July 27, 1943. R. L. JOHNSTONE 2,325,248

VIBRATOR

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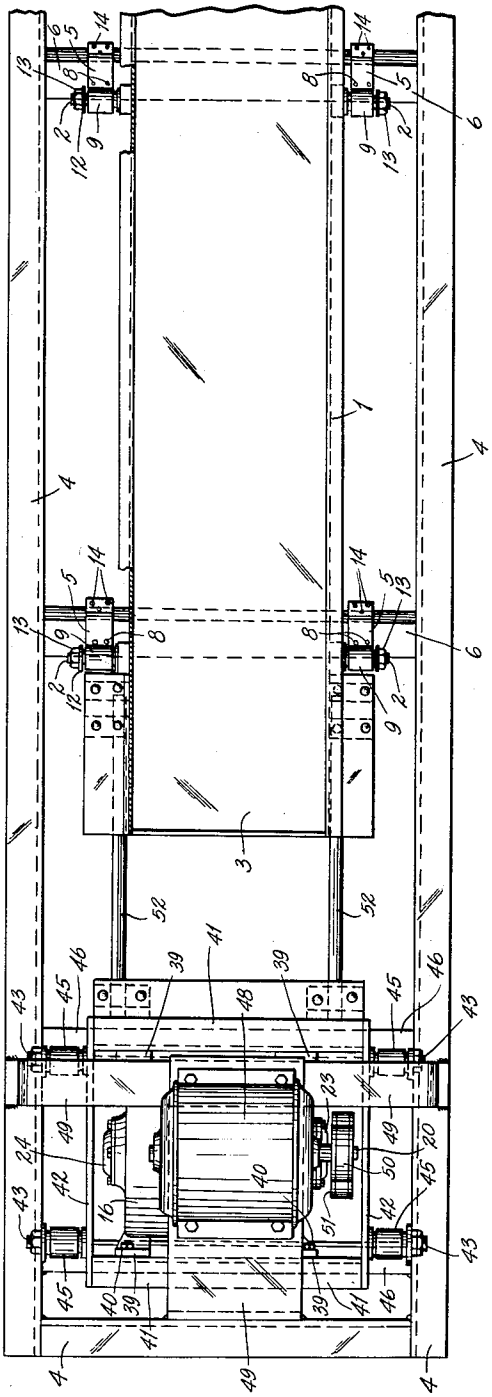


Fig. 1.

