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(54) ELEVATOR SYSTEM IMPLEMENTING A MULTI-LINEAR MULTI-PHASE INDUCTION MACHINE INCLUDING A PLURALITY OF STATORS CONTROLLED IN PARALLEL

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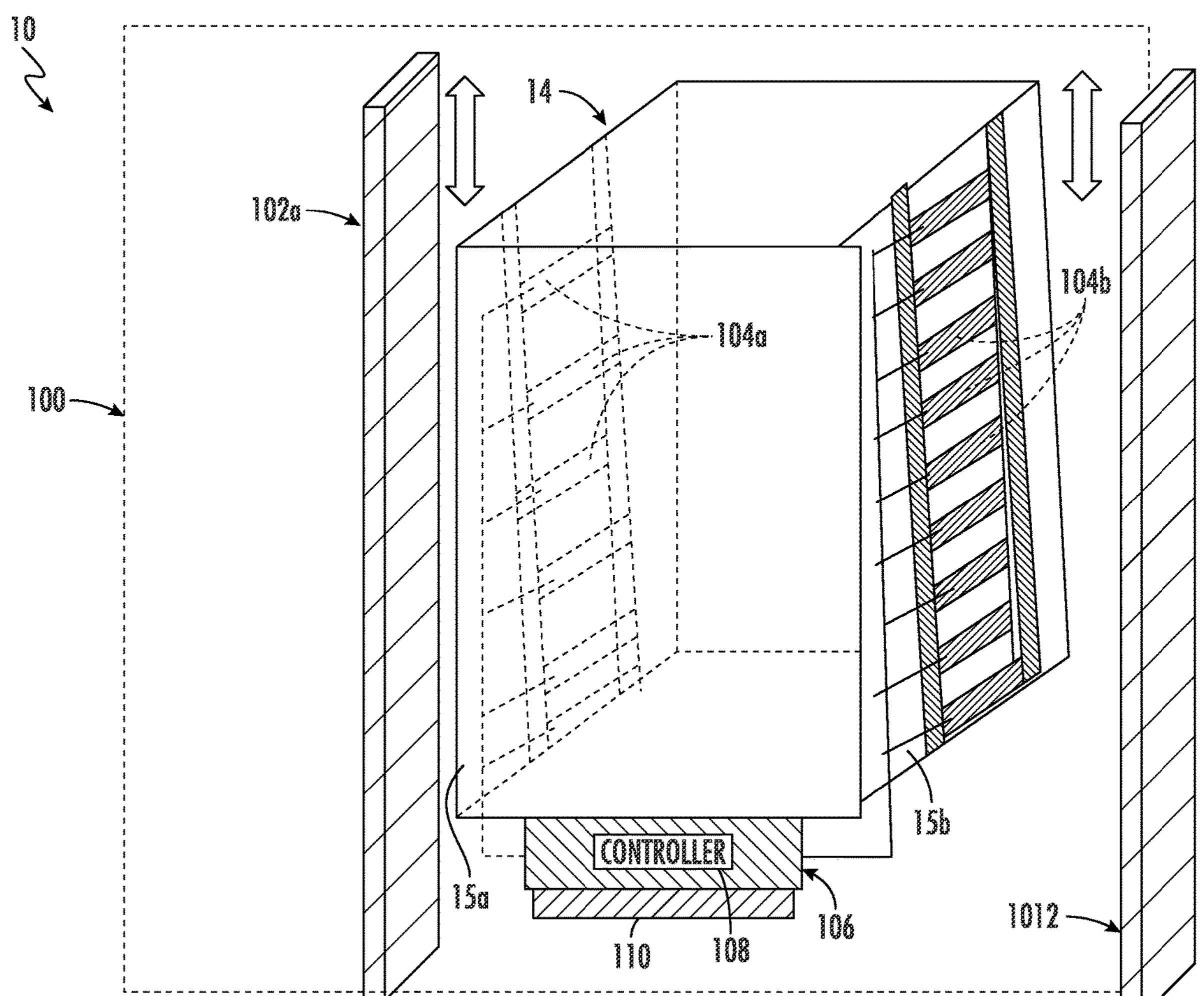
(57) **ABSTRACT**

A multi-phase linear induction machine includes at least one armature which can be disposed in an elevator hoistway and is configured to electrically conduct electromagnetic energy, and a plurality of stators which can be coupled to an elevator car that is configured to travel through the hoistway. Each of the stators are configured to conduct electrical current there-through and generate an electromagnetic field in response to the current. The electromagnetic field induces eddy currents that flow through the at least armature to generate a magnetic force to move the elevator car through the hoistway.



