March 2, 1943. H. C. POLLITZ 2,312,477

VIBRATING SCREEN

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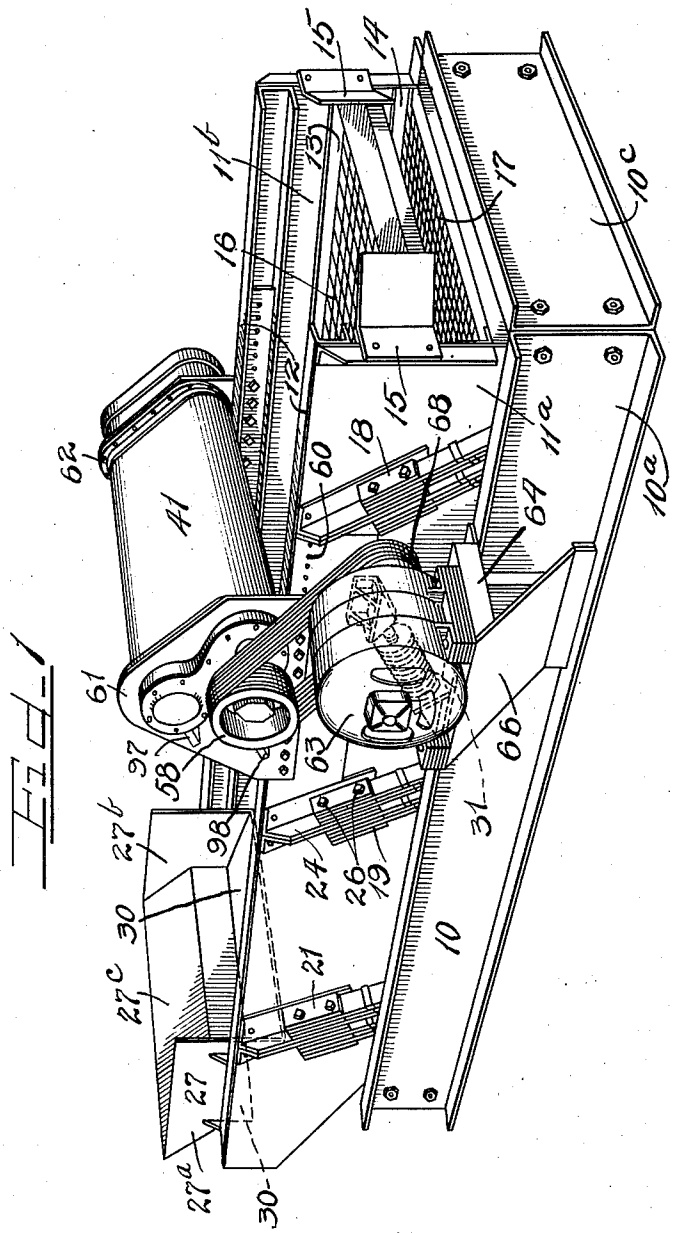

