

PERFORATED METAL DRUM SCREEN DEVICE

Technical Field

[0001]

5 The present invention relates to a drum screen device formed of a perforated metal. This application claims priority based on Japanese Patent Application No. 2018-100938 filed on May 25, 2018, contents of which are incorporated herein by reference.

10

Background Art

[0002]

 Organic waste water such as urine, purification tank sludge, and the like are treated in a sludge recycling facility. In the sludge recycling facility, to improve the efficiency of treatment of organic waste water, treatments such as
15 separating fibers from the organic waste water and concentration of sludge have been performed.

[0003]

 For example, according to the technologies in a related art described in Patent Document 1 and Patent Document 2, a fiber removal device provided
20 with a drum screen formed of a wedge wire or perforated metal separates fibers contained in sludge.

[0004]

 According to the technologies in a related art described in Patent Document 3 and Patent Document 4, a sludge concentration device provided
25 with a drum screen formed of a wedge wire or perforated metal concentrates sludge.

Citation List

Patent Document

30

[0005]

 Patent Document 1: Japanese Unexamined Patent Application
Publication No. H10-192615A

 Patent Document 2: Korean Patent No. 10-0904283

 Patent Document 3: Japanese Unexamined Patent Application
35 Publication No. 2007-330920A

 Patent Document 4: Japanese Unexamined Patent Application
Publication No. 2002-177712A

Summary of Invention
Technical Subject to Be Solved

[0006]

In a related art, when a liquid to be treated is supplied to a drum screen
5 having a large number of through-holes, in order to prevent the liquid to be
treated from leaking to the outside of the drum screen and contaminating other
devices disposed outside of the drum screen, the liquid to be treated is supplied
to the inner portion of the drum screen while avoiding the end of the drum
screen. Thus, the effective length of the drum screen cannot be sufficiently
10 utilized, which may lead to an increase in a drum screen size. In addition,
since the liquid to be treated may be discharged in one certain location of the
drum screen in a concentrated manner, the one certain location having the
substantially same size as the opening of the tube for supplying the liquid to be
treated, the flow rate of the liquid to be treated per through-hole of the drum
15 screen becomes excessive and thus, the liquid to be treated may not be properly
treated.

[0007]

The present invention is devised in light of the circumstances described
above, and provides a perforated metal drum screen device that utilizes the
20 effective length of the drum screen to the greatest extent possible, enabling
miniaturization of the device, and mitigates the flow rate of the liquid to be
treated discharged onto the drum screen such that the liquid to be treated is
appropriately treated.

25 Solution to Subject

[0008]

A perforated metal drum screen device of the present invention includes:
a cylindrical body portion having a central axis disposed in a substantially
horizontal direction and a wall face formed of a perforated metal; a first
30 blocking plate configured to block one end of the body portion except for a
vicinity of the central axis; a liquid-to-be-treated introduction tube disposed on
the central axis, the liquid-to-be-treated introduction tube being configured to
supply a liquid to be treated through the first blocking plate; a supply portion
connected to the liquid-to-be-treated introduction tube, the supply portion
35 being configured to receive the liquid to be treated; a second blocking plate
configured to block the other end of the body portion; a support member
configured to rotatably support the body portion about the central axis; and a
drive means configured to rotate the body portion, wherein a plurality of

apertures are formed in the wall face except for a vicinity of the second blocking plate, a plurality of block-like substance discharge ports larger than the apertures are formed in the wall face in the vicinity of the second blocking plate, the supply portion includes a substantially trapezoidal guide plate and a flow change plate connected to a side other than a base of the substantially trapezoid, and the flow change plate configured to direct the flow of the liquid to be treated outward in a radial direction of the body portion and to disperse the liquid to be treated on the guide plate, and causes the dispersed liquid to be treated to drop from the base onto the wall face including at least the vicinity of the first blocking plate.

[0009]

With this configuration, the liquid to be treated can be treated from the end of the body portion, making it possible to reduce the size of the perforated metal drum screen device. In addition, since the liquid to be treated is dispersed by the flow change plate and the guide plate of the supply portion and is discharged onto the wall face of the body portion, the contact area between the liquid to be treated and the wall face of the body portion can be increased, and the flow rate of the liquid to be treated for each aperture can be mitigated to appropriately treat the liquid to be treated.

