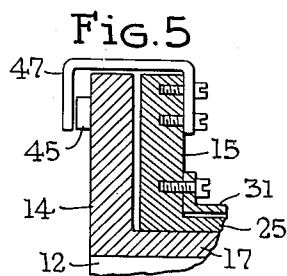
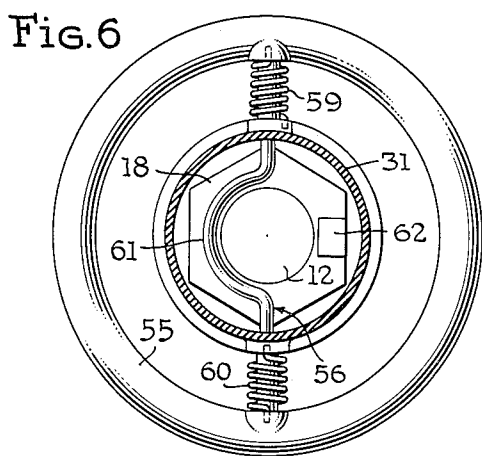
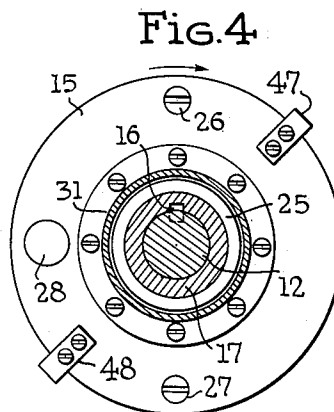
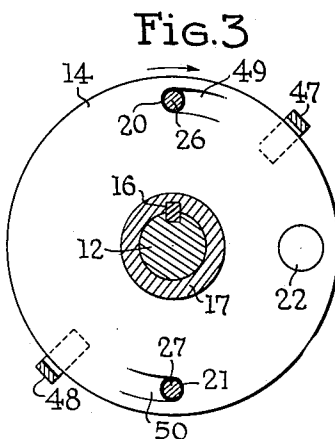
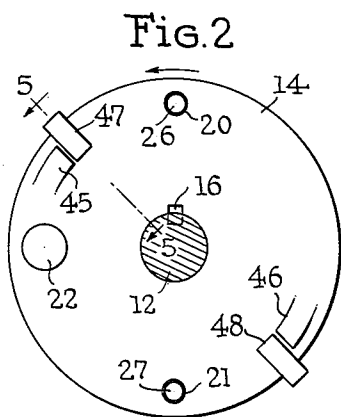
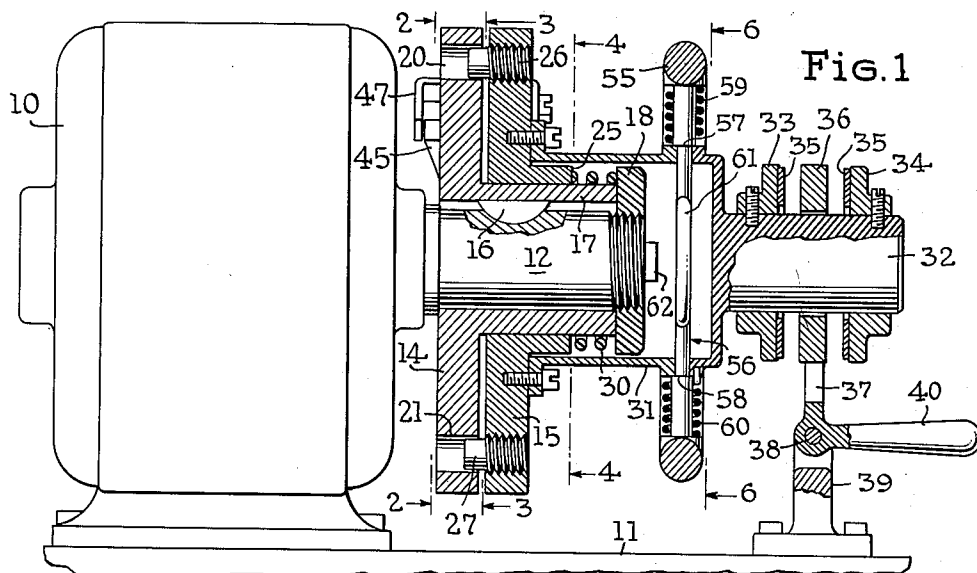


