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1

TRACTION MACHINE FOR AN ELEVATOR

The present invention relates to an elevator and more particularly to a traction machine for an elevator which is provided with a reduction gear that includes spaced parallel shafts with gears respectively secured
5 thereon so as to be engaged with each other.

Firstly a conventional traction machine for an elevator of this type will be explained with reference to Figs. 1 to 3 of the attached drawings.

In the drawings the reference numeral 1 denotes
10 beams installed in a machine room (not shown), 2 is a traction machine platform supported on beams 1 through rubber vibration isolators 3, and 4 is a reduction gear mounted to traction machine platform 2. Reduction
gear 4 comprises a gear housing 4a of generally
15 rectangular cross section, an output shaft 4b rotatively supported in the opposite walls of housing 4a, a first rotor 4c in the form of a helical gear fixedly secured to output shaft 4b, a bore 4d formed in one of the walls of housing 4a corresponding to a portion thereof where
20 one end of output shaft 4b is to be supported, four projections 4e provided at equiangular intervals on the outer surface of the wall of housing 4a around the

peripheral portion of bore 4d, a support member 4f having a generally cylindrical shape fitted within opening 4d with a gap therebetween and fixedly mounted therein a radial bearing to rotably carry output shaft 4b at the one end, support member 4f having a square flange portion symmetrical with the cylindrical portion thereof on the outer surface, bolts 4g each screwed into respective projections 4e so as to abut on the side edges of the flange of support member 4f, respectively, an intermediate shaft 4h parallel to and spaced from output shaft 4b and rotatably supported at both ends by the opposite walls of housing 4a, respectively, a second rotor 4i in the form of a helical gear fixedly secured to intermediate shaft 4h and in mesh with first rotor 4c, a third rotor 4j in the form of a helical gear fixedly secured to intermediate shaft 4h and spaced from second rotor 4i, an input shaft 4k parallel to and spaced from intermediate shaft 4h and rotatably supported at both ends by the opposite walls of housing 4a, respectively, and a second rotor 4l in the form of a helical gear fixedly secured to input shaft 4k and in mesh with third rotor 4j. An electric motor 5 is mounted to housing 4a so as to drive input shaft 4k, an electromagnetic brake 6 being interposed therebetween. A traction sheave 7 is fixedly secured to output shaft 4b at the end opposite to support member 4f outside housing 4a, a hoisting wire rope 8 is rove around traction sheave 7, a car 9 is suspended from rope 8 at

one end, comprising a cab 9h supported by car sling 9a through rubber vibration isolators 9c, and a counter weight 10 is suspended from rope 8 at its other end.

Upon energization of electric motor 5, the rotation
5 of the motor transmitted to input shaft 4k is reduced in speed by reduction gear 4 and transmitted to traction sheave 7 through output shaft 4h so that car 9 and counter weight 10 are moved in opposite directions by rope 8. Unless the backlash of the first and second
10 rotors 4c, 4i, etc., are appropriately adjusted, various difficulties such as pitching, abnormal vibration, etc., of car 9, abnormal noises, seizure of the gears, etc., may occur, resulting in abnormal abrasion of the gears, gear damage, etc. Further, if the adjustment of the
15 meshing of the teeth of first and second rotors 4c, 4i is insufficient, abnormal abrasion of the teeth, etc., may result. In order to obviate these the conventional reduction gear is so designed that one end of output shaft 4h can be displaced by moving support member 4f in
20 a desired direction by appropriate adjustment of bolts 4g, making possible the adjustment of the backlash, meshing conditions, etc., of the teeth of first and second rotors 4c and 4i.

16

However, in this arrangement the adjustment mechanism for the position of support member 4f relative to housing 4a by means of bolts 4g brings the disadvantage that, since bolts 4g are subjected to a large load, the load of traction sheave 7, i.e. the suspension load of hoisting wire rope 8, is limited by the maximum tolerable load of bolts 4g. Further, since on adjustment of the mesh, etc., of the teeth of first and second rotors 4c and 4i a displacement of several hundredths of a mm is necessary, adjustment using standardized pitch bolts 4g is difficult and troublesome, whereas if the bolts 4g have fine pitch threads it is very troublesome to displace support member 4f by any great amount, impairing the workability of the device.

