

Nov. 16, 1943.

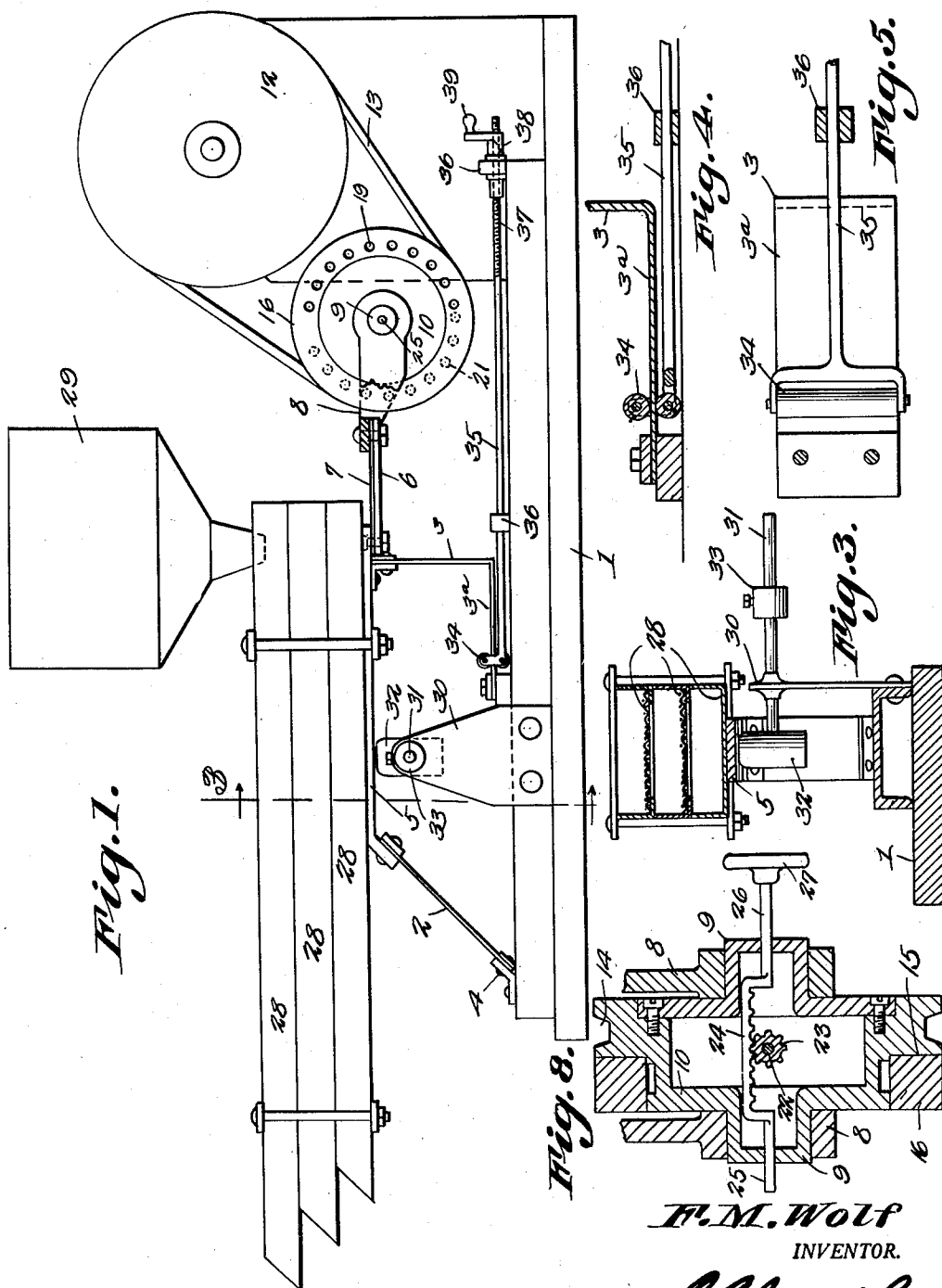
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2,334,368

FEEDER

Filed Aug. 8, 1941

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 2.

