E. BACHELET.

LEVITATING APPARATUS FOR STARTING AND STOPPING AEROPLANES AND THE LIKE.

APPLICATION FILED FEB. 15, 1912.

Patented Feb. 24, 1914.

1,088,511.

INVENTOR

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WITNESSES

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To all whom it may concern:  
Be it known that I, EMILE BACHELET, of Mount Vernon, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Levitating Apparatus for Starting and Stopping Aeroplanes and the like; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form part of this specification.

This invention is a novel apparatus for starting aeroplanes, and other things which it may be desired to launch or start without friction; and it also provides a novel apparatus for stopping aeroplanes, and the like. Its objects are—First: To provide an apparatus wherein an aeroplane may be placed in position for starting, and whereby after the aeroplane motor has attained full speed the aeroplane may be gently levitated or floated in the air and allowed to start without having to overcome any friction, thus allowing the full power of the motor to be utilized in driving the aeroplane forward, and letting it quickly acquire the speed and momentum necessary to enable it to sustain itself in the air. Second: To provide a receiver which can be levitated or floated in the air and into or onto which receiver the aeroplane may be directed, and thereby arrested without shock; as the receiver is floated in the air and the aeroplane may contact therewith without danger; the receiver is preferably made capable of movement horizontally while levitated for such a distance as may be desired, and it may be arrested by any suitable cushioning device, so as to bring the aeroplane easily and safely to a stop.

The invention is applicable for starting and stopping aeroplanes generally; and is especially well adapted for such use on shipboard, where it is desired to start an aeroplane from the vessel, or allow an aeroplane to safely alight thereupon.

In the accompanying drawings I have illustrated an apparatus embodying the general essential features of the invention and a description of which will enable others familiar with the art to readily apprehend and utilize the invention. The form, proportions, and construction of parts however may be widely varied to suit the designer, and the particular make of aeroplane or other thing in connection with which the apparatus is to be employed.

In said drawings Figure 1 is a side elevation of an apparatus with a known type of aeroplane in position thereon ready for starting; and showing in dotted lines the aeroplane levitated and traveling under its own momentum. Fig. 2 is a plan view of Fig. 1 with the aeroplane removed. Fig. 3 is an enlarged section on line 3—3, Fig. 1. Fig. 4 is a side elevation of the apparatus arranged for receiving and arresting an aeroplane. Fig. 5 is a top view of the arresting apparatus.

In the drawings I have illustrated the invention as embodied in apparatus for starting and for stopping aeroplanes; and have indicated in connection therewith an aeroplane A, which may be of any desired type, as the present invention does not relate to the construction of the aeroplane itself.

The novel apparatus comprises a plurality of what I call guideways; which are preferably arranged parallel and in the same plane. Each guideway 1, preferably comprises a plurality of electromagnets 2; and I have shown two rows of electromagnets in each guideway, such magnets being preferably set with their axes perpendicular to the upper surface of the guideway. The magnets are preferably connected by any suitable means and in any well known manner with a suitable source of electricity so that they can be simultaneously and periodically energized. The magnets may be energized either by an "alternating" current, or by an interrupted "direct" or alternating current; to create a periodic magnetic field, substantially as described in my Patents Nos. 1029042 and 1029043 of March 19, 1912—in which the broad principle of the invention is disclosed.

