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VARIABLE PITCH STEPPED SCREEN

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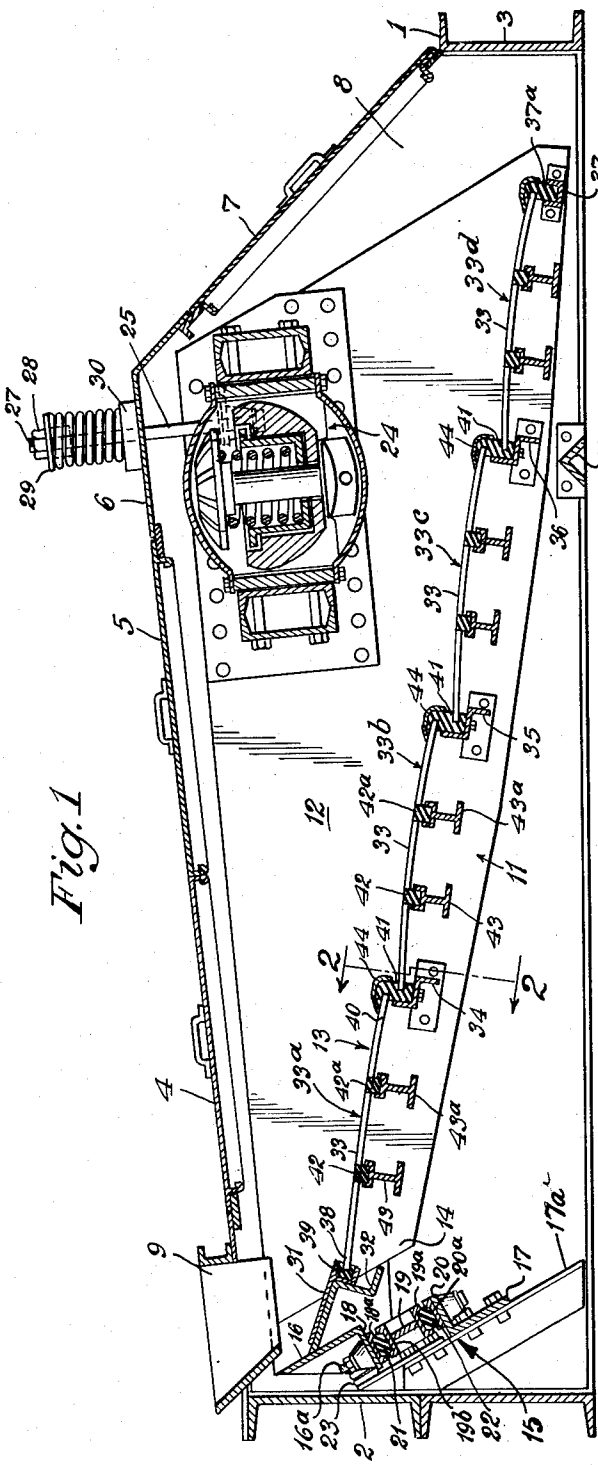

Fig. 1

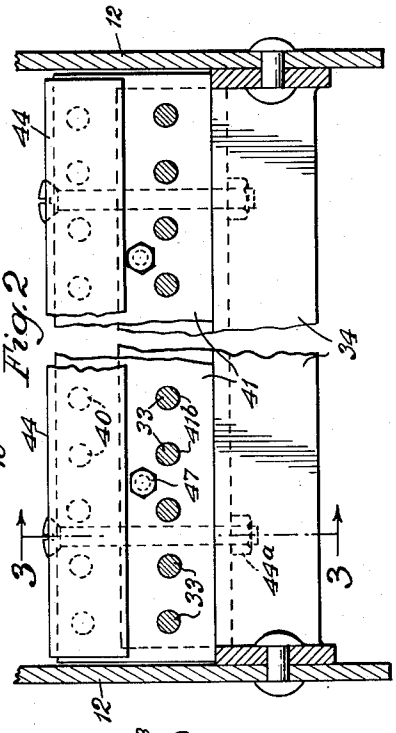

Fig. 2

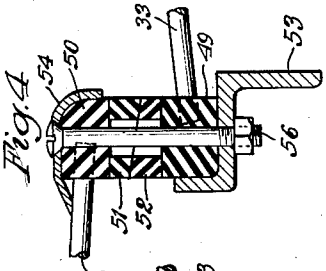

Fig. 4

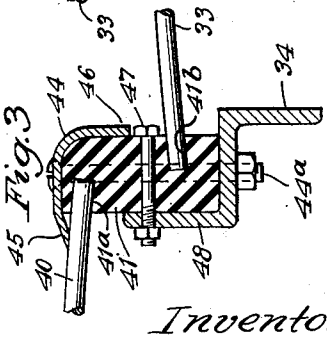

Fig. 3

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VARIABLE PITCH STEPPED SCREEN

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4 Claims. (Cl. 209—314)

This invention is directed to an improved screening device. More particularly the invention is directed to an improved screening device utilizing vibratory motion to vibrate a screen and using a plurality of spaced rods as the screening or separating elements. It is a primary object of the invention to improve the material separating properties of a vibrating screen.