[0010]

In the above perforated metal drum screen device, the liquid to be treated may be sludge containing fibers, the supply portion may cause the liquid to be treated to be discharged onto the wall face moving upward due to the rotation, and the drive means may rotate the body portion at a rotational speed at which the fibers grow into a roll shape in the body portion. With this configuration, the perforated metal drum screen device cleans itself, and the cleaning operation to remove clogging of the drum screen need not be regularly performed. Furthermore, a cleaning device such as a brush need not be separately installed. Therefore, it is possible to provide the perforated metal drum screen device that is excellent in terms of manufacturing cost and maintenance costs.

[0011]

In the above-described perforated metal drum screen device, the liquid to be treated may be sludge containing a flocculant, and the drive means may rotate the body portion at a rotational speed at which the liquid to be treated does not grow into a roll shape in the body portion.

With this configuration, the contact area between the liquid to be treated and the wall face of the body portion can be increased to efficiently concentrate sludge.

Further, the above-described perforated metal drum screen device may further include: a flow rate sensor provided on a discharge tube leading to the block-like substance discharge ports, the flow rate sensor being configured to detect the flow rate of water in the liquid to be treated; a flow rate regulation means provided on the liquid-to-be-treated introduction tube; and a control device configured to, when a detected value of the flow rate sensor is larger than a predetermined value, control the flow rate regulation means to decrease a supply amount of the liquid to be treated or control the drive means to increase a rotational speed of the body portion.

With this configuration, when the liquid to be treated is supplied more than necessary or the rotational speed of the body portion is too slow, the control device automatically regulates the supply amount of the liquid to be treated to an optimal supply amount or the rotational speed of the body portion to an optimal rotational speed. Therefore, the liquid to be treated can be appropriately treated in applications such as fiber removal, sludge concentration, and the like.

Advantageous Effects of Invention

[0012]

The present invention can provide a perforated metal drum screen device that utilizes the effective length of the drum screen to the greatest extent possible, enabling miniaturization of the device, and mitigates the flow rate of the liquid to be treated discharged onto the drum screen such that the liquid to be treated is appropriately treated.

Brief Description of Drawings

30 [0013]

Fig. 1 is a schematic configuration diagram illustrating a perforated metal drum screen device of the present invention.

Fig. 2 is a perspective view illustrating a supply portion connected to a tip of a liquid-to-be-treated introduction tube.

35 Fig. 3 is a cross-sectional view illustrating the supply portion taken along a line III-III in Fig. 1.

Fig. 4 is a schematic configuration diagram illustrating a perforated metal drum screen device in a modified example.

Description of Embodiments

[0014]

5 A perforated metal drum screen device 100 (hereinafter referred to as a drum screen device 100) according to an embodiment of the present invention will be described with reference to Figs. 1 to 3. Note that the drum screen device 100 can be used as a fiber removal device or a sludge concentration device.

[0015]

10 Fig. 1 is a schematic configuration diagram illustrating the drum screen device 100 of the present invention. The drum screen device 100 includes a cylindrical body portion 10 provided with blocking plates 20A and 20B on both ends, a straight-tube-shaped liquid-to-be-treated introduction tube 11 that introduces a liquid to be treated “A” into the interior of the body portion 10, a
15 supply portion 17 connected to a tip of the liquid-to-be-treated introduction tube 11 to direct the flow of the liquid to be treated “A”, support member 12 (12a and 12b) that rotatably support the body portion 10, and a drive means 13 that rotates the body portion 10 in one direction.

[0016]

20 The body portion 10 is a cylindrical body having a wall face 14 formed of a perforated metal. A central axis 10A (virtual axis) of the body portion 10 is oriented in a substantially horizontal direction. As illustrated in Fig. 1, the body portion 10 is divided into three parts: a liquid-to-be-treated introduction section α , into which the liquid to be treated “A” is introduced, a separated
25 liquid discharge section β , through which a part of water (sludge or water “W”) is removed from the liquid to be treated “A”, and a block-like substance discharge section γ , from which a block-like substance “S” is discharged, the block-like substance “S” being obtained by removing sludge or water from the liquid to be treated “A” in the separated liquid discharge section β . That is,
30 the total length of the body portion 10 is a sum of the lengths of the liquid-to-be-treated introduction section α , the separated liquid discharge section β , and the block-like substance discharge section γ along the central axis 10A.

