

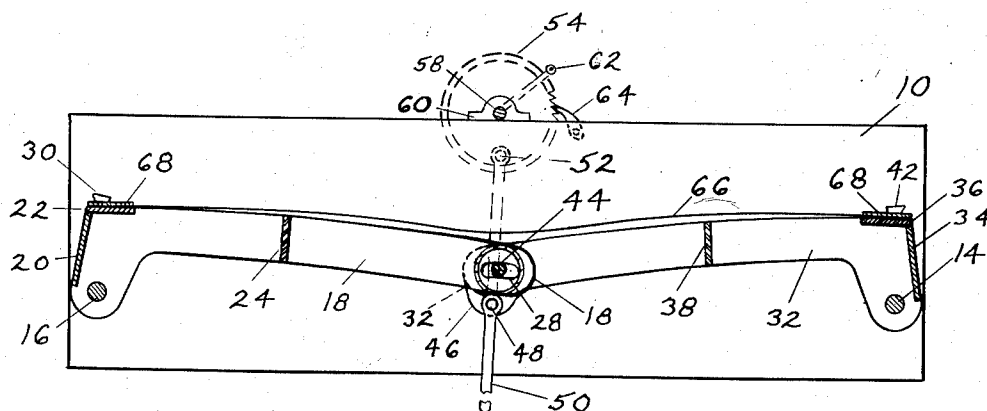
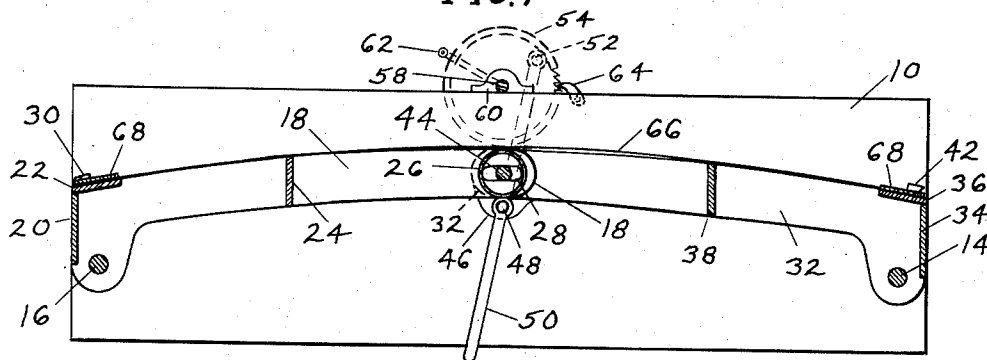
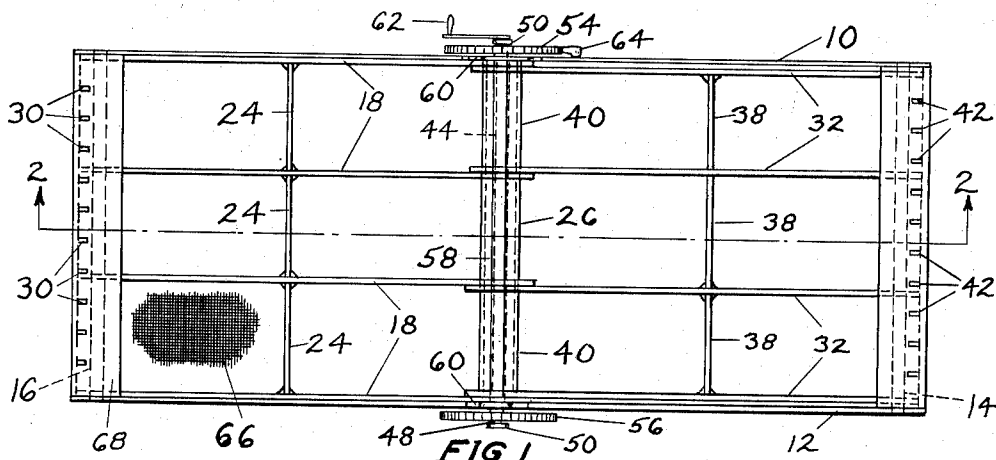
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VIBRATING EQUIPMENT

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VIBRATING EQUIPMENT

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This invention relates to improvements in vibrating equipment. More particularly, this invention relates to improvements in vibrating equipment wherein a light-weight, porous screen is used to separate particles of different sizes.

