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Declaration under Rule 4.17:
— *of inventorship (Rule 4.17(iv))*

[Continued on next page]

(54) **Title:** ELEVATOR MACHINE FRAME

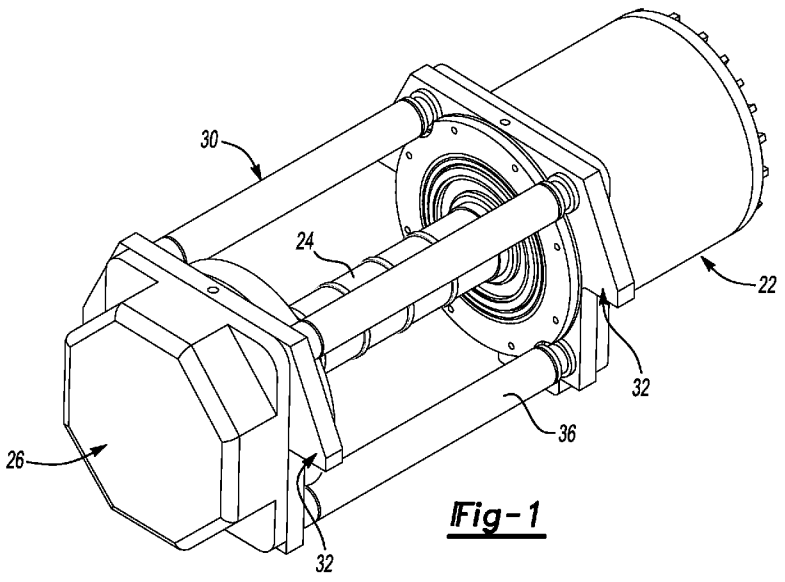

Fig-1

(57) **Abstract:** An example elevator machine frame assembly (30) includes a plurality of support plates (32) configured to support at least selected portions of. an elevator machine including a traction sheave (24). The support plates each comprise a plurality of mounting surfaces (50) that are aligned within a plane that intersects with an axis of rotation (56) of a traction sheave that is supported by the frame assembly. A plurality of support rods (36) are connected to the support plates (32). The support rods maintain a desired spacing between the plates and a desired alignment of the plates relative to each other. In a disclosed example, the support rods include a sound dampening material (44) such as sand in an interior of the rods.

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ELEVATOR MACHINE FRAME

BACKGROUND

[0001] Elevator systems typically include a machine assembly for moving the elevator car in a desired manner within a hoistway. Some elevator systems include a hydraulic arrangement for moving the elevator car. Other elevator systems are traction-based and utilize a roping arrangement (e.g., round ropes or flat belts) for suspending the elevator car and a counterweight. Movement of a traction sheave is controlled by a machine including a motor, drive and brake. There are known techniques for controlling the movement and position of an elevator car and counterweight in a traction-based elevator system.

[0002] For many years elevator machines were located in a machine room outside of the elevator hoistway. Typical arrangements included a machine room on the roof of a building. More recently, machine roomless elevator systems have been introduced. In such systems, the elevator drive is positioned within the hoistway because there is no longer a machine room. While such arrangements provide for economic advantages, they introduce new challenges to designers of elevator systems.

[0003] One challenge presented to elevator designers is how to support the elevator machine within the hoistway. One proposal is shown in the Published U.S. Application No. 2006/042882.

[0004] Another example challenge stems from placing the elevator machine within the hoistway because that introduces an additional source of noise within the hoistway. Noisy elevator systems tend to be undesirable because passengers may become annoyed or uncomfortable when hearing noises during elevator operation. It is desirable to minimize the amount of noise within a hoistway that is the result of the elevator machine operation.

SUMMARY

[0005] An exemplary elevator machine frame assembly includes a plurality of support plates that are configured to support at least selected portions of an elevator machine including a traction sheave. A plurality of support rods are connected to the support plates near ends of the support rods. The support rods maintain a desired spacing between the plates and a desired alignment of the plates. Each of the support plates includes a plurality of mounting surfaces that are aligned with a plane that

intersects an axis of rotation of a traction sheave if a traction sheave is supported on the frame assembly.

[0006] Another exemplary elevator machine frame assembly includes a plurality of support plates configured to support at least selected portions of an elevator machine. A plurality of support rods are connected to the support plates near ends of the support rods. The support rods maintain a desired spacing between the plates and a desired alignment of the places. The support rods include at least one first material on an exterior of the rods and at least one second, different material on an interior of the rods. The second material is a sound-dampening material.

[0007] The various features and advantages of the disclosed examples will become apparent to those skilled in the art from the following detailed description. The drawings that accompany the detailed description can be briefly described as follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Figure 1 diagrammatically illustrates an example elevator machine frame assembly designed according to an embodiment of this invention.

[0009] Figure 2 is a perspective view of selected portions of the example of Figure 1.

[00010] Figure 3 is an end view showing selected portions of the example of Figure 1.

