ABSTRACT

A large size drum, such as a screen drum for a screening machine or drum filter is driven by a means engaging the periphery of the drum in the same vertical plane in which the drum is supported. A plurality of rollers are mounted in a ring about the periphery of the drum and are free to run on one or more concave supporting surfaces located in position to support the drum. Drive means, such as a pinion, engage the rollers to rotate the drum.

18 Claims, 5 Drawing Figures
BEARING AND DRIVE MEANS FOR LARGE SIZE REVOLVING DRUMS

BACKGROUND OF THE INVENTION

The present invention relates to a drive and bearing design for large-size revolving drums, such as screen drums for screening machines or drum-type filters.

Screening machines are utilized, for example, in the treatment of waste water and the conditioning of potable water. Increasing efficiency and performance requirements have created a constant need for larger and more effective screens and filtering areas. In some particular cases this has led to screen drum designs with an internal diameter of almost 6 meters and a length of 12 meters. It is obvious that the design of bearing and drive means for drums of such dimensions poses some extra problems, particularly in view of bending and torsional stresses.

A design has been utilized wherein the screen drum is supported on axle bearings and the motive power is supplied by two motors at the drum ends. This design has a central tread supported by several stationary rollers. If the two drive motors are not exactly synchronous, however, this screen drum design is exposed to torsional stress. In order to endure such stress, the drum design has to be excessively heavy and sturdy. Also, in order to avoid faulty concentric running of the drum, the running surface of the entire tread has to be lathed on a vertical boring mill which is extremely difficult with a diameter surpassing 6 meters. Other smaller screen drums in practice are supported at both ends on axle bearings and are equipped with a gear rim and pinion drive at their ends or with a chain belt. However, as these drums have no additional central support, they may sag and deflect under load. Drums of considerable length simply must have an additional support; any support at the circumference, however, causes moments of reaction which — due to their application at an axial distance to the application of the drive — may also lead to undesirable torsional stress on the drum.

It is an object of the present invention to develop a new bearing and drive means for large-size revolving drums, to facilitate construction of such means and to reduce the torsion and bending stress as far as possible.

BRIEF SUMMARY OF THE INVENTION

According to the invention, the foregoing objects are achieved by having the drive means engage the drum in the same vertical plane in which the drum is supported at the circumference. Torsional stress is avoided, as the reaction moment of the bearing and the starting torque apply at the drum in the same vertical plane. The drum, therefore, may be of a particularly light construction.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

There follows a detailed description of a preferred embodiment of the invention, together with accompanying drawings. However, it is to be understood that the detailed description and accompanying drawings are provided solely for the purpose of illustrating a preferred embodiment and that the invention is capable of numerous modifications and variations apparent to those skilled in the art without departing from the spirit and scope of the invention.

FIG. 1 is a foreshortened side view of a revolving drum screen, partly a longitudinal section. The drive of the screen drum and the bearing seats supporting the drum have been left out for the sake of clearness.

FIG. 2 is a front view of the lower part of the drum screen of FIG. 1.

FIG. 3 is a front view of the upper part of the drum of FIG. 1 with drive pinion and waste trough.

FIG. 4 is a section along line IV—IV of FIG. 3.

FIG. 5 is a section along line V—V of FIG. 2.

According to a preferred embodiment of the invention, a ring of running rollers arranged in a circle at the circumference of the drum supports the drum against one or more stationary, cylindrical, and concave running surfaces and the drum drive means engages the rollers. The rollers thus supporting the drum also serve as a sort of gear ring engaged by the drive means which preferably consists of a pinion. This method assures that the drive and the bearing are actually situated in the same vertical plane transverse to the drum axis. Besides, such a construction does not require precise finishing of a peripheral running surface. Only the axes of all rollers must be located on a circle concentric with the axis of the drum which can be achieved by comparatively simple means.

The running rollers are aligned in pairs on either side of a flange radially projecting from the drum circumference, each of the roller rings thus formed is provided with a driven pinion. For equal distribution of the motive energy between both circles of rollers, notwithstanding small differences in spacing of rollers due to wear, both pinions are individually and elastically connected to a common drive shaft. The rollers on either side of the flange can be supported in pairs at the ends of a king pin driven through the flange. For further compensation of starting torque, the pin in the flange can be made elastically tiltable.

The stationary running surfaces supporting the rollers can consist of two bearing seats arranged one on either side of the vertical meridian plane of the drum. In order to have as many rollers as possible participate in the support, each bearing seat should be pivoted with its center about an axis parallel to the drum axis. Further smaller screen drums in practice are equipped with adjacent sections with a narrow clearing between them and each pivoted with their centers about axes parallel to the drum axis. Furthermore, each bearing seat or each section thereof may be elastically tiltable about an axis which is vertical to a plane containing the drum axis and the pivot of the bearing seat or bearing seat section. In this way the supporting stress is equally divided between the roller rings to either side of the flange. The running rollers and/or the drive pinion(s) preferably consist of a polyamide material.