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B. A. GALBRAITH
VIBRATING MECHANISM

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VIBRATING MECHANISM

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This invention relates to vibrating apparatus, and more particularly to an improved wobble mechanism for oscillating or vibrating machinery, said mechanism being instantly controllable to full-on and to full-off vibrating condition. The improvements disclosed and claimed herein relate to apparatus of the general character shown in my Patent No. 2,677,967, issued on May 11, 1954.

Mechanisms for vibrating shaker screens, feeders, conveyors, sifters, mixers, and the like are well known. Conventional mechanisms for such purposes include a driven shaft turning an off-center mass. Some conventional mechanisms provide for adjusting the amount of eccentricity of the off-center mass in order to vary the magnitude of the oscillating forces produced. It is desirable in certain types of apparatus to provide mechanisms for instantly initiating and for instantly stopping the vibratory action. It is also desirable to provide mechanisms having no off-center loading while the driving shaft is being brought up to its normal speed of rotation, in order to reduce the starting load on the source of driving power. It is likewise desirable in certain installations to automatically balance the unbalanced loading of the vibratory mechanism in the event of failure of the source of driving power.

It is an object of my present invention to provide an improved rotary vibrator mechanism in which the vibratory forces produced may be positively and instantly started and may be positively and instantly stopped without materially altering the speed of rotation of the driving shaft.

It is another object of my invention to provide an improved rotary vibrator mechanism driven by an electric motor and controllable so that the motor is brought up to operating speed under no vibratory load, and so that the vibratory load is applied to the drive motor only while the motor is operating at substantially normal speed.

It is another object of my invention to provide an improved rotary vibrator having cam means to bring about a positive locking engagement between two unbalanced members rotating at nearly the same speed.

It is another object of my invention to provide an improved rotary vibrator utilizing a braking action to retard the rotation of one of two unbalanced rotating members when said members are momentarily disengaged one from the other while changing from full vibration to no vibration, and vice-versa.

It is another object of my invention to provide an improved rotary vibrator having an automatic control mechanism which shifts the vibrator from a full vibration to a no vibration state in the event of a power failure causing the driving shaft to substantially decrease its speed of rotation.

Other objects and advantages of this invention will be readily apparent to those skilled in this art after an examination of the following description of the embodiment illustrated in the accompanying drawings, wherein:

Figure 1 is an axial section view partly in elevation and partly cut away of the improved vibratory mechanism;

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Figure 2 is a cross section view taken on line 2-2 of Figure 1, and looking toward the right end of the Figure 1 mechanism;

Figure 3 is a cross section view taken on line 3-3 of Figure 1, and looking toward the left end of the Figure 1 mechanism;

Figure 4 is a cross section view taken on line 4-4 of Figure 1, still looking toward the left end;

Figure 5 is a fragmentary cross section view taken on line 5-5 of Figure 2; and

Figure 6 is a cross section view taken on line 6-6 of Figure 1, again looking toward the left end.

Referring to Figure 1, for the purposes of illustration, the vibratory mechanism includes an electric motor 10 rigidly secured to an apparatus to be vibrated, said apparatus being only partly indicated by the numeral 11. The mechanism includes a rotary shaft 12 extending from the motor 10, and includes rotary members or discs 14 and 15 mounted on the shaft 12. In the mechanism illustrated, the motor 10 drives the shaft 12 in a counterclockwise direction as one views the left end of the device (see Figure 2). The rotary member 14 is rigidly secured to the shaft 12 for rotation thereby, and for this purpose a conventional drive key 16 is shown. The disc or member 14 may be provided with an elongated hub 17, and a nut 18 may be threaded on the end of the shaft 12 to engage the end of hub 17 for securing the member 14 on the shaft.

