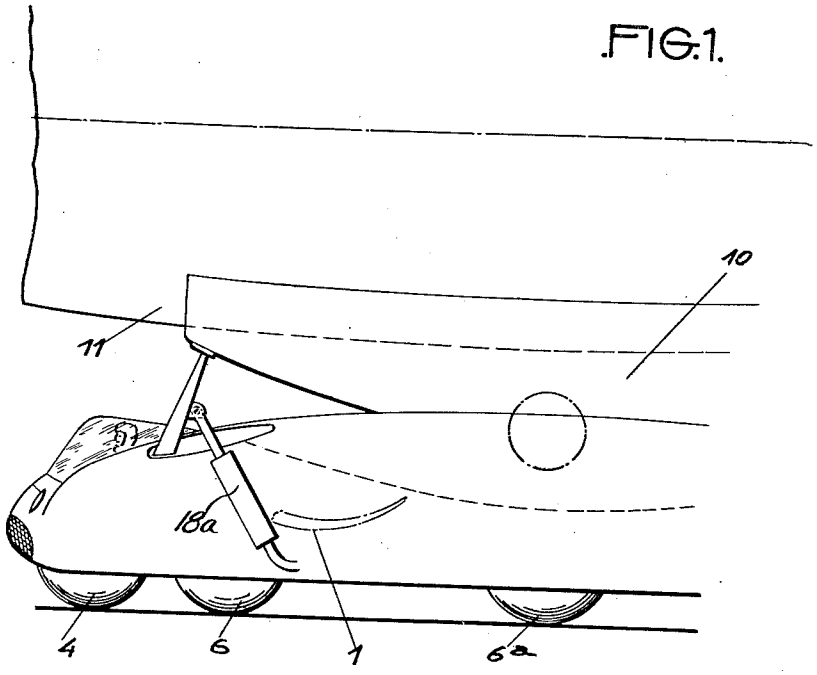
July 22, 1952 J. JEAN-MARIE JULES GERIN 2,604,279

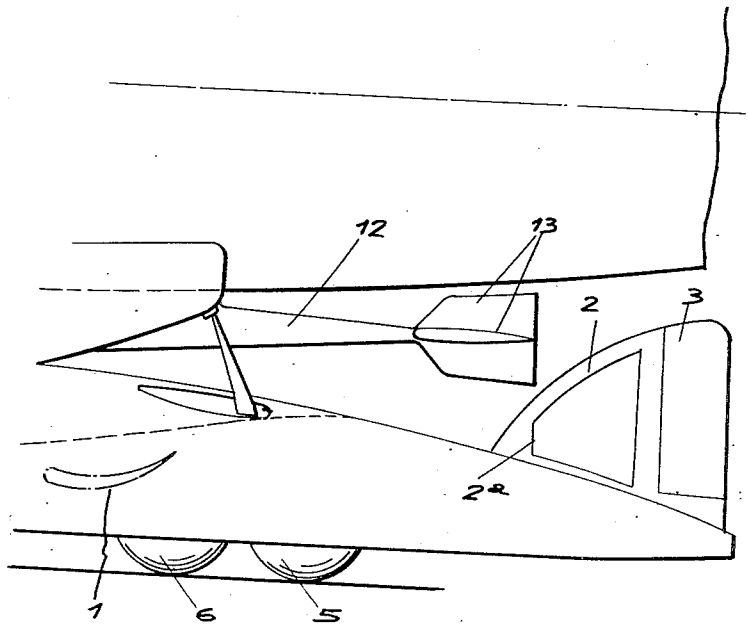
ARRANGEMENT FOR THE TAKE-OFF OF AERODYNES BY MEANS OF STARTING CARRIAGES

Filed June 23, 1948

3 Sheets-Sheet 1

FIG. 1.