In revolving drums of considerable length, the circle of running rollers with drive means is preferably arranged in the longitudinal center of the drum. In addition, the drum itself should be supported at its ends on roller rings at the circumference or on axle bearings protruding from the front faces. However, this could lead to undesirable torsional torque in the event that one of the end bearings should be blocked. Therefore, a preferred embodiment of the invention provides for the drum to be equipped with a safety switch which turns off the drive if excessive torsional torque is applied at the drum. This safety device preferably comprises (a) at least two signalers arranged in a plane with the drum axis and at an axial distance, (b) two stationary signal receivers also arranged in a plane containing the drum axis, each of the receivers cooperating with one of the signalers and emitting an electric impulse when passed by the signaler, and (c) a time control switch responding to the time difference of the pulses emitted by the signal receivers and switching off the drive if the time difference exceeds a preselected period. The signalers can be permanent magnets and the signal receivers ignition switches released when passed by the magnets. An alternative is provided by cams disposed at the drum periphery and operating stationary switches or interrupting stationary light barriers. The time lapse between occurrence of excessive torsion and interruption of drive may amount to a maximum of one revolution of the drum. This time lapse can be decreased by providing several signalers for each receiver, the signalers being arranged on the drum at regular angular distance.

With reference to the drawings, the drum screen shown in FIG. 1 is housed in a chamber 10 and comprises a revolving drum 12 formed by two front walls 14, 16, a plurality of longitudinal tubes 18 connecting the front walls, and a number of screening baskets 20 mounted to the longitudinal tubes and covered by a fine-meshed screening fabric. During operation, the drum is submerged up to level 22. The water to be
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screened enters the drum 12 through a pipe inlet 24, while the cleaned water leaves the chamber 10 through an outlet not shown. The drum 12 revolves thus the screening baskets blocked by scum during operation emerge one by one from the water and are cleaned by means of a spray pipe 26 into which water is pressure-fed through pipelines 28. The waste water and the screenings are collected in a waste trough 30 and are discharged through a pipe shaft 32 at the front wall opposite the inlet 24.

The drum 12 is pivoted on the short feed pipes 24, 42 serving as hollow axles by means of water-tight sleeve bearings 34, 36. In addition, drum 12 is supported at its longitudinal center on two rings of running rollers 38 running on two stationary bearing seats 40, 42 (FIG. 2). FIG. 1 does not show these bearing seats 40, 42 for the sake of clearness. The running rollers 38 not only serve to support the drum 12 on the bearing seats 40, 42 but also to form a drive shaft bearing engaged by a pinion 44 providing the drive means of the drum 12 (FIG. 3).

The running rollers 38 are arranged in pairs on either side of a ring 46 composed of several segments (see FIG. 2) and protruding from the periphery of the drum 12. The ring 46 has about axes 68, 70 parallel to the drum axis. The pins 44, 45 are mounted on a common drive shaft 52 which is driven by a geared engine 54 and with its free end supported on a fixed bearing 56. The pinions 44, 45 are connected to the drive shaft 52 via couplings 58, 69 allowing a slight elastic torsion of the pinions relative to the shaft and consisting e.g. of rubber liners inserted between the flanges connected to the shaft and/or the pinions. This together with the flexible fitting of the king pins 48 to the annular flange 46 assures uniform, free transmission of the motive power to any pair of running rollers engaged by the pinion. A slipper clutch 62 can be installed to avoid overload on the drive and revolving drum.

The bearing seats 40, 42 on which the running rollers 38 are working consist of two adjacent sections 64, 66 (as shown in FIG. 2). Each section is pivoted at the ends of a swingletree 72 about axes 68, 70 parallel to the drum axis and rests on a stationary support 76. This construction provides a uniform distribution of the bearing load on each of the running rollers 38 (e.g. four rollers) simultaneously touching the bearing seat 40. In addition, the swingletree 72 (as shown in FIG. 5) is supported on the axe 74 by means of a self-aligning roller bearing 78, so that the bearing seat is suitably tilted about an axis vertical to the axe 74. Thus, the bearing load is uniformly distributed onto both rollers of each pair of running rollers.

The running rollers 38 as well as the pinions 44, 45 preferably consist of a polyamide material, in addition, the bearing seats 40, 42 may have a low-friction running surface (80 in FIG. 5) also consisting of polyamide, for example.