Note that when the drum screen device 100 is used as a fiber removal device, the liquid to be treated “A” is sludge containing fibers, and the block-like substances “S” are fibers. When the drum screen device 100 is used as a
35 sludge concentration device, the liquid to be treated “A” is sludge into which a flocculant has been injected, and the block-like substances “S” become concentrated sludge.

As the body portion 10 rotates, the liquid to be treated “A” introduced into the liquid-to-be-treated introduction section α flows from the liquid-to-be-treated introduction section α toward the block-like substance discharge section γ , while sludge or water “W” is gradually removed. The liquid-to-be-treated introduction tube 11 for continuously supplying the liquid to be treated “A” is disposed on the central axis 10A on the side of the liquid-to-be-treated introduction section α , that is, at one end of the body portion 10. The liquid-to-be-treated introduction tube 11 is a straight tube inside the body portion 10, but it may be a tube appropriately bent outside the body portion 10.

As described below, the supply portion 17 is provided on a tip of the liquid-to-be-treated introduction tube 11 inside the body portion 10, and the supply portion 17 bends the flow of the liquid to be treated “A” that linearly travels along the central axis 10A and directs the flow outward in the radial direction of the body portion 10.

A plurality of circular apertures 15 are evenly arranged in the wall face 14 in the liquid-to-be-treated introduction section α by punching, and as in the separated liquid discharge section β , with the rotation of the body portion 10, sludge or water “W” is discharged from the apertures 15 to the outside and below the body portion 10. The diameter of the aperture 15 may be about 1 mm. Contaminants or fibers contained in the liquid to be treated “A” are less likely to entangle on the perforated metal having such small diameter apertures 15, compared to a wedge wire woven so as to form rectangular apertures. In other words, clogging of the aperture 15 is unlikely to occur.

At an end portion of the liquid-to-be-treated introduction section α , the blocking plate 20B is provided. The blocking plate 20 includes a circular opening that is coaxial with the central axis 10A, and it is configured to block all of the body portion 10 in the radial direction except for the opening. The opening is necessarily and sufficiently large size for allowing the liquid-to-be-treated introduction tube 11 to pass through the opening into the interior of the body portion 10. Also, the opening has a size that prevents the liquid to be treated “A” from flowing out of the body portion 10 through the opening.

The support member 12a is a tubular member that is connected to the blocking plate 20B and is coaxial with the central axis 10A. The inner diameter of the tube is necessarily and sufficiently large size for allowing the liquid-to-be-treated introduction tube 11 to pass through the tubular member into the interior of the body portion 10.

[0017]

The separated liquid discharge section β is disposed between the liquid-to-be-treated introduction section α and the block-like substance discharge section γ , and a plurality of apertures 15 are disposed uniformly in the same manner as in the liquid-to-be-treated introduction section α . Thus, with the rotation of the body portion 10, sludge or water “W” is discharged from the apertures 15 to the outside and below the body portion 10.

Note that a first discharge tube 16 that receives sludge or water “W” is provided below the liquid-to-be-treated introduction section α and the separated liquid discharge section β .

The blocking plate 20A that blocks all of the body portion 10 in the radial direction is disposed at an end of the block-like substance discharge section γ . The blocking plate 20A and the blocking plate 20B described above can prevent the liquid to be treated “A” supplied to the interior of the body portion 10 from spattering to peripheral equipment disposed outside the body portion 10, thereby preventing contamination and corrosion of the peripheral equipment.

In addition, between the blocking plate 20A and the separated liquid discharge section β , a plurality of quadrate (for example, rectangular) discharge ports 22 are evenly disposed in the circumferential direction of the wall face 14 in the block-like substance discharge section γ . Accordingly, with the rotation of the body portion 10, the block-like substances “S” are discharged from the discharge ports 22 to the outside and below the body portion 10. The discharge port 22 has a larger opening area than the aperture 15. For example, the dimensions of the discharge port 22 may be 12 cm $\times$ 15 cm. Similar to the aperture 15, the discharge port 22 may also be opened by punching. The discharge port 22 preferably has a larger dimension in the circumferential direction of the body portion 10. The larger circumferential dimension can reduce the length of the drum screen device, and it allows a large amount of the block-like substances “S” to be discharged all at once.

