Sept. 25, 1962 E. N. WOOD ETAL 3,055,501

OSCILLATION HEIGHT GAUGE

Filed Feb. 8, 1961 2 Sheets-Sheet 1

Fig-1

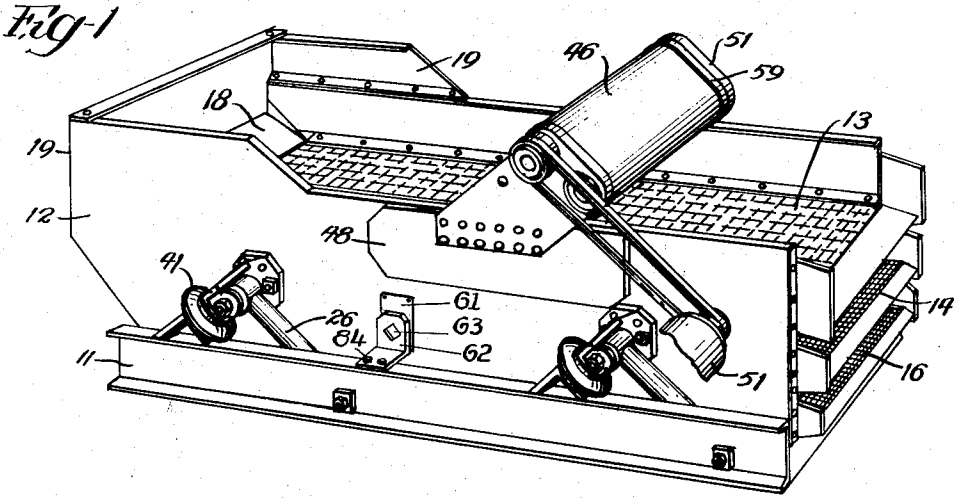
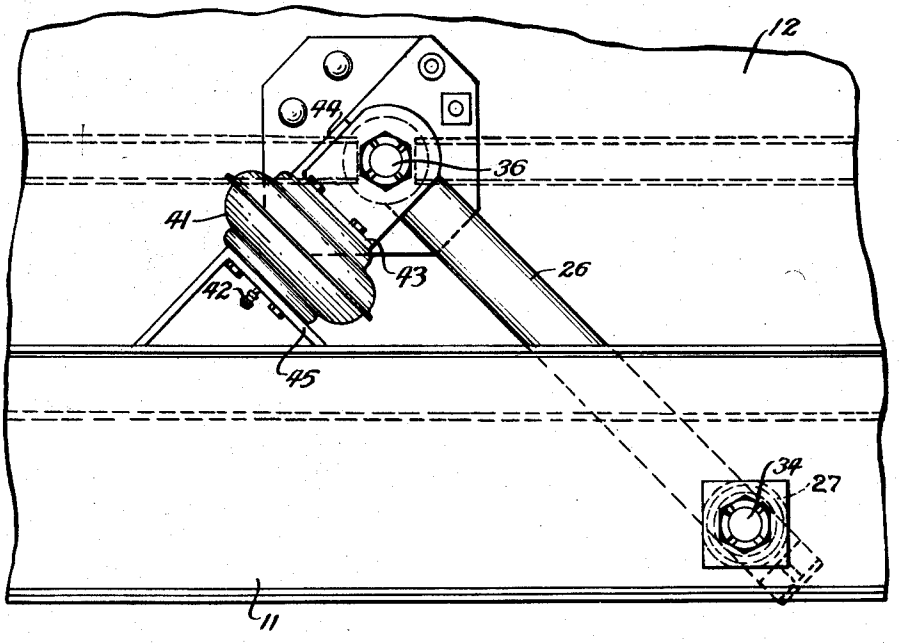


