

(No Model.)

5 Sheets—Sheet 1

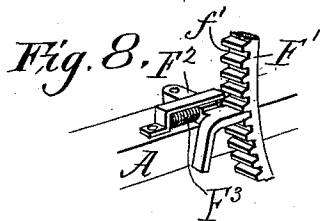
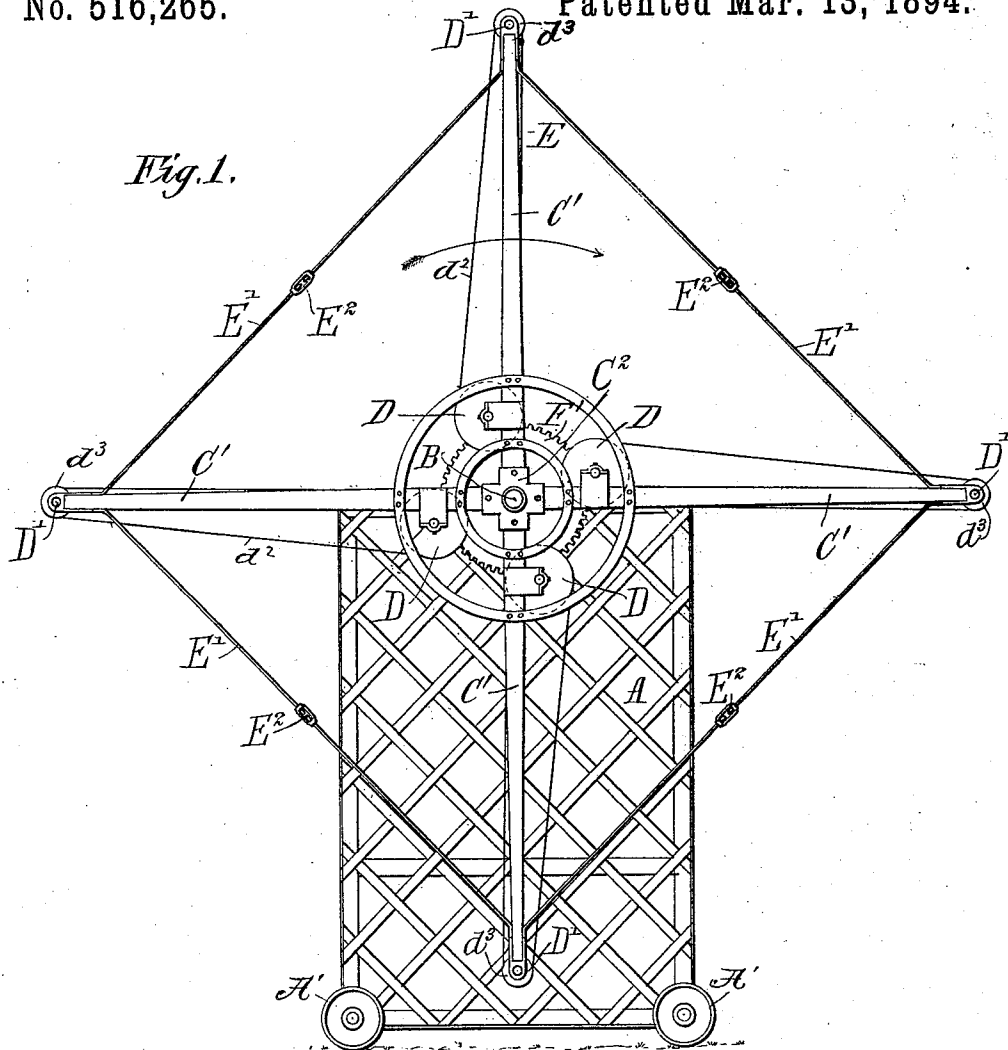
C. G. CROSS, Dec'd.

A. CROSS, Administratrix.

AERIAL LOCOMOTIVE.

No. 516,265.

Patented Mar. 13, 1894.



Witnesses:-

Samuel Kib.
Louis M. T. Whitehead.

Inventor:

Christopher G. Cross

By Dayton, Peole & Brown
Attorneys

Attorneys.

C. G. CROSS, Dec'd.

A. Cross, Administratrix.

AERIAL LOCOMOTIVE.

