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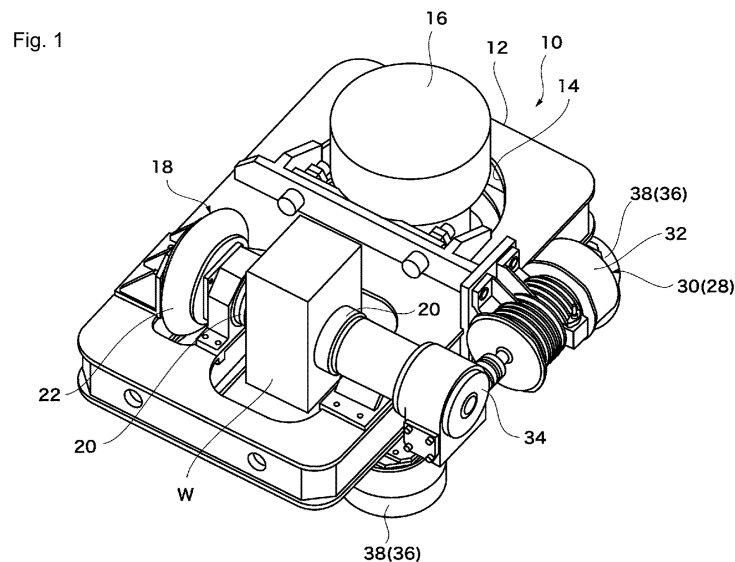
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(54) **VIBRATING SAND SHAKING-OUT APPARATUS AND AUTOMOBILE COMPONENT**

(57) To provide a vibration sand shakeout apparatus that can surely remove sand and the like from a workpiece, and an automotive part.

A vibration sand shakeout apparatus 10 for shaking out sand adhering to a workpiece W by vibration, includes: a vibration table 12; a vibrating motor 16 provided on the vibration table 12 and configured to apply vibration

to the vibration table 12; a workpiece rotation and grip part 18 provided on the vibration table 12 and configured to grip the workpiece W and rotate the workpiece W in a predetermined direction; and a rotation drive source 28 provided on the vibration table 12 and configured to rotate the workpiece W by the workpiece rotation and grip part 18.



Description

Laid-open No. 2004-237306

Technical Field

Disclosure of the Invention

[0001] The present invention relates to a vibration sand shakeout apparatus for a workpiece for shaking out sand adhering to the workpiece, in particular, core sand, dust and the like adhering to a hollow part of the workpiece from the workpiece by vibrating a cast (workpiece) molded by casting such as an automotive part, and an automotive part from which sand and the like have been removed by the vibration sand shakeout apparatus.

5 Problems to Be Solved by the Invention

Background Art

[0007] Incidentally, the aforementioned conventional vibration sand shakeout apparatus cannot sufficiently remove the sand adhering to a hole part formed in the workpiece. More specifically, the sand, dust and the like adhering to the surface of the workpiece are removed by vibrating the workpiece by applying vibration from a vibrating motor in a state where the workpiece is fixed, but gains of the sand and the like adhering to the hole part of the workpiece repeat collision with an inner wall or with each other due to the vibration and are gradually pulverized to be finer, resulting in a size with which the sand and the like are easy to discharge to the outside of the hole part.

[0002] Many of various machine parts such as an automotive part are molded by casting. To the cast (workpiece) by the casting, a large amount of sand adheres, and a work of shaking out the adhering sand is necessary.

[0008] However, in a configuration in which an opening of the hole part is not directed to a vertically lower side, the sand and the like pulverized by the vibration stay inside the hole part and cannot be completely removed from the workpiece.

[0003] As an example of a conventional vibration sand shakeout apparatus for a workpiece, there is proposed a vibration sand shakeout apparatus, which places the workpiece on a vibration table plate and shakes out sand adhering to the workpiece by vibration of the vibration table plate, configured to clamp the workpiece by a clamp lever and firmly hold the workpiece by operating the clamp lever by an air spring and thereby conduct heat of the workpiece to the air spring via the clamp lever, so as to protect the air spring from the influence of the heat and downsize the facility (refer to the following Patent Document 1).

[0009] Hence, in consideration of the above circumstances, an object of the present invention is to provide a vibration sand shakeout apparatus that can surely remove sand and the like from a workpiece, and an automotive part.

[0004] This makes it possible to shake out the sand from the workpiece and conduct the heat of the workpiece to the air spring via the clamp lever, ensuring that the air spring is not influenced by the heat and the facility is downsized because the air spring is smaller in size than a conventional cylinder.

Means for Solving the Problems

[0005] In addition, many vibration sand shakeout apparatuses are conventionally known as disclosed in Patent Documents 2 to 5.

