

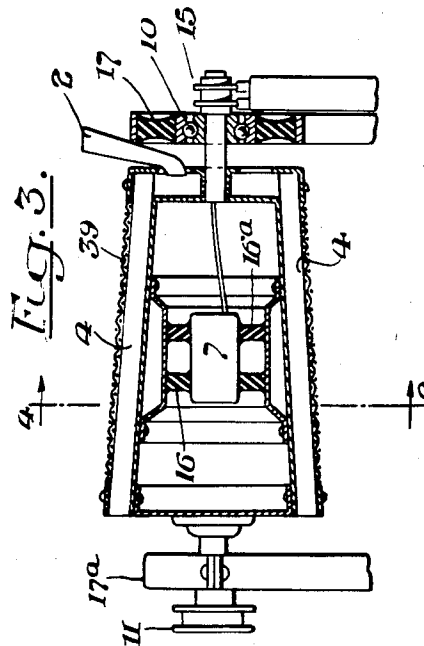
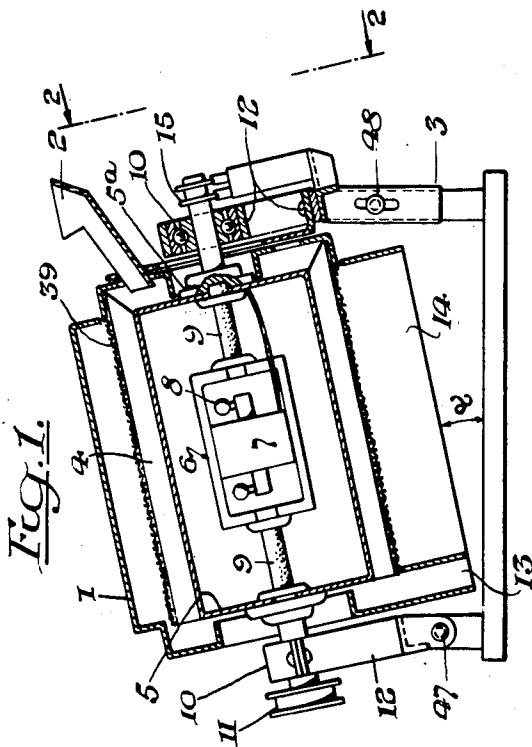
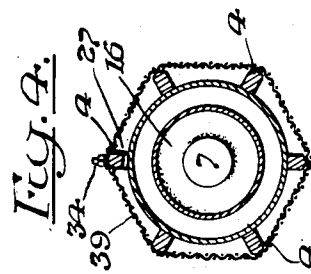
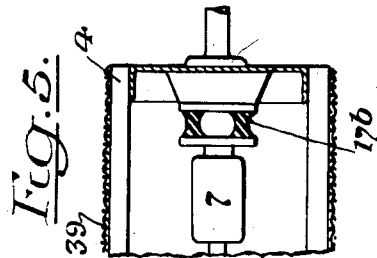
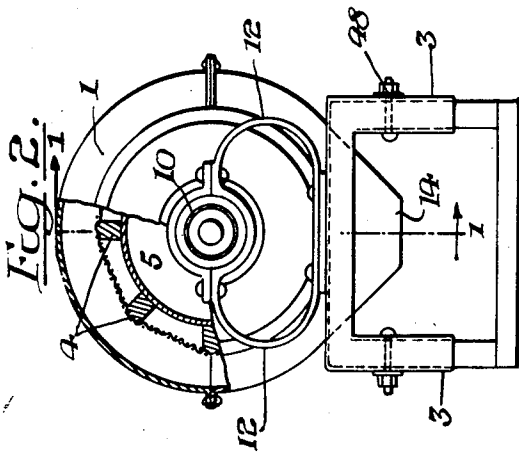
Feb. 22, 1955

L. M. DEKANSKI
VIBRATING TROMMEL SCREEN

2,702,633

Filed Oct. 20, 1947

2 Sheets-Sheet 1



INVENTOR.