Another object of the invention is to so construct a rod screen that "blinding" or "clogging" of the screen is reduced to a minimum.

Another object of this invention is to supplement the vibratory motion given a vibrating screen by a tumbling motion imparted to the material passing over the scren.

A further object of this invention is to construct a screen so that such additional movement given to material being separated by the screen may be selectively varied.

Other objects of the invention will appear from time to time in the course of the ensuing specification and claims.

Referring generally now to the drawings—

Figure 1 represents an elevational view of my improved vibrating screen;

Figure 2 is a sectional view of the screening element shown in Figure 1 taken along the line 2—2 of Figure 1;

Figure 3 represents a sectional view of the screen rod supports taken along the line 3—3 of Figure 2; and

Figure 4 represents a modification of the screen rod supporting structure shown in Figure 3.

Referring specifically now to the drawings wherein like parts are indicated by like numerals throughout and referring initially to Figure 1, it will be seen that 1 represents a conventional frame of a vibrating screen. The frame includes an end wall 2 at the material receiving end of the screen and an end wall 3 at the material discharging end of the screen. Removable cover plates 4 and 5 are inserted in the top wall 6 of the screen frame and a removable cover plate 7 is provided in the material discharging end of the screen. It will be understood that the supporting frame as herein shown is conventional in form, embodying generally parallel side walls 8, a feeding hopper 9 at the material receiving end of the screen and a transversely extending supporting member 10 to hold the side walls 8 in spaced relationship. The screening frame serves as a support for a screening assembly 11 disposed within the frame.

As seen best in Figure 2, the screening assembly 11 includes a pair of parallel side walls 12 and a screening deck indicated generally at 13. The screening assembly 11 has its material receiving end 14 disposed beneath the hopper 9 and is supported at its material receiving end by a rockable supporting structure designated generally at 15. The supporting structure 15 includes a transverse member 16 having a flange 18 disposed between the parallel side walls 12 of the screening assembly, and a transversely extending angle member 17 supported on a plate 17*a* extending between the parallel side walls 8 of the supporting frame.

An intermediate member 19 having channels 19*a* and 19*b* receiving rubber pads 21 and 22 is disposed between flange 18 and angle portion 20 on member 17 with the rubber pads received in channels 18*a* and 20*a* formed on the flange 18 and angle member 20. Any suitable pins or bolts 16*a* may serve to hold the assembly thus formed together. A spring 23 is disposed between the member 17*a* and an abutment on side plate 12 and serves to cushion the screen deck in movement perpendicular to the supporting plate 17. The details of this support do not in themselves form part of my invention, but are described herein only for the purpose of illustrating a rockable support. Suffice it to say that the combined action of the spring 23 and the rubber pads 21 and 22 serves to cushion the material receiving end of the screen which is supported by the rocker pin 16*a*.

The screen assembly 11 is supported at its material discharging end by a vibrating mechanism 24. Any one of several known forms of mechanisms may be employed for vibrating the screen deck. One form of such a mechanism may employ an eccentric weight rotated by a motor, as is commonly known in vibrating screens. By suitable adjustment of the weight, the amplitude of vibration may be varied. One form of such a vibrating mechanism is shown in United States Patent No. 2,286,770 issued on June 16, 1942, to Loren G. Symons. Essentially the vibratory structure includes a supporting rod 25 fixed to a transversely extending support member 26 and extending through the top wall 6 of the supporting frame. The rod 25 is threaded at its upper end at 27 for reception of a nut 28. A washer 29 is seated against the nut 28 and a compression spring is positioned around the rod 25 and between the washer 29 and an abutment member 30 on the top wall 6 of the main frame. It will be understood that by suitable rotation of the eccentric weight, the screen assembly 11 is given a vibratory motion, which serves to augment the material separating characteristics of the screen deck 13. Since the details of the vibrating mechanism do not in themselves form part of my invention, it is not thought necessary to illustrate the mechanism with particularity, and therefore the mechanism is shown more or less diagrammatically. Essentially, the vibrating motion of the screen "shakes" or "jars" the fine materials from the more coarse materials.

Fixed to the material receiving end of the screen assembly is a material deflecting plate 31 which is supported by an angle member 32 joining opposite sides of the screen assembly. I preferably employ a plurality of series 33*a*, 33*b*, 33*c* and 33*d* of generally parallel inclined rods 33, which serve as the material separating elements or screen sections of my screen assembly. The use of parallel rods tends to reduce "blinding" to a minimum by reason of the fact that no transverse screening elements, which accumulate material, are employed. As shown, there are several series or bays of rods. The rods themselves may be provided with a coating of rubber or a rubber substitute, or any suitable anti-corrosive and non-adhesive coating to reduce wear on the rods and to reduce the tendency of material to stick to the rods.

