April 20, 1954 G. D. BECKER 2,675,907

VARIABLE THROW FEEDER

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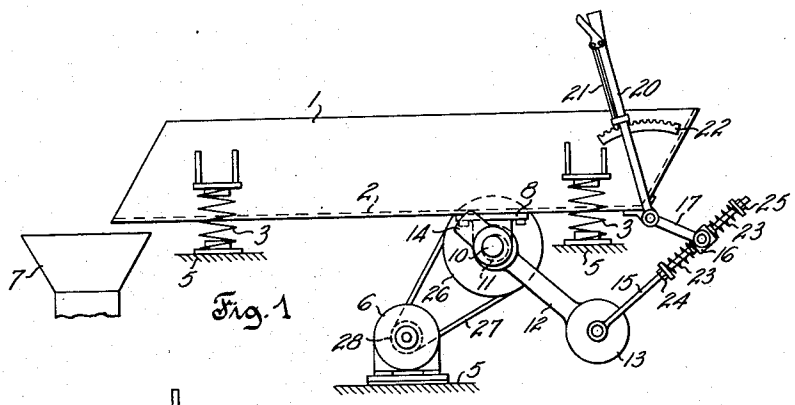


Fig. 1

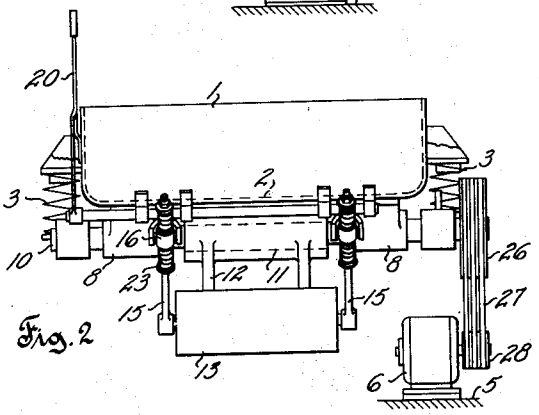


Fig. 2

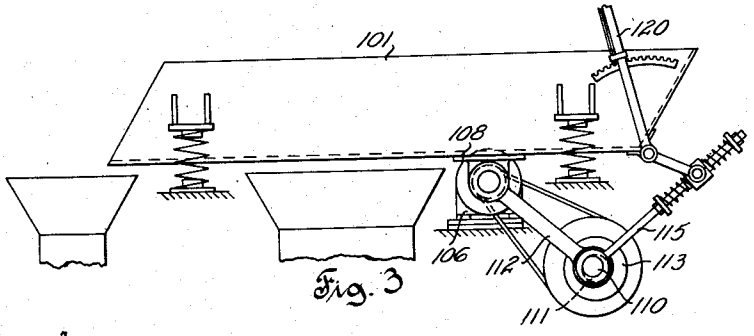


Fig. 3

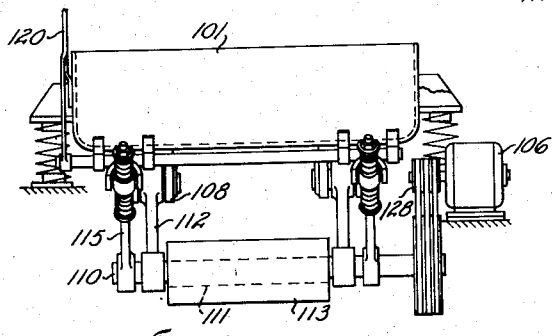


Fig. 4

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VARIABLE THROW FEEDER

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10 Claims. (Cl. 198—220)

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This invention relates to mechanical vibrating systems and more particularly to systems of the type in which rotation of a shaft is made to provide dynamic exciting forces applied to a resiliently supported vibrating body to make the body vibrate in a manner to effect progressive movement of material placed in contact with the vibratory body. Such systems are primarily useful in devices for conveying or feeding particles of material in a horizontal direction, such conveying action being in some cases accompanied by stratification, separation and the like as on horizontal vibrating screens, concentrating tables, etc.

An object of the present invention is to create a system in which mechanism for producing vibration is substantially a straight line is combined with means to vary the angle of the path of motion with reference to the vibrated body in a simple manner for freely changing the degree of conveying effect.

Another object is to create such a system in which vibrational effects are substantially insulated from the base of foundation on which the device is to be mounted.

The objects of the invention are achieved by creation of a system in which two separate reaction masses are supported resiliently in such a manner as to permit relative vibrational movement and connected mechanically by an eccentric shaft journaled in one of the bodes and having its eccentric portion linked to the other, combined with control means for changing the angle of the link with relation to one of the bodies without interfering with relative movement lengthwise of the link.

The following is a description of the best modes devised by the inventor of realizing the advantages of the invention, with reference to the drawing, in which:

Fig. 1 is a side view of an apparatus according to the present invention;

Fig. 2 is an end view of the device of Fig. 1;

Fig. 3 is a side view of another device embodying the invention in a modified form; and

Fig. 4 is an end view of the device illustrated in Fig. 3.

