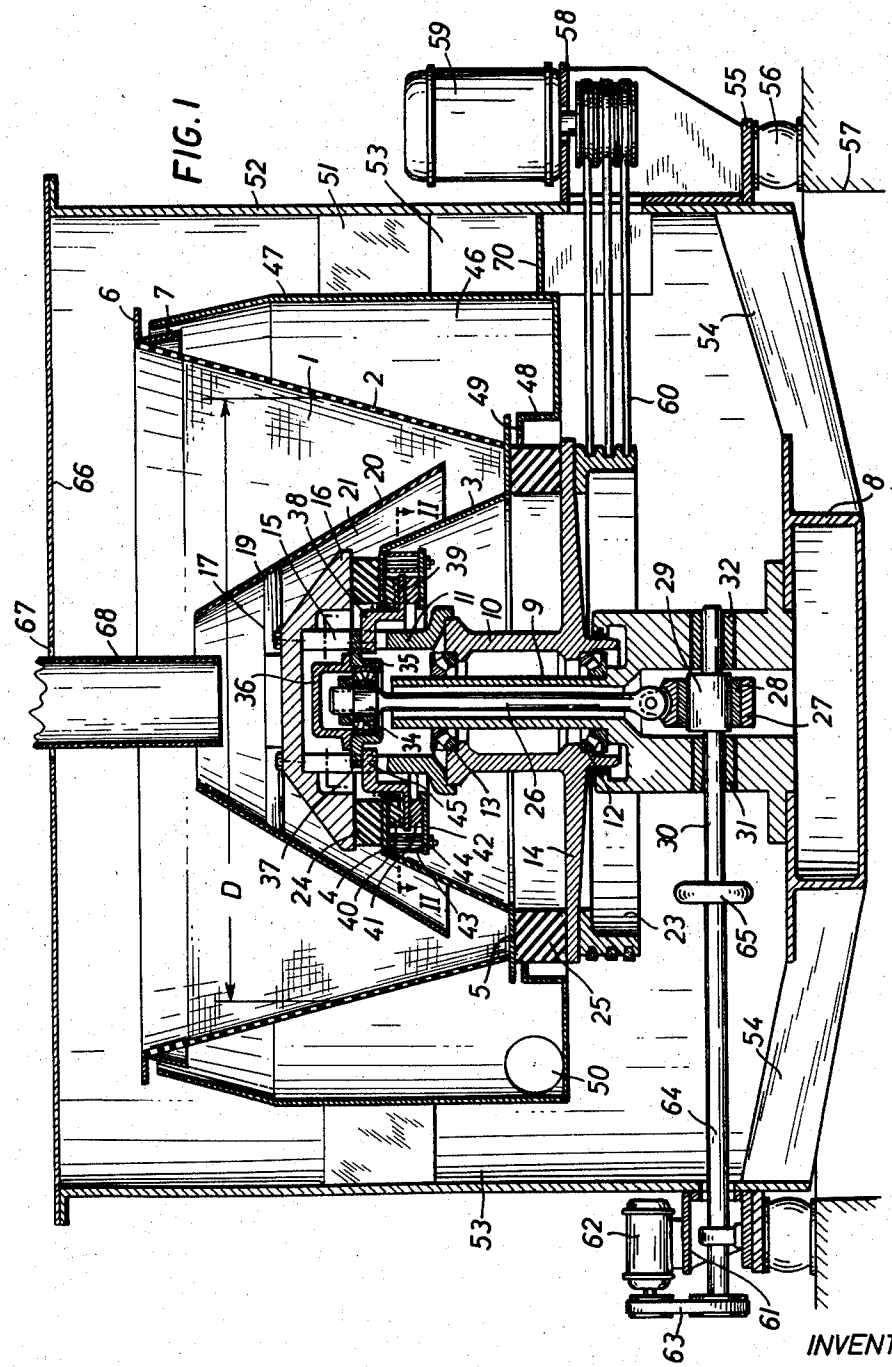
May 12, 1959 W. G. J. HECKMANN 2,886,179