[0010] A first invention is a vibration sand shakeout apparatus for shaking out sand adhering to a workpiece by vibration, the vibration sand shakeout apparatus including: a vibration table; a vibrating motor provided on the vibration table and configured to apply vibration to the vibration table; a workpiece rotation and grip part provided on the vibration table and configured to grip the workpiece and rotate the workpiece in a predetermined direction; and a rotation drive source provided on the vibration table and configured to rotate the workpiece by the workpiece rotation and grip part.

Prior Art Document

[0011] In this case, it is preferable that: the workpiece rotation and grip part includes a shaft part, and rotates the workpiece around an axis of the shaft part, while gripping the workpiece; and the rotation drive source is a motor configured to rotate and drive the shaft part.

Patent Document

[0012] Note that the motor includes all of existing motors such as a DC motor, a stepping motor, an air motor, an oil hydraulic motor and so on.

Patent Document 1: Japanese Patent Application Laid-open No. 2008-149367

Patent Document 2: Japanese Patent Application Laid-open No. 2012-50990

Patent Document 3: Japanese Patent Application Laid-open No. 2008-6481

Patent Document 4: Japanese Patent Application Laid-open No. 2007-253188

Patent Document 5: Japanese Patent Application Laid-open No. 2006-55905

Patent Document 6: Japanese Patent Application

[0013] In particular, it is preferable to use, as the motor, a vibrating motor.

[0014] In this case, it is preferable that the vibrating motor configured to apply vibration to the vibration table is arranged on the vibration table so that a barycentric position of the vibrating motor and a barycentric position of the vibration table are at substantially the same height

or close to each other.

[0015] In this case, it is preferable that the vibrating motor configured to apply vibration to the vibration table is arranged on the vibration table so that a center position in a height direction of the vibrating motor and a center position in a height direction of the vibration table are at substantially the same height or close to each other.

[0016] A second invention is an automotive part from which sand has been removed by the vibration sand shakeout apparatus of the present invention.

Effect of the Invention

[0017] According to the first embodiment, in a state where the vibration table is vibrated by application of vibration by the vibrating motor, the workpiece rotation and grip part receives a driving force from the rotation drive source and grips the workpiece and rotates the workpiece in the predetermined direction. Thus, the sand and dust adhering to the surface of the workpiece are removed by the vibration of the vibration table, and the opening of the hole part of the workpiece can be exposed to a vertically lower side, so that the sand and dust adhering, in particular, to the inside of the hole part can be removed from the workpiece utilizing the action of gravity.

[0018] Further, the workpiece rotation and grip part receives a rotational driving force from the motor being the rotation drive source, and rotates the workpiece around the axis of the shaft part, while gripping the workpiece. This makes it possible to easily rotate the workpiece while being gripped.

[0019] Further, the vibrating motor is used as the motor being the rotation drive source for rotating the workpiece by the workpiece rotation and grip part and thereby has resistance against the vibration of the vibration table, so that failure or the like of the motor hardly occurs.

[0020] Further, the vibrating motor configured to apply vibration to the vibration table is arranged on the vibration table so that the barycentric position of the vibrating motor and the barycentric position of the vibration table are at substantially the same height or close to each other, thus making it possible to suppress resonance of the vibration of the vibration table and the vibration of the vibrating motor. This prevents large violent movement of the vibration table, effectively vibrates the workpiece to improve the function of removing the sand from the workpiece, and can suppress occurrence of failure and a decrease in durability of the vibration sand shakeout apparatus.

[0021] Further, the vibrating motor configured to apply vibration to the vibration table is arranged on the vibration table so that the center position in the height direction (a height in a vertical direction) of the vibrating motor and the center position in the height direction (a height in the vertical direction) of the vibration table are at substantially the same height or close to each other, thus making it possible to suppress resonance of the vibration of the vibration table and the vibration of the vibrating motor.

This prevents large violent movement of the vibration table, effectively vibrates the workpiece to improve the function of removing the sand from the workpiece, and can suppress occurrence of failure and a decrease in durability of the vibration sand shakeout apparatus.

[0022] Further, by vibrating the automotive part as the workpiece, the sand and dust can be removed from a plurality of hole parts formed in the automotive part.

[0023] According to the second invention, vibration by the vibration sand shakeout apparatus of the first invention allows little or no sand and the like to adhere to the automotive part, realizing an improved quality.

[0024] Note that the automotive part includes a part for a two-wheeled vehicle such as a motor bicycle (motor-cycle), a part for a three-wheel vehicle and so on as well as a part for a four-wheel vehicle.

Brief Description of Drawings

[0025]

[FIG. 1] is a perspective view of a state where a vibration sand shakeout apparatus according to an embodiment of the present invention grips a workpiece;

[FIG. 2] is a plan view of the state where the vibration sand shakeout apparatus according to the embodiment of the present invention grips the workpiece;

[FIG. 3] is a front view of the state where the vibration sand shakeout apparatus according to the embodiment of the present invention grips the workpiece;

[FIG. 4] is a side view of the state where the vibration sand shakeout apparatus according to the embodiment of the present invention grips the workpiece;

[FIG. 5] is a view of a state where a workpiece rotation and grip part of the vibration sand shakeout apparatus according to the embodiment of the present invention grips the workpiece; and

[FIG. 6] is a perspective view of the workpiece rotation and grip part of the vibration sand shakeout apparatus according to the embodiment of the present invention.

