

June 18, 1946.

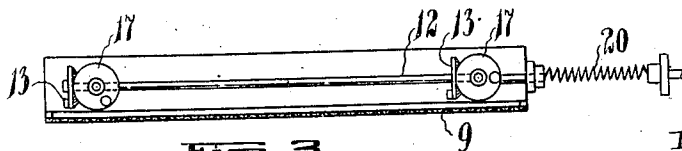
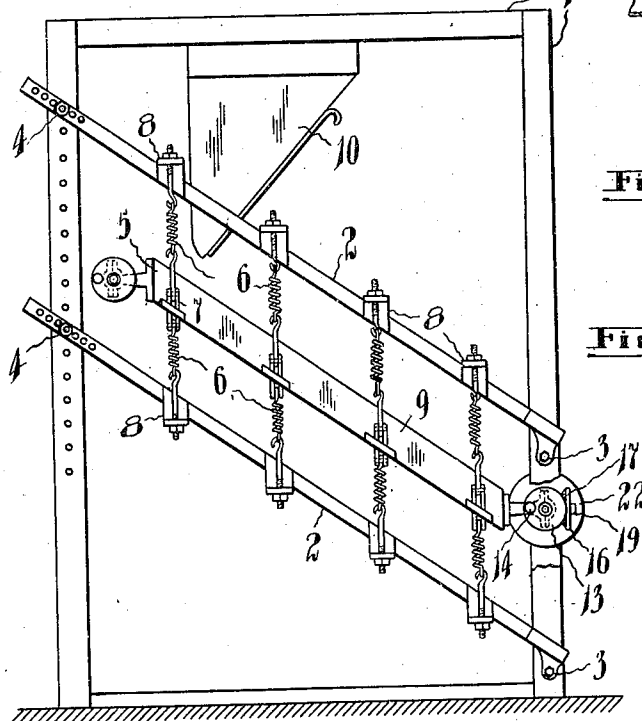
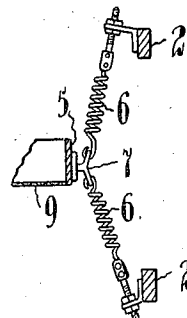
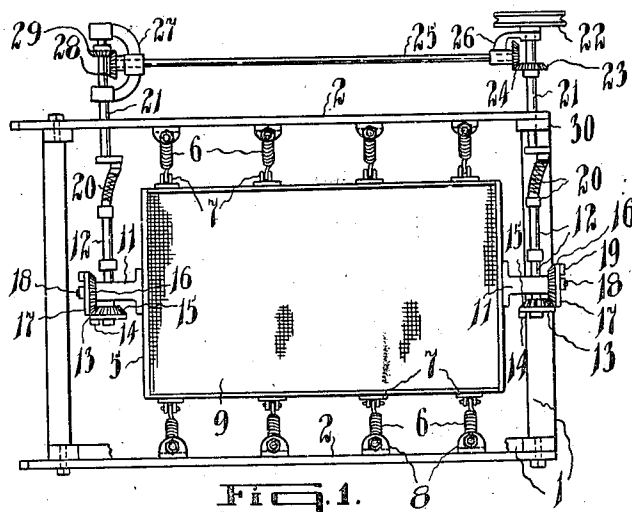
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2,402,340

SCREEN

Filed March 8, 1943

2 Sheets-Sheet 1



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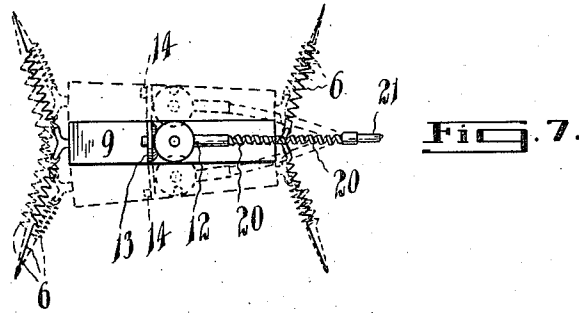


FIG. 8.

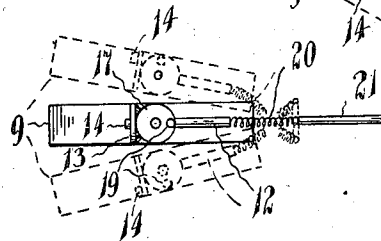


FIG. 9.



