Oct. 21, 1930. J. WINSTON 1,779,202

VIBRATING SCREEN

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Fig. 1.

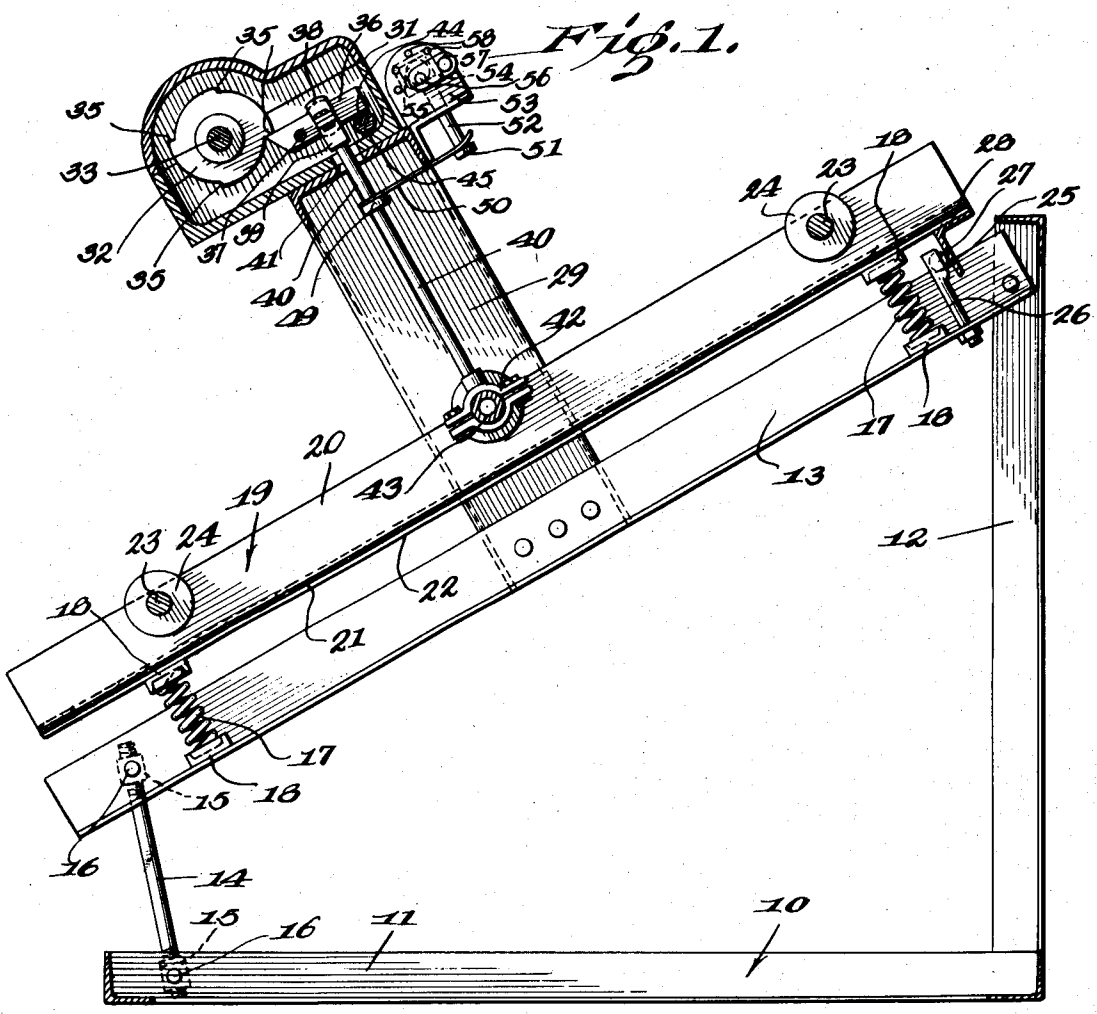


Fig. 8.

