Dec. 15, 1942. E. B. GARY 2,305,344

GYRATORY SIFTERS

Filed Feb. 24, 1941 3 Sheets-Sheet 1

Fig. 1.

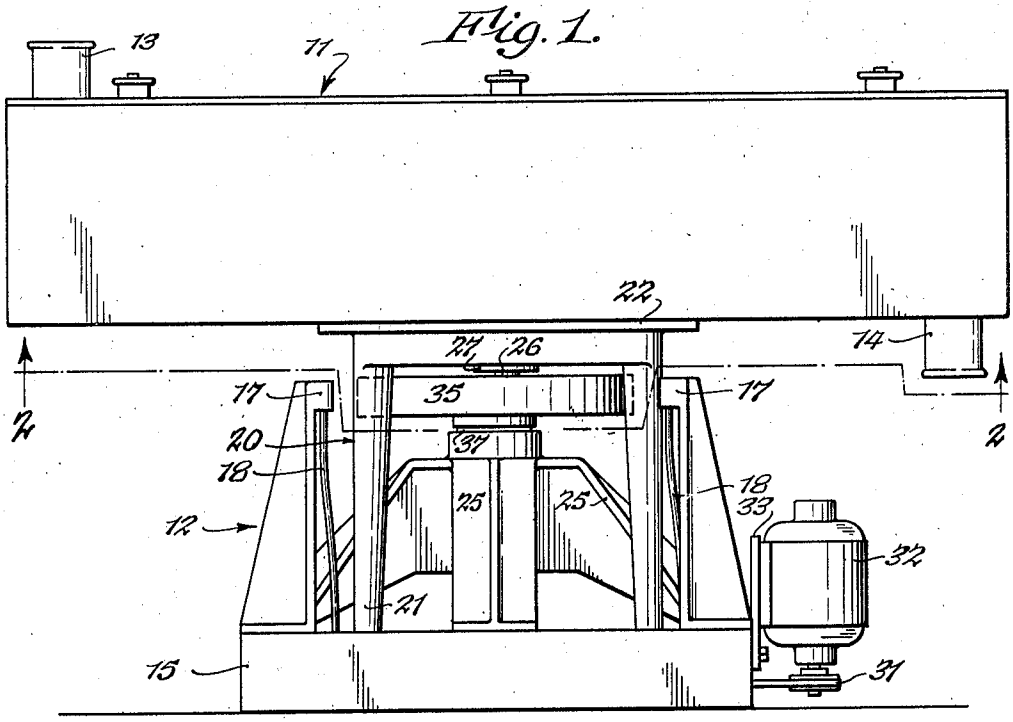
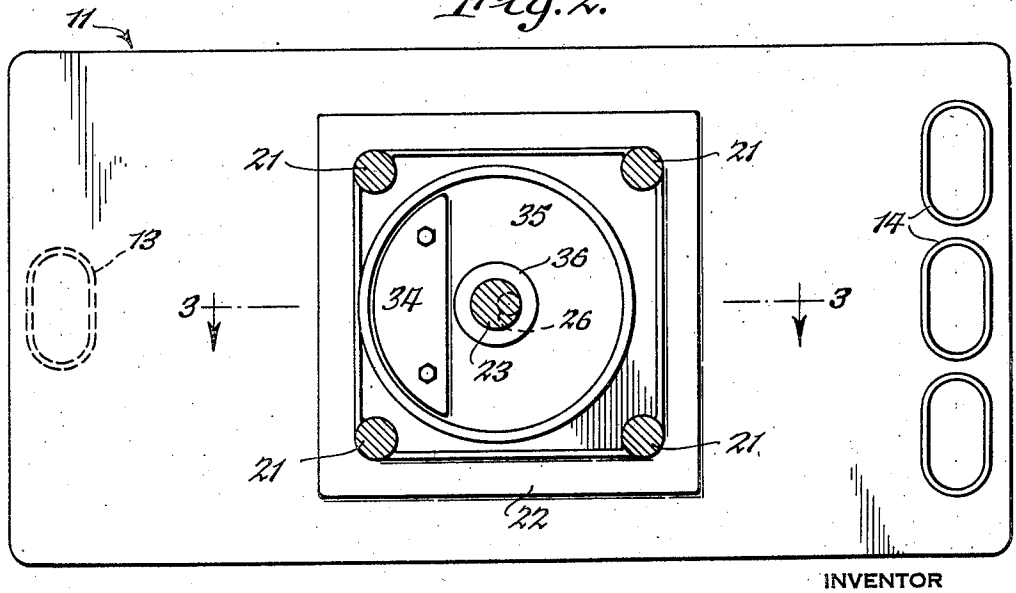


Fig. 2.



