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ELECTRICALLY PROPELLED CAR CONSTRUCTION

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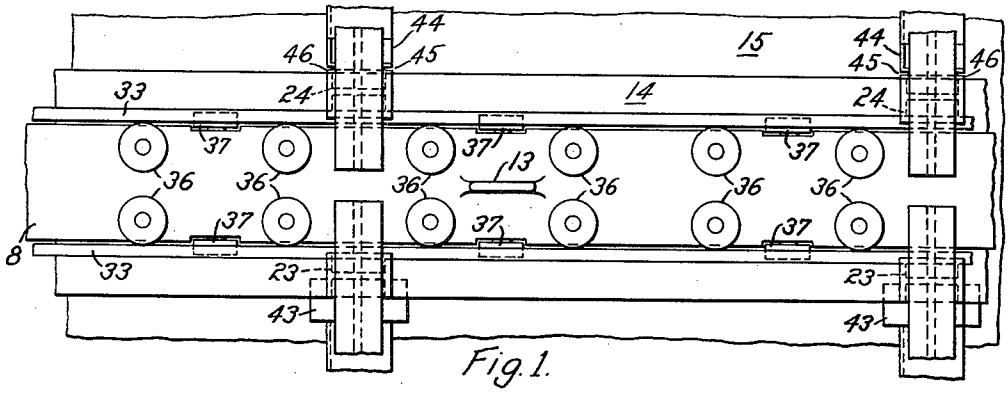

Fig. 1.

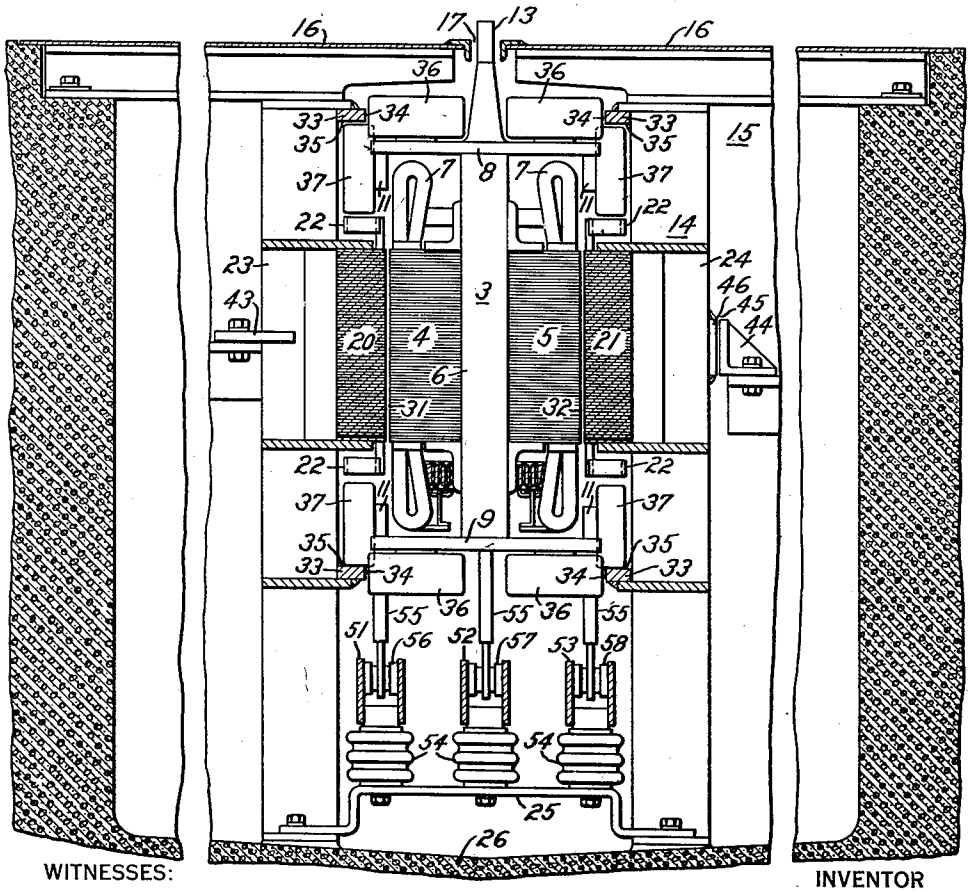

Fig. 2.

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ELECTRICALLY PROPELLED CAR CONSTRUCTION

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2 Claims. (Cl. 172—290)

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My invention relates to an elongated linear-motor construction which is particularly adapted for an underground towing-car for an electric catapult for lanching aircraft, and for other purposes.

