

Nov. 22, 1927.

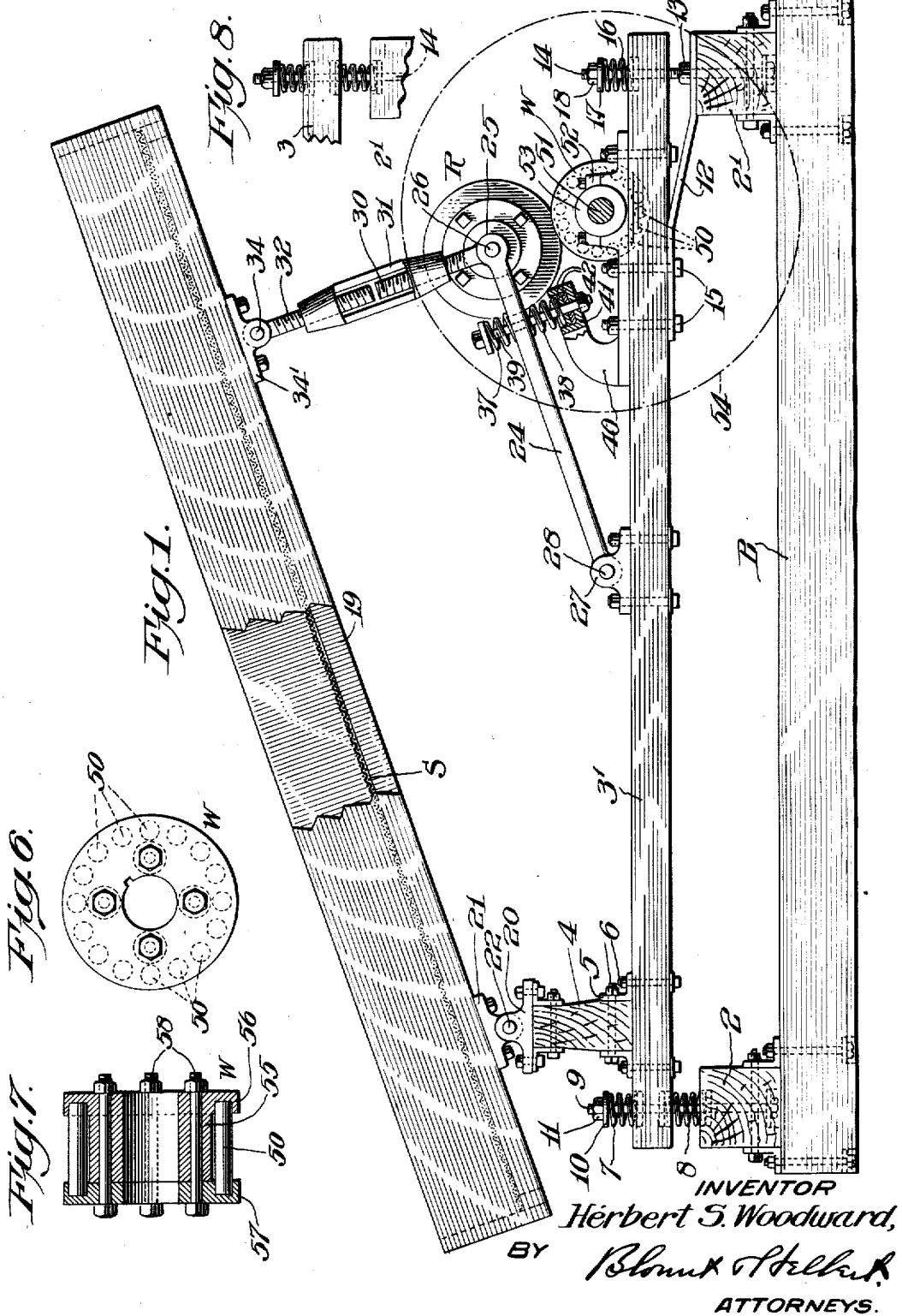
1,649,883

H. S. WOODWARD

VIBRATING SCREEN

Filed May 21, 1925

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Fig. 3.