It is therefore an object of the present invention to provide an improved vibrating device which has a light-weight, porous screen that is used to separate particles of different sizes.

In the operation of vibrating equipment, it is frequently desirable to place a light-weight, porous screen between upstanding walls, place a mixture of particles of different sizes on the screen, and impart a controlled vibration to the screen. Where the pores in the screen are larger than some of the particles placed on the screen, but are smaller than other of those particles, the controlled vibration will cause part of the mixture of particles to pass through the screen. To be efficient, the screens should have openings of a uniform size, and they should be free of areas of unequal tension. It is not difficult to make light-weight porous screens so they have openings of uniform size and so they are free of areas of unequal tension; but it is not always possible to secure those screens to vibrating devices and still maintain the initial uniformity of pore size and freedom from areas of unequal tension. This is due to the fact that the screens are customarily supported in position between the upstanding walls of the vibrating equipment by a number of individual clamps which are spaced along the length of those walls. The clamps have adjustable portions, such as wing nuts, which can be used to create desired amounts of tension in the screen; and while it is theoretically possible for each of the clamps to have the same initial setting and to receive the same amount of adjustment, it is exceedingly difficult, if not impossible, as a practical matter to make the initial setting of a large number of individual clamps exactly the same, and to attain the exact same adjustment for each clamp. This problem is particularly acute because relatively unskilled personnel operate vibrating equipment. As a result, it frequently happens that certain areas of the screens are given more tension than the other areas of the screens; and, even if all parts of the screens could be given the same amount of tension, there would be no assurance that one or more of the clamps would not loosen because of the vibration. No matter how created, these inequalities of tension are objectionable because they vary the frequency of vibration of different areas of the screens, and they can cause a dis-

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tortion of the screens that will vary the size of the pores in the screens. The present invention obviates these objections by providing a tensioning structure, for use in vibrating equipment, which can provide uniform tension in all areas of the screens of such equipment. Such a structure makes possible the maintenance of uniformity of pore size and evenness of tension. It is therefore an object of the present invention to provide a tensioning structure, for vibrating equipment, that can provide uniform tension in all areas of the screens of such equipment.

Where vibrating equipment has a porous screen which is supported and tensioned by a large number of adjustable clamps that must be individually adjusted to support and tension the screen, the insertion and removal of the screen is a time-consuming process. This is objectionable from the standpoint of the cost of labor involved and from the standpoint of idle time for the equipment; and it is also objectionable because the operators tend to become weary and to do an incomplete job of tensioning the screen. The present invention obviates these objections by providing a number of carefully aligned openings in the end frames, of porous screens, that can telescope over and be held by carefully aligned pins on the tensioning structure of the vibrating equipment. With such an arrangement, insertion and removal of the screens can be effected quickly by placing the end frames of the screens in engagement with, or separating those end frames from, the pins on the tensioning structure. It is therefore an object of the present invention to provide carefully aligned openings in the end frames, of porous screens, which can be made to telescope over and engage aligned pins on the tensioning structure of vibrating equipment.