Note that a second discharge tube 23 which has a larger opening size than the dimension of the discharge port 22 and receives the block-like substances “S”, is provided below the block-like substance discharge section γ .

The support member 12b is a cylindrical member that is connected to the blocking plate 20A and is coaxial with the central axis 10A.

[0018]

The support member 12 (supports 12a and 12b) are supported by a member (not illustrated) that rotatably supports these support members. In addition, as illustrated in Fig. 1, the drive means 13 such as a motor configured

to rotate the support member 12 is provided. When the driving means 13 rotates the support member 12, the body portion 10 which is integrally connected to the support member 12 also rotates.

A drive transmission means from the drive means 13 to the support member 12 may be known suitable means such as a chain and a sprocket.
[0019]

The supply portion 17 connected to the liquid-to-be-treated introduction tube 11 is described in detail using Fig. 2 and Fig. 3. As illustrated in Fig. 2, the supply portion 17 includes: a substantially trapezoidal guide plate 19; a flow change plate 18A connected to the upper side of the trapezoid; a flow change plate 18B connected to the liquid-to-be-treated introduction tube 11, the flow change plate 18A and the guide plate 19; and a flow change plate 18C that faces the flow change plate 18B and is connected to the flow change plate 18A and the guide plate 19. The upper side of the trapezoid is shorter than the base of the trapezoid, and it is disposed closer to the central axis 10A than the base.

An opening for introducing the liquid to be treated “A” from the liquid-to-be-treated introduction tube 11 onto the guide plate 19 is formed in the flow change plate 18B. The liquid-to-be-treated introduction tube 11 may be connected to the flow change plate 18B through the opening, or an introduction tube opening 11A, which is an end of the liquid-to-be-treated introduction tube 11, may be connected to the opening.

The flow change plates 18 (18A, 18B, 18C) are vertically connected to the guide plate 19. In addition, the height of the flow change plates 18 is set such that the liquid to be treated “A” cannot flow beyond the flow change plates 18.

The flow change plate 18A is disposed substantially parallel to the central axis 10A. The flow change plate 18B is connected to the right side of the substantially trapezoidal guide plate 19, being inclined in a direction opposite to a flow direction (F) of the liquid to be treated flowing through the liquid-to-be-treated introduction tube 11 along the central axis 10A, at an angle θ_1 from a direction perpendicular to the central axis 10A. The flow change plate 18C is connected to the left side of the substantially trapezoidal guide plate 19, being inclined in the same direction as the flow direction (F) of the liquid to be treated at an angle θ_2 from the direction perpendicular to the central axis 10A. The angle θ_1 and the angle θ_2 may be the same angle or different angles. The angles are appropriately set in the ranges of $0^\circ < \theta_1 \leq$

60° and $0^\circ < \theta_2 \leq 60^\circ$ depending on the characteristics and flow rate of the liquid to be treated.

Fig. 3 is a cross-sectional view of the supply portion 17 taken from a line III-III line in Fig. 1. The guide plate 19 is inclined in the rotational direction of the body portion 10 at an angle θ_3 from the downward direction perpendicular to the central axis 10A of the body portion 10. The angle θ_3 is set to be in a range of $0^\circ < \theta_3 \leq 60^\circ$. In Fig. 3, given that the radius of the body portion 10 is “r”, a length “L” of the supply portion 17 from the central axis 10A of the body portion 10 in the radial direction is set to be in a range of $(1/2)r \leq L \leq (4/5)r$.

In a case where the drum screen device 100 is used as a fiber removal device, the liquid to be treated “A” only needs to be mildly introduced into the body portion 10 so as not to collide with the wall face 14 and sputter. Thus, the dimension of “L” may be set small, for example, about $L \doteq (1/2)r$. In a case where the drum screen device 100 is used as a sludge concentration device, the liquid to be treated “A” needs to be supplied to the wall face 14 more mildly than the case of using the drum screen device 100 as the fiber removal device, such that sludge flock, which has increased in its size due to mixing of the flocculant in the liquid to be treated “A”, is not destroyed and subdivided by the above collision. Therefore, the dimension of “L” needs to be set as long as possible, desirably, in a range of $(3/4)r \leq L \leq (4/5)r$. When “L” is at least about $(3/4)r$, the drum screen device can sufficiently function as the sludge concentration device. Of course, even when the drum screen device 100 is used as the fiber removal device, “L” may be set in the range of $(3/4)r \leq L \leq (4/5)r$, and may be about $(3/4)r$.