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Fig. 3.

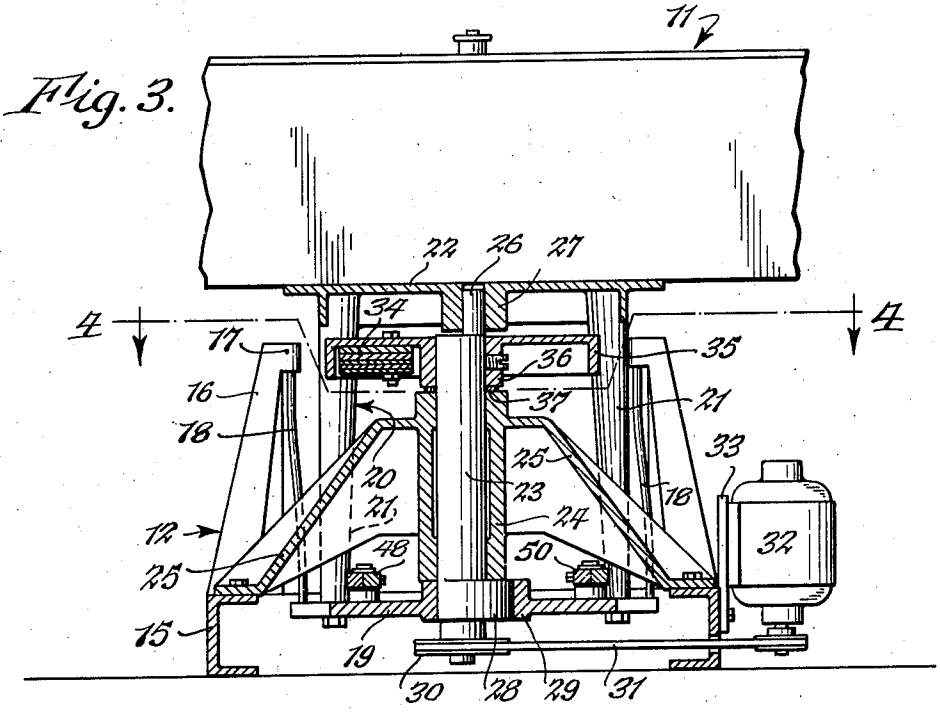
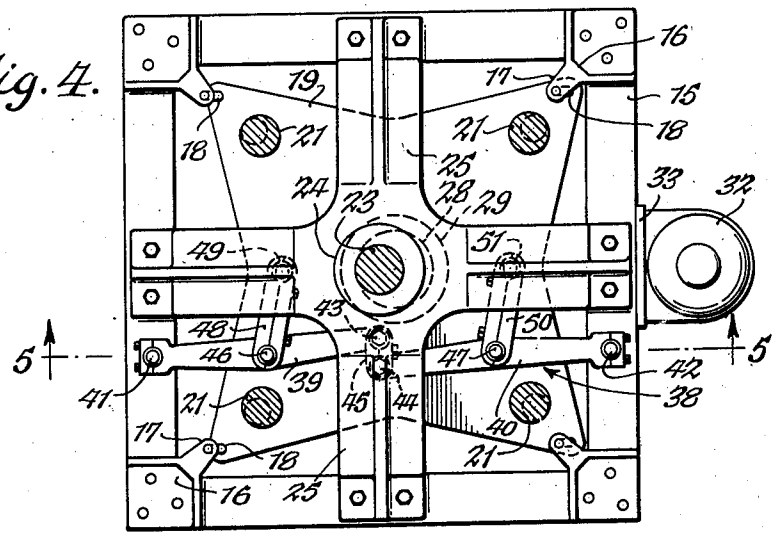


Fig. 4.



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Fig. 5.

