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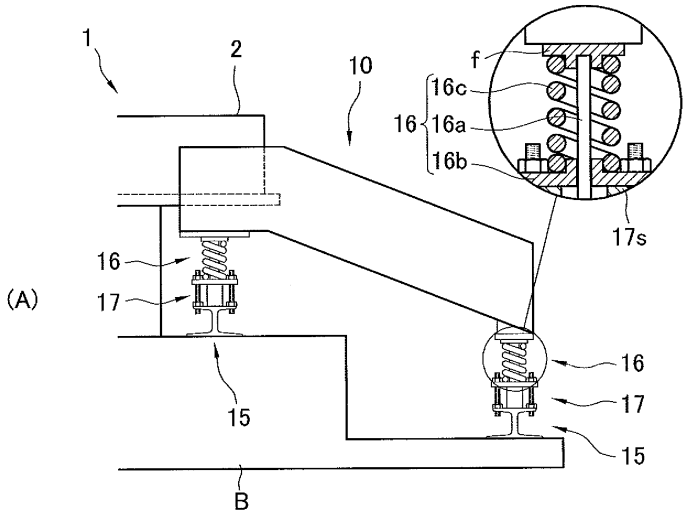
(54) **VIBRATING SCREEN DEVICE**

(57) Provided is a vibration sieve device capable of preventing the occurrence of damage to a chute while maintaining discharge of a material using the chute.

A vibration sieve device 1 includes: a case 2; a screen 3 disposed inside the case 2; and a vibration unit configured to vibrate the case 2. The case 2 has a residual material discharge port 2c configured to discharge a residual material MR remaining on the screen 3 after screening to an outside of the case 2. The case 2 includes a discharge chute 10 configured to discharge the residual material MR discharged from the residual material discharge port 2c, the discharge chute 10 having an inner bottom surface 11a where one end is disposed at a lower part of the residual material discharge port 2c of the case 2 and the inner bottom surface 11a is downwardly inclined from the one end to another end of the inner bottom surface 11a. The discharge chute 10 is disposed so as not to be brought into contact with the case 2 in a state where the case 2 is not vibrated.



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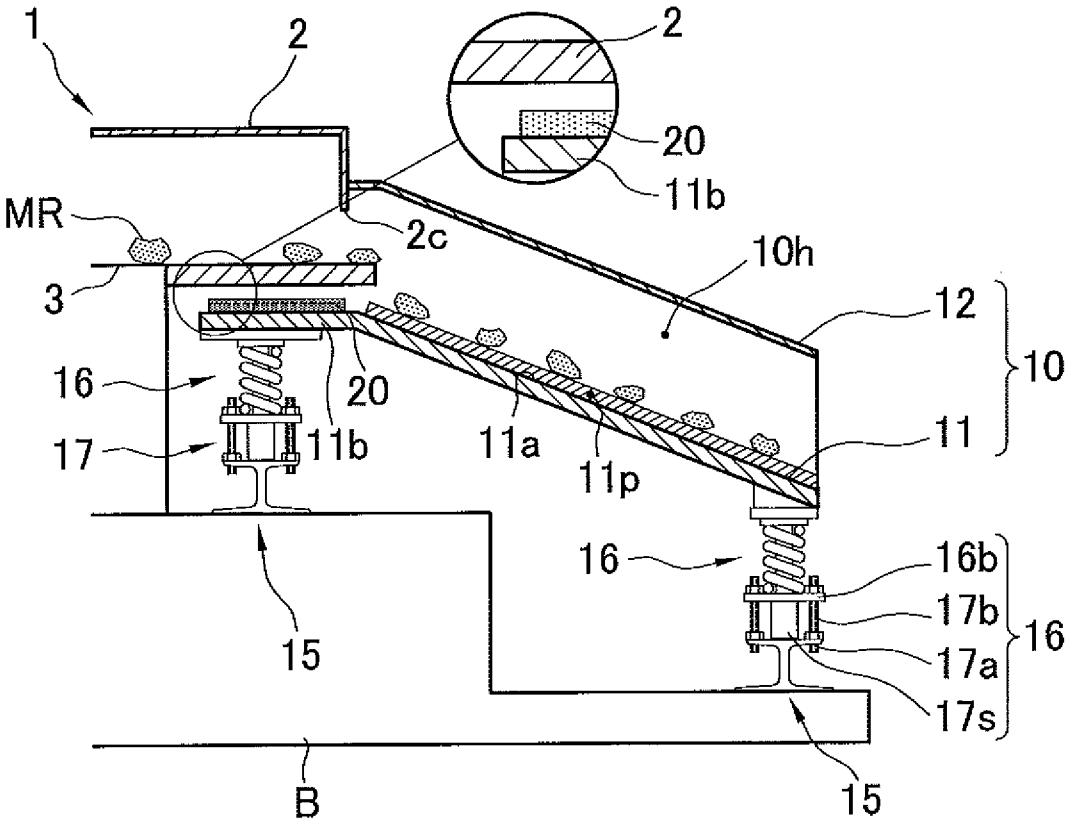
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Description

TECHNICAL FIELD

[0001] The present invention relates to a vibration sieve device, and more particularly to a vibration sieve device that includes a chute for discharging a material screened by the vibration sieve device.

BACKGROUND ART

[0002] In a case where materials are screened according to their sizes from a mixture that contains a plurality of materials having different sizes, a sieve that includes a net having a predetermined mesh is used. That is, the mixture can be screened by putting the mixture in the sieve and by swinging or vibrating the sieve.