It is a primary object of the present invention to provide a traction machine for an elevator of the type described above which can eliminate all of the defects in the conventional traction machine exemplified above.

It is another objection of the present invention to provide a traction machine for an elevator which makes the adjustment of the meshing conditions, etc., of the rotors of the reduction gear easy so that normal traction operation of the elevator car is assured.

In accordance with the present invention, there is provided a traction machine for an elevator provided with a reduction gear means having a first and a second shaft respectively rotatably supported at each end by
5 respective spaced static supports, said first and second shafts having respectively a first and a second rotor fixedly secured thereon so as to be engaged with each other, at least one said support being provided, at the position where at least one end of at least one of said
10 first and second shafts is rotatably supported with a first cylindrical support member which is provided with a main cylindrical body having an outer cylindrical periphery and a cylindrical inner periphery eccentric relative to said outer periphery, said inner periphery
15 being adapted to rotatably support said end of said shaft, and a second cylindrical support member which is provided with a main cylindrical body having an outer cylindrical periphery fitted rotatably within a bore correspondingly formed in at least one support and an
20 inner cylindrical periphery eccentric relative to said outer periphery, the first support member being fitted rotatably within the second support member with the cylindrical outer periphery of the first support member fitted in the cylindrical inner periphery of the second
25 support member, means being provided for selectively securing the first and second support members to the associated support in selected angular positions whereby the lateral position of the associated shaft end can be adjusted.

The said supports may comprise spaced parallel walls of a reduction gear housing. Alternatively, the reduction gear may be provided with a housing having spaced parallel walls and an associated bearing support
5 outside the housing, the said at least one shaft being rotatably supported at its ends in the bearing support and in the housing wall further from this, and extending through the further housing wall.

An adjustable shaft support comprising said first
10 and second support members may be provided at one or both ends of a shaft.

The rotors of the reduction gear may comprise helical gears in mesh with one another; friction wheels engaged under pressure with each other at their
15 peripheries, or a worm wheel and worm with mutually perpendicular shafts.

The above brief description as well as further objects, features and advantages of the present invention will be more fully understood by
20 reference to the following detailed description of the presently preferred, but nonetheless illustrative embodiments in accordance with the

present invention when taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a schematic view illustrating the principal parts of a conventional traction machine for an
5 elevator;

Fig. 2 is a cross-sectional view of the traction machine shown in Fig. 1 taken along the line II-II thereof;

Fig. 3 is a side elevational view of the traction machine shown in Fig. 2 as viewed from the left-hand side
10 thereof;

Fig. 4 is a view corresponding to Fig. 2 illustrating one embodiment of the traction machine in accordance with the present invention;

Fig. 5 is a partial enlarged view of the part of
15 Fig. 4 enclosed by the dotted line V;

Fig. 6 is a side elevational view of Fig. 5 as viewed from the left-hand side thereof;

Fig. 7 is a side elevational view of Fig. 5 as viewed from the right-hand side thereof;

20 Fig. 8 is a view similar to Fig. 4 illustrating another embodiment of the traction machine in accordance with the present invention;

Fig. 9 is a view similar to Fig. 4 illustrating a still further embodiment of the present invention;

25 Fig. 10 is a side elevational view of Fig. 9 as viewed from the left-hand side thereof; and

Fig. 11 is a longitudinal sectional view illustrating the principal parts of the traction machine pertaining to a further embodiment of the present invention.

