

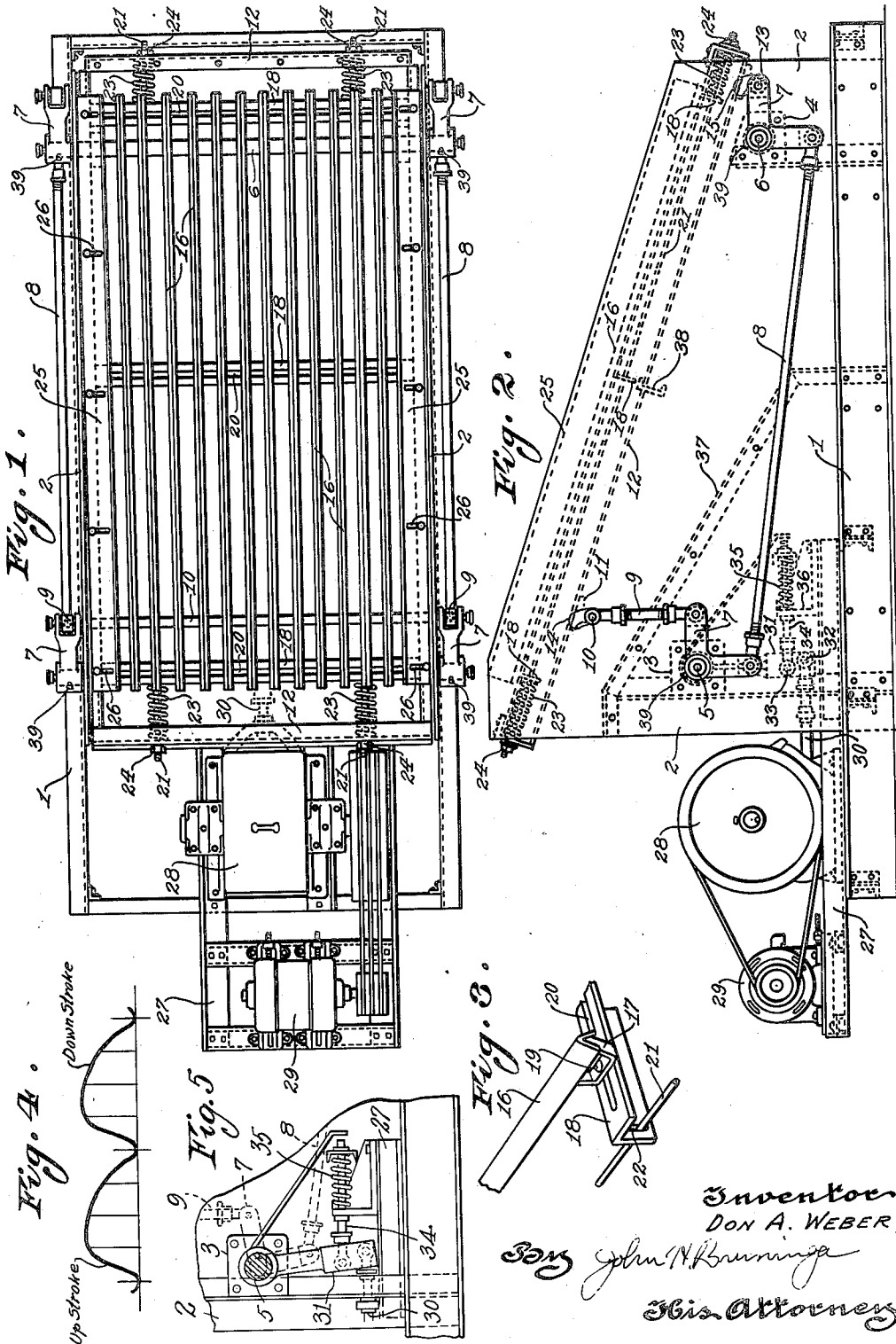
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SCREENING APPARATUS

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SCREENING APPARATUS

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This invention pertains to screening apparatus such as is used for classifying or grading granular materials.

One of the objects of this invention is to provide an apparatus of this kind with novel means for vibrating the screening medium such that the direction of vibration may be adjusted to suit requirements.

Another object is to provide such apparatus which may be adjusted to impose a different movement on different ends of the screen, and to provide for differential vibration.

Another object is to provide such apparatus with vibrating mechanism so arranged that said mechanism is protected against dust arising from the screening operation.