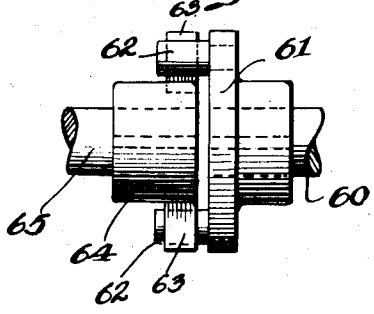
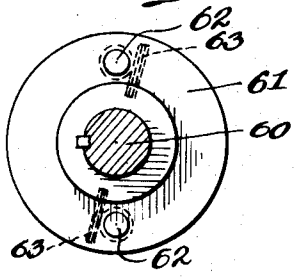


Fig. 9.



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Fig. 2.

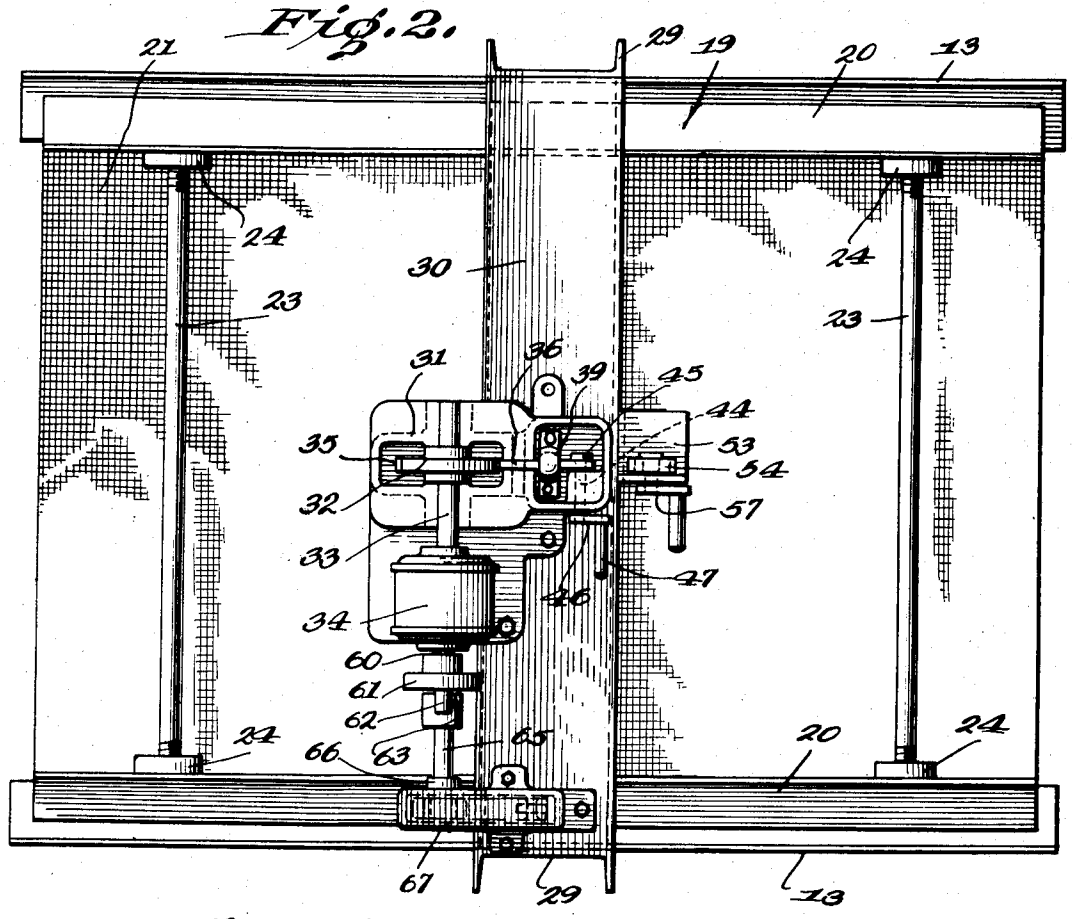


Fig. 3.

