Nov. 3, 1953 W. C. CONKLING 2,657,582

MECHANISM FOR PRODUCING GYRATORY MOTION

Filed Sept. 27, 1950 2 Sheets-Sheet 1

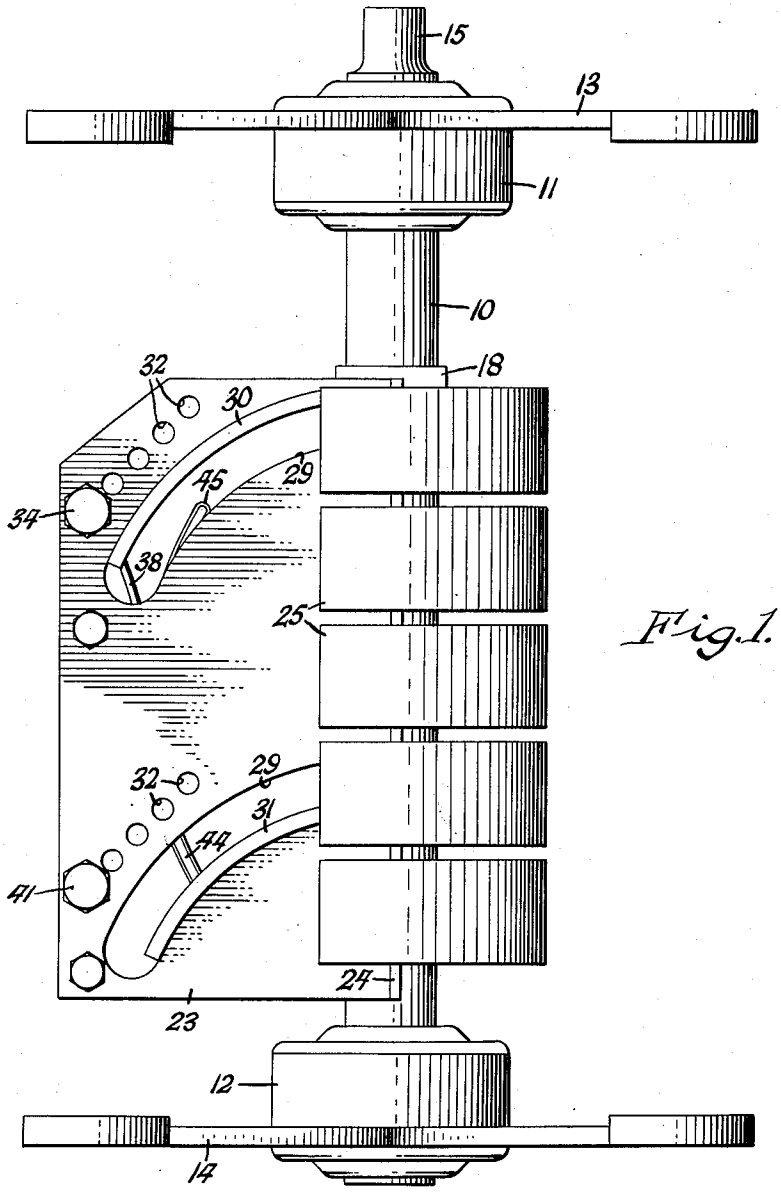


Fig. 1.

INVENTOR.
William C. Conkling
BY
Popp and Sommer
ATTORNEYS.