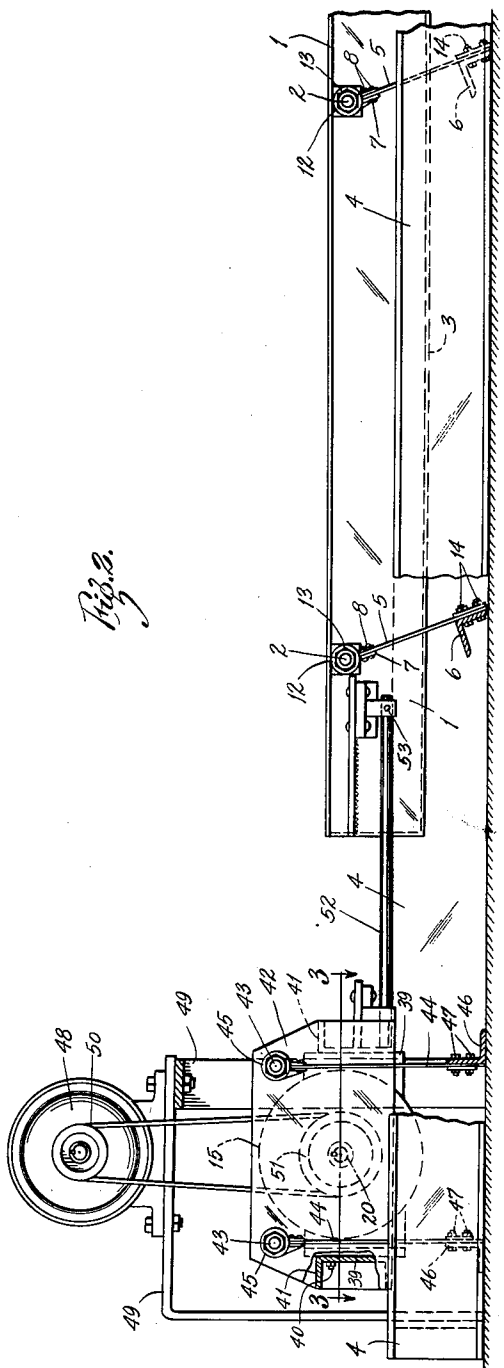


Fig. 2.

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Fig. 3.

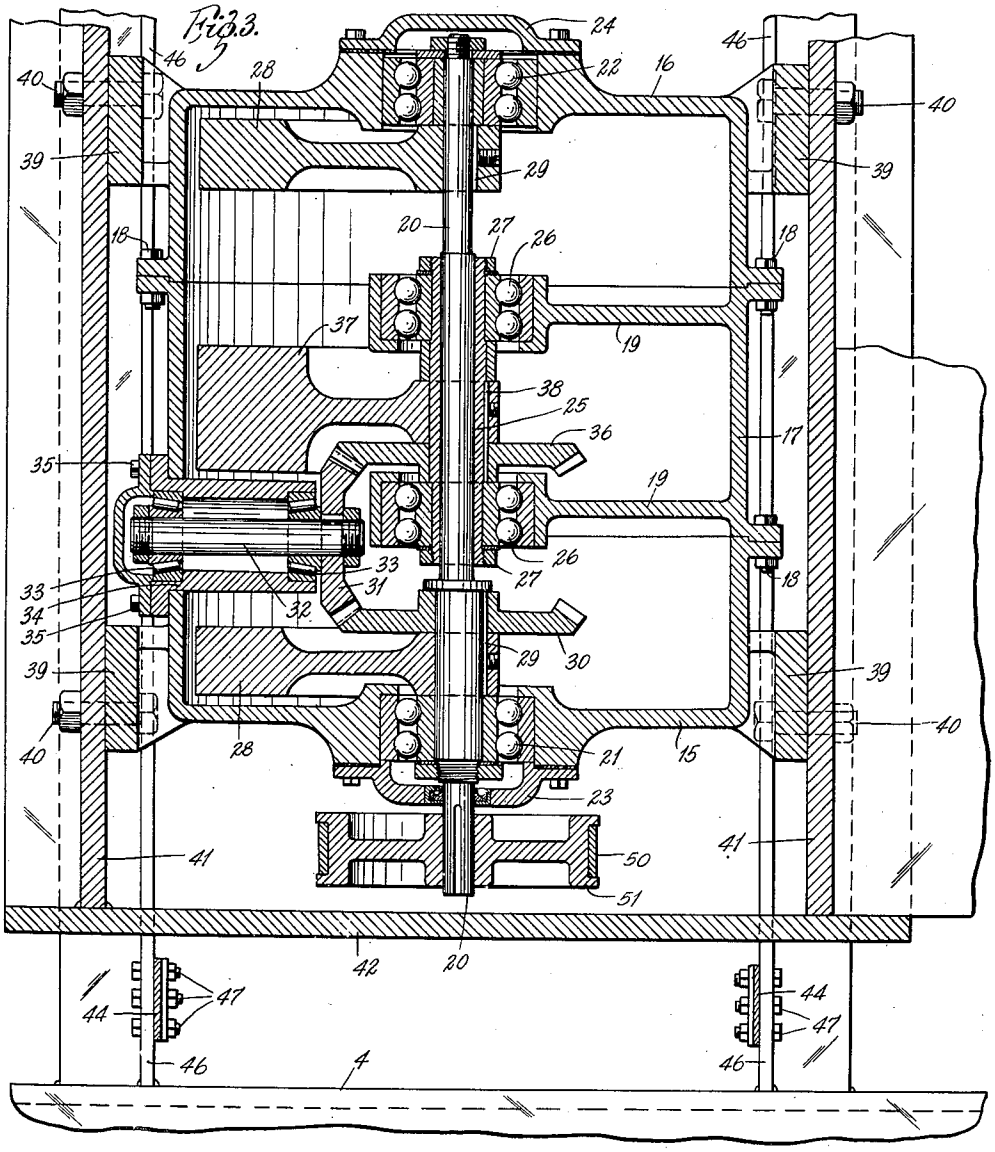
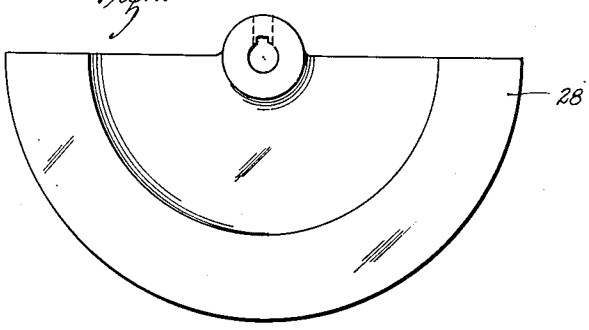