Fig-2



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Fig. 3

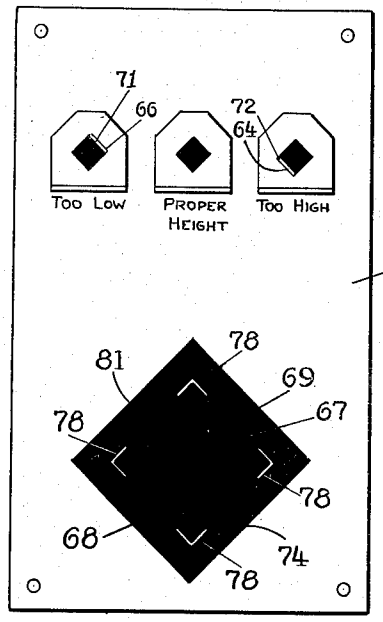


Fig. 4

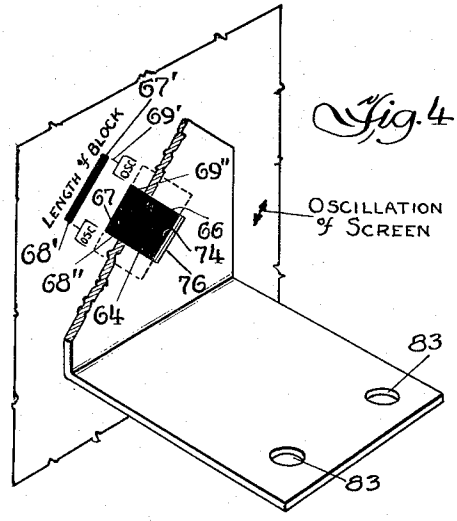


Fig. 6

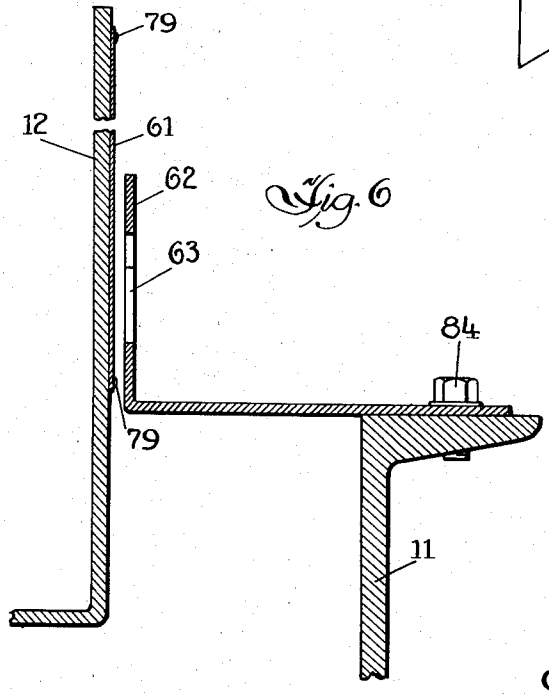
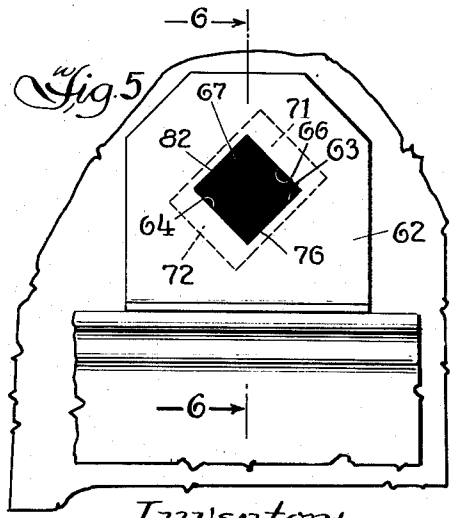


Fig. 5



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3,055,501

OSCILLATION HEIGHT GAUGE

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Filed Feb. 8, 1961, Ser. No. 87,903
10 Claims. (Cl. 209—416)

This invention relates to a gauge which may be used during operation of a horizontal shake screen to determine the average height of the oscillating screen box.

Screen shakers are generally used to sort or classify different sizes of aggregate material into predetermined sizes dependant upon the mesh sizes of the screen. They generally consist of several screens mounted in parallel planar fashion with the largest mesh size at the top and the smallest at the bottom. The invention is especially useful with a form of screen in which the screen is mounted horizontally and oscillates on a sloping path. The frame is mounted upon support springs and guided by sloping tie links which confine movement generally to the sloping plane perpendicular to the ties. Preferably, the tie links used comprise upwardly extending bars pivoted to the box frame at one end and to the base support at the other end, and rigidly connected across the bottom by a common torque tube although the tie links may also comprise the older leaf springs.