Here, the flow of the liquid to be treated “A” in the supply portion 17 is described using Figs. 2 and 3. The liquid to be treated “A” flowing the interior of the liquid-to-be-treated introduction tube 11 is discharged from the introduction tube opening 11A in the direction (F). The discharged liquid to be treated “A” collides with the flow change plate 18C of the supply portion 17 and its course is largely changed from the direction (F). That is, a part of the discharged liquid to be treated “A” flows on the guide plate 19 and along the flow change plate 18C, another part of the liquid to be treated “A” rebounds at the flow change plate 18C and flows on the guide plate 19 and along the flow change plate 18B, and yet another part of the liquid to be treated “A” rebounded at the flow change plate 18C cannot flow beyond the flow change plate 18A and flows on the guide plate 19 and between the flow change plate 18C and the flow change plate 18B.

In other words, in the supply portion 17, the liquid to be treated “A” discharged from the base of the substantially trapezoidal guide plate 19 is evenly dispersed such that the flow rate at any point along the base becomes substantially uniform, and the liquid to be treated “A” is discharged toward the wall face 14, causing the liquid to be treated “A” to drop onto the wall face.

For example, in a case where the supply portion 17 is not provided and the tip of the liquid-to-be-treated introduction tube 11 is bent downward by 90° to discharge the liquid to be treated “A” to the wall face 14, the liquid to be treated “A” may collide with the wall face 14, an area of the collision being substantially the same area as a size of the introduction tube opening 11A. As a result, the flow rate of the liquid to be treated per each of the apertures 15 of the wall face 14 at the location where the liquid to be treated “A” collides with the wall face 14 becomes excessive. This may result in a failure of fiber removal or sludge concentration of the liquid to be treated “A”, and sludge or water “W” may not be able to be appropriately discharged from the apertures 15. However, in the supply portion 17, the course of the flow of the liquid to be treated “A” is changed on the flow change plates 18 and the liquid to be treated “A” is dispersed on the guide plate 19. Thus, the liquid to be treated “A” collides with the wall face 14, an area of the collision being much larger than the size of the introduction tube opening 11A, which is the opening of the liquid-to-be-treated introduction tube 11. Thus, the flow rate of the liquid to be treated “A” for each of the plurality of regularly arranged apertures 15 can be reduced and made uniform, the sludge or water “W” of the liquid to be treated “A” can be appropriately discharged from the apertures 15.

In addition, the liquid to be treated “A” that flows on the guide plate 19 and along the flow change plate 18B, that is, the liquid to be treated “A” that has redirected downward in a direction opposite to the direction (F) is designed to be discharged onto the vicinity of a connection point of the blocking plate 20B and the wall face 14 in the liquid-to-be-treated introduction section α . Thus, since the sludge or water “W” of the liquid to be treated “A” can be discharged from the furthest end portion of the body portion 10 in which the apertures 15 are formed, the effective length of the body portion 10 can be utilized to the greatest extent possible.

[0020]

Note that in the drum screen device 100, the support member 12 (12a, 12b) that rotatably supports the body portion 10 is disposed on each side of the body portion 10. However, unless there is any problem in mechanical

strength, the support member 12 may be provided on only one side to support the body portion 10 in a cantilevered fashion.

(Modified Example)

5 A drum screen device 101, which is a modified example of the present invention, will be described with reference to Fig. 4. Only differences from the drum screen device 100 in the above-described embodiment in Fig. 1 will be mainly described, and description of similarities will be omitted.

10 In the drum screen device 101 in Fig. 4, instead of the support member 12b in Fig. 1, a support member 30 that rotatably supports the body portion 10 from below is disposed on the other end of the body portion 10. The support member 30 is a roller (roller member) that rotates about an axis that is parallel to the central axis 10A of the body portion 10. In Fig. 4, the drive means 13 is configured to rotate the support member 12a, but the drive means 13 may rotate the support member 30.