Fig. 4.



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Fig. 5.

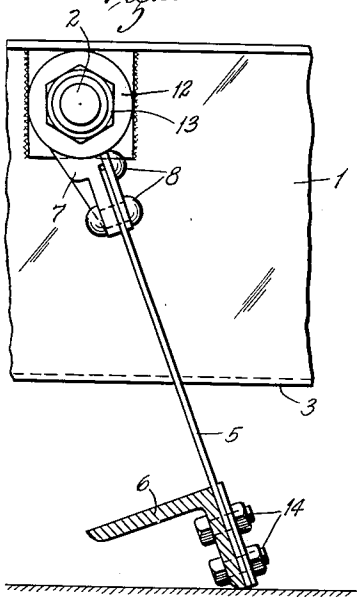


Fig. 6.

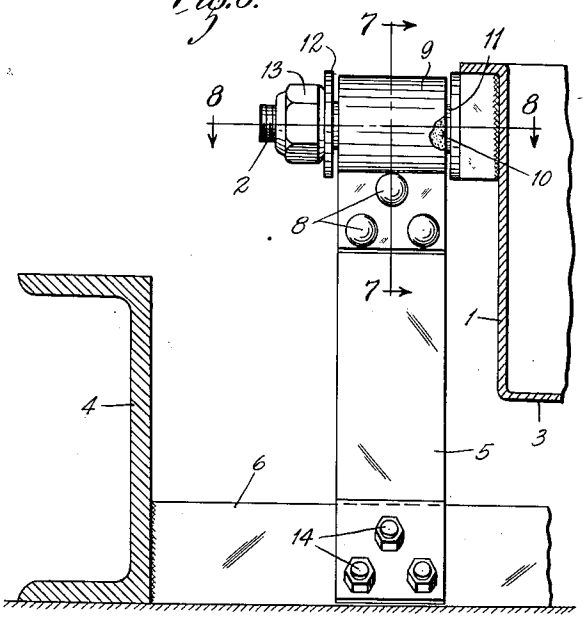


Fig. 7.

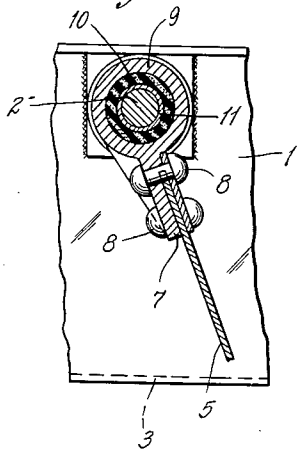


Fig. 8.

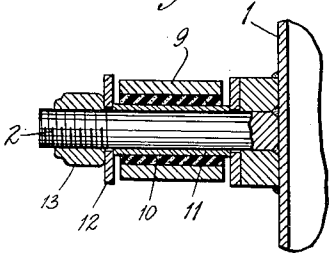
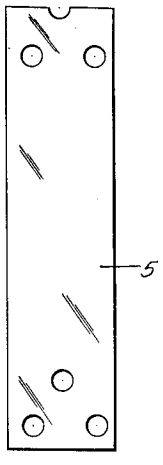


Fig. 9.



