Aug. 27, 1929. R. G. RICHARDSON 1,726,192

VIBRATING DEVICE

Filed Jan. 10, 1924

Fig: 1

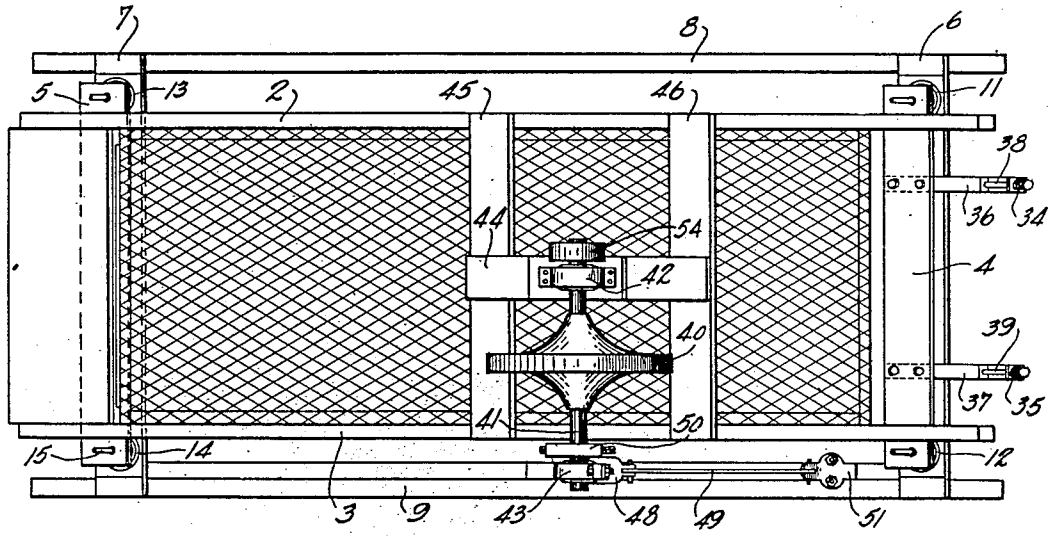


Fig: 4

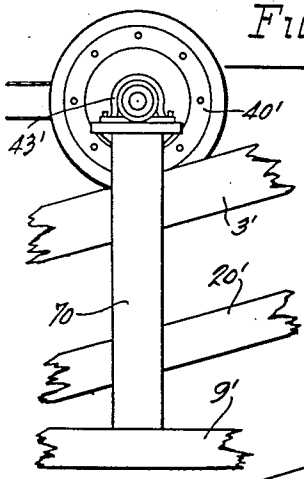


Fig: 3

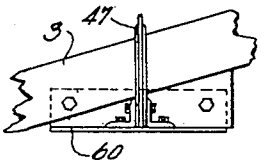
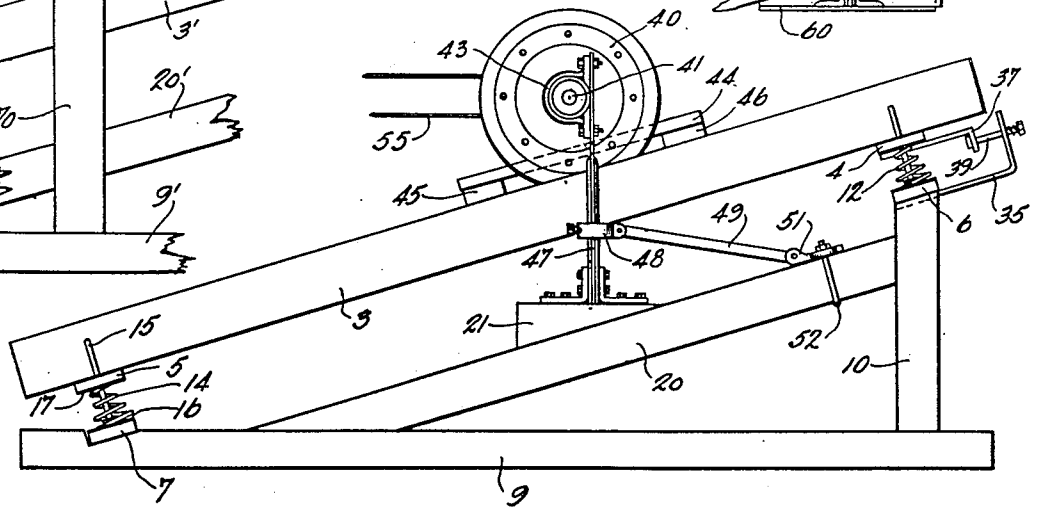


Fig: 2



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UNITED STATES PATENT OFFICE.