The magnets may be supported on bars 2, and each guideway may be incased wholly or partially if desired by any suitable non-magnetic material; but as shown the magnets are simply protected on the sides by bars 2, which may be of wood or other suitable material. I have shown three such guideways 1 in the drawings; and they are preferably inclined slightly upward from the starting point, so that as the aeroplane traverses the apparatus it will be directed upwardly. Upon these guideways I place a movable carrier, or aeroplane support, 3, 110.
which is provided with shoes or runners 3; preferably one for each guideway, each adapted to overlie a number of magnets in the corresponding guideway; the guideways being longer than the shoes 3. The exact length of the guideways would depend upon the nature and weight of the aeroplane or thing to be levitated; and the guideways should be made so long that by the time the aeroplane has traversed the guideways it will have acquired sufficient momentum and speed to maintain itself in the air. The shoes 3 should be made of aluminum, or of other material, if such be found, which will have the peculiar anti-magnetic properties of aluminum that I have discovered, and by reason of which it results that, if such shoes be made of aluminum and of sufficient thickness, say about one half inch or more, they will—when introduced into the periodic magnetic field created by the magnets on the guideway—be levitated or repelled from the guideway magnets with such force that the carrier will be raised and floated in the air. Thus if the magnets are energized by a periodic current the shoes will be repelled from the magnets and will rise above the same and endeavor to get out of the magnetic field; and such shoes when so levitated can carry considerable weight, and can even carry soft iron over the magnets. The height to which the carrier will rise or levitate, depends upon the strength of the periodic magnetic field, the size and thickness of the aluminum shoes, and the weight to be lifted. Preferably the shoes 3 are connected together by any suitable means, although this is not absolutely essential; but cross pieces and braces 3, 3 are indicated in the drawings; and the aeroplane, A, to be started, may be placed upon said shoes, or carrier; and any suitable device may be provided for keeping the aeroplane in position on the carrier, as indicated at 3 in Fig. 1, preparatory to starting. The aeroplane should not slide on the shoes or carrier, but the carrier moves with the aeroplane until the latter has acquired sufficient velocity to maintain itself in the air. The aeroplane can be supported upon the shoes or the carrier frame in any other desired manner; and the guideways could be so located that the aeroplane wheels or runners will register with the guideways, and could therefore rest directly upon the shoes over the guideways.

To start an aeroplane, it should be put in position on the carrier while the latter is resting upon the guideways and the magnets are not energized as indicated in full lines in Fig. 1; the aviator then takes his seat in the aeroplane and starts the motor, and when he is ready to go he gives a signal (or operates some conveniently located switch,) so that a periodic current shall be passed through the magnets. The instant that the magnets are energized, the carrier will be levitated above the magnets, the shoes rising entirely out of contact with any portion of the guideway, thereby obviating all friction; and of course the carrier will levitate or lift the aeroplane resting thereon, and as there is no friction to be overcome the aeroplane will be instantly moved forward by its own motor with accelerating speed, and by the time the carrier reaches the end of the guideways, as indicated in dotted lines Fig. 1, the aeroplane will be all ready self-sustaining in the air; and the levitating carrier 3 on which the aeroplane originally rested can drop clear of the aeroplane, without any shock, or danger to the aeroplane or the aviator.

In some cases as indicated in Fig. 3 of the drawings, the guideways may be so spaced apart that the aeroplane cannot be directly supported upon the shoes 3, and in such case light boards 3 may be provided upon the carrier to support the runners or wheels of the aeroplane. In either case the carrier and aeroplane will be levitated whenever the magnets are energized, and the pull of the aeroplane motor will cause the carrier and aeroplane to traverse lengthwise of the apparatus until the aeroplane has acquired sufficient momentum to sustain itself.

Any suitable devices may be employed to prevent lateral displacement of the shoes or carrier while levitated. Such for instance as rollers 4 on upright spindles 4 attached to the guideways and adapted to engage the outermost edges of the shoe.

Such devices have no function to perform other than to prevent lateral displacement of the carrier when levitated, and to guide it along the ways as it moves; as the repulsion between the magnets and the shoes, which causes the levitation of the carrier, also tends to force the latter out of the magnetic field.

I have used the words levitate and levitated in the true sense of such words as defined in the Standard Dictionary, in which "levitate" is defined as "To render light or buoyant, so as to cause to rise in the air." My apparatus will so levitate the aeroplane support to cause it to rise with the aeroplane in the air so that it can be started without friction.

It will be understood from the foregoing description that with this apparatus an aeroplane (or other object on the carrier) can be absolutely floated in the air or supported above the guideways without any contact therewith, as indicated in dotted lines in Figs. 1 and 4, and of course when so supported the only friction to be overcome would be the skin friction of the air on the aeroplane and carrier, which is entirely negligible; and the aeroplane itself tends to leave the
carrier as it progresses forward. The weight of the aeroplane and the buoyancy of the carrier will ordinarily suffice to keep the aeroplane on the carrier when the latter is levitated, and then as the aeroplane moves forward the carrier moves with it until the aeroplane clears the apparatus. It is merely a question of properly proportioning the parts of the apparatus to make it work with absolute certainty in launching any efficient aeroplane without shock or danger.