[00011] Figure 4 is a perspective illustration of an example bearing assembly used in one example embodiment.

[00012] Figure 5 is a cross-sectional illustration taken along the lines 5-5 in Figure 4.

[00013] Figure 6 schematically illustrates a portion of an example process of assembling an elevator machine frame arrangement.

[00014] Figure 7 schematically shows a subsequent step in the example process.

[00015] Figure 8 schematically shows a subsequent step in the example process.

[00016] Figure 9 schematically shows a subsequent step in the example process.

[00017] Figure 10 schematically shows a subsequent step in the example process.

DETAILED DESCRIPTION

[00018] A disclosed example elevator machine frame assembly includes unique features that reduce an amount of noise associated with operation of a corresponding elevator machine.

[00019] Figure 1 schematically shows an example elevator machine assembly 20 that includes a motor 22, a traction sheave 24 and a brake portion 26. The motor portion 22 causes desired movement of the traction sheave 24 that results in associated movement of an elevator load bearing assembly (e.g., a roping arrangement comprising flat belts or round ropes) and associated movement of an elevator car. The brake assembly 26 applies a braking force to slow down movement of the traction sheave or to prevent it from moving when an elevator car is stationary at a landing, for example. The motor portion 22 and the brake portion 26 operate in a known manner.

[00020] The motor portion 22, traction sheave 24 and brake portion 26 in the illustrated example are all supported by an elevator machine frame 30. As can be appreciated from Figures 1 and 2, the example frame 30 includes a plurality of support plates 32 that are configured to support portions of the elevator machine. Some example support plates are cast iron and others comprise steel. In this example, bearing housings 34 are supported by each of the support plates 32. The bearing housings 34 accommodate bearings that facilitate rotation of the traction sheave 24, for example.

[00021] A plurality of support rods 36 are connected to the support plates 32 near ends 38 of the support rods. The support rods 36 maintain a desired spacing between the support plates 32 and a desired alignment of the support plates 32. In this example, the support plates 32 each include a plurality of recesses or counter sunk holes 40 associated with openings through which a portion of the support rods 36 are received. In the illustrated example, fastening members 42 secure the support plates 32 relative to the support rods 36. The illustrated fastening members 42 comprise threaded nuts that are received over threaded portions of the ends 38 of the example support rods 36. Another example includes welded connections between support rods

and support plates. In another example, the support rods and the support plates are part of a single casting.

[00022] While the illustrated example includes four support rods 36, it is possible to use fewer support rods or more, depending the needs of a particular situation. One example includes two support rods 36. Given this description, those skilled in the art will be able to select an appropriate number of support rods and to configure the corresponding support plates accordingly to meet the needs of their particular situation.

[00023] As can be appreciated from Figure 2, each of the support rods 36 comprises an outer shell that is filled with a sound-dampening material 44 along at least a portion of the length of each support rod 36. In one example, approximately ¾ of the length of each support rod 36 is filled with the sound-dampening material 44. In one example, the exterior surface of the outer shell of the support rods comprises at least one of steel or iron. In one example, the sound-dampening material 44 comprises at least one of sand or foam. Including the sound-dampening material 44 within the support rods 36 provides a noise-reducing feature of the example frame 30. The sound-dampening material 44 reduces noises otherwise associated with vibrations of the machine during operation.

[00024] Another noise reducing feature of the example frame 30 includes an arrangement of mounting surfaces 50 of the support plates 32. As can be appreciated from Figure 3, mounting surfaces 50 are associated with oppositely facing sides of each support plate 32. The mounting surfaces 50 are configured to be received upon a corresponding structural member 52 within a hoistway, for example.

[00025] The example mounting surfaces 50 are aligned with each other within a plane 54. In the illustrated example, all four mounting surfaces 50 (e.g., two mounting surfaces 50 per plate 32) are coplanar with each other. The plane 54 including the mounting surfaces 50 intersects an axis of rotation 56 of the traction sheave 24 when the traction sheave 24 is appropriately supported by the machine 32. In this example, the axis of rotation 56 coincides with a centerline of the traction sheave 24, which coincides with a centerline of an opening 57 that accommodates a bearing housing 34.

[00026] Positioning the mounting surfaces 50 within the plane 54, which intersects with the axis of rotation 56, provides a noise-reducing feature of the example frame 30. Arranging the mounting surfaces 50 as shown in the illustrated

example reduces torsional vibration modes of the elevator machine assembly 20. In one example, a noise reduction factor on the order of 2.5 dB is achieved by using the example mounting surface arrangements.

[00027] The example of Figure 3 includes an additional noise-reducing feature. In this example, isolation pads 58 are associated with each of the mounting surfaces 50. The isolation pads 58 comprise a compliant material that is softer than the metal material used for making the support plates 32. Example materials useful as the isolation pads 58 comprise natural or synthetic rubber. Other elastomeric materials that are compliant and useful for enhancing dampening of vibrational energy are useful, also. The softer material of the isolation pads 58 reduces vibration and noise transmission between the support plates 32 and the structural members 52. In one example, the isolation pads 58 are secured to the mounting surfaces 50. In another example, the isolation pads 58 are formed as part of the support plates 32 such that they are an integrated part of the support plates 32.

