Dec. 26, 1944. R. L. JOHNSTONE 2,366,033

VIBRATOR

Original Filed Aug. 21, 1942 2 Sheets-Sheet 1

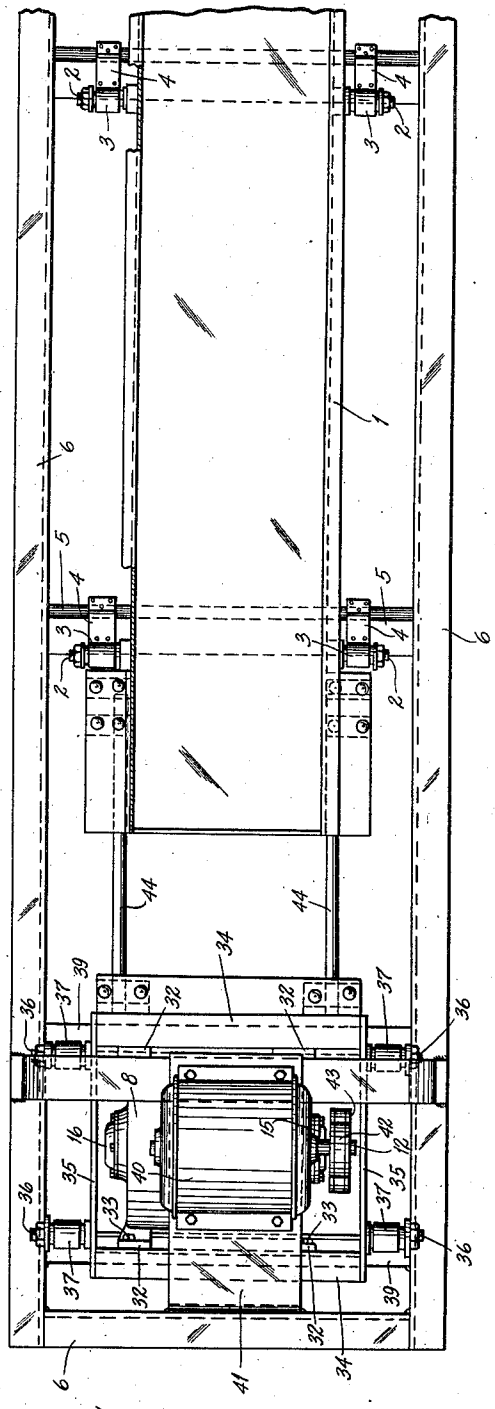

Fig. 1.