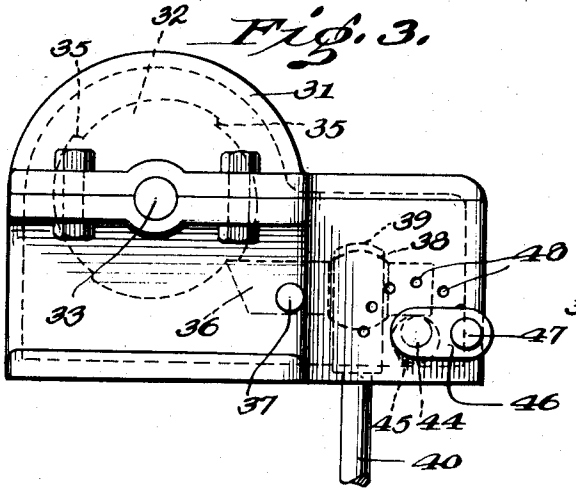
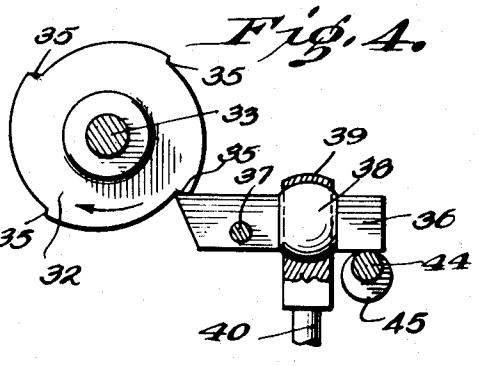


Fig. 4.



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Fig. 5.

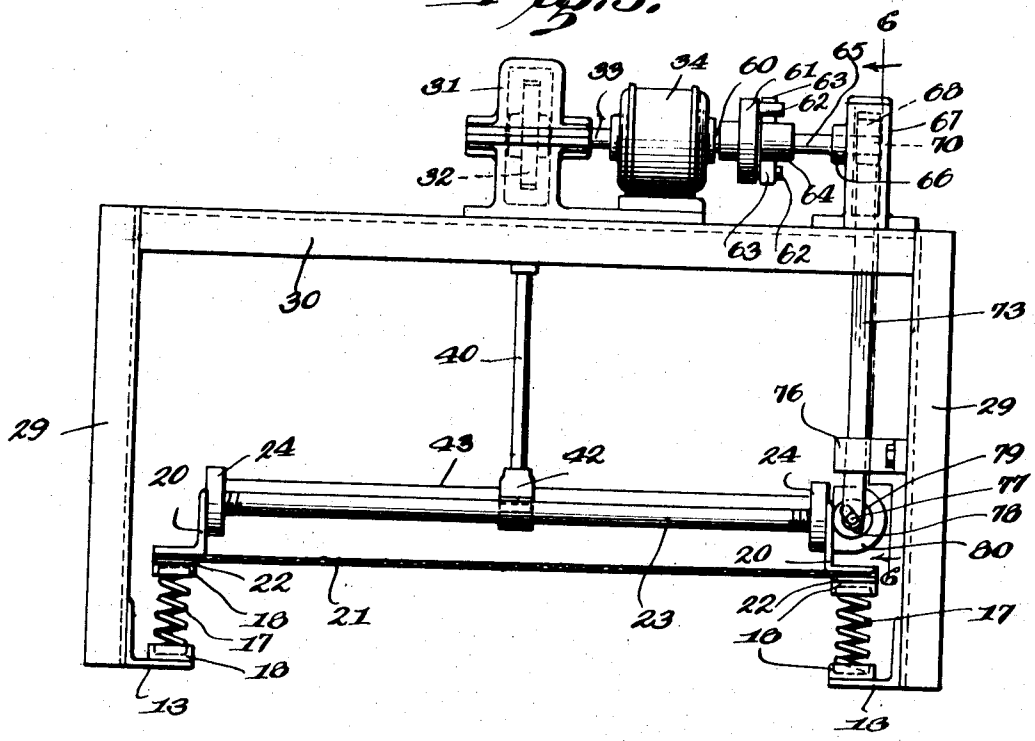


Fig. 6.