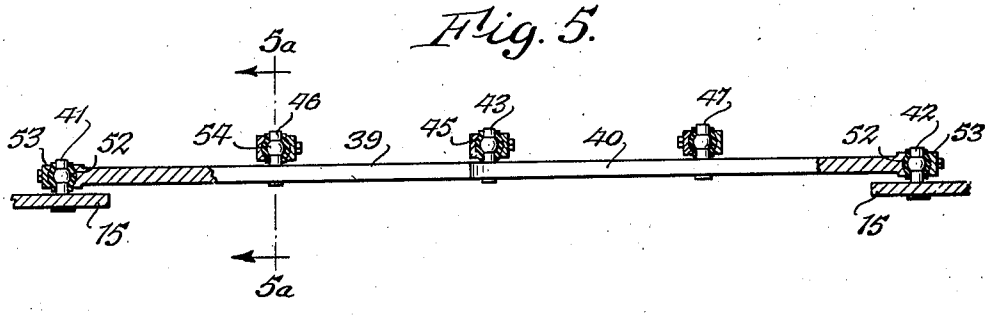


Fig. 5a.

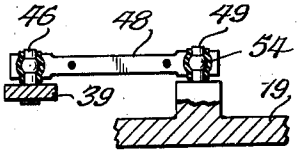


Fig. 6.

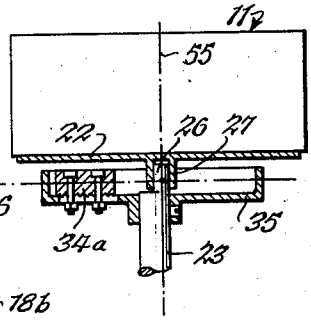


Fig. 7.

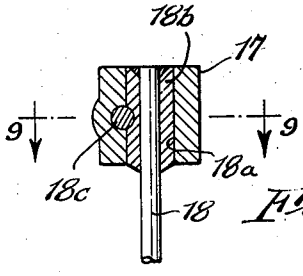


Fig. 8.

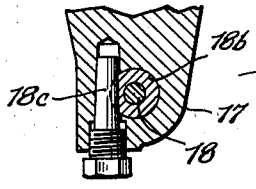


Fig. 9.

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UNITED STATES PATENT OFFICE

2,305,344

GYRATORY SIFTER

Edwin B. Gary, Kenmore, N. Y.

Application February 24, 1941, Serial No. 380,251

8 Claims. (Cl. 209—366)

This invention relates to power driven sifters which, although not necessarily limited to such use, are intended primarily for the separation and grading of finely divided materials, and more particularly the invention is concerned with improvements in sifters of the type characterized by a stationary supporting frame, a screen body mounted upon said frame and actuating means for gyrating the screen body so that throughout its extent it is caused to traverse a horizontal circular path which is substantially uniform as to shape and dimensions.

One object of the invention is to provide a sifter of the kind generally described wherein the supporting frame and actuating mechanism are located wholly below and exteriorly of the screen body, thereby eliminating any internal obstructions which might require a special design or arrangement of screening elements or trays and providing for facility in placing the screening elements or trays within, and their removal from, the screen body.

A further object is to provide a sifter which is quiet and smooth running in operation, this object contemplating a sifter which is dynamically balanced so as to prevent the transmission of objectionable impulses or vibrations to the supporting frame and associated structure.

A still further object is to provide a sifter which can be driven by a motor of low power and which is economical from standpoints of operating and maintenance costs.

A still further object is to provide a novel design and arrangement of the parts of the sifter, whereby compactness, simplicity and economy in construction are obtained and wearing of the parts under operating conditions is minimized.

The invention is illustrated in the accompanying drawings in which:

Figure 1 is a side elevation of a sifter embodying the features of the invention.

Figure 2 is a horizontal section taken along line 2—2 of Figure 1.

Figure 3 is a vertical section taken along line 3—3 of Figure 2.

Figure 4 is a horizontal section taken along line 4—4 of Figure 3.

Figure 5 is an enlarged sectional view through the stabilizing device and is taken along line 5—5 of Figure 4.

Figure 5*a* is an enlarged detail section taken along line 5*a*—5*a* of Figure 5.

Figure 6 is a fragmentary sectional view of a modified balance wheel construction.

Figure 7 is a diagrammatic view showing the location of the driving eccentric of the actuating shaft with respect to the weight carried by the balance wheel (Figure 6) and the center of gravity of the screen body and substructure assembly.

Figure 8 is an enlarged detail section illustrating the manner in which the upper ends of the suspension rods may be connected to the posts of the base frame.

Figure 9 is a detail section taken along line 9—9 of Figure 8.