[00028] In the illustrated example, the mounting surfaces 50 are on flanges that protrude from oppositely facing plate edges. In this example, an entirety of each plate 32 including the flanges and the mounting surfaces 50 is formed as a single piece of material. One example includes casting or shaping a metal to achieve a single-piece, monolithic structure for each of the support plates 32.

[00029] Referring to Figures 4 and 5, an example bearing housing 34 includes an outer ring portion 62 and an inner ring portion 64. An insert 66 is positioned between the outer ring portion 62 and the inner ring portion 64. The insert 66 in this example is made from a different material than that used for the outer ring portion 62 and inner ring portion 64. The insert 66 has a noise-reducing or noise dampening coefficient. One example includes poly-paraphenylene terephthalamide (e.g., KEVLAR™).

[00030] The bearing housings 34 provide a noise-reducing effect by being an intermediate component between the support plates 32 and the bearings used for facilitating rotational movement of the traction sheave 24, for example. If the bearings were situated directly against the support plates 32, there would be additional vibration and, therefore, additional noise. The bearing housings 34 facilitate reducing such vibration and associated noise generation.

[00031] The insert 66 further reduces noise because it comprises a noise-reducing material to provide additional damping effects resulting in less noise.

[00032] Any one of the noise-reducing features of the example frame 30 could be used alone to achieve a lower-noise elevator machine arrangement. A combination of two or more of them will provide enhanced noise-reduction in many examples. Given this description, those skilled in the art will be able to select one or all of the noise-reducing features of the illustrated example to achieve a desired amount of noise control for their particular situation.

[00033] Another feature of the example elevator machine assembly 20 is that it facilitates an efficient assembly process. One example process begins by situating at least a housing of the motor portion 22 as schematically shown in Figure 6. One of the support plates 32 is then supported on the housing of the motor portion 22 as schematically shown in Figure 7.

[00034] The plurality of support rods 36 are next connected with the support plate 32 as schematically shown in Figure 8. The other support plate 32 is then connected to opposite ends of the support rods 36 as schematically shown in Figure 9. The arrangement shown in Figure 9 is then well situated to receive the traction sheave 24 and any associated motor components as schematically shown in Figure 10. In this example, the traction sheave 24 and associated motor components are inserted through the inner portions 64 of the bearing housings 34, which are positioned within the openings 57 of the support plates 32.

[00035] As can be appreciated from the drawings, the example assembly process may be completed prior to shipping the assembled elevator machine assembly 20 to a location where it will be installed as part of an elevator system. Alternatively, it is possible to perform the assembly process on site at the location of the elevator system because the assembly process is relatively straight-forward.

[00036] The preceding description is exemplary rather than limiting in nature. Variations and modifications to the disclosed examples may become apparent to those skilled in the art that do not necessarily depart from the essence of this invention. The scope of legal protection given to this invention can only be determined by studying the following claims.

CLAIMS

We claim:

1. An elevator machine frame assembly, comprising:

a plurality of support plates configured to support at least selected portions of an elevator machine including a traction sheave, each of the support plates comprises a plurality of mounting surfaces that are aligned within a plane that intersects with an axis of rotation of the traction sheave if the traction sheave is supported by the frame assembly; and

a plurality of support rods connected to the support plates near ends of the support rods, the support rods maintain a desired spacing between the support plates and a desired alignment of the support plates.

2. The assembly of claim 1, wherein the plane is horizontal when the mounting surfaces are received upon a corresponding structure.

3. The assembly of claim 1, wherein the mounting surfaces are all parallel with each other.

4. The assembly of claim 1, wherein the mounting surfaces are on flanges that protrude from edges of the support plates.

5. The assembly of claim 4, wherein an entirety of each support plate including the flanges is formed as a single piece of material.

6. The assembly of claim 1, comprising

isolation pads on at least some of the mounting surfaces.

7. The assembly of claim 1, wherein the support rods comprise a first material on an exterior of the rods and a second, different material on an interior of the rods.

8. The assembly of claim 7, wherein the second material comprises a sound-dampening material.

9. The assembly of claim 7, wherein the second material comprises sand.

10. The assembly of claim 1, comprising

a bearing housing supported by each support plate, each bearing housing having an outer portion, an inner portion and an insert between the outer and inner portions.

11. The assembly of claim 10, wherein the insert comprises a material that is different from a material of the inner or outer portions.

12. The assembly of claim 11, wherein the insert comprises a sound-dampening material.

13. The assembly of claim 11, wherein the insert comprises poly-paraphenylene terephthalamide and each of the inner and outer portions comprise a metal.