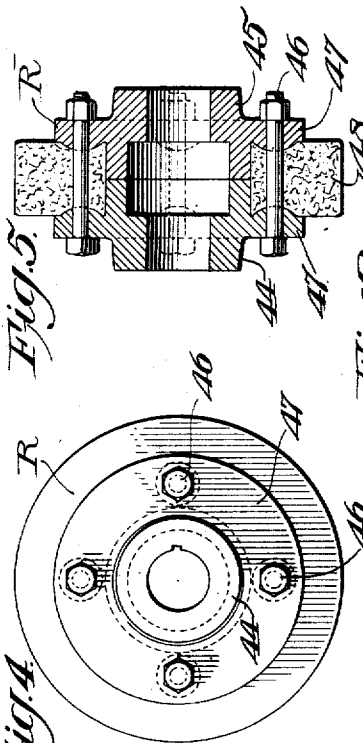
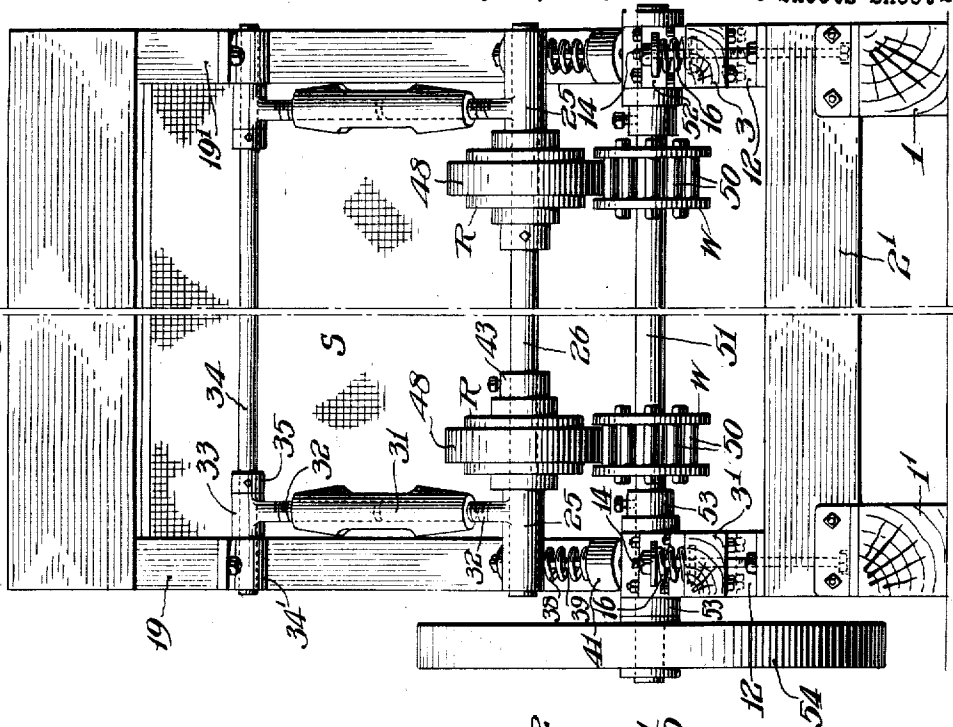


Fig. 5.