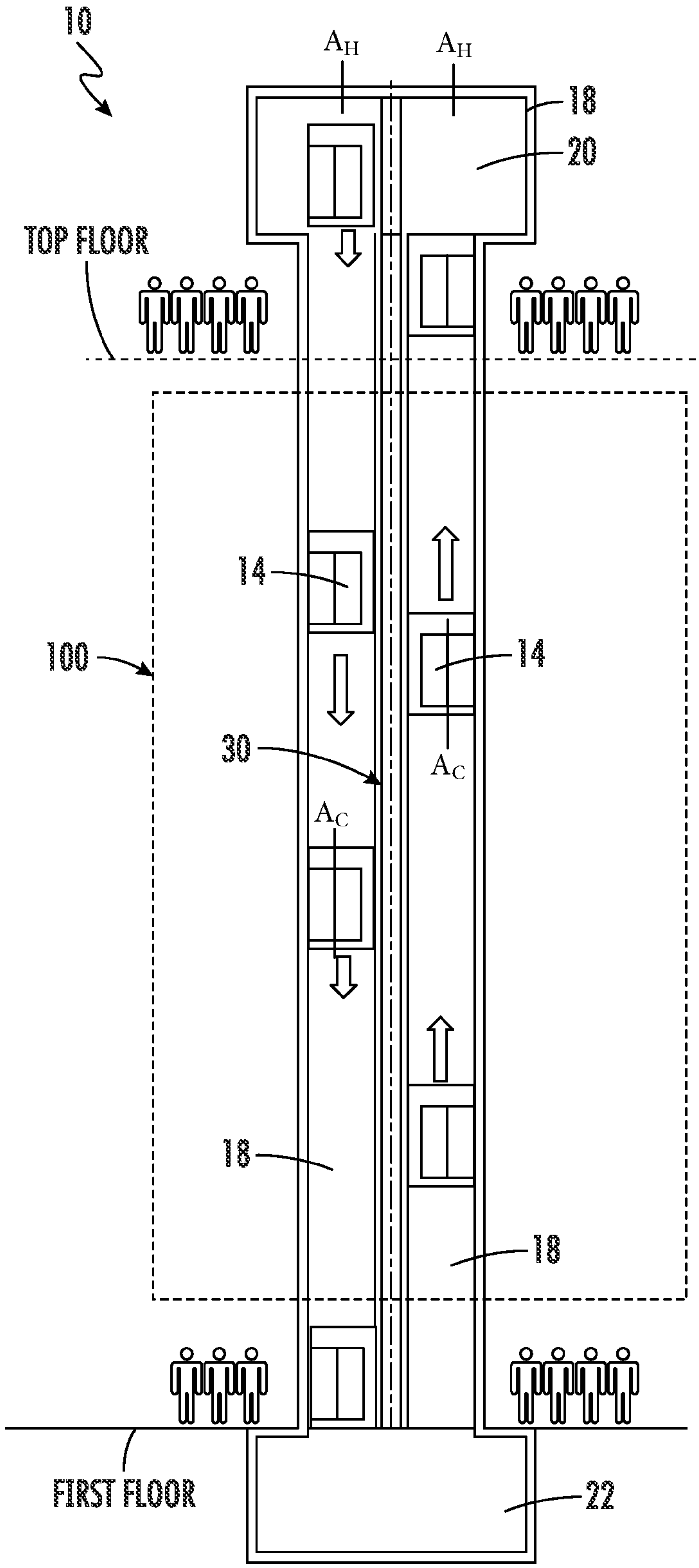


FIG. 1

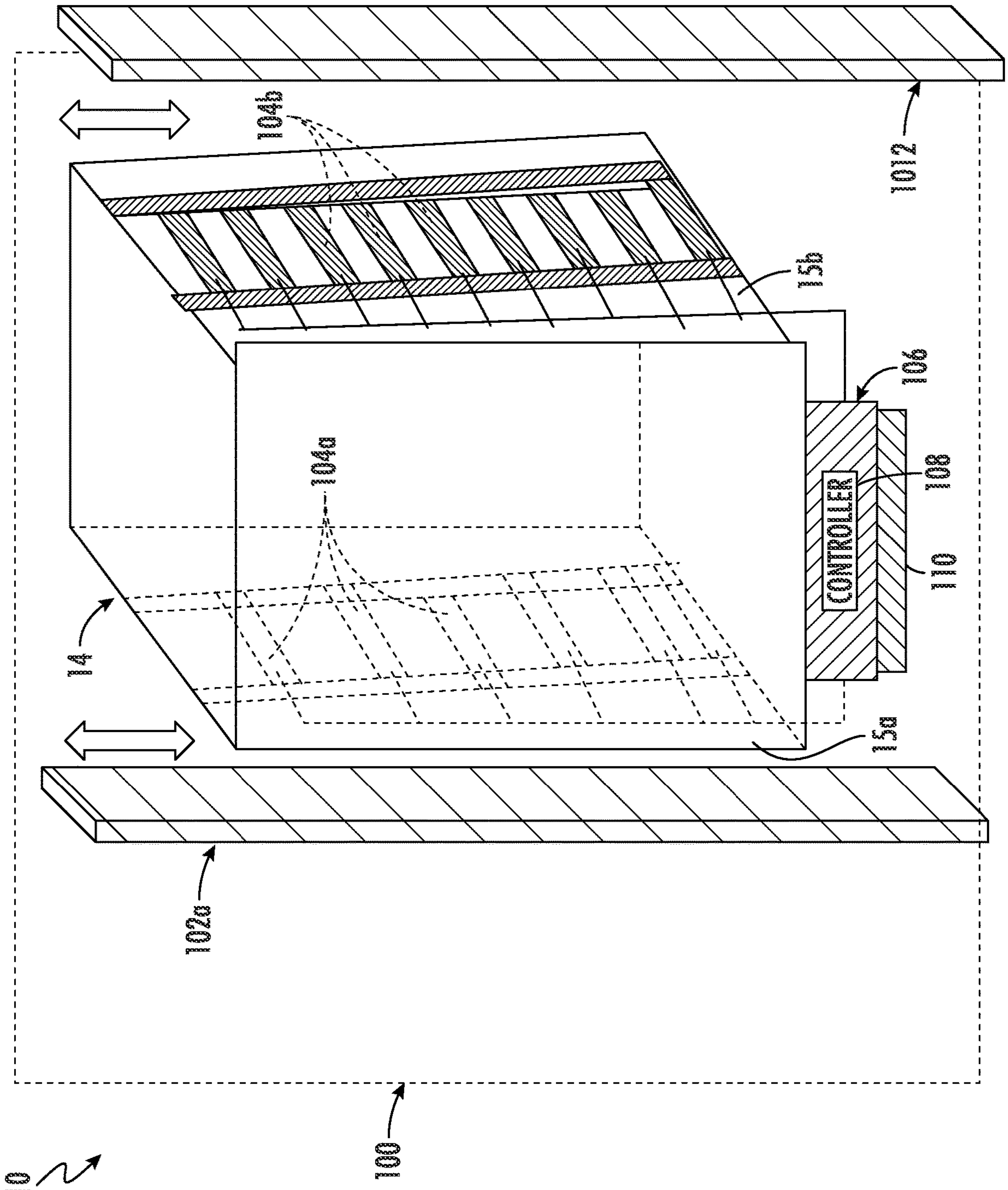


FIG. 2

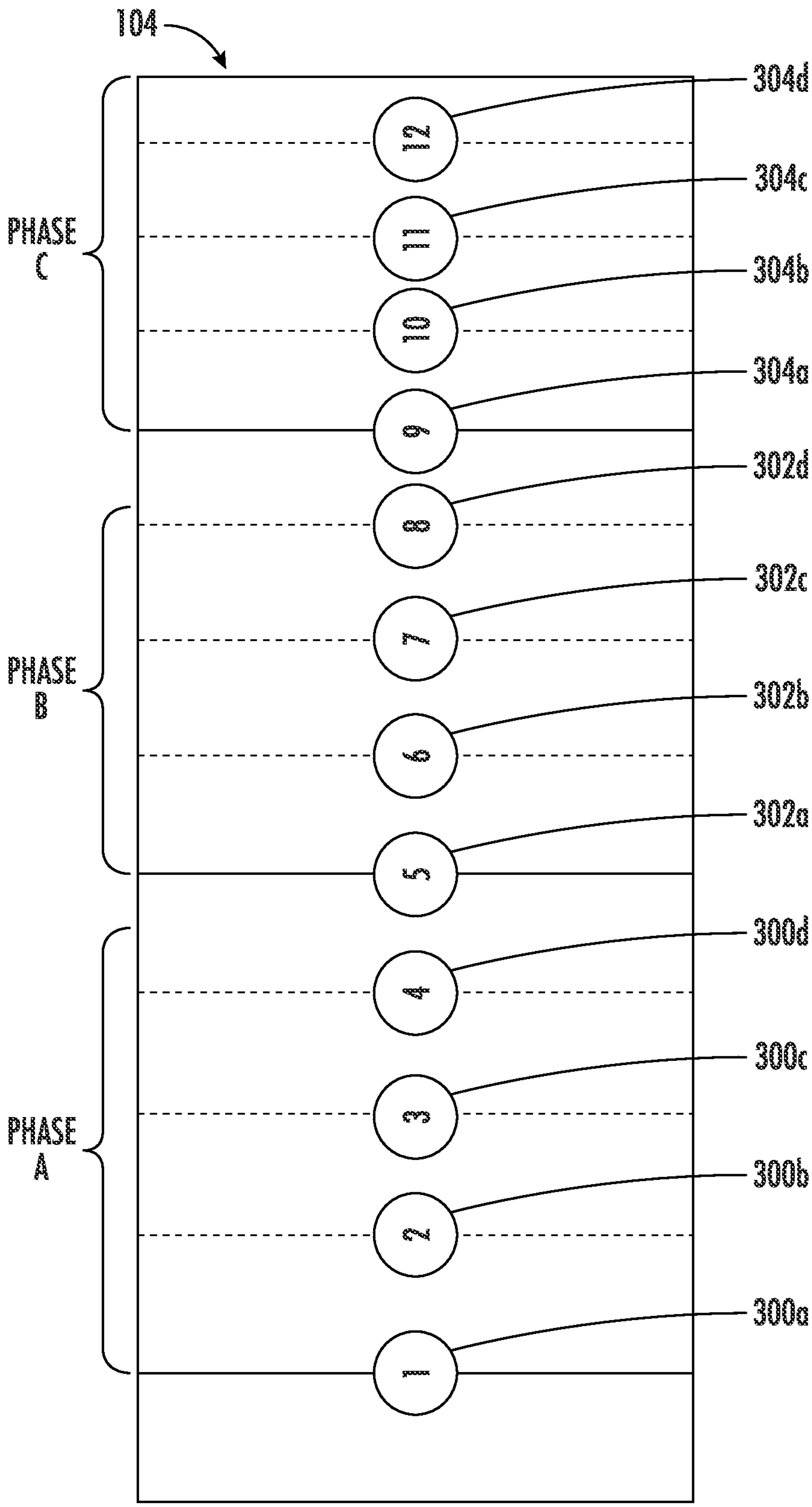

104
304d
304c
304b
304a
302d
302c
302b
302a
300d
300c
300b
300a
PHASE C
PHASE B
PHASE A
12
11
10
9
8
7
6
5
4
3
2
1