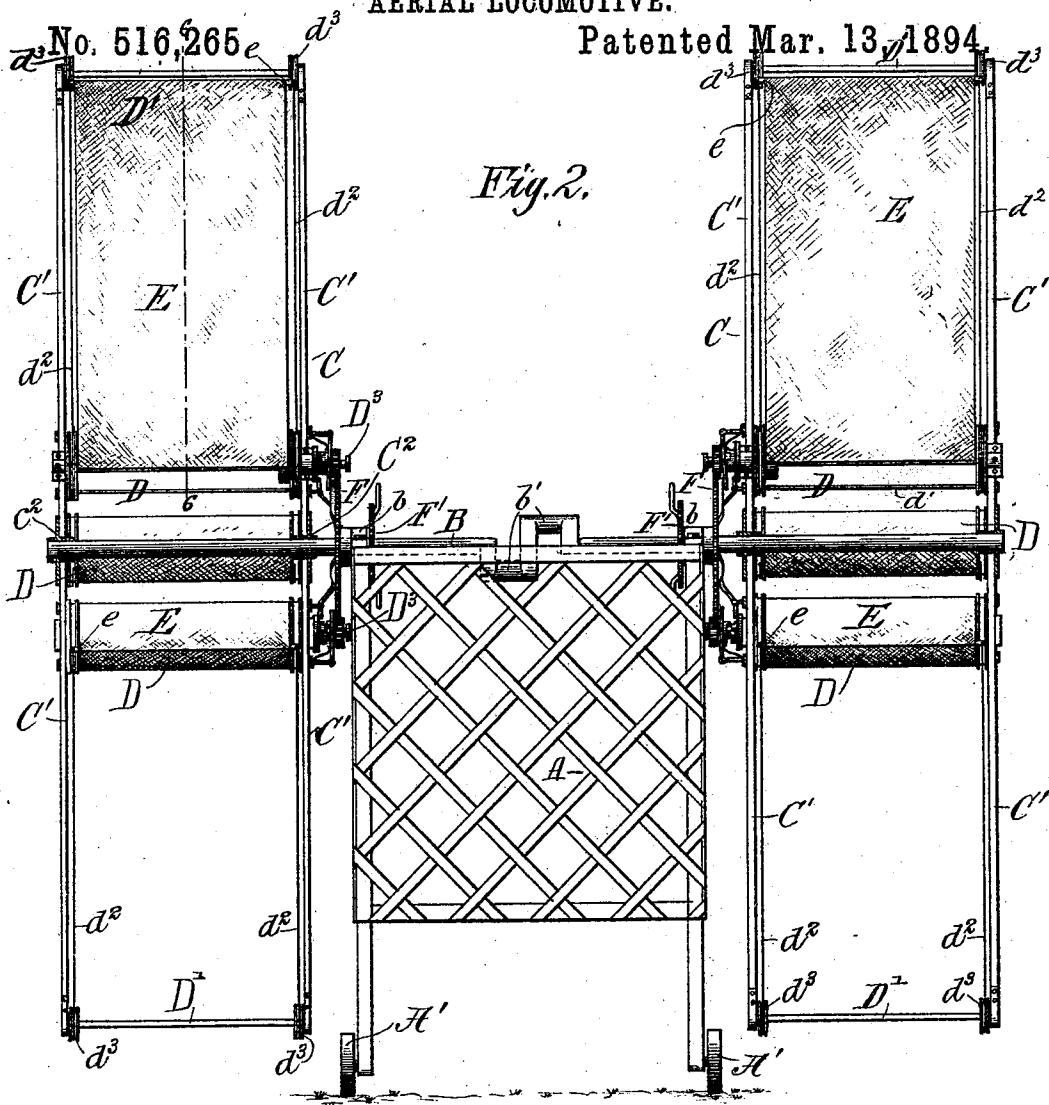
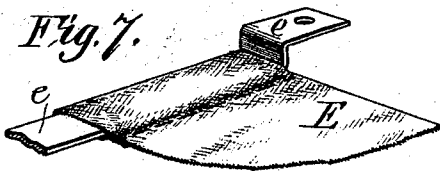


Fig. 7.



Witnesses:—

Samuel K. ...
Louis M. T. Whitehead.

Inventor:

Christopher G. Cross.

By Dayton, Poole & Brown.

Attorneys

(No Model.)