The launching apparatus, or a similar apparatus, can be also used for arresting or stopping aeroplanes. For this purpose the carrier of the launching apparatus may be provided with a removable aeroplane receiver 5, which may be placed upon the carrier 3 as indicated in Fig. 4 of the drawings. Such receiver would preferably be considerably larger in superficial area than the carrier, and could be made of a distinctive color so that it can be easily seen by the aviator, who should steer the aeroplane directly into or onto such receiver. The receiver can be made of light bars 5, that can be set upon or attached to the carrier 3, and which may be provided with outwardly and upwardly projecting rods 5' supporting a preferably non-rigid platform of canvas, or rope or wire netting 5, see Fig. 5. The aeroplane should be directed onto this receiver; and when the aeroplane is about to descend, the magnets are energized, whereupon the receiver is levitated or floated in the air as indicated in Fig. 4, so that when the aeroplane contacts with the receiver it strikes against a yielding surface actually floating in the air. Such receiver being levitated and cushioned by magnetic repulsion will be more sensitive and effective in action than if it was supported upon air cushions. When the aeroplane strikes such receiver the latter can move forward under the impact of the aeroplane, as indicated in the dotted lines Fig. 4, without any friction, which is entirely eliminated; and therefore when the aeroplane strikes the receiver the latter yields and begins to move horizontally with the aeroplane, while the aeroplane settles down upon the receiver without shock or jar. Such a receiver is admirably adapted for the purpose of stopping aeroplanes, and would be especially useful on ship-board.

When an aeroplane is to be stopped, the receiver should be placed at the starting end of the apparatus and levitated so that when the aeroplane strikes it, it can move forward over the apparatus as it does at starting; and after the aeroplane has settled on the receiver the current might be stopped to allow the carrier to drop onto the ways and check the forward movement of the receiver by friction; but I deem it preferable to arrange a cushioning device to limit the forward movement of the receiver. Such cushioning device might consist for instance of an air cylinder 6 having a piston 6' therein connected to a rod 6 which may be connected by a rope 6 to the carrier, so that the air cushion will come into operation just before the receiver reaches the extremity of the apparatus and bring the receiver and aeroplane thereon to a stop without shock or jar; and while the apparatus is still levitated. If desired any suitable devices might be provided to prevent the aeroplane bouncing or sliding off of the receiver if it strikes it while moving very rapidly; or the receiver might be so shaped as to prevent the aeroplane glancing off when it strikes same.

In the drawings I have illustrated an aeroplane with forward propellers, but of course the apparatus can be used for launching or stopping aeroplanes having rear propellers, and if this should necessitate any modification in the form of the carrier or receiver, or general arrangement of the apparatus the same could be readily made by any mechanic skilled in the art, and such changes are within the scope of the invention; which is not restricted to the particular arrangement or apparatus shown, as that of course can and must be varied by the designer to suit the machine with which it is to be used, while retaining the essential principle of the invention, to wit, the levitation or flotation of the aeroplane without friction from a position of rest until it has acquired sufficient momentum to sustain itself; and the similar levitation of the aeroplane receiver and subsequent stoppage thereof after an aeroplane has descended thereon.

While I have described the apparatus as letting the aeroplane start under its own motor it is obvious that, if desired, means might be provided for moving the carrier with the aeroplane while levitated so as to propel the aeroplane forward independent of or in addition to its own motor. This carrier when levitated could be propelled forward by means such as described in my aforesaid applications or any other suitable means which could be readily adapted for propelling the carrier with accelerating speed as the aeroplane starts forward. Just as an example of one means for propelling the carrier when levitated along the guide-ways I have indicated in Figs. 1 and 2, a weight 9 which may be connected by a cord or cable 9', running over a pulley 9, to the carrier; and this weight might be normally upheld by any suitable means and released after the carrier is levitated, so that when the weight is released the carrier will be rapidly drawn forward by dropping of the weight. This device is simply illustrated conventionally as one means for propelling the carrier independently of or in addition to the aeroplane motor and any other means might be employed.
While I have illustrated and described the magnets as arranged upon the guideways, and the anti-magnetic material as arranged upon the carrier, it would obviously be within the scope of my invention to simply reverse the positions of such parts; that is to put the magnets upon the carrier and to make the guideways of anti-magnetic material such as aluminum as described in my aforesaid applications. In such case the magnets on the carrier would be repulsed from the aluminum or anti-magnetic material on the guideways when the magnets are energized by periodic current. The carrier could be levitated and propelled as described. Of course the receiving apparatus could be constructed in a similar manner; and therefore I consider such a reversal of parts as within the scope of my invention and claims.

