meshing with pinions **175** rotatable on axes transverse to the central shaft axis. These pinions mesh with the opposed crown gear **172**—**173** in turn clutched at **147**—**149** to the sleeve shaft **136** so that the two shafts rotate at the same rate but in opposite directions.

The weights **139** and **145** carried by the sleeve shaft and the central shaft respectively will be variously disposed, that is, angularly adjusted, and the adjustment is obtained as follows, see Figs. 5 and 7: the housing **127** is provided with a threaded opening **183** that threadingly mounts a locking screw **184** having a locking projection **185**. The outer periphery of the outer sleeve **170** is provided with a series of teeth, sockets or the like such as shown at **186**. Now with the locking screw sufficiently retracted for non-locking and with, for example, a wedge interposed between the weight **139** and the housing **127** to hold the sleeve shaft stationary, rotation of the central shaft weight will affect rotation of the outer sleeve **170** to the desired degree.

When that has been obtained the locking screw is rethreaded into locking position to hold the outer sleeve **170** stationary and then the wedge aforesaid is removed. Thus angular adjustment between the weights is readily obtained.

It will furthermore be obvious that with the construction shown the angular adjustment of the sleeve **170** will be but half of the angular travel of the central shaft in the adjusting operation.

It will be perfectly clear that the other end

of the embodiment shown in Fig. 5 can be similarly modified or the left end portion of Fig. 3 support for the coaxial shafts may be duplicated in the embodiment of the invention including that form shown in Fig. 5.

Since the mechanism herein has been so fully described and its operation has been equally fully described, it will be apparent that the method of vibrating a shaking screen will be more or less obvious from the aforesaid so that no further detailed description is believed necessary relative thereto.

While the invention has been illustrated and described in great detail in the drawings and foregoing description, the same is to be considered as illustrative.

The forms described herein as well as others which will readily suggest themselves to persons skilled in this art, all are considered to be within the broad scope of the invention, reference being had to the appended claims.

The invention claimed is:

1. A vibratory device of the longitudinally balanced coaxial type comprising a pair of oppositely rotatable concentric shafts, each of appreciable length, to wit, at least five times the diameter thereof, the inner shaft projecting at opposite ends beyond the ends of the outer shaft, an eccentrically disposed weight at each projecting end of said inner shaft, an inner pair of axially spaced external bearings disposed inwardly of and contiguous to the ends of the said outer shaft for the rotative support of the same and into which the said outer shaft projects at opposite ends, another and outer pair of axially aligned spaced external bearings disposed immediately contiguous to the first mentioned bearings and inwardly of and adjacent the ends of the inner shaft for the rotative support of the same, a plurality of eccentrically disposed weights carried by the said outer shaft and inwardly of the inner pair of bearings and disposed in balanced axial relation relative to the length of said outer shaft, means for rotating an exposed portion of one of said shafts, and gearing disposed at one end of the outer shaft and interconnecting said shafts for the simultaneous rotation thereof and in opposite directions, a portion of the gearing being annularly adjustable for effecting relative arcuate displacement of the shafts for vibration direction variation, a pair of spaced housings, each enclosing a pair of adjacent bearings, said housings constituting the sole support for the device, the gearing being enclosed within one of the housings and the rotating means being disposed beyond the other housing.

2. A vibratory device of the longitudinally balanced coaxial type comprising a pair of oppositely rotatable concentric shafts, each of appreciable length, to wit, at least five times the diameter thereof, the inner shaft projecting at opposite ends beyond the ends of the outer shaft, an eccentrically disposed weight at each projecting end of said inner shaft, an inner pair of axially spaced external bearings disposed inwardly of and contiguous to the ends of the said outer shaft for the rotative support of the same and into which the said outer shaft projects at opposite ends, another and outer pair of axially aligned spaced external bearings disposed immediately contiguous to the first mentioned bearings and inwardly of and adjacent the ends of the inner shaft for the rotative support of the same, a plurality of eccentrically disposed weights carried by the said outer shaft and inwardly of the inner pair of bearings and disposed in balanced axial relation relative to the length of said outer shaft, means for rotating an exposed portion of one of said shafts, and gearing disposed at one end of the outer shaft and interconnecting said shafts for the simultaneous rotation thereof and in opposite directions, a portion of the gearing being annularly adjustable for effecting relative arcuate displacement of the shafts for vibration direction variation, said gearing comprising a jack shaft and two sets of gears, one gear of each set being associated therewith, and one gear of one set being associated with the outer shaft and one gear of the other set being associated with the inner shaft, one of the jack shaft gears being detachable for annular adjustment purposes.

3. A vibratory device of the longitudinally balanced coaxial type comprising a pair of oppositely rotatable concentric shafts, each of appreciable length, to wit, at least five times the diameter thereof, the inner shaft projecting at opposite ends beyond the ends of the outer shaft, an eccentrically disposed weight at each projecting end of said inner shaft, an inner pair of axially spaced external bearings disposed inwardly of and contiguous to the ends of the said outer shaft for the rotative support of the same and into which the said outer shaft projects at opposite ends, another and outer pair of axially aligned spaced external bearings disposed immediately contiguous to the first mentioned bearings and inwardly of and adjacent the ends of the inner shaft for the rotative support of the same, a plurality of eccentrically disposed weights carried by the said outer shaft and inwardly of the inner pair of bearings and disposed in balanced axial relation relative to the length of said outer shaft, means for rotating an exposed portion of one of said shafts, and gearing disposed at one end of the outer shaft and interconnecting said shafts for the simultaneous rotation thereof and in opposite directions, a portion of the gearing being annularly adjustable for effecting relative arcuate displacement of the shafts for vibration direction variation, said gearing comprising a differential gear set with a pair of confronting ring gears, at least one pinion gear therebetween, and an annularly adjustable support for the pinion gear, and means for locking said support in the adjusted position, the axis of the pinion gear being transverse to the axis of the confronting gears.

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