The device shown in Figs. 1 and 2 consists in part of a vibratory body in the form of a trough or pan like element 1 having a closed end and an open end, the bottom providing a surface 2 for supporting and acting upon particles of material placed thereupon in a manner more fully described hereinbelow. The body 1 is shown as resiliently supported on springs 3 at its four

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corners, though any suitable resilient supports of other known types may take the place of springs 3, the function of which is to support body 1 in such a manner that it may vibrate freely through at least a limited amplitude in a vertical plane, such as the plane of the paper in Fig. 1, when disturbed by an exciting force. A fixed base is represented in the drawing by the fragments 5 of a suitable foundation for the lower ends of the springs 3 and motor 6. In this device the invention is embodied in a vibratory or jigging feeder, hence the open end of body 1 is shown as located over a hopper 7 for receiving material discharged from feeder pan 1.

To body or pan 1 are rigidly secured a pair of bearing brackets 8 in which a shaft member 10 is journaled for rotation on a bearing axis perpendicular to the desired plane of movement of surface 2. Shaft 10 is provided with a portion 11 eccentric to its journal portions, and to this eccentric portion is connected, in relatively rotatable relation, one end of an arm member 12 which is connected at its other end with a weight or inertia body 13. Shaft 10 preferably will also be provided with eccentric masses or counterweights 14 having their effective centers of mass displaced from the shaft axis in a direction opposed to the direction of eccentricity of the eccentric portion 11, for a purpose set forth hereinbelow.

Control means for the device are also provided, and may, for example, consist of a rod 15 pivotally attached at one end to weight member 13, the rod 15 having its position controlled by a block 16 pivotally attached to one arm 17 of a bellcrank, the other arm 20 of which may be equipped with manually operated detent means 21 to selectively fix its position with reference to an arcuate rack 22, in known manner. Block 16 preferably is slidable on and resiliently positioned with reference to rod 15 as shown by opposed springs 23, the rod being threaded, and the connection adjustable along the rod, and with regard to spring force, by manipulation of nuts 24 and 25.

The device above described will be power driven as by a circular pulley 26 mounted on shaft 10 and driven by motor 6 through a flexible belt or belts 27 engaging pulley 26 and a suitable drive pulley 28 on the motor.

Operation of the device of Figs. 1 and 2 is as follows. Motor 6 drives shaft 10 at a speed preferably above the natural frequency of free vibration of the body 1 on springs 3. This causes movement of arm 12 and weight 13 relative to

the body 1. The inertia reaction of weight 13 will result in the exertion of a varying dynamic force on bearings 8 and body 1 which will tend to excite movement of the body on its resilient mounting. Neglecting, for the moment, the counterweights 14, the instantaneous exciting force at the shaft axis may be resolved into a force in the general direction of the arm 12 and one at right angles to that direction, in the plane of rotation. Since the force required to move the weight 13 in translation will be much greater than that required to turn arm 12 through a small angle, the forces along the arm 12 will be much greater than those at right angles to the arm, and the body 1 will tend to move in a closed path generally approximating an ellipse with its major axis in the general direction of the longitudinal axis of arm 12. Preferably, the transverse forces will be reduced substantially to zero by employing the counterweights 14 which will give rise to constant forces of rotation opposing the transverse exciting forces caused by the necessity of angularly moving arm 12 and augmenting the forces exerted longitudinally of the arm so that movement of body 1 may approximate reciprocation in a straight line, the inclination of which to the surface 2 will be determined by the setting of arm 20 of the controlling means, which will in turn control the mean angular relationship of the arm 12 and weight 13 to body 1 about the rotational axis of shaft 10 which serves as a pivot axis for arm 12. The resulting reciprocation of body 1 will cause a conveying action to be exerted upon material particles supported upon surface 2, the rate of conveying being variable by the control means from substantially zero when the arm 12 is vertically pendant from shaft 10 to a maximum when the arm 12 is held as shown in a position in which its angle to the surface 2 and the horizontal is something less than 45 degrees to the horizontal, the exact angle for maximum conveying action varying in a complex relationship to many factors such as material characteristics, speed and amplitude.

Alternatively, the control mechanism may be mounted on the fixed foundation, care being taken in any case to so mount and design it that the rod 15 will be at substantially 90 degrees to the arm 12 throughout the most useful range of control positions and will have little effect upon freedom of longitudinal movement of the arm 12.