[0003] As such a device that mechanically performs such screening, there has been known a vibration sieve device that includes a vibration screen (see Patent Document 1). The vibration sieve device includes: a supply part configured to supply a mixture; a screen (net) disposed horizontally or slightly obliquely; a vibration part configured to vibrate the net; a discharge part configured to discharge a screened material; and an oversize material discharge part configured to discharge a material remaining on the screen. With such a configuration, by operating the vibration part in a state where a mixture to be screened is placed on the screen, it is possible to screen the mixture on the screen. As a result, the material that passes through the screen can be discharged from the discharge part to the outside. Further, the material remaining on the screen can be also discharged to the outside from an oversize material discharge part.

[0004] A discharge chute is used in general as the oversize material discharge part configured to discharge a material remaining on the screen from the vibration sieve device. The discharge chute has an inclined inner bottom surface. With the supply of a material from one end of the discharge chute onto the inner bottom surface, the material slides or rolls on the inner bottom surface so that the material can be discharged from the other end of the discharge chute.

PRIOR ART DOCUMENT

PATENT DOCUMENT

[0005] Patent Document 1: JP-UM-A-7-25975

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0006] In the vibration sieve device having the above-mentioned structure, a material is supplied to the discharge chute by letting the material fall onto the inner bottom surface of the discharge chute from the oversize material discharge part of the vibration sieve device. The material discharged from the oversize material discharge part has a certain degree of size. Accordingly, an impact generated when the material falls onto the inner bottom surface of the discharge chute is large and hence, there may be case where the inner bottom surface of the discharge chute is deformed or damaged due to the impact. When such damage occurs, the movement of the material on the inner bottom surface of the discharge chute becomes difficult. In a worst case, there is a possibility that the discharge chute is clogged with a material. Accordingly, when the inner bottom surface of the discharge chute is damaged, maintenance such as repair becomes necessary so as to maintain the movement of the material.

[0007] On the other hand, when the vibration sieve device is provided in a facility such as a steel refining process, screening is continuously performed and hence, a material is continuously supplied also to the discharge chute. That is, a situation arises where an impact is repeatedly applied to the inner bottom surface of the discharge chute. Since there is a possibility that the inner bottom surface of the discharge chute is damaged in a relatively short time and hence, the maintenance of the discharge chute must be performed frequently.

[0008] To repair the discharge chute, it is necessary to stop an operation of the vibration sieve device, and there may be a case where an operation of a facility must be stopped due to stopping of the operation of the vibration sieve device. As a result, there may be a case where operation efficiency of the facility per se is lowered due to frequent maintenance of the discharge chute.

[0009] In view of the above, as a method of preventing the occurrence of damage to the discharge chute, there has been adopted a method where an impact resistance is increased by adhering an damping member to an inner bottom surface of a discharge chute or a method where a vibration resistance is enhanced by increasing rigidity of a discharge chute per se or by separating a discharge chute from a vibration sieve device.

[0010] However, in the case where an impact resistance is increased by adhering the damping member to the inner bottom surface of the discharge chute, although an impact generated by a falling material can be alleviated, energy for moving the material is also absorbed. As a result, there may be a case where a force that the material possesses for moving in the discharge chute after falling is also decreased. In this case, there is a possibility that the discharge chute is clogged due to a defective movement of the material.

[0011] As the method of increasing rigidity for increasing vibration resistance, a method is considered where a wall thickness of a material used for forming the discharge chute is increased or a material property of such a material is changed. In general, a discharge chute is formed using an iron plate made of carbon steel or the like, the increase in a wall thickness of the material gives rise to drawbacks such as lowering of treatment ability

or acceleration of the occurrence of cracks due to the increase in a weight of the vibration sieve device. On the other hand, when a discharge chute is manufactured using a raw material that is light-weight and has high durability compared to an iron plate, there is a possibility that a burden on cost for the manufacture and the maintenance of the vibration sieve device becomes high. Further, it is not always the case that such a material is superior to an iron plate with respect to a repeatedly applied stress.

[0012] On the other hand, there has been also known a method where a discharge chute is provided as a fixed chute that is separated from a body of a vibration sieve device. In this case, vibration of the vibration sieve device is not applied to the fixed chute and hence, it is unnecessary to take into account vibration resistance.

[0013] In the case of using the fixed chute as the discharge chute, vibration generated by the vibration sieve device cannot be used for moving a material and hence, it is necessary to smoothly supply the material from the vibration sieve device to the fixed chute. To be more specific, the material supplied to the fixed chute from the vibration sieve device must be smoothly moved on the fixed chute. As a method for smoothly moving the material on the fixed chute, considered is a method where a difference in elevation that the material falls from the vibration sieve device to the fixed chute is increased or a method where inclination of an inner bottom surface of the fixed chute is increased or the like, for example.

[0014] However, a difference in elevation or an inclination angle is limited because of restriction imposed on the connection with a succeeding step, an installation space or the like and hence, it is not always possible to ensure a proper difference in elevation or a proper inclination angle. Further, when a difference in elevation is increased, an impact generated when the material falls on an inner bottom surface of the fixed chute is increased and hence, impact resistance is lowered even when vibration resistance is increased.

[0015] As described above under the current circumstances, there has been proposed no chute that can prevent damage to a chute while maintaining smooth discharge of a material, and there has been a demand for a vibration sieve device having such a chute.

[0016] The present invention has been made in view of the above-mentioned circumstances, and it is an object of the present invention to provide a vibration sieve device capable of preventing the occurrence of damage to a chute while maintaining discharge of a material using the chute.