Fig. 1

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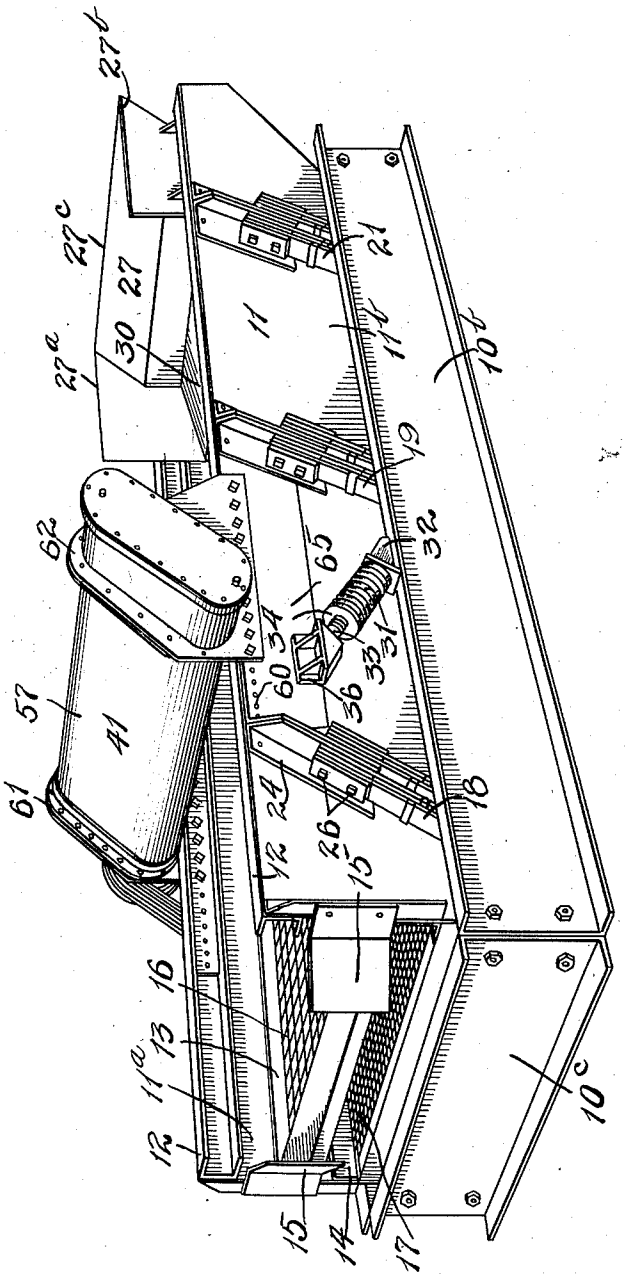
Fig. 2



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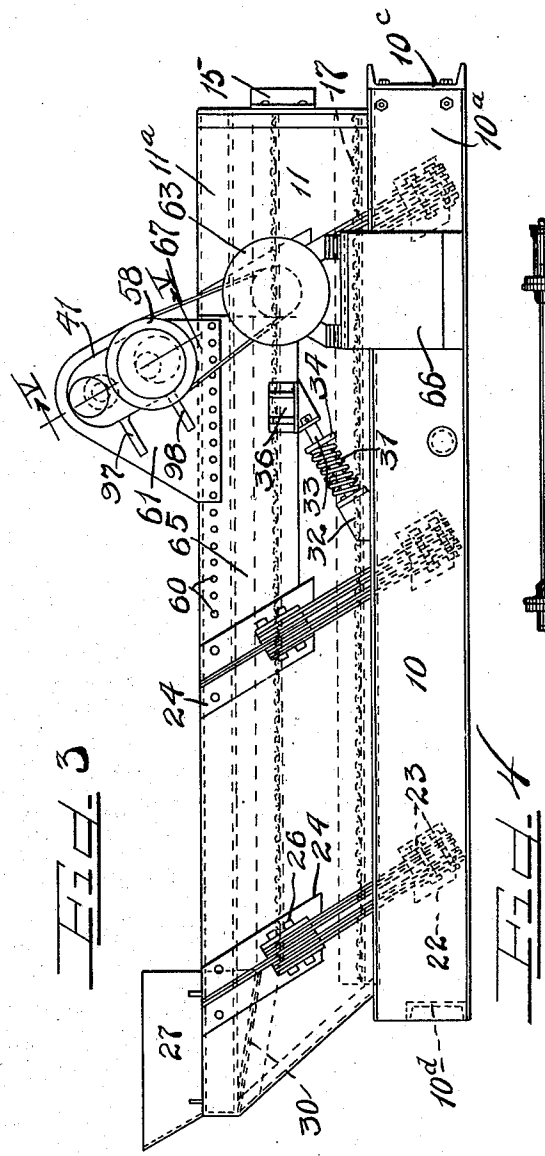