Best Mode for Carrying out the Invention

[0026] A vibration sand shakeout apparatus according to an embodiment of the present invention will be described referring to the drawings. A part from which sand and the like are removed by the vibration sand shakeout apparatus of the embodiment is called a workpiece.

[0027] The workpiece is also a cast molded, for example, by casting and is, in particular, an automotive part.

[0028] Note that the automotive part includes a part for a two-wheeled vehicle such as a motor bicycle (motor-cycle), a part for a three-wheel vehicle and so on as well as a part for a four-wheel vehicle.

[0029] As illustrated in FIG. 1 to FIG. 4, a vibration sand shakeout apparatus 10 includes, for example, a vibration

table 12 in a flat plate shape. Further, the vibration table 12 is formed with a through hole 14 being a large opening part penetrating in a thickness direction of a plane thereof.

[0030] In the through hole 14, a vibrating motor 16 being a driving source for applying vibration to the vibration table 12 is arranged. Therefore, the vibrating motor 16 is arranged to project from an upper surface side and a lower surface side of the vibration table 12. The vibrating motor 16 applies vibration to the vibration table 12, so that the entire apparatus vibrates.

[0031] Note that as the vibrating motor 16, for example, High-Performance Vibration Machine (Vibrator) by the manufacturer: MURAKAMI SEIKI MFG. CO., LTD. and the distributor: URAS TECHNO CO., LTD. can be used.

[0032] The detailed structure of the vibrating motor 16 is conventionally well known, and therefore its explanation will be omitted.

[0033] Here, the vibrating motor 16 applying vibration to the vibration table 12 is preferably arranged on the vibration table 12 so that the barycentric position of the vibrating motor 16 and the barycentric position of the vibration table 12 are at substantially the same height or close to each other.

[0034] In other words, it is most preferable that when the vibration table 12 is installed, the barycentric position of the vibrating motor 16 and the barycentric position of the vibration table 12 are located on the same horizontal line, or it is also adoptable that they are close to each other to be located on the same horizontal line.

[0035] Further, the vibrating motor 16 applying vibration to the vibration table 12 can be said to be arranged on the vibration table 12 so that the center position in the height direction of the vibrating motor 16 and the center position in the height direction of the vibration table 12 are at substantially the same height or close to each other.

[0036] On the vibration table 12, a workpiece rotation and grip part 18 is provided which grips the workpiece W and rotates the workpiece W in a predetermined direction.

[0037] As illustrated in FIG. 5 and FIG. 6, the workpiece rotation and grip part 18 includes a jig 20 that grips the workpiece W, and an air spring 22 that adjusts a gripping force for the workpiece W by the jig 20. The jig 20 includes a shaft part 24 and a bearing mechanism 26 for making the workpiece W rotatable, while gripping the workpiece W.

[0038] The shaft part 24 is rotated around an axis by the bearing mechanism 26 in a state where the workpiece W is gripped by the jig 20 with a predetermined force by the air spring 22, whereby the workpiece W is rotated around the axis of the shaft part 24.

[0039] On the vibration table 12, a rotation drive source 28 for rotating the workpiece W by the workpiece rotation and grip part 18 is provided. As the rotation drive source 28, for example, a motor 30 is preferable.

[0040] Note that the motor 30 includes all of existing

motors that generate a driving force, such as a DC motor, a stepping motor, an air motor, an oil hydraulic motor and so on.

[0041] In particular, as the motor 30, a vibrating motor 32 is preferable. In FIG. 1 to FIG. 5, the vibrating motor 32 is applied as the rotation drive source 28.

[0042] In a configuration applying the vibrating motor 32 as the rotation drive source 28, it is premised that the vibrating motor 32 is used as a normal motor only for transmitting a rotational driving force without vibration of the vibrating motor 32.

[0043] Specifically, it is necessary, for example, to remove a balance weight (weight) or the like attached to the shaft of the original vibrating motor 32, or to manufacture, from the beginning, a vibrating motor having no balance weight to thereby make a configuration where the motor does not vibrate.

[0044] As the vibrating motor 32 for rotating and driving the workpiece W, the one by the above-described distributor can be used as with the vibrating motor 16 for applying vibration to the vibration table 12.

[0045] The vibrating motor 32 used as the rotation drive source 28 for rotating the workpiece W has durability against vibration and therefore has an advantage that even when the vibrating motor 32 is installed on the vibrating vibration table 12, failure due to the vibration is less likely to occur.

