

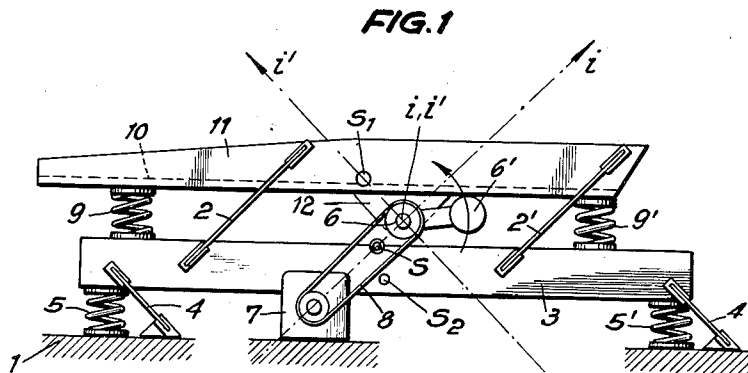
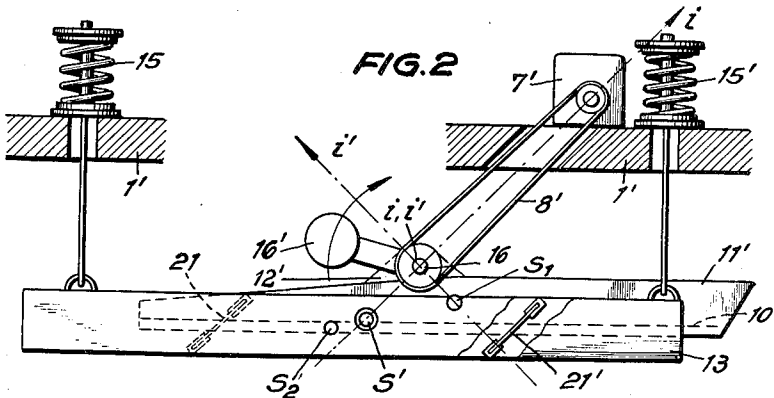
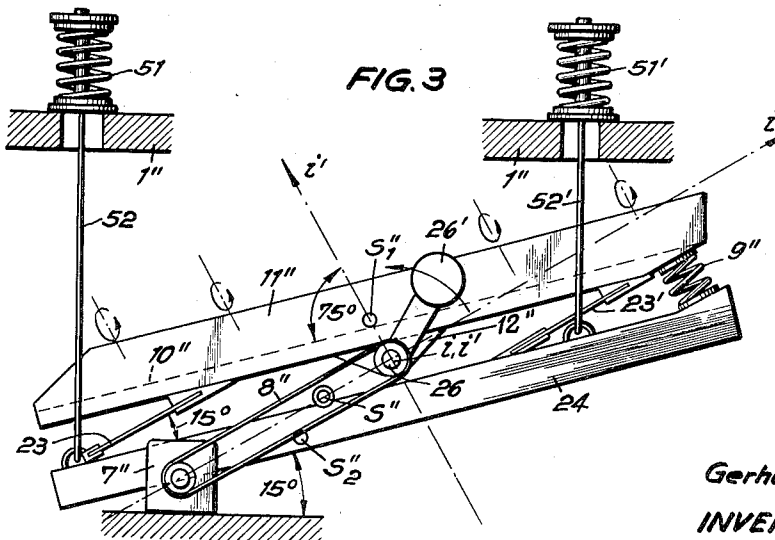
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VIBRATING SCREENS

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VIBRATING SCREENS

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The invention relates to mechanically operated plane screens for classifying solids, ores, stones, fuels, saline products and other crude materials, and more especially to structural and working improvements in so-called vibrating screens of an advanced type, wherein the screen is resiliently fixed to a heavy ground or ballast frame, likewise resiliently supported from a base, and is operated by a rapidly revolving eccentric or unbalanced shaft, so as to be bodily moved around in closed cycles of movement.

In working with screens of this type wherein the ballast frame and the screen were resiliently supported by helical springs, I have found that they are often clogged by oversize pieces not passing through—especially lengthy, cone shaped lumps, which are retained, pinched and stuck in the larger meshes of the screen.

The principal object of the invention is to overcome this drawback; I have found in the course of my experiments, empiric and research work that this can be best accomplished by so redesigning the supporting and operating means of the screen that the material under treatment on the screen is more forcibly thrown up and forward—towards the discharge end of the screen—viz. at a large angle of elevation or inclination to the screen, considerably larger than 45°—and larger than feasible with vibrating screens used heretofore—viz. shot as by a gun with a high angle of elevation.

Another object of the invention is to so structurally redesign the vibrating screen that irregular or deviating swinging or "nodding" motions, accidentally recurring, e. g. through excentric impacts of the material in progress over the screen, and likely to be dangerous to the screen by their growth and amplification in resonance, are eliminated.