14. The assembly of claim 10, wherein the inner portion, outer portion and the insert each comprise a ring and the rings are concentric.

15. An elevator machine frame assembly, comprising:

a plurality of support plates configured to support at least selected portions of an elevator machine including a traction sheave; and

a plurality of support rods connected to the support plates near ends of the support rods, the support rods maintain a desired spacing between the support plates and a desired alignment of the support plates, each of the support rods having an exterior body comprising at least one first material and at least one second, different material on an interior of the support rods.

16. The assembly of claim 15, wherein the second material comprises a sound-dampening material.

17. The assembly of claim 15, wherein the second material comprises sand.

18. A method of assembling an elevator machine frame comprising the steps of:

situating at least a portion of a motor in a desired position;

placing an elevator frame support plate against the portion of the motor;

connecting a plurality of support rods to the support plate;

connecting another support plate to the support rods such that the support plates are spaced from each other and in a desired alignment with each other.

19. The method of claim 18, comprising securing a bearing housing to each of the support plates.

20. The method of claim 18, comprising inserting a traction sheave and an associated motor component through an opening in the second support plate and at least a portion of the associated motor component through a corresponding opening in the first support plate.

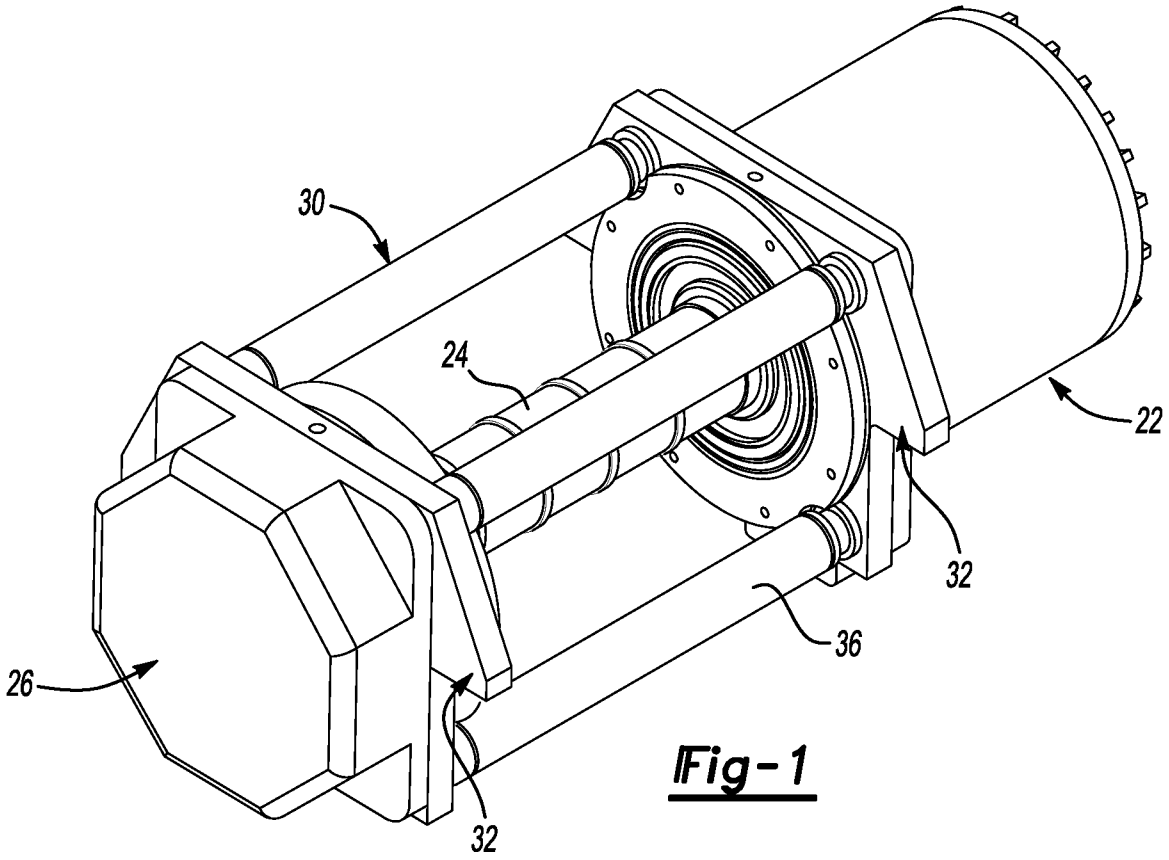

Fig-1

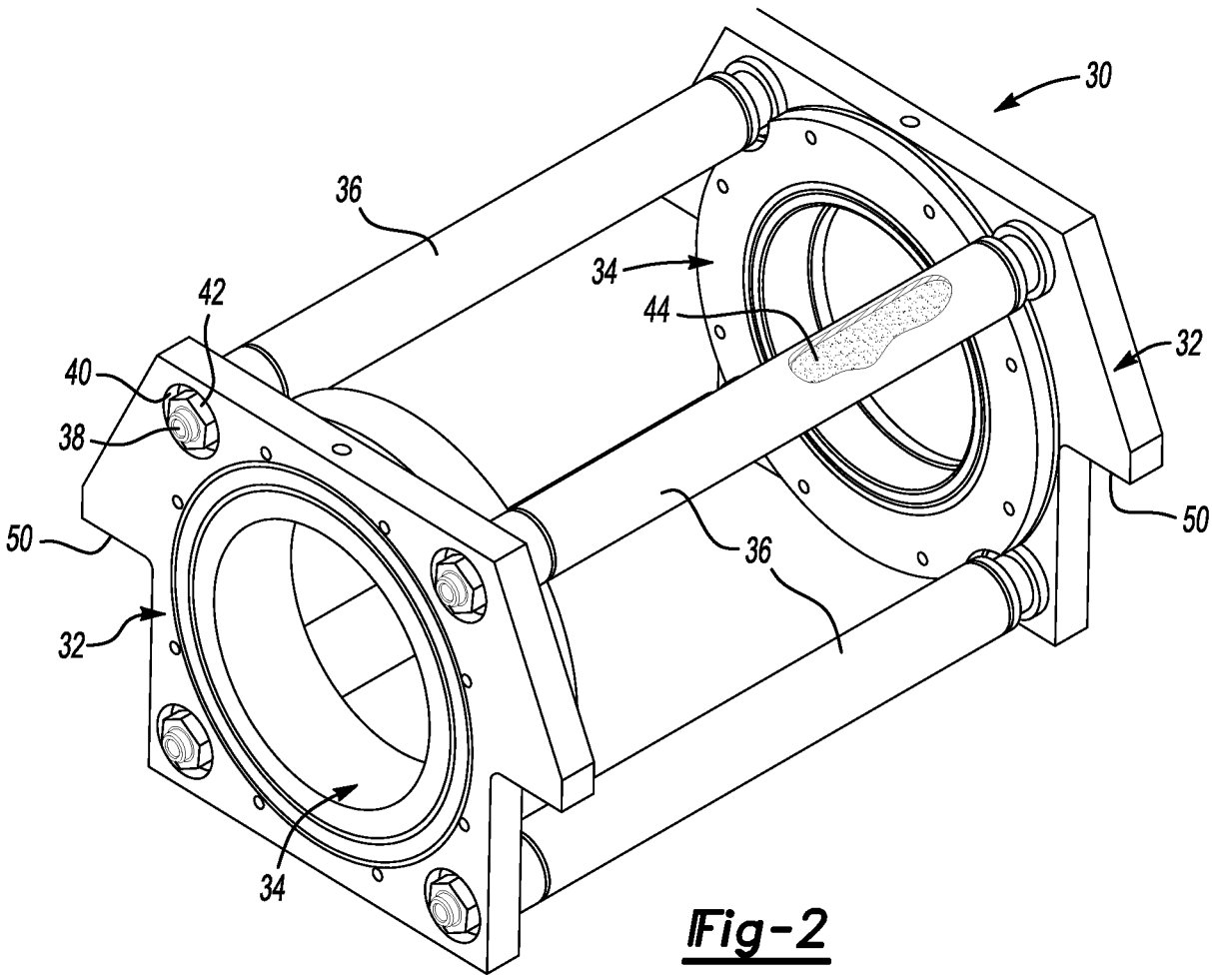

Fig-2