What I claim is:

1. In apparatus for starting aeroplanes, means for producing a periodic magnetic field, and means operative in such field for levitating the aeroplane to permit it to start without friction.

2. In apparatus for starting aeroplanes, an aeroplane support, means for producing a periodic magnetic field, and means operative in such field for levitating the support to permit it to move without friction.

3. In apparatus for stopping aeroplanes, an aeroplane receiver, means for producing a periodic magnetic field, and means operative in such field for levitating the receiver.

4. In apparatus for stopping aeroplanes, a receiver, means for producing a periodic magnetic field, and means operative in such field for levitating the receiver to permit it to move without friction, with means for stopping the receiver.

5. An aeroplane support, a guideway therefor, and means for producing a periodic magnetic field to levitate the support and aeroplane.

6. In combination, a guideway, a carrier adapted to move thereover and support an aeroplane, and means for producing a periodic magnetic field so as to levitate the carrier and aeroplane along the guideway.

7. Apparatus for starting or stopping aeroplanes comprising a guideway, a carrier adapted to traverse the guideway and support an aeroplane, electromagnets and opposed non-magnetic metal such as aluminum respectively on the carrier and guideway whereby the carrier is levitated when the magnets are energized by a periodic current.

8. An apparatus for starting or stopping aeroplanes comprising a guideway, a carrier adapted to move over said guideway and support an aeroplane, means for levitating the carrier while supporting the aeroplane, and means for limiting the movement of the carrier.

9. Apparatus for starting aeroplanes, comprising a guideway, a carrier adapted to traverse the guideway and support an aeroplane, electromagnets and opposed non-magnetic metal such as aluminum respectively on the carrier and guideway whereby the carrier is levitated when the magnets are energized by a periodic current, and means for arresting the movement of the carrier.

10. Apparatus for stopping aeroplanes, comprising a guideway, a carrier adapted to traverse the guideway and support an aeroplane, electromagnets and opposed non-magnetic metal such as aluminum respectively on the carrier and guideway whereby the carrier is levitated when the magnets are energized by a periodic current; with means for arresting the movement of the carrier.

11. Apparatus for starting or stopping aeroplanes, comprising a series of guideways, a carrier adapted to move over said guideways, opposed electromagnets and non-magnetic metal respectively on the guideways and the carrier, means for energizing the magnets with a periodic current whereby the carrier is caused to levitate above the guideways, and means for propelling the carrier while levitated along the guideway.

12. An apparatus for starting aeroplanes comprising a series of parallel guideways, a carrier adapted to move over said guideways, opposed electromagnets and non-magnetic metal respectively on the guideways and the carrier, means for energizing the magnets with a periodic current whereby the carrier is caused to levitate above the guideways, and means for arresting the movement of the carrier.

13. An apparatus for stopping aeroplanes, comprising a series of parallel guideways, a carrier adapted to move over said guideways, opposed electromagnets and non-magnetic metal respectively on the guideways and the carrier, means for energizing the magnets with a periodic current whereby the carrier is caused to levitate above the guideways, and means for arresting the movement of the carrier.

14. An apparatus for starting or stopping aeroplanes, comprising a series of guideways provided with electromagnets, and shoes of non-magnetic metal like aluminum above the guideways levitated when the magnets are energized by a periodic current.

15. An apparatus for starting or stopping aeroplanes, comprising a series of guideways provided with electromagnets, a carrier adapted to traverse along the guideways and provided with shoes of non-magnetic metal like aluminum above the guideways, whereby the carrier is levitated when the magnets are energized by a periodic current.

16. An apparatus for starting and stopping aeroplanes, comprising a series of...
guideways provided with electromagnets, a
carrier adapted to traverse along the guideways and provided with aluminum shoes above the guideways whereby the carrier is levitated when the magnets are energized by a periodic current, and an aeroplane receiver adapted to be mounted on the carrier.

17. An apparatus for stopping aeroplanes, comprising a series of guideways provided with electromagnets, a carrier adapted to traverse along the guideways and provided with aluminum shoes above the guideways whereby the carrier is levitated when the magnets are energized by a periodic current, an aeroplane receiver connected to the carrier, and means for arresting the movement of the carrier while levitated.

In testimony that I claim the foregoing as my own, I affix my signature in presence of two witnesses.

EMILE BACHELET.

Witnesses:

JAMES R. MANSFIELD,
L. E. WITHAM.