The sifter, as illustrated, includes a screen body 11 and a stationary supporting frame 12, the former being provided with an inlet connection 13 and outlet connections 14 and having any desired design and arrangement of screening elements or trays and the latter having a substantially square base 15 formed from channel members arranged upon their sides with their flanges directed inwardly. Posts 16 are mounted at each of the corners of the base 15, each post being formed at its top with a lateral extension 17 which is directed diagonally across the base toward the opposite corner.

Resilient rods 18 which are suspended from the post extensions 17 are connected at their lower ends to the four corners of the base plate 19 of a carriage (or substructure) 20, the latter having four legs 21, which are bolted or otherwise secured at their lower ends to the base plate, and a top plate 22 upon which the screen body is mounted.

The screen body and carriage are gyrated in a horizontal plane by a vertical drive shaft 23 (Figure 3). The latter is mounted in a bearing sleeve 24 which is supported upon the base 15 by upwardly and inwardly inclined arms 25. The upper end of the shaft 23 is formed with an eccentric 26 which fits in a bearing hub 27 formed or provided upon the under side of the top plate 22 of the carriage while adjacent its lower end the shaft is formed with a second eccentric 28 which fits in a bearing hub 29 formed or provided upon the base plate 19. A pulley 30 which is fixed to the lower end of the drive shaft is connected by a belt 31 to the drive pulley of a motor 32 which is mounted upon a supporting plate 33 fixed to one of the channel members of the base 15.

The eccentrics 26 and 28, although of different diameters, have the same eccentricity and throw. When the actuating shaft is driven, therefore, the rods 18 flex to permit the screen body and carriage to be gyrated in a circular path having a radius corresponding to the eccentricity of the

eccentrics, the eccentric mounting of the screen body and carriage being counterbalanced by weights 34 which are carried by a balance wheel 35. The latter is fixed to the drive shaft adjacent the upper eccentric and the hub 36 thereof seats upon a thrust washer 37 which fits against the upper end of the bearing sleeve 24, the balance wheel supporting the drive shaft so that the end of the upper eccentric is spaced from the under side of the screen body. In this connection it will be noted that the upper face of the lower eccentric abuts the lower end of the bearing sleeve 24. The balance wheel and lower eccentric thus cooperate with the opposite ends of the bearing sleeve to prevent axial movement of the actuating shaft. In order to reduce to a minimum any tendency of the actuating shaft to nutate as a result of the different axial locations of the upper eccentric and the balance wheel it is preferred that the two be located close together, for example as illustrated in Figures 1 and 3. If desired, however, any such tendency of the actuating shaft may be eliminated entirely by the use of the balance wheel construction shown in Figure 6. In this embodiment, the flange of the balance wheel extends toward the bottom of the top plate of the carriage and the weights 34*a* may, therefore, be located directly opposite, i. e. in line with, the eccentric 26.

The rods 18 may be of any suitable material, although they are preferably of metal. As illustrated in Figure 8, vertical sockets 18*a* may be formed in the post extensions 17 to accommodate the heads 18*b* of the rods, the heads being provided by sleeves which are welded or otherwise secured upon the upper ends of the rods and being secured in the sockets by elements 18*c* which are carried by the post extensions and which engage in transverse notches formed in the sleeves. The lower ends of the rods may be formed or provided with similar heads which may be similarly secured in suitable sockets formed in the base plate 19 of the carriage. Preferably the rods offer a resistance to bending such that any movement of their lower ends laterally with respect to their upper ends causes them to flex substantially throughout their entire length. Hence, as a result of the small degree of deflection which will occur at any one point crystalization of the metal is avoided.

Initially, as connected at their upper ends to the post extensions 17 and at their lower ends to the base plate and prior to the fitting of the eccentrics of the actuating shaft into the bearing hubs 27 and 29 of the carriage, the rods 18 are straight, vertical and parallel; and the parts are so designed that when the actuating shaft is fitted in the bearing sleeve 24 and the carriage 20 is adjuusted in a horizontal plane so that the eccentrics will enter the hubs 27 and 29 the lower ends of the rods will be offset laterally with respect to their original positions a distance equal to the eccentricity of the eccentrics, the direction of such offset corresponding to the angular position of the eccentrics. Hence when the actuating shaft is driven to gyrate the screen body and carriage the lower ends of the rods will describe circles about parallel vertical lines C (Figure 7) which are coaxial with the heads 18*b* of the rods. The height of the screen body and carriage thus remains constant throughout their path of movement and there is no tendency for the assembly to move up or down with respect to the actuating shaft.