15 The support member 30 is disposed between the blocking plate 20A and the discharge ports 22. Therefore, when the block-like substance “S” is discharged from the discharge port 22, the block-like substance “S” does not contact the support member 30, thereby suppressing troubles such as the occurrence of corrosion or rotation failure of the support member 30. Note
20 that both ends of the body portion 10 may be supported only by a plurality of support members 30.

[0021]

The drum screen device 101 includes a flow rate sensor 41 provided on the second discharge tube 23, a flow rate regulation means 42 provided on the
25 liquid-to-be-treated introduction tube 11, and a control device 40 that is configured to receive a detection signal from the flow rate sensor 41 and to control the flow rate regulation means 42 and the drive means 13 according to the detection signal.

30 The flow rate sensor 41 detects the flow rate of sludge or water discharged into the second discharge tube 23, and it sends a detection signal corresponding to the flow rate.

The flow rate regulation means 42 is, for example, a motor valve or a pump. The control device 40 can control the flow rate regulation means 42 to increase or decrease the supply amount of the liquid to be treated “A”.

35 The control device 40 can control the drive means 13 such as an electric motor to increase or decrease the rotational speed (number of revolutions per unit time) of the body portion 10.

Fig. 4 illustrates an addition device 50 provided on the liquid-to-be-treated introduction tube 11 downstream of the flow rate regulation means 42 and upstream of the body portion 10. The addition device 50 is a device that is configured to inject the flocculant “G” continuously into the liquid to be treated “A” through the liquid-to-be-treated introduction tube 11. Thus, in the case of using the drum screen device 101 as the fiber removal device, the addition device 50 is not necessary. In other words, the addition device 50 is provided in the case of using the drum screen device 101 as the sludge concentration device.

[0022]

In Fig.4, the control of the drum screen device 101 by the control device 40 will be described separately for the case of using the drum screen device 101 as the fiber removal device, and for the case of using the drum screen device as the sludge concentration device.

First, the case of using the drum screen device 101 as the fiber removal device will be described. As described above, in this case, the addition device 50 in Fig. 4 is not provided.

When an operator activates the drum screen device 101, for example, by turning on a power switch, the control device 40 controls the drive means 13 to rotate the body portion 10 at a predetermined rotational speed in a fixed direction, and controls the flow rate regulation means 42 to flow the liquid to be treated “A” to the liquid-to-be-treated introduction tube 11 at a predetermined flow rate. As a result, the liquid to be treated “A” is supplied from the supply portion 17 disposed in the liquid-to-be-treated introduction section α to the interior of the body portion 10.

The liquid to be treated “A” flows from the liquid-to-be-treated introduction section α toward the block-like substance discharge section γ . In this course, the majority of the sludge (for example, sludge of 95% or higher) of the liquid to be treated “A” is discharged in the separated liquid discharge section β , and substantially only fibers contained in the liquid to be treated “A” are discharged as the block-like substances “S” from the block-like substance discharge section γ .

However, depending on the characteristics of the liquid to be treated “A”, at the predetermined flow rate and the predetermined rotational speed as described above, a large quantity of sludge is discharged from the block-like substance discharge section γ , and the detected value of the flow rate sensor 41 may be larger than the predetermined value. In this case, the liquid to be treated “A” is supplied more than necessary from the liquid-to-be-treated

introduction tube 11 or the rotational speed is too slow. Therefore, the control device 40 controls the flow rate regulation means 42 to reduce the supply amount of the liquid to be treated “A” or increase the rotational speed of the body portion 10.

5 At this time, the control device 40 appropriately controls the rotational speed in the range of rotational speed at which fibers contained in the liquid to be treated “A” grow into a cylindrical shape (roll shape) in the lengthwise direction of the body portion 10. For example, the rotational speed is preferably not less than the linear speed of 0.1 m/s. The predetermined
10 rotational speed is also within the range.

 The supply portion 17 can cause the liquid to be treated “A” to be discharged onto a portion of the wall face that is moving upward within the rotating wall face 14, and appropriately set the rotational speed of the body portion 10, thereby growing fibers contained in the liquid to be treated “A” into
15 a cylindrical shape (roll shape). Note that in a case where the liquid to be treated “A” is discharged onto a portion of the wall face that is moving downward within the rotating wall face 14, fibers contained in the liquid to be treated “A” cannot be grown into a roll shape.

