

Dec. 21, 1954

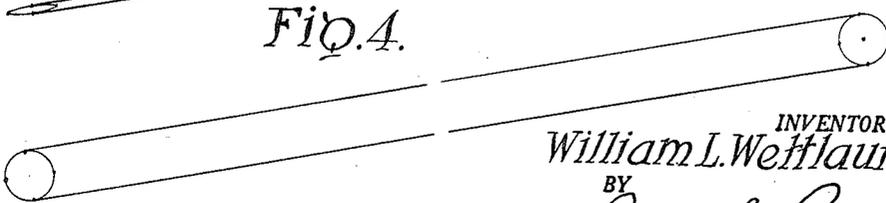
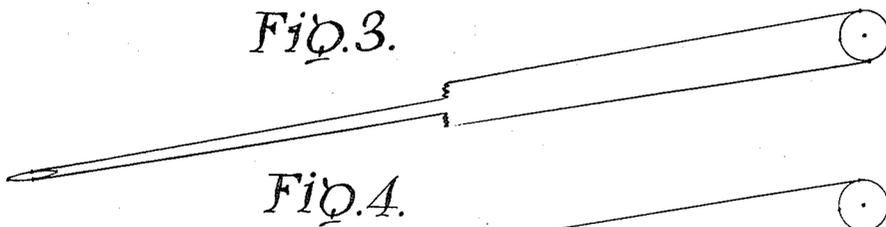
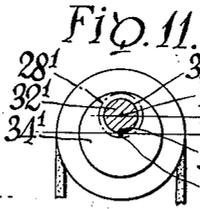
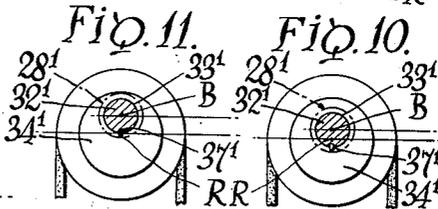
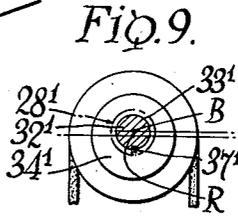
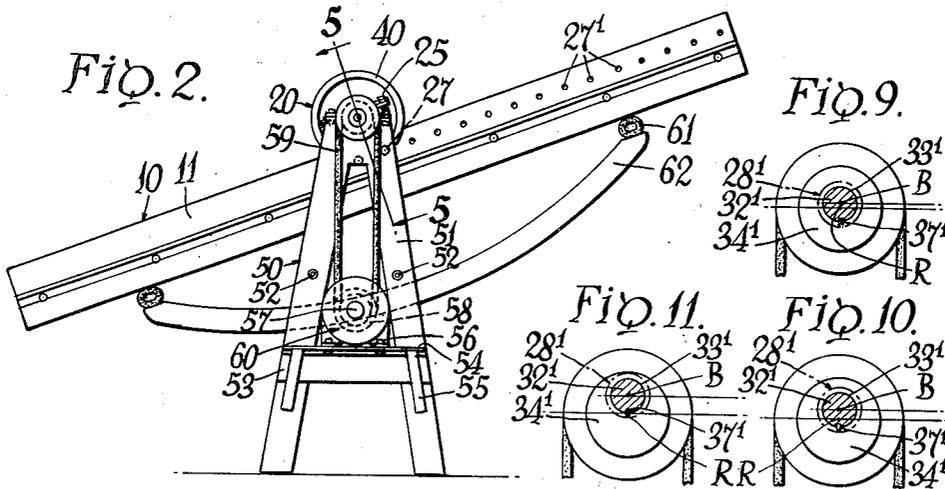
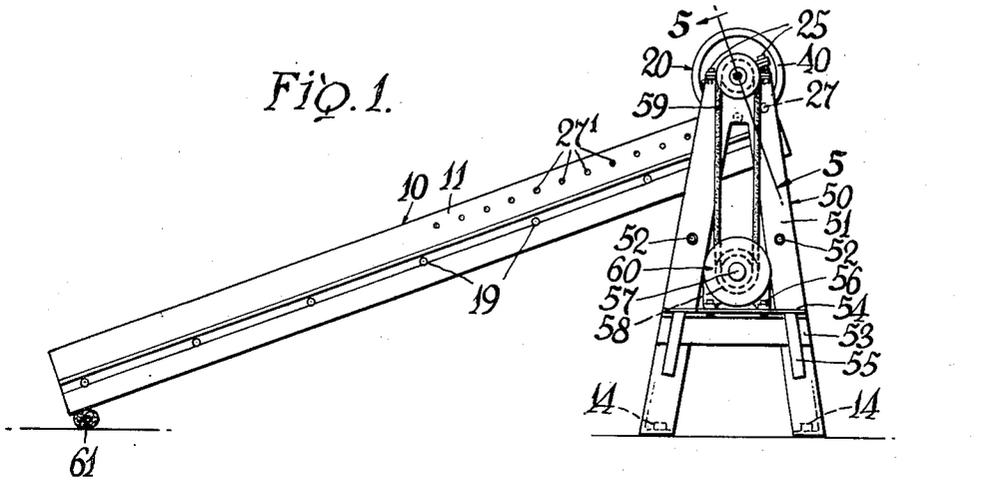
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2,697,357