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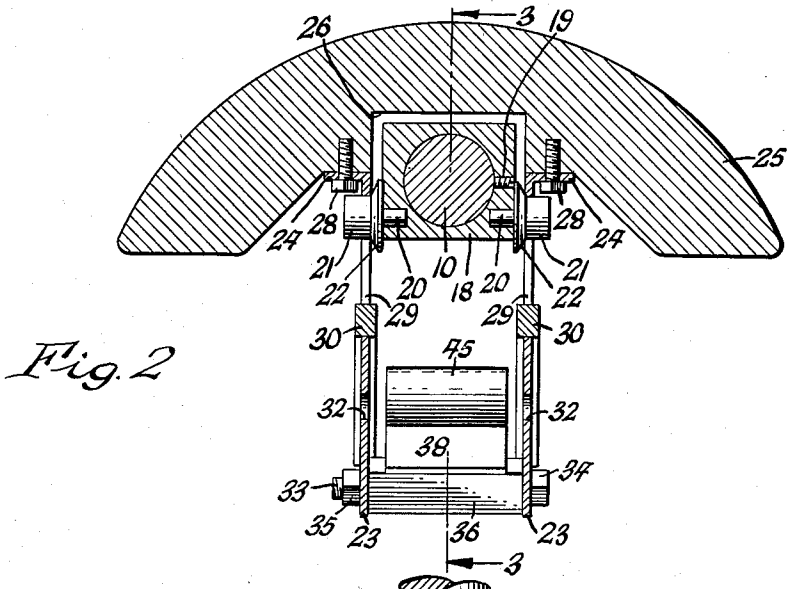


Fig. 2

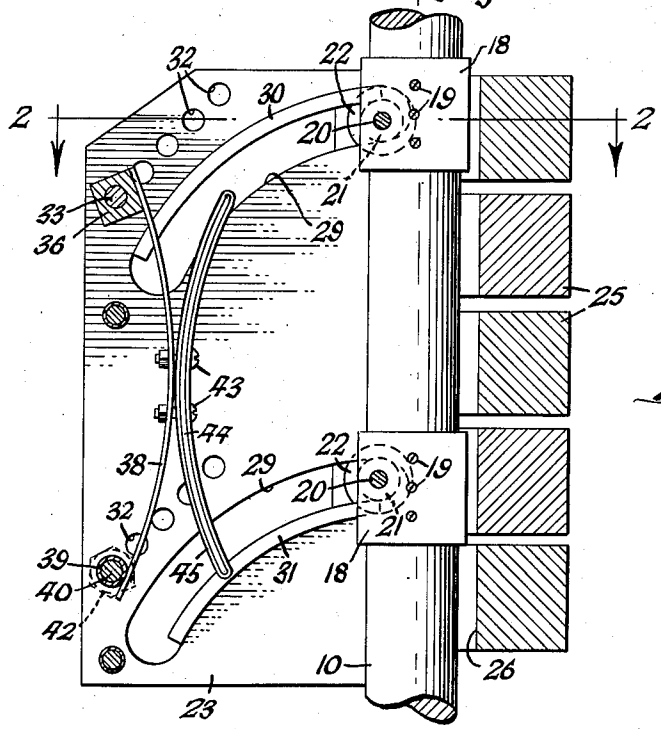


Fig. 3.

INVENTOR.
William C. Conkling
BY
Popp and Sommer
ATTORNEYS.

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MECHANISM FOR PRODUCING GYRATORY MOTION

William C. Conkling, Lockport, N. Y., assignor to Richmond Manufacturing Company, Lockport, N. Y., a corporation of New York

Application September 27, 1950, Serial No. 186,958

9 Claims. (Cl. 74—87)

1

This invention relates to a mechanism for producing gyratory motion, such as for gyrating the sifter shown in my copending application Serial No. 186,959, filed September 27, 1950, for Device for Clamping Screen Frames in Sifters although the invention can be employed wherever gyratory movement in a horizontal plane is desired.

One of the principal objects of the invention is to provide an extremely simple and low cost eccentric weight type of mechanism for producing gyratory motion which on starting produces small circles of gyration which increase in size until running speed is reached when circles of the desired amplitude are produced and which on stopping progressively decreases the amplitude of the circles until the mechanism comes to rest.

Another object is to achieve such action on starting and stopping as a function of gravity thereby to avoid sliding parts and return springs which are subject to fouling with flour dust.

Another object is to provide such a mechanism which is conveniently adjustable to produce circles of different sizes at running speed.