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UNITED STATES PATENT OFFICE

2,325,248

VIBRATOR

Robert L. Johnstone, University City, Mo.

Application August 21, 1942, Serial No. 455,657

5 Claims. (Cl. 74—61)

This invention relates to vibrators; and has special reference to apparatus for imparting vibratory or reciprocal motion to various kinds 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 having the weights that effect or increase vibration arranged to distribute the forces over a much wider area, approximately 180° more or less, than other vibrators now in general use and with which I am familiar; to provide an apparatus for imparting vibratory or reciprocal motion to different types of mechanisms comprising a central power driven shaft having two relatively symmetrical weights attached to the shaft in eccentric positions, in combination with a rotary tubular shaft or sleeve rotatively supported concentrically with the axis of said driven shaft and having a weight attached thereto between the weights that are attached to the driven shaft; to provide a construction in which the weight that is attached to said tubular shaft or sleeve is rotated about the same axis as the weights that are attached to the driven shaft throughout and is approximately equal to the sum of said two weights; to provide means for mounting said mechanism in any desired angular position, whether horizontal or vertical or at any angle between horizontal and vertical positions, to produce the desired vibratory action to obtain the results of separation and movement of the material being treated; and to provide an apparatus for imparting vibratory or reciprocal motion to different types of devices and mechanisms for handling and treating materials and substances by subjecting them to vibratory or reciprocal movements.

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 associated mechanism embodying the present invention.

Fig. 2 is a side elevation with parts broken away to show other parts in section.

Fig. 3 is a longitudinal sectional view on the line 3—3 of Fig. 2, showing the principal unit of the apparatus for imparting vibratory or reciprocal motion.

Fig. 4 is a side elevation of one of the weights showing the relatively wider area thereof for distributing the vibratory forces.

Fig. 5 is an enlarged detailed sectional view showing the construction and arrangement of one of the supports for the mechanism to which vibratory or reciprocal motion is imparted.

Fig. 6 is a sectional view looking toward the right-hand side of Fig. 5.

Fig. 7 is a sectional view on the line 7—7 of Fig. 6.

Fig. 8 is a sectional view on the line 8—8 of Fig. 6, showing the construction of the bearings and bushings supporting the device to which vibratory or reciprocal motion is imparted.

Fig. 9 is a view showing one of the resilient flexible supports for the device that is vibrated or reciprocated.

The invention is shown assembled and mounted for imparting vibratory or reciprocal motion to a device which may represent a screen, feeder, classifier, conveyor, or other mechanism to be actuated in accordance with the present invention. As shown, the device to be vibrated comprises a frame 1 provided with pairs of laterally extended trunnions 2. The trunnions 2 of each pair are axially alined. The bottom 3 of the device to be vibrated is supported within the frame 1 and may be in the form of a screen for use in screening different materials, or may be imperforate to support the materials for other purposes.

The device to be vibrated or reciprocated and the mechanism for imparting vibratory or reciprocating movements thereto may be mounted in a frame 4 which may be horizontal, vertical, or at any angle between horizontal and vertical positions. As shown, short flat springs 5 have their lower ends rigidly attached to members 6 constituting a part of the frame 4, and their upper ends attached to bearing heads 7 by rivets 8 (Figs. 5 and 7). The heads 7 are formed with tubular shells 9 in each of which a sleeve 10 of rubber or other elastic material is enclosed. An inner metallic sleeve 11 is enclosed in each rubber sleeve or bushing 10. The external diameters of the metallic sleeves or bushings 11 are greater than the normal inside diameters of the elastic sleeves or bushings 10, so that the latter are held under compression by said metallic bushings 11.