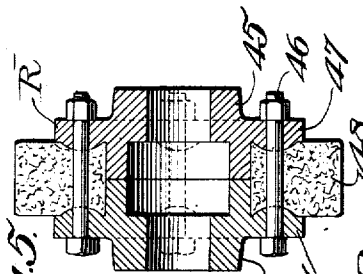
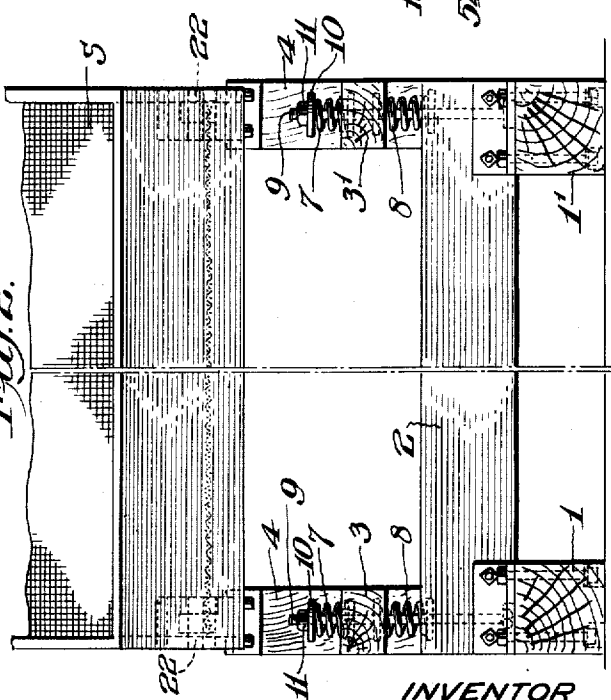


Fig. 2.



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## UNITED STATES PATENT OFFICE.

HERBERT S. WOODWARD, OF CARBONDALE, PENNSYLVANIA.

## VIBRATING SCREEN.

Application filed May 21, 1925. Serial No. 31,781.

My invention relates to apparatus for sifting material by effecting vibration of a screen or foraminous plate on which the material is disposed, a principal object of the invention being to provide an apparatus for this purpose embodying features and advantages not found in devices hitherto proposed therefor. To this end my invention contemplates the provision of an inclined screen on which the material to be sifted is disposed. In association with means for imparting to the screen a positive, rapid vibratory movement, the screen and actuating mechanism being preferably yieldingly supported in such manner that the shock or jar incident to the vibration of the screen is not transmitted to the floor or other support upon which the apparatus is disposed. My invention further contemplates the provision of means whereby the amplitude of vibrations of the screen may be controlled and also means whereby the screen may be caused to vibrate more strongly at certain points on the surface than at others or may be so arranged that the vibrations at all points of the surface will be substantially the same, thus better adapting the apparatus to the sifting or screening of different kinds of material and material of different sizes than would otherwise be the case.

My invention further includes other objects and novel features of design, construction and arrangement to which reference will hereinafter be made or which may be apparent from the accompanying drawings forming a part hereof.

In the said drawings Fig. 1 is a side elevation of an apparatus constructed in accordance with a preferred embodiment of my invention, a portion of the side wall of the screen frame being broken away to show the screen proper, and Figs. 2 and 3 are respectively fragmentary front and rear elevations of the machine shown in Fig. 1. Fig. 4 is an enlarged side elevation of the actuating roll or wheel removed from the machine and Fig. 5 a central section thereof. Fig. 6 is also an enlarged end view of an element, which I conveniently term the roller wheel, removed from the machine and Fig. 7 is a central section thereof with certain parts shown in elevation. Fig. 8 is a fragmentary detail view illustrating a slightly modified construction of certain elements. The same

symbols are used to designate the same parts in the several figures.

As shown, the machine comprises a base generally designated as B and formed by a pair of laterally spaced longitudinally extending side members 1, 1' connected near their ends by cross ties 2, 2' superimposed thereon and securely bolted thereto, the base being preferably of relatively heavy construction so as to afford a firm support. Disposed above the cross ties and supported in spaced relation therefrom by means hereinafter described, are a pair of longitudinally extending stringers 3, 3', conveniently of wood connected near their forward ends, that is, their ends adjacent the left hand side of the sheet when the machine is viewed as in Fig. 1, by a bolster 4 securely fastened to the upper faces of the stringers through the medium of angle clips 5 and bolts 6, the stringers being preferably sufficiently separated laterally to lie respectively above the side members 1, 1' of the base, the stringers and bolster thus forming a sub-frame for the support of the screen as hereinafter described.