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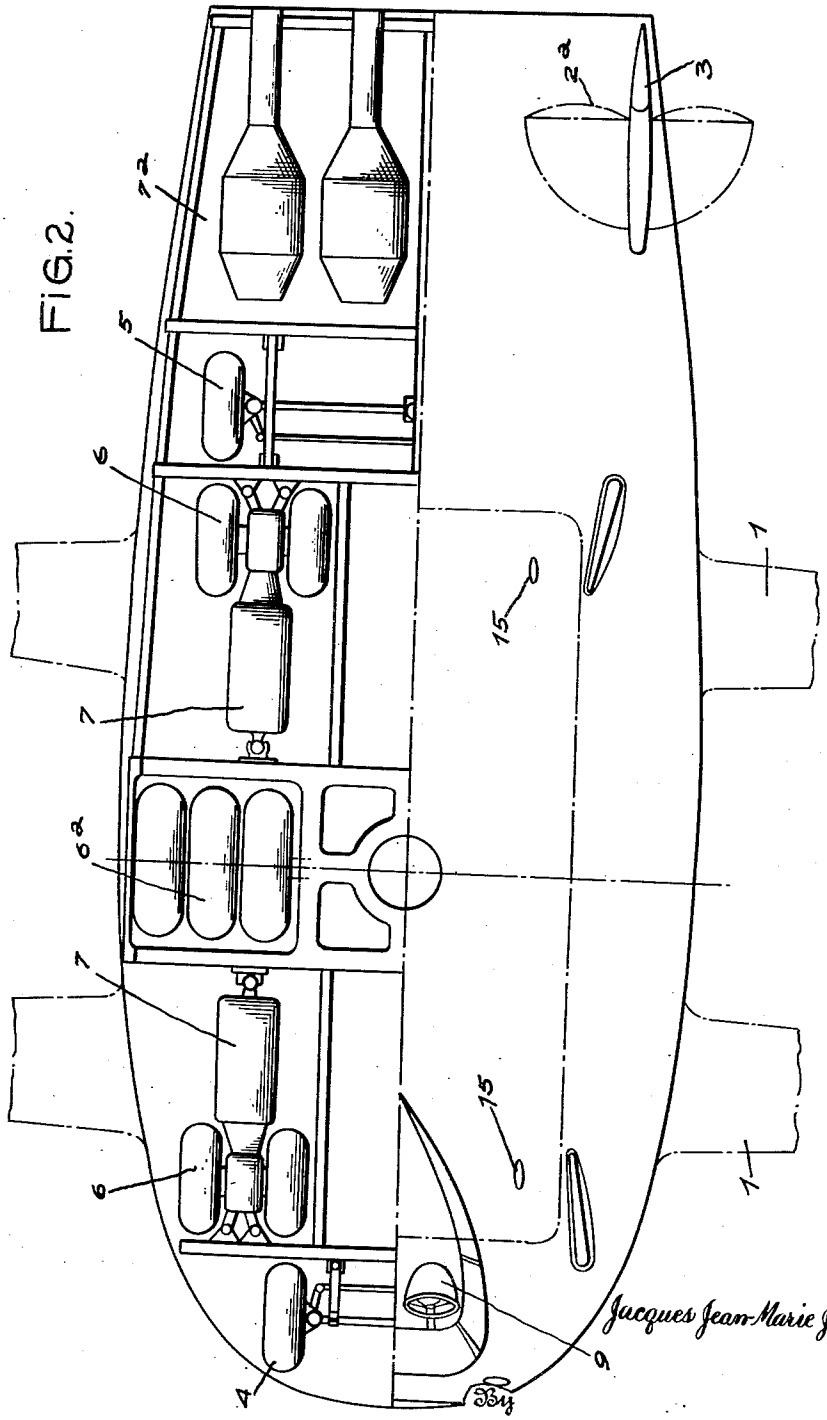
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ARRANGEMENT FOR THE TAKE-OFF OF AERODYNES BY MEANS OF STARTING CARRIAGES

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FIG.2.