[0046] Here, the rotation drive source 28 for rotating the workpiece W by the workpiece rotation and grip part 18 is mechanically connected to the shaft part 24 via a predetermined speed reducing mechanism 34. Therefore, the rotational driving force of the rotation drive source 28 is transmitted via the speed reducing mechanism 34 to the shaft part 24, thereby rotating shaft part 24.

[0047] Note that as the speed reducing mechanism 34, for example, a pinion rack mechanism and a gear train can be used.

[0048] The vibration table 12 is elastically supported on a plurality of elastic supporting parts 36. An example of the elastic supporting part 36, an air spring 38 is used.

[0049] Note that in the embodiment, four elastic supporting parts 36 are provided, and the vibration table 12 is elastically supported in a good balance by the elastic supporting parts 36.

[0050] Next, the action of the vibration sand shakeout apparatus 10 according to the embodiment will be described.

[0051] As illustrated in FIG. 1 to FIG. 6, in the state where the workpiece W is gripped by the workpiece rotation and grip part 18 with a predetermined gripping force, the vibrating motor 16 is driven and its rotational driving force is transmitted via the speed reducing mechanism 34 to the shaft part 24. Thus, the workpiece W in a state of being gripped by the workpiece rotation and grip part 18 is rotated around the axis of the shaft part 24.

[0052] At the same time, the vibrating motor 16 applying vibration to the vibration table 12 is driven to vibrate the vibration table 12. At this time, the vibrating motor 16

and the rotation drive source 28 themselves also vibrate, but the rotation drive source 28 is composed of the vibrating motor 32 and has durability against the vibration, and therefore has a feature of being less likely to break due to the vibration.

[0053] Thus, the sand and the like adhering to the surface of the workpiece W drop to be removed from the workpiece surface, and the sand and the like adhering to a hole part formed in the workpiece W drop to be removed from the workpiece W when an opening of the hole part is directed to a vertically lower side.

[0054] Here, in the state where the vibration table 12 is vibrating, gains of the sand adhering to the inside of the hole part of the workpiece W receive the vibration from the vibration table 12 and repeat collision with each other or with an inner wall of the hole part, and are thereby gradually pulverized. In the process of the collision, the finely pulverized sand the like are discharged from the inside of the hole part of the workpiece W to the outside and, in particular, when the diameter of the hole part is small, it is difficult to discharge all the sand and the like existing inside the hole part to the outside. Therefore, even after the vibration is performed by the vibration sand shakeout apparatus 10, the sand and the like remain inside the hole part of the workpiece W in some cases.

[0055] Hence, the rotational driving force of the rotation drive source 28 is transmitted to rotate the shaft part 24, thereby realizing the environment where the workpiece W in a gripped state can be rotated around the axis of the shaft part 24 in a state where the vibration table 12 is being vibrated. Thus, when the opening of the hole part of the workpiece W is directed to the vertically lower side, the sand and the like remaining inside the hole part receive the actions of the gravity and the centrifugal force and are discharged to the outside of the hole part. As a result, the sand and the like can be surely discharged from the hole part of the workpiece W.

[0056] Here, the vibrating motor 16 applying vibration to the vibration table 12 is arranged on the vibration table 12 so that the barycentric position of the vibrating motor 16 and the barycentric position of the vibration table 12 are at substantially the same height or close to each other.

[0057] As its technical background, since the vibrating motor 16 and the vibration table 12 are constituted by assembling separate members, the vibrating motor 16 vibrates the vibration table 12 to thereby vibrate the whole apparatus, but the vibration waveform (vibration frequency) at the vibrating motor 16 and the vibration waveform (vibration frequency) at the vibration table 12 independently exist. The phases of them therefore deviate from each other. When the whole apparatus vibrates in this state, there occurs, in due course, a resonance phenomenon of the apparatus at the timing when the crest of the vibration waveform at the vibrating motor 16 and the crest of the vibration waveform at the vibration table 12 overlap each other or the trough of the vibration waveform at the vibrating motor 16 and the trough of the vibration wave-

form at the vibration table 12 overlap each other. In this event, the vibration of the whole apparatus becomes too large, in other words, the whole apparatus moves too violently, possibly bringing about a problem in durability of the apparatus.

[0058] On the other hand, the vibration of the whole apparatus becomes too small at the timing when the crest of the vibration waveform at the vibrating motor 16 and the trough of the vibration waveform at the vibration table 12 overlap each other or the trough of the vibration waveform at the vibrating motor 16 and the crest of the vibration waveform at the vibration table 12 overlap each other. In this event, there arises a problem of deterioration in the function of removing the sand and the like from the workpiece W.

[0059] Hence, the vibrating motor 16 applying vibration to the vibration table 12 is arranged on the vibration table 12 so that the barycentric position of the vibrating motor 16 and the barycentric position of the vibration table 12 are at substantially the same height or close to each other, whereby the whole can be recognized as one mass system. As a result, it is possible to generate optimal vibration of the whole apparatus and effectively vibrate the workpiece W without large violent movement of the vibration table 12 to thereby improve the function of removing the sand from the workpiece W and suppress occurrence of failure and a decrease in durability of the vibration sand shakeout apparatus 10.