It frequently happens in vibrating equipment that the securement between the edges of the screen and the upstanding walls of the vibrating equipment is the sole source of support for the screen. In such instances, the screen must be made strong enough and stiff enough to be self-supporting. Where the weight of the material placed upon the screen is sizable, a self-supporting screen must be made so stiff and so heavy that its frequency of vibration is low; and a low frequency of vibration can mean a low efficiency for the screen. The present invention avoids the necessity of making the screens of vibrating equipment stiff and heavy by providing an open work supporting structure for those screens. The open work supporting structure provides a num-

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ber of points of support for the screens intermediate the upstanding walls of the vibrating equipment, and thus makes it possible to use screens which are quite resilient and quite light in weight. Such screens can be quite efficient. It is therefore an object of the present invention to provide an open work supporting structure for the porous screens of vibrating equipment.

The open work supporting structure of the present invention can serve the dual purpose of supporting and tensioning the screens of the vibrating equipment. This is made possible by forming the open work supporting structure of the vibrating equipment as two elongated, rotatable frames; the frames having aligned pins which engage the screen of the vibrating equipment and are movable toward and away from each other to selectively increase or decrease the tension in the screen. The elongated, rotatable frames of the supporting structure underlie the screen and give it full and adequate support while the pins maintain the desired amount of tension in the screen. It is therefore an object of the present invention to provide a pair of elongated, rotatable frames that constitute a supporting and tensioning structure for vibrating equipment.

The elongated, rotatable frames of the open work structure for vibrating equipment provided by the present invention are preferably movable by a single actuating mechanism. Where this is done, there is no need of adjusting a number of individual clamps; instead, only one mechanism need be adjusted to loosen or tighten the screen. This arrangement not only decreases the time required for removing and installing the screen, but it makes uniform tensioning of the screen possible. It is therefore an object of the present invention to provide a single mechanism that adjusts the position of the elongated, rotatable frames of the supporting structure of vibrating equipment.

Other and further objects and advantages of the present invention should become apparent from an examination of the drawing and accompanying description.

In the drawing and accompanying description a preferred embodiment of the present invention is shown and described but it is to be understood that the drawing and accompanying description are for the purposes of illustration only and do not limit the invention and that the invention will be defined by the appended claims.

In the drawing, Fig. 1 is a plan view of a vibrating device embodying the principles and teachings of the present invention,

Fig. 2 is a cross sectional, side elevational view of the vibrating device shown in Fig. 1, it is taken along the plane indicated by line 2—2 of Fig. 1, and it shows the supporting structure of that device in raised position, and

Fig. 3 is a cross sectional, side elevational view of the vibrating device shown in Figs. 1 and 2, it is taken along the plane indicated by line 2—2 of Fig. 1, and it shows the supporting structure of that device in lowered position.

Referring to the drawing in detail, the numeral 10 denotes one of the upstanding side walls of a vibrating device. The numeral 12 denotes another upstanding side wall of the vibrating device, and wall 12 is spaced from wall 10. The distance between the two walls 10 and 12 is spanned by pivot rods 14 and 16; and those rods cooperate with the spaced walls 10 and 12 to

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form a stiff structure. Although, not shown, other elements will preferably be provided that extend between walls 10 and 12 and help stiffen the structure of the vibrating device. The side walls of the vibrating device will be suitably secured to a vibration-imparting mechanism, not shown, that will impart a controlled vibration to those side walls of the vibrating device; and the side walls 10 and 12 will be mounted on yieldable supports which permit vibration of the vibrating device.

The numerals 18 denote a number of longitudinally-extending, transversely spaced arms which are rotatably secured to the pivot rod 16 by passing that rod through openings in vertically-directed projections which depend downwardly from the left hand ends of those arms. The arms 18 extend over one-half the length of the side walls 10 and 12; and they rotate about pivot rod 16. The arms 18 cooperate with cross members 20 and 22 and cross members 24 to form a frame that is part of the supporting and tensioning structure of the vibrating device. Cross members 20 and 22 are adjacent pivot rod 16 while cross members 24 are intermediate the ends of arms 18. The cross members 20, 22 and 24 and the arms 18 are preferably secured together, as by welding, to form an integrated unit. A tube 26 is secured, as by welding, between the free ends of the two central arms 18, and that tube assists in stiffening the frame formed by arms 18 and cross members 20, 22 and 24. The diameter of tube 26 is as large as the height of the free ends of arms 18; and the top of the tube 26 is in the plane of the tops of arms 18. Each of the arms 18 has a slot 28 formed in the free end thereof, and those slots are approximately parallel to the axes of the arms 18. A number of aligned pins 30 are secured to, and project upwardly from the cross member 22; and those pins are preferably of a generally trapezoidal form, and have inclined edges on the rear surfaces thereof. Whether or not the pins 30 are trapezoidal in form, they should be secured to the cross member 22 so the rear edges thereof incline to the left.

