

Sept. 19, 1944.

A. F. ANJESKEY

2,358,487

OVERHEAD MONORAIL SYSTEM

Filed March 16, 1943

3 Sheets-Sheet 1

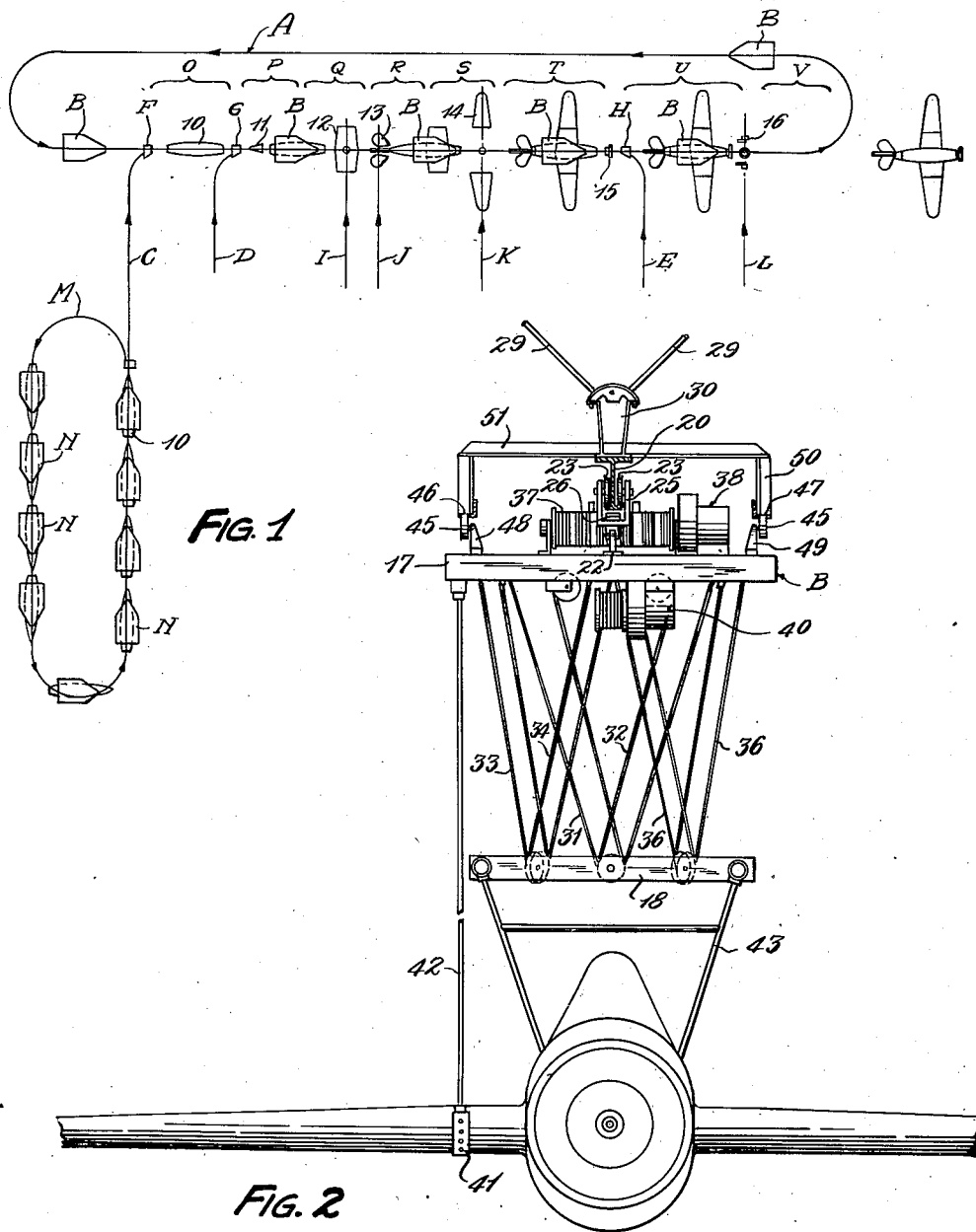


FIG. 1

FIG. 2

