April 16, 1940. R. H. FLEET ET AL 2,197,300

AIRPLANE LAUNCHING

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FIG. 1.

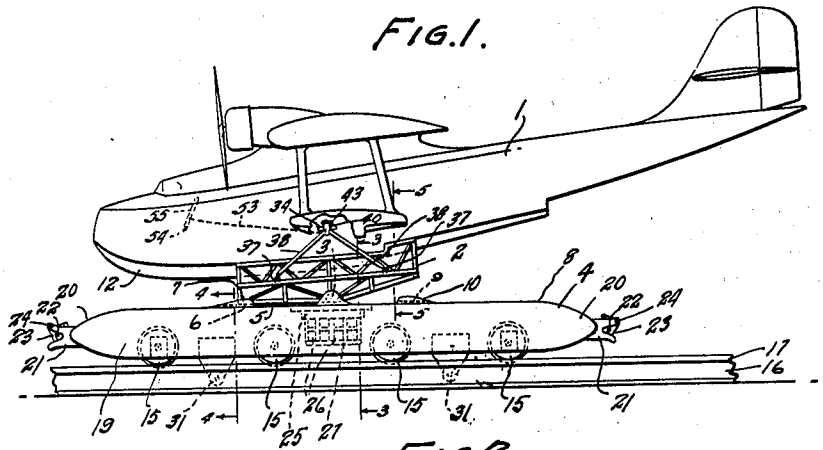


FIG. 2.

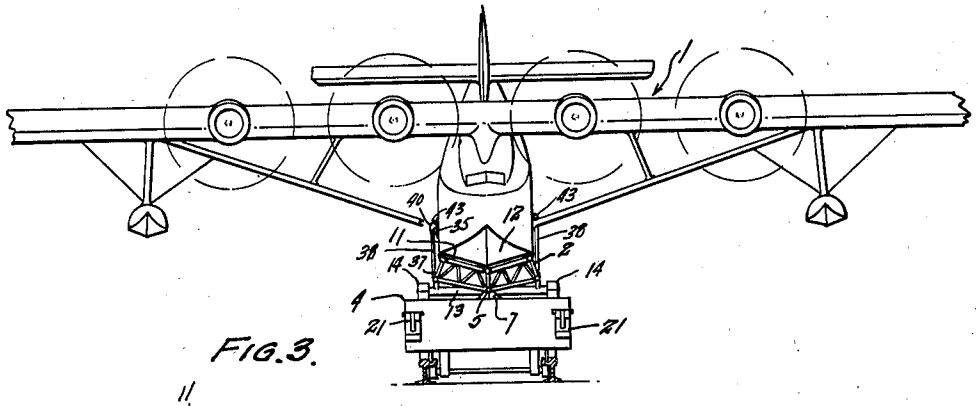


FIG. 3.

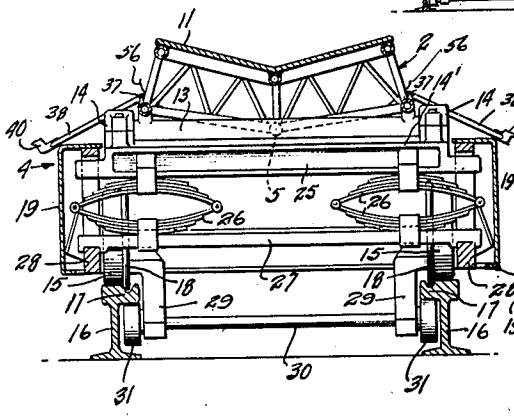
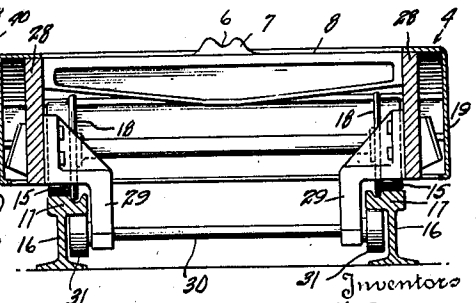


FIG. 4.