The arms 18, cross members 20, 22 and 24, tube 26, and pins 30 form a unitary frame that rotates about pivot rod 16. When that frame is rotated in a clockwise direction, the pins 30 move toward the center of the vibrating device; and when that frame is rotated in a counterclockwise direction, the pins 30 move away from that center. Thus, selective movement of that frame can cause selective positioning of the aligned pins 30.

A number of longitudinally extending arms 32, which are somewhat similar to the arms 18, are provided at the right hand end of the vibrating device. Those arms are pivotally secured to pivot rod 14, as by passing that rod through downwardly depending projections on the right hand ends of those arms. The arms 32 cooperate with cross members 34, 36 and 38 to form a frame that coacts with the frame, formed by arms 18, cross members 20, 22 and 24, and tube 26, to constitute the supporting structure for the screen of the vibrating device. Cross members 34 and 36 are adjacent the pivot rod 14 while cross members 38 are intermediate the end of the arms 32. The cross members 34, 36 and 38 are preferably secured to arms 32, as by welding, to form an integrated unit. The free ends of the arms 32 are provided with slots, not shown, which are in approximate registry with the slots 28 in

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the free ends of arms 18, and those slots are approximately parallel with the axes of arms 32.

Tubes 40 are disposed between the ends of the outermost and the central arms 32; and those tubes cooperate with arms 32 and cross members 34, 36 and 38 to form a sturdy open work frame. The tubes 40 have a diameter equal to the height of the free ends of arms 32; and the tops of those tubes is in the plane of the tops of arms 32. A number of pins 42 are secured to the cross member 36; and the rear surfaces of those pins incline to the right.

The arms 32, cross members 34, 36 and 38, tubes 40 and pins 42 form a unitary frame that rotates about pivot rod 14. When that frame is rotated in a counterclockwise direction, the pins 42 move toward the center of the vibrating device; and when that frame is moved in a clockwise direction, the pins 42 move away from that center. Thus, selective movement of that frame can cause selective positioning of the aligned pins 42.

The numeral 44 denotes a registering rod which extends through each of the slots in the free ends of the arms 18 and 32; and that rod extends from each side wall of the vibrating device to the other. The rod 44 serves to maintain the free ends of each of the arms 18 and 32 in register with each other; and it assures conjoint movement of the inner ends of the frames formed by the arms 18 and 32 and their cross members and tubes. Although the inner ends of the frames will move conjointly, the direction of movement of the frames will be out of phase. Whenever the left hand frame moves in a clockwise direction the right hand frame will move in a counterclockwise direction, and whenever the left hand frame moves in a counterclockwise direction the right hand frame will move in a clockwise direction. This arrangement enables movement of rod 44 to cause conjoint movement of pins 30 and 42 toward or away from each other.

The outermost arms 32 are provided with downwardly depending projections 46. The projections 46 carry and support pins 48; and those pins are secured to eyes formed in the upper ends of the shorter arms of J-shaped connecting rods 50. The lower ends of rods 50 extend down under the side walls 10 and 12 of the vibrating device, and the longer arms of those rods extend upwardly along the outer faces of the side walls 10 and 12. Eyes in the upper ends of the longer arms of the J-shaped connecting rods 50 fit over and engage pins 52 which are carried on discs 54 and 56. The disc 54 is provided with teeth on the periphery thereof, but otherwise the two discs 54 and 56 are the same.