FIG. 3

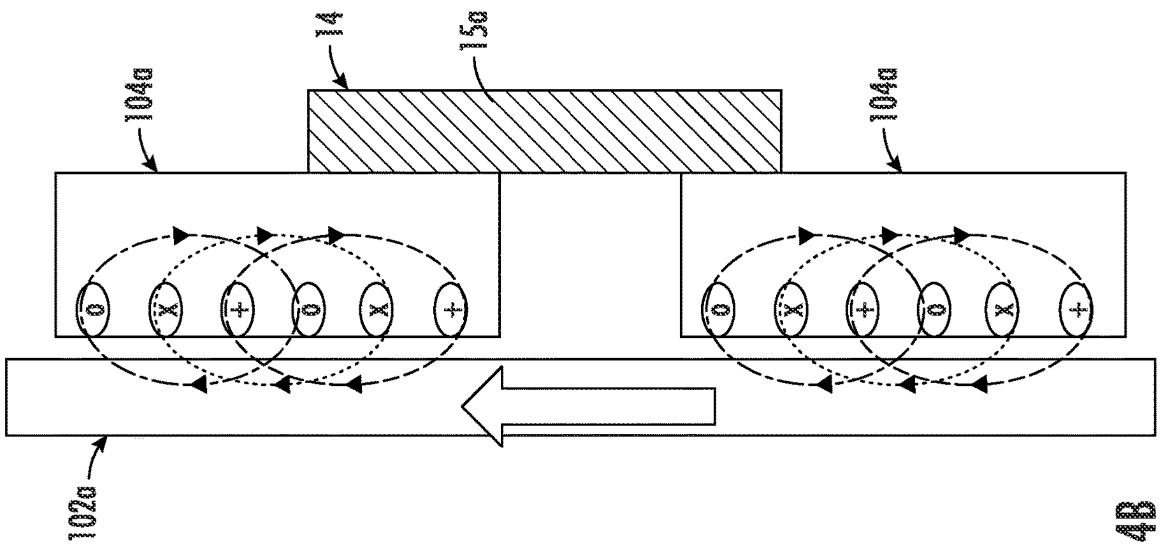


FIG. 4B

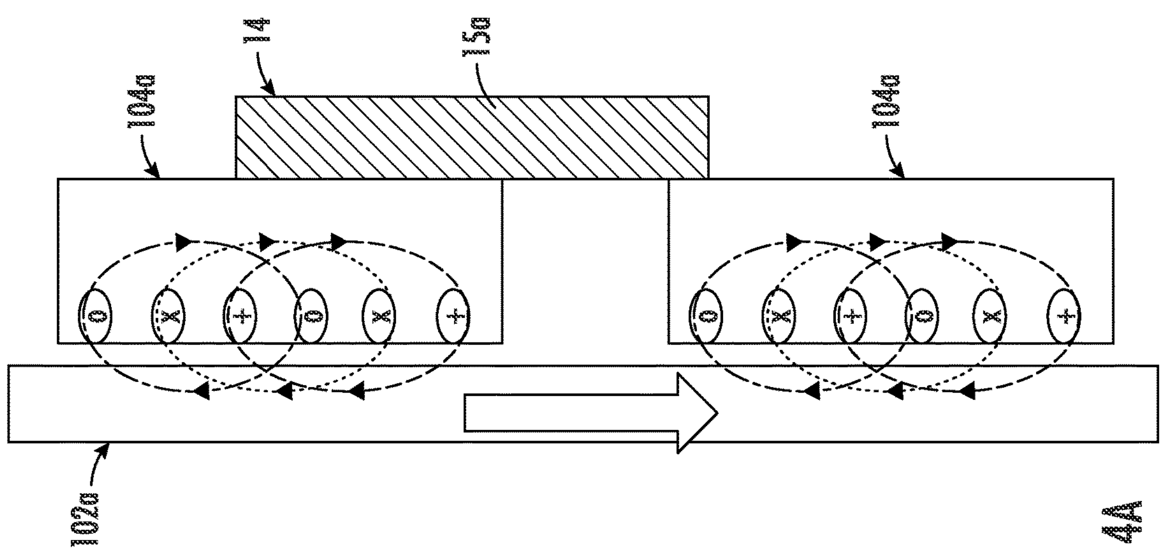


FIG. 4A

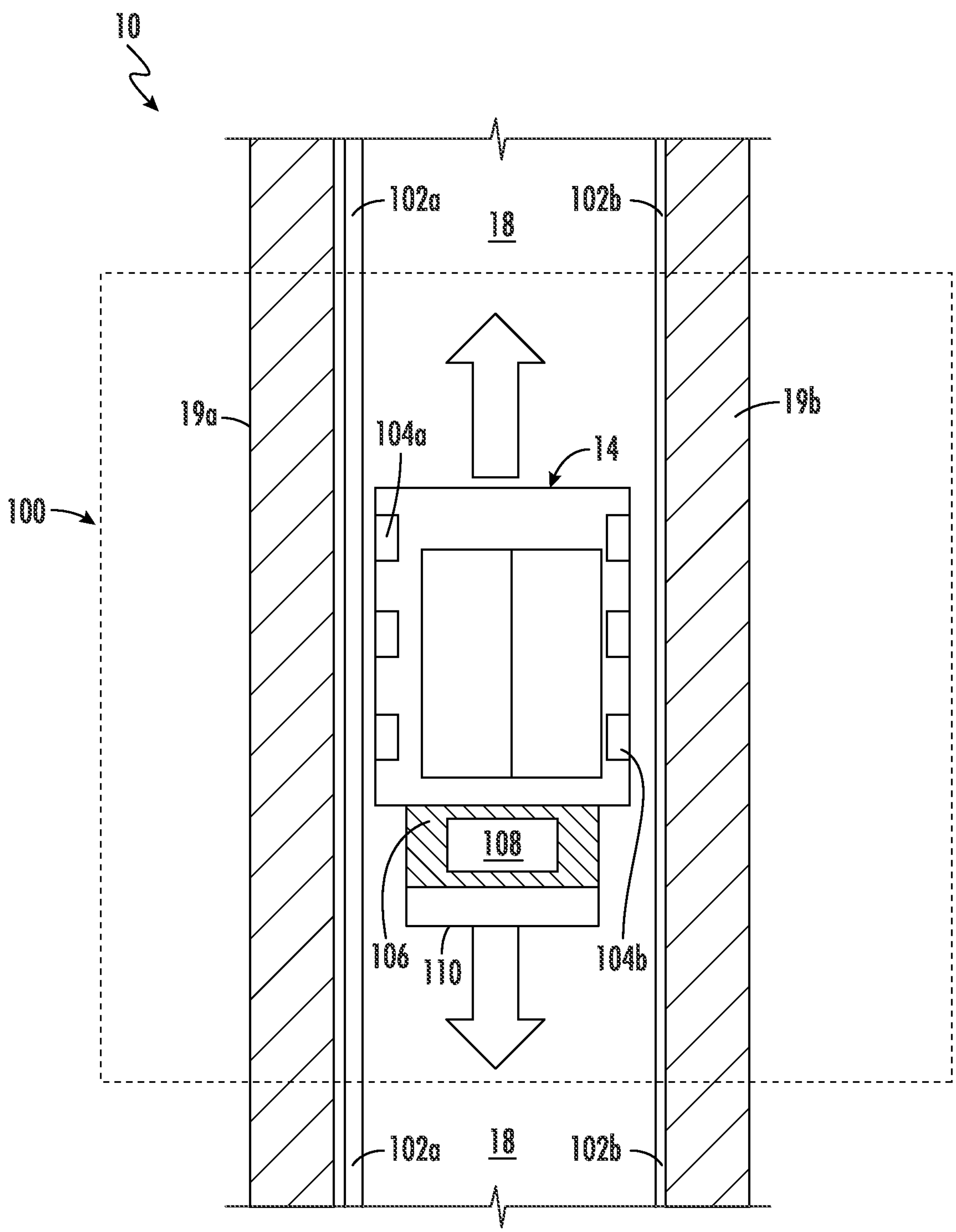

10
102a
18
102b
19a
19b
104a
14
100
108
106
110
104b
102a
18
102b

FIG. 5

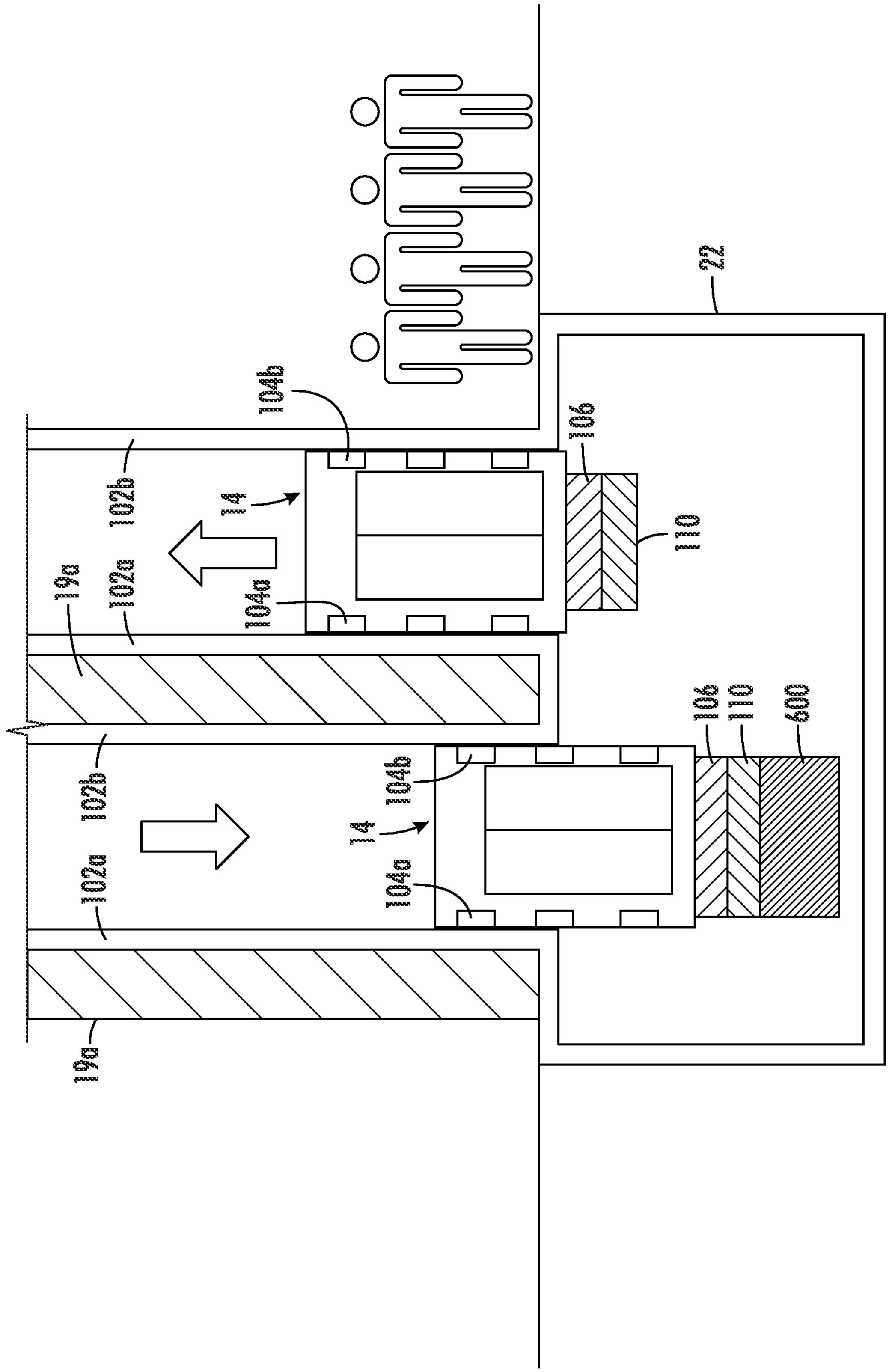

22
104b
106
14
102b
110
19a
102a
104a
104b
102b
14
102a
104a
106
110
600
19a

FIG. 6

ELEVATOR SYSTEM IMPLEMENTING A MULTI-LINEAR MULTI-PHASE INDUCTION MACHINE INCLUDING A PLURALITY OF STATORS CONTROLLED IN PARALLEL

BACKGROUND

[0001] The present disclosure generally relates to elevator systems, and in particular, to self-propelled elevator systems.

[0002] Traditional elevator systems implement tensions members such as ropes and/or cables, for example, to move one or more elevator cars in a hoistway. More recently, however, self-propelled elevator systems, also referred to as "ropeless" elevator systems, are being utilized in various applications (e.g., high rise buildings) where it is undesirable to implement traditional tension members to move the elevator car.

BRIEF SUMMARY

[0003] In accordance with some embodiments, a multi-phase linear induction machine included in an elevator system is provided. The multi-phase induction machine comprises at least one armature that can electrically interact with a plurality of stators. The at least one armature can be disposed in a hoistway and is configured to electrically conduct electromagnetic energy. The plurality of stators can be coupled to an elevator car that is configured to travel through the hoistway. Each of the stators are configured to conduct electrical current therethrough and to generate an electromagnetic field in response to the current. The electromagnetic field induces eddy currents that flow through the at least armature to generate a magnetic force which moves the elevator car through the hoistway.

[0004] In addition to one or more of the features described above, or as an alternative, further embodiments may include, a first armature disposed in the hoistway and a second armature disposed in the hoistway opposite the first armature.

[0005] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein the first and second armatures include an electrically conductive material capable of conducting the induced electric eddy currents therethrough.

[0006] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein the first and second armatures extend vertically along a length of the hoistway.

[0007] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein plurality of stators includes a first set of stators coupled to a first side of the elevator car and adjacent the first armature, and a second set of stators coupled to a second side of the elevator car opposite the first side of the elevator car and adjacent the second armature.

[0008] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein the first set of stators and the second set of stators are electrically connected to power electronics that are configured to deliver the electrical current to the first and second set of stators.

[0009] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein the power electronics receive battery power from a rechargeable battery, and covert the battery power into the electrical current that is delivered to the first and second set of stators.

[0010] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein a controller is configured to control the power electronics and selectively control the direction of the current flow through the first and second armatures.