5 Sheets—Sheet 4.

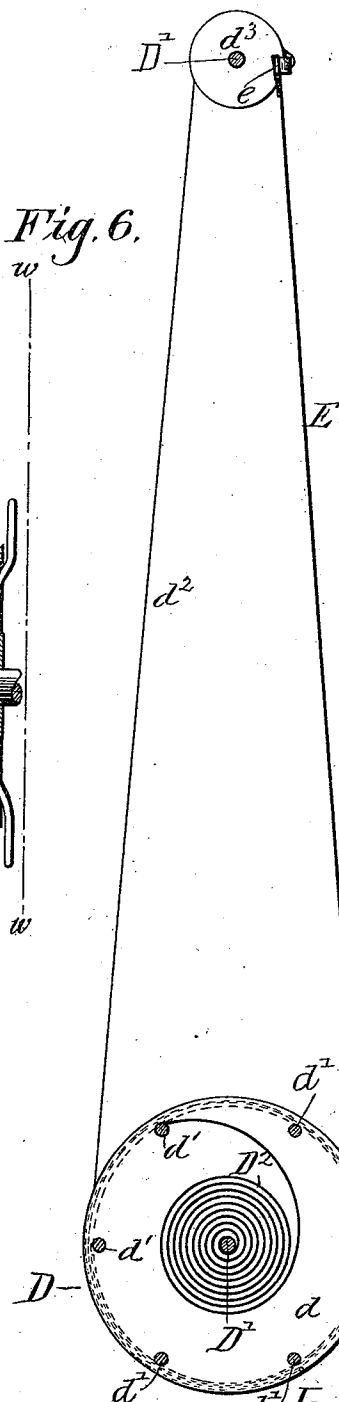
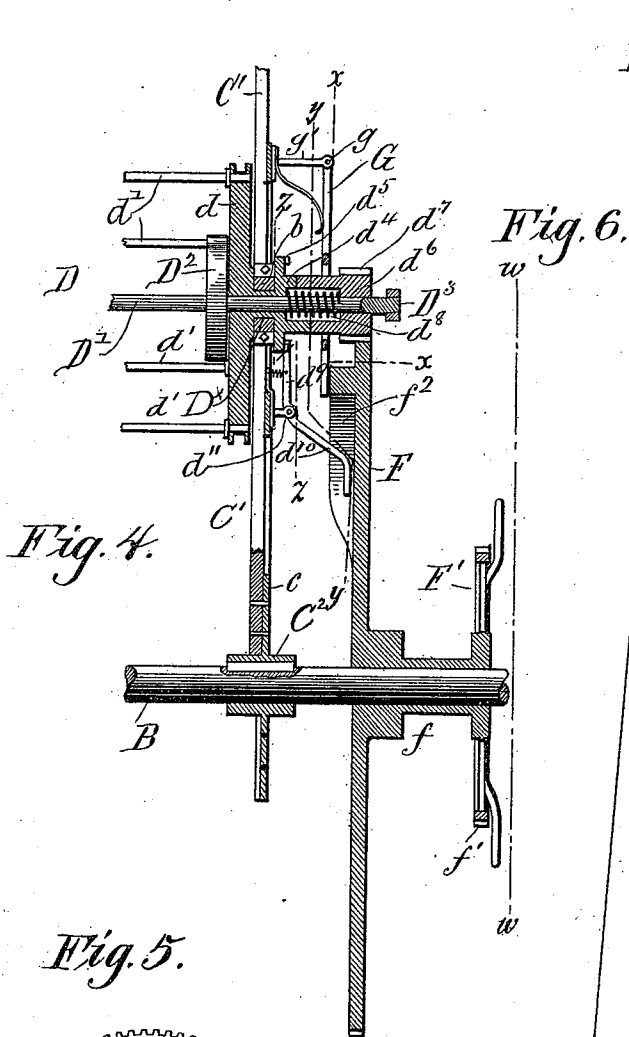
C. G. CROSS, Dec'd.

A. Cross, Administratrix.

AERIAL LOCOMOTIVE.

No. 516,265.

Patented Mar. 13, 1894.



Witnesses:—

Samuel Kid.
Louis M. F. Whitehead.

Inventor
Christopher G. Cross:

By Dayton, Pohl & Brown,
Attorneys.

(No Model.)