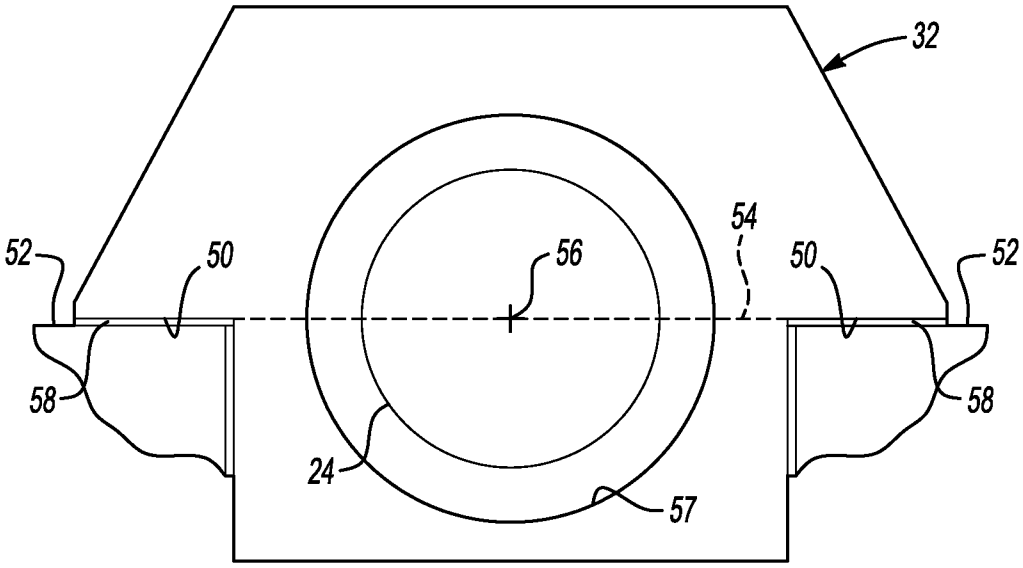

Fig-3

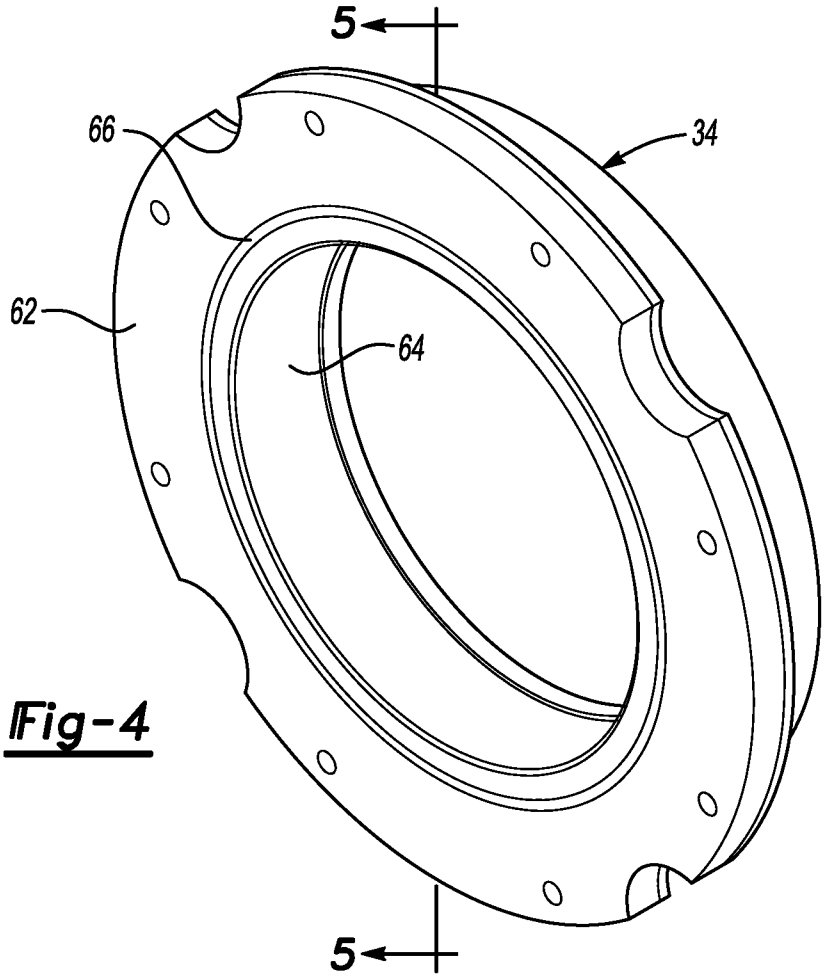

Fig-4

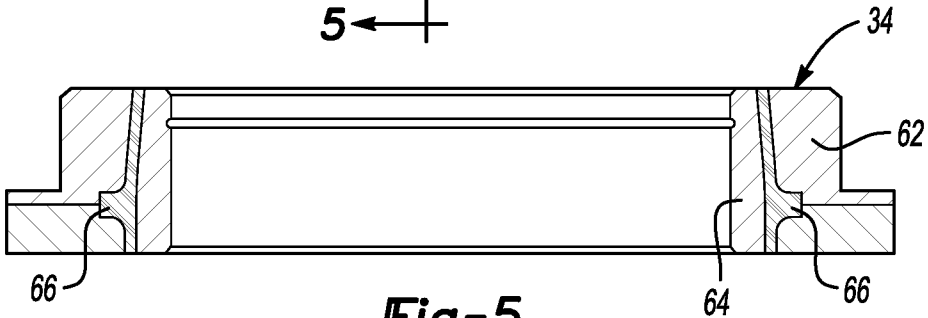

Fig-5

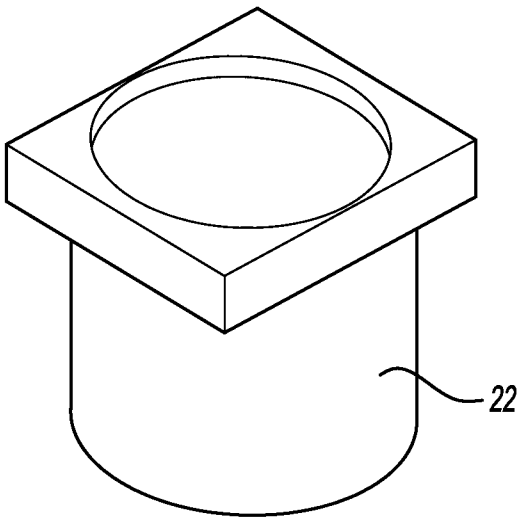

Fig-6

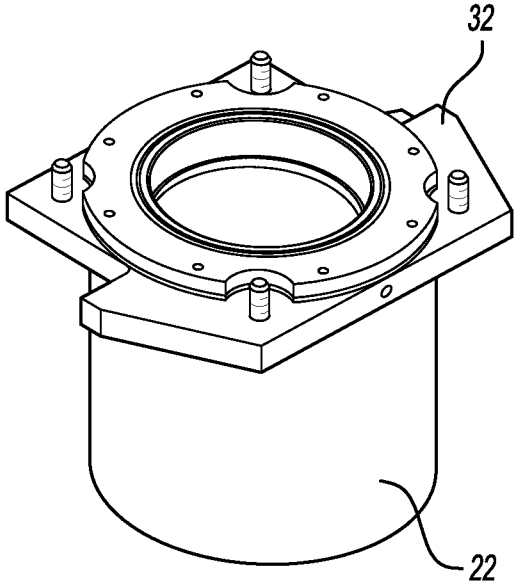

Fig-7

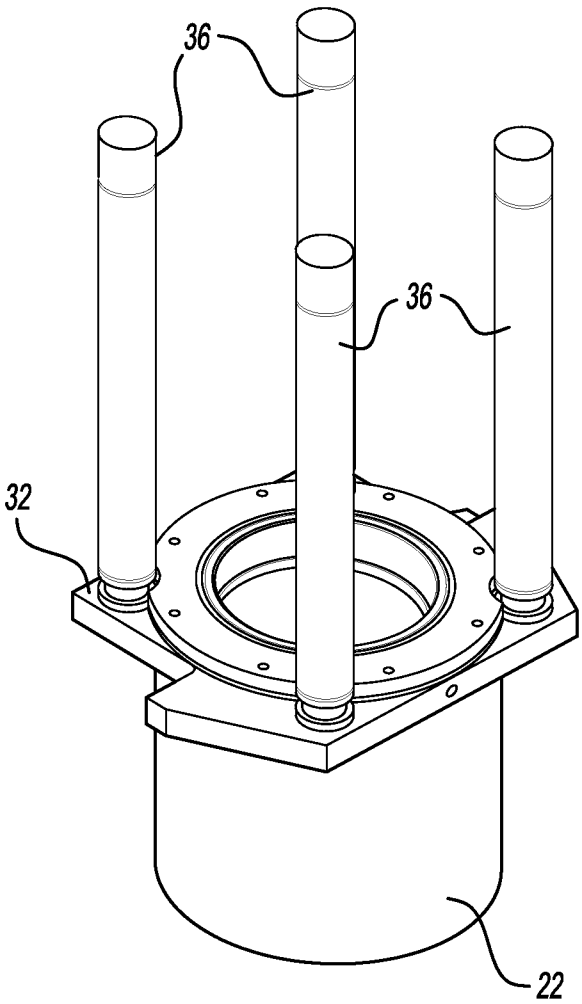

Fig-8

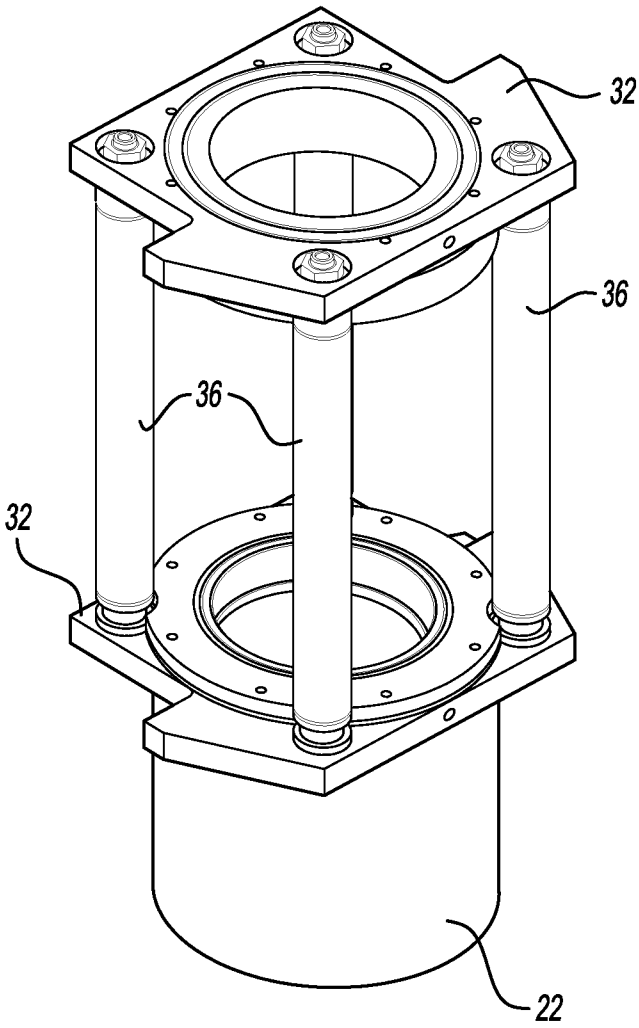

Fig-9

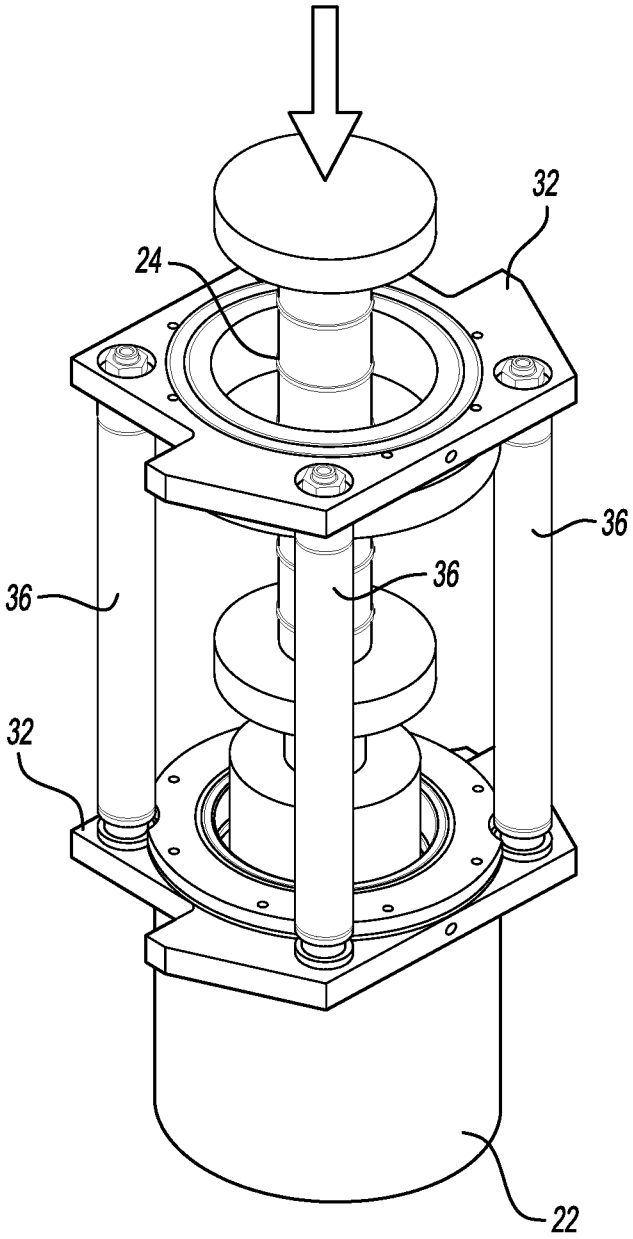

Fig-10

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/086905

A. CLASSIFICATION OF SUBJECT MATTER
INV. B66B11/04

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)
B66B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2006/151251 A1 (RENNETAUD JEAN-MARIE [US]) 13 July 2006 (2006-07-13) abstract column 2, line 66 - column 3, line 29 figures 3,4	1-14
A	EP 1 698 581 A (IND MONTANESAS ELECTRICAS MECA [ES]) 6 September 2006 (2006-09-06) abstract paragraphs [0034] - [0039] figures 1,3	1-14
A	US 2007/052308 A1 (COUPART ERIC [FR]) 8 March 2007 (2007-03-08) abstract paragraphs [0056] - [0060] figures 1-3	1-14

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[X] Further documents are listed in the continuation of Box C.

[X] 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 document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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
7 November 2008	18/11/2008

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Fax: (+31–70) 340–3016	Oosterom, Marcel

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/086905

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2005/206257 A1 (TAKAGI TAKAHIRO [JP] ET AL) 22 September 2005 (2005-09-22) abstract paragraphs [0043], [0044] figures 1-7	1
X	WO 02/103883 A (THYSSEN AUFZUGSWERKE GMBH [DE]; HAHN WOLFGANG [DE]; BUGIEL PETER [DE];) 27 December 2002 (2002-12-27) abstract page 7, line 16 - page 8, line 23 figure 2	15,16
A		17

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2007/086905

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers allsearchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☒ As only some of the required additional search fees were timely paid by the applicant, this international search reportcovers only those claims for which fees were paid, specifically claims Nos.:

1-17

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-14

Support of an elevator machine frame.

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2. claims: 15-17

Elevator machine frame comprising dampening means.

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3. claims: 18-20

Assembly of an elevator machine frame.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2007/086905

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