For yieldingly supporting each of the stringers above and in spaced relation with the cross tie I prefer to employ, at the forward end of the machine, coil springs 7 and 8 respectively disposed above and below the stringers and a vertically directed bolt 9 extending upwardly through the cross tie and freely through both of the springs and the stringer, and provided at its upper end above the spring 7 with a washer 10 and nut 11, the head of the bolt being conveniently countersunk in the lower face of the cross tie. Thus, by suitable adjustment of the nut the compression of the springs may be regulated with consequent variation in the amount of force necessary to move the stringer longitudinally of the bolt. The function and utility of this capacity for adjustment will hereinafter appear more fully.

While the rear ends of the stringers may be yieldingly supported above the cross tie 2' in a manner similar to that by which the front ends of the springs are supported, and as has just been described (such form of mounting being shown in Fig. 8) I prefer to employ beneath the rear end of each stringer a flat spring 12 instead of a coil spring. This spring may comprise at its

rear end a horizontally extending part adapted to lie on the upper face of the cross tie in which position it is securely fixed by a nut 13 carried by the bolt 14 which extends upwardly through the cross tie, the flat end of the spring 12 and the stringer similarly to the bolts 9 heretofore described, and also an upwardly and forwardly inclined portion extending forwardly from the cross tie and merging into a flat horizontally extending part which is disposed beneath the stringer and securely fastened thereto as by bolts 15. Above the stringer and surrounding the upper end of each of the bolts 14 is a coil spring 16, corresponding to springs 7, and the extremity of the bolt above the spring is provided with a washer 17 and nut 18 in the manner similar to bolts 9. It will of course be understood that while the foregoing description is more particularly directed to the manner of supporting the front and rear ends of either stringer, the ends of the other stringer are supported in a similar way, with the result that both stringers are maintained in a substantially horizontal plane in vertically spaced relation with the cross ties and are free to move up and down with respect thereto when actuated by sufficient force to overcome the resistance afforded by the several springs. While, as stated, it is entirely possible and in some cases may be desirable to employ coil springs beneath the rear ends of the stringers as shown in Fig. 8, I find that under most conditions the use of the flat springs 12 is preferable at this point as such springs tend to prevent lateral movement of the stringers, and in turn of the screen during operation of the machine, as such lateral movement is generally undesirable as the same tends to set up certain local vibrations in the screen which are inimical to the accomplishment of the best results.

The material to be sifted is supported upon a screen, generally designated as S, which may be of any suitable construction, that shown comprising an open rectangular frame having side and end walls and a bottom of wire mesh. As the construction and arrangement of these parts are clearly evident from the drawing further description is deemed superfluous save that it may be noted the frame is provided with relatively heavy longitudinally extending bottom side members 19, 19' disposed beneath the wire and which are of utility in affording rigidity to the frame and also furnishing a point for the attachment of certain elements of the means by which the screen and frame are supported and which will now be described.

In order that the material may progressively move along the screen under the vibratory action thereof the screen is supported above the stringers in an inclined position with its rear end considerably ele-

vated above its forward end which preferably terminates somewhat in advance of the bolster 4 to which the screen is suitably hingedly secured for vertical oscillation about a horizontal axis extending transversely of the apparatus. For this purpose a pair of laterally spaced pillow blocks 20 are disposed on the upper face of the bolster and corresponding inverted pillow blocks 21 secured to the members 19, 19' and a shaft or axle 22 extended through the several blocks, this or other equivalent arrangement being operative to permit vertical movement of the screen about the axis of the shaft under the influence of the mechanism now to be described and which is operative both to support the rear end of the screen and to impart thereto, when suitably actuated, a series of impulses in a plane substantially normal thereto.