[0060] Note that depending on the shape and configuration of the vibration table 12, the optimal vibration can be realized also by arranging the vibrating motor 16 applying vibration to the vibration table 12 on the vibration table 12 so that the center position in the height direction of the vibrating motor 16 and the center position in the height direction of the vibration table 12 are at substantially the same height or close to each other. This can effectively vibrate the workpiece W without large violent movement of the vibration table 12 to thereby improve the function of removing the sand from the workpiece W and suppress occurrence of failure and a decrease in durability of the vibration sand shakeout apparatus 10.

[0061] Further, the rotation drive source 28 for rotating and driving the workpiece W is arranged on the vibration table 12 so that the barycentric position of the rotation drive source 28 and the barycentric position of the vibration table 12 are at substantially the same height or close to each other, thereby making it possible to effectively vibrate the workpiece W to thereby improve the function of removing the sand from the workpiece W and suppress occurrence of failure and a decrease in durability of the vibration sand shakeout apparatus 10.

[0062] Further, depending on the shape and configuration of the vibration table 12, the rotation drive source 28 for rotating and driving the workpiece W is arranged on the vibration table 12 so that the center position in the height direction of the rotation drive source 28 and the center position in the height direction of the vibration table 12 are at substantially the same height or close to each

other, thereby also making it possible to effectively vibrate the workpiece W to thereby improve the function of removing the sand from the workpiece W and suppress occurrence of failure and a decrease in durability of the vibration sand shakeout apparatus 10.

[0063] The embodiments described above are merely examples for explaining the present invention and can be variously changed within a scope without departing from the spirit of the present invention.

Explanation of Codes

[0064]

10 vibration sand shakeout apparatus
 12 vibration table
 14 through hole
 16 vibrating motor
 18 workpiece rotation and grip part
 20 jig
 22 air spring
 24 shaft part
 26 bearing mechanism
 28 rotation drive source
 30 motor
 32 vibrating motor
 34 speed reducing mechanism
 36 elastic supporting part
 38 air spring
 W workpiece

Claims

1. A vibration sand shakeout apparatus for shaking out sand adhering to a workpiece by vibration, the vibration sand shakeout apparatus comprising:
 - a vibration table;
 - a vibrating motor provided on the vibration table and configured to apply vibration to the vibration table;
 - a workpiece rotation and grip part provided on the vibration table and configured to grip the workpiece and rotate the workpiece in a predetermined direction; and
 - a rotation drive source provided on the vibration table and configured to rotate the workpiece by the workpiece rotation and grip part.
2. The vibration sand shakeout apparatus according to claim 1, wherein:
 - the workpiece rotation and grip part comprises a shaft part, and rotates the workpiece around an axis of the shaft part, while gripping the workpiece; and
 - the rotation drive source is a motor configured

to rotate and drive the shaft part.

3. The vibration sand shakeout apparatus according to claim 2, wherein the motor uses a vibrating motor.
4. The vibration sand shakeout apparatus according to claim 3, wherein the vibrating motor configured to apply vibration to the vibration table is arranged on the vibration table so that a barycentric position of the vibrating motor and a barycentric position of the vibration table are at substantially the same height or close to each other.
5. The vibration sand shakeout apparatus according to claim 3, wherein the vibrating motor configured to apply vibration to the vibration table is arranged on the vibration table so that a center position in a height direction of the vibrating motor and a center position in the height direction of the vibration table are at substantially the same height or close to each other.
6. The vibration sand shakeout apparatus according to any one of claims 1 to 5, wherein the workpiece is an automotive part.
7. An automotive part from which sand has been removed by the vibration sand shakeout apparatus according to any one of claims 1 to 6.