UNITARY SCREEN VIBRATING MECHANISM

Filed April 24, 1953

2 Sheets-Sheet 1



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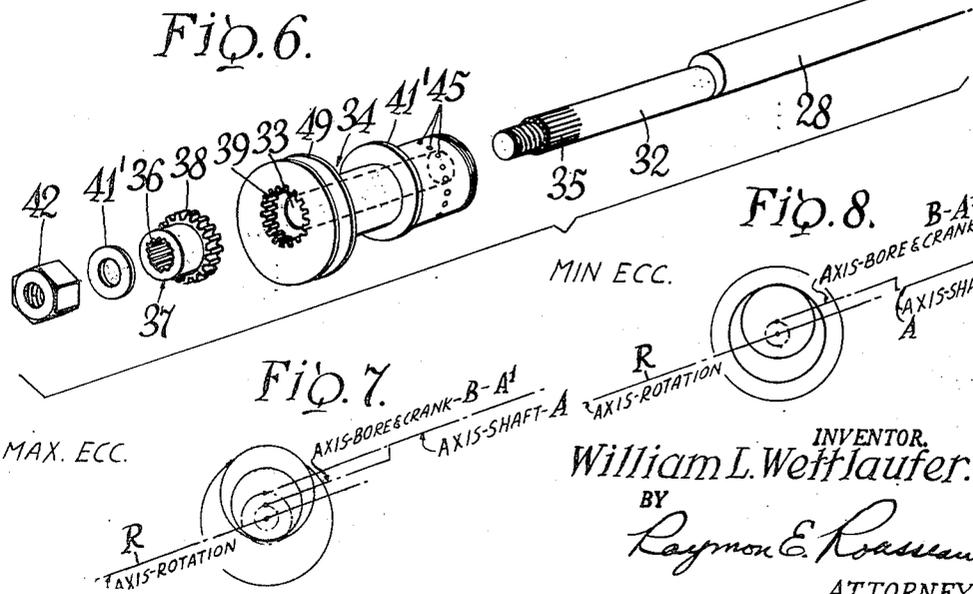
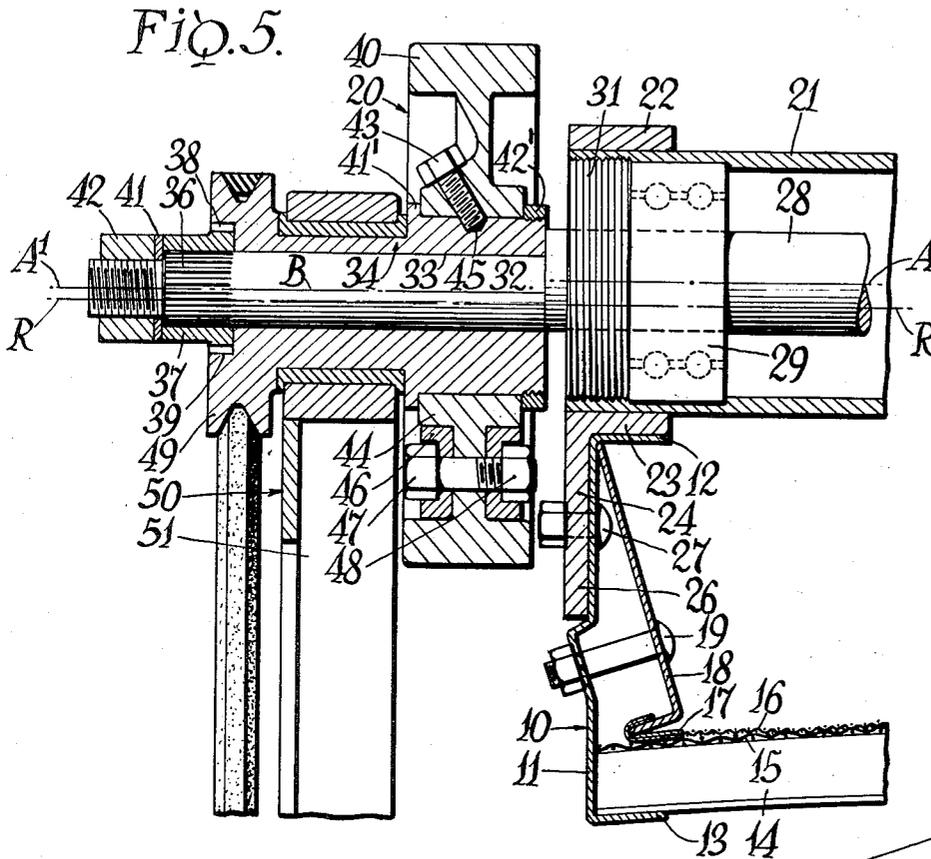
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UNITARY SCREEN VIBRATING MECHANISM