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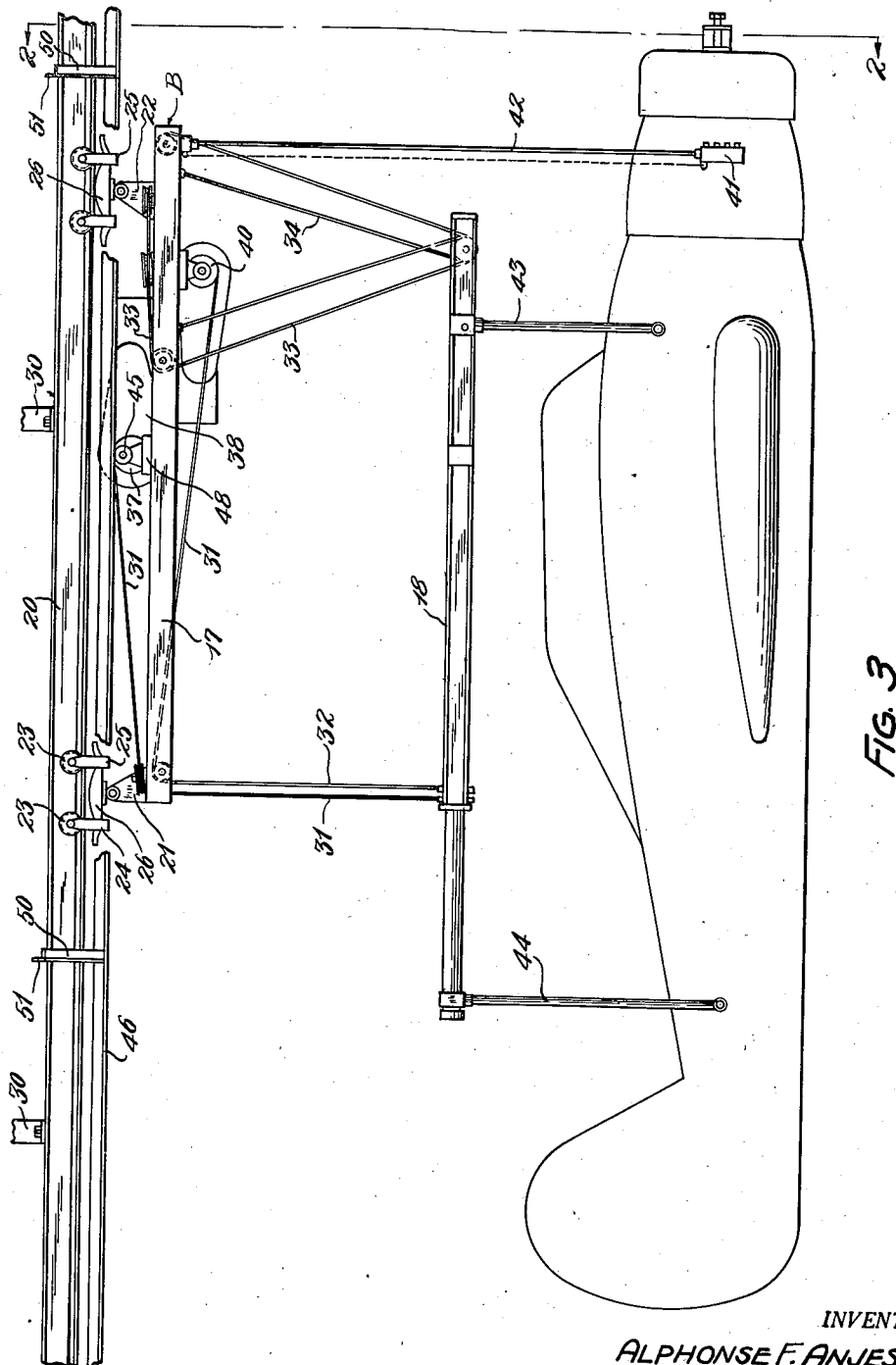
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3 Sheets-Sheet 2