CENTRIFUGE FOR SEPARATING FINE GRANULAR MATERIAL

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FIG. 1



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FIG. 4

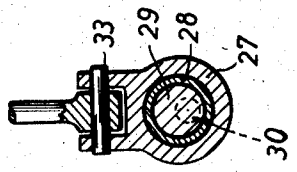


FIG. 3

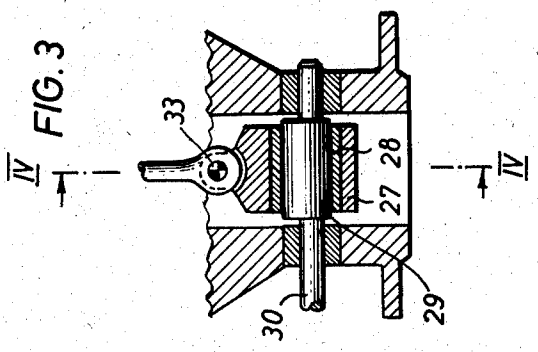
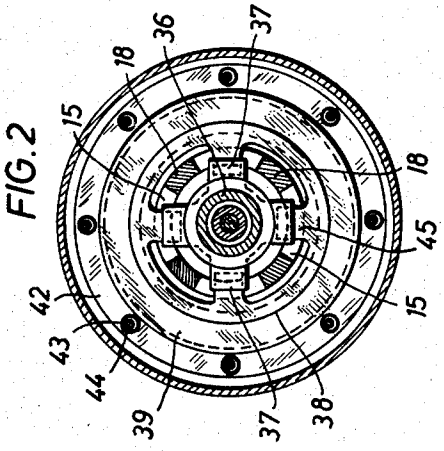


FIG. 2



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CENTRIFUGE FOR SEPARATING FINE GRANULAR MATERIAL

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Application August 2, 1957, Serial No. 676,037

Claims priority, application Germany September 21, 1956

7 Claims. (Cl. 210—370)

This invention relates to a centrifuge, commonly known as an oscillating centrifuge, for separating the water from fine granular material with a rotating screening drum which is simultaneously axially oscillated in order to discharge the dried material.

In the known construction of a centrifuge in which the screening drum is simultaneously rotated and oscillated in and axial direction there is a stationary hollow center post in which there is located a pitman, of which the upper end is supported by a bearing and a loose coupling. The screening drum is restrained between upper and lower oscillating springs which are supported by a hollow center post journaling the drum shaft.

It is an object of the present invention to provide an improved structure of the above type of centrifuge such that the screening drum is provided with a base plate in the form of a frustum of a cone disposed inside the drum, and between the base and a drum shaft cap fastened to the drum shaft there are provided upper springs which are in engagement wtih a loose coupling located beneath the base plate, which loose coupling through intermediate arms extending through the upper portion of the drum shaft are operatively connected with the bearing carried on the upper end of the pitman rod.

A centrifuge constructed in this manner results in a screening drum having a minimum weight. Thereby, it is possible to achieve an oscillatory motion having a high axial separation during the reverse movements thereof without increasing the size of the drum shaft bearing or decreasing the life of the bearing.

To achieve appreciable separation of water from the slurry it is desirable that a large centrifugal force be created at the circumference of the screening drum. On the other hand the contact pressure of the slurry on the screening surface is greater than desired with a large centrifugal force. This means that with a high centrifugal force there must also be a high oscillating force such that the particles may be discharged from the drum. In accordance with the present invention there is provided a centrifuge which achieves a high axial oscillating force which results in a positive discharge of the dried particles from the screening drum and also increases the degree of water separation without effecting the loading on the drum shaft bearings.

In the drawings:

Fig. 1 is a cross sectional elevational view of a centrifuge embodying the present invention.

Fig. 2 is a view taken substantially along the lines II—II of Fig. 1.

Fig. 3 is an enlarged elevational view of the eccentric arrangement for axially oscillating the screening drum.

Fig. 4 is a view taken substantially along the lines IV—IV of Fig. 3.

The oscillating centrifuge comprises an open top frustoconical screening drum **1** having a screening surface **2**. The median diameter D of the screening drum **1** is approximately 1000 mm. and the surface is generated with a generatrix inclined at an angle of approximately 10° to

the drum axis. The base plate **3** is in the form of an upwardly projecting frustum of a cone of which the upper surface forms a deck **4** and extending from the bottom edge is a lateral flange **5** the outer edge of which projects beyond the lower edge of the drum **1**. Projecting laterally from the upper edge of the drum **1** is a lateral flange **6** from which projects a downwardly and outwardly inclined ring **7**. A drum constructed in the above manner may be held to a weight of 120 kg.

On the machine base **8** there is secured a stationary hollow center post **9** on which is located a drum shaft constructed of two parts **10** and **11** which are journaled in two roller bearings **12** and **13** axially shiftable on the center post **9**. Supported on the screening drum **1** and spaced from the base plate is a collar **14** having a diameter substantially equal to the diameter of the base plate **3**. Secured to the collar **14** is a pulley **23**. The upper portion **11** of the drum shaft is shaped in the form of a hub having a flanged portion at its lower end, the upper end is covered with a cap **16** which is fastened to the uprights **18** of the shaft portion **11** by screws **17**. Fastened on the ribs **19** extending from the cap **16** is a conical frame **20** which is spaced from the cap **16** and the base plate **3** thereby to form an annular compartment **21**.