FIG. 3

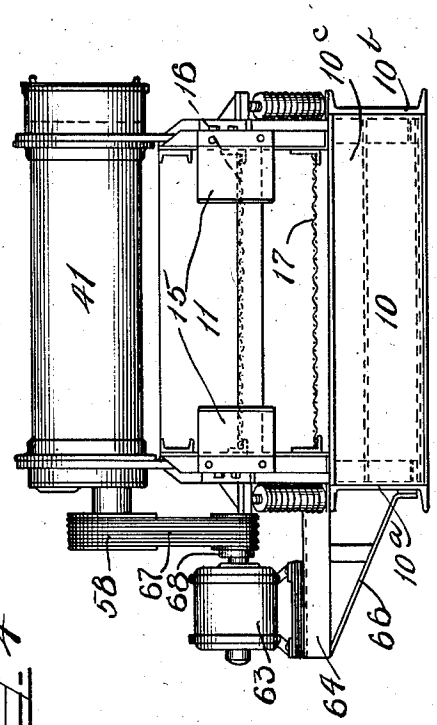

FIG. 4

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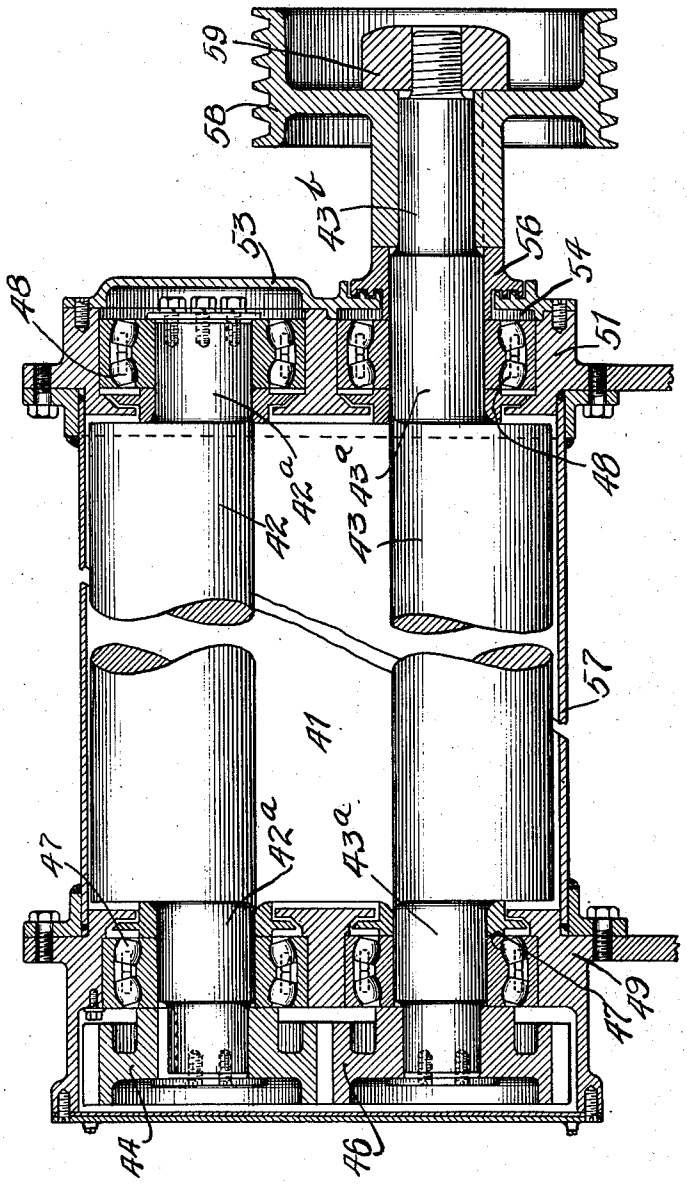