In order effectively to separate material fed from the feeding hopper 9 to the screen assembly 12, I have found that marked advantages are obtained by cascading the series or bays of rods. That is to say, each series of rods is disposed in a plane at a level lower than the preceding series. Thus, as material progressively passes from the material receiving end of the screen assembly to the material discharging end, the material will slide or roll down each of the series of rods until it reaches the end of that series and then will fall by the force of gravity to the next series of rods. In effect, this gravitational movement of the material supplements the vibratory motion given to the screen assembly. As is well known, sticky or wet material will tend to carry fine particles which are collected on the surface of the coarse particles. These fine particles tend to accumulate on the screening elements and cause what is known as "blinding" or "clogging" of the screening elements. By means of the gravitational movement imparted to material passing over the screen, the materials receive a sharp impact as they fall from one series of rods to the next and will tend to separate any fine material collected on the coarse material from the coarse material. The fine material can then fall through the screen.

In cascading the series of rods, I preferably employ transversely extending angle members 34, 35 and 36 which are fixed to the side walls 12 of the screen assembly and serve to support the adjacent ends of the rods of adjacent series. The first series of rods 33*a* at the material receiving end of the screen assembly have end por-

tions 38 received in a transversely extending rubber support member 39 suitably carried by angle member 32. The support member 39 has a series of equidistantly spaced apertures for the reception of the ends 38 of the rods. The opposite ends or material discharging ends 40 of the rods are received in a rubber insert 41 held in place by the support member 34.

The insert 41 has one series of apertures 41*a* for the reception of the material discharging ends of the rods and another series of apertures 41*b* spaced a substantial distance from the apertures 41*a* for the reception of the material receiving ends of the succeeding series of rods. Each of the support members 34, 35 and 36 carries a similar rubber insert 41 for the reception of the vertically spaced ends of adjacent series of rods. The material discharging ends of the last series of rods 33*d* are received and held in place by a rubber insert 37*a* supported and carried by the last support member 37.

Each of the rods 33, which are preferably made of spring steel, are normally rectilinear in extension, but are arched for insertion into the rubber support members 39 and 41 and are held in arched position by rubber medial supports 42 and 42*a* suitably supported by transversely extending channel members 43 and 43*a* joined to the side walls 12 of the screen assembly. Each series of rods are held in position by similar rubber supporting members.

A wear member 44 is disposed on the top of each of the rubber inserts 41, in order to protect the rubber supports against wear.

The cascading of the screen sections is achieved by disposing the material receiving ends 38 of each series of rods at a horizontal level substantially lower than the material discharging ends 40 of each series of rods. From Figure 1, it will be apparent that each series of rods is inclined generally downwardly toward the material discharging end of the screen and the plurality of series of rods presents a generally downwardly inclined screening surface.

In Figure 3, I show in detail one means of supporting adjacent ends of the rods of each series. In Figure 3 the rubber insert 41 is held in place by generally vertical bolts 44*a*, suitably secured to the support member 35 which also serves to hold the wear member 44 in place. As shown in Figure 3, the wear member 44 includes an inclined portion 45 leading from the rods and terminating in a downwardly curved portion 46, disposed adjacent the rubber insert 41 on the other side of the insert. In addition to the generally vertical bolt 44*a*, I employ generally horizontal bolts 47, which are passed through the rubber support 41 and are passed through an upstanding flange 48 on the transversely extending support 34.

In Figure 4 I show an alternative means for supporting adjacent ends of the rods of successive series. 33 represents the rods of the successive series. In this modification however, I employ a plurality of rubber supports in place of the one employed in Figures 1 through 3. As shown in Figure 4, a lower rubber support 49 serves to receive the ends of the rods of the lower series in apertures 49*a*. An upper rubber support 50 serves to receive and support the ends 33 of the higher series of rods in apertures 50*a*. Adjustable shims 51 and 52 are disposed between the upper rubber support 50 and the lower rubber support 49. Whereas two shims are shown, any number may be employed properly to space the adjacent ends of the rods. It will be apparent that by adjusting the shims or by removing one or the other of the shims, I may effectively increase or decrease the vertical distance between the upper rubber support 50 and the lower rubber support 49, thus providing for a selective variation in the relative distance between the ends of adjacent rods.