Between the deck **4** of the base plate and the hood **16** there are circularly arranged three or more upper oscillating springs **24** and between the flange **5** of the base plate **3** and the collar **14** three or more oscillating springs **25**, to mount thereby the screening drum **1** for oscillation relatively to the drum shaft. In place of the individual rubber springs **24** there may be used a single annular rubber spring which is dimensioned so as not to project into the annular compartment **21**. Similarly the lower oscillating springs **25** may also be formed of a single annular rubber spring.

In the hollow center post **9** there is disposed a pitman **26** of an eccentric mechanism. The head **27** of the pitman rod is provided with a bearing **28** which embraces an eccentric **29** formed on a shaft **30** journaled in bearings **31** and **32** carried in the center post **9**. As shown in Figs. 3 and 4 the head **27** of the pitman **26** is formed as a separate element and is connected thereto by a transverse pin **33** to form thereby a universal joint.

On the upper end of the pitman there is positioned a movable roller bearing, i.e., a pendulum roller bearing **34** which is supported in a housing **35** having a cover **36**. The upper edge of the housing **35** is provided with four radial lugs **37** which freely extend through slotted openings of the upper portion **15** of the flanged hollow hub **11**. Fastened on the lugs **37** by an arm **45** there is a shell like body **38** having a laterally outwardly projecting flange **39** disposed between the lower base plate flange **5** and the deck **4**. Engaging the upper and lower surfaces of the flange **39** for holding it constrained are two annular rubber buffers **40** and **41** of which the upper **40** abuts against the base plate and the lower **41** abuts against an annular plate **42** which is fastened to the base plate by intermediate means including spacing tubes **43** and screws **44**. In this manner the pitman, as in the prior art, is loosely coupled to the screening drum. Since the pitman **26** is supported at its upper end in the pendulum bearing **34** and is universally supported at its lower end the pitman may be inclined in any direction such that it may follow the pendulous movement of the screening drum **1**. With this construction, the heretofore end thrust load on the bearing **28** is substantially reduced.

The screening drum **1** is encircled by a stationary tank **46** of which the upper edge of the outer wall lies beneath the flange **6** and is spaced laterally from the conical ring **7**. In this manner the water is prevented from escaping over the top of the tank **46**. The inner wall **48** is provided with an inwardly projecting flange the upper sur-

face of which is spaced from the flange 5 so as to prevent the water from leaking therethrough.

The tank 46 is provided on its bottom with an outlet pipe 50 and by means of a plurality of ribs 51 is supported on the outer frame wall 52. The frame wall 52 encircles and is spaced from the tank 46 to form an annular compartment 53. The frame wall 52 is connected to the frame base 8 by a plurality of ribs 54. The base 8 is provided with three or more supporting lugs 55 which are seated upon vibration isolating pads 56 resting on the frame of a bunker 57. Mounted on a platform 58 is a motor 59 over which is entrained driving belts 60 for turning the pulley 23. Located within the compartment 53 and disposed over the belts 60 is a cover 70. On the opposite side from the motor 59 there is secured to the wall 52 a second platform 61 upon which is mounted a second motor 62, which is connected to the eccentric shaft 30 by means of a belt drive 63, a shaft 64 and an elastic coupling 65. The centrifuge is covered by a plate 66 having a central opening in which is fastened a pipe 68 which serves as an inlet for directing the slurry to the conical surface.

The device is operated by means of the motor, drum shafts 10, 11 at approximately 450 r.p.m. The torque generated by the drum shafts 10 and 11 is transmitted through the collar 14 to the hood 16 and to the oscillating springs 24, 25 and thence to the screening drum 1 such that the latter rotates at the same rate as the drum shaft. With the above rate of rotation of 450 r.p.m. there is created a centrifugal force which is approximately equal to 100 times the force of gravity. Simultaneously, the screening drum is oscillated with a frequency of approximately 35 vibrations per minute with an amplitude of approximately 3 mm. by means of the motor 65 which drives the eccentric shaft 30, the pitman 26 and the loose coupling 40 and 41. The axially separating force created by the reversal of direction during the oscillation is approximately 15 times the force of gravity. Under these conditions a screening drum weighing 120 kg. exerts a thrust load of 1800 kg. on the roller bearings 12 and 13 which is well within the rated thrust load capacities thereof.