Fig. 5

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Fig. 6

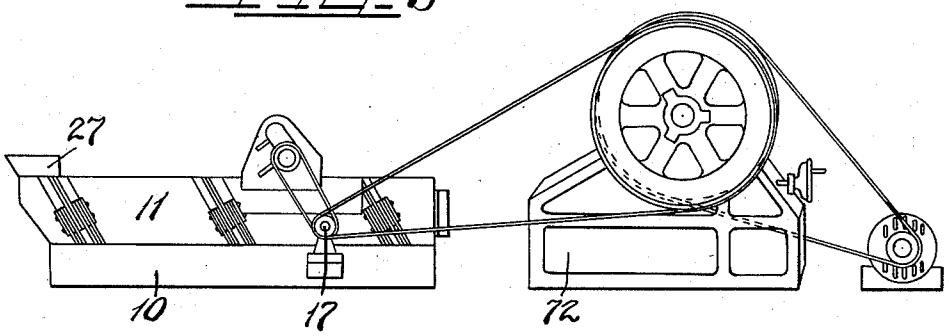

Fig. 7

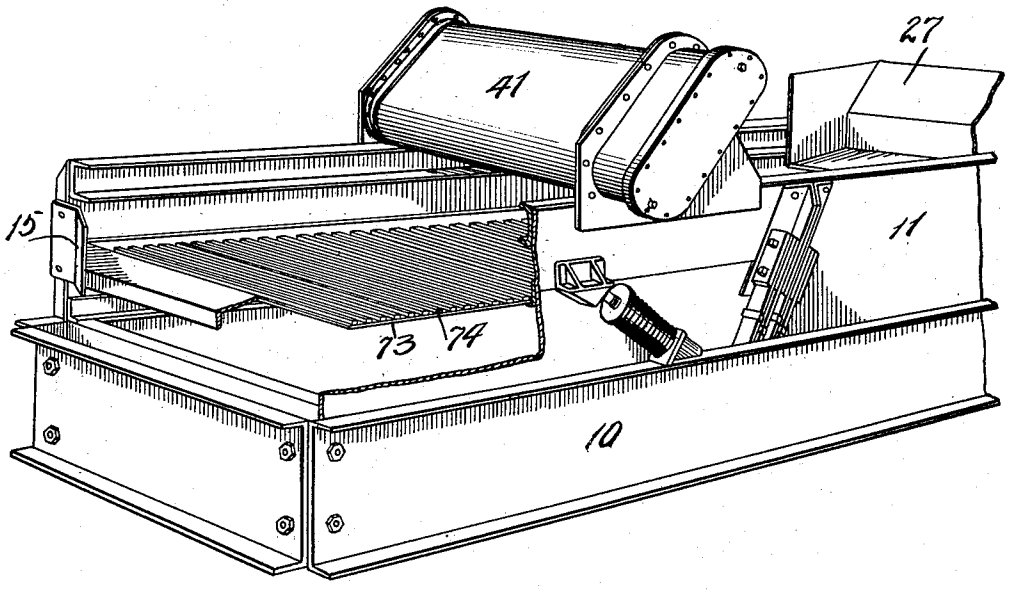

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Fig. 8

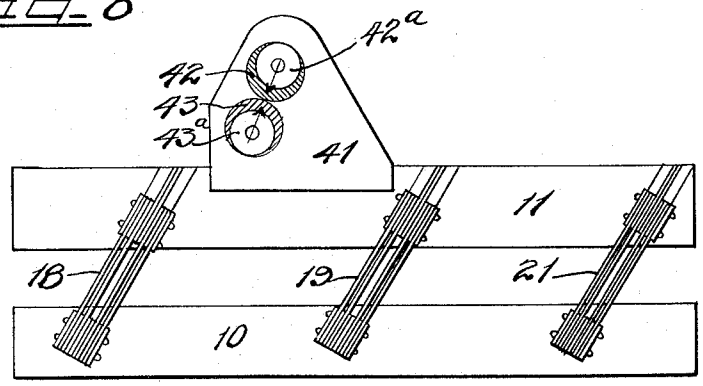


Fig. 9

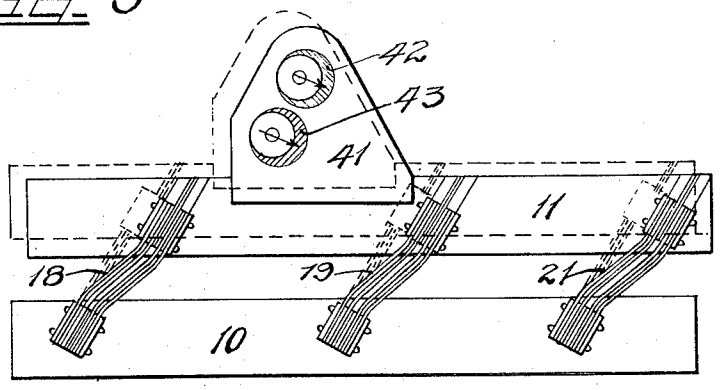
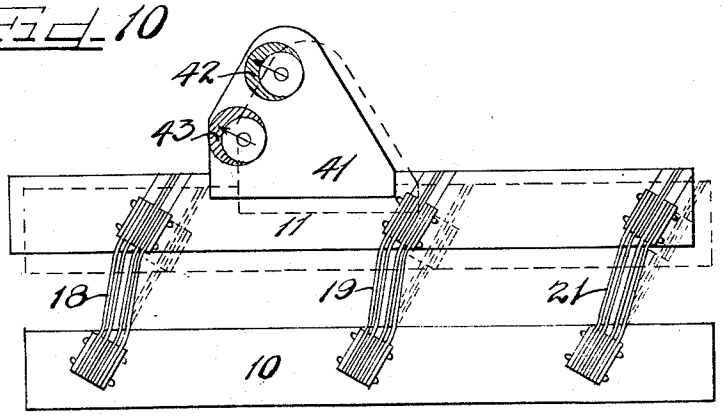