Fig. 1

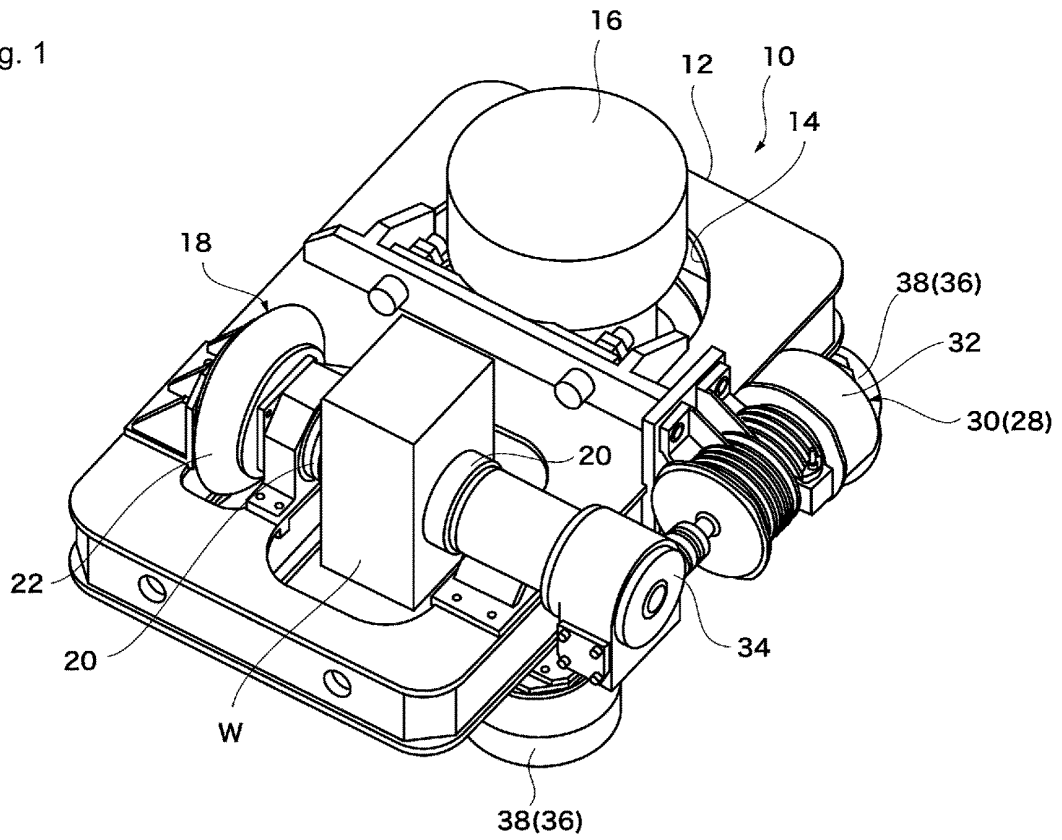


Fig. 2

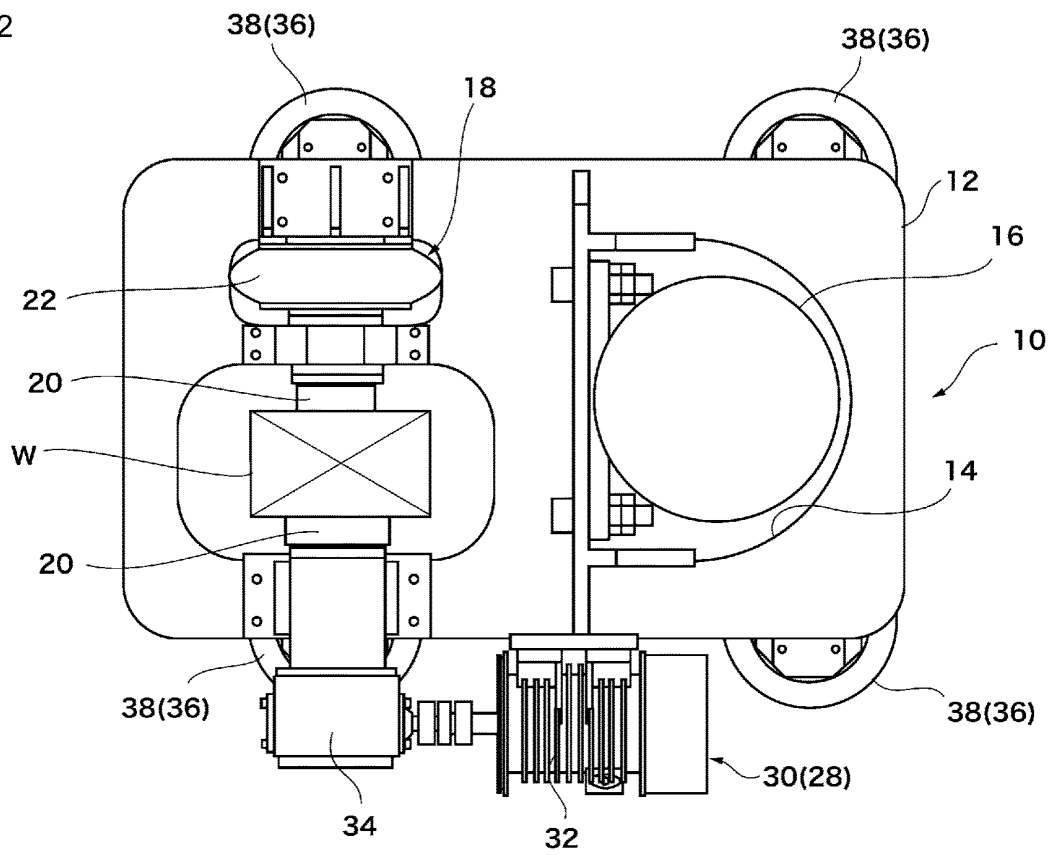


Fig. 3

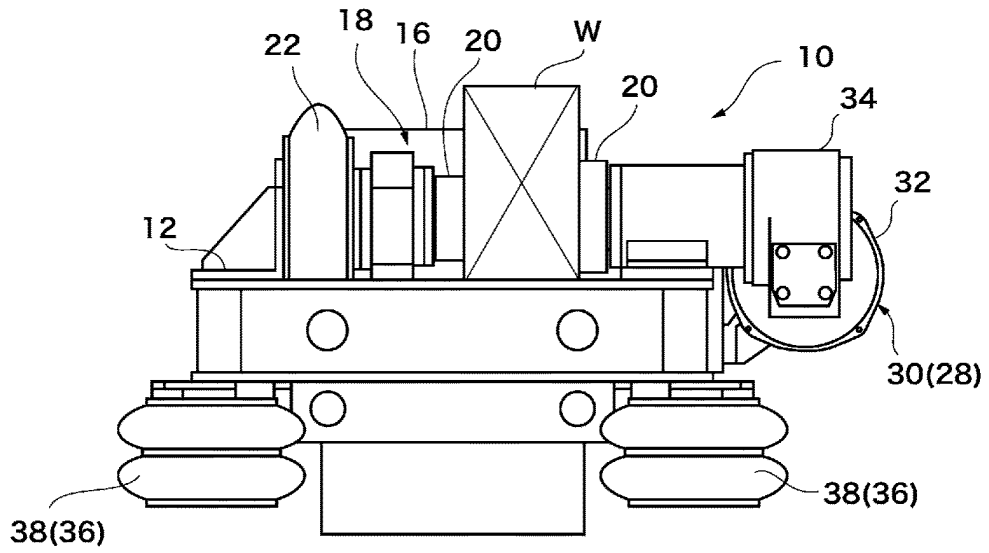


Fig. 4

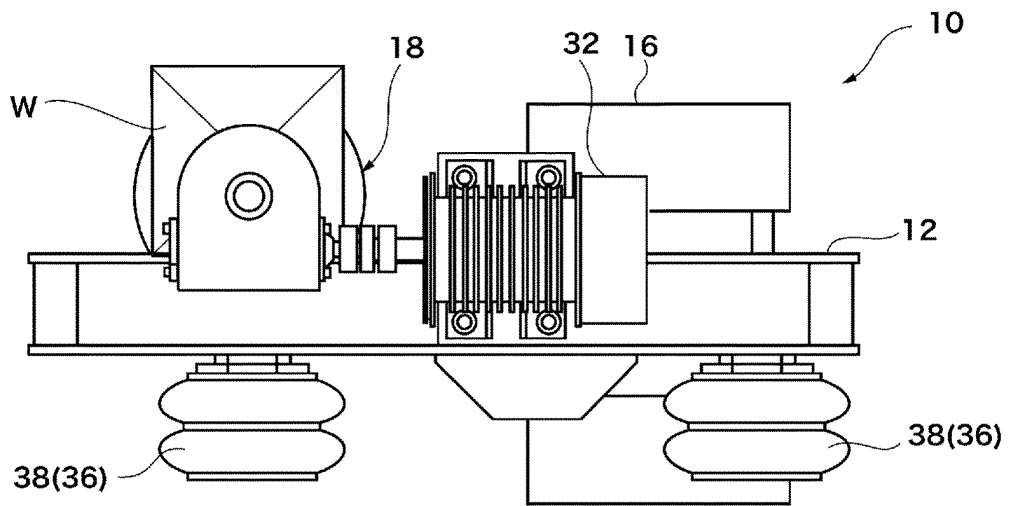


Fig. 5

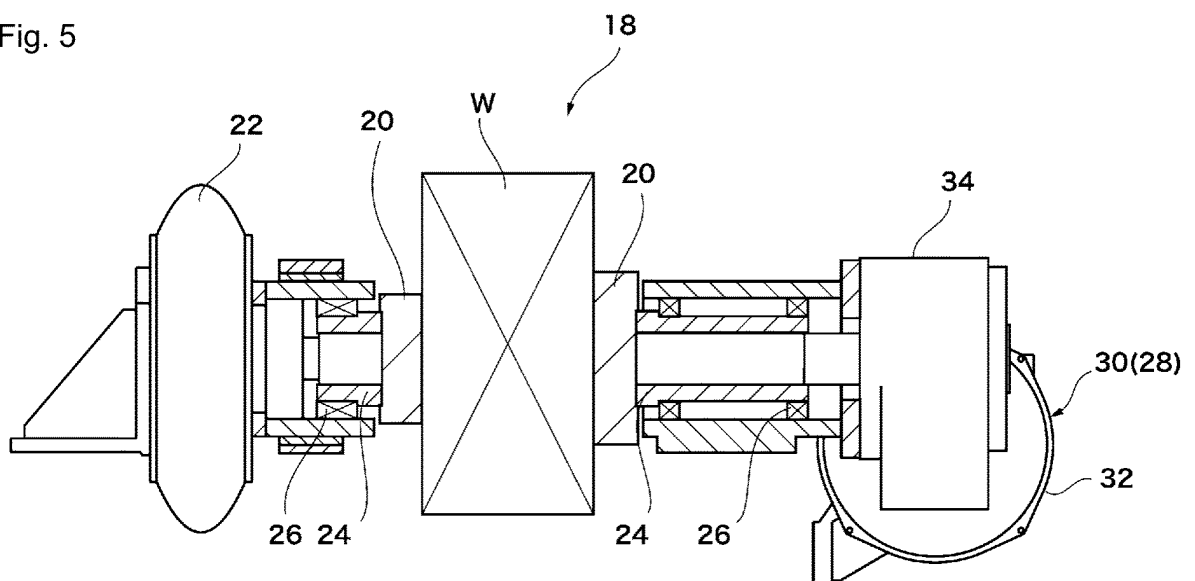
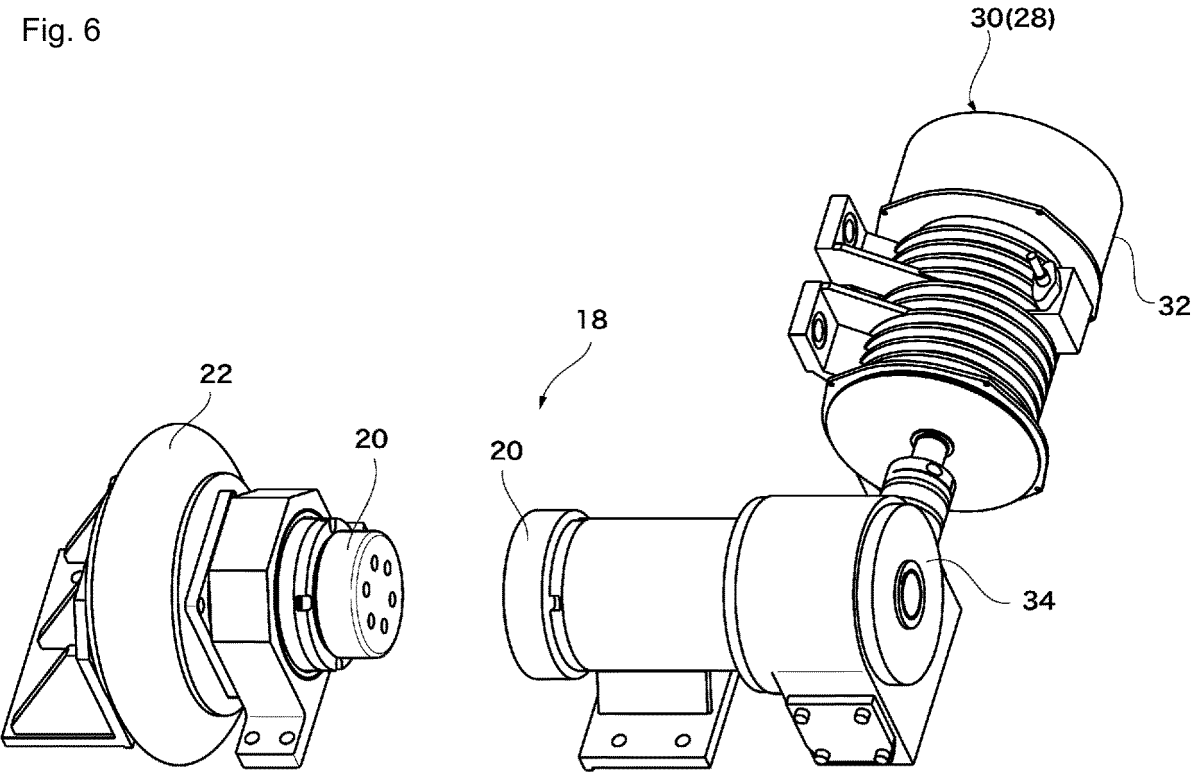


Fig. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/064310

A. CLASSIFICATION OF SUBJECT MATTER

B22D29/00(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)

B22D29/00

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 1996-2016

Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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.
Y A	JP 2008-149367 A (Shiga Yamashita Co., Ltd.), 03 July 2008 (03.07.2008), paragraphs [0014] to [0015]; fig. 1 (Family: none)	1-2, 6-7 3-5
Y	JP 2001-30064 A (Isuzu Motors Ltd.), 06 February 2001 (06.02.2001), paragraphs [0002], [0007], [0012] to [0015], [0021] to [0024]; fig. 1 to 3 (Family: none)	1-2, 6-7

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

* Special categories of cited documents:

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Date of the actual completion of the international search
25 May 2016 (25.05.16)Date of mailing of the international search report
07 June 2016 (07.06.16)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

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REFERENCES CITED IN THE DESCRIPTION

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- JP 2006055905 A [0006]
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