[0086] FIG. 33F illustrates an example motor for the swing apparatus of FIG. 31A, with two permanent magnets and two electromagnets.

[0087] FIG. 34A illustrates an example motor for the swing apparatus of FIG. 31A, with two permanent magnets and one electromagnet.

[0088] FIG. 34B illustrates the example motor of FIG. 34A with a partial stator.

[0089] FIG. 34C illustrates the example motor of FIG. 34A with a partial stator formed as a bracket.

[0090] FIG. 35A is a front perspective view of a user interface panel of a swing apparatus, according to another inventive implementation.

[0091] FIG. 35B is a side perspective view of the user interface panel of FIG. 35A.

[0092] FIG. 35C is a bottom perspective view of the user interface panel of FIG. 35A.

[0093] FIG. 35D is a top perspective view of the user interface panel of FIG. 35A.

[0094] FIG. 35E is a front view of the user interface panel of FIG. 35A.

[0095] FIG. 35F is a side view of the user interface panel of FIG. 35A.

[0096] FIG. 35G is a top view of the user interface panel of FIG. 35A.

[0097] FIG. 36A illustrates a connection between the swing frame arm and a base member of a swing apparatus as disclosed herein.

[0098] FIG. 36B illustrates the connection of FIG. 36A with the cover removed.

[0099] FIG. 36C is another view of the connection of FIG. 36A with the cover removed.

[00100] FIG. 36D illustrates details of the stalk and base member useful to form the connection illustrated in FIGS. 36A-36C.

[00101] FIG. 36E illustrates another view of the base member and shows a cutout for receiving the stalk.

[00102] FIG. 36F illustrates areas of weld formation to secure the stalk to the base member.

[00103] FIG. 36G illustrates, prior to insertion, bolts useful to secure the frame arm to the stalk.

[00104] FIG. 36H illustrates a cutout view of the connection illustrated in FIGS. 36A-36C, and shows detail of the connection as formed between the frame arm, the stalk, and the base member.

[00105] FIG. 37 illustrates the side view of FIG. 2 and references additional aspects of the swing apparatus.

CLAIMS

1. A swing apparatus (10), comprising:

a magnetic drive (20), comprising:

an electromagnet (51); and

a plurality of permanent magnets (52, 53); and

a controller (2102), coupled to the electromagnet (51) to activate the electromagnet (51) by applying an activation current having a polarity selectable from a first polarity and a second polarity and thereby initiating a motion of at least a portion of the swing apparatus (10), the controller (2102) being configured to:

A1) apply the activation current having one of the first polarity and the second polarity;

A2) determine if at least the portion of the swing apparatus (10) has moved at least a predetermined amount;

A3) if, after a predetermined time period, at least the portion of the swing apparatus (10) has not moved by at least the predetermined amount, then switch the polarity of the activation current to the other of the first polarity and the second polarity; and

A4) repeat A2) and A3) until it is determined, at A2), that the swing apparatus (10) has moved by at least the predetermined amount.

2. The swing apparatus of claim 1, further comprising:

a plurality of optical sensors coupled to the controller, the plurality of optical sensors comprising:

a first light source to emit a first light beam propagating along a first optical path;

a first detector, spaced from the first light source and disposed in the first optical path to detect the first light beam;

a second light source to emit a second light beam along a second optical path substantially parallel to the first optical path and offset from the first optical path by a separation distance;

a second detector, spaced from the second light source and disposed in the second optical path to detect the second light beam; and

an optical encoder strip disposed in the first optical path and the second optical path to modulate detection of the first light beam by the first detector to affect a change in state of the first detector, and to modulate detection of the second light beam by the second detector to affect a change in state of the second detector,

wherein the controller is further configured to determine, at A2), if at least the portion of the swing apparatus has moved at least a predetermined amount by detecting a change of state of at least one of the first detector and the second detector.

3. The swing apparatus of claim 1, wherein the controller is further configured to, when it is determined at A2) that the swing apparatus has moved by at least the predetermined amount:

A5) determine if the portion of the swing apparatus has changed direction of swing motion.