5 Sheets—Sheet 5.

C. G. CROSS, Dec'd.

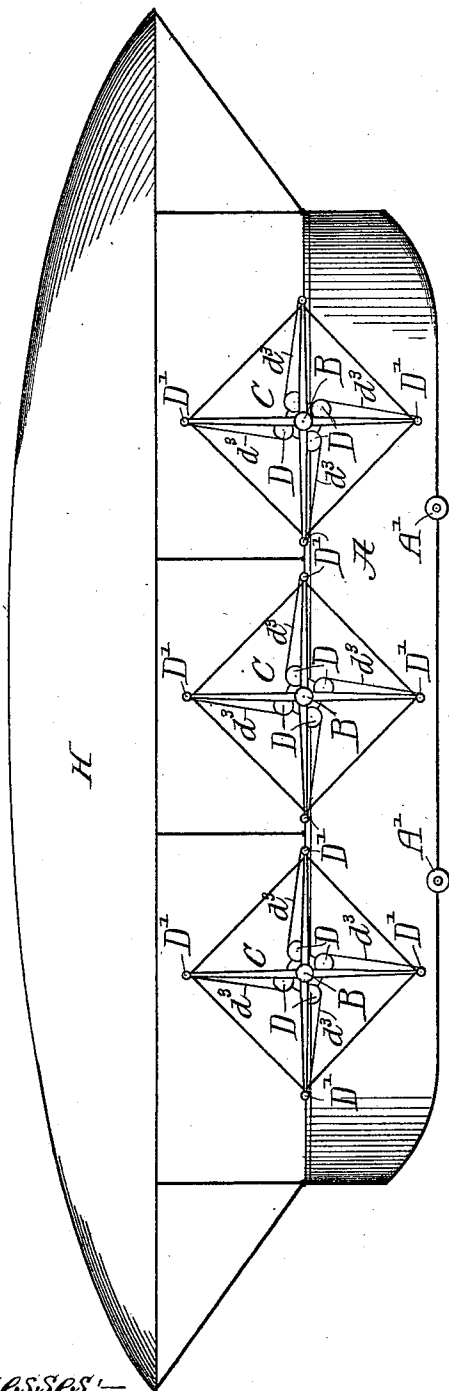
A. Cross, Administratrix.

AERIAL LOCOMOTIVE.

No. 516,265.

Patented Mar. 13, 1894.

Fig. 9.



Witnesses:—

Samuel K. K.

Louis M. F. Whitehead.

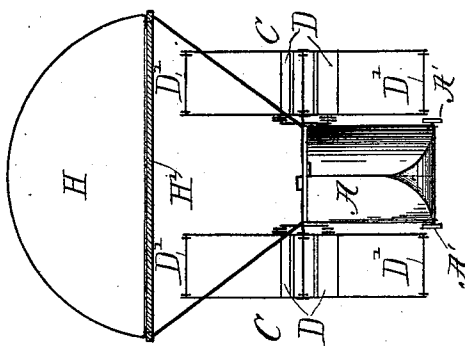


Fig. 10.

Inventor.

Christopher G. Cross.

by Dayton Poole Brown

Attorneys.

UNITED STATES PATENT OFFICE.

CHRISTOPHER G. CROSS, OF ERIE, ILLINOIS; ANN CROSS ADMINISTRATRIX
OF SAID CHRISTOPHER G. CROSS, DECEASED.

AERIAL LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 516,265, dated March 13, 1894.

Application filed October 3, 1892. Serial No. 447,653. (No model.)

To all whom it may concern:

Be it known that I, CHRISTOPHER G. CROSS, of Erie, in the county of Whiteside and State of Illinois, have invented certain new and useful Improvements in Aerial Locomotives; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention relates to mechanism for propelling aerial locomotives and for varying the direction of movement or travel of the same laterally and also upwardly and downwardly, and the objects of my invention are to produce a propelling and steering mechanism which shall operate by reaction upon the atmosphere and which shall be under the complete control of an attendant, and which shall oppose or resist the atmosphere only during the effective parts of its operative movements, but which shall offer no appreciable resistance to the atmosphere during the remainder or ineffective portion of its movement.

A still further object of my invention is to produce a buoyant attachment which shall be peculiarly adapted for application to aerial locomotives having my propelling mechanism and which shall be so formed as to operate as a parachute for modifying the rate of descent of the locomotive, and also for aiding the propelling mechanism in varying the upward and downward movements of the locomotive, as well as serving as a buoyant support for the locomotive.

To the above purposes, my invention consists in certain peculiar and novel features of construction and arrangement, as hereinafter described and claimed.