L. M. Dekanski

Feb. 22, 1955

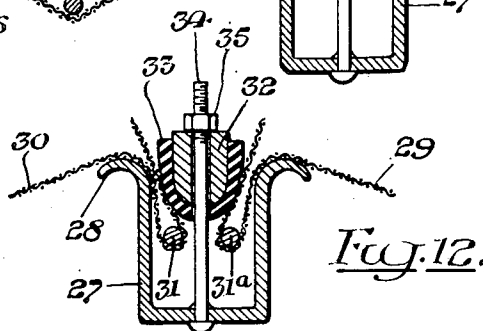
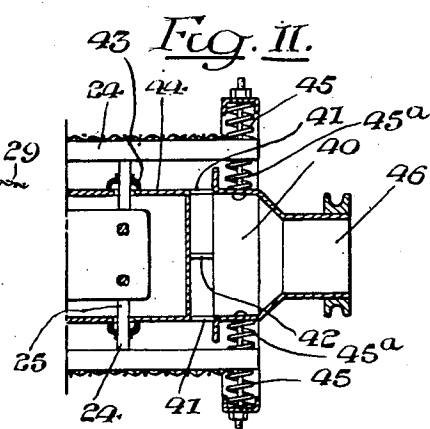
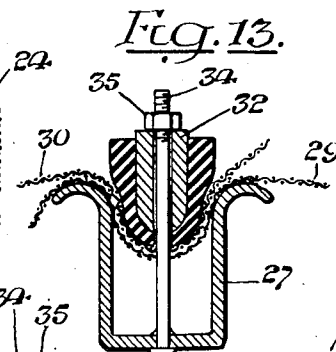
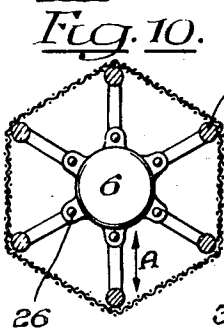
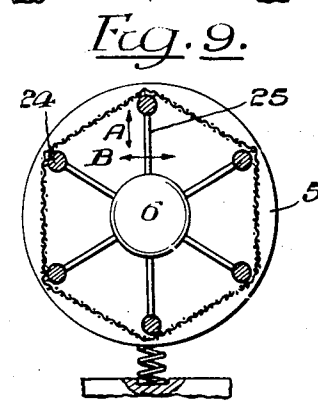
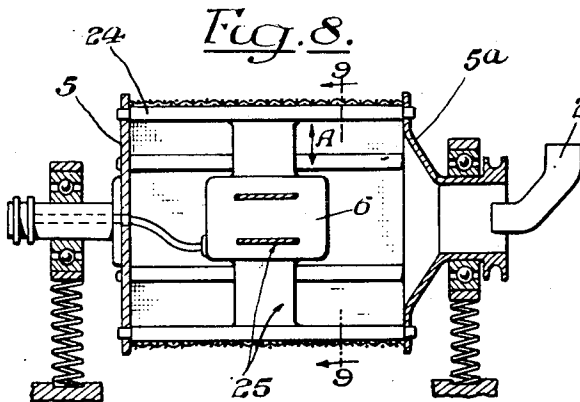
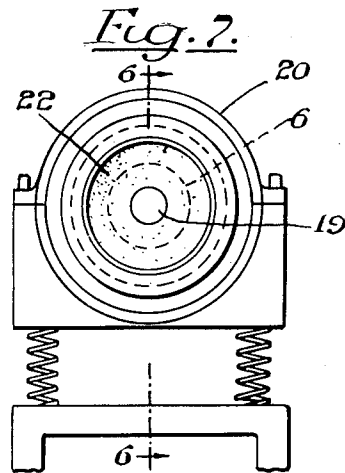
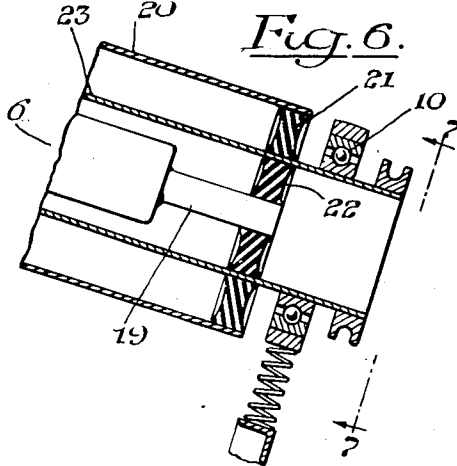
L. M. DEKANSKI

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VIBRATING TROMMEL SCREEN

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2 Sheets-Sheet 2



INVENTOR.