[0011] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein current flowing through the first and second set of stators in a first direction generates an electromagnetic filed having a flux that travels in a first direction, and current flowing through the first and second set of stators in a second direction generates an electromagnetic field having a flux that travels in a second direction opposite the first direction.

[0012] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein the flux traveling in the first direction produces a first magnetic force that moves the elevator car through the hoistway in a first vertical direction, and wherein the flux traveling in the second direction produces a second magnetic force that moves the elevator car through the hoistway in a second vertical direction opposite the first vertical direction.

[0013] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein the controller invokes a recharge mode and in response to invoking the recharge mode moves the elevator car to a docking station included in the hoistway to recharge the battery.

[0014] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein the docking station includes a battery charger, and wherein moving the elevator car to the docking station establishes electrical transfer between the rechargeable battery and the battery charger to recharge the battery.

[0015] The multi-phase induction linear induction machine of claim **1**, wherein the at least one armature and the plurality of stators establish a three-phase machine.

[0016] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein two or more stators are coupled adjacent to the elevator car.

[0017] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein the two or more stators are configured to maintain a center car axis of the elevator car in line with a center hoistway axis of the hoistway.

[0018] In accordance with some embodiments, a method of controlling a multi-phase linear induction machine included in an elevator system is provided. The method comprises disposing at least one armature disposed in a hoistway to electrically conduct electromagnetic energy, and coupling a plurality of stators coupled to an elevator car configured to travel through the hoistway. The method further comprises conducting electrical current through each of the stators to generate an electromagnetic field, and inducing a flow of eddy currents through the at least armature in response to the electromagnetic field to generate a magnetic force that moves the elevator car through the hoistway.

[0019] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein the at least one armature includes a first armature disposed in the hoistway and a second armature disposed in the hoistway opposite the first armature.

[0020] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein the first and second armatures include an electrically conductive material capable of conducting the eddy currents therethrough.

[0021] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein the first and second armatures extend vertically along a length of the hoistway.

[0022] In addition to one or more of the features described above, or as an alternative, further embodiments may include a feature, wherein the plurality of stators includes a first set of stators coupled to a first side of the elevator car and adjacent the first armature, and a second set of stators coupled to a second side of the elevator car opposite the first side of the elevator car and adjacent the second armature.