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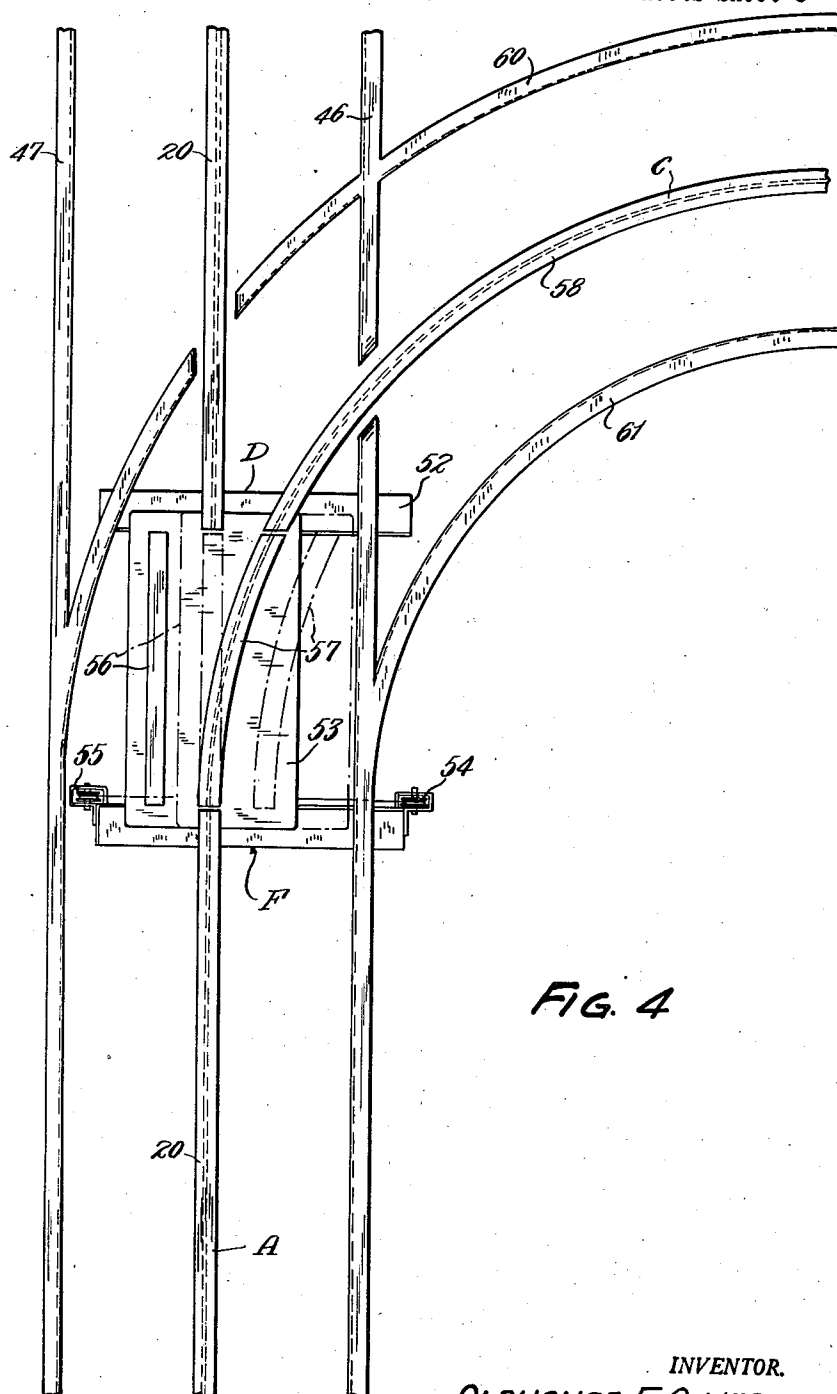
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3 Sheets-Sheet 3



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OVERHEAD MONORAIL SYSTEM

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Application March 16, 1943, Serial No. 479,315

6 Claims. (Cl. 212-126)

The present invention relates to a material handling system of the overhead monorail carrier type.

One of the characteristics of overhead monorail underslung carrier systems is the fact that the carriers thereof readily sway or move out of their normal vertical position when side pressure is applied thereto or when the load is shifted or unevenly distributed thereon, etc. In many instances this is a disadvantage, and the principal object of the present invention is the provision of a novel and improved overhead monorail carrier system wherein the carriers are stabilized or, in other words, will not sway or move out of their normal vertical position. The carriers may be stabilized throughout the entire system or only at predetermined parts of the system as desired.