In order that my invention may be fully understood I will proceed to describe it with reference to the accompanying drawings, in which—

Figure 1 is a side elevation of an aerial locomotive provided with a propelling and steering mechanism embodying my invention; the balloon or buoyant envelope being omitted, and the propelling mechanism consisting essentially of only one pair of propelling and steering wheels. Fig. 2 is an end elevation of the same, those arms of the propelling wheels

which would project forwardly being shown as cut off close to the wheel-hubs. Fig. 3 is an inner side elevation, on an enlarged scale, of the central portion of one of the propelling and steering wheels; certain of the parts being broken away and certain other parts being in section taken on the lines $x-x$ and $y-y$ and $z-z$ of Fig. 4. Fig. 4 is an oblique radial section of the same, taken on the line 4-4 of Fig. 3. Fig. 5 is a detached view in outer side elevation, of one of the stationary gear-wheels which forms a part of the wheel-vane adjusting mechanism; showing the cams of said wheel. Fig. 6 is a radial section of one of the propelling and steering wheels, taken on the line 6-6 of Fig. 2. Fig. 7 is a detached perspective view of one end of one of the cross-bars for the extensible and retractible vanes or wings, and also of an adjacent portion of one of said vanes or wings. Fig. 8 is a detached perspective view of a portion of one of the stationary gear-wheels, its locking-latch, and the adjacent portion of the car or cab. Fig. 9 is a side elevation of an aerial locomotive having a plurality of propelling and steering wheels and also provided with a balloon-parachute constructed in accordance with my invention. Fig. 10 is an end elevation of the same; the flat surface and balloon being shown in transverse vertical section.

My invention involves in its construction and operation the following essential principle of action: the action of a revoluble vane or wing which is adapted to resist or oppose the atmosphere during certain effective portions of its movement and to operate by reaction, against the atmosphere, to propel and steer the vehicle and which is also adapted to be changed in position, so as to offer no appreciable resistance to the atmosphere during the remainder or ineffective of the movement of the wing or vane. For example, let it be supposed that a series of such vanes or wings is arranged to form radial members of a revoluble propulsion-wheel for action upon the atmosphere, and that such a wheel be mounted upon a horizontal axis so as to revolve forwardly and downwardly. An adjustment of the vanes or wings such as will cause them to oppose the atmosphere in their downward

movements will obviously, by reaction upon the atmosphere, or, in other words, by the reversal of the direction of force, due to atmospheric resistance to the vanes or wings, cause the vanes to produce ascending movement of the wheel, if the vanes are subsequently so adjusted as to offer no such opposition to the atmosphere during the upward movements of the vanes. Likewise, adjustment of the vanes in such manner as will cause them to oppose the air in their backward movements, but to not oppose the atmosphere in their forward movements, will in similar manner advance the wheel. In other words, if the vanes of the wheel be so adjusted as to oppose the atmosphere in one direction of movement and to offer no such opposition in other directions of their movement, the wheel will be moved in a direction opposite that of the opposing movement of the wheel. This being the principle of my invention, its nature will be fully understood from the ensuing description and from the accompanying drawings.

Referring now to the said drawings, A designates a car or cab, or a similar structure adapted to receive persons or goods, or both, and in which a suitable motor of any type is to be mounted. Transversely of this car or cab is mounted a power shaft B the ends of which project beyond the sides of the cab and which is journaled in suitable bearings b, shown as secured to the upper part of the sides of the cab. This shaft may be provided with one or more crank-sections b', which are to be connected to the motor, either directly or by any preferred gearing between the shaft and the motor so as, in any event, to enable the motor to impart the required rotary motions to the shaft.

Upon each outwardly projecting end of the shaft B are keyed, or otherwise secured, two hubs C², which are provided with radial flanges or arms c. These outwardly projecting ends of the shaft B carry also the two propelling and steering wheels C, one at each end of the shaft, and each of these wheels is provided with four, or any other suitable number of wing or vane carriers, each of which is composed of two parallel radial arms C' of wood or other suitably light and strong material; these arms being preferably connected together by tie-rods E' and turn-buckles E², the inner ends of these arms C' being bolted, riveted or otherwise secured to the arms or flanges c.

Between the inner ends of each pair of arms C' is mounted a revoluble drum D, which is preferably of skeleton construction, for purposes of lightness, and as shown, each of these drums is composed of two end-disks d, which are connected together by a number of tie-bars or cross-rods d'; the disks being also grooved peripherally so as to serve as pulleys for the cords or ropes d².

Between the outer ends of each pair of arms C' is mounted a transverse shaft D', on which are mounted two peripherally grooved pulleys

d³, each of which is located adjacent to one of the arms C' and over each of which is trained or led one of the two ropes or cords d², the inner ends of which are secured to one of the cross-rods d'.

