(No Model.) 3 Sheets—Sheet 1.

E. F. FALCONNET.

VESSEL FOR AERIAL NAVIGATION.

No. 311,887. Patented Feb. 10, 1885.

Fig. 1.

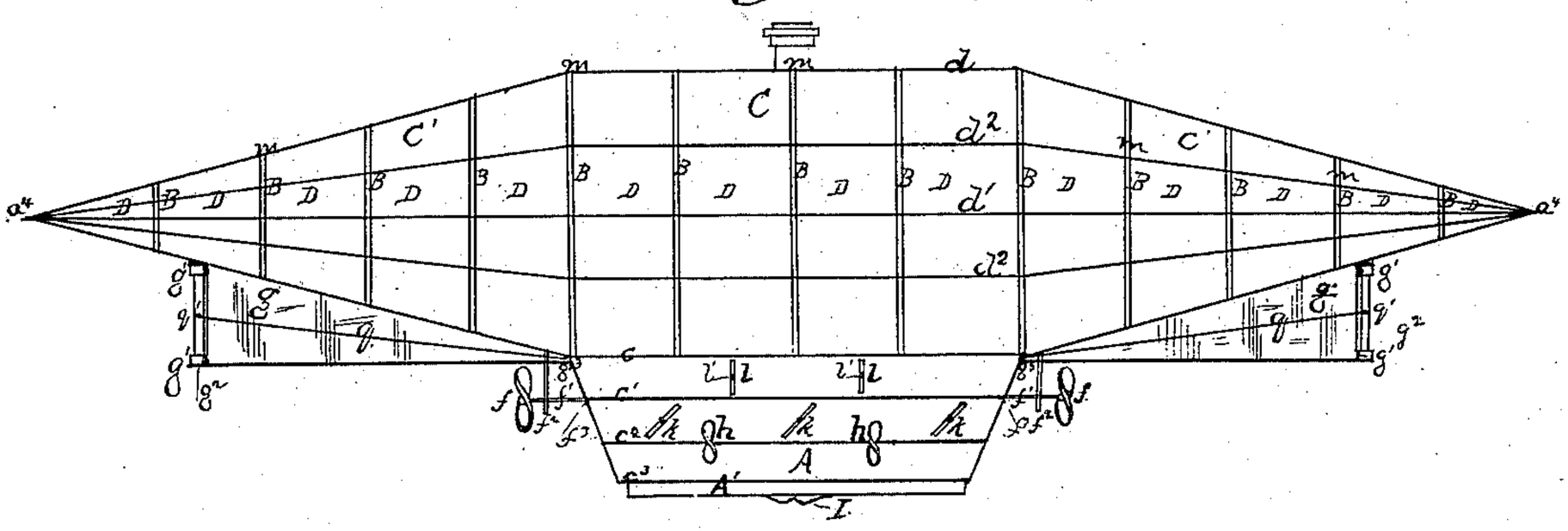


Fig. 2.

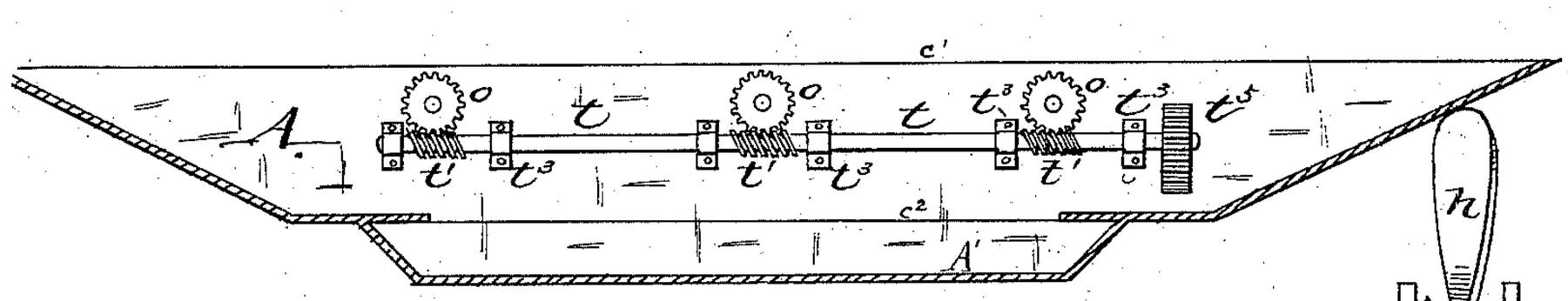


Fig. 3.