Another object of the invention is the provision of a novel and improved overhead monorail underslung carrier system of the character referred to wherein the carriers are not only stabilized in the manner referred to above but comprise upper and lower frames or members, the latter of which constitutes the load supporting member and is suspended from the former by cables connected to a hoist mechanism and so arranged that it will not tilt, swing, or sway with respect to the upper member. In other words, the lower member is stabilized with respect to the upper member.

Among other things, the invention resides in certain details of construction and combinations and arrangements of parts, and further objects and advantages thereof will be apparent to those skilled in the art to which the invention relates from the following description of the preferred embodiment described with reference to the accompanying drawings forming a part of this specification in which similar reference characters designate corresponding parts and in which

Fig. 1 is a diagrammatic view of an overhead monorail carrier system embodying the present invention;

Fig. 2 is a view approximately on the line 2-2 of Fig. 3;

Fig. 3 is a side elevational view of a portion of the system shown in Fig. 1; and

Fig. 4 is a bottom view of a portion of the system shown in Fig. 1 including a transfer switch.

While the apparatus of the present invention is susceptible of various modifications and alternative constructions, and may be employed in numerous industries for various purposes, it is herein illustrated and described as embodied in

an overhead monorail underslung carrier system employed to handle airplanes and parts thereof. Referring to the drawings, Fig. 1 shows diagrammatically an overhead monorail carrier system comprising a closed loop designated generally by the reference character A about which the carriers, designated generally by the reference character B, are adapted to travel. The monorail system shown also comprises a plurality of branch tracks designated generally by the reference characters C, D, and E connected to the loop A by transfer switches designated generally by the reference characters F, G and H, respectively, and cross tracks I, J, K, and L. The branch and cross tracks are for the purpose of bringing or feeding sub-assemblies or parts etc. to the main assembly loop and communicate with either sub-assembly areas such as the overhead monorail carrier loop M shown in Fig. 1, or with storage areas.

Referring to the particular system shown, the main part of the fuselage or frame 10 of the airplane to be produced is assembled at the area serviced by the loop M and thereafter transferred to the main assembly loop A by the carriers N on the loop M, which carriers may be similar in construction to the carriers B, if desired. After being deposited by the carriers N at the station or zone designated by the reference character O, the fuselage 10 is picked up by one of the carriers B and carried through the succeeding zones or stations P, Q, R, S, T, and U, where the tail section 11, center wing section 12, rudder and stabilizer 13, outer wing section 14, motor 15, and landing gear 16, respectively, are assembled with or attached to the main part of the fuselage. The completed airplane is discharged from the system at station V and delivered at the right hand end of the loop A, as viewed in the drawings. The carrier is thereafter returned to the starting position. Obviously operations other than those mentioned may be performed upon the airplane while suspended from the carrier and any number of carriers may be employed with any number of airplanes in the process of assembly at the same time. The carriers may be moved either continuously or intermittently. The method of assembling airplanes and the like, etc. herein disclosed is claimed in my copending application Ser. No. 479,316, filed March 16, 1943.

Referring to Figs. 2 and 3 particularly, it will be seen that the carriers B, which are all identical in construction, each comprises an upper frame 17 and a lower frame 18. The upper frame 17 which constitutes a 'movable overhead sup-

port is suspended from an I-shaped carrier monorail 20 by trucks located at opposite ends of the frame 17 and connected thereto through the medium of brackets 21 and 22. Both trucks are identical in construction and the particular construction thereof is immaterial insofar as the present invention is concerned. Each truck shown comprises two pairs of flanged wheels 23 pivotally connected to yoke members 24 and 25 which in turn are connected to opposite ends of a load bar 26. The brackets 21 and 22 are welded to the upper frame or member 17 at its longitudinal center line and are pivotally connected to the load bars by horizontal pivot pins. The wheels 23 of each pair engage opposite horizontal lower flanges of the carrier rail 20. The carrier rail 20 is fixed to any suitable overhead support in any convenient manner as by the hanger rods 29 arranged to hold the rail stationary and eliminate side sway. The hanger rods 29 are secured to the rail 20 through the medium of a fixture 30.