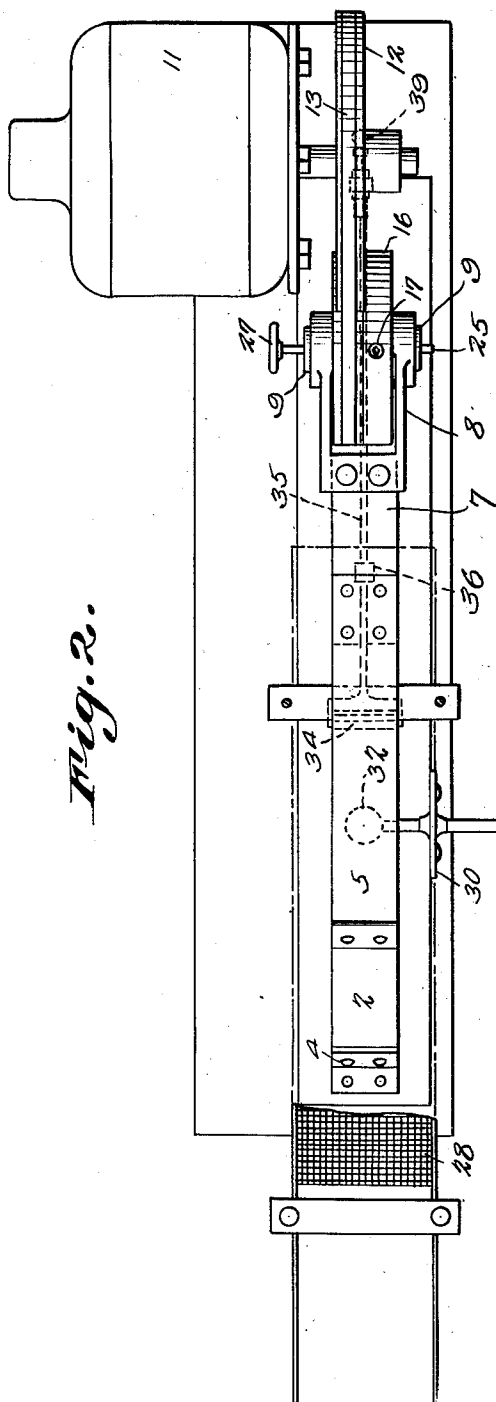


Fig. 7.

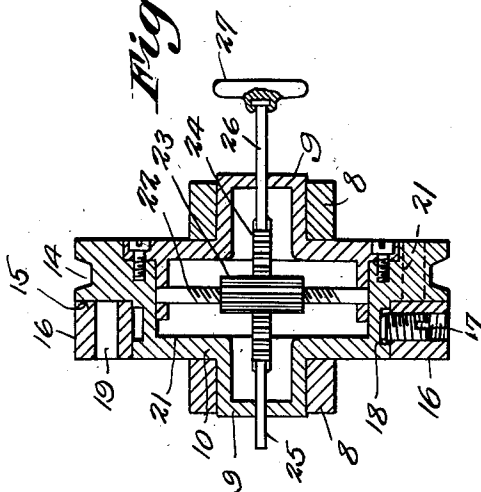
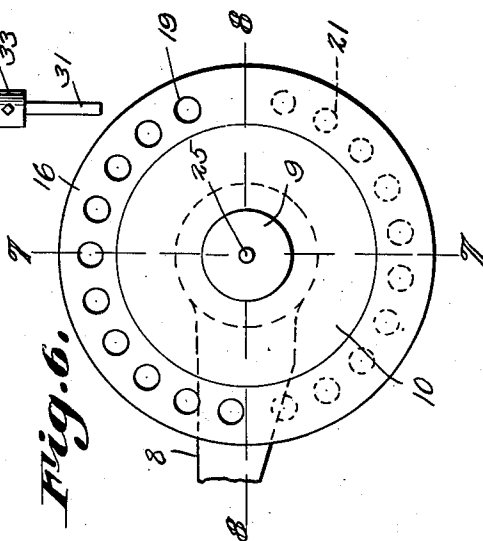


Fig. 6.