MEANS FOR SOLVING THE PROBLEMS

[0017] A vibration sieve device according to a first invention is a vibration sieve device including a case; a screen disposed inside the case; and a vibration unit configured to vibrate the case, characterized in that the case has a residual material discharge port configured to discharge a residual material remaining on the screen after screening to an outside of the case, the case includes a discharge chute configured to discharge the residual material discharged from the residual material discharge port, the discharge chute having an inner bottom surface where one end is disposed near the residual material discharge port of the case and the inner bottom surface is downwardly inclined from the one end to another end of the inner bottom surface, and the discharge chute is disposed so as not to be brought into contact with the case in a state where the case is not vibrated.

[0018] A vibration sieve device according to a second invention is the vibration sieve device according to the first invention, characterized in that a damping member is disposed between the discharge chute and the case, and the damping member is disposed such that the discharge chute is brought into contact with the case by way of the damping member when the vibration unit vibrates the case.

[0019] A vibration sieve device according to a third invention is the vibration sieve device according to the first or the second invention, further including a leg portion configured to fix the discharge chute to a foundation or the like, characterized in that the leg portion includes a moving portion configured to hold the discharge chute in a movable manner along an axial direction of the leg portion, and the moving portion includes an elastic member extendable and compressible along the axial direction of the leg portion.

[0020] A vibration sieve device according to a fourth invention is the vibration sieve device according to the third invention, further including a plurality of the leg portions, characterized in that each of the leg portions includes an axial length adjusting portion for adjusting a length of the leg portion.

[0021] A vibration sieve device according to a fifth invention is the vibration sieve device according to the first, the second, the third or the fourth invention, characterized in that a layer made of ultrahigh molecular weight polyethylene is formed on the inner bottom surface of the discharge chute.

EFFECT OF THE INVENTION

[0022] According to the first invention, although the case and the discharge chute are not fixed to each other, when the case, which is vibrating, is brought into contact with the discharge chute, vibration of the case can be transmitted to the discharge chute. As a result, vibration of the case can be converted into a force that moves a residual material in the discharge chute and hence, the residual material can be smoothly moved in the discharge chute. Further, compared to a case where the case and the discharge chute are brought into direct contact with each other, vibration applied to the discharge chute can be decreased and hence, the occurrence of damage to the discharge chute due to vibration can be prevented.

[0023] According to the second invention, when the

case is vibrated, the case and the discharge chute are brought into contact with each other by way of the damping member and hence, damage to the chute, which occurs when the case and the discharge chute are brought into contact with each other, can be prevented.

[0024] According to the third invention, the discharge chute is held by the elastic member in a movable manner and hence, the discharge chute can be easily vibrated due to the vibration of the case.

[0025] According to the fourth invention, a height of the discharge chute or inclination of the inner bottom surface can be adjusted by adjusting the length of the leg portion and hence, the discharge chute can be brought into a proper state according to a state of the residual material.

[0026] According to the fifth invention, an impact generated when a residual material falls can be alleviated and hence, the occurrence of damage to the discharge chute can be suppressed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

Fig. 1 is a schematic explanatory view of a vibration sieve device 1 according to the present embodiment.
Fig. 2 is a schematic explanatory view of a vibration sieve device 1 according to another embodiment.

MODE FOR CARRYING OUT THE INVENTION

[0028] The vibration sieve device according to the present invention is provided for screening a mixture containing a plurality of materials having different sizes, and is characterized in that the vibration sieve device can stably discharge a screened residual material while preventing the occurrence of damage to a chute.

[0029] The vibration sieve device according to the present invention can be used in various applications where a mixture is screened. For example, the vibration sieve device according to the present invention can be used as a device that screens a mixture manufactured in a preceding step, and supplies a material having a predetermined size to a succeeding step or the like in a manufacturing facility. As such a manufacturing facility, a high pressure acid leach (HPAL) process, ore separation or the like can be named. In a facility that recovers valuable metal such as nickel from a low-grade nickel oxide ore using a high pressure acid leach (HPAL) process, the vibration sieve device according to the present invention can be used as a device that separates oversized ores containing undesired rocks or the like from valuable ores and discharges these materials.

(Vibration sieve device 1 according to the present embodiment)

[0030] The vibration sieve device 1 according to the present embodiment is a device that screens a mixture supplied from another device or the like into a material having a predetermined size or less and a residual material MR by a screen 3, and supplies the screened material to another device or the like.

[0031] Although the vibration sieve device 1 according to the present embodiment is characterized by a discharge chute 10 that discharges the residual material MR, first, the overall configuration of the vibration sieve device 1 according to the present embodiment is described.

[0032] In Fig. 1, symbol 2 indicates a case of the vibration sieve device 1 according to the present embodiment. The case 2 is a hollow member, and a mixture is supplied to the inside of the case 2 from above. The case 2 is disposed in a movable manner with respect to a base B such as a floor by way of a damping member such as a spring, and is connected to a vibration unit that vibrates the case 2 vertically.

[0033] As shown in Fig. 1, the screen 3 is disposed in the inside of the case 2 so as to vertically divide a space formed in the case 2. The screen 3 is a sheet-like or a plate-like member such as a net in which apertures that penetrate from a front side to a rear side of the member are formed. That is, the screen 3 is provided such that when a mixture is supplied to an upper surface of the screen 3, a material having a size smaller than a predetermined size is allowed to pass through apertures formed in the screen 3 and to fall downward, while a residual material MR larger than the material in size remains on the screen 3.

[0034] A residual material discharge port 2c is formed on a discharge end portion (a right end in Fig. 1) of the case 2. The residual material discharge port 2c is disposed such that an upper end of the residual material discharge port 2c is positioned above the screen 3. That is, the residual material discharge port 2c is disposed such that the residual material MR on the screen 3 can be made to fall to the outside.

[0035] As shown in Fig. 1, a discharge chute 10 is disposed near the discharge end portion of the case 2. To be more specific, the discharge chute 10 has a space 10h surrounded by a bottom plate 11 and a cover 12, and is disposed such that one end portion of the discharge chute 10 covers the residual material discharge port 2c of the case 2.