The lower frame 18 is suspended from the upper frame 17 by three pairs of cables 31, 32; 33, 34; 35, 36; arranged in a manner similar to that disclosed in a copending application of Arthur L. Medenwald, Serial No. 516,206, now Patent No. 2,357,443. One end of each of the cables 33 to 36 inclusive is connected to the upper frame 17 while the other end thereof, together with one end of each of the cables 31 and 32, is connected to the drum 37 of a motor driven hoist mechanism designated generally by the reference character 38 through the medium of which the lower frame 18 may be raised or lowered. The ends of the cables 31 and 32 other than the ends connected to the drum 37 are connected to a motor driven drum 40 hereinafter referred to as the tilting drum, through the medium of which the lower frame 18 may be tilted about a horizontal axis. The cables 31 to 36 inclusive not only constitute suspension means but also serve as guy wires to maintain the lower frame 18 steady with respect to the upper frame 17. As shown, each cable is arranged in such manner that the vertical portions thereof form single tackles. However, it will be understood that any desired form of tackle may be employed.

The construction and operation of the motor driven hoist and tilting mechanism, per se, forms no part of the present invention and will not be described in detail. Suffice it to say that they are adapted to be controlled from a pendant push button switch station, designated generally by the reference character 41, connected to the lower end of a tubular member 42 fixed to the upper frame 17. In the present instance the member 42 is a rigid member and provides means for hand-propelling the carrier B about the monorail track. Alternatively, the carriers may be motor driven. The load, in the present instance an airplane, is rigidly supported from the lower frame 18 by members such as tubular frames 43 and 44 connected to the lower frame 18 and to the airplane in such a manner that the airplane is stabilized with respect to the lower frame or member 18.

Both the upper and the lower frames 17 and 18, as shown, are generally rectangular in shape and the upper frame 17 is provided with rollers 45 located on opposite sides of the longitudinal center line of the carrier and spaced a considerable distance therefrom. The rollers 45 are on the top of the frame 17 and engage the under-

side of guide members 46 and 47 located on opposite sides of the carrier rail 20. In the embodiment shown, the rollers 45 are carried by members 48 and 49 welded to and projecting above the upper frame 17 at opposite sides of the center line of the carrier and approximately midway of the length thereof. The members 46 and 47 are in the form of angle irons supported in fixed position with respect to the carrier rail 20 by being welded to vertical brackets 50 connected to opposite ends of cross-arms 51. The cross-arms 51 are in turn fixed to the upper flange of the carrier rail 20, as by being welded thereto. It is to be understood, however, that the members 46 and 47 which form a trackway or guideway paralleling the carrier rail 20 may be supported in any convenient manner so long as they are fixed with respect to the carrier rail. From the foregoing description it will be apparent that the upper frame 17 of the carrier cannot sway with respect to the carrier rail but must remain in a predetermined horizontal plane. Any tendency of the carrier to pivot about the carrier rail 20 is prevented by the engagement of the rollers 45 with the members 46 and/or 47. The guide means comprising members 46 and 47 etc. can extend throughout the entire system or only a part thereof as desired.

Referring to Fig. 4, which shows the preferred construction where a switch for connecting a branch track or tracks is employed, the rail 20 comprising a part of the main loop A is adapted to be connected with the branch track C by a sliding type switch designated generally by the reference character F. The switch F for the most part is similar to commercial switches being manufactured at the present time by The Cleveland Crane & Engineering Company. Suffice it to say that the switch shown comprises an outer or supporting frame 52 suspended in a suitable manner from the overhead structure to which the rail 20 is attached, and an inner or sliding frame 53 slidably supported on the frame 52 and adapted to be moved transversely of the rail 20 by operating chains connected thereto and passing over the pulleys 54 and 55. The inner or sliding frame 53 carries two sections of rail 56 and 57 the former of which is a straight section and the latter a curved section. When the inner or sliding frame 53 is in the position shown in Fig. 4, the curved section of track 57 of the switch aligns with the section of rail 20 shown at the lower part of the drawing and the rail 58 of the branch track C. When the inner or sliding frame 53 is moved to the position shown in dot-dash lines in Fig. 4 of the drawings, the straight section of rail 56 aligns with the two sections of rail 20 shown.