In Figs. 4 to 7 of the attached drawings wherein one embodiment of the present invention is shown with identical or similar parts to those shown in Figs. 1 to 3 bearing the same reference numerals as in Figs. 1 to 3, reduction gear 4 is formed with circular bores 4d in the opposite parallel walls of housing 4a, respectively, at positions confronting the ends of intermediate shaft 4h, respectively, and a number of threaded holes 4m are formed in the walls of housing 4a around circular bores 4d, respectively, at equi-angular intervals. Rotatably received in bores 4d, respectively, are a first and a second cylindrical support member 11 and 12 as follows: Second cylindrical support member 12 comprises a main cylindrical body having a cylindrical outer periphery 12a adapted to be rotatably received in bore 4d of housing 4a, and a circular flange 12b integrally formed with the main cylindrical body at one end concentrically therewith and adapted to abut at one surface against the outer wall of housing 4a. The main cylindrical body of support member 12 is formed with a cylindrical inner periphery 12c eccentrically with the center axis of the main cylindrical body. Circular flange 12b of first cylindrical member 12 has such a radial dimension as to accommodate a number of bolt holes 12d to respectively correspond to threaded holes 4m formed in the wall of housing 4a, bolt hole 12d preferably being of a circular cross section.

First cylindrical support member 11 comprises a main cylindrical body having a cylindrical outer periphery

11a corresponding to cylindrical inner periphery 12c_ of support member 12, and a disk-like circular flange 11b integrally formed concentrically with the main cylindrical body thereof. The main cylindrical body of first cylindrical support member 11 is formed with a cylindrical well or recess having a cylindrical inner periphery 11c_ eccentrically with the centre axis thereof and adapted to rotably support one end of intermediate shaft 4h through a radial bearing. Circular flange 11b of first support member 11 has the same diameter as the circular flange 12b of second support member 12 so as to form a smooth common periphery and is similarly formed with bolt holes 11d so as to respectively correspond to screw threaded holes 4m of housing 4a, bolt hold 11d being preferably of a radially oblong cross section (see Fig. 7).

On the mounting first and second support members 11 and 12 to housing 4a, after second support member 12 is received in bore 4d with the surface of circular flange 12b abutting the wall, then first support member 11 is introduced into second support member 12 by sliding outer cylindrical periphery 11a_ of the main cylindrical body of first support member 11 along inner cylindrical periphery 12c_ of the cylindrical main body of second support member 12 until circular flanges 11b and 12b come into contact, and a corresponding number of bolts 13 are passed through bolt holes 11d and 12d and screwed into threaded holes 4m so that first and second support members 12, 11 are fixedly secured to the walls of housing 4a.

Thus, intermediate shaft 4h is rotatably supported at both ends in housing 4a through first and second support members 12 and 11. Rotation of first support member 11 relative to second support member 12,
5 and of second support member 12 relative to housing 4a, displaces the position of intermediate shaft 4h through the double eccentricity of inner cylindrical peripheries 11c and 12c of first and second support member 11, 12. Therefore, the backlash, the mesh, etc. of the teeth of first and
10 second rotors 4c and 4i can be suitably adjusted by a simple operation. Moreover, since the radial load of intermediate shaft 4h is carried by large areas namely the inner periphery of bore 4d of the wall of housing 4a, outer cylindrical periphery 11a of first support member 11, etc. a
15 large load can be easily born so that the suspended load limitations on hoist rope 8 are lessened. Additionally, in the embodiment illustrated, the mutual backlash, etc. of the teeth of the third and fourth gears 4j, 4l can be simultaneously adjusted by movement of
20 intermediate shaft 4h together with the adjustment of the space between the first and second rotors 4c, 4i.

Further, it is also possible that if at the time of assembly first and second rotors 4c, 4i, etc. are designed so as to be at an optimum engaging condition when the center
25 line of intermediate shaft 4h is arranged above or below the plane connecting the center lines of output shaft 4b and input shaft 4k, then, when the teeth of first and second rotors 4c, 4i, etc. wear down, the optimum engaging conditions, etc. of first and second rotors 4c, 4i, etc. can

be easily restored by causing the center line of intermediate shaft 4h to approach the plane connecting the center lines of output shaft 4b and input shaft 4k by the adjustment of first and second support members 11, 12. It is also
5 conceivable that when the eccentricities of first and second support members 11 and 12 are previously selected so that one of them is larger than the other the adjustment operation can be carried out efficiently in such a manner that when a large positional displacement is necessary the support
10 member having the larger eccentricity is rotated, whereas when a small positional displacement is required the one having a smaller eccentricity is rotated. It should also be added that when a third support member is provided similar to first and second support members 11, 12 so as to be
15 relatively rotatably combined with each other in a similar manner a finer adjustment can be realized than when only first and second support members 11, 12 are combined.