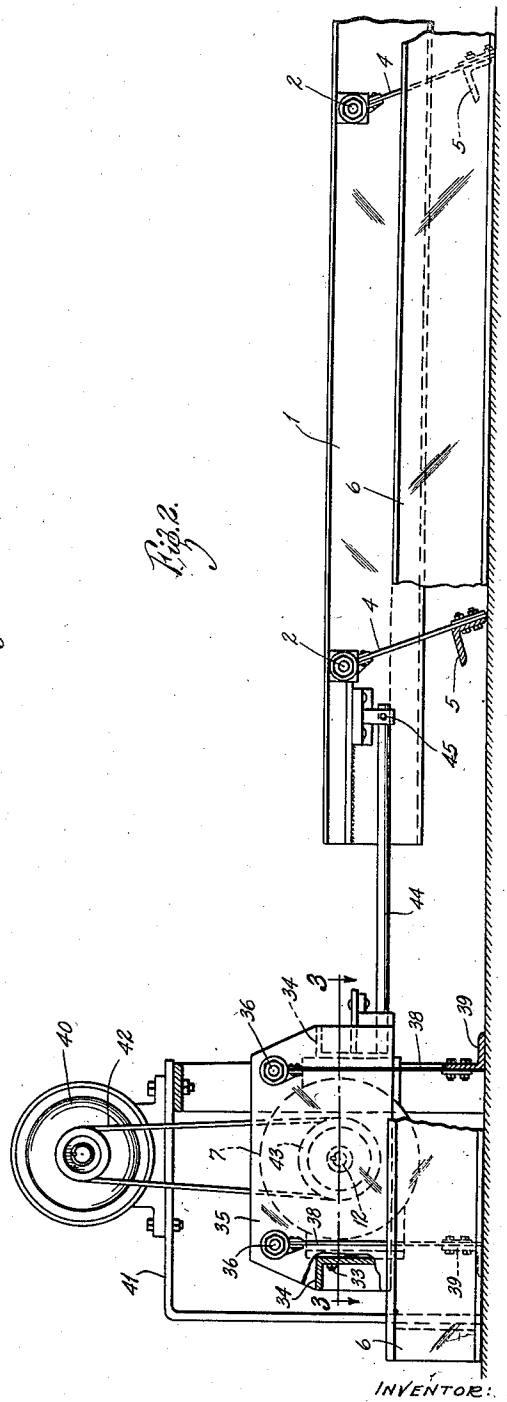

Fig. 2.

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Original Filed Aug. 21, 1942 2 Sheets-Sheet 2

Fig. 3.

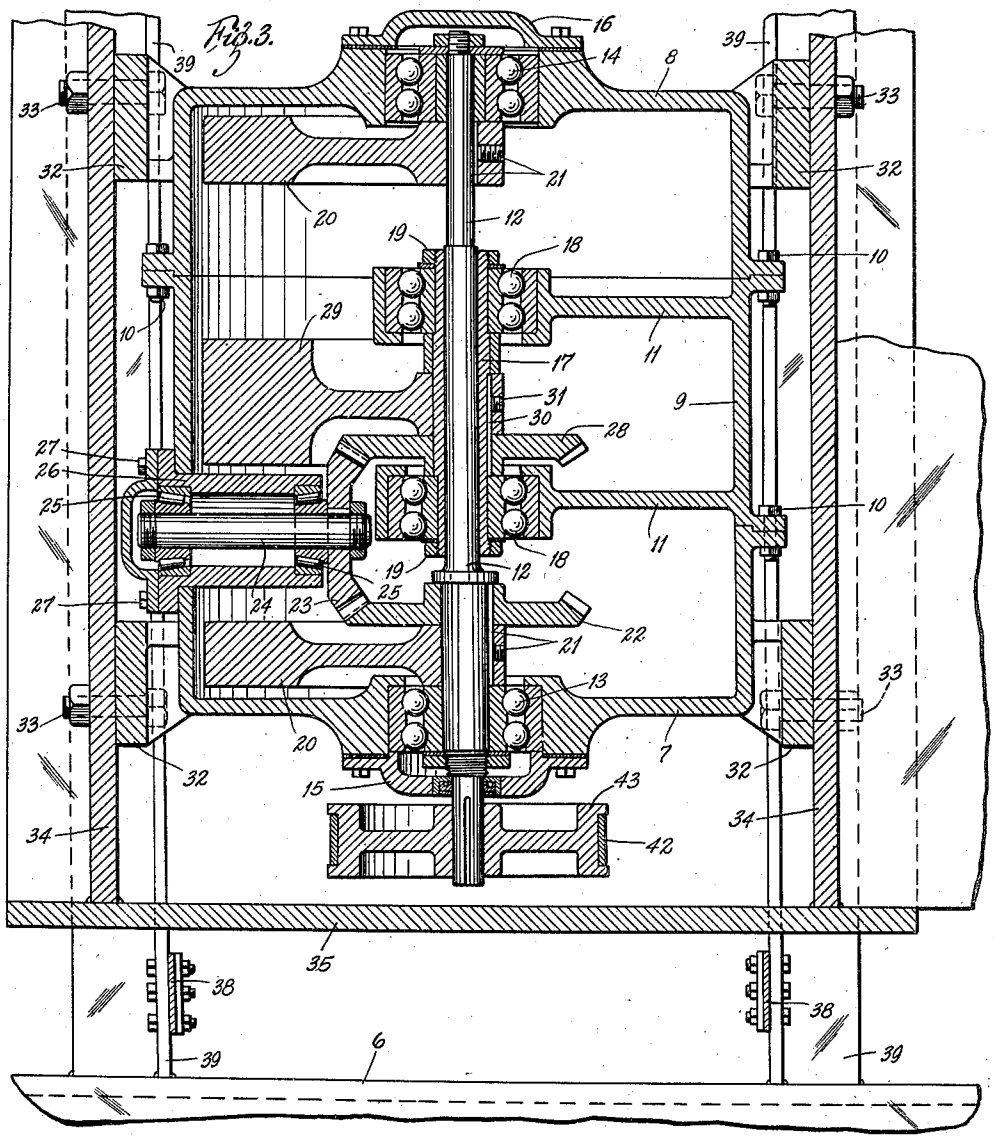
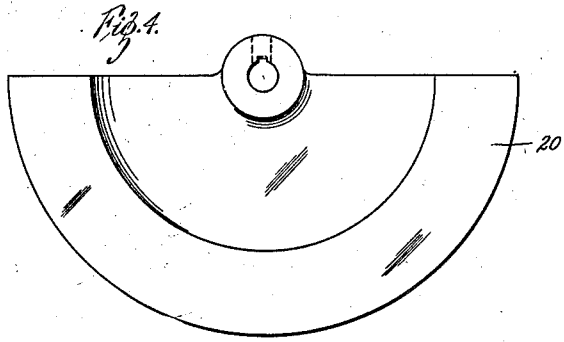