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UNITED STATES PATENT OFFICE

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FEEDER

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15 Claims. (Cl. 198—220)

This invention relates to a material-handling apparatus such as a feeder or the like, and one of its objects is to utilize, as an essential part of its operating mechanism, a rotor which can be brought into or out of balance, thereby to set up oscillations or vibrations of desired amplitude which are transmitted to a vibratory material-supporting element.

A further object is to so mount said element that the vibration or oscillation thereof by the rotor will produce an intermittent arcuate motion or vertical oscillation which can be controllable in extent and is effective in advancing material along the supporting element.

Another object is to utilize a tappet adjustable to different frequencies and operable by the vibrating element for striking said element at predetermined time intervals, thereby to keep all material in motion upon the surface supporting it.

A still further object is to provide a feeder in which the frequency, amplitude and curve of motion are all adjustable at the will of the operator, thereby adapting the structure for laboratory and other purposes where minute control is desired.

Another object is to provide a feeder the driving means of which can be adjusted to the natural period of vibration of the material-supporting element, thereby materially reducing the body vibration of the apparatus and reducing the power required for operation.

A further object is to provide a material support utilizing the resiliency of its supporting means for effecting movement in each of two directions without the necessity of utilizing electromagnetic or other devices as supplemental actuating means.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel details of construction and combinations of parts hereinafter more fully described and pointed out in the claims, it being understood that changes may be made in the construction and arrangement of parts without departing from the spirit of the invention as claimed.

The present invention is adaptable to many uses but for the purposes of illustration, it has been shown combined with material-handling mechanism in the form of a separator and conveyor.

In the accompanying drawings

Figure 1 is a front elevation of the invention combined with a screen separator, a portion being broken away.

Figure 2 is a top plan view, portions of the screen being removed.

Figure 3 is a section on line 3—3, Figure 1.

Figure 4 is a central longitudinal section through the angular spring support provided for the separator.

Figure 5 is a bottom plan view of the structure shown in Figure 4, the guide for the operating rod being shown in section.

Figure 6 is a front elevation on an enlarged scale of the rotor.

Figure 7 is a section on line 7—7, Figure 6.

Figure 8 is a section on line 8—8, Figure 6.

Referring to the figures by characters of reference, 1 designates a base on which are anchored the lower ends of spaced leaf springs 2 and 3. The lower ends of these leaf springs are rigidly attached to the base, as by means of rivets or the like engaging fixed flanges 4. The upper ends of the springs are rigidly attached to a plate 5. The points at which the spring 2 is attached to base 1 and plate 5 are in a plane which is inclined upwardly from the base and the anchored ends of the spring 3 are also positioned in an upwardly inclined plane.

Extending from that end of the plate 5 remote from the spring 2 is a rigid coupling bar 6 supported parallel with a leaf spring or tongue 7. Both bar 6 and tongue 7 are securely attached to the plate 5 and also to the middle portion of a rigid fork 8 which is thus supported so as to move with the plate 5 as long as the bar 6 is in position. Under some conditions, however, the bar 6 can be removed so that leaf spring 7 will constitute the sole connection between the plate 5 and fork 8 and thus permit a limited relative movement of these two parts.

Fork 8 provides bearings for oppositely extending trunnions 9 located at the center of a rotor 10 which can be driven at any desired speed by any means provided for that purpose. For example, and as shown in the drawings, an electric motor 11 can be mounted in a support provided therefor on base 1 and this motor can transmit motion through a pulley 12 and a belt 13 to the rotor 10, a groove 14 being provided in the periphery of the wheel for the reception of the belt. Obviously other means could be used for driving the rotor at any predetermined speed. It is preferred to have the anchored ends of the springs 2 and 3 in planes which normally are substantially parallel with an inclined plane extending through the axes of rotation of pulley 12 and rotor 10.

The rotor has an annular recess in one side of its peripheral portion as shown at 15 and in this

recess is seated a ring 16 adapted to be held against free rotation in any desired manner, as by means of a set screw 17 extending therethrough into an annular groove 18 in the rotor as shown in Figure 7.

In the structure illustrated, an arcuate series of apertures 19 is provided within the ring 16, these apertures being extended transversely through the ring, regularly spaced, and of equal size. The series of apertures 19 is extended through 180°.