The discs 54 and 56 are fixedly secured to a transverse shaft 58 which is supported in bearings 60 on the side walls 10 and 12 of the vibrating device. The discs 54 and 56 are secured to the shaft 58 in such a way that the pins 52 of those discs are always in register with each other; and when the shaft and discs are rotated by crank 62, the pins 52 will move conjointly. Such movement causes conjoint movement of the J-shaped connecting rods 50; and thus causes conjoint movement of the inner ends of the eccentrically mounted frames of the vibrating device. This latter movement causes the pins 30 and 42 to move toward or away from each other. As indicated in Fig. 2 the pins 30 and 42 are spaced relatively far apart, while in Fig. 3 those pins are spaced closer together.

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When the pins 30 and 42 are moved into the position shown in Fig. 3, those pins are close enough to readily receive the perforated end frames 68 of a light-weight, porous screen 66. This screen can be made by weaving wires or fibers together or by soldering or brazing wires to supports. The end frames 68 of the screen have a number of openings which are carefully formed and are in exact registry with the aligned pins 30 and 42 on the elongated, rotatable frames of the vibrating device. In the position shown in Fig. 3, the pins 30 and 42 also permit ready removal of the screen 66. It is only necessary to make the openings in end frames 68 engage or disengage pins 30 and 42 to secure or remove screen 66. Although not shown, side frames may be provided for the screen 66; such frames being light in weight and being flexible. Such frames protect the operators from raw wire edges while handling the screens, and also protecting the sides of the screen against raveling.

Once the end frames 68 are telescoped over the pins 30 and 42, the crank 62 is rotated in a counter-clockwise direction. Such rotation will cause rotation of the discs 54 and 56, and will raise the J-shaped connecting rods 50. Such raising will cause the inner ends of the frames to move upwardly; and during this movement, the pins 30 and 42 will move away from each other. In doing so, the pins will move the end frames 68 of screen 66 away from each other and will thus impart a desired amount of tension to the screen. The inclined rear faces of the pins 30 and 42 will hold the end frame 68 of the screen 66 in secure engagement with those pins.

As the pins 30 and 42 move further apart, the screen will be stretched until it assumes a configuration similar to that shown in Fig. 2. Continued outward movement of the pins 30 and 42 will pull the screen 66 into intimate engagement with the tops of arms 18 and 32, cross members 24 and 38, and tubes 26 and 40. At such time, the elongated, rotatable frames will give adequate support to the screen 66 and yet will permit large areas of that screen to vibrate freely.

When the desired amount of tension has been attained, the pawl 64 is pressed into engagement with an adjacent tooth on disc 54 and will prevent diminution of the tension in the screen. In this way, a desired amount of tension can quickly be applied to all parts of the screen 66 and can be positively held. This arrangement facilitates prompt, even tensioning of the screen by actuation of a single element.

To remove the screen 66, all that need be done is move the pawl away from disc 54, rotate the crank 62 until the frames are in the position shown in Fig. 3, and then lift the end frames 68 of the screen 66 away from the pins 30 and 42. Thereafter, a new screen or the original screen, after cleaning, can be replaced; and the screen can be tensioned by rotating the crank 62. This provides a quick and accurate way of supporting and tensioning a screen without creating areas of unequal tension in that screen.

The tubes 26 and 40 serve to provide transverse support for the center of the screen 66, and the cross members 24 and 38 serve to provide transverse support for the screen intermediate its ends. The tops of the arms 18 and 32 provide longitudinal support for the screen; and thus the two elongated, rotatable frames constitute an open work supporting structure for the screen which fully supports the screen. This makes it possible to employ light weight screens

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in vibrating devices that impart vibration to large quantities of material. Such screens will operate with high efficiency when the vibration-imparting mechanism is connected to the side walls 10 and 12. At such time, all portions of the screen 66 and its supporting structure will vibrate; but the portions of the screen which are not touching the supporting structure will have a high frequency of vibration.