Preferably and as best shown in Fig. 3 said mechanism is arranged in duplicate on opposite sides of the machine and it will therefore be understood that the following description while directed more particularly to the mechanism shown on the left side of the machine in said figure, is equally applicable to that upon the opposite side, thereby avoiding needless repetition.

Hingedly supported at its forward end on the stringer 3 is an arm 24 extending rearwardly and angularly upward and provided at its rear end with a boss 25 having a horizontal bore to receive the end of the transversely extending actuating roll shaft 26. The hinge connection between the arm and the stringer may be made in any suitable way, conveniently by block 27 located about midway between the ends of the stringer, bolted thereto and, together with the end of the arm, bored for the reception of a hinge pin 28, but any other suitable means may be employed for this purpose. Preferably formed integral with the boss 25 and extending upwardly therefrom at right angles to the arm 24 is a threaded rod 30 which enters one end of a turn buckle sleeve 31, the opposite or upper end of which is entered by another threaded rod 32. The upper end of this rod is provided with a head or boss 33 bored for the passage of a horizontal shaft 34 which extends transversely across the bottom of the screen and is movably supported thereon by brackets 34' secured to the under side of the frame members 19, 19' or other suitable point on the screen and bored for the passage of the ends of the shaft. In order to prevent displacement of the various parts a collar 35 is mounted on the shaft so as to engage the inner face of the adjacent head 33, the outer face of which conveniently abuts the inner face of the adjacent lug; this collar may be secured in position by a set screw or the like. Thus, by adjusting the turn buckle sleeve 31 the centers of

the shafts 34 and 26 may be brought nearer together or spread further apart with consequent variation in the angular disposition of the screen as the lower end turns about the hinge pin 28.

Means are provided for yieldingly supporting the arm 24 which may comprise a pair of coil springs 37 and 38 respectively disposed above and below the arm near its rear end and surrounding a bolt 39 which passes through both springs and a hole provided in the arm. In turn, the bolt is supported through the medium of an overhanging bracket 40 which is secured to the subjacent stringer and preferably provided adjacent its rear end with a cup or depression 41 opening upwardly and adapted to receive the lower end of the spring 38. In order to give a certain capacity for adjustment at this point I prefer to interpose between the end of the spring and the bottom of the cup a plurality of disks or washers 42; thus if the spring after a period of use should become permanently shortened or compressed any lost motion which might result therefrom between the spring and the arm can be taken up by inserting more washers without changing the adjustment of the bolt which might result in alteration of the spring tension or if, by reason of wear of the actuating roll or for other cause, it be desired to position the springs a little lower with respect to the bracket, a suitable number of washers can be readily removed.

The shaft 26 which is revoluble in the bosses 25 is operative to support the actuating roll, generally designated as R, and which is preferably arranged to turn with the shaft by being keyed thereto and is also held from longitudinal displacement by a collar 43 and the adjacent boss 25. As best shown in Figs. 4 and 5 this roll preferably comprises a pair of complementary, oppositely disposed elements 44 and 45 secured together by bolts 46 to form a hub suitably bored for the passage of the shaft. Each of these elements is provided with an outwardly projecting flange 47 which may be inwardly bulged or curved on the face which is directed toward the other element when the parts are assembled so that when so assembled a peripheral groove is formed having more or less undercut walls and in this groove is seated a ring or annulus 48 of yielding or resilient material such as rubber, leather or the like preferably having a high frictional coefficient, the ring being firmly retained in position by the bolts 46 which are arranged to pass through it as well as through the flanges of the elements. This ring is adapted to be engaged by a cam generally designated as W and which in its preferred embodiment comprises a roller wheel having a plurality of rollers which is positioned upon and

arranged to revolve with a transversely extending drive shaft 51 mounted beneath the shaft 26 in journal boxes 52 carried by the stringers 3, 3' near their rear ends, the shaft being prevented from longitudinal movement in the boxes by collars 53 and provided with a pulley 54 disposed on one of its ends outside of the adjacent journal box adapted for the reception of a drive belt through which power may be transmitted to the shaft, preferably the disposition of the several parts is such that the centers of the shafts 34, 26 and 51 all lie substantially in the same plane which is substantially normal to the axis of the arm 24.