 With the rotation of the body portion 10, roll-shaped fibers catch fibers
20 entangled in the apertures 15 and grow (become larger). Thus, during operation of the drum screen device 101, clogging of the apertures 15 in the wall face 14 can be prevented. Accordingly, the body portion 10 washes itself (cleans itself), and it is not necessary to regularly perform the cleaning operation of the drum screen device 101 for a long time. In other words, the
25 drum screen device 101 is free of maintenance and thus, is excellent from the perspective of manufacturing costs and maintenance costs.

[0023]

 Next, a case of using the drum screen device 101 as a sludge concentration device will be described.

30 As described above, in this case, the addition device 50 in Fig. 4 is installed, and the flocculant “G” is injected into the liquid to be treated “A”.

 When the operator activates the drum screen device 101, for example, by turning on a power switch, the control device 40 controls the drive means 13 to rotate the body portion 10 at a predetermined rotational speed in a fixed
35 direction, and controls the flow rate regulation means 42 to flow the liquid to be treated “A” to the liquid-to-be-treated introduction tube 11 at a predetermined flow rate. When the operator activates the drum screen device 101, the addition device 50 is activated, and the flocculant “G” is mixed into

the liquid to be treated “A” flowing through the liquid-to-be-treated introduction tube 11. As a result, from the supply portion 17 disposed in the liquid-to-be-treated introduction section α , flocculated sludge containing sludge flocks increased in size due to the flocculant “G”, that is, the liquid to be treated “A” containing the flocculant “G”, is supplied to the interior of the body portion 10.

The liquid to be treated “A” flows from the liquid-to-be-treated introduction section α toward the block-like substance discharge section γ . In this course, water in the liquid to be treated “A” is discharged in the separated liquid discharge section β , and the flocculated sludge concentrated as the block-like substances “S” is discharged from the block-like substance discharge section γ .

However, depending on the characteristics of the liquid to be treated “A”, at the predetermined flow rate and the predetermined rotational speed as described above, a larger quantity of water than set is discharged from the block-like substance discharge section γ , and the detected value of the flow rate sensor 41. In this case, since the liquid to be treated “A” is supplied more than necessary from the liquid-to-be-treated introduction tube 11 or the rotational speed is too slow. Therefore, the control device 40 controls the flow rate regulation means 42 to reduce the supply amount of the liquid to be treated “A”, or to increase the rotational speed of the body portion 10. Note that in the case of using the drum screen device 101 as the sludge concentration device, unlike the case of using the drum screen device as the fiber removal device, the control device 40 controls the rotational speed within a range in which the liquid to be treated “A” does not grow into a cylindrical shape (roll shape). The predetermined rotational speed is also within the range. This is because, in the case of sludge concentration, treatment can be effectively performed if the contact area of the liquid to be treated “A” containing sludge flocks of larger diameter with the body portion 10 is large.

[0024]

As described above, the drum screen devices 100, 101 in the embodiment and the modified example of the present invention enable the supply portion 17 to discharge the sludge or water “W” of the liquid to be treated “A” from the furthest end portion of the body portion 10 where the apertures 15 are formed. Therefore, the effective length of the body portion 10 can be utilized to the greatest extent possible.

In addition, the liquid to be treated “A” is dispersed in the supply portion 17 and discharged onto the wall face 14 of the body portion 10.

Therefore, the flow rate of the liquid to be treated “A” to each of the apertures 15 can be mitigated, and the liquid to be treated “A” is appropriately treated.

[0025]

Note that, in the drum screen device 101, the control device 40 can
5 control the supply amount of the liquid to be treated “A” and the rotational
speed of the body portion 10. However, the control device 40 may not be
provided, and based on the detected value obtained by the flow rate sensor 41,
the operator may manually operate the flow rate regulation means 42 to change
the supply amount of the liquid to be treated “A”, or the operator may manually
10 operate the drive means 13 to change the rotational speed of the body portion
10. Furthermore, various sensors such as electromagnetic sensors, ultrasonic
sensors, and the like can be used as the flow rate sensor 41. In addition, in the
drum screen device 101, the addition device 50 is provided in the middle of the
liquid-to-be-treated introduction tube 11, but a separate reaction tank (not
15 illustrated) may be provided in a preceding stage of the flow rate regulation
means 42, and a coagulation operation of increasing the size of sludge flocks
may be performed.