Another object is to provide such a mechanism which is fully cushioned, particularly on starting and stopping, and is free from destructive escaping vibrations while running, starting or stopping.

Another object is to provide such a mechanism which is adaptable to large sifters carrying heavy loads and to the space requirements imposed on such sifters.

Another object is to provide such a mechanism which can be driven from a motor on the sifter, from a belt running to the sifter or from a direct drive shaft above or below the sifter.

Another object is to provide such a mechanism which is simple and inexpensive in construction, reliable in operation, and which will stand up under conditions of severe and constant use without getting out of order or requiring repairs.

Another object is to provide such a mechanism which is free from friction.

Other objects and advantages of the invention will be apparent from the following description and drawings in which

Fig. 1 is a side elevational view of a mechanism embodying the present invention for gyrating a sifter, a part of the frame of which is illustrated. The mechanism is shown in its static state.

Fig. 2 is a horizontal section taken generally on line 2—2, Fig. 3.

2

Fig. 3 is a vertical longitudinal section taken generally on line 3—3, Fig. 2.

The mechanism embodying the present invention for producing gyratory motion in a horizontal plane is shown as comprising a vertical shaft 10 suitably journalled at its upper and lower ends in bearings 11 and 12 one or both of which can be thrust bearings to support the shaft. The upper bearing 11 is shown as being part of an upper spider 13 and the lower bearing 12 is shown as being part of a lower spider 14. These spiders can form part of the central frame structure of a high speed gyratory sifter, but since this frame structure forms no part of the present invention it is not illustrated in further detail.

The vertical shaft 10 can be rotated in any suitable manner and for this purpose can be provided at its top or bottom with a projecting end 15. This projecting end can be driven by an electric motor (not shown) mounted on the spider 13; a belt and pulley drive (not shown); or a vertical drive shaft (not shown) having a universal and directly connected with the shaft end 15.

Between the bearings 11 and 12 the vertical shaft 10 carries a pair of spaced rectangular blocks 18 the vertical faces of which are parallel with the axis of the shaft 10 and these blocks being preferably secured to the shaft 10 by set screws 19. Each block 18 also has a pair of pins 20 projecting horizontally from opposite sides thereof, the four pins 20 being parallel and in vertical alinement with each other. A roller 21 is journalled on each of these pins, preferably by roller bearings to reduce friction, and each roller is preferably radially flanged, as indicated at 22, on one side.

The blocks 18 are flanked by vertical plates 23 each having a vertical flange 24 along the vertical edge nearest the shaft 10 when the mechanism is at rest as shown in the drawings. These vertical flanges 24 project outwardly or away from each other and are secured together by a vertical gang of weights 25. The purpose of the flanges 22 of the rollers 21 is to restrain the plate and weight assembly from cocking and to space the plates 23 from the blocks 18. These weights are preferably made of roughly cast iron of C-shaped form in horizontal section each being idented, indicated at 26, so that the corresponding weights fit around the blocks 18, and each weight being secured to the flanges 24 by screws 28. As shown, these weights 25 are in a vertical gang, a column of four weights being

shown. It will therefore be seen that this gang of weights 25 is, in effect, a vertically elongated weight.

Each plate 23 is provided with upper and lower arcuate slots 29 which are arranged to receive the rollers 21 and which curve downwardly away from the vertical shaft 10. The upper or working edge of each of the upper slots has welded thereto an arcuate hardened rail 30. Each of the lower slots 29 also has welded thereto an arcuate hardened rail 31. The reason for the arrangement of the hardened rails 30 along the top edges of the upper arcuate slots 29 and of the hardened rails 31 along the lower edges of the lower arcuate slots 29 is that the gang of weights tend to tip in a corresponding direction and hence establish these rails as the working surfaces.

Each plate 23 is also provided with an upper and a lower series of holes 32 extending toward the shaft 10, each hole of the upper series being preferably in vertical alinement with a corresponding hole of the lower series and the holes of the two plates 23 alining horizontally with one another. The series of holes 32 are preferably, but not necessarily, arranged at an angle inclined to conform to the arcuate slots 29.