[0036] The bottom plate 11 of the discharge chute 10 is disposed such that one end portion of the bottom plate 11 extends to an area below the discharge end portion of the case 2, and an inner bottom surface 11a of the bottom plate 11 is inclined downwardly from one end portion to the other end portion of the inner bottom surface 11a (from a left end toward a right end in Fig. 1).

[0037] The discharge chute 10 is mounted on the base B or the like using a plurality of leg portions 15 independently of the case 2. The discharge chute 10 is held by a plurality of leg portions 15 such that the discharge chute 10 is not brought into direct contact with the case 2 in a state where the case 2 is not vibrated.

[0038] With such a configuration, by supplying a mixture onto the screen 3 while vibrating the case 2 by the vibration unit, the screen 3 can screen the mixture into a screened material and a residual material MR. Then, the residual material MR on the screen 3 can be supplied to the discharge chute 10 through the residual material discharge port 2c.

[0039] The discharge chute 10 is disposed such that the inner bottom surface 11a of the bottom plate 11 is inclined downwardly from one end portion to the other end portion. Accordingly, a residual material MR in the space 10h of the bottom plate 11 slides or rolls on the inner bottom surface 11a of the bottom plate 11 and moves toward the other end of the discharge chute 10.

[0040] Accordingly, a residual material MR supplied from the residual material discharge port 2c of the case 2 to the discharge chute 10 can be discharged from the other end of the discharge chute 10 to the outside of the discharge chute 10 through the space 10h of the discharge chute 10.

[0041] In the inside of the case 2, the screen 3 may be arranged horizontally, or may be disposed in a downwardly inclined manner toward the residual material discharge port 2c by slightly inclining the screen 3. The position of a residual material MR on the screen 3 changes due to vibration of the case 2 and hence, even when the screen 3 is arranged horizontally, the residual material MR can be moved to the residual material discharge port 2c. However, by disposing the screen 3 in a downwardly inclined manner toward the residual material discharge port 2c, the residual material MR can be moved to the residual material discharge port 2c within a shorter time and with certainty.

[0042] Although a material that passes through the screen 3 is discharged from a lower portion of the case 2 to the outside, a method of discharging the material is not particularly limited. The material may be discharged to the outside by forming a discharge port in a bottom plate of the case 2, or the material may be directly made to fall into a tank or the like without providing a bottom plate.

(Discharge chute 10)

[0043] In the vibration sieve device 1 according to the present embodiment, the discharge chute 10 is held by a plurality of leg portions 15 such that the discharge chute 10 is not brought into direct contact with the case 2 in a state where the case 2 is not vibrated. However, the discharge chute 10 is configured such that vibration of the case 2 is transmitted to the discharge chute 10 when the case 2 is vibrated.

[0044] Hereinafter, the structure of the discharge chute 10 is described.

[0045] As described previously, one end portion of the bottom plate 11 is arranged below the lower end portion of the case 2. To be more specific, one end portion of the bottom plate 11 is arranged below the discharge end portion of the case 2 at the position where the residual material discharge port 2c is disposed. One end portion of the bottom plate 11 is arranged in a state where one end portion is spaced apart from a lower end of the discharge end portion of the case 2.

[0046] A vibration transmission portion 11b is formed on one end portion of the bottom plate 11. A damping member 20 is mounted on an upper surface of the vibration transmission portion 11b. The damping member 20 is made of a raw material having elasticity such as hard rubber or a silicon resin.

[0047] An upper surface of the damping member 20 is not brought into contact with a lower end portion of the case 2 in a state where the case 2 is not vibrated. However, the damping member 20 is disposed such that the upper surface of the damping member 20 can be brought into contact with the lower end portion of the case 2 when the case 2 is vibrated.

[0048] To be more specific, the damping member 20 is disposed such that a gap that is shorter than a stroke of vertical movement of the case 2 when the case 2 is vibrated is formed between the upper surface of the damping member 20 and the lower end portion of the case 2 in a state where the case 2 is not vibrated. For example, the damping member 20 is disposed such that a gap L between the upper surface and the lower end portion falls within a range of approximately 50 to 100 mm in a state where the case 2 is not vibrated.

[0049] By adopting the above-mentioned structure, when the case 2 is vibrated by the vibration unit, a state is brought about where the damping member 20 and the lower end portion of the case 2 repeat contacting and separating therebetween. Accordingly, along with vibration of the case 2, it is also possible to vibrate the bottom plate 11 (that is, the discharge chute 10). In other words, although the case 2 and the discharge chute 10 are not fixed to each other, vibration of the case 2 can be transmitted to the discharge chute 10. As a result, vibration of the case 2 can be converted into a force that moves a residual material MR in the discharge chute 10 and hence, it is possible to smoothly move the residual material MR in the discharge chute 10.

[0050] Further, vibration of the case 2 is transmitted to the discharge chute 10 only in a state where the case 2 is brought into contact with the damping member 20. As a result, compared to a case where the discharge chute 10 is fixed to the case 2 or is brought into direct contact with the case 2, vibration applied to the discharge chute 10 can be reduced. That is, a force that the discharge chute 10 receives due to vibration of the case 2 can be reduced and hence, the occurrence of damage to the discharge chute 10 due to such vibration can be prevented.

[0051] The lower end portion of the case 2 and the vibration transmission portion 11b of the bottom plate 11 may be brought into contact with each other directly or by way of the damping member 20 in a state where the case 2 is not vibrated. Also in this case, it is sufficient

that a state is brought about where the lower end portion of the case 2 and the vibration transmission portion 11b of the bottom plate 11 are separated from each other when the case 2 is vibrated (such a state also including a state where the lower end portion of the case 2 or the vibration transmission portion 11b of the bottom plate 11 is separated from the damping member 20).