The member 14 is provided near its periphery with two apertures 20 and 21 equal radial distances from the center of the member and spaced 180° apart, as shown in Figures 1 and 2. The member 14 is also provided with a relatively heavy insert (mass) 22 secured to or set into one side of the member 14 with the center of gravity of the insert 22 located at 90° from each of said apertures 20 and 21. The second disc or rotary member 15 is provided with a hub 25 journaled and slidable on the hub 17 of member 14. The member 15 is provided near its periphery with two pins 26 and 27 projecting axially from the face of the member and positioned equal distances radially from the center of the disc and also spaced 180° apart, as shown in Figures 3 and 4. The pins 26 and 27 are thus mounted on member 15 so as to project into the apertures 20 and 21 of member 14. The pins and apertures serve as locking means to lock member 15 to member 14 for rotation therewith. The pins 26 and 27 are engaged by the side walls of the apertures 20 and 21 to provide a driving connection, and it is obvious that various other equivalent forms of abutments and abutting or engaging members may be substituted for the locking means illustrated. The member 15 is also provided with a relatively heavy insert (mass) 28 secured to or set into one side of the member 15 with the center of gravity of the insert 28 located at 90° from each of said pins 26 and 27. The masses and positions of inserts 22 and 28 are such that when the members 14 and 15 are connected together by pins 26 and 27 entered in apertures 20 and 21 with the inserts 22 and 28 diametrically opposite, the connected members provide a balanced rotatable assembly which, when rotated by the drive shaft 12, produces substantially no vibration or wobble. A compression spring 30 may be provided on the end of hub 17 between the nut 18 and the end of hub 25 to bias the member 15 toward the member 14.

A control member 31 is secured to and rotates with member 15, and may be of modified cup-shape enclosing the end of shaft 12. The outer end of member 31 is provided with a stub shaft 32. A pair of spaced collars 33 and 34 are securely mounted on the shaft 32 with set screws or the like to rotate the collars with the shaft. The opposed faces of collars 33 and 34 may be provided with annular friction material 35 such as brake lining

material. A ring 36 carried by a yoke 37 is positioned between and normally spaced from the lined faces of collars 33 and 34. Collar 33 is spaced far enough from the normal position of the ring 36 to allow the locking pins 26 and 27 to be withdrawn from the apertures 20 and 21 before the brake lining 35 on collar 33 engages the ring 36. The yoke 37 is pivotally mounted at 38 on the fixed base 39 and is provided with an operating handle 40. Movement of handle 40 downward moves the ring 36 to the right in Figure 1 so that it engages material 35 on collar 34, and further downward movement results in moving the shaft 32 and control member 31 to the right in Figure 1. Since member 31 is secured to member 15, the latter is also shifted to the right on sleeve 17 and the pins 26 and 27 are withdrawn from the apertures 20 and 21. The fact that ring 36 is held against rotation by yoke 37 causes rotation of member 15 with control member 31 and shaft 32 to be slightly slowed or retarded with respect to the rotation of drive member 14.