Fig. 10



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Patented Mar. 2, 1943 2,312,477

UNITED STATES PATENT OFFICE

2,312,477

VIBRATING SCREEN

Harold C. Pollitz, Cedar Rapids, Iowa, assignor to Iowa Manufacturing Company, Cedar Rapids, Iowa, a corporation of Iowa

Application August 3, 1940, Serial No. 350,525

1 Claim. (Cl. 209—329)

This invention relates to vibrating screens, and more particularly to separating devices for sorting and classifying aggregates.

This application is a continuation-in-part of my co-pending application for "Screen," U. S. Serial 181,637, filed December 24, 1937, and assigned to the same assignee as the present invention.

In mechanisms of this kind it is important that the screen be rapidly vibrated in order that large quantities of aggregates may be handled per hour, that the mechanism be so designed that the screen will not easily clog, and that none of the vibration of the screen be reflected in or transmitted to the base or supporting frame. Prior structures have not, in a single machine, possessed all of these desirable characteristics.

An object of the present invention is to provide a novel method and means of classifying and sorting aggregates or gravel.

A further object of the present invention is to provide a novel vibrating screen mechanism which is economical to manufacture, which is efficient in operation, and which is rugged and reliable in use.

A still further object of the present invention is to provide novel vibrating means for material and aggregate-classifying devices.

Another and further object of the present invention is to provide a novel vibrating screen in which the screen is given a greatly amplified vibration when the screen first starts to vibrate and also when the vibrating motor is shut off.

Another and still further object of the present invention is to provide a novel vibrating screen mechanism wherein the screen has a floating cantilever mounting on obliquely extending leaf springs and in which the vibrating forces all lie in an oblique plane substantially perpendicular to the direction of extension of the leaf springs and passing through the center of gravity of the floating mass.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and manner of construction, together with objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a perspective view of a vibrating screen mechanism or aggregate-classifying device constructed in accordance with the teachings of the present invention;

Figure 2 is a perspective view of the vibrating screen mechanism shown in Figure 1 but viewed from the opposite side thereof;

Figure 3 is a side elevation of the vibrating screen mechanism;

Figure 4 is an end elevation of a vibrating screen mechanism;

Figure 5 is a partial sectional view of the vibrating mechanism taken along the line V—V of Figure 3;

Figure 6 is a schematic diagram illustrating how a shaker constructed according to my invention may be driven from other equipment, such as a crusher or the like;

Figure 7 is a perspective view of a modified form of vibrating screen mechanism designed especially as gold-separation device; and

Figures 8, 9, and 10 are diagrammatic representations illustrating the action and force direction of a vibrating screen and vibrating screen drive mechanism constructed in accordance with the teachings of the present invention.

The vibrating screen mechanism illustrated in Figures 1 to 5 of the drawings includes, in general, a base or supporting frame 10 and a screen member 11. The base 10 may be of any suitable rigid construction and is shown as constructed of steel channel members forming side members 10*a* and 10*b* and end members 10*c* and 10*d*. Other types of structural members may, of course, be employed without departing from the spirit and scope of the present invention.