(Moving portions 16 of the plurality of leg portions 15)

[0052] Particularly, by adopting a structure where the plurality of leg portions 15 respectively have the moving portion 16 that holds the discharge chute 10 in a state where the discharge chute 10 is movable along an axial direction (a vertical direction in Fig. 1) of the leg portions 15, the discharge chute 10 can be effectively vibrated due to vibration transmitted from the case 2. That is, even when vibration transmitted from the case 2 is not so large, it is possible to generate vibration in the discharge chute 10 to an extent that a residual material MR can be smoothly moved due to such vibration.

[0053] The configuration of the moving portion 16 is not particularly limited provided that the moving portion 16 can hold the discharge chute 10 such that the discharge chute 10 is movable along the axial direction of the leg portions 15, and the moving portion 16 has an elastic member which is compressible and restorable. The elastic member is not also particularly limited provided that the elastic member is compressible and restorable. For example, a coil spring, rubber, a pneumatic spring or the like can be used as the elastic member.

[0054] For example, as shown in Fig. 1, the moving portion 16 may have the structure where the moving portion 16 includes: a shaft portion 16a that has one end connected to the discharge chute 10; a bearing portion 16b that holds the shaft portion 16a movably along the axial direction of the leg portion 15; and a coil spring 16c that is disposed between a flange f formed on one end of the shaft portion 16a and the bearing portion 16b. When the case 2 vibrates, the case 2 moves up and down. When the case 2 moves downward so that a force is applied to the discharge chute 10 so as to press the discharge chute 10 downward, the coil spring 16c is compressed by the force, and the discharge chute 10 moves downward. On the other hand, when the case 2 moves upward so that the force that presses the discharge chute 10 downward is removed, the coil spring 16c extends and the discharge chute 10 moves upward. That is, the discharge chute 10 can be moved vertically with a certain stroke in an interlocking manner with the movement of the case 2 in the vertical direction due to vibration. In other words, with the provision of the moving portion 16 described above, a moving amount of the discharge chute 10 can be increased compared with the case where the moving portion 16 is not provided. Accordingly, an amount of vibration that enables smooth movement of a residual material MR can be generated in the discharge chute 10 due to vibration of the case 2.

[0055] From a viewpoint of an advantageous effect that a restoring force can be easily generated, it is preferable to mount the coil spring 16c in a compressed state.

[0056] In the case where the coil spring 16c is used as described above, to prevent falling of the coil spring 16c when the discharge chute 10 vibrates, it is desirable to form a projecting guide on the flange f and the bearing portion 16b. The coil spring 16c can be mounted in a stable state by inserting the projecting guides into both ends of the coil spring 16c.

(Axial length adjusting portions 17 of the plurality of leg portions 15)

[0057] It is desirable that each leg portion 15 include the axial length adjusting portion 17 that adjusts a length of the leg portion 15. By adjusting the length of each leg portion 15 by the axial length adjusting portion 17, it is possible to adjust a distance between the damping member 20 and the lower end portion of the case 2 in a state where the case 2 is not vibrated. With such a structure, when the case 2 is vibrated, a state of vibration applied to the discharge chute 10 from the case 2 can be properly adjusted according to a residual material MR.

[0058] A height of the discharge chute 10 and inclination of the inner bottom surface 11a of the bottom plate 11 can be adjusted and hence, the inclination and the height of the discharge chute 10 can be also brought into a proper state according to a state of a residual material MR.

[0059] The configuration of the axial length adjusting portion 17 is not particularly limited provided that the length of each leg portion 15 can be adjusted. For example, as shown in Fig. 1, the axial length adjusting portion 17 may be configured such that a plate 16b and a base 17a are connected to each other by adjusting bolts 17b, and a spacer 17s (for example, a hollow cylindrical spacer) is disposed between the plate 16b and the base 17a. The length of the leg portion 15 can be changed by adjusting a length of the spacer 17s and by fixing the plate 16b and the base 17a to each other by the adjusting bolts 17b.

(Damping member 20)

[0060] In the above-mentioned embodiment, the case has been described where the damping member 20 is mounted on one end portion of the bottom plate 11. However, the damping member 20 may be mounted on a lower end portion of the case 2, or may be mounted on both of one end portion of the bottom plate 11 and the lower end portion of the case 2. In either case, a state is brought about where one end portion of the bottom plate 11 and the lower end portion of the case 2 are not brought into contact with each other by way of the damping member 20 in a state where the case 2 is not vibrated.

[0061] It is not always necessary to provide the damping member 20. That is, the structure may be adopted

where one end portion of the bottom plate 11 and the lower end portion of the case 2 are brought into direct contact with each other when the case 2 is vibrated. However, with the provision of the damping member 20, it is possible to acquire an advantageous effect that damaging of both portions can be prevented compared to the case where both portions are brought into direct contact with each other.

(Stepped difference between screen 3 and bottom plate 11)

[0062] The height of the inner bottom surface 11a of the bottom plate 11 to the screen 3 is not particularly limited. However, it is preferable to set the height to approximately 150 to 300 mm from a viewpoint of preventing the generation of noise when a residual material MR falls and the occurrence of damage to the bottom plate 11 due to an impact generated when the residual material MR falls, and also from a viewpoint of smoothly moving a residual material MR supplied to the inner bottom surface 11a of the bottom plate 11.