A removable pin 33 extends through a corresponding pair of the upper series of holes 32 in the two plates 23 and can be moved to extend through any pair of these holes thereby to adjust the position of this pin with reference to the gang of weights 25. For this purpose the pin 33 is preferably in the form of a bolt having a head 34 at one end and a nut 35 at its opposite end so that it can readily be pulled out from one pair of the two upper series of holes 32 and replaced in another of these pairs of holes.

This pin 33 carries, between the plates 23, a square block 36 to one face of which the upper end of a leaf spring 38 is secured. This leaf spring hangs from this block and preferably arches toward the vertical shaft 10. At its lower end this spring bears against a roller 39 on a pin 40 extending through a corresponding hole 32 of the lower series of these holes. This pin 40 is also replaceable in any pair of holes 32 of the lower series in the two plates 23 and hence is preferably in the form of a bolt having a head 41 at one end and a nut 42 at its opposite end so that it can be readily pulled out from one pair of the two lower series of holes 32 and replaced in another of these pair of holes.

Secured, as by bolts 43, to the center of the leaf spring 38 is a second vertically arranged arched leaf spring 44 which, however, bows oppositely to the leaf spring 38 so that its ends project toward the gang of weights 25. This last arched leaf spring 44 is preferably faced with leather 45 and its ends are arranged to engage the blocks 18.

The mechanism is particularly designed for a high speed gyratory sifter to be driven at from, say, 180 to 300 revolutions per minute with from say, 2 to 4 inch circles. With the sifter having, say, a natural frequency of 30 revolutions or pendulum-like gyrations per minute, determined by the effective length of the flexible suspension, until the sifter gets to gyrate above this natural frequency perfect circles are impossible since the natural frequency may be carrying the sifter frame in one direction and the weights 25 in the same direction with a doubled unbalancing force. Accordingly before and after the sifter is running at full speed it is desirable that it describe smaller circles since otherwise there would be excessive escaping vibrations due to the fact that the circles are not perfect.

To accomplish this the center of gravity of the gang of weights 25 is initially arranged near the axis of the vertical shaft 10 which preferably intersects the center of gravity of the sifter. It will be understood, however, that the center of gravity of the gang of weights must initially be slightly on the side of the axis of the shaft 10 remote from the leaf springs 38 and 44. Accordingly as this shaft starts to rotate the weights have relatively small effect in gyrating the sifter and it describes relatively small circles. As the shaft 10 picks up in speed the centrifugal force acting on the weights 25 causes them to move radially outwardly, the rollers 21 riding down the hardened rails 30 and 31 and hence the weights also rising vertically. In this action the gang of weights 25 have a tendency to tip and hence the hardened rail 30 is disposed along the top of its slot 29 while the hardened rail 31 is disposed along the bottom of its slot 29.

As the shaft 10 reaches its maximum speed the rollers 21 approach close to the bottoms of the arcuate slots 29 and the ends of the leather faced leaf spring 44 engage the blocks 18. This causes this spring and its supporting leaf spring 38 to flatten out against the pins 33 and 40, these springs thereby serving as a resilient stop to the outward movement of the gang of weights 25. The springs 38 and 44 so flattened against the pins 33 and 40 act as positive stops which prevent complete bottoming of the rollers 21 in the bottoms of the slots 29. The resiliency provided by these leaf springs prevents jarring of the sifter as it is brought under control to describe running circles of the desired amplitude.

The size of these running circles of gyration can easily be adjusted. Thus the sifter is set to gyrate with circles of maximum amplitude. If smaller circles are desired, the bolts 33 and 40 are removed and replaced in the next higher pair of holes 32, the block 36 and roller 39 being thereby relocated closer to the weights 25. According the leaf springs 38 and 44 are relocated closer to these weights and hence these weights are stopped closer to the axis of the shaft 10 as this shaft reaches full running speed and circles, at running speed, of smaller amplitude result.