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FIG. 5.

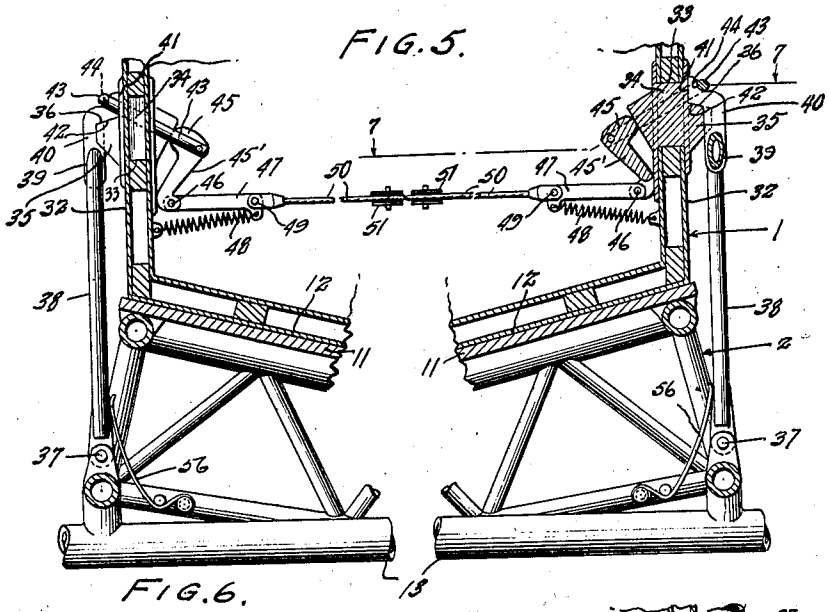


FIG. 6.

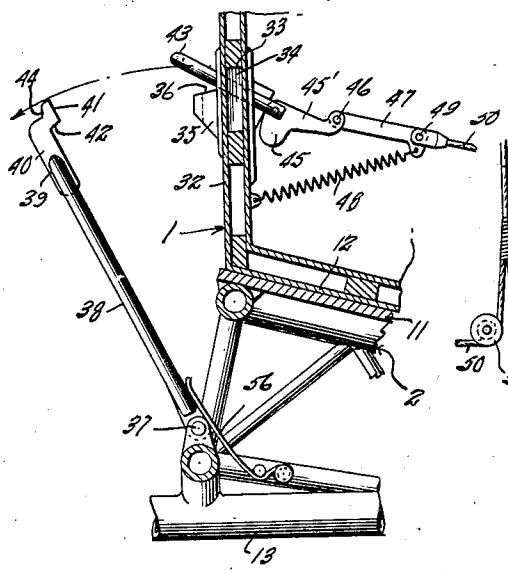
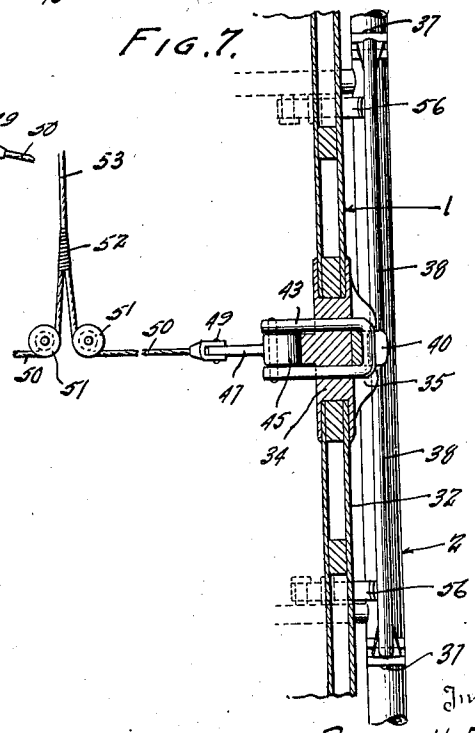


FIG. 7.