The trunnions 2 extend through and are journalled in the bushings 11 and are detachably held in this assembly by washers 12 and nuts 13 mounted on the outer ends of the respective trunnions 2. The lower ends of the springs 5 may be detachably secured to the members 6 by bolt and nut devices 14. The inherent resiliency of the springs 5 will cooperate with the actuating mechanism to move or return the vibrated

device to an initial or starting position when the actuator is stopped.

The principal unit of the apparatus for imparting vibratory or reciprocal motion to the device above described is shown in Fig. 3. The principal parts of the mechanism are enclosed in a housing comprising two end members 15 and 16 and an intermediate housing member 17. These three housing members are fitted in endwise abutting position and are attached together by removable and replaceable bolts 18. The intermediate housing member is formed with integral webs 19 which are spaced apart about the same distance that separates them from the respective end walls of the housing.

A power driven shaft 20 is journalled in bearings 21 and 22 mounted in the end housing members 15 and 16, respectively. The shaft 20 extends through an appropriate bushing in a covering cap 23 attached to the end member 15, and the opposite end of said shaft 20 and the bearing 22 in which it is journalled are covered and enclosed by a cap 24 detachably secured to the end member 16.

A tubular shaft or sleeve 25 is mounted on and is coaxial with the driven shaft 20. Said bushing or sleeve has its ends journalled in bearings 26 mounted in and supported by the two webs 19. Thus, the bearings 21, 22 and 26 are in axial alinement. The tubular shaft or sleeve 25 is held from endwise displacement by nuts 27 attached to the ends thereof and cooperating with the bearings 26 to maintain the assembly.

Two approximately semi-circular weights 28 are secured to the driven shaft 20 by keys 29 or otherwise. Because of the fact that these weights extend approximately 180° more or less, they distribute the 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 of widely distributing the forces.

A bevel gear 30 is attached to and rotated by the shaft 20 adjacent to one of the weights 28, and meshes with a bevel gear 31 attached to a stud shaft 32 which is mounted in anti-friction bearings 33. The bearings 33 are carried by a removable and replaceable support 34 detachably secured to the housing members 15 and 17 by fasteners 35. In this way, the stud shaft 32 is supported at right angles to the driven shaft 20. The gear 31 meshes with a bevel gear 36 attached to the tubular shaft or sleeve 25 between the bearings 26 and adjacent to one of said bearings. By this system of gearing, the tubular shaft or sleeve 25 will be rotated by and in the opposite direction from the shaft 20.

A weight 37 is attached to the tubular shaft or sleeve 25 for rotation thereby. The same key 38 that attaches the gear 36 to the shaft 25 may also attach the weight 37 to said shaft. The radial width and the circumferential length of the weight 37 are the same as the radial width and the circumferential length of the weights 28, so that the end areas of all of the weights are approximately uniform. The sum of the two weights 28 is approximately equal to that of the single weight 37.

The housing members 15 and 16 are formed with diametrically opposite pads or feet 39 which are secured by bolts 40 to cross-members 41 of a frame. The cross-members 41 are rigidly attached to side members 42 which have pairs of laterally extended trunnions 43. The trunnions 43 are journalled in bearings precisely like the bearings in which the trunnions 2 are journalled and which are clearly shown in Figs. 7 and 8 of the drawings. The frame 41—42 and the housing 15—16—17 with its enclosed mechanism are supported by flat springs 44 having their upper ends attached to tubular shells 45 exactly like the tubular shells 9, and having their lower ends detachably secured to frame members 46 by bolts 47. Thus, when the shaft 20 is driven to rotate the weights 28 in one direction and the weight 37 in the opposite direction, the entire mechanism is vibrated or reciprocated. Such vibratory or reciprocal motion may be imparted to the mechanism or device supported by the frame 1.

As shown, an electric motor 48 is mounted on a stationary support 49 and has driving connection 50 with a pulley 51 attached to the shaft 20. Thus, the motor 48 will rotate the shaft 20 constantly in one direction and thereby rotate the tubular shaft or sleeve 25 constantly in the opposite direction, with the result that the two weights 28 are rotated in one direction about the axis of the shaft 20, and the weight 37 is rotated in the opposite direction. As is known, such opposite rotative movements of these weights vibrate or reciprocate the frame 41—42.