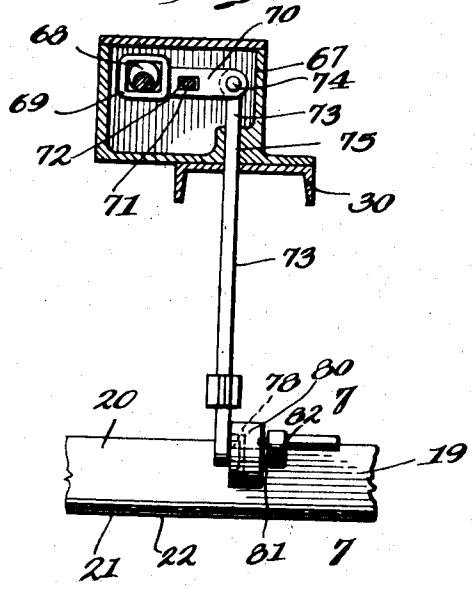
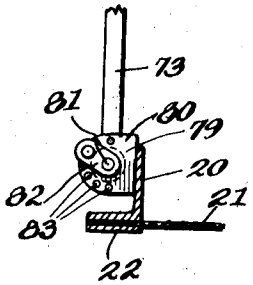


Fig. 7.



Inventor

James Winston

Patented Oct. 21, 1930

1,779,202

UNITED STATES PATENT OFFICE

JAMES WINSTON, OF CHUQUICAMATA, CHILE

VIBRATING SCREEN

Application filed June 22, 1927. Serial No. 200,633.

The present invention relates to vibrating screens, and aims to provide a novel and improved machine of this character which can be conveniently operated for efficiently screening material.

Another object of the invention is to provide a vibrating screen having a side shake besides the usual up and down movement and constructed so that the amplitude of vibration up and down and the amplitude of side shake may be adjusted while the machine is in operation, such adjustment rendering the machine efficient in screening different classes of material.

A further object of the invention is to provide a vibrating screen capable of producing a violent stroke which will materially increase the screening capacity of the machine.

A still further object of the invention is the provision of a vibrating screen in which the screen is arranged at an angle and the vibration transmitted at or near the center of gravity of the screen when loaded, so as to produce uniform vibration of the entire screen area, relieving the machine of unbalanced strain and permitting an economical utilization of power.

As another object of the invention I provide an anti-friction supporting member for the screen during the vibrating thereof in order to relieve strain on the vibrator and mechanism for transmitting vibration to the screen.

I have for still another object of the invention the provision of spring means for returning the vibration imparting mechanism besides springs which support and return the screen, thus returning said mechanism immediately after a stroke so that all strokes will be in a sudden, violent manner.

Also I have for an object to provide a flexible, resilient shaft coupling between the power transmitting mechanism and the side shaker for absorbing shocks from the side shaker and thus preventing the power mechanism from being subjected to such shocks.

It is also an object of the invention to provide a vibrator in which the amplitude of some vibrations are different from other vibrations, which will act as means for freeing clogged meshes of the screen or for preventing them from clogging.

In carrying forward my invention, I also have for an object to provide an adjustment for permitting the taking up of wear on the vibrator so as to permit the same amplitude of vibrations after the machine has been subjected to continuous use.

Still another object of the invention is to provide a device of the above indicated character, which is of a relatively simple nature, substantial in construction, which can be manufactured rather economically, and which will be thoroughly efficient and practical in use.

With the foregoing and other objects in view, which will be apparent as the description proceeds, the invention resides in the construction and arrangement of parts, as hereinafter described and claimed, it being understood that changes can be made within the scope of what is claimed, without departing from the spirit of the invention.