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AIRPLANE LAUNCHING

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FIG. 8.

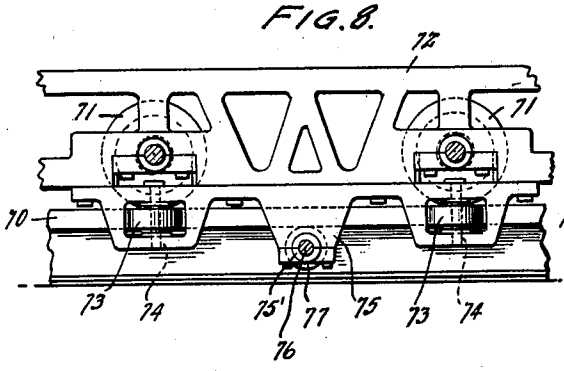


FIG. 9.

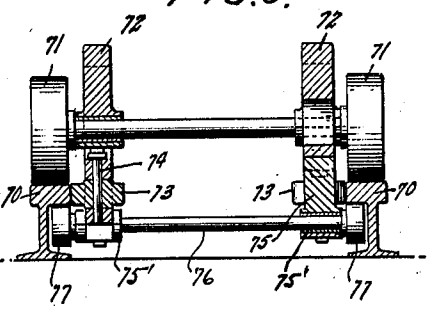


FIG. 10.

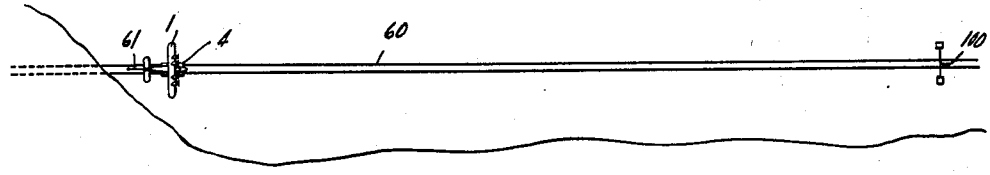


FIG. 11.

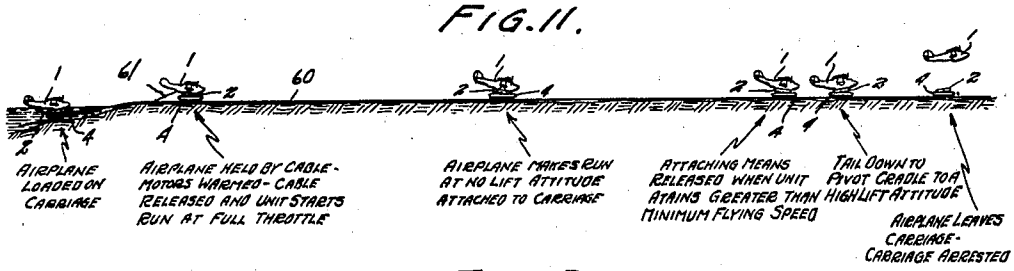
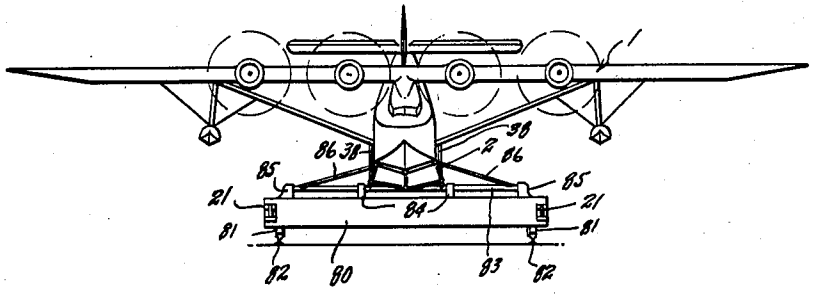


FIG. 12.