E designates a number of flexible wings or vanes of canvas, or other suitably light, strong and at the same time flexible material, each of these wings or vanes being of such width as to extend from one disk or pulley d of each skeleton drum D to the opposite pulley d thereof. One end of each wing or vane E is secured to one of the cross-rods d' of the corresponding skeleton drum D, while the other end of said wing or vane is secured to a cross-bar e; the wing or vane E being approximately equal in length to the length of the space inclosed between each of the arms C'. Each of the cross-bars e is shown as projecting at its ends beyond the side-edges of the wing or vane E and into the planes of the grooved pulleys, and to each of said cross-bars is connected the outer end of the corresponding wing or vane E; the outer ends of the ropes d² being secured to the ends of the cross-bars e and the said ropes being of such length as to permit the vanes or wings E to be retracted inwardly by being wound upon the drums D. When the vanes E are being thus retracted, the ropes d² will unwind from the grooved disks d, while when the disks d are rotated in the opposite direction the ropes d² will be wound upon said disks and thus extend the vane or wing E from the drum D to the outer ends of the arms C'. As a means for automatically so retracting the vanes or wings E, a spiral spring D² is provided, the inner end of this spring being secured to the non-revoluble shaft D' of the drum and the opposite or outer end of the spring being secured to one of the tie-rods d' of the drum. Two such springs may be employed if desired, each spring being placed adjacent to the inner side of one of the pulley-disks d, or, for the general purposes of my invention, any other suitable means may be employed for retracting or winding the vanes or wings E upon the drums D.

For the purpose of extending the vanes or wings E and retaining them temporarily so extended, against the retractive force of the springs D², the following mechanism is employed: The inner end disk d of each drum D is provided with an inwardly extended hub D^x, which surrounds the non-revoluble shaft D' and which is provided at its inner end with a clutch section d⁴ and also with a ratchet wheel d⁵. The clutch-section d⁴ is engaged by a second clutch-section d⁶, this clutch-section d⁶ being adapted to slide longitudinally upon the shaft D' and being also provided with peripheral gear-teeth d⁷. A spiral spring d⁸ is shown as interposed between the clutch sections d⁴ and d⁶, this spring surrounding the inner end of the shaft D' and operating to force the clutch-sections apart. A gear-wheel F is mounted loosely upon the shaft B and is

designed to be rotated thereon by hand to any extent desired and to be voluntarily set or held stationary after being so rotated. As a means for so rotating the gear-wheel F, it is shown as provided with a hand-wheel F', which is carried by the inner end of the hub f of the gear-wheel, and which is provided with peripheral gear-teeth f' and as a means for setting this gear-wheel and locking it, against further rotation, a pivoted dog or latch F² (see Fig. 8) is provided. This latch or dog F² is shown as pivoted upon an adjacent part of the frame of the cab and as retained normally in engagement with the peripheral teeth of the hand-wheel F' by a spiral spring F³. When the gear-wheels F' are thus locked they obviously impart continuous rotation to the clutch-sections d⁶, owing to the revolution of the arms of the propelling wheels, and the clutch-sections d⁶ consequently, when engaged with the clutch-sections d⁴, correspondingly rotate with the latter and also rotate the drums D. Hence, the vanes or wings E will be automatically extended or drawn out, by reason of the winding of the ropes d² upon the drum-disks d, whenever the clutch-sections d⁴ and d⁶ are engaged with each other. As a means for automatically effecting this engagement of the clutch-sections d⁴ and d⁶, the following attachments are provided: On the outer side of each gear-wheel F is placed a segmental cam-flange f², concentric with the center of the gear-wheel. This cam-flange f² is engaged at times by one end of a yoked shipper-lever G, which is pivoted at g to an arm g', carried by the corresponding arm C' of the propelling wheel; an intermediate portion of this yoked lever embracing the corresponding clutch section d⁶ and a suitable spring serving to insure contact of the lever G with the cam-flange f². Thus, when the lever G strikes the cam-flange f² said lever is thrown so as to move the clutch section d⁶ into engagement with the clutch-section d⁴, and the corresponding vane or wing E is instantly extended. When the wing or vane has been thus fully extended, the free end of the shipper lever G runs off the cam-flange f² and the clutch section d⁶ is automatically disengaged from the clutch-section d⁴, and consequently the extension of the vane or wing E ceases. In order to retain the vanes or wings extended throughout the entire length of their effective movements, the ratchet-wheel d⁵ is engaged at times by a spring-pawl d⁹. This spring pawl is pivoted upon the adjacent arm C' of the wheel, as at d¹¹, and is provided with an inwardly projecting extension arm d¹⁰. The free end of this extension-arm projects in such manner as to engage, at times, a second cam or lug f³ on the outer side of the gear-wheel F; the cam f³ being so located as to be engaged by the free end of the extension d¹⁰ at the instant when the vane or wing E has reached the limit of its effective movement. Thus as soon as the wing or vane E has reached the limit of its effective movement,