In aircraft-launching towing-car designs, one of the outstanding features has been the necessity for providing an elongated car-construction, and providing for the maintenance of the smallest possible airgap between the car-borne primary-member and the stationary secondary-member which forms a part of the trackway, and resisting tons of attractive force between the primary and secondary members, in such large amounts that the stiffest possible car-frame construction would sway or sag into binding-contact with the stationary secondary-member if the car were not supported by numerous pairs of wheels spaced throughout its length.

The principal object of my present invention is to provide a double-primary linear-motor car-construction, having two outwardly facing, magnetizable, multipolar, polyphase wound, primary-members disposed back-to-back, and operating within a trackway comprising a hollow construction comprising two inwardly facing, magnetizable, linear-motor secondary-members, and supports therefor so disposed as to accommodate the car between said secondary-members. A large number of pairs of rollers, spaced along the car-length, prevent collapse of the secondary-members by reason of the heavy attraction of the car-borne primary-members, as the car passes along the trackway. In this manner, neither the car nor the secondary-member supports of the trackway need to be heavy enough or stiff enough to rigidly resist the powerful magnetic attraction between the primary-members and the respective secondary-members, because the force-reactions of the two car-borne primary-members cancel each other, because of their back-to-back disposition, while the forces on the elongated secondary-members, extending along the trackway, are taken up by the many pairs of car-borne rollers, as the car travels along.

With the foregoing and other objects in view, my invention consists in the methods, systems, combinations, structures and parts hereinafter described and claimed, and illustrated in the accompanying drawing, wherein:

Figure 1 is a plan view of a preferred form of construction of a linear-motor catapult which is disposed within a trough or trench just below the surface of the flying field, the top-plates over the trough being removed to show the underground construction, and

Fig. 2 is an end view of the car and a cross sectional view of the track-structure.

The moving part of my linear-motor catapult is shown in the form of an elongated towing-car 3 having two vertically disposed, elongated,

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outwardly facing, magnetizable, multipolar, polyphase, linear-motor primary-members 4 and 5, disposed back-to-back. In the particular form illustrated, the primary-members 4 and 5 are carried by a vertical center-plate 6 which extends both above and below the core-portions of the primary-members 4 and 5, so as to clear the end-windings 7, although this structure is not necessary. The upper and lower edges of the vertical, longitudinally extending plate 6 engage top and bottom horizontal-members 8 and 9, respectively, having edge-flanges 11. The top plate 8 also carries a centrally disposed, upstanding towing-hook 13.

This movable part, or car 3 of the linear-motor construction, cooperates with a stationary trackway 14, comprising a hollow, preferably trough-like construction, disposed within a trench or ditch 15 which may be covered by suitably supported top-plates 16 having a centrally disposed slot 17 therein, through which extends the towing-hook 13 of the car. The trough-like trackway 14 comprises two vertically disposed, inwardly facing, magnetizable, linear-motor secondary-members 20 and 21, preferably of the type having squirrel-cage windings 22. The secondary-members 20 and 21 extend the entire length of the trackway, and are supported, at frequent intervals, on vertical supports 23 and 24, joined, at their base, by crosswise-disposed base-members 25, or by the bottom wall 26 of the trench or ditch 15 in which the entire trackway is mounted. The secondary-member supports 23 and 24, and the base-member 25 or 26, thus provide a space, between the inwardly facing secondary-members 20 and 21, through which the car 3 travels, with airgaps 31 and 32 between the respective primary-members 4 and 5 and the respectively cooperating secondary-members 20 and 21.

The trackway 14 also comprises upper and lower, right-hand and left-hand guide-members 33, having inwardly facing guide-surfaces 34, and upwardly and downwardly facing guide-surfaces 35. These guide-members 33 are, or may be, preferably carried by the same uprights 23 and 24 which support the secondary-members 20 and 21.

The towing-car 3 is provided with a large number of pairs of upper and lower right-hand and left-hand guide-engaging members, in the form of rollers 36 and 37, which are disposed at frequent intervals along the length of the car, in cooperative relation to the stationary guide-surfaces 34 and 35, respectively. The rollers 36, which engage the inwardly facing guide-surfaces 34 of the guide-members 33, must be particularly numerous, and spaced at close intervals along the entire length of the car, because it is these rollers which sustain the powerful magnetic attractive force which is exerted across each of the air-

gaps 31 and 32, preventing the inward collapse of the trough-like trackway-construction 14, and keeping the air-gaps 31 and 32 at a substantially constant minimum gap-lenth, which is the smallest gap which can be reasonably maintained, within reasonable manufacturing and constructional tolerances, without risk of having the primary and secondary-members bind against each other.