When the carrier B is on the branch track C the upper frame 17 thereof is stabilized with respect to the carrier rail 58 by members 60 and 61 similar to the members 46 and 47 and preferably supported from the carrier rail in a similar manner. It will be observed that it is not necessary to shift any part of either of the trackways for the guide rollers 45 when manipulating the switch F to transfer a carrier from one part of the system to another. Where the carrier rails 20 and 58 pass through the members 60 and 46, respectively, the latter members are merely interrupted. As shown, the bottom surfaces of the carrier rails 20 and 58 align with the bottom surfaces of the members 46, 47, 60 and 61. While a sliding type of switch has been shown, it will be understood that the invention is equally ap-

plicable to other types of switches and to electrified switches as well as to manually operated switches.

One of the most important advantages of an overhead monorail underslung carrier system utilizing carriers provided with hoist mechanism is the flexibility of the system, that is the ease with which the load can be raised and/or lowered, the ease with which the runway or rail can be made to conform to particular requirements of the system, and the ease with which the carriers can be shifted from one track or part of the system to another and otherwise moved thereabout. However, as previously stated, one of the objections to such system is the fact that the carriers and/or load pivot readily about the rail, but according to the provisions of the present invention this disadvantage is overcome without detracting materially from the flexibility of the system. As provided herein neither the lower frame 18 nor the load connected thereto will swing or sway relative to the upper frame 17 or the monorail runway under usual conditions of operation. In the case of an airplane assembly line the usual conditions referred to contemplate an uneven or shifting load such as might be occasioned by assembling parts on one side of the plane in advance of similar parts on the other side, by workmen walking or climbing about the airplane, particularly about the outer ends of the wings, by placing ladders against the plane, etc. In the event the load is something different, for example, a pouring ladle of the order used in steel mills and foundries, the usual conditions referred to would be different.

From the foregoing description of the preferred embodiment of the invention it will be apparent that the objects heretofore enumerated and others have been accomplished and that a new and improved monorail underslung carrier system has been provided wherein the load is suspended by cables and stabilized or prevented from swinging without interfering with the flexibility of the system. While the preferred embodiment of the invention has been herein shown and described in considerable detail, it is to be understood that the invention is not limited to the particular construction shown, and it is my intention to hereby cover all adaptations and arrangements thereof which come within the practice of those skilled in the art to which the invention relates.

Having thus described my invention, I claim:

1. In an overhead monorail underslung carrier system the combination of: an overhead monorail; means for fixedly supporting said monorail; a carrier supported by and movable along said monorail; said carrier comprising an upper frame member, means for suspending said upper frame member from said monorail, a load member, means comprising three pairs of cables for suspending said load member from said upper frame member, means for operatively connecting the respective cables of each pair to one of said members at spaced points so located that vertical planes embracing the points at which the respective pairs of cables are connected form a triangle at their intersection with a horizontal plane, means for operatively connecting the respective cables of each pair to the other of said members so that the respective cables of each pair are connected to said last named member at substantially the same point but spaced from and disaligned with the points at which the other pairs of cables are connected thereto whereby the respective cables of each pair are angularly dis-

posed to each other and the respective pairs of cables lie in non-parallel generally vertical planes, and means for letting out and taking up said cables; a trackway paralleling said monorail but spaced therefrom; means for fixedly supporting said trackway; and means on said carrier engaging said trackway.

2. In an overhead monorail underslung carrier system the combination of: an overhead monorail; means for fixedly supporting said monorail; a carrier supported by and movable along said monorail; said carrier comprising an upper frame member; means for suspending said upper frame member from said monorail, a load member, means comprising three pairs of cables for suspending said load member from said upper frame member, means for operatively connecting the respective cables of each pair to one of said members at spaced points so located that vertical planes embracing the points at which the respective pairs of cables are connected form a triangle at their intersection with a horizontal plane, means for operatively connecting the respective cables of each pair to the other of said members so that the respective cables of each pair are connected to said last named frame at substantially the same point but spaced from and disaligned with the points at which the other pairs of cables are connected thereto whereby the respective cables of each pair are angularly disposed to each other and the respective pairs of cables lie in non-parallel generally vertical planes, and means for letting out and taking up said cables; a trackway paralleling said monorail; said trackway comprising members spaced from said monorail and located on opposite sides thereof; means for fixedly supporting said last named members; and means on said carrier engaging said last named members.