the spring or springs D² instantly retract said vane by winding it upon the drum D. As here shown, the cams f³ are placed about ninety degrees from the cam-flanges f², so that the vanes or wings E, after being extended, will remain extended through one-fourth of a complete revolution of the wheels C, but it is obvious that the cams f³ may be otherwise placed relative to the cam-flanges f² without departing from the essential spirit of my invention.

It will be seen from the above description that, by rotative adjustment of the gear-wheels F on their axes, the wings or vanes E of the several arms of the propelling wheels may be extended for effective action throughout any portion of the revolution of the propelling wheels, and that consequently said wings or vanes can be readily caused to operate either to propel the car forward or backward, or upward or downward, as desired. Also that the wheel at one side of the car may have its vanes so adjusted as to propel forwardly while the wheel at the opposite side of the car has its vanes so adjusted as to propel backwardly, (the wheels revolving in the same direction,) for veering the course of the car laterally. Thus the fullest possible control of the locomotive is attained.

While I have shown and described the propelling wheels as provided with vanes which are rendered resistant and non-resistant to the atmosphere by extension and retraction respectively, I desire it to be particularly understood that I contemplate various other ways of effecting this resistance and non-resistance of the vanes. For example, I may employ wings or vanes which are, like blades, always extended but provided with means for turning the vanes edgewise to the direction of movement of the wheels when the vanes are to be non-resistant and for turning said blades flatwise to the direction of movement of the wheels when the vanes are to be resistant to the atmosphere.

The car or cab A is shown as provided with carrying-wheels A', mounted at the base of the car or cab and serving to carry the apparatus when it is being moved on the ground either continuously or preparatory to making an ascent. I have also shown the buoyant envelope H as provided with a flat under surface H', which is made of any light and at the same time rigid material. This flat surface H' is located directly above the car or cab A so as to extend parallel therewith and is connected to the car or cab by suitable ropes or cords, approximately as shown. Immediately above this flat surface H' is located a balloon or inflatable envelope H, for containing a buoyant gas. This balloon or envelope H is either in the form of a continuous inclosing envelope which is secured in suitable manner to the upper side of the flat surface H', or the said flat surface H' may form the bottom of the balloon or inclosing envelope, as preferred. In either event, the

flat surface H' aids in elevating the apparatus, because if, for example, the vanes of the forward propelling wheels C are so adjusted as to raise the front portion of the apparatus while the vanes of the rear wheels C are so adjusted as to propel the apparatus forward, or downward, the flat surface H' will also be inclined upwardly and forwardly. Thus the atmosphere will impinge against the under side of the flat surface H' and will elevate the apparatus. The flat surface H' also serves, as a parachute, to check or moderate too rapid descent of the apparatus, because in the event of such descent, the atmosphere will be confined or condensed beneath the flat surface H' and thus check or retard the descent of the apparatus.

The apparatus shown in Figs. 9 and 10 of the drawings does not differ essentially from that shown in the preceding figures thereof, the only difference being that the car or cab A is shown in Figs. 9 and 10 as elongated and as provided with a number of pairs of propelling and steering wheels C, instead of being shorter and having only a single pair of such wheels C, as in the preceding figures.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. In a mechanism for propulsion by reaction upon the atmosphere, a revoluble and longitudinally and radially extensible and retractible wing for resistance and non-resistance to the atmosphere, and means by which the wing may be given its extended position in a desired part or arc of its revolution.

2. In a locomotive apparatus operating by reaction upon the atmosphere, a cab, carriage or vessel having on each of its opposite sides revoluble wheels, each of which is provided with a plurality of wings which are separately extensible and retractible for resistance and non-resistance to the atmosphere, and means combined with the wheel or wheels at each side of the machine adapted to successively extend and retract the several wings of said wheel or wheels, said means being adjustable whereby the position of the arc of such extension may be changed.