RODNEY G. RICHARDSON, OF CHICAGO, ILLINOIS.

VIBRATING DEVICE.

Application filed January 10, 1924. Serial No. 685,344.

My invention relates in general to vibrating devices, and is especially applicable to vibrating screens, although its use is not so limited; and the object is to provide an arrangement and means for utilizing the gyroscopic couples generated by vibrating the axis of rotation of a heavy fly wheel or gyroscope thereby producing a powerful and efficient vibrating device.

One embodiment of my invention, in which the same is applied to a vibrating screen of the well known type used for screening or grading sand, gravel, ore, and like material, is shown in the accompanying drawing, wherein:—

Fig. 1 shows a top view of a screen equipped with the invention;

Fig. 2 shows a side view of the same screen;

Fig. 3 is a fragmentary view showing a modification of the screen depicted in Figs. 1 and 2; while

Fig. 4 is a fragmentary view showing the application of the gyroscope as an auxiliary vibrator.

Referring to Figs. 1 and 2, the screen itself may be of any approved type. As shown herein it comprises a rectangular wooden frame about 8 ft. over all in length, and 2 ft. in width, with an inner frame of square strips on which a sheet metal or wire mesh screen is stretched and held by staples, cleats, or any suitable means. The method of construction is sufficiently indicated in the drawing, and since it is well understood by persons familiar with screens, no further consideration will be necessary on this phase of the matter.

The means for supporting the screen will now be explained. The sides 2 and 3 of the frame are attached at opposite ends to the cross pieces 4 and 5, which support the weight of the frame. The cross pieces 4 and 5 are in turn supported by means of springs on cross pieces 6 and 7, respectively. The latter may form part of some other machine, or may be supported in any preferred manner, depending on the circumstances. As shown two heavy sill pieces of 2 x 6 inch timber are set on edge and the lower cross piece 7 fits in a mortise about a foot from the left end. At the right the cross piece 6 is supported by two uprights, one of which is indicated by reference character 10, at such a height that the screen will be inclined at an angle of about 30° from the horizontal.

The springs which support the cross pieces 4 and 5 are four in number and are indicated by reference characters 11 to 14, inclusive. These springs and associated parts are all alike. Considering spring 14 and its mounting more in detail, the centering bolt 15 fits tightly in a hole bored in cross piece 7 and is held firmly in place by nuts above and below. A large steel disc or washer 16 is placed on the centering bolt before the upper nut is screwed down. This washer forms a bearing surface for the spring 14, the lower coil of which fits tightly around the upper nut. The upper coil of the spring fits loosely around the centering bolt 15 and supports one end of the cross piece 5, there being a second washer 17 interposed between the spring and cross piece. This second washer is drilled with small holes and is secured to the cross piece 5 with screws. The centering bolt 15 passes up through a central hole in the washer and cross piece, the hole being large enough to insure a loose fit. The upper end of the spring may or may not be attached to washer 17. If the former, the end of the spring is bent up at right angles and extends into a hole drilled in the washer to receive it. As stated before, the other three springs and associated parts are like the one described. These springs evidently constitute a loose or flexible support for the frame of the screen, on which it is free to vibrate.

In order to hold the screen in position against the tension of the belt, which is used to drive the gyroscope, or vibrator, two loose or flexible connections are provided at the upper end of the screen. These consist of two L shaped bars of iron 34 and 35 which are bolted to the cross piece 6, and two similar L shaped bars 36 and 37 which are bolted to the cross piece 4, together with the bolts 38 and 39 by means of which the corresponding bars are connected. It is noted that the holes through which bolts 38 and 39 pass are large enough to make a loose fit, so that the attachments will not interfere with the vibrations of the screen.