In doing this, it will be understood that gravitational movement imparted to material passing over the rods may be varied in accordance with the material being processed. As shown, the lower rubber support 49 is held in place by a transversely extending channel member 53. A wear resistant member 54 of the shape of the transversely extending member 53 is disposed on top of the upper rubber support 50, and is held in place by suitable bolts 56 passed through the wear resistant member 54, upper rubber support 50, the shims 51 and 52, lower rubber support 49 and transversely extending support member 53. By making the wear resistant member 54 of the same configuration as the transversely extending support 53, the upper and lower rubber supports 50 and 49 may be interchanged. The modification shown in Figure 4 may be used advantageously to provide a compound section screen in which a comparatively large vertical distance may be employed between adjacent ends of the adjacent series of rods and a comparatively small vertical distance between adjacent ends of other adjacent series of rods. In other words, the slope or pitch of each series of rods may be different from the other series. Since the time during which material being processed is on one of the screen sections is a function of the slope or incline of the screen section, it will be apparent that the adjustability of the screen sections provides for varying the rate of flow of material from one screen section to the next.

As an alternate method of varying the slope or incline of the screen sections, extensible members such as a screw and nut assembly or a fluid motor may be employed to support and adjust the material discharging ends of the rods in lieu of the adjustable shims.

It will be realized that whereas I have described and claimed a practical and operative device, nevertheless many changes may be made in size, shape, number and disposition of parts without departing from the spirit and scope of my invention. I therefore wish my description and drawings to be taken as in a broad sense illustrative or diagrammatic, rather than as limiting me to my specific showing herein. For example, in lieu of the adjustable rubber supports 49 and 50 of Figure 4, different sizes of unitary rubber supports having apertures for the reception of adjacent ends of successive series of rods may be employed, in order selectively to vary the vertical distance between the adjacent ends of the rods.

The use and operation of my invention are as follows:

The screening assembly 12 is inserted within the main frame 1 and is supported by the rockable support 19 at the material receiving end and the vibrating mechanism 24 at the material discharging end. As material to be separated is passed through the feed hopper 9, it falls onto the deflecting member 31 and then onto the inclined screen deck. As the vibrating mechanism vibrates the screening assembly 12 and the screen deck, the fine material will be separated from the coarse material and fall through the rods of the screen deck for suitable collection. As material passes from one series of rods to the next, it is given an additional gravitational movement, which results in a sharp impact of material on the next series of rods, which jars or shakes the fine materials collected on the coarse materials from the coarse materials. In addition, the gravitational movement or fall of the material introduces a general tumbling or rolling movement of the material. Material passing from the material receiving end of the screen deck to the material discharging end of the screen deck then receives a compound movement.

When it is desired to remove or replace any of the individual rods, they are simply grasped at their medial portion and arched upwardly, which results in removal of the ends of the rod from the rubber supports.

In handling some materials which under some circumstances may be more wet or sticky than other materials, such as clayey ores, I find it advantageous to increase the fall of the material from one series of screen rods to the next series. In order to do this, the rubber supporting members 50 and 49 of Figure 4 are spaced further apart by means of the shims 51 and 52. When handling dry material, the vertical distance between adjacent ends of the rods of successive series may be lessened by moving the shim or the rubber supports 49 and 50 closer together. I thus provide a vibrating screen which reduces to a minimum the tendency of the screen to blind and supplements the vibratory motion imparted to the screen deck.

By varying the amplitude of vibration of the screen deck and providing for selective variation of the incline of the screen rod sections, a material separating screen of maximum flexibility is obtained.

I claim:

1. A material separating screen including a supporting frame, a screen-supporting assembly mounted for movement in relation to said frame, means for vibrating said assembly, a screen deck carried by said supporting assembly and including a plurality of screen sub-sections arranged in end to end relationship between the material-receiving end and the material-discharging end, each successive screen sub-section being placed at a lower level with respect to the screen supporting assembly than the immediately preceding sub-section, each of said sub-

sections being formed of a plurality of parallel rods, support means for the ends of said rods, said support means including rubber-like support members supported in said assembly transversely of said rods and apertured to receive said rod ends, some of said support members having one longitudinal face apertured adjacent the upper edge thereof and receiving in said apertures the material-discharging ends of the rods of one sub-section and having an opposite longitudinal face apertured adjacent the lower edge thereof and receiving in said last-named apertures the material-receiving ends of the rods of the succeeding sub-section.

2. Structure of claim 1, wherein said last named support members each has an upper portion extending above said material-discharging rod ends to form an upstanding baffle transversely extending across the screen along abutting edges of said sub-sections and characterized by and including wear plate members overlying said upper portions, said wear members having an upwardly inclined material-receiving face and a downwardly curved material-discharging face.

3. Structure of claim 1, wherein said last-named support members comprise an upper portion, a lower portion and shim means therebetween and characterized by and including clamping means for clamping said upper portion, lower portion and shim means together, said upper portion having an apertured sidewall receiving said material-discharging rod ends, said lower portion having an apertured sidewall receiving said material-receiving rod ends.

4. Structure of claim 3, wherein said upper and lower portions are identical.

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