The support springs are generally under the upper ends of the angularly disposed springs or tie links, and may be coil springs, air pillows or the like. These are adjustable to support the upper ends of the tie links at the correct elevation. Such screens are shaken by twin eccentric weights which are rotated jointly to exert their force in a given sloping "force plane" (perpendicular to their common axial plane). The correct spring adjustment is that at which the links are perpendicular to the force plane at the midpoint of the shaking movement.

If the support springs are not properly adjusted, the screen shaker, during operation, will have less than peak efficiency and may produce an unusual degree of vibration in the support structure to such an extent that a noisy or objectionable condition arises. It is then necessary to adjust the support springs to avoid such operation.

Where air cushions are used, adjustment is quite simple. The air pressure in the cushion is raised or lowered through a valve stem in the cushion. The valve stem is in the lower, stationary end of each air cushion, so that a pump can easily be attached to it during operation of the shake screen. Where coil springs or other supports are utilized, the adjustment may require more complicated manipulation.

The present invention provides an improved gauge to indicate during operation the amount of adjustment necessary. It is not enough to observe the height of the gauge while the screen is stationary, because that may not be its average height during operation.

The gauge which accomplishes these several advantages, comprises an escutcheon plate affixed to the box frame for the screen, and an apertured viewing plate which is affixed to the base support and coacts with the escutcheon plate to indicate screen height or screen tilt. The aperture has opposite reference edges perpendicular to the line of oscillation of the screens.

The escutcheon plate has a black square figure, which also has opposite sides perpendicular to the line of oscillation. Beyond these sides is a wide bright area, with the result that during oscillation a shorter black figure appears. The dimensions are such that it just fills the aperture, if all is well. If adjustment is needed there is a line of marked contrast clearly in view which easily shows the amount of adjustment needed. In addition, the escutcheon plate uniquely contains indicia which facilitates accurate attachment of the plate to the screen frame so that a proper reading can be made thereafter.

The detailed description of the gauge of this invention is more aptly related by reference to the accompanying drawings in which:

FIGURE 1 is a perspective view of a horizontal shake screen with the gauge of the invention affixed thereto.

FIGURE 2 is a detailed side view of the air cushion portion of the shake screen shown in FIG. 1.

FIGURE 3 is a view of the face of the escutcheon plate forming part of the height gauge.

FIGURE 4 is a perspective view of the viewing plate forming another part of the height gauge, partly broken away, and with diagrammatic matter added.

FIGURE 5 is a face view showing the coaction of the escutcheon plate and the viewing plate, and

FIGURE 6 is a vertical cross-sectional view of the entire gauge taken on line 6—6 of FIG. 5.

Background Description

Although the following disclosure offered for public dissemination is detailed to ensure adequacy and aid understanding, this is not intended to prejudice that purpose of a patent which is to cover each new inventive concept therein no matter how others may later disguise it by variations in form or additions or further improvements. The claims at the end hereof are intended as the chief aid toward this purpose, as it is these that meet the requirement of pointing out the parts, improvements, or combinations in which the inventive concepts are found.

The height gauge of the present invention finds its greatest advantages in connection with a horizontal shake screen of the type generally illustrated in FIG. 1. Here a base or stationary frame **11** supports a shaker frame or box **12**, in which are located three screens **13**, **14** and **16** of progressively finer mesh. Material to be classified is fed to the shake screen at its feed end, at the left in FIG. 1, and may initially strike sloping plate **18**. Surrounding walls **19** ensure against spillage of the material.

The box **12** is supported from the stationary frame **11** by means of sloping parallel pivoted links **26**. As seen best in FIG. 2, each link **26** is pivoted to the stationary frame at **34** and to the box at **36**. Only the two near links **26** are visible in FIG. 1, but on the opposite side of the machine are two corresponding links similarly sloped. Preferably each link is rigidly joined to the link opposite it, on the far side of the machine, by a torque tube **27** represented only by the dotted lines in FIG. 2.