It will particularly be noted that these bolts 33 and 40 are readily replaced to secure the desired circular orbit of the sifter. There is no need to jack up the weights 25 or to undertake any other difficult work.

When the driving force is relieved from the vertical shaft 10 it gradually slows down and since decreasing centrifugal force is applied to the weights 25 they gradually lower by gravity, the rollers 21 riding up the arcuate slots 29 and the gang of weights coming closer to the axis of the shaft 10 as the sifter comes to rest. Accordingly as the rate of gyration of the sifter falls below the natural frequency thereof the size of the circles generated is small and the unbalance of the forces do not set up a pronounced walking or cradling action of the sifter.

In the action of the sifter, the shape of the arcuate slots 29 is important. Thus, it will be noted that the slope of the rails of each of these slots increases toward its lower end. Accordingly as a result of the action of the inclined rails on the rollers there is a restraining horizontal force to the movement of the gang of

weights **25** which increases with the movement of the weights from the axis of the shaft **10**. This is desirable as the centrifugal force of the gang of weights is proportional to the length of the radius from the center of the shaft **10** to the center of gravity of the weights **25**. Accordingly it is desirable that the horizontal component due to the action of the rollers in the slots **29** increases at a greater rate than this radius so that there is no tendency for a sudden outward movement of the weights due to the increase in centrifugal force as they move outwardly. Expressed in another way, the form of the rails of the arcuate slots **29** is such that the horizontal force opposing movement of the weight **25** away from the shaft **10** increases at a greater rate than the centrifugal force of the weight increases.

From the foregoing it will be seen that the present invention provides an extremely simple and low cost mechanism for gyrating heavy sifters and the like which is easily adjustable to produce different amplitudes of gyration at running speed, is free from tendency to foul, and accomplishes the many objects enumerated.

I claim:

1. A mechanism for producing gyratory motion, comprising a vertical shaft, a pair of vertical plates flanking said shaft, a vertically elongated weight connecting said plates and arranged adjacent said shaft in the static condition of the mechanism, means for guiding said plates to cause an upward movement of said weight away from said shaft, and a stop interposed between said plates on the side of said shaft opposite from said weight and arranged to limit the horizontal movement of said weight away from said shaft.

2. A mechanism for producing gyratory motion, comprising a vertical shaft, a pair of vertical plates flanking said shaft, a vertically elongated weight connecting said plates and arranged adjacent said shaft in the static condition of the mechanism, means for guiding said plates to cause an upward movement of said weight away from said shaft, and a stop resiliently mounted on said plates and interposed therebetween and coacting with said shaft to limit the horizontal movement of said weight away from said shaft.

3. A mechanism for producing gyratory motion, comprising a vertical shaft, a pair of vertical plates flanking said shaft, a vertically elongated weight connecting said plates and arranged adjacent said shaft in the static condition of the mechanism, means for guiding said plates to cause an upward movement of said weight away from said shaft, a stop interposed between said plates on the side of said shaft opposite from said weight and arranged to limit the horizontal movement of said weight away from said shaft, and means for shifting said stop horizontally along said plates toward and from said weight.

4. A mechanism for producing gyratory motion, comprising a vertical shaft, a pair of vertical plates flanking said shaft, a vertically elongated weight connecting said plates and arranged adjacent said shaft in the static condition of the mechanism, means for guiding said plates to cause an upward movement of said weight away from said shaft, a stop resiliently mounted on said plates and interposed therebetween and coacting with said shaft to limit the horizontal movement of said weight away from said shaft, and means for shifting said stop horizontally along said plates toward and from said weight.