The screen member 11 is illustrated as being in the form of a rectangular box-like member open at its discharge end and having side walls 11*a* and 11*b* in the form of rectangular plates. These side walls are braced by means of channels 12 at the upper edges thereof, which channels extend inwardly from the plates, by means of angle irons 13 and 14 on the inner sides of the plates 11*a* and 11*b*. The angle iron 13 serves as a support for the coarse screen 16, while the angle iron 14 serves as a support for the fine screen 17. Of course, any number of screens or decks, such as 16 and 17, may be employed if desired. Other types of constructions may also be used. The discharge end of the screen member is preferably provided with converging guide plates 15 for guiding material being discharged from the end of the screen member.

The screen member 11 is in the nature of a floating mass and is carried on the ends of a plurality of leaf springs 18, 19, and 21, which extend obliquely upwardly from the base or supporting frame 10. The springs 18, 19, and 21

are secured in pairs to the opposite inner faces of the channels 10a and 10b by means of brackets 22 and bolts 23. The upper ends of the laminated springs are secured to the outer walls of the plate side members 11a and 11b by means of angle iron brackets 24 and bolts 26, which pass through the spring. Since the springs are secured and carried by the base 10 at one end and carry the floating mass at their other ends, it will be at once apparent that the screen member 11 has a cantilever support on the ends of the springs. It will also be understood by those skilled in the art that due to the fact that the springs extend obliquely with respect to the base or supporting frame 10, that as the screen is vibrated any material or aggregate thereon will be moved progressively across the length of the screen by continually throwing the material or aggregate upwardly and forwardly.

In order to feed material onto the screens, I preferably employ a hopper, indicated generally at 27, having approximately triangular side walls 27a and 27b and inclined end walls 27c, the hopper being secured at one end of the shaker 11 and preferably within the shaker and being adapted to guide material onto the upper shaker screen. An inclined plate 30 is provided inside the walls 27a, 27b, and 27c.

In order to relieve some of the vibrating load from the leaf springs 18, 19, and 21, one or more sets of coil springs 31 are mounted on opposite sides of the shaker, and these coil springs are supported on the base or supporting frame 10 by means of the bracket 32. Adjustable jack screws 33 are provided which are threaded through washers 34 which bear against the upper end of the coil spring 31, the jack screws being rotatably connected to the upper side of the shaker 11 by means of the bracket 36. The coil springs 31 serve primarily to counteract the weight of the shaker itself so that the springs 18, 19, and 21 act only to return the shaker to its neutral point or position.

The adjustable jack screws 33 may be regulated to adjust the compression on the coil spring 31 to maintain the leaf springs 18, 19, and 21 in a straight line and keep them from sagging because of the weight of the main screen box 11.

One of the novel features of the present invention is the mechanism which has been developed for applying vibrating forces to the screen member 11. One requisite of a good vibrating mechanism is that the vibrating forces must all act in a single plane, while any other forces or component of forces must neutralize themselves about this plane. A second requisite of a good vibrating mechanism is that all of the vibrating forces must act in a plane passing through the center of gravity of the floating mass which is to be vibrated.

In Figure 5 of the drawings, I have shown a novel form of vibrating mechanism 41 which includes a pair of eccentrically mounted shafts 42 and 43. The machined eccentric end portions 42a and 43b of the shafts 42 and 43, respectively, are mounted in barrel roller bearings 47 and 48, which, in turn, are carried in end castings 49 and 51, respectively. Gears 44 and 46 are mounted on and keyed to the ends of the shafts 42 and 43 and are so arranged that the shaft 42 is rotated in the opposite direction from the shaft 43 and at the same speed. An intermediate housing or cover member 57 extends around the shafts 42 and 43 and is mounted on the end castings 49 and 51 by means of angle members 57a, which are folded or otherwise suitably secured to the castings 49 and 51. The end plates 52 and 53 are also bolted or otherwise suitably secured to the end castings 49 and 51. The end plate or bell 53 is provided with a plurality of circular flanges 54, which interengage with like flanges on a bushing 56 to form labyrinth packing to prevent oil from escaping from the casing. A complete housing is thus provided for the vibrating mechanism which includes the intermediate housing member 57, the end castings 49 and 51, and the end plates 52 and 53. The vibrating mechanism is driven through a drive pulley 58, which is keyed to a reduced extension 43b of the shaft 43, and this pulley and the bushing 56 are secured in place by means of a nut 59.