FIG. 6.

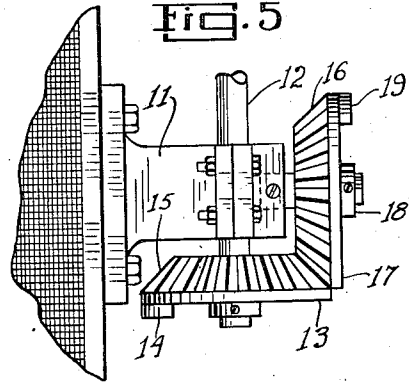


FIG. 5.

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UNITED STATES PATENT OFFICE

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SCREEN

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5 Claims. (Cl. 209—326)

1

This invention relates to screens, and the object of the invention is to produce a vibratory screen for screening various materials with a maximum of efficiency using a minimum of power. A further object is to reduce as much as possible the wear and tear on both the fixed and vibrating parts and simplify the structure of the screen.

The above objects and other objects which will hereinafter appear, are achieved by the construction hereinafter described in detail and illustrated, by way of example in the accompanying drawings in which:

Figure 1 is a diagrammatic plan view, with the feed hopper removed;

Figure 2 a side elevation partly broken away;

Figure 3 an end view of the screen frame showing a modified form of vibratory mechanism;

Figure 4 a fragmentary cross section through the screen frame and the supporting frame showing the resilient mounting;

Figure 5 a plan view on an enlarged scale of the vibrator;

Figure 6 a perspective view, partly broken away, of the elastic spring shaft;

Figure 7 a diagrammatic end view of the screen and elastic spring drive shaft illustrating in exaggerated form the tilting movement thereof, showing the screen in various positions in dotted lines;

Figure 8 a diagrammatic side view more or less in perspective of the screen and drive shaft; and

Figure 9 is a view similar to Figure 7 in which the connection of the elastic drive shaft to the rigid drive shaft is offset in the opposite phase to that of the vibration of the screen.

In the drawings corresponding numbers refer to corresponding parts in the different figures.

A suitable rigid supporting frame 1 having vertical members and cross members is provided on which is supported the tilting frame 2 comprising upper and lower members which are pivotally connected to the rigid frame 1 at one end by means of pivot pins 3, 3 and to another upright of the frame 1 at the other end by means of bolts 4, 4 which extend through holes in the tilting frame and holes in the rigid frame 1. A series of holes in each frame is provided as illustrated in Figure 2 whereby the angle of slope of the tilting frame 2, and hence the screen frame 5 may be varied as desired.

The screen frame 5 is supported on the tilting frame 2 by means of a series of coil springs 6 pivotally secured by means of knuckle joints to a series of lugs 7 along the longitudinal sides of

2

the screen frame 5. The other ends of the coil springs 6 are secured to the upper and lower members of the tilting frame 2 by means of tension varying devices 8 comprising hooks 8 threaded at one end and passed through brackets and adjustably held in position by nuts on the threaded ends of the hooks. It will be observed that if the upper and lower members of the tilting frame are vertically adjusted by moving the free end of each an equal distance up or down the distance apart of the said upper and lower members and hence the tension of the springs will remain substantially the same, and the direction of the longitudinal axis of the springs will not be changed. The tilting frame is wider than the screen frame so that the coil springs extend at an angle outwardly from the sides of the screen frame, thus holding the screen more firmly under tension, as shown in Figures 1 and 4.

The screen 9 is mounted within the screen frame 5, and may be removable to replace it when worn out or to substitute a screen of a different mesh. A suitable hopper 10 may be provided for feeding materials to the upper end of the screen.

The illustrated means for vibrating the screen 5 comprises a central bearing post 11 which may be mounted on one or both ends of the screen at either end of the longitudinal center line or at any intermediate point on said line. In the construction shown in Figure 1 there is a central bearing post mounted on each end. Rotatably mounted on a drive shaft 12 in the said central bearing post 11 is a flywheel 13 provided with a suitable unbalancing weight 14. This flywheel is provided with a bevel gear 15 which faces the bearing post 11 and meshes with a bevel gear 16 on another flywheel 17 which is rotatably mounted on the bracket bearing post 11 by a stub shaft 18 and which is provided with an unbalancing weight 19. The bevel gear 15 likewise faces the bearing post 11. The flywheel 13 causes longitudinal oscillation of the screen and the flywheel 17 causes simultaneous transverse oscillation thereof.