The mechanism for causing the screen to vibrate may now be considered. This comprises a heavy fly wheel or gyroscope 40, and shaft 41, supported on self aligning ball bearings 42 and 43. Bearing 42 is rigidly secured to the frame of the screen by means of a member 44 and the two cross pieces 45 and 46. The other bearing, bearing 43, is secured to the free end of a stiff spring 47. As a support for the spring the main frame work has

a member 20 secured at opposite ends to the sill 9 and upright 10, and having a block 21 to provide a horizontal surface to which the spring brackets are bolted, as shown in Fig. 2.

The spring 47 is adjustable, that is, means is provided to change the tension for regulating the natural period of vibration. This comprises a perforated block 48, which may be clamped on the spring at any desired point, a link 49, and a bracket 51 and U bolt 52 for securing the end of the link to member 20. The showing of these parts in Fig. 2 is self explanatory, but it may be pointed out, nevertheless, that if one desires to increase the spring tension, for instance, the block 48 is shifted upward on the spring, the U bolt 52 being moved to the left at the same time.

The gyroscope shaft is rotated by a pulley wheel 54 and belt 55, with a small motor (not shown). An adjustable weight 50 is mounted on the shaft next to the bearing 43 in order to throw it off balance.

The operation is as follows: When the motor is running, the gyroscope and shaft are revolved at a high rate of speed, preferably around 1800 R. P. M., and the weight 50, which is off center with respect to the shaft, causes the bearing 43 to vibrate on spring 47. The vibrations thus produced are in a horizontal plane. The accompanying movements of the end of shaft 41 set up gyroscopic couples which tend to move the other end of the shaft up and down, or in a vertical plane, and these forces are transmitted to the screen through bearing 42. The gyroscope thus translates the horizontal vibrations of bearing 43 into vertical vibrations of bearing 42. It will be understood that the vibrations are of small amplitude, and cause but slight changes in alignment between the shaft and bearings, which are readily taken care of by the self aligning feature of the latter.

The construction illustrated produces vibrations in a vertical plane, which gives excellent results in most cases. Vibrations may be produced in a plane perpendicular to the screen, however, if desired, by supporting spring 47 directly on member 20 and without the intervening block 21. As a matter of fact any direction of vibration desired can readily be obtained by mounting the spring 47 in the proper position. For instance, certain types of screens or separators are intended to vibrate horizontally, which motion can be secured by mounting spring 47 in a horizontal position instead of vertical, and by changing the position of the motor so that the belt will extend upward from the pulley. With the pulley mounted adjacent the bearing 42, it will be understood that the belt should be run in a direction which is as nearly as possible at right angles to the spring 47 in order that the belt may not interfere with the vibrations of the screen. The pulley 54 may obviously be placed on the other end of the shaft if found more convenient, in which case the belt should run in a direction parallel to the spring.

The various modifications just described involve nothing but adjustment or rearrangement of the parts, the principle of operation remaining the same. Other modifications are possible, however, which produce modified operating results, although still retaining the gyroscopic vibrating principle. One of these is shown in Fig. 3, wherein the spring 47 is attached to the frame member 3 of the screen itself instead of to the rigid frame work on which the screen is supported. A piece of angle iron 60 and V shaped block may be used for this purpose. When the spring is supported in this manner a double vibration is produced. The gyroscope vibrates the screen in a vertical plane, as formerly, but at the same time the spring will react against its support and cause the screen to vibrate horizontally also.

Fig. 4 shows another modification, according to which a gyroscope is used to produce an auxiliary vibratory motion in a screen which is given a primary vibratory motion by separate means. Reference characters 9′, 20′, and 3′, indicate parts of a screen support and frame corresponding to similar parts in Fig. 2, member 3′ being the side member of a screen which is, however, supported primarily for horizontal vibration, rather than for vertical vibration. It will be understood that the spring supports illustrated provide for a limited horizontal vibration, sufficient to take care of the secondary horizontal vibrations produced by the arrangement in Fig. 3, but where the main purpose is to vibrate the screen horizontally a somewhat different type of spring is perhaps more desirable. To continue, one end of the gyroscope shaft is supported on a bearing 43′ which in turn is mounted on a rigid member 70, attached to member 9′ and 20′. The other bearing of the shaft (not shown) is attached to the screen frame as shown in Fig. 1. With this arrangement, vibrations of the screen in a horizontal plane will cause the screen bearing of the gyroscope to vibrate, and the gyroscope, reacting against the fixed bearing 43′, will set up secondary vibrations in the screen in a vertical plane.