Another object is to provide a novel construction for the screening medium such as to render the same adjustable to suit different service requirements.

Further objects will appear from the following description taken in connection with the accompanying drawing, in which:

Figure 1 is a plan view of a screening apparatus embodying this invention;

Figure 2 is a side view of the same;

Figure 3 is a perspective detail of the construction of the screen;

Figure 4 is a motion diagram of the vibration; and

Figure 5 is a detail of the vibrating mechanism.

In the embodiment illustrated in the accompanying drawing, the machine is arranged to serve as a picker for separating slate from coal or similar operations whereby flat pieces are to be separated from pieces having a cubical or similar shape. The use of the machine is not, however, confined to such service but, by the mounting of a screen jacket of a suitable type, may be adapted to practically any type of screening operation.

Referring to the drawing, 1 designates a suitable base which may be constructed of structural iron shapes such as channel bars or the like in any suitable manner. Extending upwardly from the base 1, is a pair of vertical side plates 2. Journalled in suitable bearings 3 and 4 on the side plates 2 are transverse shafts 5 and 6. Each of the shafts 5 and 6, has mounted on each end thereof a bell crank 7. These bell cranks are in Figure 2 as positioned with one arm horizontal and the other extending vertically downward from the shafts. Arranged to connect the downwardly extending arms of each pair of bell cranks 7 on the same side of the machine is an adjust-

able link 8. The horizontal arms of the bell cranks mounted on the shaft 5 each has pivoted thereto an adjustable link 9 extending upwardly and pivoted to a cross shaft 10, secured by means of suitable brackets 11 to a vibrating frame 12. The horizontal arm of each bell crank 7 on the shaft 6 is similarly connected to a cross shaft 13, which carries the lower end of the vibrating frame 12. The shafts 10 and 13 extend through suitable openings 14 and 15 in the side plates 2 in order to accommodate the vibratory movement of the frame 12.

The frame 12 may be constructed of channel iron or other suitable shapes, preferably in rectangular form as illustrated in Figure 1. The screen jacket is mounted to vibrate in this frame.

The screen jacket illustrated in the accompanying drawing is constructed of a series of picker bars 16, extending longitudinally of the jacket. Each bar 16 is equipped with a plurality of attachment brackets 17. These brackets may be welded or otherwise secured to the bars 16 at suitable intervals. Each bar 16 is secured to a plurality of cross members 18 of which three are shown in the drawing. The attachment to the cross bar 18 may be made by means of a bolt 19, adjustably engaged in a slot 20, provided in the member 18. These cross members 18 may be constructed of metal angles as illustrated in Figure 3, the slot 20 being formed in one flange which extends horizontally while the other flange extends downwardly therefrom. The bars 16 are adjustable along the cross members 18 by adjusting the bolts 19 along the slots 20. This provides for adjusting the spacing of the picker bars in order to accommodate the handling of different sizes of material. It also provides for setting these bars at a slightly flaring angle with respect to one another toward the lower end of the screen so as to prevent the lodgment of pieces between the bars.

The screen is supported by two or more tension rods 21 extending lengthwise of the screen and passing through slots 22 arranged vertically in the vertical flanges of the cross members 18. At the ends of the screen, the bars 21 pass through compression springs 23, and then through suitable perforations in the end members of the frame 12. These rods are then secured in place by nuts 24 bearing against the ends of the frame 12. The springs 23 are arranged between the end cross member 18 of the jacket and the end member of the frame 12 at each end of the screen so that the latter is resiliently suspended in the frame 12. It will

be seen that this suspension is resilient in two directions—longitudinally and normally of the plane of the screen jacket.

Adjustably mounted on the side members of the frame 12 are angle members 25. These are arranged with their horizontal flanges secured to the frame 12 and their vertical flanges upstanding along the sides of the screen jacket so as to form guides for the material as it moves down the jacket. The attachment to the frame 12 may be made by bolt and slot connections as indicated at 26 in Figure 1, so as to allow for lateral adjustment of these guides.