Means are provided for causing the withdrawn pins 26 and 27 to enter the apertures 21 and 20 after the member 15 has been retarded one-half a revolution from its initial position relating to member 14 after the operation of handle 40. Such means are illustrated in the form of a pair of cam surfaces 45 and 46 on the face of member 14, shown in Figures 1, 2 and 5. The cam surfaces 45 and 46 are equal radial distances from the center of member 14 and are diametrically opposite one another. Cam followers in the form of arm members 47 and 48 are rigidly secured to and carried by the disc member 15. The arms 47 and 48 each have a leg portion secured to the surface of member 15 by screws as shown in Figures 4 and 5, and each includes a central portion extending across the periphery of members 14 and 15, and a flange portion for engagement with the cams 45 and 46. The arm members 47 and 48 are mounted diametrically opposite one another, and are positioned on member 15 so that the flange cam follower portions of the arm members engage the cams 45 and 46 to positively move member 15 axially toward member 14 as the members 14 and 15 approach a locked-together relation. As illustrated in Figure 3, the surface of disc member 14 may be provided with grooves 49 and 50 leading into the apertures 20 and 21. When the disc member 15 slips behind the rotation of disc member 14, the arms 47 and 48 engage the cams 45 and 46 to pull the disc members 14 and 15 back into locked engagement as the relative slippage approaches 180°. As the disc members are pulled together, the locking pins 26 and 27 enter the grooves 49 and 50 in disc member 14, and the pins then positively seat in the apertures 20 and 21 locking the members together. The location of the cams and cam follower surfaces is such that they are not engaged when the pins 26 and 27 are seated in apertures 20 and 21, and thus the members 14 and 15 may be drawn apart when it is desired to shift their relative positions another 180°.

Means are also provided for shifting the disc members 14 and 15 to the no vibration balanced relation automatically in the event that the drive motor slows down because of power failure or the like. Said automatic means includes a governor assembly in the form of a ring 55 mounted by a cross member 56, shown best in Figure 6. The ring 55 is external to the control member 31, and the cross member 56 is provided with shoulders 57 and 58 for pivotally mounting the ring on the member 31. Torsion springs 59 and 60, having ends secured to the ring 55 and to the control member 31, bias the ring to a position in a plane at an angle to the plane that is perpendicular to the axis of shaft 12 when the device is at a standstill or is rotating at substantially less than normal speed. The cross member 56 includes an offset central portion 61 in the plane of the ring 55 and engageable with a cam or projection 62 carried by the nut 18 on the end of shaft 12. The location of the projection 62 is such that

it will be engaged by the offset 61 if the speed of rotation decreases enough to allow the springs 59 and 60 to turn the ring 55 to a position at an angle to the axis of the shaft 12 and if the members 14 and 15 are locked together in the full vibration position. Contact of the offset 61 with the projection 62 then causes the control member 31 and disc member 15 to be shifted away from disc member 14 enough to disengage the pins from the apertures and thereby shift to the no vibration relationship of disc members. The ring 55 and its associated parts thus operates as an automatic control to shift the mechanism to the no vibration position if and when the drive motor 10 slows down due to power failure. When the electric power returns, the mechanism is easily brought up to its normal speed of rotation in the no vibration condition. Excess starting loads on the motor are thereby avoided.

The operation of the mechanism illustrated will be readily apparent from the foregoing description. Briefly summarizing the operation, the construction permits the drive motor 10 to be started and brought up to full speed without any off-center loading and thus in a fully balanced condition. When it is desired to operate with full vibration or wobble, the control 40 is momentarily depressed to withdraw the locking pins 26 and 27 from apertures 20 and 21. As the disc member 15 slips 180° relative to disc member 14, by virtue of the slowing effect of lining 35, the cams 45 and 46 engage the arms 47 and 48 to positively pull the member 15 toward the member 14. The pins 26 and 27 are thus caused to reseat in the apertures 20 and 21, but in a position 180° displaced from the starting no vibration condition. The new position is the full vibration position with inserts 22 and 28 adjacent one to the other, resulting in full unbalance of the assembly. When it is desired to shift from the full vibration condition to the no vibration condition, another downward movement of the control 40 again separates the disc member 15 from disc member 14 and causes the member 15 to slip half a revolution and positively re-engage the member 14 in the no vibration condition. The control 40 may be solenoid-operated for remote electric control.

The automatic operation upon power failure or turning off the motor, results from a reduction in motor speed permitting the ring 55 to be turned by springs to an angular position in which the offset 61 engages the projection 62 only if the mechanism happens to be in the full vibration position. Such engagement causes the mechanism to shift automatically to the no vibration position in which weights 22 and 28 are diametrically opposite one another and the assembly balanced. When electric power is resumed the motor 10 comes up to normal speed without the burden of an unbalanced loading.