3. In a mechanism having revoluble arms for propulsion by reaction upon the atmosphere, the combination with said arms of a winding drum, a flexible wing-sheet attached to said drum, means for unwinding and extending said sheet lengthwise of the arms for rendering the sheet resistant to the atmosphere, and means for rotating the drum in the opposite direction for the purpose of winding in and retracting said sheet, for rendering it non-resistant to the atmosphere.

4. In combination with revoluble arms of mechanism for propulsion by reaction upon the atmosphere, a winding drum, a flexible wing-sheet attached to said drum, one or more springs arranged to rotate the drum to wind in or retract the sheet, a cord or cords attached to the free end of the sheet for its ex-

tension, and means for winding and letting off said cord.

5. In combination with a revoluble propulsion wheel provided with arms arranged in pairs, a rotatable drum on the wheel near its axis, a clutch pinion adapted to engage the drum, a stationary spur engaged with said pinion, a wing-sheet which winds upon the drum, cords attached to the free end of said sheet and to the drum, pulleys at the outer ends of the wheel arms over which said cords are trained, an adjustable cam adapted to throw the clutch pinion into temporary engagement with the drum for the forward rotation of the latter, means for temporarily holding the drum from backward rotation after disengagement of the clutch pinion, and a spring or springs arranged to give backward rotation of the drum.

6. In combination with a revoluble, armed propulsion wheel, wing-sheets on said wheel and mechanism for extending and retracting said sheets embracing a winding drum adapted to rotate in opposite directions, a clutch pinion adapted to engage with said drum, a rotatively adjustable gear-wheel mounted on the axis of the revoluble propulsion wheel, a cam on said gear-wheel adapted to throw the clutch pinion into temporary engagement with the drum and means for locking the spur at any desired point in its possible rotation.

7. In combination with a revoluble, armed wheel carrying rotatable winding drums and extensible and retractible wing-sheets, clutch pinions adapted to engage said drums, a rotatively adjustable gear-wheel engaged with the clutch pinions, a cam on the gear-wheel for throwing the clutch pinions into engagement with the drums, a ratchet wheel attached to each drum, a spring pawl engaged with said ratchet wheel and a cam on the gear-wheel arranged to release the pawls from the ratchets.

8. In a mechanism for propulsion by reaction upon the atmosphere, a revoluble wheel having a plurality of wings separately extensible longitudinally, to enable them to be rendered resistant or non-resistant to the atmosphere, and means constructed to successively throw said wings longitudinally into and out of action, comprising a non-rotating wheel applied to control the times at which the wings are resistant or non-resistant, said wheel being adjustable on its central axis to enable the arc in which the wings are in action to be changed, substantially as described.

9. In a mechanism for propulsion by reaction upon the atmosphere, a revoluble wheel having a plurality of wings separately extensible longitudinally, to render them resistant and non-resistant, and means constructed to throw said wings into and out of action, comprising a non-rotating wheel provided with gear teeth for actuating the wings and with means for controlling the times at which the wings are resistant or non-resistant, said wheel being adjustable on its cen-

tral axis to enable the arc in which the wings are in action to be changed, substantially as described.

10. In a mechanism for propulsion by reaction upon the atmosphere, a revoluble wheel having a plurality of wings separately movable to enable them to be rendered resistant or non-resistant to the atmosphere, and means for successively throwing said wings into and out of action, comprising a plurality of gear-pinions, clutch devices for connecting the gear-pinions with the said wings, a non-rotating wheel provided with gear-teeth intermeshing with the said pinions, and provided with means acting on said clutch-devices for actuating the same in the turning of the main wheel, said non-rotating wheel being adjustable on its axis to change the position of the arc in which the wings are in action, substantially as described.

11. In a mechanism for propulsion by reaction upon the atmosphere, a revoluble wheel

having a plurality of wings separately movable to enable them to be rendered resistant or non-resistant to the atmosphere, and means for successively throwing said wings into and out of action, comprising a plurality of gear-pinions, clutch devices for connecting the gear pinions with said wings, a non-rotating wheel provided with gear-teeth intermeshing with said pinions, and with cam-surfaces for actuating the said clutch devices, said non-rotating wheel being adjustable on its axis to change the position of the arc in which the wings are in action, substantially as described.

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

CHRISTOPHER G. CROSS.

Witnesses:

TAYLOR E. BROWN,
G. A. STEPHENS.