L. M. Dekanski

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2,702,633

VIBRATING TROMMEL SCREEN

Leon M. Dekanski, Hollywood, Calif.

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19 Claims. (Cl. 209—287)

A vibrating trommel screen for processing of particulate materials is known in the art. As described, for example, in the United States Patent No. 1,455,907. The principle involved includes a substantially cylindrical screen cloth supporting structure supported and arranged for rotation about its axis of symmetry, at the same time as it rotates the screen supporting structure is also vibrated at a considerably higher rate than it rotates. The material to be processed is fed at one end under the cylindrical screen surface and if the axis of the screen is inclined, the oversize particles progress along the screen until they are discharged at the other end, while the undersize is thrown off the screen.

The obvious advantages of such a screening machine resides in its high capacity and thorough screening action in respect to its overall dimensions. This is especially so if the screen is rotated at a speed sufficient to spread the material over the whole surface of the screen due to the centrifugal force. This force will push the material against the vibrating screen stronger than the force of gravity does in flat screens.

The main purpose of this invention is to provide a novel type of centrifugally acting vibrating trommel screen.

Some of the other objects of the invention may be enumerated as follows: to provide a novel vibrating system in a trommel screen; to provide a vibrating system from which vibrations are not transmitted to the foundations; to provide a trommel structure and to provide screen supporting and screen tensioning means.

Other objects will appear from time to time in the course of specifications and claims.

A clear conception of embodiments of several novel features constituting the present invention and of the mode of operating machines built in accordance therewith, may be had by referring to the drawings attached to this specification in which like reference characters designate the same or similar parts.

In the figures:

Fig. 1 is a partial axial section of a vibrating trommel screen.

Fig. 2 is a side view of Fig. 1.

Fig. 3 is a partial axial section of a vibrating trommel screen.

Fig. 4 is a section 3—3 of Fig. 3.

Fig. 5 is a longitudinal section showing rubber springs working in shear.

Fig. 6 is a partial axial section of a vibrating trommel screen.

Fig. 7 is an end view of Fig. 6.

Fig. 8 is a partial axial section of a vibrating trommel screen.

Fig. 9 is a fragmentary transversal section 8—8 of Fig. 8.

Fig. 10 is a fragmentary transversal section of a vibrating trommel screen in a trommel.

Fig. 11 is a fragmentary axial section of a vibrating trommel screen.

Figs. 12 and 13 are details of screen tensioning means, shown also in Fig. 4, on a section across the trommel axis.

In Fig. 1, 1 is the stationary enclosure, 2 spout for feeding of material to be treated, 3 a stationary frame which may be adjustable to change the inclination of the screen to the horizontal, 4 screen supporting structure, 39 screen, 5 and 5a headsides at the trommel, 6 vibrator enclosure, 7 electric motor as the vibration exciter, 8

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eccentric weights attached to the motor shaft, 9 active elastic means connecting the vibrator and the trommel, 10 bearings on which the trommel rotates, 11 a pulley to transmit rotary motion to the trommel from a motor (not shown), 12 nonactive elastic supporting means which hereinafter will be called "soft springs," 13 discharge spout for oversize, 14 discharge for undersize, 15 contact rings and contacts to transmit current to the vibrator motor. As it was mentioned, in order to adjust the two operational variables, i. e., the capacity and the screening or sizing efficiency, the vibration characteristics and the velocity of rotation or the centrifugal effect may be changed. If, however these values are kept constant then the above results within practical limits may be obtained by changing the elevation of the trommel axis to the horizontal. As an example, one arrangement to this end is shown in the drawing, Figure 1, where 47 is a pivot and 48 adjusting slot and screw. In certain cases the axial progression of material may be obtained by using a conical shape of the trommel as shown in the Figure 3. While the material is fed in the narrower end, it progresses toward the opposite end due to the slope at the conical surface. At the same time, due to the increase in the radius of the screen, the centrifugal action increases toward the discharge end and therefore the material is subjected to a progressively increasing screening action. This is a very advantageous feature with certain materials and it also facilitates the feeding and distributing of material and also permits a level location of the trommel bearings.