Since the shafts 42 and 43 are supported on an axis displaced from their centerline, it is obvious that they provide a mass eccentrically mounted for rotation. They further provide an eccentrically mounted mass which is distributed evenly along the entire length of the shaft rather than being concentrated at one or more spaced points on the shaft. This distributed loading of the shaft enables the use of the material forming the eccentric load to be used for strength, as well as to provide a vibrating force. It will also be appreciated by those skilled in the art that because the vibrating mechanism is completely encased in a housing unit which substantially prevents the infiltration of dust and other foreign matter into the rotating mechanism, that the life of the vibrating mechanism is greatly increased.

It is further to be understood that with this vibrating mechanism, the eccentrically mounted shafts 42 and 43 are symmetrical about a plane perpendicular to a line passing through the supporting axes of the shafts 42 and 43 and intersecting such a line half way therebetween. The shafts 42 and 43 are rotated in opposite directions and at the same speed, and for that reason all components of unbalanced forces lying in a plane perpendicular to the line of the supporting axes of the two shafts 42 and 43 are cumulative, while all components of unbalanced forces at right angles to this plane are completely balanced out or neutralized (see Figures 8, 9, and 10).

End castings 49 and 51 have relatively large depending skirt portions 61 and 62, which are bolted or otherwise secured to the side plates 11a and 11b of the screen member 11, thereby providing a suitable support for the vibrating mechanism 41. In order to reinforce these depending skirt portions 61 and 62 to prevent rupture due to repeated pounding of the vibrating mechanism, it has been found in some instances to be desirable to provide reinforcing ribs 97 and 98 on the skirt which extend in the direction of the vibrating forces. The ribs 97 and 98 are preferably formed as an integral part of the castings 49 and 51.

In the various figures of the drawings I have shown the driving mechanism 41 as being adjustably mounted on the screen member 11 so that the driving mechanism 41 may be moved longitudinally on the screen member or shaker as desired. This adjustable mounting is provided by a plurality of openings 60 formed in the plate 65 on the sides of the members 11a and 11b. It is to be understood, however, that the provision of this adjustable mounting of the vibrating mechanism 41 is for the purpose of locating the vibrating mechanism with respect to the screen member 11 in such a manner that the vibrating forces will act in a plane passing through the center of

gravity of the floating mass. Where a large number of similar machines are being manufactured and where the center of gravity of the floating mass is known, it is obviously unnecessary to provide an adjustable mounting for the vibrating mechanism 41, since it may be directly and immediately mounted in its required location.

Power for driving the vibrating mechanism 41 is supplied by the motor 63, which is mounted on a platform 64, which, in turn, is supported on a base 10 by means of a bracket 66, the drive being accomplished by means of the V-belt 67, which drives the driven pulley 58 from the drive pulley 68 on the motor 63. It is to be noted that the motor is located in substantially the same plane which passes through the end portions 42a and 43a on the shafts 42 and 43, and thus the driving mechanism 41 may be moved in a plane at right angles to the plane passing through the shafts without materially disturbing the belt drive. The distance center to center of the pulleys is very nearly the same as the spring length and hence they operate in parallel or in the same arc of travel.

It is apparent, of course, that when the eccentrics 42 and 43 are substantially in the plane of their respective end portions 42a and 43a (Figure 8), the centrifugal forces of these eccentrics act one against the other so as to substantially neutralize any force tending to move the driving mechanism in a plane passing through the shafts; while if the eccentrics are positioned in rotation so that their axes are in other than a plane passing through the shaft ends 42a and 43a (Figures 9 and 10), the eccentrics will act together to impart an upward or downward movement perpendicular to the plane passing through the shaft ends 42a and 43a.

Inasmuch as the plane passing through the shafts is substantially parallel to the plane passing through any opposite pair of leaf springs, it will be seen that as the eccentrics are rotated, they will cause motion of the driver unit 41 and screen member or shaker 11 in a direction perpendicular to the plane of the vibrating mechanism 41.

In this way the screen member or shaker is caused to vibrate in such a manner that any point on the shaker will describe substantially the arc of a circle, the chord of which is perpendicular to the plane of the eccentric shafts 42 and 43. This produces up-and-down, as well as longitudinal, movement of the screen member or shaker which throws the material forward and upward in small increments, as well as to shake and separate it as it passes over the screen. The screen is operated at a comparatively high speed so that the downward and upward slanting motion is faster than gravitational motion. This allows the material to be kicked upwardly, and before gravity can act, the screen moves back under it, and on the next vibration it has advanced the material again and so on.