Filed April 24, 1953

2 Sheets-Sheet 2



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2,697,357

UNITARY SCREEN VIBRATING MECHANISM

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8 Claims. (Cl. 74—87)

My invention relates to improvements in screens and more particularly to mechanism adaptable to vibrate a screen at speeds, positive amplitudes and patterns of vibration suited to the characteristics of materials which have been extremely difficult to screen as well as materials which are ordinarily screened without difficulty.

The vibrating mechanisms of prior screens have not been readily adaptable to successfully screen more than a comparatively few materials, have not been capable of sustained operation at the high speeds found desirable for certain materials, have applied the screen vibrating forces in a manner to cause bearings and other parts to fail to function properly after relatively short periods of high speed operation, and have had to be constructed extremely strong and bulky to withstand, for reasonably long operating periods, the effects of the vibration on the screen and the sundry parts of its vibrating mechanism.

The objects of my invention are to provide a unitary screen vibrating mechanism which is adaptable to many sizes and types of screens and which will screen many different materials; to provide a vibrating mechanism which is adjustable to obtain maximum, intermediate and minimum amplitudes of positive vibration; to provide a screen vibrating mechanism which is counter-balanced throughout its entire range of positive amplitudes of vibration and may be driven at speeds higher than speeds ordinarily used; to provide a screen vibrating mechanism which is readily securable to different portions of a screen to provide different patterns of positive vibration of the screen; and to provide a screen vibrating mechanism which may be constructed of simple, easily fabricated and inexpensive parts, which may be lightly constructed, yet strong and rugged and which will withstand long operating periods with a minimum of servicing.

These and other objects and advantages of my invention will appear from the following detailed description. In the drawings:

Figure 1 is a side elevational view of an inclined screen having its lower end resiliently supported and having my improved vibrating mechanism operatively connected to its upper end.

Figure 2 shows a side elevational view of an inclined screen having its opposite end portions resiliently supported by my unitary vibrating mechanism and operatively connected thereto between the resilient supports.

Figures 3 and 4 are diagrammatic views showing the vibration patterns of the screens shown in Figures 1 and 2 respectively when the vibrating mechanism is adjusted for a maximum amplitude of vibration.

Figure 5 is an enlarged vertical sectional view taken on the lines 5—5 of Figures 1 and 2 and showing the mechanism adjusted to provide the maximum amplitude of vibration.