[0023] The foregoing features and elements may be combined in various combinations without exclusivity, unless expressly indicated otherwise. These features and elements as well as the operation thereof will become more apparent in light of the following description and the accompanying drawings. It should be understood, however, that the following description and drawings are intended to be illustrative and explanatory in nature and non-limiting.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The subject matter which is regarded as the invention is particularly pointed out and distinctly claimed in the claims at the conclusion of the specification. The foregoing and other features and advantages of the invention are apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

[0025] FIG. **1** illustrates a self-propelled elevator system capable of implementing a multi-phrase linear induction machine according to a non-limiting embodiment of the present disclosure;

[0026] FIG. **2** illustrates a multi-phrase linear induction machine for moving an elevator car in a self-propelled elevator system according to a non-limiting embodiment of the present disclosure;

[0027] FIG. **3** illustrates a stator included in a three-phrase linear induction machine configured to move an elevator car in a self-propelled elevator system according to a non-limiting embodiment of the present disclosure;

[0028] FIG. **4**A illustrates a magnetic field interaction between an armature and a plurality of stators included in a three-phrase induction machine to induce movement of the stator in a first direction according to a non-limiting embodiment of the present disclosure;

[0029] FIG. **4**B illustrates a magnetic field interaction between an armature a plurality of stators included in a three-phrase induction machine to induce movement of the stator in a second direction according to a non-limiting embodiment of the present disclosure;

[0030] FIG. **5** illustrates an elevator system implementing a three-phrase induction machine that includes one or more stators and an elevator car installed with rechargeable battery according to a non-limiting embodiment of the disclosure; and

[0031] FIG. **6** illustrates the elevator car of FIG. **5** stowed in a lower docking station to charge the rechargeable battery according to a non-limiting embodiment of the disclosure.

DETAILED DESCRIPTION

[0032] At present, self-propelled elevator systems utilize a power system that employs various power electronics to facilitate the power necessary to propel an elevator car in a hoistway. These power electronics include, for example, a power inverter (e.g., as switched variable speed alternating drive (AC) motor drive) to improve performance of the power system. A switched variable speed AC motor drive, for example, typically utilizes the switching of the semiconductor switches (e.g., transistors) to create the variable voltage and variable frequency output. However, the switching of power electronic devices in a power system can cause undesirable electromagnetic interference (EMI). In general, EMI noise can be categorized into two groups: differential mode (DM) noise and common-mode (CM) noise. DM noises are conducted between phases, while CM noises are conducted together with all phases through the parasitic capacitors to the ground. CM noises can cause additional concern in motor drive applications because CM noises increase the EMI in the motor drive, which can damage the motor bearing and winding insulation.

[0033] Various non-limiting embodiments described herein avoid the CM noise concerns by providing a self-propelled elevator system that implements a multi-phase linear induction machine, which includes one or more stators coupled to the elevator car. The stators operate in response to an electromagnetic field produced by an electrically conductive armature that is coupled to an inner area of the elevator system **10** such as, for example, a wall or facade of the hoistway. The electromagnetic field energizes the stators, thereby propelling (i.e., "self-propelling) the elevator car through the hoistway. Although the system is described as a three-phase system, it should be appreciated that the system can be implemented using different phases, such as, for example, two, four, five six, etc., without departing from the scope of the present disclosure. Accordingly, sound, noise, and/or vibration of the system is virtually zero because there is no mechanical contact between the moving parts as the elevator car (also referred to as the cabin) moves through the hoistway. In addition, each car included in the elevator system is self-propelled and energized, can travel autonomously inside the hoistway to service the customer calls requested at various floor following the software protocol installed in an elevator controller.

[0034] With reference now to FIG. **1**, an elevator system **10** may be utilized in applications that require movement of a vehicle along a track. For example, the elevator system **10** may be utilized for elevators, trains, roller coasters, or the like. The elevator system **10** (sometimes referred to as a "linear propulsion system") includes a three-phrase linear induction machine **100**.

[0035] As shown in FIG. **1**, the elevator system **10** comprises one or more hoistways **18**. The hoistways **18** are disposed within a multi-story building and extend vertically along a center hoistway axis (A_H). The hoistway **18** is not limited to two hoistways **18**. In some embodiments, the hoistways **18** may include a single hoistway **18** or more than two hoistways **18**.

[0036] According to a non-limiting embodiment illustrated in FIG. **1**, elevator cars **14** may travel upward in the first hoistway **18** and may travel downward in the second hoistway **18**. It should be appreciated, however, that the elevator system **10** can be designed such that the elevators cars **14** travel both upwards and downwards in a common hoistway **18** without departing from the scope of the invention. In any case, the elevator cars **14** are configured travel in line with a center hoistway axis (A H). Although not shown in FIG. **1**, elevator cars **14** may stop at intermediate floors to allow ingress to and egress from an elevator car **14**.

[0037] According to the example illustrated in FIG. **1**, the elevator system **10** can transport elevator cars **14** from a first floor to a top floor in the first hoistway **18** and can transport elevator cars **14** from the top floor to the first floor in the second hoistway **18**. Above the top floor is an upper docking station **20** where elevator cars **14** can be docked or stowed. Likewise, below the first floor is a lower docking station **22** where elevator cars **14** can be docked or stowed. In one or more non-limiting embodiments, elevator cars **14** can be moved to the lower docking station for battery recharging as described in greater detail below. It should be appreciated that the upper docking station **20** may be located at the top floor, rather than above the top floor, and the lower docking station **22** may be located at the first floor, rather than below the first floor.

[0038] Turning now to FIG. **2**, a three-phrase linear induction machine **100** is illustrated according to a non-limiting embodiment of the present disclosure. The three-phrase linear induction machine **100** includes one or more armatures **102** disposed in the hoistway **18** and one or more stators (collectively referred to as stators **104**) coupled to an elevator car **14**. In one or more non-limiting embodiments, a first armature **102***a* is disposed in the hoistway **18** and a second armature **102***b* disposed in the hoistway **18** opposite the first armature **102***a*. In one or more non-limiting embodiments, the first and second armatures **102***a* and **102***b* (assigned numeral **102** when referring to a single armature) are fixed to a location opposite the elevator car **14** such as, for example, a guide rail disposed in the hoistway **18**, a first inner wall **19***a* or facade of the hoistway **18** included in the elevator system **10** and the second stationary armature **102***b* is coupled to the opposite inner wall **19***b* or facade of the hoistway **18**.

[0039] The first and second armatures **102***a* and **102***b* are configured to electrically conduct electromagnetic energy. In one or more non-limiting embodiments, the first and second armatures **102***a* and **102***b* include a strip or beam, or in other embodiments can include several individual strips or beams, capable of conducting eddy currents therethrough. The electrically conductive material includes, for example, metal, a magnetic material, or a combination of both. The first and second armatures **102***a* and **102***b* extend vertically along the length of the hoistway **18**.

[0040] The stators **104** are configured to generate a linear traveling electromagnetic field, which in turn generates a force capable of forcing the stators to move **104** upward or downward with respect to the first and second armatures **102***a* and **102***b*. As described herein, the electromagnetic field induces eddy currents that flow through the first and second armatures **102***a* and **102***b*, which in turn generate a magnetic force capable of moving the elevator car **14** through the hoistway **18**.