In the accompanying drawings, forming a part of the specification,

Figure 1 is a vertical longitudinal section through my improved vibrating screen,

Figure 2 is a top plan thereof, showing a part of a casing removed,

Figure 3 is a side view of the vibrator,

Figure 4 is a section through the vibrator showing the main operating mechanism,

Figure 5 is a front elevation with the supporting structure removed,

Figure 6 is a detail section taken on line 6—6 of Figure 5,

Figure 7 is a fragmentary vertical section taken on line 7—7 of Figure 6,

Figure 8 is a side elevation of the flexible shaft coupling between the power mechanism and side shaker,

Figure 9 is an end elevation of said coupler.

Referring to the drawings, the numeral 10 designates the base or supporting structure for the screens which is constructed of angle iron to form a base section 11 and a vertical section 12 rising from the rear end thereof, said vertical section supporting from and between its upper end a pair of angle irons 13

inclined downwardly towards the forward end of the base structure and supported above the same by means of bars 14 adjustably connected at their ends to the base 11 and angle irons 13, whereby the inclination of the latter may be changed as desired, for which purpose the aforesaid supporting rods 14 are threaded at their ends and the blocks 15 to which they are connected are pivoted, at 16, to the base 11 and angle bars.

Supported from the angle bars 13 is an inclined screen 19 resting at its upper and lower ends on interposed coiled springs 17 the ends of which are seated in cup-shaped members 18 secured to the angle bars and screen frame respectively. The screen frame is also constructed of angle bars and is disposed at the same inclination as the bars 13, said frame having screening material 21 secured to the angle bars 20 forming the same by attaching strips 22 under the latter and clamping the edges of the screening material between said strips and the undersurfaces of the angle bars. At each end of the screen frame and extending between the side pieces thereof are tension rods 23 having their opposite ends threaded in blocks 24 secured to said side pieces. The tension rods have right hand threads on one end and left hand threads on the other so that by turning said rods in either direction the angle members 20 will be moved towards or away from each other for tensioning the screen 21.

As the screen frame 19 is supported above the angle members 13 by means of coil springs, anti-friction members 25 are provided at the upper ends of the angle members 13 for preventing longitudinal movement of the screen frame, said anti-friction members consisting of short upright bars 26 secured to the angle bars 13 and having rollers 27 at their upper ends engaging an angle member 28 extending across the upper end of the screen frame between the angle bars 20 thereof. It can be seen that when the screen frame is vibrated the angle member 28 engaging the rollers 27 will permit said screen frame to move in and up and down direction without danger of longitudinal movement thereof with relation to the means supporting the same.

The driving mechanism, hereinafter described, for operating the screen is mounted in a frame supported from the angle bars 13 and consisting of uprights 29 secured at their lower ends to the outer sides of said angle bars and connected together at their upper ends by a cross-piece 30, the uprights and cross-piece being preferably formed of channel bars or plates. Mounted on the cross-piece intermediate its ends is a casing 31 in which is rotatably mounted a cam or tappet-wheel 32 on a shaft 33 extending beyond the casing for attachment to an electric motor 34 also mounted upon the cross-piece of the supporting frame. While I have shown an electric motor for operating the cam or tappet-wheel it is to be understood that any type of power may be supplied to the shaft 33 for the purpose, said cam or tappet-wheel having tappets in the form of teeth 35 thereon adapted to strike one end of an arm 36 pivoted in the casing 31, as at 37, for causing said arm to be swung on its pivot. The tappets or ratchet-teeth of the cam are of different lengths alternately so as to cause greater swinging movement of the arm 36 when engaged by one tooth than the other or adjacent tooth. The arm 36 has a spherical pivot member 38 confined in a bearing member 39 at the upper end of a vertically reciprocating rod 40 which extends downwardly to the screening frame through openings 41 in the casing 31 and cross-piece 30 and at its lower end is provided with a clamping member 42 which engages about a tubular shaft or bar 43 carried by the screen frame. The bar 43 has its opposite ends attached to the side pieces 20 of the screen frame and is attached thereto at a point towards the upper end thereof from the center of gravity or at the center of gravity of the screening frame when loaded with material to be screened.