Figure 6 is an exploded view of the major elements of the vibrating producing mechanism.

Figure 7 is a diagrammatic view illustrating the offset relation of the axes of the elements as adjusted for the maximum eccentricity and amplitude of vibration.

Figure 8 is a diagrammatic view illustrating the relation of the axes of the elements as adjusted for the minimum eccentricity and amplitude of vibration.

Figures 9, 10 and 11 are diagrammatic views of a series of interchangeable bushings, each having a differently located eccentric bore and each providing a different amplitude of vibration.

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Referring to the drawings a screen is indicated generally by the numeral 10.

As is usual in screens of the type illustrated, the screen 10 has spaced side plates 11 formed as channels having their top and bottom flanges 12, 13 extending inwardly. A series of spaced slightly bowed angle iron cross braces 14 extend between and have their ends rigidly secured to the side plates 11 and the flanges 13 thus serving to retain the side plates in spaced parallel relation. A heavy screen 15 usually formed of interwoven rods covers the entire area bounded by the inner sides of the side plates and the cross braces at the ends of the plates and is secured upon the cross braces by fastening means (not shown).

The heavy screen 15 serves to support a lighter screen cloth 16 selected to suit the characteristics of the material to be screened and its fineness. Each of the side edges of the screen 16 is secured to an inwardly opening channel 17 into which the lower outwardly turned flange of a screen cloth tensioning angle plate 18 is inserted. The upper end of the plate 18 is seated in the juncture of the side plate 11 with its top flange 12 and the plate 18 has a downward and inward inclination so that when the take-up devices 19 are tightened the screen cloth is drawn taut upon the screen 16 all in a well known manner.

As best illustrated in Figure 5 my unitary mechanism for positively vibrating and varying the amplitude of vibration of a screen, typified by the screen 10, is generally designated by the numeral 20. In the mechanism illustrated a tubular housing 21 of slightly greater length than the width of the screen 10 has each of its opposite ends rigidly clamped between the upper detachable and the lower fixed embracing halves 22 and 23 of a bracket 24 by bolts 25. The bottom halves 23 of the brackets 24 are each seated upon the top flange 12 of one of the side plates 11 and are each formed with a depending plate 26 which while rigidly secured upon the outer surface of the plate it engages, as by the bolts 27, to support the screen is detachable for a purpose to be hereinafter described.

A shaft 28 extends through and beyond the tubular housing 21 and has each of its opposite end portions mounted in a bearing 29.

The bearings 29 each being pressed into a counterbore formed concentrically with and in opposite ends of the housing are each retained therein by a suitable seal indicated at 31. By reason of the bearings 29 being so mounted and secured in the housing, the axis "A" of the shaft and the housing are coincident and the shaft may be rotated therein at any speed within the capacity of the bearings.

The shaft 28 has each of its opposite ends formed with reduced shaft-like ends or crank arms 32 having a common axis "A" which is located eccentrically to the axis "A" of the shaft and housing. The cranks 32 are each rotatably fitted in a bore 33 of one of a pair of drive sleeves 34 which are each mounted in a fixed rigid support, to be described later, for rotation about an axis "R." The axis "B" of the bores 33 is located eccentrically with respect to the axis of rotation "R" of the drive sleeves 34 and since the eccentric distance between the axes "A" and "A'" is made substantially equal to the eccentric distance of the axis "B" from the axis "R" (and the axes "A'" and "B" coincide) it will be seen that the cranks 32 may be rotated in the bores 33 about the axis "A'," so that the axis "A" of the shaft 28 may be made to substantially coincide with the axis of rotation R or located so that the radial distance of the axis "A" of the shaft from the axis R is equal to the sum of the distances between the axes "R"—"B" and between the axes "A"—"A'."

It will be obvious that in the last described position the eccentric distances are compounded to provide the maximum total eccentricity of the axis "A" from the axis R, that when the cranks are secured to and rotated with the drive sleeves the total throw of the shaft will be equal to twice the total eccentricity and that the maximum amplitude of vibration of the mechanism will be equal to the total throw of the axis "A" of the shaft around the axis "R."