Another arcuate series of apertures 21 is provided in the rotor 10 and are equal in number, size and shape to the apertures 19. Thus when ring 16 is positioned with its series of apertures diametrically opposed to the series of apertures 19, the wheel remains perfectly balanced on its axis of rotation and can be driven without vibration. However by loosening the set screw 17 and turning the ring 16 relative to the rotor 10 the center of mass is moved away from the axis of rotation with the result that when the rotor is driven at a high speed, it will be caused to oscillate or vibrate, the amplitude of the vibration being in proportion to the position of the center of mass relative to the axis of rotation.

The means described for changing the center of mass is very effective where minute variations are not necessary. However under some conditions it is desirable to effect a very slight shift in the center of mass and for that purpose a supplemental means may be utilized as shown particularly in Figures 7 and 8. By referring to those figures it will be noted that the rotor has a central circular recess 21 and extending diametrically within this recess is a screw-threaded pin 22 on which is mounted a weight 23 in the form of a nut having gear teeth extending longitudinally of its outer surface. A rack 24 meshes with this gear and has terminal stems 25 and 26 coaxial with the rotor. One of these stems 26, projects beyond one side of the rotor and has a head or knob 27 swiveled thereon. Normally the weight 23 is perfectly centered relative to the axis of rotation of the rotor. However by pushing or pulling on the head 27, rack 24 can be caused to rotate the weight or gear 23 in either direction so as to cause it to feed longitudinally along the threaded pin 22. Obviously this changes the center of mass of the rotor and such change can be made very minute. Shifting of the weight can be effected while the rotor is operating because the head 27 is swiveled and the stem 26 is located in line with the axis of rotation. This last means for shifting the center of mass is especially advantageous in laboratory work.

The plate 5 constitutes a support for material to be vibrated. In the present structure this plate is shown supporting superposed screens 28 which can be of different mesh and to which granular or other material to be treated can be supplied from a hopper 29 or the like.

Instead of screens, an ordinary trough could be used or any other means to be vibrated could be employed.

Connected to the base is a resilient support 30 preferably in the form of a flat spring to which is secured a rod 31 one end of which is extended under the plate 5 and carries a hammer head 32 located directly under and normally slightly spaced from the plate. The other end portion of the rod carries an adjustable weight 33. By shifting the position of this weight, support 30 can be flexed so that the upper end of the ham-

mer will be positioned at any desired normal distance from the plate 5.

For the purpose of changing the position of the lower fulcrum of the supporting spring 3, the lower arm 3a thereof can be extended through a slide 34 adapted to be moved by an operating rod 35 or the like which is suitably guided on the base 1, as by means of lugs 36. This rod can be screw-threaded as at 37 for engagement by a nut 38 which, when rotated, as by means of a crank 39, will feed the rod 35 longitudinally and shift slide 34 along arm 3a in either direction desired. Obviously when the slide is moved toward the upstanding portion of spring 3 the curve of movement of the upper end of the spring is changed and this is for the purpose hereinafter pointed out.

Assuming that the parts are positioned as shown in the drawings and that it is desired to feed material through and longitudinally of the material-supporting element 28, the rotor 10 is adjusted to bring its center of mass at a predetermined distance from the axis of rotation. The rotor is then driven at a predetermined speed and as it is supported solely by the bearing fork 8 rigidly connected to plate 5, the vibrations set up by the operation of the rotor will be transmitted to the material-supporting element or elements and spring supports caused to vibrate. This vibration of the supports causes them to set up a minute oscillation of the material-supporting element or elements thereabove and as the anchored upper ends of the oscillating supports are out of vertical alinement with the anchored lower ends thereof, such oscillation will produce a tossing action tending to advance the supported material with a rapid, intermittent motion along the element on which it is supported. The amplitude of the vibration or oscillation is of course dependent upon the location of the center of mass of the rotor and in practice it is possible to drive the rotor at a speed conforming to the natural period of vibration of the resilient supports 2 and 3.

When it is desired to decrease the action of the supporting element in feeding material thereon, the slide 34 can be drawn toward the upwardly extended portion of the spring 3 so as to change the curve of motion of the upper end of the spring 3 to reduce the resultant tossing action.