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AIRPLANE LAUNCHING

Reuben H. Fleet, William B. Wheatley, and Isaac M. Laddon, San Diego, Calif.

Application December 22, 1936, Serial No. 117,234

13 Claims. (Cl. 244—63)

Our invention relates to a method and apparatus for launching airplanes.

This application is a continuation in part and an improvement on our application Serial No. 105,610, filed October 14, 1936.

Often a straightaway rail track running in one direction can be found, or laid, where it is not possible to locate a number of rail tracks lying in different directions, or to locate a field of sufficient size for take-off by ordinary methods. It is highly desirable that a method and apparatus capable of launching airplanes in a cross wind be devised, and it is with these problems in view that we have conceived the present system.

"A cross wind" is a term meaning a wind acting in any direction having a perpendicular component not in line with the direction of motion of the vehicle.

We can employ a single straightaway stretch of rail track, with means provided to prevent lateral tipping of the vehicle supporting the airplane from which it is launched. Another form of device which we may employ is one in which the vehicle supporting the airplane is supported on a wide base, as, for instance, where the vehicle is mounted on trucks which run on the outside rails of two parallel tracks such as are found on the two-track rights of way of railroads.

Since it is possible in many localities to find rails running in one direction where it would be impossible to find rails running in many directions, our invention is of particular advantage in that the rails running in one direction can be employed to launch an airplane from a vehicle running on them, even though a cross wind is blowing.

It is an object of our invention to provide means for launching an airplane from a vehicle, wherein guiding means are provided for holding the vehicle in one direction of travel, and such launching can be effected from the vehicle even though a cross wind is blowing.

A further object of the invention is to provide a method and apparatus for safely launching airplanes in cross winds.

Another object of our invention is to provide a system of launching airplanes which is inexpensive and can make use of stretches of rails running in one direction, such as are found on a railroad right of way, for the launching of airplanes.

In one form of our system we employ rails, on which a vehicle is adapted to travel, and in which means are provided to hold the vehicle to the rails. The airplane is mounted on the vehicle, and when minimum speed well in excess of the flying speed of the airplane is achieved, the controls of the airplane are quickly manipulated to change the position from the substantially no-lift attitude to a substantially high lift attitude somewhat below the maximum lift. This causes the airplane to "jump" off its supporting vehicle, giving but slight immediate opportunity for sideways movement of the airplane, or for lateral tilting of the wings, both of which are resisted by the weight and inertia of the airplane. The airplane quickly rises to a position where a tilting of the wings, or a sideways movement of the airplane with respect to the supporting vehicle, or surrounding objects, is unimportant. It is obvious that we can employ a vehicle which is not designed to run on rails, but in the preferred form of our invention the vehicle is mounted on a rail track.

In one of the methods employed, we lock the airplane to the vehicle until just before the time the airplane is brought from the substantially no-lift position into a high angle of attack position. Then the airplane is unlocked from the vehicle, and immediately thereafter the airplane is brought into a high angle of attack attitude, and because speed well in excess of the flying speed of the airplane has been attained, the airplane quickly "jumps" off the vehicle to a safe height, where tilting of the wings or sideways movement of the airplane with respect to the vehicle becomes unimportant.

One of the important features of our invention is that the airplane is held, while on the vehicle, in a straight line of movement without danger of tilting of the airplane on the vehicle, or tilting of the vehicle itself. Thus, the pilot does not have to try to compensate for the cross wind, but merely waits until a speed well in excess of the flying speed is obtained, and then releases his airplane from the vehicle and "jumps" into the air.