This invention contemplates the use of various modifications of the constructions illustrated and described herein, as it will be readily apparent that numerous variations and equivalent details are possible and within the scope of the following claims.

I claim:

1. A controllable vibration producing mechanism comprising in combination: a member mountable on a driven shaft for rotation therewith, said member having a mass unbalanced with respect to the axis of rotation of said members; a second member mounted adjacent to said first member for rotation on the same axis of rotation, said second member also having a mass unbalanced with respect to said axis of rotation; locking means carried by one of said members for engagement with the other of said members in only two relative positions of said members, said locking means being movable with respect to and into and out of locking engagement with the other of said members during the rotation of both of said members; control means operable during rotation for momentarily disengaging said locking means, said two relative positions of said members being spaced apart, where-

by in one position the unbalanced mass of one member balances the unbalanced mass of the other member, and in the other position of said members the unbalanced masses are adjacent and combine to produce vibration; and speed responsive means connected to one of said members for rotation therewith, for automatically disengaging said members from an unbalanced relationship whenever the speed of the driven shaft falls below a predetermined minimum.

2. A controllable vibration producing mechanism comprising in combination: a member mountable on a driven shaft for rotation therewith, said member having a mass unbalanced with respect to the axis of rotation of said member; a second member mounted adjacent to said first member for rotation on the same axis of rotation, said second member also having a mass unbalanced with respect to said axis of rotation; locking means carried by one of said members for engagement with the other of said members in only two relative positions of said members, said locking means being movable with respect to and into and out of locking engagement with the other of said members during the rotation of both of said members; control means operable during rotation for momentarily disengaging said locking means; and cam means for causing said members to enter into positive engagement during relative movement between said members of less than 360°, said two relative positions of said members being spaced apart; whereby in one position the unbalanced mass of one member balances the unbalanced mass of the other member, and in the other position of said members the unbalanced masses are adjacent and combine to produce vibration.

3. A controllable vibration producing mechanism comprising in combination: a member mountable on a driven shaft for rotation therewith, said member having a mass unbalanced with respect to the axis of rotation of said member; a second member mounted adjacent to said first member for rotation on the same axis of rotation, said second member also having a mass unbalanced with respect to said axis of rotation; locking means carried by one of said members for engagement with the other of said members in only two relative positions of said members, said locking means being movable with respect to and into and out of locking engagement with the other of said members during the rotation of both of said members; control means operable during rotation for momentarily disengaging said locking means; and brake means for retarding the rotation of one of said members when said members are momentarily disengaged, said two relative positions of said members being spaced apart, whereby in one position the unbalanced mass of one member balances the unbalanced mass of the other member, and in the other position of said members the unbalanced masses are adjacent and combine to produce vibration.

4. A vibration producing mechanism comprising: a member having an unbalanced mass adapted to be rotated by a driven shaft; a second member also having an unbalanced mass mounted adjacent said first member for rotation on the same axis of rotation; locking means carried by one of said members for engagement with the other of said members whereby the members are locked only in balanced or unbalanced relationship; biasing means normally urging said members into locking relationship; means for positively moving said members into and out of locking relationship during the rotation of said members; and speed responsive means for automatically changing said members from an unbalanced to a balanced relationship when the speed of the driven member falls below a predetermined minimum.

5. A vibration producing mechanism comprising: a member having an unbalanced mass adapted to be rotated by a driven shaft; a second member also having an unbalanced mass mounted adjacent said first member for rotation on the same axis of rotation; locking means carried by one of said members for engagement with the

other of said members whereby the members are locked only in balanced or unbalanced relationship; biasing means normally urging said members into locking relationship; means including a brake for moving said members out of locking engagement and braking said second member; cam and cam follower means mounted on said members for positively moving them into locking engagement during relative movement between said members; rotatable speed responsive means for automatically changing said members from an unbalanced to a balanced relationship when the speed of the driven member falls below a predetermined minimum.