Owing to the weight of the screen body and carriage and the resiliency of the rods 18 any tendency of the screen body to rock in a horizontal plane is resisted. In order, however, to insure that there will be no such movement and to positively control the movement of the screen body so that all points are caused to traverse circular paths which as to shape and dimensions are substantially uniform, a stabilizing device 38 (Figure 4) is preferably employed. The said device includes a pair of arms 39 and 40 which are arranged end-to-end, the outer end of the arm 39 being pivotally connected to an upstanding pin 41 which is carried by the upper flange of one of the channel members of the base 15 and the outer end of the other arm being pivotally connectedd to a similar pin 42 which is carried by the upper flange of an opposite channel member of the base. The adjacent ends of the said arms carry pins 43 and 44 which are connected by a link 45. Intermediate their ends the arms 39 and 40 carry pins 46 and 47, respectively, the pin 46 being connected by a link 48 to a trunnion 49 carried by the base plate 19 of the carriage at one side of the actuating shaft and the pin 47 being connected by a link 50 to a trunnion 51 carried by the base plate 19 at the opposite side of the actuating shaft.

As the screen body and carriage are gyrated the arms 39 and 40 rock upon the pins 41 and 42, respectively, to a degree determined by the eccentricity of the eccentrics 26 and 28, the link 45 permitting each of the arms to pivot freely upon its own pin. At the same time the links 48 and 50 which connect the arms to the base plate of the carriage rock upon the pins 46 and 47, respectively, and also upon the trunnions 49 and 51. The arms thus provide for one component of the path of movement of the screen body and carriage while the links 48 and 50 provide for the other component. So long as the screen body and carriage gyrate without any tendency to rock in a horizontal plane the arms and links of the stabilizing device rock freely in the manner described and are subjected to substantially no load. If, however, owing to non-uniform distribution of the load, or for any other reason, one end of the sifter body tends to move ahead of the other this will be prevented. For example, any force which tends to rotate the screen body and carriage in a clockwise direction is transmitted by the links 48 and 50 to their respective arms, the link 48 urging the inner end of the arm 39 toward the actuating shaft and the link 50 urging the inner end of the arm 40 away from the said shaft. The two forces being equal and in opposite directions thus neutralize one another. Likewise, any force which tends to rotate the screen body and carriage in a counterclockwise direction is counteracted by the tendency of the arms 39 and 40 to move in opposite directions, although in this instance the action of the link 48 urges the inner end of the arm 39 away from the actuating shaft while the link 50 urges the inner end of the arm 40 toward the actuating shaft.

As best shown in Figure 5, rubber sleeves 52 are preferably fitted over the pins 41 and 42 and the arms 39 and 40 are connected to the pins by caps 53. In a like manner similar sleeves may be fitted over the pins 43 and 44, 46 and 47, and the trunnions 49 and 51. In this connection it will be noted that the links 45, 48 and 50 are each divided lengthwise into separable sections which are bolted together.

When the stabilizing device is attached the

caps 53 and the sections of the links 45, 48 and 50 are all tightened so as to grip the rubber sleeves 52 firmly, that is to say place them under a compression high enough to insure a firm, non-slipping grip between the surfaces of the sleeves and the connected parts. The sleeves, therefore, serve as torsion elements, twisting to permit the necessary rocking movements of the arms and links without any relative movement between the surfaces which contact the relatively movable parts of the joints. Annular enlargements 54 which are formed on the pins and trunnions are adapted to hold the arms and links in the assembled relation described. It will thus be apparent that there will be no wearing of the joints of the stabilizing device as there is no relative movement between any contacting parts of the joints. Lubrication of the joints is, therefore, rendered unnecessary, the mechanism having the further advantage that it is quiet in operation.