Mounted on a sub-frame 27 on the base 1 is a vibrating mechanism 28 of any suitable type, driven by a motor 29. The vibrating mechanism 28 may be provided with an oscillating driving rod 30 of any suitable type. This mechanism is such as to impose upon the rod 30 a differential vibration. By differential vibration is meant one in which the characteristics of the movement as regards speed, acceleration and the like are different during opposite strokes. As the details of this mechanism form no part of the present invention, a detail description is unnecessary as such mechanisms are well known in the art. A detail description of such a mechanism may be found in U. S. Patent No. 1,468,575, issued September 18, 1923 to C. F. Reiff. The particular nature of these vibrations being imposed upon the rod 30 will be transmitted thereby to the screen jacket so that a similar differential form of vibration will be imposed upon the jacket. The particular form of this vibration may be adjusted to the requirements of the material handled by proper selection or adjustment of the vibrating mechanism 28. Accordingly, a screen jacket may be operated with any desired form of vibration, suitable to the material being handled.

The diagram of Figure 4 illustrates such a differential movement. In this diagram the uniform rotary movement of the shaft of the mechanism 28 is plotted horizontally while the corresponding movement of the rod 30 is plotted vertically. It will be noted that on the down stroke of the jacket the movement is at a lower velocity than on the upstroke and that the rapidity of reversal from up stroke to down stroke is much greater than from the reversal from down stroke to up stroke. Accordingly the screen jacket will have a movement giving a definite throw to the material at the end of the up stroke. By suitable adjustment of the mechanism 28, these relations may be varied and if desirable reversed.

Rigidly secured to the shaft 5 and extending downwardly therefrom is an arm 31 pivoted at 32 to the oscillating rod 30. There is also pivoted to the arm 31 at 33, a rod 34 tensioned by a spring 35 bearing against a bracket 36 on the sub-frame 27. The spring 35 tensions the arm 31 in a direction opposite to the pull of the rod 30. Accordingly the operation of the vibrating mechanism 28 will oscillate the arm 31 and, therefore, the shaft 5. Oscillation of the shaft 5 causes angular oscillation of the bell cranks 7 attached thereto, and these in turn acting through the links 8 oscillate the bell cranks on the shaft 6 in a similar manner. The bell cranks 7, through their connections to the frame 12, will cause said frame to vibrate in an up and down direction in response to the oscillations of the shaft 5. The up and down movement of the frame 12 will cause the screen jacket to vibrate in said frame in a direction nor-

mal to the plane of said jacket. This movement causes the material moving over the screen to be thrown up in rapid vibration and as the screen inclines downwardly towards its discharge end the material is thereby caused to move along the screen. During this movement flat pieces thin enough to pass between the bars drop through the screen, while the remaining material travels down to the discharge end thereof.

Mounted between the side plates 2 and below the vibrating screen is a chute 37 adapted to receive the material that falls through the screen and convey it to a suitable receptacle (not shown). The chute 37 is built over and encloses the vibrating mechanism, including the spring 35, the arm 31 and its connections to the mechanism 28. These parts are, therefore, protected against the material passing through the screen and the dust arising therefrom.

It will be noted that there are no rotating bearings on this machine outside of the mechanism 28. All the other bearings involved are pivotal or slightly oscillating bearings such as are subject to very little wear. All bearings requiring continuous lubrication are confined to the mechanism 28, which may be completely enclosed against the entrance of dust to its bearings, so that adequate lubrication may be supplied and the bearings thereby protected against excessive wear.

The bell cranks 7 are mounted for adjustment on the shafts 5 and 6 in any suitable manner. This may be accomplished by securing each bell crank to the shaft by a set screw 39 or the like so that its angular position may be changed at will. Any other type of connection capable of such adjustment may, of course, be used. By adjusting the angular positions of the bell cranks 7, the direction of movement of the frame 12 may be altered at will, thus a movement directly at right angles to the plane of the screen jacket may be employed or by proper adjustment such movement may be more nearly vertical or more nearly horizontal.

By adjustment of the link 8, the relative positions of the bell cranks on the shafts 5 and 6 may be changed so that if desired, the upper and lower ends of the screen jacket may be given movement in different directions.

The inclination of the screen jacket may be adjusted by adjusting the length of the link 9.

It will be seen that this invention provides a simple and robust construction for screening apparatus of this type. While the vibration imposed upon the screen jacket is generally in a direction substantially normally to the plane of the jacket, such direction may be altered by adjustment of the bell cranks so as to give the screen a throw which is more nearly vertical or more nearly horizontal. This is an important feature in a screen of this type, in which a screening medium vibrates substantially normally of its plane. By control of the particular direction of movement of the screen, the travel of the material over the screen may be controlled. Furthermore, the direction of throw may also be made use of to effect the manner in which the material is made to pass through the screen. As a wide range of adjustment is provided, a corresponding range of control is possible.