Extending through the casing 31 beneath the outer end of the arm 36 is a shaft 44 having a stop cam 45 thereon which is engaged by the arm 36 after it has been swung on its pivot for limiting return movement of said arm. It can be seen that when the shaft 44 is turned in the casing 31 the return movement of the arm 36 may be adjusted so as to cause greater or less swinging movement thereof and thus regulate the reciprocating motion of the rod 40 which in turn will regulate the vibrating of the screen. The shaft 44 is turned for changing the position of the stop cam 45 by means of a crank handle 46—47, the latter being held in adjustment by a series of depressions 48 in the side wall of the casing 31 with which a pin (not shown) on said crank handle engages. Cam 45 is of a sufficient size to hold the arm 36 out of position to be engaged by the teeth 35 of the ratchet or cam 32 when it is desired to stop the reciprocating of said rod 40 and vibrating of the screen.

Attached to an intermediate portion of the reciprocating rod 40, as at 49, is a leaf spring 50, which extends therefrom and engages the head 51 of a depending bar 52 supported by a bracket 53 secured to the cross piece 30 of the supporting frame at one side thereof, said depending bar being provided at its upper end within a rectangular frame 54 in which is a cam 55 mounted on a shaft 56 mounted in upstanding side pieces of the bracket 53. The shaft 56 has a crank arm 57 attached to the outer ends thereof for turning the same in order to adjust the position of the cam 55 in the rectangular frame 54 so as to change posi-

tions of the head 51 of the bar 52, thus changing the tension of the spring 50. In the bracket 53 are a series of depressions 58 into which the crank arm 57 engages for holding the cam in adjusted position. The leaf spring provides the principal means for returning the arm 36 to its initial position after being rocked by the teeth on the cam or tappet wheel 32 as it returns the arm 36 to its position without depending on the springs 17 which support the screen frame, thus providing a means for resetting the arm 36 immediately so that all strokes of the reciprocating rod 40 will be in a sudden, violent manner. By swinging the cam 55 to a different position, the tension of the spring 50 may be regulated for causing proper returning of the arm 36.

The motor 34 has mounted on the rotary shaft 60 thereof a wheel 61 provided with a pair of pins 62 extending from its face and adapted to engage yieldable leaf spring members 63 projecting from the periphery of a collar 64 secured to a shaft 65 in alinement with the motor shaft. The shaft 65 is mounted in a bearing 66 at the inner side of a casing 67 mounted upon the cross piece 30 adjacent one end thereof, and said shaft extends into the casing where it carries a cam 68 working in a rectangular box-shaped frame 69 on one end of an arm 70 pivotally mounted in the casing by means of a pin 71. The arms 70 is slotted, as at 72, where the pin extends therethrough in order to permit longitudinal movement of said arm when swung on its pivot by rotation of the cam 68. To the end of the arm opposite the cam is pivotally connected the upper end of a rod 73 which extends through a bearing 75 in the casing 67 and through the cross piece 30 which supports said casing. The rod 73 extends downwardly adjacent one of the uprights of the supporting frame and is slidably mounted in a bearing 76 secured to said upright. On the lower end of the rod 73 is a laterally extending pin 77 which extends into a slot 78 in one side of a collar 79 mounted in a bracket 80 for turning movement, said bracket 80 being secured to one of the angle bars 20 of the screening frame. The collar 79 is on a short shaft 81 which extends through the bracket 80 and is provided at its outer end with a crank arm 82, and on the adjacent side of the bracket 80 are a series of indentations 83 into which a projecting pin on said crank arm is adapted to engage for holding the collar 79 in adjusted position. It can be seen that by turning the crank, the position of the slot 78 in the collar may be changed. By changing the angle of the slot the side shaking of the screening frame will be regulated, as reciprocating motion of the rod 73 causes the screening frame to be moved sideways due to the fact that the pin 77 carried thereby is arranged in an angularly extending slot.