Fig. 4.



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UNITED STATES PATENT OFFICE

2,366,033

VIBRATOR

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Original application August 21, 1942, Serial No. 455,657. Divided and this application January 8, 1943, Serial No. 471,747

8 Claims. (Cl. 74—61)

This invention relates to vibrators for imparting vibratory or reciprocal motion to various types of devices, such as screens for different purposes, feeders, classifiers, conveyors, and other mechanisms.

Objects of the invention are to provide an improved vibrator mechanism for translating a continuous rotary motion into a vibratory or straight line reciprocal motion and imparting said vibratory or straight line reciprocal motion to the operated device such as a screen, etc.; to provide a continuously rotated vibrator mechanism having the weights that effect or create vibration arranged to distribute the forces over a much wider area, approximately 180° more or less, than other types of vibrators now in general use and with which I am familiar; to provide an improved vibrator mechanism having a rotary shaft driven by the motor, in combination with a tubular shaft or sleeve mounted concentrically on said first shaft and having a weight attached thereto between weights that are attached to the driven shaft; to provide a novel system of bearings for supporting the driven shaft and the tubular shaft or sleeve, respectively, so that the weight and forces of each shaft are supported independently of the other shaft, thus relieving each shaft from forces, strains, and stresses of the other shaft; and to provide a novel system of gearing for rotating the tubular shaft or sleeve by the coaxial driven shaft in order to create vibration and distribute the forces over approximately 180° more or less.

Other objects will appear from the following description, reference being made to the annexed drawings, in which—

Fig. 1 is a top plan view of a vibrator and cooperating mechanism constructed and assembled in accordance with the present invention.

Fig. 2 is a side elevation of the vibrator and mechanism shown in Fig. 2, parts being broken away to show other parts in section.

Fig. 3 is an enlarged longitudinal sectional view of the vibrator mechanism on the line 3—3 of Fig. 2.

Fig. 4 is a side elevation of one of the weights showing the relatively wider area thereof for distributing the vibratory forces over approximately 180° more or less.

This is a division of my copending application Serial No. 455,657, filed August 21, 1942, now Patent No. 2,325,248, July 27, 1943, for Vibrator.

The present invention for translating a continuous rotary motion into a vibratory or reciprocal motion, and thereby imparting a vibratory or reciprocal motion to the ultimate device to be operated, is shown assembled and mounted for imparting such motion to a screen or the like. In the embodiment chosen for illustration of the invention, the device 1 to be vibrated is supported by pairs of trunnions 2 having the trunnions of each pair axially alined. While the device 1 is shown in an approximate horizontal position, it is plain that said device may be mounted in a vertical position, or at any angle between horizontal and vertical positions. The trunnions 2 are supported in bearings 3 provided with elastic bushings, as disclosed in my said copending application. The bearings 3 are detachably connected with the upper ends of flat springs 4. The lower ends of said springs are detachably secured to supporting members 5 constituting a part of a rigid frame 6. The inherent resiliency of the flat springs 4 will cooperate with the vibrator or actuating mechanism to move or return the device 1 to an initial or starting position when the actuator or vibrator is stopped. The springs 4 are freely bendable throughout their lengths so that the tendency to crystallize or deteriorate as a result of their bending operations is minimized. Further, the elastic bushings in the bearings 3 additionally reduce the tendency toward deterioration of the springs 4.