It will be equally clear that while the cranks 32 may be rotated in their bores 33 to swing the axis "A" of shaft 26 from its position of maximum eccentricity (Figure 7) through intermediate positions of less eccentricity to its position of minimum eccentricity or vice versa (Figure 8) they must be secured against rotation in their bores in each position and that by and during operation of the screen vibrating mechanism a positive circular movement equal to twice the selected eccentricity will be imparted to the screen body.

In order to facilitate securing the cranks in any of their aforesaid positions they may be, for example, extended beyond their drive sleeve and provided with a finely splined end portion 35 upon which the similarly splined bore 36 of a driver 37 is slidably fitted (Figure 5). The driver being formed with a radially extending coarsely splined flange 38 is slidably engageable in a similarly splined recess 39 formed in the outer end of the drive sleeve 34 and is secured in driving engagement therewith by a washer 41 against which a nut 42 having threaded engagement with the end of the crank is tightened.

Assuming that the parts are assembled as shown in Figure 5 to provide the maximum positive eccentricity and vibration and that less eccentricity and vibration are desired, the nuts 42 are loosened and backed off sufficiently to allow the coarsely splined flange 38 to be withdrawn from engagement with their splined recess 39 whereupon the cranks 32 may be rotated in their bores 33 to rotate the axis "A" of the shaft toward the axis of rotation "R," and when the desired eccentricity is found the driver is reengaged in the new position and the nut retightened. In the event the desired eccentricity cannot be obtained by using the coarsely splined surfaces 38-39 the nut may be removed to allow use of the finely splined surfaces 35-36 alone or in combination with the coarsely splined surfaces 38-39.

It is customary in screens of this type to rigidly secure a flywheel to the vibrating mechanism and to provide the flywheel with counterweights of a size to counterbalance the thrown weight of the vibrating parts, however, due to the different eccentric settings of my vibration producing mechanism it has been found necessary to rotatably mount a flywheel on each of the sleeves or shaft and to provide means for rigidly securing them in a multiplicity of counterbalancing positions wherein the forces of suitable counterweights secured thereto are opposite and equal to the forces generated by and during operation of the vibrating mechanism. Accordingly one of the flywheels 40 is rotatably secured on the inner end portion of each bushing 34 between a flange or shoulder 41' formed on the bushing and a threaded ring 42' screwed on the innermost end of the bushing.

The inner end of a radially disposed setscrew 43 projects through the hub 44 of each flywheel and is engaged in one of a series of circumferentially aligned sockets 45 formed in the periphery of its bushing 34, thereby rigidly securing each flywheel in its counterbalancing position and against rotation on the bushing. By disengaging the inner ends of the bolts from their sockets each flywheel may be rotated and the bolt reengaged in any of the other sockets to secure the flywheels in its other counterbalancing positions. Suitable blocks or counterweights 46 are detachably secured to the flywheels 40 by one or more bolts 47 and the nuts 48. The weight of the blocks, bolts and nuts is made equal to the thrown weight of the vibrating mechanism and the screen resulting from the selected eccentric setting of the axis "A" of the shaft 28 about the axis of rotation "R" in the manner above described. The weight being less for smaller eccentric settings and more for larger eccentric settings and the flywheels being adjustably secured on their drive sleeves, the center of mass of the weights may be positioned and secured by the setscrew 43 diametrically opposite to the eccentric location of the axis "A" from the axis "R," to effectively counterbalance the thrown weight of the vibrating mechanism and the screen regardless of its speed of rotation.

As stated above the drive sleeves 34 are mounted for rotation in a fixed rigid support, and while they may be rotated by any suitable means they are preferably rotated by a V pulley 49 formed on the outer end of one of the drive sleeves in concentric relation to its axis of rotation "R."

A suitable rigid support is generally designated by the numeral 50 and preferably is formed of a pair of A-shaped angle iron side frames 51 rigidly connected together in

spaced, opposite and parallel relation by cross bracing rods 52 with their bases rigidly secured upon a surface such as a floor by bolts 14. The legs of each frame 51 are connected together by horizontally disposed angle iron braces 53 which further reinforce their A frames and as a matter of convenience one of the braces may serve as a support for one side of a motor supporting plate 54, the other side of which may be supported by braces 55. A motor 60 is adjustably secured upon the plate 54 by bolts 56 passing through suitable slots formed in the plate (but not shown) and its shaft 57 is provided with a V pulley 58 which by means of a V belt 59 is connected to and drives the pulley 49.