The feature of attaining a speed well in excess of minimum flying speed, thus enabling quick "jumping" of the airplane off the vehicle is of considerable importance. This "jumping" takes effect by reason of such excess speed, and also by reason of the quick manipulation of the controls by the pilot to effect a rapid rise. It is desirable, as above set forth, that the airplane be brought from approximately the no-lift attitude to a higher lift attitude quickly. Because in attaining the desired speed the airplane is in

a substantially no-lift attitude, there is but slight tendency for tilting either of the airplane or of the vehicle, but both of these may be prevented, as before indicated, by either broadening the lateral support for the vehicle or, alternatively, by providing means for preventing the vehicle leaving the rails.

Preferably, as previously stated, the airplane is held on the vehicle by fastening means, which are released just prior to manipulation of the controls to take off. This holds the airplane in a proper position for take off during the period where speed in excess of flying speed is acquired.

With these and other objects in view, which may be incident to our improvements, the invention consists in the parts and combinations to be hereinafter set forth and claimed, with the understanding that the several necessary elements comprising our invention may be varied in construction, proportions and arrangements, without departing from the spirit and scope of the appended claims.

In order to make our invention more clearly understood, we have shown in the accompanying drawings means for carrying the same into practical effect without limiting the improvements in their useful applications to the particular constructions which, for the purpose of explanation, have been made the subject of illustration.

In the drawings:

Figure 1 is a view in side elevation of a flying boat mounted on a vehicle embodying our invention.

Figure 2 is a front elevation of the flying boat and supporting vehicle shown in Figure 1, with a portion of the wings of the flying boat broken away.

Figure 3 is a view along the line 3—3 of Figure 1, looking in the direction of the arrows;

Figure 4 is a view taken along the line 4—4 of Figure 1, looking in the direction of the arrows.

Figure 5 is a view taken along the line 5—5 of Figure 1, looking in the direction of the arrows.

Figure 6 is a detail view showing the holding members shortly after they have become detached from the airplane.

Figure 7 is a view taken along the line 7—7 of Figure 5, looking in the direction of the arrows.

Figure 8 is a detail view showing a modified form of track, and holding means to hold the vehicle to the track.

Figure 9 is a detail view showing the position and construction of the track and the holding rollers of the form of invention shown in Figure 9, some of the parts being shown in section.

Figure 10 is a schematic view, looking down from a height on a stretch of water and of track mounted on land upon which the airplane in our system is adapted to travel.

Figure 11 is a schematic view showing the position of the airplane at different stages of its travel during a launching operation from the track shown in Figure 10.

Figure 12 is a view in end elevation of a flying boat mounted on another form of launching vehicle.

Referring to the drawings, we have shown a flying boat 1 mounted on a cradle 2 which is pivoted at 3 on a vehicle 4.

The pivot 3 mounted on the vehicle 4 may be slightly behind the perpendicular line drawn through the center of gravity of the flying boat. In most forms of flying boat, the center of gravity of the airplane lies about a quarter of a wing chord back from the leading edge of the wing. At rest, the airplane will assume a no-lift attitude, such as is shown in Figure 1, by reason of the fact that the cradle 2 will be tilted into its forward position, wherein a main longitudinal bottom brace 5 will lie within a groove 6 formed in a front support 7 carried on the top 8 of the vehicle 4. In the high lift attitude of the airplane the cradle will be tilted so that the longitudinal bottom brace 5 will lie within the groove 9 formed in a rear support 10.

The cradle 2 is provided with a V-shaped upper surface 11 in which the bottom 12 of the flying boat is adapted to rest. Attached to the cradle is a shaft 13 which is journaled in supports 14 on a platform 14' flush with the upper surface 8 of the vehicle 4.

The vehicle 4 is provided with flanged wheels 15 which are adapted to run on rails 16 which in general are of the type used on railroad rights of way. The rails 16 have grooved heads, or upper flanges, 17 in which grooves the flanges 18 of the wheels 15 are adapted to travel. The vehicle 4 is provided with side sheathing 19 and is tapered at either end, as indicated at 20, to cut down air resistance. The side sheathing 19 comes down close to the bottom of the wheels 15 and likewise minimizes air resistance.