The vibration of the screen is obtained from a vibration exciter and is magnified and balanced through the use of a "mechanical vibratory system."

Theoretically the arrangement is built up from two masses bound together by resilient means which form a conservative oscillating circuit. The features of such an oscillating system include the fact that the oscillation of the masses is possible with extremely low power consumption, provided that the impulses from the motor occur in resonance with the natural frequency of the system. The vibrating energy travels between the two masses and resilient medium and changes periodically from kinetic to potential, without leaving the system except for the slight friction loss. Thus no vibration is transmitted to the supporting structure on which the machine embodying the system may be suspended by means of relatively soft springs. This dynamic system including two resiliently interconnected vibrating masses or bodies is herein called a resonance vibrating system.

From the theory of vibration it is seen that the forced vibration always lags behind the disturbing force (vibration exciter) and the general expression for forced vibration is

$$X=A \sin (wt-a)$$

where

X is the displacement

A—amplitude

W—angular velocity of vibration

t—time elapsed from a reference instant

60 a—phase angle between force and displacement

Now it is known that the maximum amplitude will be obtained at resonance, but with such tuning the system may be more sensitive to the variation of mass or of damping (from heavy feed of material) than it would be desired in a screening machine.

It was found that such system may be rendered considerably less sensitive by tuning it somewhat under its magnification curve peak. Under such conditions it may be stated that the system has a reserve of power manifested in its "power factor" which is a function of the phase angle a.

In the embodiment of the Fig. 1, one of the masses is composed of the vibrator together with its enclosure, the second mass is the rest of the rotating part of the trommel structure together with the bearings 10. Whereas, as an example of vibration exciters, an electric motor with an unbalanced shaft is shown in the drawing, it is clear that any vibration exciting means such as electromagnetic reciprocating motor, or a pneumatic one, etc., may be used within the scope of this invention.

It is also understood that any elastic active means may be used, such as for example metal springs of various forms or non-metallic springs made of rubber or similar materials, etc. One example of which is shown in Figs. 3, 5, and 6. In Fig. 3 the vibrator 7 is connected to the rest of the vibrating system through annular main rubber springs 16 and 16a, while 17 and 17a are the soft rubber springs supporting the bearings 10. In Fig. 5 is shown another embodiment where the rubber spring works in shear.

As it was explained, the two masses of the vibrating system oscillate synchronously with a 180° phase opposition, there is therefore a certain portion of the main spring which practically does not move relatively to the frame, and therefore transmits only a relatively small amount of energy which is consumed in useful work and friction. It may be advantageous to make a connection to the frame through said portion of the main spring, also called nodal region.

An example of such embodiment is shown in Fig. 6 where 20 is the trommel body which is one of the masses, 19 rigid motor supported member. The main spring is made of two concentric rubber rings 21 and 22. 23 is the tubular supporting structure which is connected to the rest of the machine through the nodal portion of the main spring at the junction of the two rubber rings.

Another embodiment of this invention is shown in Figures 8, 9, and 10. The main spring is represented by resilient structural elements 24 which at the same time support the screen. The vibrating impulses are transmitted from the motor to said elements through members 25 which are adapted to transmit only radial forces (arrow A) while being flexible in the direction of the arrow B. Such results may for example be obtained by resilient metallic rods as shown in Figure 9 or by members pivotally supported in 26, as shown in Figure 10. The material is fed through a central opening.

Another embodiment is shown in Fig. 11, where the screen supporting members 24, which may be rigid per se, are resiliently supported on the rest of the rotating mass by means of spring 45. The vibration is transmitted to them from the vibrator by means of a system similar to that shown in Figures 9 and 10. In the same figure is also shown an arrangement of feeding through a central opening 46 where the material enters in the internal space 40 of a supporting drum-shaped structure 44. Then the material is thrown centrifugally by impellers 42 and reaches the internal surface of the screen through openings 41. The members 25 pass through the openings on the structure 44, without directly touching it. If necessary the gaps around them may be closed by rubber gaskets 43 to protect the internal structure from the material.