The screen box **12** is further supported adjacent the upper end of each link **26** by an air spring or air cushion **41**. Each air cushion is provided with a valve stem **42** through which it may be inflated, or on occasion, partially deflated. Each air spring **41** is carried between a bracket **43** secured to screen box **12** and provided with a stiffening flange **44**, and a bracket **45** secured to base **11**. It is thus seen that the links **26** serve essentially as guide links to confine the shaking movement of the screen box **12** to its slightly arcuate path approximately lying in a chosen plane of oscillation. Within the range of oscillation permitted by the air springs **41**, the links **26** offer substantially no resistance to the oscillation of the screen box **12** in the intended direction, except for the rigidity of the U-shaped link structures which tend to help ensure movement of the two sides of the screen box exactly in phase. Preferably the pivotal connection at the two ends of the links **26** are by means of rubber bushings, but within the range of oscillation these also give substantially no opposition to the oscillation.

The screen box is shaken by a driving unit **46** which is driven by a motor **51**. The driving unit **46** includes two eccentrically weighted shafts rotating in opposite direc-

tions, with the eccentric weights in phase with one another so that the resultant force is entirely in a force plane perpendicular to the plane in which both of the axes of rotation are found. More briefly it may be stated that the force is exerted only in the direction perpendicular to the common axial plane.

It is desirable that this plane of force be perpendicular to the planes coinciding with the pivotal axes of links **26**, when the links **26** are at the midpoint of their oscillating movement. This condition achieves the greatest efficiency in the shaking of the screen with the least transmission of vibration to surrounding structure. Indeed, if there is a firm foundation, a floor does not seem to be noticeably vibrated when this condition exists, though the vibration might be quite severe if there is a wide departure from this condition.

The plane of force is not adjustable. It is determined by the design of the machine and its original manufacture, being perpendicular to the common axial plane of the drive unit **46** which is immovably mounted with respect to the box **12**, and must be very firmly secured to the box **12** in order to transmit the great thrust necessary for oscillating the box **12**. Accordingly, the ideal perpendicular relationship of the links **26** to the force plane must be achieved by other adjustment. It has been commonly recognized that it could be achieved by adjusting the springs **41** or coil springs which have previously been used in their location, to raise or lower the shaker box **12** until the mid height about which it oscillated was the height at which the links **26** (or leaf springs which comprised an earlier form of link) are perpendicular to the force plane. With the air springs **41** this adjustment can be very easily made through the valve stem **42** which remains stationary while the machine oscillates.

The main difficulty in making this adjustment is in knowing precisely when the ideal condition is met. With the machine stationary, the air cushions **41** could be adjusted until the pivot **36** was at a given height above stationary frame **11**, and the height representing the ideal condition is easily determined. In fact, it is usually announced by the manufacturer of the shake screen. However, making this adjustment when the machine is stationary is not likely to provide quite the correct adjustment during operation. Depending on such factors as the nature of the material being classified and the rate of feeding, there would be variation during operation from the height of the box when at rest.

There has been at least one previous device for aiding in the determination of the medial height of a shake screen box during its operation, and the present invention is designed to provide a better device of this kind, a better height gauge. Particularly, it is desired to have one which is always easily read to determine the amount of adjustment needed.

Height Gauge of This Invention

According to the illustrated form of the present invention, the height gauge includes two parts. One is a plate **61**, which may be called an escutcheon plate, and which is secured to the shake box **12**. The other is a viewing plate **62** secured to the stationary frame **11**. The viewing plate **62** has a viewing aperture **63** through it which is shown as a square. For purposes of present discussion, the most important aspect of this aperture is that it has opposite edges **64** and **66** which are perpendicular to the force plane, or at least steeply cross it.

Likewise, the escutcheon plate bears a pattern or block **67** of marked contrast as compared to the field surrounding it. Again the most important consideration with respect to the block **67**, for present discussion purposes, is that it has opposite edges **68** and **69** which are parallel to the edges **64** and **66**, and properly spaced with respect to them. As the invention has so far been practiced, the block **67** is black and the field is a bright metal (brass) surface. The result can be explained best with reference to FIG. 4.