(Structure of bottom plate 11)

[0063] It is desirable to form a layer 11p having impact absorbing property on the upper surface of the bottom plate 11 from a viewpoint of preventing the generation of noise when a residual material MR falls and the occurrence of damage to the bottom plate 11 due to an impact when the residual material MR falls. A raw material used for forming the layer 11p or the like is not particularly limited, ultrahigh molecular weight polyethylene or the like can be used. Particularly, by arranging a plurality of sheet-like members made of ultrahigh molecular weight polyethylene parallel to each other on the bottom plate 11, the layer 11p exhibits small friction and becomes slippery and hence, stagnation of a residual material MR can be easily prevented. Further, when the sheet is damaged, the sheet can be exchanged individually and hence, it is possible to acquire an advantageous effect that an operation time for maintenance or the like can be shortened.

[0064] The bottom plate 11 may be formed of a planar member, or may be formed of a groove-shaped member having an approximately U-shaped cross section or the like.

(Other configuration of discharge chute 10)

[0065] The bottom plate 11 of the discharge chute 10 may be formed of one sheet. However, from a viewpoint of enhancing rigidity of the discharge chute 10, it is desirable that the bottom plate 11 have the duplicate structure as shown in Fig. 2 and, further, a reinforcing frames 10f be formed on side walls of the discharge chute 10. With such a configuration, it is possible to increase rigidity of the discharge chute 10 per se against vibration.

INDUSTRIAL APPLICABILITY

[0066] The vibration sieve device according to the present invention is suitable as a device for screening a mixture that contains lumps having a certain degree of size.

DESCRIPTION OF REFERENCE SIGNS

[0067]

1:	vibration sieve device
2:	case
2c:	residual material discharge port
3:	screen
10:	discharge chute
11:	bottom plate
12:	cover portion
15:	leg portion
16:	moving portion
17:	axial length adjusting portion
20:	damping member
M:	mixture
MR:	residual material

Claims

1. A vibration sieve device comprising:

a case;
a screen disposed inside the case; and
a vibration unit configured to vibrate the case,

wherein
the case has a residual material discharge port configured to discharge a residual material remaining on the screen after screening to an outside of the case,
the case includes a discharge chute configured to discharge the residual material discharged from the residual material discharge port, the discharge chute having an inner bottom surface where one end is disposed near the residual material discharge port of the case and the inner bottom surface is downwardly inclined from the one end to another end of the inner bottom surface, and
the discharge chute is disposed so as not to be brought into contact with the case in a state where the case is not vibrated.

2. The vibration sieve device according to claim 1, wherein
a damping member is disposed between the discharge chute and the case, and
the damping member is disposed such that the discharge chute is brought into contact with the case by way of the damping member when the vibration

unit vibrates the case.

3. The vibration sieve device according to claim 1 or 2 further comprising a leg portion configured to fix the discharge chute to a foundation or the like, wherein
the leg portion includes a moving portion configured to hold the discharge chute in a movable manner along an axial direction of the leg portion, and
the moving portion includes an elastic member extendable and compressible along the axial direction of the leg portion.

4. The vibration sieve device according to claim 3, further comprising a plurality of the leg portions, wherein each of the leg portions includes an axial length adjusting portion configured to adjust a length of the leg portion.

5. The vibration sieve device according to claim 1, 2, 3, or 4 wherein a layer made of ultrahigh molecular weight polyethylene is formed on the inner bottom surface of the discharge chute.