The manner of supporting and, especially, tensioning the screen is very important because it greatly affects the operation and maintenance of the machine. In this particular case and especially in the embodiments as shown in Figures 3 and 8, the screen also takes part in the vibration characteristics of the system; and therefore to a certain extent may be considered as its part.

One way of screen attachment is shown in Fig. 4 where the screen is tensioned in a special clamp contained in one of the screen supporting elements 27. Two embodiments of these screen tensioning means are shown in Figures 12 and 13. In Figure 12, 27 is the U-shaped screen supporting element with rounded edges 28. 29 and 30 are the two edges of the screen parallel to the trommel axis which are bent around rods 31 and 31a. This assembly is inserted in the channel 27 and locked by a rod 32 (which may be covered with rubber 33). The tension is obtained by tightening nuts 35 on bolts 34 passing through said rod 32. The embodiment of Figure 13 shows the edges of the screen 29 and 30 passing under the rod 32. The bolts 34 pass through holes made in the screen for that purpose. The screen tightening method is the same as in Figure 12.

Having now described and illustrated one form of my invention, I wish it to be understood that my invention is not to be limited to the specific form or arrangement of parts herein described and shown or specifically covered by claims, for various modifications within the scope of the claim may occur to persons skilled in the art.

As used in the appended claims, the term "two-mass system" will be understood to have its common meaning

in the art of physical mechanics, namely, a pair of masses joined by an elastic energy-absorbing and releasing member (of which a spring is one example) in which the energy of movement of the two masses toward one another is transferred to and stored in the elastic member and is thereafter returned to the two masses to add to their kinetic energy to cause them to move away from each other, this process operating cyclically to produce periodic vibration or gyration.

Having thus described my invention, I claim:

1. In a vibrating trommel screen, a stationary frame, a screen supporting a structure of a substantially axially symmetrical form, screen holding and screen tensioning means on said supporting structure, bearing means to support said structure for rotation on said frame coaxially with said figure of revolution, means imparting rotary movement to said structure about the axis of said bearing means, vibration insulating means interposed between said bearing means and said frame, a mass connected to a vibrator located inside said trommel screen, said vibrator being constructed and arranged to induce vibratory movement in said mass, means for actuating said vibrator, and a main spring connecting said mass with said screen supporting structure and forming thus a two-mass vibratory system, said system being tuned in relation to the frequency of said vibrator to produce vibrations of desired amplitude in the said screen.

2. A vibrating trommel screen as in claim 1, wherein said vibrator-including mass is located inside said screen supporting structure.

3. A vibrating trommel screen as in claim 1, wherein said vibrator-including mass is located inside said screen supporting structure with its center of gravity substantially along the axis of rotation of said structure.

4. A vibrating trommel screen as in claim 1, wherein said vibrator includes an unbalanced rotor, said rotor being coaxial with said screen.

5. A vibrating trommel screen as in claim 1, wherein said bearing means are connected to said screen supporting structure through the nodal portion of said main springs.

6. In a two-mass vibrating trommel screen, the combination including a stationary frame, a screen supporting trommel structure of a substantially axially symmetrical form and constituting one of said two masses, bearing means to rotatably support said trommel on said frame coaxially with said figure of revolution, screen holding and screen tensioning means on said supporting structure, vibration insulating means interposed between said bearing means and said frame, a vibrator constituting the other of said two masses and located inside and coaxially with said trommel and forming the other of said two masses, said vibrator being adapted to produce gyratory vibration in a plane substantially perpendicular to the axis of said trommel, said screen supporting structure including longitudinal screen supporting members spaced around said trommel, said members being flexurally resilient and constituting the main spring of the two-mass system, and rods connecting each of said longitudinal members with said vibrator, said connecting rods being adapted to transmit only radial centrifugal forces.