For separating water, as for example from wet bituminous coal having a granular diameter of from 0 to 10 mm., the coal is inserted into the centrifuge through the pipe 68. Upon leaving the pipe 68 the coal drops over the cap 16 into the compartment 21 wherein the coal is separated in the direction of rotation of the screening drum on the conical surface 20 and the base plate 3. After leaving the compartment 21 the bituminous coal engages the screening drum surface 2 and due to the oscillation movement moves upwardly thereon at which time the water is separated therefrom under the influence of a centrifugal force approximately 100 times greater than the force of gravity which centrifugal force is created by the rotating drum shaft. The coal particles are discharged from the drum over the flange 6 on the upper edge thereof and then drop through the compartment 53 into the bunker 57. It is for this reason that the belts 60 are shielded by the cover 70. The water which is separated from the coal is thrown off through the screening drum and is then entrapped in the tank 56 and discharged from the latter through the outlet 50.

As shown in Fig. 1 the lower oscillating springs 25 are arranged in a circle having a large diameter. Also the upper and lower oscillating springs 24 and 25 are vertically spaced. With this arrangement there is created an increased stability of the screening drum against pendulum movement when the load in the screening drum becomes unbalanced.

In the disclosed structure of the present invention it is not essential that the conical surface of the cap 16 be fastened to the drum shaft and thereby be oscillated with the screening drum, but it may be separately rotatably mounted.

What I claim is:

1. A centrifugal device for dehydrating a fine granular material by imparting to the material simultaneously a rotary and axial motion, comprising in combination: a stationary hollow center post, a rod adapted to be reciprocated in said hollow center post, means for reciprocating said rod connected thereto, a screening drum sleeve shaft co-axially and rotatably journalled on said stationary center post having a plurality of slots at its upper end, an outwardly extending supporting flange integrally connected to said screening drum sleeve shaft at its lower end, a concentric screening drum having an interior base plate of frusto-conical shape, said plate having an opening surrounding said stationary post and said screening drum shaft, a cap having an annular horizontal portion covering the upper end of said screening drum shaft, loose coupling means connected to the upper end of said rod, said coupling means extending radially outward through said slots of said drum shaft, means connecting said base plate to said coupling means, a first resilient means connecting the bottom of said screening drum base plate to said flange, and a second resilient means connecting the top of said screening drum base plate to said annular horizontal portion of said cap.

2. The invention as defined in claim 1 in which there is secured to and above said cap a coaxial open ended frusto-conical frame and in which there is axially aligned with said frusto-conical frame an inlet opening.

3. A centrifugal device for dehydrating a fine granular material by imparting to the material simultaneously a rotary and axial motion, comprising in combination: a stationary hollow center post, a rod adapted to be reciprocated in said hollow center post, means for reciprocating said rod connected thereto, a screening drum sleeve shaft co-axially and rotatably journalled on said stationary center post having a plurality of slots at its upper end, an outwardly extending supporting flange integrally connected to said screening drum sleeve shaft at its lower end, a concentric screening drum having an interior base plate of frustro-conical shape, said plate having a horizontal upper portion provided with a circular opening surrounding said stationary post which extends upwardly therethrough, a cap having an annular horizontal portion covering the upper end of said screening drum shaft, loose coupling means connected to the upper end of said rod, said coupling means extending radially outward through said slots of said drum shaft, means connecting said base plate to said coupling means, a first resilient means connecting the bottom of said screening drum base plate to said flange and a second resilient means connecting said horizontal upper portion of said frustro-conically shaped base plate to said annular horizontal portion of said cap.

4. A centrifugal device for dehydrating a fine granular material by imparting to the material simultaneously a rotary and axial motion, according to claim 1, wherein said loose coupling means include at least one rubber spring secured to the lower surface of the top of said frustro-conically shaped base plate.

5. A centrifugal device for dehydrating a fine granular material by imparting to the material simultaneously a rotary and axial motion, according to claim 4, wherein each of said plurality of connecting members include an L-shaped angle having one leg connected to said pendulum roller bearing means, and a Z-shaped angle connected to the other leg of said L-shaped angle, said Z-shaped angle having one leg disposed between a pair of rubber springs and secured thereto.

6. A centrifugal device for dehydrating a fine granular material by imparting to the material simultaneously a rotary and axial motion, according to claim 3, wherein said loose coupling means further include pendulum roller bearing means secured to the upper end of said rod, and a plurality of radially outward projecting connecting members secured to said pendulum roller bearing means.

7. A centrifugal device for dehydrating a fine granular material by imparting to the material simultaneously a rotary and axial motion, according to claim 1, wherein said first and second resilient means consist of annularly shaped rubber members.

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