Numerous other modifications are possible and I do not therefore wish to be limited to the constructions described herein, but desire to include and have protected by Letters Patent all forms of my invention which come fairly within the scope of the appended claims.

What I claim is:

1. A vibrating device comprising a gyroscope, a bearing for the gyroscope shaft fixed to the part to be vibrated, a second bearing independently supported so as to vibrate in

only one plane, and means for vibrating the said second bearing.

2. A vibrating device comprising a gyroscope and shaft, two bearings for said shaft, one fixed to the part to be vibrated and the other independently supported so as to be free to vibrate, and means for vibrating the said second bearing.

3. A vibrating device comprising a shaft connected at one end to the part to be vibrated, a gyroscope mounted on said shaft, and means for vibrating the other end of said shaft.

4. A vibrating device comprising a shaft, means for vibrating one end of said shaft, a gyroscope mounted on said shaft, and means for connecting the other end of said shaft to a part which it is desired to vibrate.

5. The combination with a movable device, of a vibrating member, and a gyroscope for transmitting the vibrations of said member to said device.

6. The combination, with an apparatus to be vibrated, of a vibrating member, a gyroscope and shaft, and means connecting one end of said shaft to said apparatus and the other end to said member.

7. The combination, with an apparatus to be vibrated, of a fly wheel, a shaft supporting said wheel and connected to said apparatus at one end, and means for vibrating the other end of said shaft to set up gyroscopic couples which cause vibrations in said apparatus.

8. The combination, with an apparatus to be vibrated, of a gyroscope, and means for causing the gyroscope to vibrate said apparatus, said means comprising a member vibrating independent of said apparatus, and a mechanical connection between said member and said gyroscope for causing precession of the gyroscope.

9. A vibrating device comprising a gyroscope, a shaft supporting said gyroscope, and bearings for said shaft supported for vibration in non-parallel planes.

10. In combination, a member, means for vibrating said member in a certain plane, a second member adapted to be vibrated responsive to the vibrations of said first member, and translating means comprising a gyroscope intervening between said members whereby said second member is vibrated in a different plane.

11. The combination, with an apparatus to be vibrated, of a gyroscope, a bearing for the gyroscope shaft attached to said apparatus, a spring independently supported with respect to said apparatus, a second bearing for the gyroscope shaft attached to the free end of said spring, and means for vibrating said second bearing.

12. In a vibrating device, a gyroscope including a shaft, a spring supporting one bearing for said shaft, the other bearing being attached to the part to be vibrated, means for vibrating said spring and the said first bearing supported thereon, and means for adjusting the frequency of the vibration.

13. In a machine, means for generating centrifugal forces, a member free to move responsive to said forces, means controlled by said member for generating gyroscopic couples, and a second member free to move responsive to said couples.

14. In combination, a gyroscope, two bearings for the gyroscope shaft, means for moving one bearing back and forth in a certain plane so that the shaft is given a reciprocating movement about a pivot point passing through the other bearing, and means for confining the movement of the first bearing to said certain plane, whereby the gyroscope reacts against the first bearing and moves the second bearing in a different plane.

15. In combination, a gyroscope, two bearings for the gyroscope shaft, means for giving the shaft a reciprocating movement about an axis which intersects the shaft, means for substantially confining one bearing to the plane of said reciprocating movement, and an apparatus to which the second bearing imparts a reciprocating movement in a different plane by gyroscopic reaction against the first bearing.

16. In a machine, a motion translating device comprising a gyroscope, said gyroscope having a shaft rotating in bearings, supporting means for one bearing which prevents movement in one plane while permitting movement in a different plane, means for moving said bearing in the plane in which it is free to move, whereby a couple is generated which moves the other bearing in the plane as to which the first bearing is immovable, and apparatus to which the translated motion is to be imparted connected to the said other bearing.

17. In a device for producing reciprocating motion, a gyroscope, a device actuated by centrifugal forces for causing periodic precession of the rotating axis of said gyroscope, and means for imparting the gyroscopic couples thus generated to the apparatus in which the reciprocating motion is to be produced.

18. In combination, a movable apparatus, means for generating centrifugal forces, means responsive thereto for generating gyroscopic couples, and means whereby said couples and the reactions against said centrifugal forces produce a compound reciprocating movement of said apparatus.

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