6. A vibration producing mechanism comprising: a shaft adapted to be driven by a motor mounted on an object to be vibrated; a disc secured to said shaft for rotation therewith, said disc having a mass unbalanced with respect to the axis of rotation; a second disc rotatably and slidably mounted on said shaft, said second disc also having a mass unbalanced with respect to the axis of rotation; locking means carried by said discs for locking them in a position with the unbalanced masses either adjacent or opposite each other; biasing means for normally urging said discs into locking relationship; means for manually moving said second disc out of locking engagement with said first disc; a brake means for braking the rotation of the disengaged disc; a speed governor carried by said second disc; means actuated by said speed governor to disengage said discs only when they are in unbalanced relationship and the speed of the driven shaft falls below a predetermined minimum; cams attached to one of said discs; and cam followers attached to the other of said discs adapted to engage said cams only when said discs are out of locking engagement and bring said discs into locking engagement.

7. A vibration producing mechanism as defined in claim 1, said speed responsive means comprising: an annular mass pivotally mounted on said second member, the pivotal axis being perpendicular to the axis of rotation; an arm secured to said mass and adapted to engage a projection on the first member only when said members are locked in unbalanced relationship; and a torsion spring normally biasing said arm into engagement with said projection; whereby the members will be disengaged by the force exerted by said arm on said projection when the speed of the drive shaft falls below a predetermined minimum.

8. A vibration producing mechanism as defined in claim 2, said cam means comprising: a pair of cams secured to a radial face of one of said members adjacent the periphery thereof, one of said cams being spaced 180° from the other said cam; and a pair of cam followers secured to the other of said members adjacent the periphery thereof, said cam followers being positioned to engage said cams only when said members are disengaged from locking relationship.

9. A device as defined in claim 3, said brake means comprising: two brake shoe members secured to said second member and each having a friction facing; a yoke interposed between and normally spaced from said brake shoe members; and means for moving said yoke into engagement with said brake shoe members.

10. A vibration producing mechanism comprising: a shaft adapted to be driven by a motor mounted on the object to be vibrated, said shaft having a projection radially offset and extending axially from its free end; a disc secured to said shaft for rotation therewith; a second disc rotatably and slidably mounted on said shaft, each of said discs having a relative heavy mass secured to one side thereof; means defining a pair of openings in the radial face of said first disc adjacent the periphery thereof and spaced 180° apart and 90° from the center of gravity of said mass in said first disc, said disc having arcuate grooves leading into said openings; a pair of axially projecting pins mounted on the radial face of said second disc adjacent the periphery thereof, spaced 180° apart, and 90° from

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said mass in said second disc, said pins being movable with respect to and into and out of locking engagement with said openings; spring means to bias said discs into locking engagement; a pair of cams mounted on a radial face of said first disc adjacent said pair of openings; two cam followers mounted on said second disc spaced 180° apart, said cam followers being positioned to engage said cams only when said discs are disengaged, thereby forcing the discs together into locking relationship in response to relative movement between the discs; two brake shoe members secured to said second disc in spaced relationship and each having a friction facing; a yoke interposed between and normally spaced from said brake shoe members; means for moving said yoke into engaging relationship with one of said brake shoe members thereby disengaging the discs and braking the second disc; an annular mass pivotally mounted on the second disc, the pivotal

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axis being perpendicular to the axis of rotation of the shaft; an arm secured to said mass and adapted to engage said projection on said shaft when the discs are locked in unbalanced relationship; and a torsion spring normally biasing said arm into engagement with said projection whereby the discs will be disengaged by the force exerted by said arm on said projection when the speed of the driven shaft falls below a predetermined minimum.

References Cited in the file of this patent

UNITED STATES PATENTS

1,943,076	Jackson	Jan. 9, 1934
2,063,509	Lacy	Dec. 8, 1936
2,528,620	Stroud	Nov. 7, 1950
2,677,967	Galbraith	May 11, 1954