5. A mechanism for producing gyratory motion, comprising a vertical shaft, a pair of vertical plates flanking said shaft, a vertically elongated weight connecting said plates and arranged adjacent said shaft in the static condition of the mechanism, means for guiding said plates to cause an upward movement of said weight away from said shaft, a cross bolt insertable through registering holes through said plates of a series of holes extending horizontally toward said shaft from the side thereof opposite said weight, and a stop on said cross bolt between said plates and coacting with said shaft to limit the horizontal movement of said weight away from said shaft.

6. A mechanism for producing gyratory motion, comprising a vertical shaft, a pair of vertical plates flanking said shaft, a vertically elongated weight connecting said plates and arranged adjacent said shaft in the static condition of the mechanism, means for guiding said plates to cause an upward movement of said weight away from said shaft, comprising a pair of vertically spaced blocks fast to said shaft, a pair of coaxial rollers projecting in opposite directions from each of said blocks with their axes arranged perpendicularly to said plates and each roller riding in an inclined guideway provided in the adjacent part of the corresponding plate, said guideways being generally parallel with one another, a pair of resilient stops interposed between said plates on the side of said shaft opposite from said weight and each arranged to engage a corresponding one of said blocks to limit the horizontal movement of said weight away from said shaft, and means for shifting each of said stops horizontally along said plates toward and from said weight.

7. A mechanism for producing gyratory motion, comprising a vertical shaft, a pair of vertical plates flanking said shaft, a vertically elongated weight connecting said plates and arranged adjacent said shaft in the static condition of the mechanism, means for guiding said plates to cause an upward movement of said weight away from said shaft, comprising a pair of vertically spaced blocks fast to said shaft, a pair of coaxial rollers projecting in opposite directions from each of said blocks with their axes arranged perpendicularly to said plates and each roller riding in an inclined guideway provided in the adjacent part of the corresponding plate, said guideways being generally parallel with one another, a leaf spring interposed between said plates on the side of said shaft opposite from said weight and having its opposite ends arranged to engage said blocks to limit the horizontal movement of said weight away from said shaft, and means for shifting said leaf spring horizontally along said plates toward and from said weight.

8. A mechanism for producing gyratory motion, comprising a vertical shaft, a pair of vertical plates flanking said shaft, a vertically elongated weight connecting said plates and arranged adjacent said shaft in the static condition of the mechanism, means for guiding said plates to cause an upward movement of said weight away from said shaft, comprising a pair of vertically spaced blocks fast to said shaft, a pair of coaxial rollers projecting in opposite directions from each of said blocks with their axes arranged perpendicularly to said plates and each roller riding in an inclined guideway provided in the adjacent part of the corresponding plate, said guideways being generally parallel with one another, a vertical leaf spring interposed between said plates

on the side of said shaft opposite from said weight, a bolt securing one end of said leaf spring to said plates and insertable in registering pairs of holes through said plates of a series extending horizontally toward said shaft, a backing bolt engaging the other end of said leaf spring and insertable in registering pairs of holes through said plates of a series extending horizontally toward said shaft, and a second leaf spring secured at its central part to the central part of said first leaf spring, the ends of said second leaf spring being engageable with said blocks to limit the outward movement of said weight relative to said shaft.

9. A mechanism for producing gyratory motion, comprising a vertical shaft, a pair of vertical plates flanking said shaft, a vertically elongated weight connecting said plates and arranged with its center of gravity on one side of said shaft at all times and adjacent the shaft in the static condition of the mechanism, and means permitting said weight and plates to move translationally as a unitary structure transversely of said shaft whereby the horizontal force opposing movement of said weight away from said shaft

increases at a greater rate than its centrifugal force increases, comprising a guide slot and roller connection between the upper end of each of said plates and said shaft, and a second guide slot and roller connection between the lower end of each of said plates and said shaft, each of said guide slots being arcuate and of substantially identical form with its lower end arranged remote from said weight and its upper end arranged adjacent said weight and having a slope, relative to the horizontal, which progressively decreases from its lower end to its upper end, the major portion of said guide slots, in the static condition of the mechanism, being disposed on the side of said shaft opposite from said one side thereof.

WILLIAM C. CONKLING.

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