3. In an overhead monorail underslung carrier system the combination of: an overhead monorail; means for fixedly supporting said monorail; a carrier supported by and movable along said monorail; said carrier comprising an upper frame member, means including wheels in engagement with and movable along said monorail for suspending said upper frame member from said monorail, means comprising three pairs of cables for suspending said load member from said upper frame member, means for operatively connecting the respective cables of each pair to one of said members at spaced points so located that vertical planes embracing the points at which the respective pairs of cables are connected form a triangle at their intersection with a horizontal plane, means for operatively connecting the respective cables of each pair to the other of said members so that the respective cables of each pair are connected to said last named member at substantially the same point but spaced from and disaligned with the points at which the other pairs of cables are connected thereto whereby the respective cables of each pair are angularly disposed to each other and the respective pairs of cables lie in non-parallel generally vertical planes, and means for simultaneously letting out and taking up said cables, a trackway paralleling said monorail; said trackway comprising members spaced from said monorail and located on opposite sides thereof; means for fixedly supporting said last named members; and rollers on said carrier engaging said last named members.

4. In an overhead monorail underslung carrier system the combination of an overhead monorail; means for fixedly supporting said monorail; a

carrier supported by and movable along said monorail; said carrier comprising an upper frame member, a load member, means for suspending said upper frame member from said monorail, means comprising three pairs of cables for suspending said load member from said upper frame member, means for operatively connecting the respective cables of each pair to the upper frame member at spaced points so located that vertical planes embracing the points at which the respective pairs of cables are connected form a triangle at their intersection with a horizontal plane, means for operatively connecting the respective cables of each pair to said load member at substantially the same point but spaced from and disaligned with the points at which the other pairs of cables are connected thereto whereby the respective cables of each pair are angularly disposed to each other and the respective pairs of cables lie in non-parallel generally vertical planes, and means for letting out and taking up said cables; a trackway paralleling said monorail but spaced therefrom; means for fixedly supporting said trackway; and means on said carrier engaging said trackway.

5. In an overhead monorail underslung carrier system the combination of: an overhead monorail; means for fixedly supporting said monorail; a carrier supported on and movable along said monorail; said carrier comprising an upper frame member, means comprising wheels in engagement with said monorail for suspending said upper frame member from said monorail, a load member, means comprising three pairs of cables for suspending said load member from said upper frame, means for operatively connecting the respective cables of each pair to said upper frame member at spaced points so located that vertical planes embracing the points at which the respective pairs of cables are connected form a triangle at their intersection with a horizontal plane, means for operatively connecting the respective cables of each pair to said load member at substantially the same point but spaced from and disaligned with the points at

which the other pairs of cables are connected thereto whereby the respective cables of each pair are angularly disposed to each other and the respective pairs of cables lie in non-parallel generally vertical planes, and means for letting out and taking up said cables; a trackway paralleling said monorail; said trackway comprising members spaced from said monorail and located on opposite sides thereof; means for fixedly supporting said last named members; and means on said carrier engaging said last named members.

6. In an overhead monorail underslung carrier system the combination of: an overhead monorail; means for fixedly supporting said monorail; a carrier supported on and movable along said monorail; said carrier comprising an upper frame member, means comprising wheels in engagement with said monorail for suspending said upper frame member from said monorail, a load member, means comprising three pairs of cables for suspending said load member from said upper frame, means for operatively connecting the respective cables of each pair to one of said upper frame members at spaced points so located that vertical planes embracing the points at which the respective pairs of cables are connected form a triangle at their intersection with a horizontal plane, means for operatively connecting the respective cables of each pair to said load member at substantially the same point but spaced from and disaligned with the points at which the other pairs of cables are connected thereto whereby the respective cables of each pair are angularly disposed to each other and the respective pairs of cables lie in non-parallel generally vertical planes, and means for simultaneously letting out and taking up said pairs of cables; a trackway paralleling said monorail; said trackway comprising members spaced from said monorail and located on opposite sides thereof; means for fixedly supporting said last named members; and rollers on said carrier engaging the under surface of said last named members.

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