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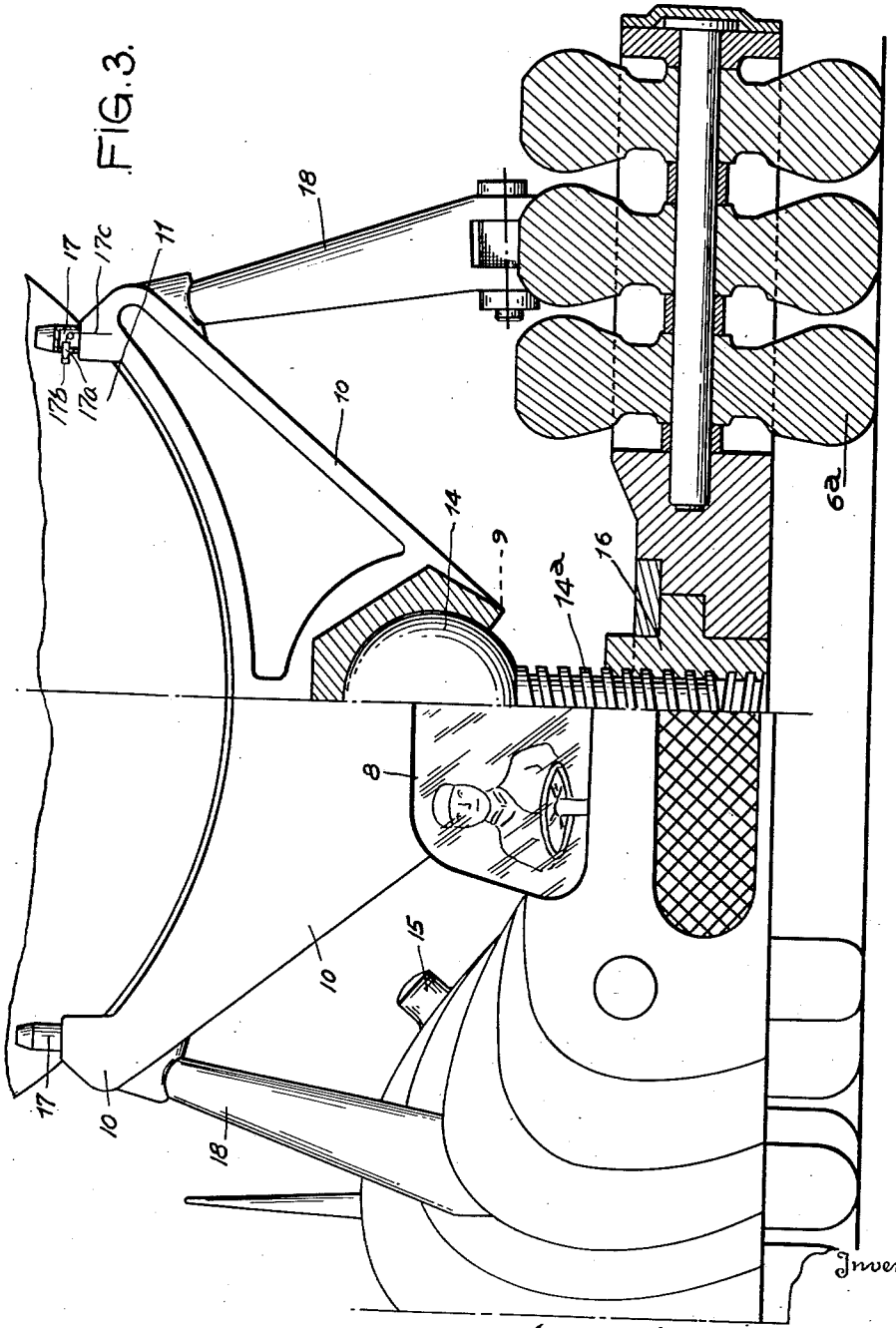
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ARRANGEMENT FOR THE TAKE-OFF OF AERODYNES BY MEANS OF STARTING CARRIAGES

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FIG. 3.



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2,604,279

UNITED STATES PATENT OFFICE

2,604,279

ARRANGEMENT FOR THE TAKE-OFF OF AERODYNES BY MEANS OF STARTING CARRIAGES

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Application June 23, 1948, Serial No. 34,775
In France June 26, 1947

7 Claims. (Cl. 244—63)

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The present invention relates to the take-off of aerodynes by means of self-propelled starting carriages.

It is known that with certain types of aerodynes, taking-off is difficult or even impossible to effect. It is known in particular that aerodynes operated by static jet propulsion cannot take off of their own accord, whereas aerodynes operated by turbine jet propulsion can only take off with great difficulty owing to their poor efficiency at low take-off speeds. On the other hand, long range heavy aircraft, which are therefore heavily loaded at the start, require runways of very great length, whatever their means of propulsion. In a more general manner, it may finally be advantageous to shorten the length of the take-off even of light aerodynes of any type.

It has already been proposed to make possible or to facilitate the take-off of aerodynes by means of a self-propelled starting carriage on which the aerodyne is placed and from which it is released when, owing to the combined action of the propelling means of the carriage and of those of the aerodyne, the whole arrangement has reached the desired take-off speed.