The construction of the screen jacket itself as illustrated in the accompanying drawing has the advantage of being adjustable to various sizes of material, and also to provide in a simple manner for the removal of bars which may become

worn. The provision of the cross members 18 not only provides for rigid spacing of the bars, but the middle cross member may in certain cases be arranged to strike a suitable abutment 38 mounted below the frame 12 so as to provide a bumping action which will assist in working the material through the screen.

While this apparatus has been described as a unitary machine, it is obvious that various individual features or sub-combinations thereof may be useful by themselves without reference to the other features of the machine. It is understood that the employment of such individual features or sub-combinations is contemplated by this invention and within the scope of the appended claims. It is further obvious that various changes may be made in the details of construction within the scope of the appended claims without departing from the spirit of this invention. It is understood, therefore, that the invention is not limited to the specific details shown and/or described.

Having thus described the invention, what is claimed is:

1. Screening apparatus of the character described, comprising, a screen frame, a screen jacket mounted therein for vibration as a whole longitudinally and normally of its plane, bell-cranks connected to support the head and foot ends of said frame, connections between said bell-cranks to control their relative movements, means for adjusting said bell-cranks relatively to each other, vibrating mechanism, and operating connections from said mechanism to said bell-cranks adapted to vibrate said jacket with different movements at its head and foot.

2. Screening apparatus of the character described, comprising, a screen frame, a screen jacket mounted for vibration in said frame having a plurality of supporting rods extending longitudinally of said frame, a plurality of picker bars, cross members extending transversely of said jacket and secured to said bars, means for resiliently mounting said cross members on said rods, and means for vibrating said jacket.

3. Screening apparatus of the character described, comprising, a screen frame, a screen jacket mounted for vibration in said frame having a plurality of supporting rods extending longitudinally of said frame, a plurality of picker bars, cross members extending transversely of said jacket and secured to said bars for adjustment therealong, means for resiliently mounting said cross members on said rods, and means for vibrating said jacket.

4. Screening apparatus of the character described, comprising, a screen frame, a screen jacket mounted for vibration in said frame having a plurality of supporting rods extending longitudinally of said frame, a plurality of picker bars, cross members extending transversely of said jacket and secured to said bars, means for resiliently mounting said cross members on said rods including springs on said rods between said cross members on said frame, and means for vibrating said jacket.

5. Screening apparatus of the character described, comprising, a screen frame, a unitary screen jacket resiliently suspended in said frame for vibration as a whole along and normally of its plane, means supporting said frame near both ends thereof adapted to vibrate the same in a direction angular to its plane, means for controlling the direction of action of said vibrating means, and means for operating said vibrating means.

6. Screening apparatus of the character described, comprising, a screen frame, a screen jacket having a plurality of longitudinally extending laterally spaced picker bars mutually interconnected to form a unitary jacket, said jacket being resiliently suspended in said frame for vibration as a whole along and normally of its plane, means supporting said frame near both ends thereof adapted to vibrate the same in a direction angular to its plane, means for controlling the direction of action of said vibrating means, and means for operating said vibrating means.

7. Screening apparatus of the character described, comprising, a screen frame, a unitary screen jacket resiliently suspended in said frame for vibration as a whole along and normally of its plane, means supporting said frame near both ends thereof adapted to vibrate the same in a direction angular to its plane, means for independently controlling the direction of action of said vibrating means at opposite ends of said frame, and means for operating said vibrating means.

8. Screening apparatus of the character described, comprising, a screen frame, a plurality of picker bars, means for adjustably securing said bars together to form a unitary jacket, resilient means for mounting said jacket in said frame for vibration at an angle to the plane of the jacket, and means for vibrating said jacket.

9. Screening apparatus of the character described, comprising, a screen frame, a plurality of picker bars, means for adjustably securing said bars together to form a unitary jacket, resilient means for mounting said jacket in said frame for vibration at an angle to the plane of the jacket, and means for vibrating said jacket adjustable to vary the direction of vibration.

10. In a screening apparatus of the character described, a screen jacket comprising, a plurality of longitudinally extending supporting rods, a plurality of picker bars, cross members extending transversely of the jacket and secured to said bars, and means for resiliently mounting said cross members on said rods.

11. In a screening apparatus of the character described, a screen jacket comprising, a plurality of longitudinally extending supporting rods, a plurality of picker bars, cross members extending transversely of the jacket and secured to said bars, and means for resiliently mounting said cross members on said rods and for resiliently supporting said rods.

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