Another embodiment of the present invention is shown in Fig. 8 wherein the parts similar or identical to
20 those in the first embodiment shown in Figs. 4 to 7 bear the same reference numerals as those in this figure.

In Fig. 8 the reference numeral 4b is an output shaft one end of which projects from traction sheave 7 in the direction opposite to housing 4a, 4a' is a bearing
25 support member integrally formed with housing 4a so as to constitute a part thereof and adapted to rotatably support the projecting end of output shaft 4b, 4c is a first rotor fixedly secured to output shaft 4b in the form of a friction wheel, 4i is a second rotor fixedly secured to intermediate

12

shaft 4h in the form of a friction wheel urged toward first rotor 4c, 4j is a third friction wheel fixedly secured to intermediate shaft 4h spaced apart from second rotor 4i, and 4l is a fourth friction wheel fixedly secured to input shaft 4k and urged toward third friction wheel 4j. Further, as shown in Fig. 8 both ends of output shaft 4b are rotatably supported by housing 4a and bearing support member 4'a, respectively, through first and second support members 11 and 12 in the same manner as in Figs. 4 to 7.

Thus, in this embodiment the ends of output shaft 7 are rotatably carried by frame 4a and bearing support member 4'a, respectively, through first and support members 11, 12. Therefore, in this case, the engagement condition between first and second rotors 4c and 4i can be adjusted by displacing the position of output shaft 4b through the manipulation of first and second support members 11, 12. This adjustment must be made since if the distance between the center lines of first and second rotors 4c, 4i is not within a predetermined tolerance such problems as a decrease in power transmission, abnormal vibration, noise, abrasion or breakage, etc. of the rotors occur. When the parallelism between the friction surfaces of first and second friction wheels 4c and 4i is not within a predetermined tolerance, abnormal abrasion of the friction surfaces, decrease in the power transmission capacity, etc. also occur. The above various difficulties or defects can be compensated for by the displacement of output shaft 7 as described above. Thus, although no detailed explanation is given here, it will be apparent that this embodiment

operates and has effects similar to those in the first embodiment.

The third embodiment of the present invention is illustrated in Figs. 9 and 10 with the parts identical or similar to those in Figs. 4 to 7 being identically numbered.

In Figs. 9 and 10 the reference numeral 4h is a first intermediate shaft rotatably supported by the housing 4a, 4'h is a second intermediate shaft similarly rotatably supported within housing 4a parallel with and spaced apart from first intermediate shaft 4h, 4n is a first gear fixedly secured to output shaft 4b, 4p is a second gear fixedly secured to first intermediate shaft 4h and in mesh with first gear 4n, 4c is a first rotor fixedly secured to first intermediate shaft 4h apart from second gear 4p and in the form of a third gear, 4j is a second rotor fixedly secured to second intermediate shaft 4'h and in the form of a fourth gear in mesh with third gear 4c or first rotor, and 4l is a fifth gear fixedly secured to input shaft 4k parallel with second intermediate shaft 4'h spaced apart therefrom and in mesh with second rotor 4j. As can be seen from Fig. 9 both ends of second intermediate shaft 4'h are respectively rotatably supported within the walls of housing 4a by first and second support members 11 and 12 just as for intermediate shaft 4h in the case of the first embodiment.

Thus, also in this embodiment both ends of second intermediate shaft 4'h are rotatably supported in housing 4a by first and second support members 11 and 12, respectively. Therefore, the engagement condition of the teeth of first and second rotors 4c and 4j can be adjusted by the

displacement of second intermediate shaft 4'h through the manipulation of first and second support members 11, 12. Although the detailed explanation therefor is omitted here, it will be apparent that this embodiment operates quite
5 similarly to the case of the first embodiment shown in Figs. 4 to 7, revealing similar effects.

Finally the fourth embodiment of the present invention is shown in Fig. 11 wherein parts identical or similar to those in the first embodiment shown in Figs. 4 to
10 7 bear the same reference numerals as those in Figs. 4 to 7.