In the arrangements of this type heretofore known, the aerodyne remains closely secured to the carriage throughout the entire launching period during which the manoeuvring of the whole arrangement, in particular for making it follow the take-off runway, is solely effected by the pilot of the aerodyne. This arrangement has several drawbacks: in particular when the wind is blowing in an oblique direction to the take-off runway, the aerodyne remains orientated in the direction of said runway and not in the direction of the relative wind; owing to this fact, it offers an increased frontal resistance, thereby increasing the launching time and distance.

On the other hand, after the aerodyne is airborne, the carriage which no longer has any driver is left on its own and continues and completes its travel without control, which may cause accidents and makes it necessary to go and fetch it, sometimes fairly far away.

The present invention overcomes these drawbacks and is essentially characterised by the fact that the aerodyne is mounted on the carriage through the intermediary of fixing means which, at the beginning of the take-off run, completely secure the two machines to one another, but which, when a certain speed is reached, can be altered so as to render the aerodyne aerodynamically independent and enable it to be orientated in the direction of the relative wind while remaining secured, as regards the tractive force, to the

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starting carriage which provided with its own steering means operated by a driver located in said carriage, and from which the aerodyne is completely and finally released as soon as the take-off speed is reached.

According to a particularly advantageous embodiment, the aerodyne is fixed by retractable bolts to a cradle which is mounted on the carriage by means of a ball-and-socket joint and which is held stationary relatively to the carriage by means of pivotally mounted struts which are retracted when the aerodyne is to be rendered aerodynamically independent, whereas the bolts are retracted only at the instant when the aerodyne becomes airborne.

According to another feature of the invention, the ball is adapted to be moved vertically, thereby making it possible, when said ball and also the cradle which it supports are in their lower position, to move the carriage under the aerodyne, whereupon said ball is raised so as to enable the carriage to support the aerodyne completely, and after its undercarriage has been retracted, said aerodyne can thus be loaded with freight, munitions and fuel.

This arrangement has the advantage, when the carriage is applied to aerodynes for which there is a considerable difference between the weight on take-off and the weight on landing (bomber aircraft, heavy fuel consuming aircraft, etc.), of enabling such aerodynes to be provided with undercarriages which are calculated only for the stresses to which they are subjected on landing, when the weight of the aerodyne is comparatively light.

It also makes it possible to replace the landing wheels merely by skids.

The starting carriage according to the invention may furthermore have the following constructional features:

(*a*) It may be provided with separate multiple propelling means which can be used separately for the slow evolutions of the carriage either alone or loaded with the aerodyne, and simultaneously for the propulsion at the take-off speed.

(*b*) It may be provided with means which enable its driver to steer it on the ground like a road vehicle.

(*c*) The cradle is provided with fins in vertical and horizontal planes so that it retains a correct position on the carriage when same is travelling on its own, after the aerodyne has been released, and there is no danger of its overturning and fouling said aerodyne when the release takes place.

The invention covers still further advantageous

peculiarities which will become apparent from the ensuing description made with reference to the accompanying drawings which illustrate diagrammatically and only by way of example one embodiment of a starting carriage which simultaneously embodies all the features hereinbefore defined.

In these drawings:

Fig. 1 is a side view of the carriage and of the cradle.

Fig. 2 is a corresponding top plan view, with the cradle removed.

Fig. 3 shows a front view, on a larger scale, of a partial transverse section of the carriage and the cradle, along the axis of the ball-and-socket connection.

As in some known starting carriages, the carriage is an automobile vehicle with as low a chassis as possible and is provided with suitable fairing. According to a feature of the invention, it may be provided with wings 1 of predetermined section which is so orientated as to apply, by aerodynamic effect during the launching operation, a vertical component to the wheels in order to maintain a useful adhesion thereof to the ground, in opposition to the increasing vertical lift applied to the aerodyne. Vertical fins 2 with rudders 3 and braking flaps 2*a* fitted in the fins are also provided for stabilizing the carriage in its launching travel and aerodynamically braking it when it continues its course, after the aerodyne has been released. In order to make the braking still more powerful, a parachute may be opened and connected to the rear part of the carriage, so as quickly to decrease the speed of same.

It is very advantageous to have a high propulsive power for the carriage, in order to reduce as much as possible the load per H. P. of the aerodyne plus carriage assembly during the travel along the ground prior to the take-off. The propelling power of the carriage may be provided by suitably distributed independent power plants which actuate the driving wheels provided with pneumatic tyres by means of suitable change speed gears. The pilot of the carriage can make any desired number of said power plants operative at will according to whether the carriage is to roll slowly along the ground or is to accelerate to reach the maximum take-off speed.