The roller wheel W may be of any suitable construction adapted to support the ends of a plurality of rollers 50 equidistantly disposed about the axis of the wheel and parallel thereto so that each roller is freely rotatable on its own axis with its center portion exposed for engagement by the resilient periphery of the actuating roller. Thus, as shown, the roller wheel may comprise a cylindrical body 55 bored for the passage of the shaft and having an overhanging flange 56 at one end whose inner face is countersunk at spaced intervals for the reception of the ends of the rollers and a cap 57 of the same diameter as the flange, substantially similar thereto and similarly countersunk for the reception of the other ends of the bolts, this cap being adapted to be secured to the body after the rollers have been assembled in position by bolts 58 extending through the parts, but if desired the roller wheel may be constructed in any other suitable way as may be dictated by convenience of manufacture.

It will of course be understood, as indicated in Figs. 2 and 3, that the machine may be constructed of any suitable width and that ordinarily two of the roller wheels will be employed each in association with an actuating roll and other mechanism as hitherto described and under these conditions the roller wheels will preferably be respectively disposed adjacent the stringers 3, 3', although in certain constructions but a single roll, roller wheel and actuating roll may be used in which case the former will usually be disposed substantially midway between the stringers.

In the preferred embodiment of the apparatus and with a view to insuring its most satisfactory operation, I so proportion the length and resiliency of each spring 38 that it will constantly be in a state of compression and further preferably so adjust the adjacent bolt 39 as to bring about a certain, but ordinarily lesser, amount of compression in the spring 37. More particularly, the length and resiliency of the spring 38 is preferably such that the weight of the empty screen and its attached parts is alone suffi-

cient to compress it to an extent greater than the maximum extent of expansion of which it is capable when the arm 24 is moved up by the co-action of the roll R and the rollers of the roller wheel, so that, irrespective of the extent of oscillation or up and down movement imparted to the arm 24 by said co-action, the spring 38 will always be in a state of compression. However, the said spring is preferably so proportioned that the weight of the screen and attached parts is sufficient alone to bring the roll R into engagement with the roller wheel, the additional force requisite to effect such engagement being supplied by a suitable compression of the spring 37 through adjustment of the bolt 39, this adjustment, however, being preferably such that with the screen empty the roll is still a little above the lowest position which it is desired to have it occupy during operation, the weight of the material which is to be sifted being sufficient as it is supplied to the screen to induce the final downward movement of the parts required to bring the roll R to the desired position of operative adjustment with respect to the rollers of the roller wheel. It will thus be understood that this said position of the roll is not always the lowest position to which the roll can be brought before engagement of the periphery of the roll with any adjacent pair of the rollers of the roller wheel finally limits its further downward movement, as for best results in screening numerous classes of material it is preferable to so position the roll that it will extend for a very small distance only into the path of the rollers, for example one-eighth to one-quarter of an inch, rather than to the maximum extent to which it is possible for it to do so extend.

With the parts adjusted in the manner described it will thus be apparent that the springs 38 are always in a considerably greater state of compression than the springs 37, as the former are operative alone to sustain the weight of the screen and frequently of the material disposed thereon as well, while the latter are normally merely compressed sufficiently to supply the requisite force to obtain the desired relation between the roll and the rollers on the roller wheel. Thus when the latter is rapidly rotated, a series of consecutive impulses of relatively small amplitude will be imparted to the roll and in turn transmitted to the screen in a direction substantially normal to its surface, and as the weight of the screen and material disposed thereon is carried either wholly or in large part by the springs 38 but a relatively small amount of power is required to rotate the drive shaft 51. Such would not, however, be the case if the entire weight of the screen and material was transmitted through the actuating rolls to the roller wheels, since