Figs. 3 and 4 illustrate a modified embodiment of the invention, and description will be kept to a minimum by employing reference characters in the series beginning with 101 in which the last two digits will, in general, be the same as have been used with reference to corresponding parts in the description of Figs. 1 and 2, 101 representing a body similar to body 1 of Fig. 1, etc. In this device arm members 112 are pivotally connected to brackets 108 secured to body 101, and shaft 110 is journaled for rotation in the ends of arms 112, remote from their pivotal connection to body 101 while weight or inertia body 113 is mounted in relatively rotatable relation on eccentric portion 111. Control rod 115 is pivotally connected to arm members 112 as through shaft 110 or other suitable pivotal connection (not shown) which will permit control of the angle of arm members 112 to the surface 102. The drive pulley 128 on motor 106 will be so placed as to be substantially in alignment with the pivot axis of brackets 108 so that the arms 112 may be angularly moved through a large arc without substantial variation of the belt drive center distance.

The operation of the device of Figs. 3 and 4 is analogous to that of the device of Figs. 1 and 2, but counterweights will preferably not be employed. In brief, rotation of shaft 110 will cause relative movement of body 101 and inertia body 113 with resulting dynamic exciting forces exerted on body 101 through pivot brackets 108, which will result in a narrow elliptical motion of body 101 (virtually in a straight line), the major axis of the ellipse being parallel to the longitudinal axis of arms 112. The action of the surface 102 on material particles will be the same as that of surface 2 in the first described device and may be controlled in rate by the manipulation of the control lever 120.

It will be understood that the surface 2 (102) may be perforated (not shown) if the device is to serve as a combination conveying and separating screen, such as that of Lincoln U. S. Patent No. 2,144,382, or otherwise given any other known special form (not shown) for application in other separating processes involving stratification, hindered settling and the like combined with conveying as in the device of U. S. Patent No. 2,097,422. In short, wherever a controllable jigging conveying action is desirable, the applicant's invention will be useful.

It will be further understood that the specific devices described and illustrated are exemplary embodiments of an invention not limited to their precise mechanical details but including such modifications and equivalents as may be within the scope of the invention as defined in the claims appended hereto.

It is claimed and desired to secure by Letters Patent:

1. In a vibrating apparatus of the type described: a first body having a material handling surface; means resiliently supporting said body for vibration in at least one general plane relative to a fixed base; an inertia body; means supporting said inertia body for vibration in the same general plane, including a rotary shaft having a first portion rotatably journaled in one of said bodies for rotation on an axis perpendicular to said plane and having a second portion eccentric to said first portion, an arm operably connected to said first body in rotatable relation thereto for angular movement relative to said first body in response to rotation of said rotary shaft, said arm having one end relatively rotatably connected with said second portion and having the other end connected in force transmitting relation with the other of said bodies at a point spaced from its point of connection with said second portion; and control means operable to vary the angular position of said arm in said plane about its point of connection with said first body, relative to said first body.

2. In vibrating apparatus of the type described: a vibratory body, an inertia body; means resiliently supporting said bodies for vibratory movement relative to a stationary base; a rotary exciter shaft having a first portion journaled in one of said bodies and having a second portion eccentric to said first portion; link means operably connected to said vibratory body in rotatable relation thereto for angular movement relative to said vibratory body in response to rotation of said rotary exciter shaft, said link means connecting said second portion with the other of said bodies in longitudinal force transmitting relation; and control means operable to

vary the angular relationship of said link and inertia body to said vibratory body about an axis parallel to the axis of said shaft.

3. In apparatus as defined in claim 2 said rotary exciter shaft being journaled in said vibratory body.

4. In apparatus as defined in claim 3 said shaft having a counterbalance weight opposed to said eccentric portion.

5. In the apparatus of claim 2, said exciter shaft being journaled for rotation in said inertia body and said link being pivotally connected with said vibratory body on an axis parallel to the axis of rotation of said shaft.

6. In vibrating apparatus of the type described: a vibratory body having a material supporting surface; an inertia body; resilient means supporting said bodies for vibration in a plane substantially perpendicular to said material supporting surface; a rotary exciter shaft having a first portion journaled for rotation in one of said bodies on an axis perpendicular to the plane of vibration and having a second portion eccentric to said first portion; a link member operably connected to said vibratory body in rotatable relation thereto for angular movement relative to said vibratory body in response to rotation of said rotary exciter shaft, said link member being rotatably connected adjacent one end with said second portion and connected adjacent its other end in longitudinal force transmitting relation with the other of said bodies; and control means operable to adjust the angular relationship of said link and inertia body to said material supporting surface about an axis perpendicular to said plane of vibration.

7. In the apparatus of claim 6 said shaft being journaled in said vibratory body.

8. The apparatus of claim 7 in which said shaft is provided with a counterbalance weight diametrically opposed to the throw of said eccentric portion.

9. In the apparatus of claim 6, said shaft being journaled in said inertia body and said link being pivotally connected with said vibratory body for pivoting on an axis parallel to the axis of rotation of said shaft.

10. In combination with the apparatus of claim 9, driving means for said shaft comprising a circular drive wheel mounted on said shaft, a second circular drive element journaled for rotation on a fixed axis substantially aligned with said pivot axis, and means connecting said circular drive elements in rotary motion transmitting relation.

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