4. The swing apparatus of claim 3, wherein the controller is further configured to, when it is determined at A5) that the portion of the swing apparatus has not changed direction of swing motion, repeat A2) and A3).

5. The swing apparatus of claim 3, wherein the controller is further configured to, when it is determined at A2) that the swing apparatus has moved by at least the predetermined amount:

A6) increment a swing angle measure associated with the motion of the portion of the swing apparatus.

6. The swing apparatus of claim 5, wherein the controller is further configured to, when it is determined at A5) that the portion of the swing apparatus has changed direction of motion:

A7) switch the polarity of the activation current being applied to the electromagnet.

7. The swing apparatus of claim 6, wherein the controller if further configured to, after A7):

A8) if the swing angle measure exceeds a predetermined setpoint, set the activation current to zero.

8. The swing apparatus of claim 7, wherein the controller is further configured to, after the activation current is set to zero at A8), repeat A2) and A3).

9. The swing apparatus of claim 7, wherein the controller is further configured to, after A7):

A9) if the swing angle measure is less than the predetermined setpoint, modulate the activation current.

10. The swing apparatus of claim 9, wherein the controller is further configured to modulate the activation current at A9) by:

computing an error value based on the swing angle measure and the predetermined setpoint;

computing one or more of a proportional term, a derivative term, or an integral term based on the error value; and

modulating the activation current based on the one or more of the proportional term, the derivative term, or the integral term.

11. The swing apparatus of claim 9, wherein the controller is further configured to, after the activation current is modulated in A9), repeat A2) and A3).

12. The swing apparatus of claim 1, wherein the controller is further configured to determine when the portion of the swing apparatus changes direction during the motion without determining when the portion of the swing apparatus passes through an equilibrium position of the motion.

13. A swing apparatus (10), comprising:

an electromagnet (51);

a plurality of permanent magnets (52, 53) positioned proximate to the electromagnet (51) such that, upon electrical activation of the electromagnet, magnetic forces are generated between the electromagnet and each permanent magnet of the plurality of permanent magnets; and

a controller (2102), coupled to the electromagnet, to electrically activate the electromagnet and thereby initiate swing motion of the swing apparatus without manual intervention by a user of the swing apparatus.

14. The swing apparatus of claim 13, wherein neither the electromagnet nor any of the plurality of permanent magnets is formed on the seat.

15. The swing apparatus of claim 13, wherein adjacent permanent magnets of the plurality of permanent magnets are arranged to have opposing polarities facing the electromagnet, and wherein, upon electrical activation, the electromagnet attains a predefined polarity on a face of the electromagnet facing the plurality of permanent magnets, and such that attractive magnetic forces and repulsive magnetic forces are concurrently generated between the electromagnet and the plurality of permanent magnets.

16. The swing apparatus of claim 13, wherein in a neutral position, the electromagnet is disposed in a pivot plane that includes the pivot axis, and each permanent magnet of the set of permanent magnets is disposed outside the pivot plane.

17. A swing apparatus (10), comprising:

an arm assembly (15) including a seat (18);

a frame assembly (12) coupled to the arm assembly (15) and defining a pivot axis (P--P') about which the arm assembly (15) rotates during operation of the swing apparatus (10);

an electromagnet (51) disposed on the frame assembly (12); and

a plurality of permanent magnets (52, 53) disposed on the arm assembly and positioned to define an arc centered on the pivot axis (P--P'),

wherein the electromagnet (51) has an angular offset about the pivot axis (P--P') relative to the plurality of permanent magnets (52, 53) positioned along the arc when the swing apparatus is in a neutral position.

18. The swing apparatus of claim 17, wherein neither the electromagnet nor any of the plurality of permanent magnets is formed on the seat.

19. The swing apparatus of claim 17, wherein adjacent permanent magnets of the plurality of permanent magnets are arranged to have opposing polarities facing the electromagnet.

20. The swing apparatus of claim 19, further comprising a controller to electrically activate the electromagnet such that the electromagnet attains a first magnetic polarity on a face of the electromagnet facing the plurality of permanent magnets, and such that attractive magnetic forces and repulsive magnetic forces are concurrently generated between the electromagnet and the plurality of permanent magnets.