The unit of the apparatus for imparting vibratory or reciprocal motion to any device such as the device 1 is shown in Fig. 3 of the drawings. The principal parts of the unit are enclosed in a housing comprising end members 7 and 8 and an intermediate housing member 9. These three housing members are assembled in endwise abutting arrangement and are rigidly secured together by removable and replaceable bolts 10. The intermediate housing member 9 encloses integral webs 11 which are spaced apart about the same distance that separates them from the respective end walls of the housing.

A power-driven shaft 12 is journalled in bearings 13 and 14 in the end housing members 7 and 8, respectively. One end of the shaft 12 projects through an appropriate bushing in a covering cap 15 attached to the end member 7, and the opposite end of said shaft 12 and its bearing 14 are covered and enclosed by a cap 16 detachably secured to the end member 8.

A tubular shaft or sleeve 17 is mounted on and is coaxial with the driven shaft 12. As shown, the shaft or sleeve 17 is much shorter than the shaft 12, leaving the ends of the shaft 12 projecting beyond the shaft 17 and into the bearings 13 and 14. The bushing or sleeve 17 has its ends journalled in bearings 18 mounted in and supported by the two webs 11 in axial alinement with each other and with the bearings 13 and 14. This novel system of bearings supports the driven shaft 12 and the tubular shaft or sleeve 17, respectively, so that the weight and forces of each shaft are supported independently of the other shaft, thus relieving each shaft from forces, strains and stresses of the other shaft. The tubular shaft or sleeve 17 is held from endwise

displacement by nuts 19 attached to the ends thereof and cooperating with the bearings 18 to maintain the parts in proper assembly and prevent displacement. Obviously, the shaft or sleeve 17 may be held in proper position otherwise than by the nuts 19.

Two approximately semi-circular weights 20 are detachably secured to the driven shaft 12 by key and set screw elements 21 or otherwise. Because of the fact that these weights extend through approximately 180° more or less, they distribute the centrifugal forces over a wider area and contribute importantly to a more uniform starting operation and stopping of the entire apparatus without objectionable counter vibratory forces inherent in vibrators that do not embody these features for widely distributing the forces.

A beveled gear 22 is attached to and rotated by the shaft 12 adjacent to one of the weights 20, and meshes with a beveled gear 23 attached to a stud shaft 24 mounted in anti-friction bearings 25. The shaft 24 extends radially of the plane of the shaft 12. The bearings 25 are carried by a removable and replaceable support 26 detachably secured to the housing members 7 and 9 by fasteners 27. In this way, the stud shaft 24 is rotatably supported at right angles to the shaft 12. The gear 23 meshes with a beveled gear 28 attached to the tubular shaft or sleeve 17 between the bearings 18 and adjacent to that one of said bearings 18 beyond which the beveled gear 22 is located. By this arrangement one of the bearings 18 is between the two beveled gears 22 and 28. By this system of gearing, the tubular shaft or sleeve 17 will be constantly rotated by and in the opposite direction from the shaft 12.

A weight 29 is attached to the tubular shaft or sleeve 17 between the bearings 18. The same key 30 that attaches the gear 28 to the shaft 17 may also attach the weight 29 to said shaft and cooperate with the set screw 31 to prevent displacement of the weight. The radial width and the circumferential length of the weight 29 are the same as the radial width and the circumferential length of the weights 20, so that the end areas of all of the weights are approximately uniform. The sum of the two weights 20 is approximately equal to that of the single weight 29. The two end housing members are formed with integral and diametrically opposite pads or feet 32 which are detachably secured by bolts 33 to cross members 34 of a frame which is rigid per se but is supported for vibratory movements. The cross members 34 are rigidly attached to said members 35 having pairs of laterally extended trunnions 36. The two trunnions 36 of each pair are axially alined and are journalled in elastic bearings 37 which may be precisely like the bearings 3 in which the trunnions 2 are journalled. The frame 34—35, and the housing 7—8—9 with its enclosed mechanism, are supported by flat springs 38 having their upper ends attached to the bearings 37 and their lower ends secured to members 39 rigid on the frame 6. Thus, when the shaft 12 is driven to rotate the weights 20 in one direction and the weight 29 in the opposite direction, the entire mechanism is vibrated or reciprocated, and such vibratory or reciprocal motion may be imparted to the mechanism or device 1.