At either end are mounted arresting cable catches 21 having throats 22 into which an arresting cable is adapted to be guided, and latches 23 pivoted at 24 which are pivoted out of the way when a cable enters the throat 22, and which then fall in place behind the cable to retain it in place.

An arresting cable is diagrammatically illustrated at 100 in Figure 10. The details of this arresting gear cable are not given, as they are well known in the art. The type of cable such as is used on airplane carriers to arrest airplanes can be employed, although there are other types well known in the art, which may be used.

The platform 14' is formed of a bolster 25 under which are a series of springs 26 which carry it. The springs 26 are attached to cross bars 27 which are carried in side frames 28. Attached to the side frames 28 are support brackets 29 which depend down below the upper flanges 17, or rail heads, of the rails 16. At the bottom of the brackets 29 are carried axles 30 having at either end wheels 31. The wheels 31 are adapted to bear against the under side of the rail heads 17 and prevent the vehicle 4 from leaving the track if it is subjected to severe tipping strains. In a construction of this kind, it is desirable that there be small motion between the wheels 15 and the wheels 31. However, the airplane should have a spring suspension, and the bolster and springs just described furnish the desired spring suspension for the airplane.

Referring to Figures 5, 6 and 7, we have shown the details of the holding mechanism whereby the pilot may hold the airplane to the cradle until the desired moment for release. The bottom surface 12 of the flying boat, as previously set forth, lies against an upper surface 11 formed on the cradle 2. The sides of the body of the flying boat are indicated at 32. These sides are provided with apertures 33 in which lie locking supports 34 formed with projections 35 having downwardly sloping surfaces 36. Pivoted to the cradle 2 at 37 are arms 38, a pair of arms on either side forming a holding element to the upper end of which are attached at 39 fastening heads 40.

The fastening heads 40 are provided with flat surfaces 41 adapted to lie against the sides 32 of the boat hull and sloped surfaces 42 corresponding to the sloped surfaces 36 of the locking

supports. This provision of sloped surfaces 36 and 42 permits the fastening heads 40 to fall free when released, without danger of binding.

In order to hold the fastening heads 40 to the locking supports 35, we have shown loop catches 43 which pass through apertures formed in the locking supports 34. The end of the loops fit into depressions 44 made in the fastening heads 40. In order to hold the loop catches firmly in place to retain the holding elements in the position to exert their holding function, each loop 43 is provided with a pivoted cam element 45 operated by an arm 45'. In the position of the parts shown in Figure 5, the cam 44 is exerting a strong wedging action, holding the loop catches 43 firmly against the fastening heads 40.

Pivoted to the arms 45' of the cam elements 45 at 46 are connecting links 47 to which are attached tension springs 48 which are also attached to the sides 32 of the boat hull. These tension springs 48 tend to hold the parts in the position shown in Figure 5, with the loop catches 43 exerting their holding function.

Pivoted at 49 to the links 47 are cables 50 which pass over pulleys 51 in the airplane and are joined together as indicated at 52. From the juncture 52 a single cable 53 passes up to a point near the pilot where it is attached to an operating arm 55 that is pivoted at 54. This construction permits the pilot through tension on the cable 53 to pull on the cam arms 45' to cause the cams and associated parts to assume the position shown in Figure 6 wherein the springs 48 are stretched. In this position, the loop catches 43 release the fastening heads 40. The fastening heads 40 are propelled outwardly, as indicated by the arrow in Figure 6, by reason of springs 56 which are attached to the cradle 2 and which press outwardly on arms 38. In the position of the parts shown in Figure 6, the airplane is released from the cradle and the controls can be manipulated by the pilot to effect a take-off.

In operation, the airplane, such as the flying boat illustrated, may be loaded on the carriage while the carriage is under water, as indicated in Figure 11, the carriage running on rail track 60. The airplane is held by a cable 61, or some other suitable holding means, while the motor is warmed up and then run full throttle. The cable is then released and the airplane runs forward mounted on the vehicle in a substantially no-lift attitude until speed well in excess of minimum flying speed is attained.