Still other objects and advantages obtained by the invention are described in the following specification and will be better understood from the accompanying drawing, wherein—

Figure 1 is a side elevation diagrammatically showing by way of an example a vibrating screen redesigned according to this invention,

Figures 2 and 3 show structurally modified screens.

In the embodiment of the invention shown in Figure 1 the vibrating screen comprises the cooperative association with a base 1, of a ground or ballast frame 3, a primary set of leaf springs 4—4', resiliently supporting the ballast frame 3 from the base 1, and allowing it to be bodily swung up and reciprocated in an elevated path of movement, indicated by arrow *i*, inclined to the base, of a screen 10 thereabove and an open box frame 11 enclosing it, and a secondary set of leaf springs 2, 2' resiliently supporting the screen on the ballast frame 3 and allowing the screen to be bodily swung up and reciprocated in an elevated path of movement indicated by arrow *i'*, viz. at right angles to arrow *i* of the ballast frame.

A rotary shaft 6 which carries an out of balance or eccentric weight 6' is provided for operating the screen structure 10, 11. This shaft 6 is journaled in brackets 12

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fixed to the screen frame 11. The level at which shaft 6 is positioned is critical and should be on line of intersection $i+i'$, where the cross sectional plane *i'*, going through the center of gravity *S*₁ of the screen structure and in the direction (*i'*) of its swinging movements, and the cross sectional plane *i*, going through the center of gravity *S* of the associated screen- and ballast-frame-unit and at right angles to the screen's movements, intersect. A motor 7 and belt drive 8 is provided for revolving the rotary shaft 6.

The weights of the unbalances 6' at both ends of the rotary shaft, of the screen 10, 11 and of the ballast frame 3, the position of their centers of gravity *S*₁, *S*₂ and the lengths and recoiling power of their supporting springs and their angles of inclination to the screen and to the ballast frame should be so chosen and proportioned that the screen structure in action will be bodily vibrated all over, viz., moved in upright elliptical cycles of movement, congruent to each other and forcibly stabilized in strictly axial, or feeding and discharging direction, and with their major axis at a high angle of inclination, larger than 45°, as seen in Fig. 3.

Good results, viz. elliptical cycles of movement with their major axis exceeding 10 mm. in length, were obtained by making the ballast frame three or more times heavier than the screen and by adding auxiliary helical springs 5, 5', in cooperative association with the leaf springs 4, 4' and adapted to take up most of the total weight of the screen and ballast frame, while the leaf springs 4, 4' clamped at the base 1 and the ballast frame 3 are to take up smaller shares of the machine's weight, and will guide the ballast frame 3 in its swinging movements, acting in fact as flexible links virtually fulcrumed on the base.

Likewise auxiliary springs 9, 9' may be arranged at the screen 10, 11 in cooperative association with its leaf springs 2, 2'.

Instead of plain leaf springs, springs of other form—e. g. bow shaped ones (not shown)—may be used to advantage so as to prevent any lateral deviations of the ballast frame and screen from their exact courses of movement, viz. within a sectional plane of symmetry vertically and axially going through the machine.

An advantageous feature of the invention is the specific position of line $i+i'$ and the arrangement described of the rotary shaft 6, which is spaced and apart from the screen's center of gravity (*S*₁), and is journaled in brackets 12 of the screen frame so that no holes need be drilled through its side walls, which would increase manufacturing costs and weaken its rigidity.

The structurally modified vibrating screen redesigned according to this invention and diagrammatically shown in Figure 2 by way of another example, is of lighter weight and of a more simplified and compact type, having a U-shaped ballast frame 13, as seen from above, resiliently suspended by springs 15, 15' from a base 1', while the screen 10', 11' is resiliently supported on the legs of the ballast frame by leaf springs 21, 21'; the rotary unbalanced shaft 16, 16' is driven through the belt drive 8' of a motor 7' and is journaled in brackets 12' on top of the screen's box frame 11', widely spaced from the screen 10 proper, so as to clear the passage for the material proceeding thereon and giving easy access to the screen for inspection, alterations, maintenance and repair.

Various other changes and structural modifications may be conveniently made and useful complementary features added to vibrating screens, redesigned as shown and described, without departing from the spirit and the salient ideas of this invention.

The structurally modified vibrating screen shown in Fig. 3 by way of another example is redesigned according to this invention for coping with rather coarse materials containing many oversize pieces and odd shaped lumps which

would not pass through meshes as wide as 40 mm. and more.

The screen 10", enclosed in a box frame 11", and their ballast frame 24 underneath are arranged in slightly inclined position, sloping towards the delivery end in an angle of about 15°; the screen is adapted to be vibrated in elliptical cycles with their major axis longer than 10 mm. and inclined in a rather high angle of elevation of about 75° to the screen, viz. by an unbalanced shaft 26, 26' rotating at about 1,000-600 R. P. M. retrogressively according to the growing size of the meshes; in special cases the screen 10" and the ballast frame 11" thereunderneath may be arranged to advantage even at steeper angles to the base, from 20° to 25°.