By having the arms 18 and 32 mounted as shown and described, any given amount of tension can be created in the screen 66 by moving the inner ends of those arms upwardly. The slots 28 permit relative movement of the ends of arms 18 and 32 while maintaining those arms in assembled relation.

Whereas a preferred embodiment of the present invention has been shown and described in the drawing and accompanying description it should be obvious to those skilled in the art that various changes may be made in the form of the invention without affecting the scope thereof.

What I claim is:

1. In a vibrating device that includes a porous screen, a support for said screen, and side walls confining material placed on the upper surface of said screen, the improvement which comprises perforated end frames on said screen and an extendible support for said screen which has projections thereon to engage the perforations in said end frames, said support comprising two elongated frames that are disposed with their axes parallel to said side walls and spaced pivots for said frames that are disposed with their axes perpendicular to said side walls, said frames being supported by said pivots for rotation relative to each other and relative to said side walls, each of said frames having a screen-engaging surface spaced horizontally from the pivot for said frame, said projections on said frames being spaced vertically from the pivots for said frames, said screen-engaging surfaces of said frames underlying said screen and being intermediate said projections on said frames, said frames underlying a large portion of the area of said screen, said frames being rotatable about said pivots to move said screen-engaging surfaces vertically and to move said projections horizontally and thereby move said screen-engaging surfaces on said frames away from or toward said screen and also move said projections toward or away from each other to free said screen from said extendible support or to tension said screen by pressing the central portions of said screen upwardly with said screen-engaging surfaces while pulling the ends of said screen outwardly with said projections.

2. A vibrating device comprising spaced side walls, a first frame that has longitudinally extending arms and transversely extending cross members, vertically-directed projections at the outer ends of said longitudinally extending arms, a pivot rod passing through openings in said projections, a second frame that has longitudinally extending arms and transversely extending cross members, vertically-directed projections on the outer ends of the arms of said second frame, a second pivot rod passing through openings in the projections on the arms of said second frame, said pivot rods being spaced apart and being supported by said spaced side walls, a porous screen supported on said frames, the inner ends of the longitudinally extending arms of the first said frame and said second frame being adjacent

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each other and underlying and engaging said screen, said inner ends being spaced horizontally from said pivot rods, and pins that are carried by said frames and are vertically spaced relative to said pivot rods, said pins being adapted to engage the ends of said screen and maintain said screen and frames in assembled relation, said frames being rotatable about said pivot rods to move said pins toward and away from each other, and to move said inner ends away from and toward said screen and thereby free said screen from said frames or tension said screen by pressing the central portions of said screen upwardly with said inner ends while pulling the ends of said screen outwardly with said pins.

3. A vibrating device comprising a first frame that has longitudinally extending arms and transversely extending cross members, vertically-directed projections at the outer ends of said longitudinally extending arms, a stationary pivot rod extending through openings in said projections, a second frame that has longitudinally extending arms and transversely extending cross members, vertically-directed projections on the outer ends of the arms of said second frame, a second stationary pivot rod extending through openings in the projections on the arms of said second frame, a screen supported on said frames, and pins that are mounted on said frames and can maintain said screen and frames in assembled relation, the inner ends of said longitudinally extending arms of said frames being selectively engageable with portions of said screen that are located inwardly of said screen, said frames being movable about said pivot rods to cause said inner ends of said longitudinally extending arms to press upwardly against said inwardly located portions of said screen and to vary the spacing between said pins and thereby tension said screen.