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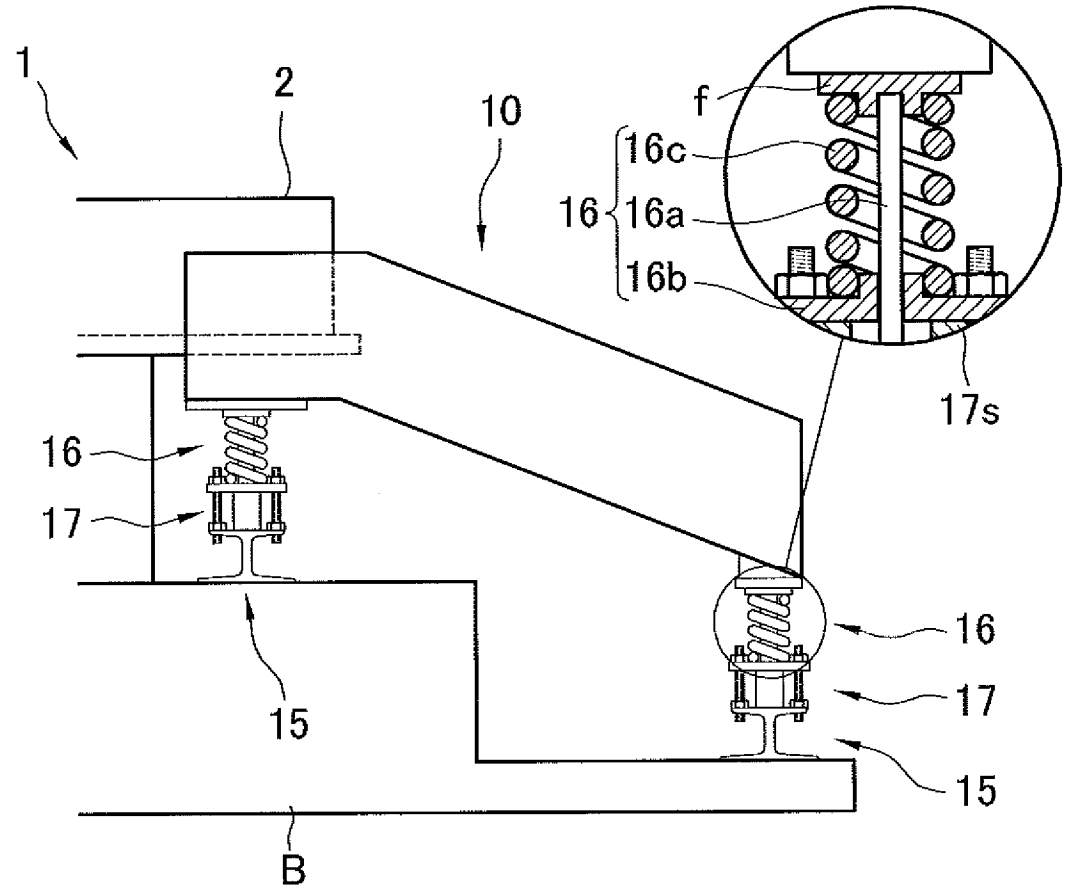
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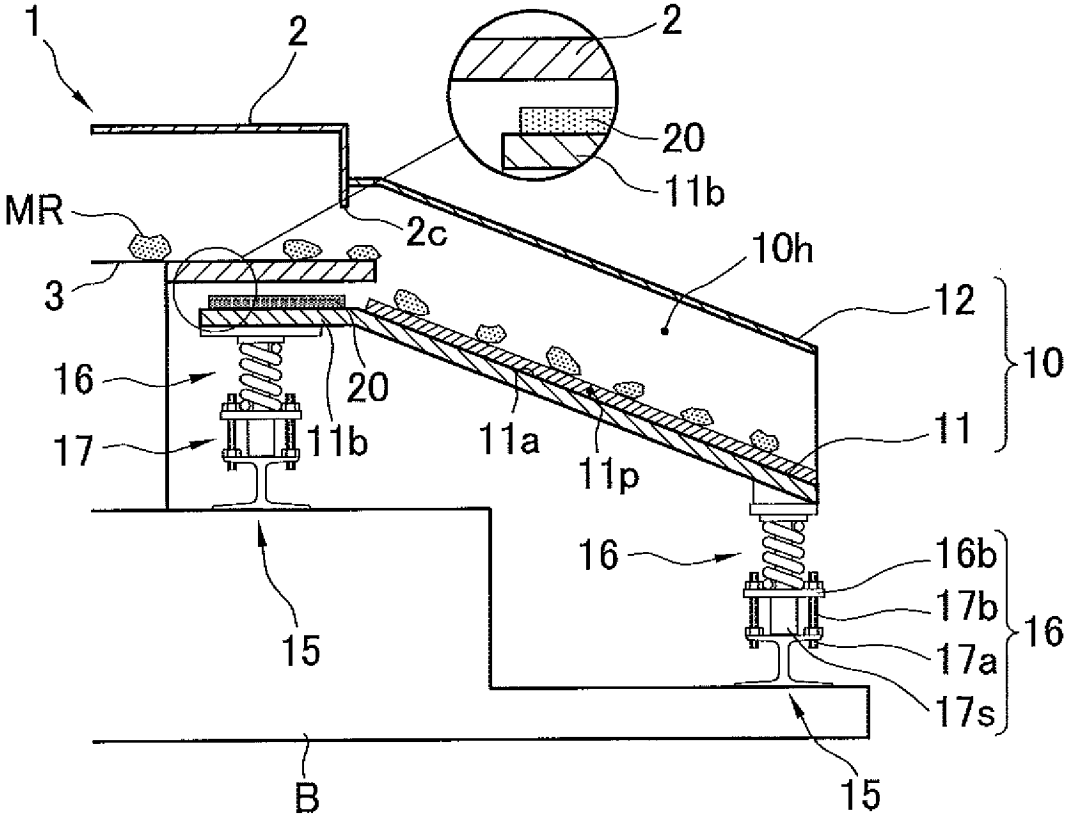
(B)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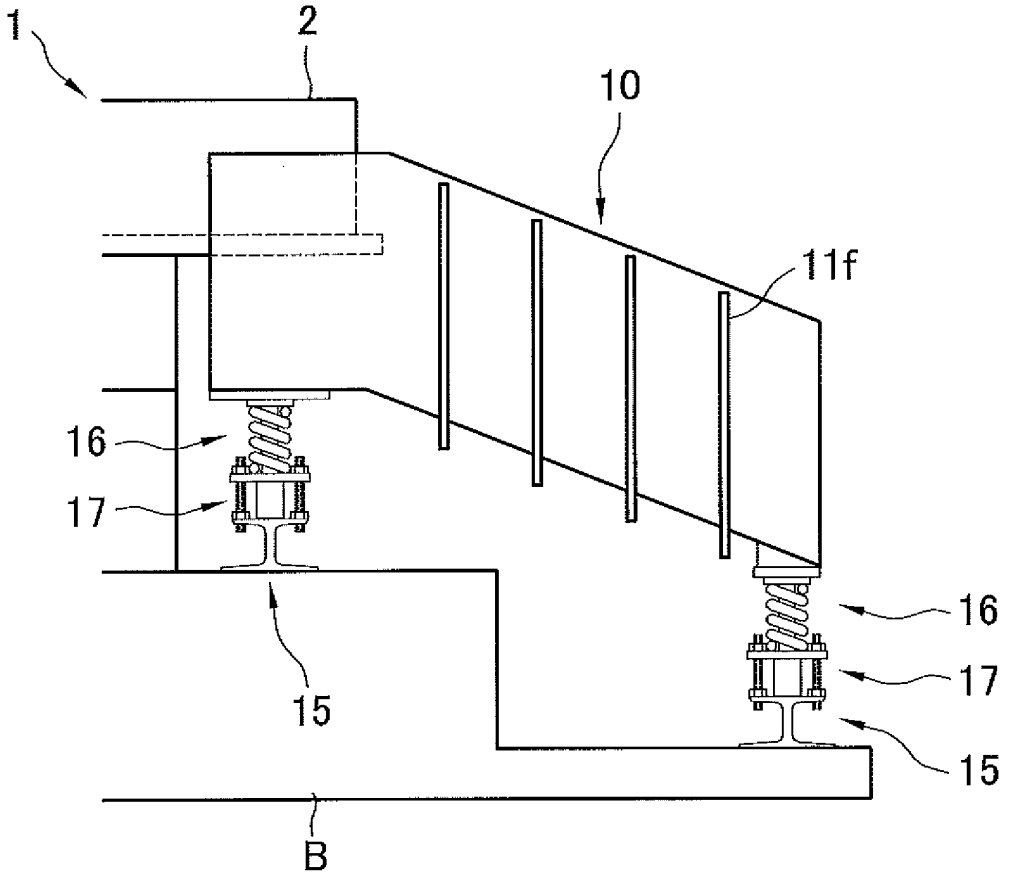
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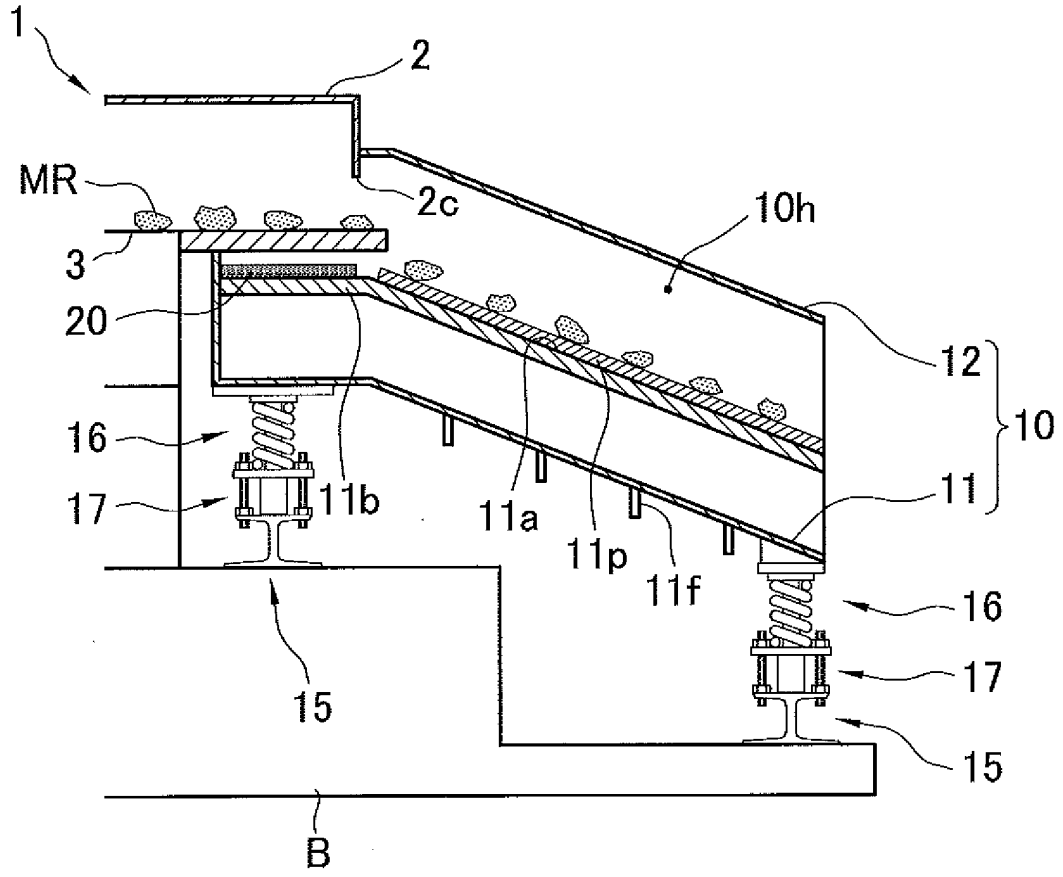
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2017/008415