In FIG. 4 diagrammatic matter including a bar **67'** has been added for the purpose of illustration. It represents the actual length of the block **67**. The edges **68** and **69** are therefore represented at **68'** and **69'**. Adjacent each of these edge representations is a bracket marked "OSC" which represents the amount of oscillation of the box **12** and hence of each of these edges. As a result of this oscillation only the part of the actual block **67** between the lines represented at **68''** and **69''** appears to be black. Beyond this black appearing area in both directions there will seem to be a slightly darkened or gray area which by contrast to the black will appear quite bright, however.

FIG. 4 has been drawn on the assumption that the screen height is exactly correct, this fact being shown by the perfect alignment of the apparent edges **68''** and **69''** with the actual viewing edges **64** and **66**. This is the condition shown in the middle of the three small upper diagrams at the top of the escutcheon plate **61** as shown in FIG. 3. Thus as actually manufactured, the escutcheon plate **61** has three diagrams, the middle of which shows appearance that the height gauge should give when the screen is at the proper height. The left-hand diagram shows how the appearance would be if the screen box were too low. In this instance there would be a narrow bright band **71** shown adjacent but inside the edge **66**. If the screen box were too high, the appearance would be as shown in the right-hand diagram of FIG. 3 in which there would be a bright band **72** adjacent but just inside of the lower edge **64** of the viewing aperture **63**.

FIG. 5 is a view corresponding to the middle diagram of FIG. 3, the block **67** being seen through the aperture **63** without any apparent bright band beside it. In fact, the band **71** and the band **72** would both be present, but hidden by the viewing plate **62**.

It is not necessary to view the height gauge directly from the full face view as seen in FIG. 5. Inasmuch as the aperture **63** is not likely to be at eye level, it may be more convenient to view it from a diagonally located position higher or lower but in alignment with the edges **64** and **66**. This is, in fact, the view represented by FIG. 4.

One of the advantages of the present height gauge is that it is extremely easy to read.

The screen height gauge is easily applied to a shake screen. As a preliminary to its application, the screen box **12** will be adjusted to the correct position, while stationary, by adjusting the air pressures in the various cushions. The viewing plate **62** will now be secured in position, usually firmly but temporarily, as by vise wrenches. The holes for its permanent mounting may now be drilled. Also the escutcheon plates **61** may now be held against the side of box **12** and moved until the four corner demarcations **78** on the block **67** are accurately aligned with the four corners of the aperture **63**. An escutcheon plate may be secured in this place by self sticking tapes and the two upper holes drilled for upper drive-screws **79**. Usually viewing plate **62** will be removed while the holes for lower drive-screws **79** are drilled and these screws pounded in.

The viewing plate **62** occasionally gets badly bent. Because secured by bolts **84**, it is easily replaced, holes **83** being fairly snug to ensure accurate location of the replacement.

An advantage of having both the viewing aperture **63** and the block **67** square is that the height gauge can be placed on either side of the shake screen depending on which side is most convenient for inspection by the operators. If on the opposite side of the machine from that shown in FIG. 1, the edge **74** and the edge **81** of the block **67** will be the edges perpendicular to the force plane. Likewise the edge **76** and the edge **82** of the viewing aperture **63** will be the edges of this aperture perpendicular to the force plane.

An advantage of using a complete height gauge on both

sides of the machine is that lateral tilting (if not prevented by torque tube **27**) can then be detected which might not be detectable from one height gauge alone. Also, sometimes one side is too dusty for good visibility while the other remains clean.

Whenever any improper action of the screen box is detected by the height gauge of this invention, it is very easily corrected by correcting the inflation of one or more of the air cushions **41**. This can be done without stopping the operation of the machine, inasmuch as the valve stems **42** are stationary and freely accessible for attachment of a pump. An operator will usually get quite skilled in estimating the amount of pumping needed for correction, or discharge of air if the screen is too high. Nevertheless it is a great convenience to be able to watch the height gauge as the correction proceeds. Of course, only about one-fourth of the correction should be made with each of the air cushions **41**.