At this point the pilot pulls on the cable 53 to release the airplane from its attachment to the cradle 2 and then manipulates his controls to bring the airplane into a high lift attitude. This is done quickly, in order that any cross wind which may be blowing will not have a chance to laterally tip the wings or to cause the airplane to have any great sideways movement with respect to the vehicle on which it is travelling until it is "jumped" well above the vehicle and is well in the air. Therefore, the quick bringing of the airplane into a considerable lift attitude is important. The carriage is then arrested by the arresting cable 100 which passes into the arresting cable catches 21. Brakes can also be applied to the wheels of the vehicle 4 through some suitable mechanism, not shown.

Since the airplane in substantially its no-lift attitude while the airplane and the vehicle are acquiring speed is held firmly to the cradle, and hence to the vehicle, there can be no lateral tipping of the airplane or sideways movement of the airplane with respect to the vehicle. In order to prevent the vehicle from being tipped by any forces which may be exerted by cross winds or other factors, the vehicle is provided with the wheels 31 previously described which run under the rail heads 17 of the rails 16. The flanges 18 travel in the grooved heads 17 to prevent sideways movement of the vehicle on the rails 16.

By our system we are enabled to efficiently take off in a strong cross wind and thus may make use of single stretches of rail tracking, a feature of great importance, enabling airplanes to be used in localities where heretofore it has been impossible because no launching facilities were provided.

It is of course to be understood that, although we have illustrated this invention as applied to a flying boat, the same principles can be employed for launching of all types of airplanes, such as landplanes, seaplanes, amphibians and any other heavier-than-air aircraft.

In Figures 8 and 9 we have illustrated another form of track and running gear for the vehicle. In this form of device the rails which form the track are provided with wide flat heads, or upper flanges, 70, on which run the main supporting wheels 71 which are journaled in side frames 72. The wheels 71 are without flanges and run on the flat upper surface of the heads 70. Journaled in the side frames 72 are wheels 73 supported on axles 74. The wheels 73 bear against the inner surfaces of heads 70 and prevent sideways movement of the vehicle under strains which tend to produce such sideways movement. Hangers 75 are adapted to carry bearings 75' in which rotate shafts 76 which carry at either end wheels 77 that bear against the under surfaces of the heads 70. This construction prevents tipping of the vehicle and, as already explained, the wheels 73 bearing against the inner surfaces of the heads 70 prevent sideways movement of the vehicle.

In Figure 12 we have shown another form of carriage which comprises a broad body construction 80 supported by wheels 81 which travel on conventional rails 82. The cradle 2 is supported on a shaft 83 which is journaled on inner supports 84 and outer supports 85. The shaft 83 has braces 86 which brace the cradle 2 against lateral movement.

It is to be noted in this form of construction that the wide gauge of the track gives a form of construction that is not easily upset or tipped; hence in this type of our device it is often possible to dispense with auxiliary means which are adapted to overcome the tipping tendency which occurs when cross wind launchings are made.

While we have shown and described the preferred embodiment of our invention, we wish it to be understood that we do not confine ourselves to the precise details of construction herein set forth by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art, without departing from the spirit of the invention, or exceeding the scope of the appended claims.

We claim:

1. A device for holding an airplane to a vehicle comprising holding elements attached to the vehicle, locking heads carried by the holding elements, locking supports against which the locking heads rest, loop catches holding the locking heads to the locking supports, and release means for releasing the loops to free the holding elements from the locking supports.

2. A device for holding an airplane to a vehicle comprising holding elements attached to the vehicle, locking heads carried by the holding elements, locking supports against which the locking heads rest, loop catches holding the locking heads to the locking supports, and release means for releasing the loops to free the holding elements from the locking supports, said locking heads and locking supports having sloped surfaces at an angle to the perpendicular to the line of pull on the holding elements when they are under tension whereby binding between the locking heads and the locking supports is minimized.