under such circumstances it would be necessary to impart to the wheels sufficient force to lift this entire weight each time that the actuating rolls rode over one of the rollers, while conversely, each time that the actuating rolls descended between the adjacent rollers, the weight of the rapidly falling screen and material would impart a considerable shock to the mechanism which would in turn be received by the stringers and transmitted, at least to some extent and in spite of their preferred resilient support, to the base of the machine, with consequent substantially continuous vibration, shock and jar to the floor and other parts of the building in which the apparatus is disposed. By the provision of a yielding and substantially floating support for the arms 24, however, so designed and adjusted that the major portion of the weight of the material and screen is carried thereby, the roller wheels are very largely relieved from any duty of sustaining this weight while the whole apparatus is relieved from excessive shock and vibration. As the rings 48 of the actuating rolls are preferably made of a somewhat resilient or yielding material having a high frictional coefficient they readily tend, when in engagement with the rollers of the roller wheels, to follow the irregularities in the peripheries of the wheels as formed by the spaced rollers and the spaces therebetween so as to insure the desired regularity in the impulses transmitted to the screen; additionally, since the actuating rolls are not operative to sustain the whole weight of the material as hitherto explained the wear and tear on the rings 48 and the rollers of the roller wheels is minimized. Furthermore as the action of the roller wheel produces a very rapid vertical reciprocal movement which may exceed 3000 vibrations per minute, it is necessary that the downward movement of the roll after each upward actuation thereof shall take place very rapidly to enable it to follow the, in effect, sinuous face of the roller wheel, a result which is satisfactorily brought about by the action of the springs 37 which supplement the gravitational pull on the screen and the roll, but which in the absence of these springs might frequently not act with sufficient rapidity to return the roll to lowermost position in time to be again fully raised by the succeeding roller of the roller wheel.

Under certain conditions and in the screening of certain classes of material it is desirable that the amplitude of the vibrations in the vicinity of the lower end of the screen shall be less than those in the vicinity of the upper end, while under other conditions it is desirable that the amplitude of the vibrations at all points of the screen shall be substantially uniform; these results in my apparatus may be readily attained by

suitable adjustment of the springs on which the stringers 3, 3' are supported, while, of course, these springs are operative, whatever be their particular adjustment, to cushion the stringers and prevent transmission to the supporting base of any vibrations induced therein.

While I have illustrated and described herein with considerable particularity a preferred embodiment of my invention I do not thereby desire or intend to confine myself specifically thereto as the design, construction and arrangement of the various parts may be modified if desired from the precise forms to which I have referred without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, I claim and desire to protect by Letters Patent of the United States:

1. In a machine of the class described, the combination of a base, a sub-frame, means for yieldingly supporting the sub-frame on the base, a screen disposed above the sub-frame, means hingedly connecting one end of the screen to the sub-frame, and means for supporting and vibrating the other end of the screen comprising a yieldingly supported arm carried by the sub-frame, an actuating roll, and means for imparting a series of impulses to said roll.

2. In a machine of the class described, the combination of a support, a screen hingedly connected adjacent one end with the support for oscillation about a horizontal axis, an arm hingedly connected at one end of the support, means extending from the other end of the arm to a point adjacent the other end of the screen substantially normal to the surface thereof and operative to support the screen, and resilient means supported from the support disposed on opposite sides of the arm and operative to form a support therefor.

3. A machine as specified in claim 2 in which said resilient means comprise coil springs disposed above and below the arm, a bolt extending through both springs and the arm and a bracket carried by the support and operative to support the bolt and the lower spring.