The power plants may comprise piston-operated heat engines. It is also possible to provide a combination of power plants comprising piston-operated heat engines and jet propelling means which can be stopped automatically when the aerodyne has been released, the automatic control devices being however doubled by manual safety controls. The jet propelling means may, for example, be either turbine-operated jet engines, or powder or liquid operated rockets, or any other jet propelling means used alone or in combinations. They may, in particular, be grouped in a battery at 7*a*, at the rear of the carriage. The changes of direction of the carriage are obtained, according to the invention, by the driver in such a manner as to enable evolutions and manoeuvres to be effected on the ground and the carriage to be kept on the take-off runway during the take-off, despite the changes of direction of the wind. Since it is steered like an automobile road vehicle, it can avoid the obstacles at the end of the runway, retain its direction during the braking period and quickly return to its station.

These changes of direction may be obtained by means of steering wheels or axles at the front,

or both at the front and at the rear. In Figs. 1 and 2, there have been provided, by way of example, two front steering wheels 4 and two rear steering wheels 5, and four groups 6 of twin driving wheels which may be coupled, by means of automatic or controlled change speed gears and suitable clutches, to any number of interchangeable power plants 7, according to the weight of the aircraft to be launched. Wheels 6*a*, which act solely as carriers, may also be provided. The pilot or driver of the carriage is seated in a station at 8 and the assistant is located symmetrically at 9.

The chassis of the carriage, the arrangement of which may vary and does not per se affect the invention, may advantageously be constructed in several portions assembled together in such a manner that they can be taken apart in order to decrease the general bulk in the case in which the carriage is to be transported on railroad vehicles.

According to the invention: the aerodyne which is to be launched is supported by the carriage by means of a cradle 10, the construction of which may obviously vary according to the types of aerodynes to be supported. In the embodiment considered, said cradle comprises a frame, the upper face of which may be complementary to the shape of the lower surface of the fuselage 11 of the aerodyne (Fig. 3). It rests on the carriage by means of a joint of the ball-and-socket type 14, the centre of which is as close as possible to the centre of gravity of the fully loaded aircraft and in any case is located on the vertical line which passes through said centre of gravity. The cradle 10 and its load can thus be orientated in the vertical plane and the horizontal plane about the centre of the joint, in order to enable the cradle alone to be orientated when the aircraft has been released, it is provided, at the end of a beam 12 which is extended rearwards, with a double fin 13. The bottom face of the cradle is suitably profiled and faired.

With the aircraft resting on the ground by means of its undercarriage which supports it empty, i. e. without fuel or cruising load, the carriage guided by its driver engages under the central body of fuselage 11 of the aircraft, the ball 14 being in its extreme low position and the cradle resting with its bottom face against resilient abutments 15 provided on the chassis of the carriage. When said carriage is in the suitable position, an electric or other motor, which is started by the driver, raises the ball 14 and the cradle. In the example illustrated, the ball is provided with a screw-threaded rod 14*a* which is raised or lowered by rotating a nut 16, but any other lifting mechanism actuated mechanically or hydraulically may obviously be used. While it is being raised, the cradle can readily be orientated by an assistant so that tenons 17 exactly engage in jaws provided on the fuselage 11 and provided with any suitable locking means remotely controlled by the pilot of the aerodyne, said locking means consisting, for example, of a bolt 17*a* extending into a recess 17*b* in the fuselage and which the pilot can actuate by means of a cable 17*c*.

After the cradle has been suitably locked on the fuselage 11, struts such as props 18, for example, which are pivotally connected to the carriage, are raised to engage the corners of the cradle and support it rigidly relatively to the carriage. The undercarriage of the aircraft is then retracted and the aircraft is absolutely se-

cured to the carriage and follows all the movements thereof on the ground.

The aircraft can be loaded with fuel and freight, and finally the crew and the passengers, if any, can go on board. The whole arrangement is driven to the take-off runway, orientated in the suitable direction, and the carriage is started. When the speed is sufficient, the props 18 are swung down by the jacks 18*a*, and the aircraft-cradle assembly can be freely orientated. By means of this arrangement, when the wind is blowing obliquely to the direction of the take-off runway which must obviously be followed by the carriage, the cradle-aerodyne assembly can be orientated in the direction of the relative wind, thereby decreasing the frontal resistance and enabling the take-off speed to be reached more quickly. When said speed is reached the bolts 17*a* of the tenons 17 are disengaged, automatically or not, and the aircraft is released from the carriage which continues its travel and slows down. The cradle, which is kept in a correct position owing to its own fins, has not overturned and risked fouling the rear portions of the aircraft. It falls down again when the speed of the carriage has been considerably reduced and becomes inclined as it bears against the front or rear abutments 15. The ball 14 is moreover simultaneously lowered so as to return the cradle to its extreme low position, as soon as the aircraft has been released.