[0041] In one or more non-limiting embodiments, the stators **104** include a first set of stators **104***a* fixed to a first side **15***a* of the elevator car **14** and adjacent the first armature **102***a*, and a second set of stators **104***b* fixed to a second side **15***b* of the elevator car **14** opposite the first side **15***a* of the elevator car **14** and adjacent the second armature **102***b*. The first set of stators **104***a* and the second set of stators **104***b* are electrically connected to power electronics **106**. The power electronics **106** include a power inverter (not shown) in signal communication with and a controller **108**. The controller **108** is configured to control the inverter and generate current that flows through the first and second set of stators **104***a* and **104***b*. In one or more non-limiting embodiments, each stator is in signal communication with its own dedicated sub-controller (not shown), and each sub-controller is in signal communication with the controller **108**. Accordingly, the sub-controllers can drive current through a respective stator and the controller **108** can independently control each of the sub-controllers to control the current flow through a respective stator.

[0042] In one or more non-limiting embodiments, the elevator car **14** further includes a rechargeable battery **110** (e.g., a lithium-ion battery) in signal communication with the power electronics **106** (e.g., the power inverter) and the controller **108**. Accordingly, the power electronics **106** can receive power from the rechargeable battery **110**, and covert the battery power into electrical current that is delivered to the first and second set of stators **104***a* and **104***b*. As shown in FIG. **2**, for example, the power electronics (e.g., the energy/power components including the battery, power electronics, controller, motors, etc.) can be installed on the elevator car **14** rather than located externally from the elevator car **14** (e.g., in a machine room) as in conventional elevator systems.

[0043] Referring to FIG. **3**, a stator **104** is illustrated according to a non-limiting embodiment. The stator **104** includes a plurality of stator slots configured to receive a stator coil. In some embodiments, each stator coil corresponds to a respective phase and is disposed in a stator slot corresponding to the phase of the coil. In some embodiments the stator coils can be connected in series with one another, while in other embodiments the stator coils can connected in parallel with one another. The connection of the stator coils can be determined based on the application of elevator system **100**. In one or more non-limiting embodiment, the stator **104** includes a first group of stator slots **300***a*-**300***d* assigned to a first phase (e.g., phase A), a second group of stator slots **302***a*-**302***d* assigned to a second phase (e.g., phase B), and a third group of stator slots **304***a*-**304***d* assigned to a third phase (e.g., phase C). Accordingly, each group of stator slots (e.g., **300***a*-**300***d*, **302***a*-**302***d*, **304***a*-**304***d*) generates a magnetic field having poles (e.g., north or south) that change position as the AC current oscillates through a complete cycle, thereby generating a linear traveling electromagnetic field. In one or more non-limiting embodiments, the phases of the AC current flowing through the coils of each respective group of stator slots (e.g., **300***a*-**300***d*, **302***a*-**302***d*, **304***a*-**304***d*) are phase-shifted by 120 electric degrees. Accordingly, the magnetic polarity of the groups of stator slots (e.g., **300***a*-**300***d*, **302***a*-**302***d*, **304***a*-**304***d*) are not all identical at the same instant of time.

In one or more non-limiting embodiments, there is a direct match between the number of phases of the stator **104** and the power electronics **106**. For example, when the power electronics **106** include a multi-phase (3, 4, 5, 6, etc. phases) inverter, the stators **104***a* and **104***b* can be designed to operate with a corresponding number of phases (e.g., 3, 4, 5, 6, etc. phases).

[0044] In one or more non-limiting embodiments, the controller **108** can selectively control the direction of the current flow through one or both of the first and second armatures **102***a* and **102***b*. In this manner, the controller **108** can generate current flow through the first and second set of stators **104***a* and **104***b* in a first direction (e.g., a downward direction) or in a second direction (e.g., an upward direction). Referring to FIG. **4**A, for example, current flowing through the stators **104***a* in the first direction generates an electromagnetic filed having a flux that travels in a first direction. Accordingly, the magnetic flux traveling in the first direction induces a magnetic force that moves the elevator car **14** in a first direction (e.g., downward) through the hoistway **18**. Referring to FIG. **4**B, for example, current flowing through the first and second set of stators **104***a* in the second direction generates an electromagnetic field having a flux that travels in a second direction opposite the first direction. Accordingly, the magnetic flux traveling in the second direction induces a magnetic force that moves the elevator car **14** in a second direction (e.g., upward) through the hoistway **18**. In one or more non-limiting embodiments, the arrangement of the stators **104***a* and **104***b* and their respective coils allows a corresponding elevator car **14** to magnetically levitate between the hoistway walls and move upward and/or downward therein, while also balancing and aligning the elevator car **14** along the center hoistway axis (A H).

[0045] In one or more non-limiting embodiments, the controller **108** can control first electrical current delivered to the first set of stators **104***a* independent from second electrical current delivered to the second set of stators **104***b*. In this manner, the controller **108** can independently adjust the level of the current delivered to the first and second stators **104***a* and **104***b* to control the balance of the elevator car **14**. In one or more non-limiting embodiments, the controller **108** can monitor the load distribution applied to the elevator car **14**, and actively control the level of current delivered to the first set of stators **104***a* and/or the second set of stators **104***a* based on the load distribution. For example, if a greater load or weight is present at the first side **15***a* of the elevator car **14** with respect to the second side **15***b*, a greater amount of current can be delivered to the first set of stators **104***a* compared to the second set of stators **104***b* so that a greater amount of magnetic force is applied to the right side **15***a* of the elevator car **14**. In this manner, the elevator car **14** can be balanced using, for example, two stators **104***a* and/or **104***b* which can maintain a center car axis (A_C) of the elevator car **14** in line with the center hoistway axis (A_H). The controller **108** can further continuously monitor the load distribution and actively control the current delivered to the first and second set of stators **104***a* and **104***b* to maintain the balance of elevator car **14** while it travels through the hoistway **18**. In addition, the elevator car **14** can maintain the center car axis (A_C) in line with the center hoistway axis (A_H) to prevent elevator car **14** from tilting inside of the hoistway **18** during a scenario where the elevator car **14** is loaded unevenly.

[0046] Turning now to FIGS. **5** and **6**, a given elevator car **14** can selectively operate in a recharge mode, which can be invoked by the controller **108**. In response to invoking the recharge mode, the elevator car **14** is moved (e.g., under the control of the controller **108**) to the lower docking station **22** or the upper docking station **20** to recharge the battery **110**. In one or more non-limiting embodiments, the controller **108** can monitor the remaining power of the battery **110** during normal operation of the elevator car **14**. In response to the remaining battery power falling below a power threshold, the controller **108** can invoke the recharging mode and command the elevator car **14** to move to the lower docking station **22** or the upper docking station **20**.