The shaft 12 is driven by an elastic spring shaft 20 formed of a strip of flat zig-zag steel spring of substantially uniform thickness and width as shown in Figure 6. The said elastic spring shaft is in turn driven by a rigid shaft 21 which is driven by a pulley 22 or in other suitable manner from a motor (not shown).

The vibratory devices at each end of the screen 5 may be operated separately by an independent

3

motor, but it is preferred that they be synchronized by the following means:

Mounted on the shaft 21 is a bevel gear 23 which meshes with another bevel gear 24 on the shaft 25, which shaft is journaled in a bracket 26 at one end and a bracket 27 at the other end, and is provided at the other end with a bevel gear 28 which meshes with another bevel gear 29 which is mounted on the drive shaft 21 which drives the spring shaft 20 and the vibratory mechanism at the other end of the screen. The synchronizing drive mechanism above described may be mounted on any suitable support. In the drawings for the sake of clarity and simplicity, no special support has been shown, although the shaft 21 at the front or lower end of the screen is shown as being journaled in a bearing 30 in one of the upright members of the frame 1.

As stated above, instead of having a vibrator at each end of the screen, a vibrator at only one end of the screen, or mounted elsewhere on the screen, may be used. Furthermore, instead of providing the vibrator with two unbalanced wheels, the wheel 13 alone may be used giving only a longitudinal vibratory movement, or if desired the wheel 17 alone may be provided with an unbalancing weight, giving only a transverse gyratory movement. The power and scope of the vibrator may be varied by changing the weight or position of the unbalancing weights, or the speed of the vibrator. The gyratory effect may also be varied by changing the strength of the springs 6 or adjusting their tension. It will thus be seen that the device may be adapted for use with an infinite variety of weights and kinds of materials and for different purposes.

The elastic shaft is an important feature of the invention. Such a shaft is different in construction and essentially functions differently from a shaft having universal, swivel or hinged joints or like construction. An elastic shaft is one which will stretch and rebound or will compress and rebound. It is also flexible. In the drawings are shown an elastic spring shaft of spring metal of flattened form e. g. ellipsoid or rectangular in cross section in folds or zig-zagged back and forth from side to side with their flat sides transverse to the longitudinal axis of the shaft, after the fashion of pleating or other formation as shown in Figure 6. A spring shaft of this form will expand and contract with the movements of the screen but practically no expansion or contraction will be imparted thereto by the rotary force applied thereto. The shaft is arranged so that when the screen gyrates the shaft will be under tension at least when the screen is at the upper and lower positions in its cycle of movement: This results in a tilting of the screen in one direction when in its uppermost position and in the opposite direction when the screen is in its lower position, as illustrated diagrammatically in Figures 7 and 9 in which the screen is shown in dotted lines in various positions of its vibratory movement. A slight transverse movement of the screen is also obtained since the stress on the elastic shaft tends to pull the screen towards the shaft when the screen is above or below its place of starting, while the springs 6 tend to pull the screen back when in its gyratory movement it returns to its place of starting. Since this transverse movement is slight and merges with the transverse gyratory movement caused by the wheel 7, it is not shown in the diagrammatic views.

Thus there is imparted to the screen not only

4

a gyratory movement, but also transverse and a tilting movement, the latter being obtained by the use of an elastic drive shaft. The mounting of the vibrator on the longitudinal center line of the screen also assists in obtaining the tilting effect since the tilting takes place on this center line. The delicate adjustable spring mounting of the screen is a further factor in obtaining the desired movement, which is much more efficient than the ordinary vibratory or oscillatory movement.

The tilting effect may be accentuated by connecting the elastic spring shaft 20 off center of the rigid drive shaft 21 (see Figure 9). The elastic spring shaft 20 is arranged out of phase with the vibrator, i. e., the point of connection between the shaft 21 and the elastic spring shaft 20 is down when the screen is up and vice-versa.