It will be apparent that the screen body and carriage assembly comprises upper and lower parts of what is in effect a single mass. Preferably, therefore, the sifter is so designed that a vertical line 55 (Figure 7) through the centers of the upper and lower eccentrics of the actuating shaft will pass through the center of gravity of the screen body and carriage assembly while a horizontal line 56 through the upper eccentric will also pass through the center of gravity, it being understood that as the carriage is located substantially wholly below the upper eccentric and will in many instances provide a lever arm of greater length than that of the screen body, the mass of the carriage may, as illustrated, be predetermined to lower the center of gravity of the gyrated mass to a point below the screen body. Such a construction is particularly desirable as it enables the connection of the actuating shaft to an exterior part of the screen body and eliminates any obstructions within the screen body. The necessity of screening elements or trays of special design or arrangement is thus avoided, it being understood in this connection that when, as described and illustrated, horizontal and vertical lines through the center of gravity of the screen body and carriage assembly both pass through the upper eccentric the latter will be the working eccentric while the lower eccentric merely provides a stabilizing influence to reinforce the screen body and carriage assembly against rocking in a vertical plane or the transmission of compression forces to the rods 18.

From the foregoing it will be apparent that when the center of gravity of the screen body and carriage assembly is located at, or in the vicinity of, the hub bearing 27 for the upper eccentric and the weight carried by the balance wheel acts in close proximity to the plane of the upper eccentric (Figure 3) or in the same plane of the eccentric (Figure 6), the sifter will be dynamically balanced and hence may be operated at any desired speed without imparting objectionable vibrations or impulses to the base 15 and the associated supporting structure. The sifter, therefore, is smooth running and quiet in operation.

As the entire weight of the screen body and carriage assembly is supported by the rods 18, the static load upon the actuating shaft is negligible. The use of expensive heavy duty bearings for the shaft is thus avoided; and as the gyratory movement of the sifter body is obtained and positively controlled without the use of joints having contacting surfaces which are relatively movable, wearing of the parts is reduced to a minimum, the only parts of the sifter, other than the motor, requiring lubrication being parts which are subjected only to light loads, namely the bearings in the sleeve 24, the two bearings for the eccentrics and the thrust washer 37. The sifter, therefore, has the further advantages that it is economical from standpoints of initial cost and operating and maintenance costs.

It will be understood that, although the gyrated assembly comprising the screen body and carriage, or sub-structure, is illustrated and described as being carried by resilient rods which are adapted to flex to permit the said assembly to be gyrated in the manner described, this is intended by way of example only and that, if desired, substantially rigid rods may be employed instead. In such a case, of course, the connection of the upper ends of the rods to the posts 16 of the stationary frame and their lower ends to the base plate 19 of the carriage would, of necessity, involve the use of joints designed to permit relative movement between the stationary and movable parts.

I claim as my invention:

1. A sifter comprising a stationary base frame, a screen body carried by said base frame, means connected to the under side of said screen body substantially midway between the ends and sides thereof for gyrating said screen body in a horizontal plane and a stabilizing device for positively controlling the movement of said screen body so that throughout its extent it is caused to traverse a circular path which is substantially uniform as to shape and dimensions, said device including a pair of arms arranged in end-to-end relation for rocking movement in horizontal planes and which have their outer ends pivotally connected to said base frame, a link connecting the inner ends of said arms and links pivotally connected to said arms intermediate their inner and outer ends and to said screen body at opposite sides of said last named means.

2. A sifter comprising a stationary base frame, a screen body, substructure carried by said base frame and upon which said screen body is mounted, a vertical actuating shaft for gyrating the screen body and substructure assembly in a horizontal plane, a stationary bearing for said actuating shaft, means for mounting said bearing in said base frame, upper and lower eccentrics formed upon said actuating shaft at opposite sides of said stationary bearing, means for connecting the upper eccentric to said assembly below said screen body and substantially midway between the sides and ends thereof and means for connecting the lower eccentric to said assembly in spaced relation with respect to the upper eccentric, whereby to reinforce the assembly against rocking in a vertical plane.

3. A sifter comprising a stationary base frame, a screen body, substructure carried by said base frame and upon which said screen body is mounted, a vertical actuating shaft mounted in said base frame for gyrating the screen body and substructure assembly in a horizontal plane, upper and lower eccentrics formed upon said actuating shaft, the upper eccentric being connected to said assembly below said screen body and substantially midway between the ends and sides thereof and a stabilizing device for positively controlling the movement of said assembly so that throughout its extent said screen body is caused to traverse a circular path which is substantially uniform as to shape and dimensions, said device including a pair of arms which are arranged in

end-to-end relation for rocking movements in horizontal planes and which have their outer ends pivotally connected to said base frame, a link connecting the inner ends of said arms and links pivotally connected to said arms intermediate their inner and outer ends and to said assembly at opposite sides of said actuating shaft, the lower eccentric being connected to said assembly in spaced relation with respect to the upper eccentric and cooperating with the latter to reinforce said assembly against rocking in a vertical plane.