In the mechanism shown, two rods 52 provide a connection for imparting a vibratory or reciprocating movement to the device 1 by the vibration of the frame 41—42. The rods 52 are connected to opposite sides of the device 51 by releasable attaching devices 53, and are connected at their opposite ends to the frame 41—42.

From the foregoing, it should be apparent that this invention attains all of its intended objects and purposes very efficiently and satisfactorily. The weights 28 and 37 that effect or increase vibration are constructed and arranged so that they distribute the forces over a wider area than other vibrators with which I am familiar. As shown, these weights distribute the forces through approximately 180°, more or less. The coaxial arrangement of the shaft 20 with respect to the tubular shaft or sleeve 25 enables me to obtain a more compact mechanism with maximum efficiency than if the axes about which the different weights are rotated are relatively disalined. In my improved arrangement, the weights are rotated about the same axis. Moreover, it is apparent that the device 1 and the vibrating mechanism within the frame 41—42 may be mounted at any angle of inclination from horizontal to vertical; and, when operated, will produce the desired vibratory action for the 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, two coaxial shafts in said housing supported for relative rotation in opposite directions, separate pairs of bearings supporting said respective shafts for rotation and leaving each shaft substantially free from the weight of the other shaft, mechanism for rotatively driving one of said shafts, gearing for rotating the other shaft by said one shaft, weights attached to said shafts, respectively, for rotation thereby within said housing, a frame supporting said housing, a plurality of pairs of flat springs supporting and preventing tilting of said frame and thereby said housing and leaving said frame and housing free for vibration by said

weights, and a connection for imparting vibratory movement of said frame and housing to a device to be operated.

2. Mechanism for producing and imparting vibratory motion, comprising a frame, a housing rigidly supported in said frame, pairs of trunnions projecting from said frame and having the two trunnions of each pair longitudinally spaced and axially alined, elastic and resilient bearings in which said trunnions are journalled, flat springs supporting said respective bearings for vibratory movements of said frame and said housing and preventing tilting of said frame and housing during vibration thereof, a connection for imparting vibratory movements of said frame to a device to be operated, mechanism in said housing for vibrating the same and thereby said frame, and a motor for operating said mechanism.

3. Mechanism for producing and imparting vibratory motion, comprising a frame having pairs of supporting trunnions projecting therefrom with the two trunnions of each pair axially alined, an elastic and flexible bearing in which each of said trunnions is journalled, flat springs attached to said trunnions, respectively, for supporting and preventing tilting of said frame, a rigid support to which said trunnions are attached, mechanism mounted in said frame for vibrating said frame and thereby flexing said springs, a motor for operating said mechanism, and a connection from said frame for imparting vibratory movements thereof to a device to be vibrated.

4. Mechanism for producing and imparting vibratory motion, comprising a frame having pairs of supporting trunnions projecting therefrom with the two trunnions of each pair axially alined, a rigid support, pairs of flat springs complementary to said pairs of trunnions and having ends adjacent to said frame supporting said trunnions, respectively, and having their opposite ends detachably secured to said support for supporting and preventing tilting of said frame, mechanism in said frame for vibrating said frame and thereby flexing said springs, and a motor for operating said mechanism.

5. Mechanism for producing and imparting vibratory motion, comprising a rigid supporting frame, pairs of trunnions projecting from opposite portions of said frame and having the two trunnions of each pair axially alined, upwardly extending flat springs, a rigid support to which the lower ends of said springs are attached, bearings supported by the upper ends of said springs for receiving and supporting said trunnions, respectively, vibrating mechanism mounted in said frame for vibrating the same while the said springs prevent tilting of said frame, a device to be vibrated, a number of upwardly extended flat springs supporting said device, and a connection from said frame to said device for imparting vibratory movements of said frame to said device.

ROBERT L. JOHNSTONE.