7. A vibrating trommel screen as in claim 1, wherein said screen tensioning means includes a longitudinal U-shaped structural member, a screen tensioning member which may be lowered inside said U-shaped member, having substantially parallel inside faces, said screen tensioning member being provided with lateral compressible faces of rubber-like material, and bolts with nuts connecting said two members, whereby the ends of the screen passing underneath said screen tensioning member may be gripped and tensioned while said tensioning member is being lowered and forced together with the screen inside said U-shaped member.

8. In a two-mass vibrating trommel screen, the combination comprising a frame, a screen-supporting trommel structure constituting one of said two masses, bearing means to rotatably support said trommel on said frame, vibration insulating means interposed between said bearing means and said frame, a vibrator constituting the other of said two masses located inside and coaxially with said trommel, said vibrator being adapted to produce gyratory vibration in a plane substantially perpendicular to the axis of said trommel, said screen-supporting structure including longitudinal screen-supporting members

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spaced around said trommel, resilient elements connecting each end of each of said structural members to said trommel and constituting the main spring of the two-mass system, and rods connecting each of said longitudinal members with said vibrator, said connecting rods being adapted to transmit only radial centrifugal forces.

9. In a vibrating trommel screen as in claim 6, said connecting rods being flexible in the plane of said gyratory vibration and substantially rigid along their axes in the direction of said centrifugal vibratory forces.

10. In a vibrating trommel screen as in claim 8, said connecting rods being flexible in the plane of said gyratory vibration and substantially rigid along their axes in the direction of said centrifugal vibratory forces.

11. In a vibrating trommel screen as in claim 6, said connecting rods being substantially rigid and being attached to said vibrator pivotally, in the plane of said gyratory vibration.

12. In a vibrating trommel screen as in claim 8, said connecting rods being substantially rigid and being attached to said vibrator pivotally, in the plane of said gyratory vibration.

13. A two-mass vibrating trommel screen system comprising a frame, a trommel screen structure resiliently and rotatably mounted on said frame and forming one of the two masses of said two-mass system, drive means for rotating said screen structure, a vibrator within said trommel structure and supported from said trommel structure for movement in a plane substantially perpendicular to the axis of said trommel structure and constituting the other mass of said two-mass system, means for actuating said vibrator, and energy-storing means coupled between said vibrator and said screen structure for cyclically converting into potential energy the kinetic energy of the motion of said screen structure and for delivering said potential energy to said vibrator and screen structure to cause them to move relative to each other, said vibrator being thereby adapted to produce gyratory vibration in said plane.

14. A two-mass vibrating trommel screen system comprising a frame, a trommel screen structure resiliently and rotatably mounted on said frame and forming one of the masses of said two-mass system, drive means for continuously rotating said screen structure, a vibrator forming the other mass of said system and substantially coaxial with and within said trommel structure, means for actuating said vibrator, and resilient means interconnecting said vibrator and said trommel structure, said resilient means being substantially symmetrical with respect to the axis of said trommel structure and absorptive of the kinetic energy of relative motion of said vibrator and said trommel structure in a plane substan-

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tially perpendicular to said trommel structure axis, whereby said vibrator produces gyratory vibration in said plane.

15. A system as in claim 14, wherein said resilient means comprises a plurality of elastic members extending between said vibrator and said trommel structure.

16. A system as in claim 15, wherein said members extend substantially radially of said trommel structure and are compressionally elastic.

17. A system as in claim 15, wherein said members extend substantially axially of said trommel structure and are flexurally elastic.

18. A system as in claim 15, wherein said members extend substantially axially of said trommel structure and are elastic shear-wise.

19. A two-mass vibrating trommel screen system, comprising a frame, a substantially axially symmetrical trommel screen structure, a shaft fixed to said screen structure coaxially thereof, bearings for said shaft resiliently mounted on said frame for permitting rotation of said screen structure, drive means for continuously rotating said shaft and screen structure, a vibrator substantially coaxial with and within said screen structure, means for actuating said vibrator and resilient means interconnecting said vibrator and said trommel structure and capable of storing and releasing the kinetic energy of relative motion of said vibrator and screen structure perpendicularly of said screen structure axis, said screen structure and vibrator forming the two masses of said system to produce gyratory vibration of said screen structure.

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