4. In a machine of the class described, the combination of a screen disposed above the frame and hingedly connected thereto adjacent one end for oscillation about a horizontal axis, a pair of laterally spaced arms respectively hingedly connected to the frame at one end and extending angularly upward therefrom, a transversely extending shaft journaled in the other ends of the arms, supports extending to the screen from said arms and hingedly connected thereto, a roll mounted on said shaft, a drive shaft carried by the frame, a cam wheel carried by and

rotatable with the drive shaft and adapted for engagement by said roll, and means carried by the frame for yieldingly supporting said arms so as to normally maintain said roll out of contact with said cam wheel but allow said roll to engage said cam wheel when the screen is slightly depressed by the deposit of material thereon.

5. A machine as specified in claim 4 in which the yielding means for supporting the arms comprise coil springs disposed above and below each arm and arranged so that a predetermined amount of compression of the lower spring is required to bring said roll into engagement with said cam wheel.

6. A machine as specified in claim 4 and comprising adjustable means for yieldingly supporting the frame whereby the amplitude of the vibrations in different parts of the screen as imparted thereto by the cooperation of said roll with said cam wheel may be controlled by adjustment of said means.

7. In a machine of the class described, the combination of a frame, a screen, means for hingedly supporting one end of the screen from the frame and means for supporting and vibrating the other end of the screen comprising an arm hinged to the frame, coil springs disposed above and below the arm for yieldingly supporting the arm, means operative to cause vertical oscillation of the arm between said springs and adjustable means extending between the arm and the screen whereby the height of the adjacent end of the screen may be raised or lowered by adjustment of said means and the angular disposition of said screen varied with respect to the frame.

8. In a machine of the class described, the combination of a screen, means for hingedly supporting one end of the screen, and means for supporting and vibrating the other end of the screen comprising a cam, a roll movable with the screen and adapted to engage said cam, an arm hinged at one end and movable with the roll, and a spring beneath the arm operative to normally maintain the arm in a position in which the roll is out of contact with said cam, the extent of compression of said spring induced by the weight of the screen being greater than the extent of movement of the arm adjacent the spring induced by the co-action of the roll and the cam.

9. In a machine of the class described, the combination of a screen, a frame disposed beneath the screen, means for hingedly connecting the screen with the frame, and means for supporting and vibrating the screen comprising an actuating cam carried by the frame, an arm hinged to the frame at one end, a support extending between the other end of the arm and the screen, a roll carried by the arm adjacent its free end and a spring disposed beneath the arm and normally

operative to lift the arm sufficiently to maintain the roll out of contact with said cam, the extent of compression of said spring induced by the weight of the screen being greater than the movement of the arm adjacent the spring induced by the coaction of the cam and the roll when the latter rides thereover.

10 In a machine of the class described, the combination of a screen, means for hingedly supporting one end thereof, and means for supporting and vibrating the other end thereof comprising an actuating cam, an arm

hinged at one end, a longitudinally adjustable supporting means disposed between the other end of the arm and the screen, a roll carried by the arm having a resilient face and adapted to engage and ride on the actuating cam and yielding means operative to normally support the arm with the roll out of contact with the cam but compressible sufficiently to permit the roll to engage the cam.

In testimony whereof, I have hereunto set my hand this 19th day of May, 1925.

HERBERT S. WOODWARD.

- operative to lift the arm sufficiently to maintain the roll out of contact with said cam, the extent of compression of said spring induced by the weight of the screen being  
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- HERBERT S. WOODWARD.

#### Certificate of Correction.

Patent No. 1,649,883.

Granted November 22, 1927, to

HERBERT S. WOODWARD.

It is hereby certified that error appears in the printed specification of the above-numbered patent requiring correction as follows: Page 4, line 41, for the word "do" read *to*; page 5, line 37, claim 1, for the word "of" read *to*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of December, A. D. 1927.

[SEAL.]

M. J. MOORE,  
*Acting Commissioner of Patents.*

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[SEAL.]

M. J. MOORE,  
*Acting Commissioner of Patents.*