In order to more satisfactorily screen a greater range of materials my counterbalanced positive action variable vibration screen vibrating mechanism may be selectively driven at different speeds. To this end the motor 60 may be of any suitable variable speed type having the desired range of speeds, or the motor may be a constant speed type and a pair of the well known variable diameter type of pulleys may be substituted for the pulleys 49 and 58. At this point it should be noted that the vibrating mechanism, its support and its drive advantageously provide a unity structure.

As shown in Figure 1 the vibrating mechanism 20 of the unity structure is secured to and supports the upper end of the inclined screen 10 and the lower end of the screen is secured to and resiliently supported by resilient mountings 61 secured to and supported on a surface located to incline the screen at a desired angle. When the vibrating mechanism is adjusted to produce the maximum amplitude of vibration the pattern of vibration will be substantially the same as that shown in Figure 3, however, since the screen 10 is readily detachable from the vibrating mechanism 20 by removing the bolts 27 and its side plates 11 are each provided with an equally spaced series of bolt holes 27' it may be rigidly secured to the vibrating mechanism in other inwardly spaced positions in which, while the amplitude of vibration of the vibrating mechanism is constant, the amplitude of vibration of the upper end of the screen is increased in direct proportion to the distance of the point of application of the vibration to the screen from its resilient mountings 61 is decreased.

As shown in Figure 2 the vibrating mechanism 20 is secured to and supports the center portion of the screen 10 and, to maintain the screen at a selected angle of inclination, its side plates 11, intermediate their ends and the vibrating mechanism, are secured to and supported upon resilient mountings 61 secured to and supported by a pair of arcuately shaped braces 62 each detachably secured by suitable fastening devices (not shown) to the legs of one of the A frames. The pattern of vibration which results when the vibrating mechanism is set for the maximum amplitude of vibration is shown in Figure 4 and it will be apparent that the pattern of vibration may be varied by shifting the screen with respect to the vibrating mechanism and the supports 61 and that the angle of inclination of the screen may be readily changed to suit the characteristics of the material to be screened.

In the event the multiplicity of eccentricities and amplitudes of vibration obtainable with the vibrating mechanism above described is neither necessary nor required a desired lesser number of predetermined amplitudes of vibration of the mechanism and screen may be had by substituting for the shaft 28 a shaft 28' having reduced shaft-like concentric ends 32' and substituting for the pair of drive sleeves 34 a pair of drive sleeves 34' each having a bore 33' which has its axis "B" located eccentrically from its axis of rotation "R" a distance equal to one-half of one of the desired amplitudes of vibration and in which the concentric ends 32' are slidably fitted and secured against rotation as by a driver key 37'. The eccentric distances of the axis "B" from the axis "R" of each of the bushings 34 shown in Figures 9, 10 and 11 may be, for example, $\frac{1}{16}$, $\frac{1}{8}$ and $\frac{3}{16}$ of an inch respectively and will produce amplitudes of vibration of $\frac{1}{8}$, $\frac{1}{4}$ and $\frac{3}{8}$ of an inch respectively.

It will be obvious that other desired amplitudes of vibration may be obtained by using other pairs of the sleeves 34' with the shaft 28' and that the amplitude of vibration of the first described form of my invention may be further varied by providing other pairs of the bushings 34 having their bores located a greater or lesser distance from their axis of rotation.

For the reason that the speed of vibration, the ampli-

tude of vibration, the pattern of vibration, and the counter-balancing of my unitary mechanism for positively vibrating a screen are independently adjustable and allow any suitable inclination of the screen, different combinations of adjustments of these factors may be obtained. And because of the range of these adjustments combinations have been found which make possible satisfactory screening of materials which have been considered unscreenable or at least very difficult to screen. Another advantage of the adjustments is that when a combination suitable to a certain material is found a given quantity of that material may be satisfactorily screened in a shorter period of time and with less blinding of the screen cloth.