An electric motor 40 is shown rigidly mounted on a stationary support 41. A connection 42 driven by the motor engages a pulley 43 attached to the extended end of the shaft 12 adjacent to the cap 15. Thus, the motor 40 will rotate the shaft 12 constantly in one direction and thereby rotate the tubular shaft or sleeve 17 constantly in the opposite direction, with the result that the two weights 20 are rotated in one direction about the axis of the shaft 12 and the weight 29 is rotated in the opposite direction about said axis. It is known that such opposite rotative movements of these weights will vibrate or reciprocate the frame 34—35. Two rods 44 provide a connection from the frame 34—35 to the device 1 for imparting a vibratory or reciprocating movement to the latter. The rods 44 are connected to opposite sides of the device 1 by releasable attaching devices 45, and are connected at their opposite ends to the frame 34—35. In this arrangement, the vibrator per se is mounted between the device 1 and the driving motor 40 so that constant rotation of the shaft 12 in one direction and constant rotation of the tubular shaft or sleeve 17 in the opposite direction will vibrate the frame 34—35 and thereby impart a vibratory or straight line reciprocal movement to the device 1.

It should now be apparent that this invention attains all of its intended objects and purposes with a high degree of efficiency. The weights 20 and 29 that effect and create vibration are constructed and arranged so that they distribute the forces over a wide area which is wider than other vibrators with which I am familiar and which are in use. These weights distribute the forces through approximately 180° more or less, and are supported by coaxial shafts. The coaxial arrangement of the shafts 12 and 17 with the weight 29 mounted between the bearings 18 for the tubular shaft 17, and the weights 20 mounted between the bearings 18 and the bearings 13 and 14, respectively enable me to obtain a more compact mechanism with maximum efficiency than is otherwise obtainable. The bearings 18 prevent the strains and forces generated by the weight 29 from being imparted against the shaft 12. It is apparent that the device 1 and the vibrating mechanism within the frame 34—35 may be mounted at any desired angles of inclination from horizontal to vertical; and that, irrespective of the angle of inclination in which they are mounted, they will produce the desired vibratory action for treatment of the material on the device 1.

The mechanism may be varied within the scope of equivalent limits without departure from the nature and principle of the invention.

I claim:

1. Mechanism for producing and imparting vibratory motion comprising a housing having end walls, bearings supported by said end walls, a driven shaft journalled for rotation in said bearings, a pair of spaced alined unitary and radially immovable weights each having a circumferential length of about 180° attached to said shaft for rotation thereby, a pair of spaced bearings supported by said housing between said weights and between and axially alined with said first bearings, a tubular shaft between said weights coaxial with said driven shaft and journalled in said pair of bearings for rotation relative to said driven shaft, a unitary and radially immovable weight attached to said tubular shaft between said pair of bearings and having about the same circumferential length as said first named weights and cooperating therewith to distribute centrifugal forces through a complete circle when said second weight is diametrically opposite from said first weights, and gearing operated by said driven

shaft for rotating said tubular shaft and thereby said second weight.

2. Mechanism for producing and imparting vibratory motion comprising a housing supported for vibratory movements, connections for imparting vibratory movements of said housing to a device to be vibrated, a driven rotary shaft supported by said housing for rotation, a pair of spaced alined unitary and radially immovable weights each having a circumferential length of about 180° attached to said shaft for rotation thereby, a pair of spaced bearings supported in said housing between said weights, a tubular shaft coaxial with said driven shaft journalled in said bearings for rotation relative to said driven shaft, a unitary and radially immovable weight attached to said tubular shaft having about the same circumferential length as said first named weights and cooperating therewith to distribute centrifugal forces through about 360° when said second weight is diametrically opposite from said first weights, axially alined gears attached to said first shaft and to said tubular shaft respectively, and a gear for rotating said gear that is attached to said tubular shaft by said gear that is attached to said driven shaft.