Between the two features of ease of correction during oscillation and ease of determining precise adjustment, it is entirely practicable to keep the shake screen operating under ideal conditions. This in turn results in maximum efficiency and minimum annoyance from vibration of the supporting surface.

The square is most advantageous for the aperture **63** and for the block or figure **67** when the plane of force and the plane of oscillation are at 45° to the vertical. It is then possible to make plates **61** and **62** to be mounted vertically on either side and (because the squares have their diagonals vertical) the squares will have sides perpendicular to the line of force. Fortunately the 45° angle is a very suitable angle for the plane of force and plane of oscillation and in fact is frequently preferred even aside from this advantage.

A skilled operator may use the appearance of fine corner marks **78** to judge the proper balance of the load. If there is sufficient unbalance to cause harmonics or distort the normal oscillation, these marks may appear to be fuzzy, while they appear sharp if oscillation is correct.

An important advantage of this height gauge is that whenever it is off-height, this fact and the amount of adjustment needed is easily observed. An easily read line of substantial length, separating zones of great contrast will appear. To accomplish this, it is necessary that throughout that substantial length of line, as along lines **68** and **69**, the areas on opposite sides have great visual contrast for a distance greater than the amplitude of oscillation.

We claim:

1. A shake screen and height gauge combination including:

a shake screen assembly including a base, a screen box, drive means exerting an oscillating force on the box in a force plane, link means extending generally perpendicularly to the force plane between the box and the base for confining the box to a movement slightly arcuate, and spring means supporting the screen box and adjustable for adjusting the height of the screen box with respect to the base, and

means rigid with the base forming a viewing aperture with opposite straight viewing edges steeply angled with respect to the force plane;

the screen box bearing a figure having opposite straight edges paralleling said viewing edges, and each separating areas of great optical contrast such that during oscillation visible lines appear, at least one of which will be visible through said aperture if said screen box is not oscillating at such height that the link means is closely perpendicular to the force plane.

2. A shake screen and height gauge combination including:

a shake screen assembly including a base, a screen box, drive means exerting an oscillating force on the box in a force plane, link means extending generally perpendicularly to the force plane between the box and the base for confining the box to a movement slightly arcuate, and spring means supporting the screen box and adjustable for adjusting the height of the screen box with respect to the base, and

means rigid with the base forming a viewing aperture with opposite viewing edges steeply angled with respect to the force plane;

the screen box bearing a figure having opposite edges paralleling said viewing edges, and each separating areas of great optical contrast such that during oscillation visible lines appear, at least one of which will be visible through said aperture if said screen box is not oscillating at such height that the link means is closely perpendicular to the force plane.

3. A shake screen and height gauge combination including:

a shake screen assembly including a base, a screen box, drive means exerting an oscillating force on the box in a force plane, link means extending generally perpendicularly to the force plane between the box and the base for confining the box to a movement slightly arcuate, and spring means supporting the screen box and adjustable for adjusting the height of the screen box with respect to the base, and

means rigid with the base forming a rectangular viewing aperture with opposite straight viewing edges steeply angled with respect to the force plane;

the screen box having an escutcheon plate thereon, bearing a rectangular figure similarly proportioned having opposite straight edges paralleling said viewing edges, and its four edges each separating areas of great optical contrast such that during oscillation visible lines appear, at least one of which will be visible through said aperture if said screen box is not oscillating at such height that the link means is closely perpendicular to the force plane.

4. A shake screen and height gauge combination including:

a shake screen assembly including a base, a screen box, drive means exerting an oscillating force on the box in a force plane, link means extending generally perpendicularly to the force plane between the box and the base for confining the box to a movement generally at 45° to the vertical and slightly arcuate, and spring means supporting the screen box and adjustable for adjusting the height of the screen box with respect to the base, and

means rigid with the base forming a rectangular viewing aperture with opposite straight viewing edges steeply angled with respect to the force plane;

the screen box having an escutcheon plate thereon, bearing a rectangular figure similarly proportioned having opposite straight edges paralleling said viewing edges, and its four edges each separating areas of great optical contrast such that during oscillation visible lines appear, at least one of which will be visible through said aperture if said screen box is not oscillating at such height that the link means is closely perpendicular to the force plane.