In the screen structure shown in Figure 3 the ballast frame 23 is resiliently suspended by springs and cables 51-52, 51'-52' on a base thereabove, while the screen 10", 11" is cooperatively associated with the ballast frame 24 by leaf springs 23, 23' arranged at small angles of about 15°, and by compression springs 9", underneath the feed-end of the screen.

The critical line of intersection $i+i'$ referred to above with reference to Figures 1 and 2 is here at a distance from and below the screen 10", while the unbalanced rotary shaft 26, 26' is journaled in brackets 12 attached at the lower faces of the frame 11" and is rotated by a motor 7" and a belt drive 8".

It will be found advantageous, to let the belts run substantially in parallelism to the leaf springs interconnecting the screen and ballast frame.

The critical angle of elevation of the major axis of the elliptical cycles concerned may be conveniently enlarged to 80°, and the angle of inclination of the screen 10" to the base 1" up to 25°.

What I claim is:

1. A vibrating screen, comprising a ballast frame, a primary set of springs resiliently supporting said ballast frame, a screen frame, a secondary set of springs connecting said screen frame with said ballast frame and extending transversely to the direction of said primary set of springs, whereby said ballast frame along with said screen frame may swing while reciprocating along an elevated path of movement and whereby said screen frame may swing relatively to said ballast frame upon said secondary set of springs while reciprocating along an elevated path of movement which intersects the first-mentioned path of movement, a single unbalanced rotary shaft located at the point of intersection of a line passing through the center of gravity of the screen frame and extending in the direction of its path of movement with a line passing through the center of gravity of the combined screen and ballast frames and extending in the direction of the path of movement of the ballast frame, and means connecting said shaft with said screen frame for vibrating said screen frame, and a motor connected with said shaft for driving said shaft, whereby a plane passing through the center of gravity of the screen frame extends perpendicularly to said secondary set of helical springs and leaf springs, and a plane passing through the center of gravity of the combined screen and ballast frames extends parallel to said secondary set.

2. A vibrating screen, comprising a ballast frame, a primary set of helical springs and leaf springs resiliently supporting said ballast frame, a screen frame, a secondary set of helical springs and leaf springs mounted upon said ballast frame and supporting said screen frame, the leaf springs of the secondary set extending transversely to the direction of the leaf springs of the primary set, whereby said ballast frame along with said screen frame may swing upon said primary set of springs while reciprocating along

an elevated path of movement and whereby said screen frame may swing relatively to said ballast frame upon said secondary set of springs while reciprocating along an elevated path of movement which intersects the first-mentioned path of movement, brackets located below the screen frame, a single unbalanced rotary shaft journaled in said brackets at the point of intersection of a line passing through the center of gravity of the screen frame and extending in the direction of its path of movement with a line passing through the center of gravity of the combined screen and ballast frames and extending in the direction of the path of movement of the ballast frame, and a motor connected with said shaft for driving said shaft.

3. A vibrating screen, comprising a ballast frame, a primary set of helical springs resiliently carrying said ballast frame and located above the ballast frame, a screen frame, a secondary set of leaf springs mounted upon said ballast frame and supporting said screen frame, said secondary set of leaf springs extending transversely to the direction of said primary set of helical springs, whereby said ballast frame along with said screen frame may swing upon said primary set of springs while reciprocating along an elevated path of movement and whereby said screen frame may swing relatively to said ballast frame upon said secondary set of springs while reciprocating along an elevated path of movement which intersects the first-mentioned path of movement, brackets located below the screen frame, a single unbalanced rotary shaft journaled in said brackets at the point of intersection of a line passing through the center of gravity of the screen frame and extending in the direction of its path of movement with a line passing through the center of gravity of the combined screen and ballast frames and extending in the direction of the path of movement of the ballast frame, and a motor connected with said shaft for driving said shaft.

4. A vibrating screen, comprising a ballast frame, a primary set of helical springs resiliently carrying said ballast frame, a screen frame, a secondary set of helical springs and leaf springs mounted upon said ballast frame and supporting said screen frame, the springs of the secondary set extending transversely to the direction of the springs of the primary set, whereby said ballast frame along with said screen frame may swing upon said primary set of springs while reciprocating along an elevated path of movement and whereby said screen frame may swing relatively to said ballast frame upon said secondary set of springs while reciprocating along an elevated path of movement which intersects the first-mentioned path of movement, brackets located below the screen frame, a single unbalanced rotary shaft journaled in said brackets at the point of intersection of a line passing through the center of gravity of the screen frame and extending in the direction of its path of movement with a line passing through the center of gravity of the combined screen and ballast frames and extending in the direction of the path of movement of the ballast frame, and a motor connected with said shaft for driving said shaft.

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