3. Mechanism for producing and imparting vibratory motion comprising a housing, a driven shaft, a tubular shaft in said housing coaxial with said driven shaft, separate pairs of axially alined bearings supporting said driven shaft and said tubular shaft for rotation in opposite directions, means for rotating said driven shaft, gearing for rotating said tubular shaft by and in the opposite direction from said driven shaft, and unitary and radially immovable weights attached to and wholly supported at all times by said shafts respectively for rotation thereby.

4. Mechanism for producing and imparting vibratory motion comprising two coaxial shafts of different lengths, bearings for supporting the longer of said two shafts, a pair of additional bearings located between said first bearings supporting the shorter of said two shafts, mechanism for rotating said longer shaft, gearing for rotating said shorter shaft by said longer shaft, and unitary and radially immovable weights attached to and wholly supported at all times by said shafts respectively and each having an arc of at least 180° providing a substantially even and uniform flow of centrifugal force when said shafts are rotated.

5. Mechanism for producing and imparting vibratory motion comprising two coaxial shafts one of which is longer than the other, spaced bearings for supporting said longer shaft, a pair of additional bearings located between said first bearings and supporting said other shaft, gearing for rotating said other shaft by said longer shaft, unitary and radially immovable weights attached to and wholly supported at all times by said longer shaft beyond the ends of said other shaft and each having an arc of at least 180°, a unitary and radially immovable weight attached to and wholly supported at all times by said other shaft between said additional bearings and having an arc of at least 180° and cooperating with said first weights to provide substantially even and uniform flow of centrifugal force when said two shafts are rotated, and mechanism for rotating said longer shaft.

6. Mechanism for producing and imparting vibratory motion comprising two end bearings and two intermediate bearings between and axially alined with said end bearings, a tubular shaft journalled in said intermediate bearings, a driven shaft extending through and rotative in said tubular shaft and journalled in said end bearings, gearing for rotating said tubular shaft by said driven shaft in the opposite direction of rotation of said driven shaft, a pair of spaced alined unitary and radially immovable weights attached to and wholly supported at all times by said driven shaft laterally beyond said intermediate bearings, and a weight attached to said tubular shaft between said intermediate bearings and having about the same circumferential length as said first named weights and cooperating therewith to distribute centrifugal forces through a complete circle when said second weight is diametrically opposite from said first weights.

7. Mechanism for producing and imparting vibratory motion comprising a frame supported for vibration, two end bearings and two intermediate bearings between and axially alined with said end bearings, means for supporting all of said bearings in said frame, a tubular shaft journalled in said intermediate bearings and terminating short of said end bearings, a driven shaft extending through and beyond the ends of said tubular shaft and journalled in said end bearings, a gear wheel attached to said driven shaft, a complementary gear wheel attached to said tubular shaft between said intermediate bearings, a gear engaging both of said gear wheels for rotating said tubular shaft by and oppositely from said driven shaft, a pair of spaced alined unitary and radially immovable weights attached to and wholly supported at all times by said driven shaft laterally beyond said intermediate bearings and between said end bearings, and a unitary and radially immovable weight attached to and wholly supported at all times by said tubular shaft between said intermediate bearings and having about the same weight as the sum of said pair of weights.

8. A unit for imparting vibratory or reciprocal motion comprising two end members, an intermediate member rigidly and detachably secured to said end members, two end bearings mounted in said end members, two intermediate bearings supported by said intermediate member between and in axial alinement with said end bearings, a tubular shaft journalled in said intermediate bearings and terminating short of said end bearings, a driven shaft extending through and rotative in said tubular shaft and journalled in said end bearings, gear wheels attached to said tubular shaft and said driven shaft respectively at opposite sides of one of said intermediate bearings, a gear engaging said two gear wheels for rotating said tubular shaft by and oppositely from said driven shaft, a pair of alined unitary and radially immovable weights attached to and wholly supported at all times by said driven shaft laterally beyond said intermediate bearings, and a unitary and radially immovable weight attached to and wholly supported at all times by said tubular shaft between said intermediate bearings and having about the same circumferential length as said first named weights and cooperating therewith to distribute centrifugal forces through a complete circle when said second weight is diametrically opposite from said first weights, said second weight having about the same weight as the sum of said pair of weights.

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