4. In a vibrating device that includes a porous screen, a support for said screen, and side walls confining material placed on top of said screen, the improvement which comprises an adjustable support for said screen and a plurality of aligned pins carried by said support, said support having two sections that underlie and engage said screen, said sections being movable to increase or decrease the total overall length of said support, said pins being engageable with said screen and being movable with said sections of said support to create tension in said screen, said sections of said support having screen-engaging surfaces which move upwardly to raise and tension the central portions of said screen.

5. A vibrating device that comprises a porous screen, an open work supporting structure disposed below and in supporting relation with said screen, and pins that engage said screen and said structure and hold them in assembled relation, said structure having two relatively movable sections that can be moved to vary the overall length of said structure, such variation determining the position of said pins and the tension in said screen, said two relatively movable sections being rotatable to cause portions thereof to raise central portions of said screen upwardly to tension said screen.

6. A vibrating device that comprises a porous screen, an open work supporting structure disposed below and in supporting relation with said screen, and pins that engage said screen and said structure and hold them in assembled relation, said structure having two relatively movable pivoted sections that can be moved apart to

tension said screen, said sections having portions disposed vertically above and horizontally inward of the pivots therefor, said sections being rotatable to cause said horizontally inwardly disposed portions to raise the central portions of said screen upwardly and to cause said vertically disposed portions to move said pins apart.

7. A vibrating device that comprises an upstanding side wall, a second upstanding side wall spaced from said first wall, a pair of pivot rods disposed between and secured to said upstanding side walls, a pair of frames pivoted to said pivot rods, and a porous screen securable to said frames, said frames having the inner ends thereof disposed adjacent each other to provide continuous support for said screen, said frames being rotatable to cause the inner ends thereof to raise upwardly on the central portions of said screen and thereby tension said screen.

8. A vibrating device that comprises an upstanding side wall, a second upstanding side wall spaced from said first wall, a pair of pivot rods disposed between and secured to said upstanding side walls, a pair of frames pivoted to said pivot rods said frames having inner ends, and a porous screen securable to said frames, slots in the inner ends of said frames, and a connecting rod extending through said slots to adjust the position of the inner ends of said frames, said frames being rotatable to cause the inner ends thereof to raise upwardly on the central portions of said screen and thereby tension said screen.

9. A vibrating device that comprises an upstanding side wall, a second upstanding side wall spaced from said first wall, a pair of pivot rods disposed between and secured to said upstanding side walls, a pair of frames pivoted to said pivot rods, and a porous screen securable to said frames adjacent the outer ends of said frames, slots in the inner ends of said frames, and a connecting rod extending through said slots, said connecting rod being movable to adjust the position of the outer ends of said frames and thereby adjust the tension in said screen.

10. In a vibrating device that includes a porous screen, a support for said screen, and side walls confining material placed on top of said screen, the improvement which comprises an adjustable support for said screen, a plurality of aligned pins carried by said support, said support having two sections that underlie and engage said screen, said sections being movable to increase or decrease the total overall length of said support, flat end plates for said screen that are

permanently secured to the opposite ends of said screen and can be in the same plane with said screen, and openings through said end plates, said pins being engageable with said openings in said end plates of said screen and being movable with said sections of said support to create tension in said screen, said pins having the rear edges thereof inclined outwardly from the center of said screen and said sections of said support being adjustable to move said rows of pins relative to each other, whereby the inclined rear faces of said pins will coast with those portions of said end plates which define the outer ends of said openings in said end plates to clamp said screen against said support whenever the distance between said rows of pins is increased.

11. A vibrating device that comprises an upstanding side wall, a second upstanding side wall spaced from said first wall, a pair of pivot rods disposed between and secured to said upstanding side walls, a pair of frames pivoted to said pivot rods, and a porous screen that overlies and is supported by said pair of frames and is secured to the outer ends of said frames, slots in the inner ends of said frames, a connecting rod extending through said slots, and a shaft that spans said upstanding side walls and carries levers secured to said connecting rod, said shaft being rotatable to move said levers and thereby adjust the position of the outer ends of said frames.

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