The same ball, or more generally the same coupling, may be used for mounting on the same carriage cradles of different types suited to separate types of aircraft. As hereinbefore stated, the carriage is equipped with the necessary number of standard power plants according to the weight of the aircraft to be launched.

In certain cases, it may be necessary to construct the carriage in the shape of as light a machine as possible. Thus, for speed and convenience, the aircraft may be adapted to transport its own starting carriage from one airport to another. In this case, the aircraft is relieved of as much weight as possible. The bolts of the tenons are locked and as soon as the aircraft-carriage assembly has become airborne, the control nut of the ball is actuated so as to move the carriage closer to the fuselage and decrease the aerodynamic resistance. The aircraft, which has been rendered as light as possible, obviously only carries the load of fuel necessary for the journey.

In any case, the centre of gravity of the carriage must be very close to the ball so that when taking off, the carriage does not tend to overturn and particularly so as to prevent it from moving the aircraft out of centre by shifting the centre of gravity of the whole arrangement.

On the other hand, if necessary, the weight of the carriage may be increased by ballast and for example by water tanks in order to increase the adhesion of the wheels to the ground. The wings 1 may advantageously be adapted to fold or to be detached in order to facilitate placing the carriage in position under the aerodyne when the same is still resting on its wheels or has to manoeuvre on the ground.

It is obviously possible to provide a light and simplified carriage and, in particular, a carriage which is not provided with fairings and fins and is equipped with a single power plant for transporting the aerodyne and effecting the operations on the ground. Such a carriage is obviously very suitable for aircraft provided with landing skids.

I claim:

1. A launching device for aerodynes comprising a self-propelled carriage, steering means located in said carriage, an aerodyne supported rotatably mounted on said carriage, securing means for holding an aerodyne to said support, retaining means for maintaining the said aerodyne support stationary with respect to said carriage, means for releasing the said retaining means to permit the aerodyne support to rotate with respect to said carriage to orient the aerodyne in the direction of the wind, and means for releasing the said securing means to release the aerodyne from the support on attainment of take-off speed.

2. A launching device for aerodynes comprising a self-propelled carriage, steering means located in said carriage, an aerodyne support rotatably mounted on said carriage by means of a ball-and-socket joint, retractable bolts for holding an aerodyne to said support, pivotally mounted struts for maintaining the aerodyne support stationary relative to the carriage, means for retracting the said struts to permit the aerodyne support to rotate with respect to the carriage to orient the aerodyne in the direction of the wind, means for retracting the bolts to release the aerodyne from the support on attainment of take-off speed.

3. A launching device for aerodynes according to claim 1 wherein means are provided for moving said aerodyne support in a vertical direction with respect to said carriage to enable the carriage to be driven under the aerodyne when the support is in its low position, and to lift the aerodyne from the ground when the aerodyne support is raised to its elevated position.

4. A launching device for aerodynes according to claim 2 wherein means are provided for moving the ball of said ball-and-socket joint in a vertical direction for raising and lowering said aerodyne support with respect to said carriage.

5. A launching device for aerodynes according to claim 1 wherein separate multiple propelling means are provided on said carriage which are used separately for slowly propelling said carriage and simultaneously for attaining take-off speed.

6. A launching device for aerodynes according to claim 1 wherein vertical and horizontal fins are provided on said aerodyne support to retain said support in correct position on said carriage.

7. A launching device for aerodynes according to claim 2 wherein vertical and horizontal fins are provided on said aerodyne support to retain said support in correct position on said carriage.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,604,279 Dated September 14, 1971

Inventor(s) Marion H. Davis

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Page 1, the Assignee should be --Ferraloy-- instead of "Ferralog"

Column 1, line 66, "connection" should be --connected--

Column 2, line 46, "member" should be --members--

Column 3, line 7 "from he" should be --from the--

Column 3, line 58 "pat" should be --path--

Column 5, line 15 "dive" should be --drive--

Column 5, line 34 "fist" should be --first--

Signed and sealed this 28th day of March 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

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