In operation, the electric motor 34 will rotate the shaft 33 causing the cam or tappet wheel 32 to be rotated in the direction indicated by the arrow in Figure 4 of the drawings. Upon such rotation of the wheel the teeth 35 thereof will engage one end of the arm 36 swinging the same on its pivot, thus imparting a sudden, violent upward movement to the screening frame, due to the fact that the rod 40 is connected to the arm 36 and to the screening frame. It is to be noted by referring to Figure 4 of the drawings that four teeth are provided on the cam or tappet wheel 32, two of one size and the other two of a larger or smaller size and that the teeth alternate in size around the periphery of the wheel, thus causing the amplitude of some vibrations to be different from other vibrations. The result obtained is similar to that obtained by an outside blow for freeing clogged meshes of the screen or preventing them from clogging. While I have shown four teeth on the cam or tappet wheel it is to be understood that any number of teeth of different sizes may be provided and the relative arrangement thereof modified, it being my idea to provide a vibrator in which the amplitude of some vibrations is different from others. By adjusting the position of the stop cam 45, the amplitude of all vibrations is changed, thus providing a means whereby the amplitude of vibrations may be increased or decreased according to the material being screened. The top cam also provides means for taking up wear on the vibrator arm 36 and tappet or cam 32 after the same have been subjected to considerable use.

It can be seen that when a tooth 35 on the cam or tappet strikes the end of the arm 36, said arm acquires a sudden, violent and positive motion which will cause efficient screening of material on the screen frame, due to the fact that the other end of the arm 36 connected to rod 40 acquires a motion of the same characteristics but in an opposite direction. The return movement of the arm is effected by the leaf spring 50 so as to immediately return the arm to a position to be engaged by the next tooth on the cam or tappet 32. The tension of the leaf spring may be varied by turning the cam 55 in the rectangular frame so as to raise or lower the bar 52 which the spring 50 engages.

Operation of the motor 34 will also cause the shaft 65 to be rotated as it is connected to the motor through a flexible coupling and upon rotation of this shaft, the arm 70 will be rocked causing the rod 73 to be reciprocated. Upon reciprocating motion of the rod 73 the pin 77 thereon will cause the screen frame to be moved sideways due to the fact that the slot 78 in the collar 79 is arranged at an angle and the fact that the rod 53 is supported by bearings and is not permitted to

swing to the side, thus causing a side shaking motion to the screening frame. The side shaking mechanism imparts to the screen a vibration perpendicular to that produced by what might be called the primary vibrator above described. When the collar 79 is arranged so that the angle thereof is parallel with the reciprocating movement of the transmitter rod 73, the pin 77 reciprocates in the slot 78 without imparting any side shake to the screen, thus permitting the side shake of the machine to cease during operation of the machine. When the collar 79 is turned so that the slot therein is at an angle with relation to the movement of the rod 73, there is a sidewise movement imparted to the screen as the rod 73 is held against side movement. It is to be noted that this movement is at both sides of the normal position of the screen and that the side shaking mechanism greatly increases the efficiency and capacity of the screen, as it increases the path of movement of particles which travel over the screen.

By providing a resilient, flexible shaft coupling between the motor and the side shaker, shocks are absorbed from the side shaker or secondary vibrator, thus relieving strain on the motor. By providing springs 63 in the resilient, flexible coupler, the same act as cantilever springs and are engaged by the pins or lugs 62 in forming the driving connection. On the pins 62 are leather or other non-metallic sleeves to prevent a metal to metal contact, thus obviating the need of lubrication.

When it is desired to tighten the screening material or when a worn screen is replaced by a new one, the bars 23 are rotated by means of any approved wrench so as to cause the oppositely threaded ends of said bar to turn in the blocks 24 for moving the angle bars 20 having the screen material attached thereto away from each other.

The reciprocating rod 40 is attached to the screen frame 19 between the center line of the screen and the feed end thereof, the object being to form a connection to the screen at the center of gravity of the screen when loaded, as there is more material on the screen at the upper or feed end than at the lower or discharge end for some of the material passes through the screen on its way down, consequently this arrangement will provide a more uniform vibration of the entire screen area, less eccentric, relieves an unbalanced strain on the machine, and produces a more economical utilization of power.