In Fig. 11 the reference numeral 4c is a first rotor in the form of a worm wheel fixedly secured to an output shaft 4b rotatably mounted within housing 4a and 4i
15 is a second rotor in the form of a worm fixedly secured to an input shaft 4h at right angles to output shaft 4b in mesh with first rotor, i.e. worm wheel 4c.

As can be seen from Fig. 11, one end of output shaft 4b is rotatably supported by the wall of housing 4a and the other end thereof is rotatably supported by bearing
20 support member 4'a disposed outside housing 4a so as to be integral therewith, both through first and second cylindrical support members 11 and 12. Therefore, although no detailed explanation is given here, it will be apparent that this
25 embodiment operates similarly to the embodiment shown in Figs. 4 to 7, revealing similar effects.

From the foregoing it will be appreciated that the present invention allows the engagement condition of the first and second rotors of a reduction gear for an elevator to be appropriately adjusted by a simple
 5 operation, preventing the generation of any abnormal vibration, noise, etc., in the traction machine, and prolonging its life with minimum maintenance and expense. Further, since the load of the shaft on which the rotor is fixedly secured is carried by the surfaces
 10 of the first and second cylindrical support members a large load can be easily born, whereby a traction machine for an elevator is attained in which the limitations on the suspension loads are lessened.

**CLAIMS:**

1. A traction machine for an elevator provided with a reduction gear means having a first and a second shaft respectively rotatably supported at each end by respective spaced static supports, said first and second
5 shafts having respectively a first and a second rotor fixedly secured thereon so as to be engaged with each other, at least one said support being provided, at the position where at least one end of at least one of said first and second shafts is rotatably supported with a
10 first cylindrical support member which is provided with a main cylindrical body having an outer cylindrical periphery and a cylindrical inner periphery eccentric relative to said outer periphery, said inner periphery being adapted to rotatably support said end of said
15 shaft, and a second cylindrical support member which is provided with a main cylindrical body having an outer cylindrical periphery fitted rotatably within a bore correspondingly formed in at least one support and an inner cylindrical periphery eccentric relative to said
20 outer periphery, the first support member being fitted rotatably within the second support member with the cylindrical outer periphery of the first support member fitted in the cylindrical inner periphery of the second support member, means being provided for selectively

29



securing the first and second support members to the associated support in selected angular positions whereby the lateral position of the associated shaft end can be adjusted.

5 2. A traction machine as claimed in claim 1 in which the reduction gear means is provided with a housing having spaced parallel walls which constitute the said supports.

10 3. A traction machine as claimed in claim 1 in which the reduction gear means has a housing with spaced parallel walls, and in which the said at least one shaft is rotatably supported at one end in a said wall and extends through the other said wall to a second shaft end which is rotatably supported in a static bearing
15 support outside and fast with the housing, the first housing wall and/or the bearing support being provided with a said first and second support member for supporting the associated shaft end.

20 4. A traction machine as claimed in claim 3 in which both the first housing wall and the bearing support are each provided with said first and second support members for the respective shaft ends.



5. A traction machine as claimed in claim 4 wherein one of said shafts which is rotatably supported at each end by said first and second cylindrical support members is disposed at right angles to the other of said shafts,
- 5 and said rotors are a worm wheel and a worm in mesh with each other, respectively, fixedly secured to said first mentioned and second mentioned shafts, respectively.
6. A traction machine for an elevator as claimed in any of claims 1 to 4 wherein said first and second rotors
- 10 are helical gears, in mesh with each other.
7. A traction machine for an elevator as claimed in any of claims 1 to 4 wherein said first and second rotors are friction wheels forcedly engaged with each other at their peripheries.
- 15 8. A traction machine for an elevator as claimed in any preceding claim wherein said first and second cylindrical support members have said outer peripheries provided with radial annular flanges which serve to fixedly secure said first and second cylindrical support
- 20 members to a said support by screwing bolts loosely passed through the bolt holes formed circumferentially therein at regular intervals into said support.



9. Traction machinery for an elevator substantially as herein described with reference to Figures 4 to 7, Figure 8, Figures 9 and 10 or Figure 11 of the accompanying drawings.