While two forms of my unitary screen vibrating mechanism have been illustrated and described as being applied to one type of screen it should be understood that the principles of my invention are applicable to other types of screens and that various modifications and rearrangements of the elements of my mechanism may be made within the scope of the appended claims wherein I claim:

1. A unitary vibrating mechanism adaptable to vary the pattern, amplitude and speed of vibration of a screen body detachably secured thereto, comprising a rigid support; a pair of drive sleeves each detachably mounted on the support for rotation about a common axis; drive means for rotating the drive sleeves at a multiplicity of speeds; a tubular housing secured to the screen body with its axis extending transversely of the screen body; a shaft journaled concentrically in the housing with its outer ends located beyond the ends of the housing; and means for detachably securing each outer end of the shaft to one of the drive sleeves in predetermined eccentric relation to the common axis of rotation of the drive sleeves, whereby rotation of the drive sleeves imparts a positive circular movement to the shaft, the housing and the screen and the amplitude of vibration of these parts resulting from such movement is equal to twice the eccentric distance of the axis of the shaft from the common axis of rotation of the drive sleeves.

2. A unitary vibrating mechanism as set forth in claim 1 wherein a flywheel is rotatably mounted on each drive sleeve, weights sufficient to counterbalance the thrown weight of the vibrating mechanism and the screen are detachably secured to each flywheel, and wherein means are provided for detachably securing each flywheel on its drive sleeve with its weights in a counterbalancing position diametrically opposite to the eccentric location of the axis of the shaft from the axis of rotation of the bushings.

3. A unitary vibrating mechanism as set forth in claim 1 wherein means are provided for detachably securing the housing to several different portions of the screen body thereby to vary its pattern of positive vibration.

4. A unitary vibrating mechanism as set forth in claim 1 wherein the axis of the body of the shaft is offset from the axis of its outer ends a distance substantially equal to the eccentric distance of the axis of said ends from

the axis of rotation of said drive sleeves and may be moved from a position substantially coincident with the axis of rotation of the bushings through intermediate positions to a position spaced from said axis of rotation a distance equal to the sum of said eccentric distances, thereby providing variable amplitudes of positive vibration of the screen.

5. A unitary vibrating mechanism as set forth in claim 1 wherein the means for rotating the drive sleeves at a multiplicity of speeds is carried by the rigid support and includes a pulley on one of the drive sleeves, a variable speed motor mounted on the support, a pulley on the output shaft of the motor and a belt drivingly connecting the V pulleys.

6. A unitary vibrating mechanism as set forth in claim 1 wherein said mechanism is detachably secured to said screen body intermediate its ends, a brace detachably secured to the rigid support is extended therefrom and beneath opposite end portions of the screen body, and each end of the braces is provided with resilient elements for resiliently supporting end portions of the screen body.

7. A unitary vibrating mechanism as set forth in claim 4 wherein a flywheel is rotatably mounted on each drive sleeve, each flywheel carries means for detachably securing it to and against rotation on its drive sleeve in a plurality of positions, counterbalancing blocks are detachably secured to each flywheel, and the center of mass of said blocks is located by said means diametrically opposite to the axis of the shaft from the axis of rotation of the drive sleeve and the weight of said blocks is made sufficient to counterbalance the thrown weight of the vibrating mechanism and the screen.

8. A unitary vibrating mechanism as set forth in claim 4 wherein the drive sleeves are each formed with a bore parallel and eccentric to its axis of rotation, the outer ends of the shaft are each formed with parallel shaft-like crank arms located eccentrically from the axis of the shaft a distance substantially equal to the eccentric distance of the bores from the axis of rotation of the drive sleeves, and each of said arms is mounted for rotation in one of said bores, whereby the axis of the shaft may be swung from a position substantially coincident with the axis of rotation of the drive sleeve through intermediate positions to a position spaced therefrom a distance equal to the sum of said eccentric distances; and wherein the means for selectively securing each outer end of the shaft to one of the drive sleeves includes a driving element formed for selective splined engagement with splined surfaces of the drive sleeve and the arm; and means for securing said driving element in its selected engagement with said driver sleeve and arm.

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