By providing the anti-friction mechanism at the upper end of the screening frame the latter is held against tendency to move downwards during operation, thus relieving the reciprocating rod or transmitter 40 from strain of such movement. The ball bearing against the angle member 28 will also permit side movement of the screening frame by the supplemental vibrator or side shaker. The springs 17 which support the weight of the screen are arranged in such a manner that the vibrator furnishes power only for vibrating the screen and is relieved from carrying dead weight.

It is to be noted that I have provided adjustments for the amplitude of vibrations of the primary vibrator, for the amplitude of vibrations of the side shaker, and for the tensioning of the spring that returns the primary vibrator mechanism, by means of crank arms which may be simply turned to known positions for obtaining different adjustments, thereby obviating the use of tools for such work and permitting the proper adjustment without experimenting with same.

Having thus described my invention, what I claim as new is:

1. A vibrating screen for the purposes set forth comprising a supporting frame, an inclined screen yieldably supported in said frame for vertical and lateral vibrations, an auxiliary supporting frame overlying the screen and having a cross-piece at its upper end, a motor mounted on the cross-piece and having a driving shaft projecting at opposite sides, means for imparting a vertical vibratory motion to the screen operated by the shaft at one side of the motor, and means for imparting a lateral vibration to the screen operated by the shaft at the other side of the motor.

2. A vibrating screen for the purposes set forth comprising a supporting frame, an inclined screen yieldably supported in said frame for vertical and lateral vibrations, an auxiliary supporting frame overlying the screen and having a cross-piece at its upper end, a motor mounted on said cross-piece and having a driving shaft projecting at opposite sides thereof, a tappet-wheel keyed to the shaft at one side of the motor and operating a lever connected to the screen for imparting a vertical vibration thereto, a wheel carried by the shaft at the other side of the motor and having outwardly projecting pins, and means for imparting lateral vibrations to the screen and having yieldable members engaged by said pins for operating said vibrating means.

3. A vibrating screen comprising a supporting frame, an inclined screen mounted therein for vertical vibrations, a supporting frame for the vibrating mechanism attached to the aforesaid supporting frame and overlying the screen, a tappet-wheel and means for operating the same supported on said last mentioned supporting frame, and a pivoted lever with which the tappet-wheel engages at one end, and a rod pivoted to the lever at the other side of its pivot and connected to the screen; together with means adapted to engage the outer end of the lever for holding it

out of operation with respect to the tappet-wheel.

4. A vibrating screen for the purposes set forth comprising a supporting frame, an inclined screen yieldably supported on said frame for vertical and lateral vibrations, an auxiliary supporting frame overlying the screen and having a crosspiece at its upper end, a motor mounted on the crosspiece and having a driving shaft, means operated by the driving shaft for imparting a vertical vibratory motion to the screen, and means operated by the shaft for imparting a lateral vibration to the screen; together with a plate extending across the underside of the inclined screen, and an arm projecting from the supporting frame and bearing against the plate to oppose downward movement of said screen.

5. A vibrating screen for the purposes set forth comprising a supporting frame, an inclined screen yieldably supported on said frame for vertical and lateral vibrations, an auxiliary supporting frame overlying the screen and having a crosspiece at its upper end, a motor mounted on the crosspiece and having a driving shaft, means operated by the driving shaft for imparting a vertical vibratory motion to the screen, and means operated by the shaft for imparting a lateral vibration to the screen; together with a plate extending across the underside of the inclined screen, an arm projecting from the supporting frame to cooperate with said plate for opposing downward movement of the screen, and a ball bearing interposed between the arm and plate to freely permit of the vibratory motions of said screen.

6. A device of the character described comprising a frame, an inclined screen loosely supported therein, spring means for yieldably supporting said screen by said frame, means for imparting vibration to said screen, an angle plate carried by said screen, an upright carried by said frame and having a roller bearing engaging said plate for preventing longitudinal movement of said screen with relation to said frame.

In testimony whereof, I have affixed my signature.

JAMES WINSTON.