5. A height gauge for a shake screen including:

a plate having a rectangular viewing aperture therethrough, and an attaching formation for attaching it to the base of a shake screen on either side thereof, and

an escutcheon plate having thereon a rectangular figure of proportions similar to the viewing opening, a wide area adjacent all four sides of the figure having an appearance in great contrast with that of the figure so that if the escutcheon plate is attached to a shake screen box to be viewed through the aperture with sides parallel to the aperture sides and with two opposite sides perpendicular to the line of oscillation, the opposite sides will be visible where they stop between oscillations.

6. A height gauge for an oscillating shake screen including:

means forming a viewing opening with two straight and parallel opposite edges, and

means forming a figure with two straight and parallel opposite sides and with wide areas adjacent these sides having an appearance in great contrast to the figure;

the spacing between the sides being different from the spacing between the opposite edges of the viewing aperture by an amount corresponding to the expected oscillation to make the apparent spacing of the sides during oscillation equal to that of the edges, so that if centered as to the aperture and arranged for parallelism the sides will appear to substantially coincide with the opposite edges.

7. A shake screen and height gauge combination including:

a shake screen assembly including a base, a screen box, drive means exerting an oscillating force on the box in a force plane, link means extending generally perpendicularly to the force plane between the box and the base for confining the box to a movement slightly arcuate, and spring means supporting the screen box and adjustable for adjusting the height of the screen box with respect to the base, and

said screen box carrying a figure with edge portions located on spaced parallel straight lines steeply angled to the force plane and each having adjacent to it a wide area of field of great contrast with said figure to provide during oscillation a visible indication of the location of both positions of rest, and

comparison means fixedly carried by the base and marking for visible comparison the correct positioning of said visible indication.

8. A shake screen and height gauge combination including:

a shake screen assembly including a base, a screen box, drive means exerting an oscillating force on the box in a force plane, link means extending generally perpendicularly to the force plane between the box and the base for confining the box to a movement slightly arcuate, and air cushion means supporting the box at at least four locations and having a plurality of stationarily located valve stems for differentially inflating the air cushion means to adjust the height of the screen box with respect to the base,

said screen box carrying a figure with edge portions located on spaced parallel straight lines steeply angled to the force plane and each having adjacent to it a wide area of field of great contrast with said figure

to provide during oscillation a visible indication of the location of both positions of rest, and

comparison means fixedly carried by the base and marking for visible comparison the correct positioning of said visible indication.

9. A shake screen and height gauge combination including:

a shake screen assembly including a base, a screen box, drive means exerting an oscillating force on the box in a force plane, link means extending generally perpendicularly to the force plane between the box and the base for confining the box to a movement slightly arcuate, and air cushion means supporting the box and having a stationarily located valve stem for inflating the air cushion means to adjust the height of the screen box with respect to the base,

said screen box carrying a figure with edge portions located on spaced parallel straight lines steeply angled to the force plane and each having adjacent to it a wide area of field of great contrast with said figure to provide during oscillation a visible indication of the location of both positions of rest, and

comparison means fixedly carried by the base and marking for visible comparison the correct positioning of said visible indication.

10. A height gauge for a shake screen including:

means adapted to move with a screen box for carrying a figure with edge portions of substantial length located on spaced parallel straight lines and each having a wide area of great contrast with the figure adjacent to it to provide during oscillation a visible indication of the location of both positions of rest, and

separate comparison means adapted to be fixedly carried by a base from which the screen box is supported and marking for visible comparison the correct positioning of said visible indication.

References Cited in the file of this patent

UNITED STATES PATENTS

511,987	Andrews	Jan. 2, 1894
2,920,762	Muller	Jan. 12. 1960

FOREIGN PATENTS

791,315	France	Sept. 23, 1935

OTHER REFERENCES

Iowa Manufacturing Company Service Bulletin, DK-348, October 21, 1955.