It has been found that by mounting the screen member or shaker on the end of a group of leaf springs and by applying vibrating forces through the center of gravity of the screen member and its associated floating assembly, that none of the vibrations of the screen and vibrating mechanism are reflected in or transmitted to the base or supporting frame 10.

A further novel feature of the present invention is that the construction is so designed that when the screen is first being started up and also when the motor has been shut off and the screen is slowing down to a standstill, a greatly amplified surge of "kicks" or "hops" occur at a predetermined speed which is a fraction of the normal operating speed of the motor. This is obtained by designing the support for the floating mass so that it has a natural resonance period of mechanical vibration at a speed which is a fractional part of the normal operating speed of the vibrating device. It will thus be apparent that when the rotating eccentric shafts 42 and 43 are being brought up to speed, as well as when they are being slowed down to a standstill, the vibrating forces will momentarily have a frequency corresponding to the natural resonance frequency of the mechanical system, and thereby cause a greatly amplified oscillation at that time of the screen member 11. This feature has been found to be an extremely important one, for it tends to clear the screen of pebbles and other materials which have become lodged in the openings of the screen during normal operation.

In the modified arrangement of the present invention shown in Figure 6 of the drawings, the motor 63 has been replaced with a short countershaft and the drive brought over to the countershaft by belt or chain with pulleys or sprockets. In Figure 6 I have shown how the screen may be driven through the agency of a countershaft 71 from a crusher 72 or the like.

This screen can also be used as a conveying device; also, by putting in pans and baffles, as a gravel scrubber; also, as a gold or metal separator in which case retarding baffles scour and jar the dirt and clay or silt in conjunction with a water-spraying system. In Figure 7 I have illustrated how the shaker may be modified by the substitution of pans 73 and baffles 74 for the upper screen element.

In providing a driving mechanism located above the shaker and inclined leaf springs for supporting the shaker, I provide an extremely simple and reliable mechanism in which the ends of the shaker are opened so that the material may be fed into and easily discharged from the shaker. Furthermore, the driving mechanism acts directly in the arc of movement of the ends of leaf springs, and only a minimum of power is required. In using the rectangular shaker here shown, in combination with leaf springs for supporting the shaker, the entire shaker moves always in a substantially horizontal plane regardless of whether material is piled higher at one end of the screen than at the other. The weight of the driving mechanism is substantially counterbalanced by the weight of the hopper 27, and the entire machine is very effective in screening material.

By supporting the vibrating member on a plurality of obliquely extending leaf springs, the member is fully floated, but at the same time is confined to a single plane of movement. By this, it is meant that the screen moves obliquely downwardly and then obliquely upwardly in the same path of movement, while the surface of the screen remains substantially horizontal at all times.

The combination of the oblique spring support and the vibration-exciting mechanism or driver is particularly efficient in preventing unwanted vibration in the supporting frame and securing high efficiency of operation.

While I have shown particular embodiments of my invention, it will, of course, be understood that I do not wish to be limited thereto, since

many modifications may be made, and I therefore contemplate by the appended claim to cover all such modifications as fall within the true spirit and scope of my invention.

I claim as my invention:

A vibrating machine comprising a base, a member to be vibrated, a plurality of leaf springs secured to said base and extending obliquely upwardly therefrom into secured engagement with said member, said springs forming a cantilever floating support for said member, a vibration-exciting mechanism mounted on said member and forming a floating assembly therewith, said mechanism including a pair of heavy shafts eccentrically mounted for rotation in opposite directions with respect to each other and at the same speed, and which shafts provide a uniformly distributed off-center load over substantially the entire length of said shafts, the unbalanced forces created by the rotation of said shafts being symmetrical about a plane passing between the shafts and perpendicular to the direction of extension of said springs, said vibration-exciting mechanism being located on said member in a position such that the plane of action of the vibrating forces passes directly through the center of gravity of said floating assembly.

HAROLD C. POLLITZ.