It will be noted that the U-shaped construction of the trackway is not very stiff, with respect to its ability to resist a collapse, or inward bending, of the upstanding legs of the U, and this construction is deliberately made so, in order that the U-shaped stationary member may yield sufficiently to permit the airgap-length to be determined by the rollers 36 and the vertical guide-surfaces 34, without risk of binding, as the car attempts to pass through or along, within the trough of the U. In this manner, I avoid the necessity for building the U-shaped trackway-trough with extremely close manufacturing tolerances, making allowance for a slight yielding or flexing of the stationary construction in order to make the precise spacing-adjustments at the particular point where the car 3 may be, at the moment.

In order to safeguard against the possibility of the development of a momentary repulsive force, instead of an attraction, across the airgaps 31 and 32, as when the car is being plug-reversed by suddenly reversing the phase-sequence of its energy-supply, I preferably provide the vertical supports 23 and 24 of the trackway with suitable attachment-means which will serve to limit an undesirable spreading apart of these vertical legs of the U. On one side of the trackway, the vertical supports 23 may be engaged, at some point preferably opposite, or back of, the secondary-member 20, by a rigid attachment 43, which prevents lateral or sidewise movement of these vertical members 23, either inwardly or outwardly, at this point.

On the other side of the trackway 14, only outward or spreading movement of the upright supports 24 is prevented, at the corresponding point on the other side of the trackway, opposite or back of, the other secondary-member 21, and this support is preferably provided in the form of a rigid abutment-member 44, which may be spaced, by a slight gap or separation 45, from a corresponding abutment 46 carried by the upright members 24. The provision of the gap or separation 45 between the abutment-members 44 and 46 makes it unnecessary to provide for extremely close structural tolerances in the mounting and maintenance of the stationary abutment 44, so as to avoid any risk of rigidly pressing the legs of the U-shaped trackway together so closely as to have a binding action on the car when the car attempts to pass through or along the trackway. At the same time, any large amount of separating movement, tending to spread apart the two rows of vertical uprights 23 and 24 of the trackway, will be positively limited by the abutment-member 44.

The bottom or lower portion of the trough of the trackway 14 is preferably large enough to house a plurality of insulatedly supported third-rail members 51, 52 and 53, extending the entire length of the trackway, and preferably supported on insulators 54 carried by the cross-ties 25. The bottom plate 9 of the car 3 is also provided with downwardly depending members 55, carrying suitable collector-shoes 56, 57 and 58 which engage

the respective third-rail structures 51, 52 and 53, whereby polyphase energy is fed into the primary windings 7 of the towing-car 3.

As a result of my construction, it will be observed that I have provided an improved linear-motor construction, in which the necessity for extremely massive structural members is in large measure avoided, and in which the trackway may be easily laid out, and maintained, without the necessity for extremely close structural tolerances. The relatively lightweight construction of the car-member is particularly desirable, because this car may weigh as much as several tons, anyway, and it is desirable to keep this weight down as much as possible, so as to reduce the total mass or weight which has to be accelerated during an aircraft-launching accelerating-run of the towing-car.

I claim as my invention:

1. An elongated linear-motor construction, comprising an elongated towing-car movable in the direction of its length, said car having two vertically disposed, elongated, outwardly facing, magnetizable, multipolar, polyphase-wound linear-motor primary-members disposed back-to-back, and a trackway for said car, said trackway comprising a trough-like construction comprising two vertically disposed inwardly facing, magnetizable, linear-motor secondary-members, and supports therefor so disposed as to accommodate the primary-members of the car between said secondary members, with airgaps between the primary-members and the respective secondary-members, said secondary-member supports including upper and lower, right-hand and left-hand guide-members having inwardly facing guide-surfaces, said trackway having polyphase supply-means comprising a plurality of insulatedly supported third-rail members disposed in the lower portion of the trough, said car having centrally disposed upwardly and downwardly extending members extending respectively upwardly and downwardly from the backs of said primary-members, towing-means carried by said upwardly extending car-member, collector-shoe third-rail-engaging means carried by said downwardly extending car-member, and said car further having a plurality of pairs of upper and lower, right-hand and left-hand guide-engaging members carried by said upwardly and downwardly extending car-members respectively, said guide-engaging members being spaced at a plurality of points along the length of the car, for engaging said inwardly facing guide-surfaces in such manner as to prevent the collapse of the trackway-construction under the magnetic attraction between the primary-members and the respective secondary-members as the car travels along.

2. The invention as defined in claim 1, characterized by said secondary-member supports being deformable, under operating conditions, in a direction which contracts the spacing between the two inwardly facing secondary-members, said trackway including abutment-means which limit the separation of the inwardly facing secondary-members without preventing an adequate amount of contracting-movement necessary for keeping the airgaps at a minimum thickness determined by said guide-surfaces and said guide-engaging car-members, without binding, as the car passes along.

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