When the double unbalanced fly-wheel vibrator is used there is a positive tilting or rocking action, and the unbalancing weight on the vibrator will be so arranged as to supplement and accentuate the sideways tilting action which would be imparted to the screen by the elastic spring shaft, that is to say, the vibrator will tend to tilt the screen away from the drive shaft when it is down and towards the drive shaft when it is up.

A modified construction is shown in Figure 3, in which two vibrators are mounted on one end of a screen, said vibrators being spaced apart and balanced. The shaft 12 extends from the first vibrator which is operated by the elastic shaft 20, to the second vibrator and rotates the unbalanced flywheel 13 of the second vibrator. By arranging the counterbalancing weights on the two vibrators 17 so that they are slightly out of phase, it will produce a side to side positive tilting throw. By increasing the number of supporting springs the size and strength of the spring may be reduced thus making the screen more sensitive to vibrating movement. By varying the tension on the springs the amount of vibratory movement may be regulated and controlled. The increased number of springs provides like support throughout the full length of the screen.

The combined oscillatory movement of the screen is such that screening is rapid and effective with a comparatively slow movement of the screen. This reduces the wear and tear on the machine and the amount of power used.

Although the invention has been described in some detail, it will be understood that it is not desired to be limited to such details except as may be specified in the annexed claims.

What I claim is:

1. In apparatus of the kind described, a screen; means for vibrating the screen; a tilting frame having upper and lower members; springs extending between the screen and the upper and lower members to yieldingly support the screen in the frame; a supporting frame on which the upper and lower frame members of the tilting frame are separately and independently pivoted at one end; and means for adjustably securing the other ends of the upper and lower frame members to the supporting frame at various vertically spaced positions, whereby the screen may be tilted to various desired angles without substantially varying the tension of the supporting springs or the direction of the longitudinal axis thereof.

2. In apparatus of the kind described, a screen; means for vibrating the screen; a tilting frame having upper and lower members; springs extending between the screen and the upper and lower

5

members to yieldingly support the screen in the frame; a supporting frame on which the upper and lower frame members of the tilting frame are separately and independently pivoted at one end; means for adjustably securing the other ends of the upper and lower frame members to the supporting frame at various vertically spaced positions, whereby the screen may be tilted to various desired angles without substantially varying the tension of the supporting springs or the direction of the longitudinal axis thereof; a vibrator mounted on said screen at the end thereof nearest the pivoted end of the tilting frame; and a drive shaft for operating said vibrator.

3. In apparatus of the kind described, a frame; a screen yieldingly mounted on said frame; a rotatable vibrator mounted on said screen; a rotary driving element on the frame; and a rotatable longitudinally stretchable elastic drive shaft connecting the vibrator and the drive shaft, formed of a strip of spring metal of flattened form and of substantially uniform thickness and width in zig-zag formation, with flat sides transverse to the longitudinal axis of the shaft, for operating the vibrator, said elastic shaft being so arranged that it will be under tension at least when the screen is at the upper and lower positions in its cycle of movement.

4. In apparatus of the kind described, a frame; a screen yieldingly mounted on said frame; a central bearing post mounted on said screen; a

6

drive shaft journaled in said bearing post; an unbalanced wheel on said drive shaft; a stub shaft mounted on said bearing post and extending substantially at right angles to the drive shaft; an unbalanced wheel mounted on said stub shaft and having propelling contact with the wheel on the drive shaft; and means for rotating the drive shaft to rotate said unbalanced wheels, whereby one of the wheels will vibrate the screen longitudinally and the other will vibrate it transversely.

5. In apparatus of the kind described, a frame; a screen yieldingly mounted on the frame; a rotatable vibrator mounted on said screen; a rotary driving element on the frame; a rotatable longitudinally stretchable elastic drive shaft connecting the vibrator with the driving element for operating the vibrator, said drive shaft being formed of a strip of spring metal of flattened form of substantially uniform thickness and width in zig zag formation, with flat sides transverse to the longitudinal axis of the shaft, whereby the shaft will stretch and compress under tension with the movements of the screen, but substantially no stretching or compression will be imparted thereto by the rotary force applied thereto, the said shaft being so arranged that it will be substantially under no tension when the screen is at rest.

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