4. A sifter comprising a stationary base frame, a screen body, substructure upon which said screen body is mounted, rods carried by said base frame and upon which said substructure is suspended, a vertical actuating shaft for gyrating the screen body and substructure assembly in a horizontal plane, a stationary bearing for said actuating shaft, means for mounting said bearing in said base frame, upper and lower eccentrics on said actuating shaft at opposite sides of said stationary bearing, the upper eccentric being connected to said assembly below said screen body and substantially midway between the ends and sides thereof and stabilizing means for controlling the movement of said assembly so that throughout its extent said screen body is caused to traverse a circular path which is substantially uniform as to shape and dimensions, the lower eccentric being connected to said assembly in spaced relation with respect to the upper eccentric and cooperating with the latter to reinforce the assembly against rocking in a vertical plane.

5. A sifter comprising a stationary base frame, screen body, substructure upon which said screen body is mounted, rods carried by said base frame and upon which said substructure is suspended, a vertical actuating shaft in said base frame for gyrating the screen body and substructure assembly in a horizontal plane, upper and lower eccentrics on said actuating shaft, the upper eccentric being connected to said assembly below said screen body and substantially midway between the ends and sides thereof and stabilizing means connected to said base frame and to said assembly at opposite sides of said actuating shaft for positively controlling the movement of said assembly so that throughout its extent said screen body is caused to traverse a circular path which is substantially uniform as to shape and dimensions, the lower eccentric being connected to said assembly in spaced relation with respect to the upper eccentric and cooperating with the latter to reinforce the assembly against rocking in a vertical plane.

6. A sifter comprising a stationary base frame, a screen body, substructure upon which said screen body is mounted, rods carried by said base frame and upon which said substructure is suspended, a vertical actuating shaft mounted in said base frame for gyrating the screen body and substructure assembly in a horizontal plane, upper and lower eccentrics on said actuating shaft, the upper eccentric being connected to said assembly below said screen body and substantially midway between the ends and sides thereof and a stabilizing device for positively controlling the movement of said assembly so that throughout its extent said screen body is caused to traverse a circular path which is substantially uniform as to shape and dimensions, said device including a pair of arms which are arranged end-to-end and which are pivotally mounted for rocking movements in horizontal planes, links pivotally connected to said arms intermediate their ends and means connecting the adjacent ends of said arms, said device having pivotal connections with said base frame and being pivotally connected to said assembly at opposite sides of said actuating shaft, the lower eccentric being connected to said assembly in spaced relation with respect to the upper eccentric and cooperating with the latter to reinforce said assembly against rocking in a vertical plane.

7. A sifter comprising a stationary base frame, a screen body, substructure upon which said screen body is mounted, rods carried by said base frame and upon which said substructure is suspended, a vertical actuating shaft mounted in said base frame for gyrating the screen body and substructure assembly in a horizontal plane, upper and lower eccentrics on said actuating shaft, the upper eccentric being connected to said assembly substantially at the center of gravity, the weight and distribution of weight of said substructure being predetermined to lower said center of gravity to a point in the vicinity of the bottom of said screen body and stabilizing means for controlling the movement of said assembly so that throughout its extent said screen body is caused to traverse a circular path which is substantially uniform as to shape and dimensions, the lower eccentric being connected to said assembly in spaced relation with respect to the upper eccentric and cooperating with the latter to reinforce the assembly against rocking in a vertical plane.

8. A sifter comprising a stationary base frame, a screen body, substructure upon which said screen body is mounted, said substructure including depending legs, the lower ends of which carry a horizontal bridge-piece, rods carried by said stationary frame and upon which said substructure is suspended, a vertical actuating shaft mounted in said base frame for gyrating the screen body and substructure assembly in a horizontal plane, upper and lower eccentrics on said actuating shaft, the upper eccentric being connected to said assembly below said screen body and substantially midway between the ends and sides thereof and stabilizing means for controlling the movement of said assembly so that throughout its extent said screen body is caused to traverse a circular path which is substantially uniform as to shape and dimensions, the lower eccentric being connected to said bridge-piece and cooperating with the upper eccentric to reinforce the assembly against rocking in a vertical plane.

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