For the purpose of preventing material from adhering to the surface of the supporting element and not properly feeding therealong when vibrated, the hammer 32 has been provided. When the supporting element is agitated as heretofore explained, it will intermittently engage and press the hammer 32. The hammer will rebound to strike intermittently against the supporting element and the intensity of the impact of the hammer obviously can be varied by changing the position of the weight 33.

Should it be desired under some conditions to provide a slightly flexible connection between the rotor and the material-supporting element instead of a rigid connection, the bar 6 could be removed and the spring 7 utilized as the connection between the parts.

If, while the apparatus is in motion, it should be desired to minutely change the position of the center of mass of the rotor, all that would be required would be to shift the stem 26 in one direction or the other so as to cause the weight 23 to rotate and feed in one direction or the other along the threaded pin 22.

What is claimed is:

1. In a material-handling apparatus a material-supporting element, separate angular and inclined springs constituting means for supporting said element, one of said means having a vertical component of vibration and the other one of said means having a horizontal component of vibration, a rotor adjustable to change its center of mass relative to its axis of rotation, means for driving the rotor, means carried by said element for supporting the rotor and transmitting to said element vibrations of an amplitude determined by the position of said center of mass, said yielding means cooperating to resolve their vertical and horizontal components of vibration to effect movement of material longitudinally of said element, and means for varying said vertical component of vibration during the operation of said element.

2. In a material-handling apparatus a material-supporting element, separate angular and inclined springs constituting means for supporting said element, one of said means having a vertical component of vibration and the other one of said means having a horizontal component of vibration, a rotor adjustable to change its center of mass relative to its axis of rotation, means for driving the rotor, means carried by said element for supporting the rotor and transmitting to said element vibrations of an amplitude determined by the position of said center of mass, said yielding means cooperating to resolve their vertical and horizontal components of vibration to effect movement of material longitudinally of said element, and means for varying said vertical component of vibration during the agitation of said element by the rotor.

3. In a material-handling apparatus a material-supporting element, separate yielding means for supporting said element for up and down curvilinear motion, a rotor, a substantially cylindrical weight in the rotor centered on and mounted for sliding movement along a diametrical line intersecting and at right angles to the axis of rotation of the rotor, means operable independently of the movement of said element and rotor for shifting the weight along said line for changing the center of mass of the rotor relative to its axis of rotation, means for driving the rotor, and means carried by said element for supporting the rotor and transmitting to said element vibrations of an amplitude determined by the position of said center of mass.

4. In a material-handling apparatus a base, a material-supporting element, separate angular and inclined springs anchored at their ends to said element and the base respectively and each normally supported in an intermediate position for vertical and horizontal components of vibration respectively, means operable independently of the movement of said element for regulating the vertical component of vibration of the angular spring, a rotor having its center of mass spaced from its axis of rotation, means carried by said element for supporting the rotor, and means for driving the rotor at such speed as to vibrate the springs and the element thereon substantially at their natural period of vibration.

5. In a material-handling apparatus a base, a material-supporting element, resilient vibratory means anchored at their ends to said element and the base respectively and each normally supported in an intermediate position for vertical and horizontal components of vibration respectively, means operable independently of the movement

of said element for regulating the vertical component of vibration, a rotor having its center of mass spaced from its axis of rotation, means carried by said element for supporting the rotor, means for driving the rotor to vibrate said element and its supports, a hammer tiltably mounted, and hammer counterbalancing means adjustable independently of the operation of said element for maintaining the hammer in position for oscillation by intermittent contact of the vibrated material-supporting element and for varying the reaction of the hammer under the force exerted by said element.

6. In a material-handling apparatus a base, a material-supporting element, angular and inclined springs anchored at their ends to said element and the base respectively and each normally supported in an intermediate position for vertical and horizontal vibration respectively, means operable independently of the movement of said element for regulating the vertical component of vibration, the points of attachment of each spring being out of vertical alignment, a rotor having its center of mass spaced from its axis of rotation, means carried by said element for supporting the rotor, and means for driving the rotor to vibrate said element and its anchored supports.