[0047] As shown in FIG. **6**, for example, the lower docking station **22** includes a battery charger **600**. When the recharge mode is invoked and the elevator car **14** is moved to the lower docking station **22**, the rechargeable battery can be brought into close proximity, or physically connected, with the battery charger **600** to initiate battery recharging. In one or more non-limiting embodiments, the battery **110** can include a first connector and the battery charger **600** can include a second connector configured to mate with the first connector. In one or more non-limiting embodiments, the battery **110** can be recharged wirelessly positioned in close enough proximity to the charger **600**. In either case, power from the charger **600** can be delivered to the battery **110** facilitate recharging. When the power of the battery **110** exceeds the power threshold or reaches full charge capacity (e.g., full available power), the controller **108** can invoke the normal operating mode of the elevator car **14**. Accordingly, the elevator car **14** can be moved out of the docking station **22** and returned to service.

[0048] As described herein, various non-limiting embodiments of the present disclosure described herein provide a three-phrase induction machine included in an elevator system is provided and is capable of avoiding CM noise concerns by realizes in a tradition an elevator system that implements a three-phrase induction machine. The three-phrase induction machine includes one or more armatures and a plurality of stators. The armatures are disposed in a hoistway and configured to electrically conduct electromagnetic energy, and the plurality of stators fixed to an elevator car configured to travel through the hoistway. Each of the stators are configured to conduct electrical current therethrough and to generate an electromagnetic field in response to the current. The electromagnetic field induces eddy currents that flow through the at least armature to generate a magnetic force to move the elevator car through the hoistway.

[0049] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the present disclosure. The terms "about" and "substantially" are intended to include the degree of error associated with measurement of the particular quantity and/or manufacturing tolerances based upon the equipment available at the time of filing the application. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, element components, and/or groups thereof.

[0050] Those of skill in the art will appreciate that various example embodiments are shown and described herein, each having certain features in the particular embodiments, but the present disclosure is not thus limited. Rather, the present disclosure can be modified to incorporate any number of variations, alterations, substitutions, combinations, sub-combinations, or equivalent arrangements not heretofore described, but which are commensurate with the scope of the present disclosure. Additionally, while various embodiments of the present disclosure have been described, it is to be understood that aspects of the present disclosure may include only some of the described embodiments. Accordingly, the present disclosure is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.

What is claimed is:

1. A multi-phase linear induction machine included in an elevator system, the multi-phase induction machine comprising:

at least one armature disposed in a hoistway and configured to electrically conduct electromagnetic energy; and

a plurality of stators coupled to an elevator car configured to travel through the hoistway, each of the stators configured to conduct electrical current therethrough and to generate an electromagnetic field in response to the current,

wherein the electromagnetic field induces eddy currents that flow through the at least armature generate a magnetic force to move the elevator car through the hoistway.

2. The multi-phase induction machine of claim **1**, wherein the at least one armature includes a first armature disposed in the hoistway and a second armature disposed in the hoistway opposite the first armature.

3. The multi-phase linear induction machine of claim **2**, wherein the first and second armatures include an electrically conductive material configured to conduct the eddy currents therethrough.

4. The multi-phase induction machine of claim **3**, wherein the first and second armatures extend vertically along a length of the hoistway.

5. The multi-phase induction machine of claim **4**, wherein the plurality of stators includes a first set of stators coupled to a first side of the elevator car and adjacent the first armature, and a second set of stators coupled to a second side of the elevator car opposite the first side of the elevator car and adjacent the second armature.

6. The multi-phase induction machine of claim **5**, wherein the first set of stators and the second set of stators are electrically connected to power electronics that are configured to deliver the electrical current to the first and second set of stators.

7. The multi-phase induction machine of claim **6**, wherein the power electronics receive battery power from a rechargeable battery, and covert the battery power into the electrical current that is delivered to the first and second set of stators.

8. The multi-phase induction machine of claim **7**, wherein a controller is configured to control the power electronics and selectively control the direction of the current flow through the first and second armatures.

9. The multi-phase induction machine of claim **8**, wherein current flowing through the first and second set of stators in a first direction generates an electromagnetic filed having a flux that travels in a first direction, and current flowing through the first and second set of stators in a second direction generates an electromagnetic field having a flux that travels in a second direction opposite the first direction.

10. The multi-phase induction machine of claim **9**, wherein the flux traveling in the first direction produces a first magnetic force that moves the elevator car through the hoistway in a first vertical direction, and wherein the flux traveling in the second direction produces a second magnetic force that moves the elevator car through the hoistway in a second vertical direction opposite the first vertical direction.

11. The multi-phase induction machine of claim **8**, wherein the controller invokes a recharge mode and in response to invoking the recharge mode moves the elevator car **14** to a docking station included in the hoist to recharge the battery.

12. The multi-phase induction machine of claim **11**, wherein the docking station includes a battery charger, and wherein moving the elevator car to the docking station establishes electrical transfer between the rechargeable battery and the battery charger to recharge the battery.

13. The multi-phase induction linear induction machine of claim **1**, wherein the at least one armature and the plurality of stators establish a three-phase machine.

14. The multi-phase induction linear induction machine of claim **13**, wherein each of the first and second set of stators includes two or more stators.

15. The multi-phase induction linear induction machine of claim **13**, wherein the two or more stators are configured to maintain a center car axis of the elevator car in line with a center hoistway axis of the hoistway.

16. A method of controlling a multi-phase linear induction machine included in an elevator system, the method comprising:

disposing at least one armature in a hoistway to electrically conduct electromagnetic energy;

coupling a plurality of stators to an elevator car configured to travel through the hoistway;

conducting electrical current through the plurality of stators to generate an electromagnetic field; and

inducing a flow of eddy currents through the at least armature in response to generating the electromagnetic field to generate a magnetic force that moves the elevator car through the hoistway.

17. The method of claim **16**, wherein the at least one armature includes a first armature disposed in the hoistway and a second armature disposed in the hoistway opposite the first armature.

18. The method of claim **17**, wherein the first and second armatures include an electrically conductive material configured to conduct the eddy currents therethrough.

19. The method of claim **18**, wherein the first and second armatures extend vertically along a length of the hoistway.

20. The method of claim **19**, wherein plurality of stators includes a first set of stators coupled to a first side of the elevator car and adjacent the first armature, and a second set of stators coupled to a second side of the elevator car opposite the first side of the elevator car and adjacent the second armature.

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