[0026]

The embodiment and the modified example of the present invention have
20 been described above in detail with reference to the drawings, but the specific
configurations are not limited to these, and also include design changes and the
like that do not deviate from the scope of the present invention.

Industrial Applicability

25 [0027]

The present invention relates to a drum screen device formed of a
perforated metal. According to the present invention, the effective length of
the drum screen can be optimized to miniaturize the device and further, the
flow rate of the liquid to be treated dropping onto the drum screen can be
30 mitigated to appropriately treat the liquid to be treated.

Reference Signs List

[0028]

- 10 Body portion
- 35 10A Central axis
- 11 Liquid-to-be-treated introduction tube
- 11A Introduction tube opening
- 12a, 12b Support member

- 13 Drive means
- 14 Wall face
- 15 Aperture
- 16 First discharge tube
- 5 17 Supply portion
- 18A, 18B, 18C Flow change plate
- 19 Guide plate
- 20A Blocking plate (second blocking plate)
- 20B Blocking plate (first blocking plate)
- 10 22 Discharge port
- 23 Second discharge tube
- 30 Support member (roller member (roller))
- 40 Control device
- 41 Flow rate sensor
- 15 42 Flow rate regulation means
- 50 Addition device
- 100 Perforated metal drum screen device
- 101 Perforated metal drum screen device
- “A” Liquid to be treated
- 20 “G” Flocculant
- “S” Block-like substance
- “W” Sludge or water

Claims

[Claim 1]

A perforated metal drum screen device comprising:

- a cylindrical body portion having a central axis disposed in a substantially horizontal direction and a wall face formed of a perforated metal;
- a first blocking plate configured to block one end of the body portion except for a vicinity of the central axis;
- a liquid-to-be-treated introduction tube disposed on the central axis, the liquid-to-be-treated introduction tube being configured to supply a liquid to be treated through the first blocking plate;
- a supply portion connected to the liquid-to-be-treated introduction tube, the supply portion being configured to receive the liquid to be treated;
- a second blocking plate configured to block the other end of the body portion;
- a support member configured to rotatably support the body portion about the central axis; and
- a drive means configured to rotate the body portion, wherein

- a plurality of apertures are formed in the wall face except for a vicinity of the second blocking plate,
- a plurality of block-like substance discharge ports larger than the apertures are formed in the wall face in the vicinity of the second blocking plate,

the supply portion includes a substantially trapezoidal guide plate and a flow change plate connected to a side other than a base of the substantially trapezoid, and

the flow change plate configured to direct the flow of the liquid to be treated outward in a radial direction of the body portion and to disperse the liquid to be treated on the guide plate, and causes the dispersed liquid to be treated to drop from the base onto the wall face including at least the vicinity of the first blocking plate.

[Claim 2]

The perforated metal drum screen device according to claim 1, wherein

- the liquid to be treated is sludge containing fibers,
- the supply portion causes the liquid to be treated to be discharged onto the wall face moving upward due to the rotation, and

the drive means rotates the body portion at a rotational speed at which the fibers grow into a roll shape in the body portion.

[Claim 3]

The perforated metal drum screen device according to claim 1, wherein the liquid to be treated is sludge containing a flocculant, and the drive means rotates the body portion at a rotational speed at which the liquid to be treated does not grow into a roll shape in the body portion.

[Claim 4]

The perforated metal drum screen device according to any one of claims 1 to 3, further comprising:

a flow rate sensor provided on a discharge tube leading to the block-like substance discharge ports, the flow rate sensor being configured to detect a flow rate of sludge or water in the liquid to be treated discharged through the block-like substance discharge ports;

a flow rate regulation means provided on the liquid-to-be-treated introduction tube; and

a control device configured to, when a detected value of the flow rate sensor is larger than a predetermined value, control the flow rate regulation means to decrease a supply amount of the liquid to be treated or control the drive means to increase a rotational speed of the body portion.