The above-described bearing and drive for the drum filter can be constructed very simply. The annular flange 46 supporting the running roller 38 is composed of segments and remains entirely unmachined. Only the pitch circles for the axes 46 of the running rollers and for the longitudinal tubing 18 which are fixed or welded to the flange 46 have to be marked. Shipment is effected in single parts which can be side-assembled. The annular flange 46 can be elevated to such an extent that the running rollers 38 are entirely outside of the drum diameter determined by the screening baskets 20, so the baskets 20 can be arranged immediately at the annular flange 46. The loss of screening area caused by the peripheral arrangement of the drum drive is comparatively insignificant.

In case one of the water-tight sleeve bearings 34, 36 should be blocked due to pollution, etc. thereby exposing the drum 12 to undue torsional forces, it is useful to install a safety switch which responds to torsion on the drum 12 by automatically turning off the drive 54. For this purpose the circumference of the former has cuts 16 of the drum 12 are provided with a number of signalers comprising permanent magnets 82 spaced at regular angular distance and cooperating with two stationary signal receivers comprising ignition switches 84, 86. These ignition switches 84, 86 are connected to a conventional time control switch of commercial-type construction which responds to the time difference between the impulses 84a and 86a given respectively, by switches 84 and 86. If the drum operates normally, the impulses of switches 84 and 86 are given simultaneously. However, in case one of the bearings 34, 36 slows down and the drum 12 is exposed to torsion switches 84, 86 no longer respond simultaneously. As soon as the time difference exceeds a certain preselected period, signal 89 turns off the drive 54. Should both bearings 34, 36 be jammed (which is extremely unlikely) the slipper clutch 62 will prevent overload torque on the drum 12.

What is claimed is:

1. Rotating drum apparatus comprising a cylindrical drum rotatable about a horizontal cylindrical axis, a plurality of rollers mounted in a ring about the periphery of said drum, drum support means comprising a concave running surface adjacent said drum in which said rollers run supporting said drum, and means for driving said drum engaging the periphery of said drum in the same vertical plane in which the drum is supported by said rollers.

2. Rotating drum apparatus according to claim 1 wherein said drive means engages said rollers.

3. Rotating drum apparatus according to claim 2 wherein said drive means comprises a pinion the tooth pitch of which corresponds to the spacing of said rollers.

4. Rotating drum apparatus according to claim 1 wherein said running rollers are arranged in pairs on either side of a flange projecting radially of the drum periphery thus forming a pair of rings of rollers about the drum periphery.

5. Rotating drum apparatus according to claim 4 wherein said drive means includes a pair of pinions, each pinion driving one of said rings of rollers.

6. Rotating drum apparatus according to claim 5 wherein said pinions are independently and flexibly coupled to a common drive shaft.

7. Rotating drum apparatus according to claim 4 wherein said rollers are supported in pairs on the ends of a king pin extending through said flange.

8. Rotating drum apparatus according to claim 7 wherein said king pin is elastically tiltable.

9. Rotating drum apparatus according to claim 1 wherein said drum support means comprises two bearing seats located on opposite sides of the vertical meridian plane of the drum.

10. Rotating drum apparatus according to claim 9 wherein each bearing seat is pivoted with its center about an axis parallel to the drum axis.

11. Rotating drum apparatus according to claim 10 wherein each bearing seat comprises two adjacent sections which are pivoted independent of each other with their centers about an axis parallel to the drum axis.

12. Rotating drum apparatus according to claim 11 wherein each bearing seat section is elastically tiltable about an axis which is vertical to a plane containing the drum axis and the pivot of the bearing seat section.

13. Rotating drum apparatus according to claim 1 wherein the rollers, the running surfaces, or the drum driving means are made of a polyamide material.

14. Rotating drum apparatus according to claim 1 wherein said ring of rollers with its drive is arranged in the longitudinal center of the drum, the drum ends being additionally rotatably supported.

15. Rotating drum apparatus according to claim 1 wherein the drum comprises a safety switch means responsive to excessive torsional torque on the drum drive to turn off the drive means.

16. Rotating drum apparatus according to claim 15 wherein the safety switch means comprises at least two signalers ar-
ranged in the same plane as the drum axis and two stationary signal receivers arranged in the same plane with drum axis, each receiver cooperating with one of the signalers and responding with an electric impulse when passed by the signaler, and a time control switch responding to the time difference between the two impulses given by the signal receivers to turn off the drive if said time difference surpasses a preselected period.

17. Rotating drum apparatus according to claim 16 wherein each of the two signal receivers is provided with several signalers arranged at equal angular distance in a circle on the drum periphery.

18. Rotating drum apparatus according to claim 16 wherein the signalers comprise permanent magnets and the signal receivers being ignition switches.