7. Material-handling apparatus including a material-supporting element, an inclined straight spring and an angular spring, said springs constituting resilient supports for the element and anchored fixedly at their ends and mounted for oscillation, means for oscillating the flexible supports and the element supported thereby to effect flow of supported material longitudinally of said element, and means for varying the rate of flow of said material by changing the path of movement of one of the flexible supporting members independently of the other member during its period of oscillation.

8. Material-handling apparatus including a material-supporting element, resilient supports therefor anchored fixedly at their ends and mounted for oscillation, said supports including a straight spring and an angular spring, means for oscillating the flexible supports and the element supported thereby to feed supported material longitudinally of said element, and means for changing the path of movement of one of the flexible supporting members during its period of oscillation to vary the rate of flow of said material, said means comprising a slide engaging one end portion of the angular spring and means for shifting the slide along said end portion, said slide being held against vibration.

9. Material-handling apparatus including a supporting element for material to be supported for movement therealong, flexible means thereunder and anchored at their ends for supporting said element, said means including a straight spring, and an angular spring having a substantially horizontal lower portion and a substantially vertical upper portion, the upper anchored ends of said springs being out of vertical alignment with their lower anchored ends, a rotor, means held against vibration and adjustable along said lower portion of the angular spring for varying the vertical component of vibration of said spring to regulate the rate of flow of material along said element, means carried by the material-supporting element for supporting the rotor, means for driving the rotor, and means for changing the center of mass of the rotor to vibrate said element and its supporting springs.

10. Material-handling apparatus including a

material-supporting element, flexible means thereunder and anchored at their ends for supporting said element, the upper anchored ends of said means being out of vertical alignment with their lower anchored ends, a rotor, means carried by the material-supporting element for supporting the rotor, means for driving the rotor, a weight in the rotor centered on and mounted for sliding movement along a diametrical line intersecting and at right angles to the axis of rotation of the rotor, means for shifting the weight along said line for changing the center of mass of the rotor while the rotor is in motion.

11. In material-handling apparatus a material-supporting element, flexible oscillating means for supporting said element, said means being anchored at their upper ends at points out of vertical alignment with their lower ends and being fixedly mounted at both ends, a rotor, means extending from the material-supporting element for supporting the rotor, means for shifting the center of mass of the rotor to vary the amplitude of vibrations of the material-supporting element, means for driving the rotor at predetermined speeds to vary the frequency of the vibrations, and means adjustable independently of the movement of said element for changing the point of leverage of one of said flexible means.

12. Material-handling apparatus including a movably supported material-supporting element, a rotor, means on said element for supporting the rotor, and means for driving the rotor, said rotor including a screw-threaded member disposed on a diametrical line at right angles to and intersecting the axis of rotation of the rotor, a normally centered substantially cylindrical gear thereon constituting a weight and nut, and a rack extended axially of the rotor for rotating the gear to feed it along the threaded member and change the center of mass of the rotor while in motion.

13. In a material-handling apparatus a resil-

iently supported element for holding and feeding material thereon, means for vibrating said element, a hammer tiltably mounted, and hammer counterbalancing means adjustable independently of the operation of said element for maintaining the hammer in position for oscillation by intermittent contact of the vibrated element and for varying the reaction of the hammer under the force exerted by said element.

14. In apparatus of the class described an element for supporting material to be fed therealong, separate resilient means for supporting said element, one of said means having a horizontal component of vibration and one having a vertical component of vibration, means for vibrating said element thereby to resolve the two components of vibration of the support to effect forward movement of the supported material on said element, and means held against movement with said element for varying the vertical component of vibration during the vibration of said element, thereby to vary the flow of the supported material on said element.

15. In apparatus of the class described an element for supporting material, means for vibrating said element, separate springs anchored at their lower ends and fixedly attached at their upper ends to said element, one of said springs including a substantially horizontal portion and a substantially vertical portion, said springs constituting the sole support for said element, whereby the components of vibration of the springs normally are resolved to advance supported material along said element when the element is vibrated, and retarding means movably mounted on the horizontal portion of one of the springs during the vibration of said element for varying the components of vibration of said springs and correspondingly varying the flow of supported material.

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