3. A device for holding an airplane to a vehicle comprising holding elements attached to the vehicle, locking heads carried by the holding elements, locking supports against which the locking heads rest, loop catches holding the locking heads to the locking supports, release means for releasing the loops to free the holding elements from the locking supports, said locking heads and locking supports having sloped surfaces at an angle to the perpendicular to the line of pull on the holding elements when they are under tension whereby binding between the locking heads and the locking supports is minimized, and springs urging the locking heads away from the locking supports.

4. A device for holding an airplane to a vehicle comprising holding elements attached to the vehicle, locking heads carried by the holding elements, locking supports against which the locking heads rest, loop catches holding the locking heads to the locking supports, toggle means for releasing the loops, and means operable by the pilot to operate the toggle elements.

5. A device for holding an airplane to a vehicle comprising holding elements attached to the vehicle, locking heads carried by the holding elements, locking supports against which the locking heads rest, loop catches holding the locking heads to the locking supports, said locking heads and locking supports having sloped surfaces at an angle to the perpendicular to the line of pull on the holding elements when they are under tension whereby binding between the locking heads and the locking supports is minimized, spring means urging the locking heads away from the locking supports, and release means for releasing the loops to free the locking heads from the locking supports.

6. A device for holding an airplane to a vehicle comprising holding elements attached to the vehicle, locking heads carried by the holding elements, locking supports against which the locking heads rest, loop catches holding the locking heads to the locking supports, said locking heads and locking supports having sloped surfaces at an angle to the perpendicular to the line of pull on the holding elements when they are under tension whereby binding between the locking heads and the locking supports is minimized, spring means urging the locking heads away from the locking supports, toggle elements for releasing the loops and means operable by the pilot to operate the toggle elements.

7. A vehicle for supporting an airplane for launching comprising a body, a pivoted cradle on the body on which the airplane is adapted to rest, means to lock the plane to the cradle, and means to prevent sideways movement and tipping of the vehicle under the action of forces tending to produce such movements.

8. A vehicle for supporting an airplane for launching comprising a body, wheels for carrying the body adapted to run on the rails of a track, a pivoted cradle on the body, means to lock the plane to the cradle, and means adapted to contact the rails to prevent upsetting.

9. A system for supporting an airplane for launching comprising flanged parallel rails forming a track, a vehicle body, wheels for the vehicle body adapted to run on the flanged rails, a pivoted cradle on the vehicle body, means to lock the plane to the cradle, and means adapted to fit under the flanges on the rails to prevent tipping.

10. A system for supporting an airplane for launching comprising grooved flanged parallel rails forming a track, a vehicle body, wheels carrying the vehicle body having flanges adapted to fit in the grooves on the rails, a pivoted cradle on the vehicle body, means to lock the plane to the cradle, and means adapted to fit under the flanges on the rails to prevent tipping.

11. A system for supporting an airplane for launching comprising grooved flanged parallel rails forming a track, a vehicle body, wheels carrying the vehicle body having flanges adapted to fit in the grooves on the rails, a pivoted cradle on the vehicle body, means to lock the plane to the cradle, and wheels carried by the body and adapted to fit under the rail flanges on each rail to prevent tipping.

12. In a vehicle adapted to travel on parallel rails for launching an airplane, a vehicle body, wheels for carrying the vehicle body adapted to run on the rails, a pivoted cradle on the vehicle body, means to lock the plane to the cradle, and wheels adapted to lie against the rails on the side thereof to prevent sideways movement.

13. In a system of the character described for launching an airplane, a pair of rails, a vehicle body of relatively great width, wheels on the body adapted to run on the rails, and a pivoted cradle for supporting the airplane, means to lock the plane to the cradle, the distance between the rails being such that dangerous tendency to tip under the action of cross winds in launching the airplane is substantially eliminated.

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