A. CLASSIFICATION OF SUBJECT MATTER
B07B1/28(2006.01)i, *B07B1/46*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B07B1/28, B07B1/46, E02F7/06, B22C5/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2017
Kokai Jitsuyo Shinan Koho 1971-2017 Toroku Jitsuyo Shinan Koho 1994-2017

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 066966/1974(Laid-open No. 155661/1975) (NKK Corp.), 23 December 1975 (23.12.1975), page 4; fig. 1 (Family: none)	1 5 2-4

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 May 2017 (12.05.17)	23 May 2017 (23.05.17)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2017/008415

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 123915/1977(Laid-open No. 50389/1979) (Central Glass Co., Ltd.), 07 April 1979 (07.04.1979), page 5, line 19 to page 6, line 3; page 7, line 10 to page 8, line 2 (Family: none)	5 1-4
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 69758/1989(Laid-open No. 11468/1991) (Ishikawajima-Harima Heavy Industries Co., Ltd.), 05 February 1991 (05.02.1991), (Family: none)	1-5
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 119709/1980(Laid-open No. 43870/1982) (Masayoshi MAEDA), 10 March 1982 (10.03.1982), (Family: none)	1-5
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 110424/1981(Laid-open No. 19789/1983) (Seirei Industry Co., Ltd.), 07 February 1983 (07.02.1983), (Family: none)	1-5
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 079927/1978(Laid-open No. 181070/1979) (Niichi NISHIWAKI), 21 December 1979 (21.12.1979), (Family: none)	1-5
A	JP 2005-87075 A (Shinko Sangyo Kabushiki Kaisha), 07 April 2005 (07.04.2005), paragraph [0025] (Family: none)	5

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 7025975 A **[0005]**