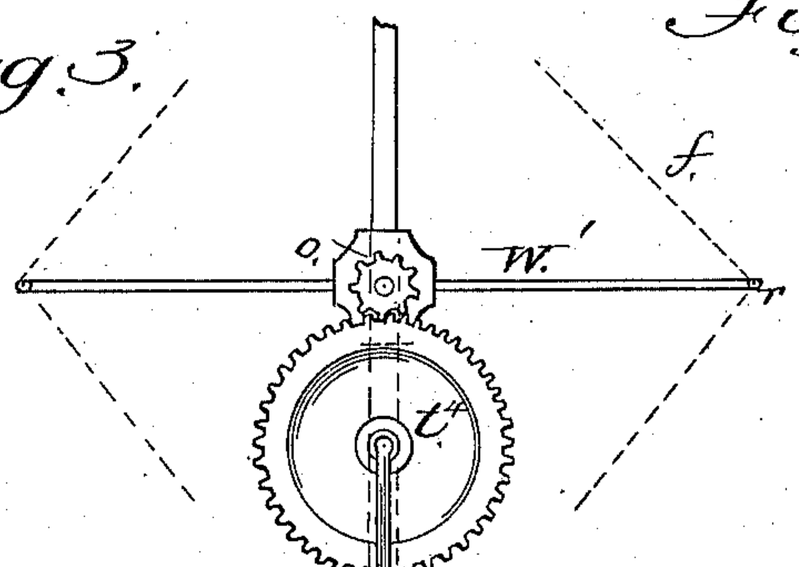


Fig. 20.

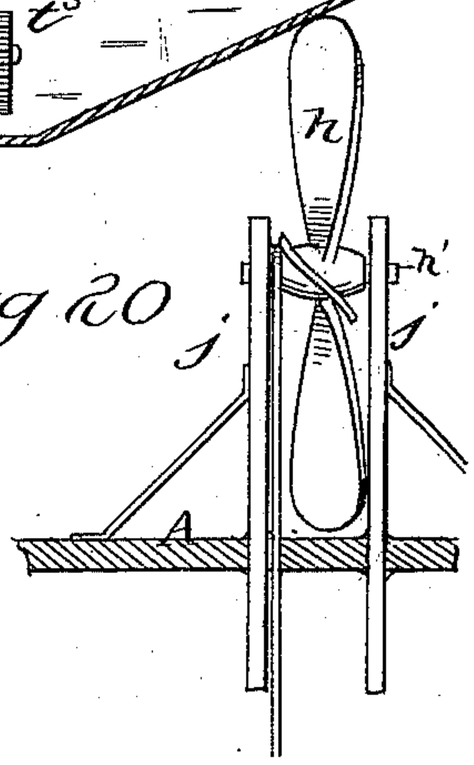
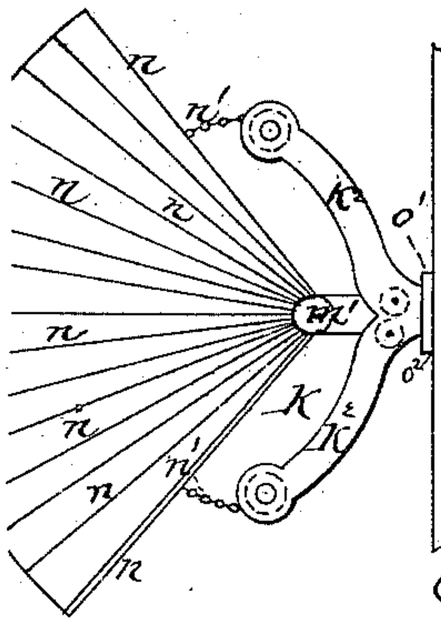


Fig. 11.



Attest;
Walter Fowler
Henry Glassie.

Inventor;
Eugene F. Falconnet
By D. Y. Glassie
his attorney

(No Model.) 3 Sheets—Sheet 2.

E. F. FALCONNET.

VESSEL FOR AERIAL NAVIGATION.

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Fig. 16.

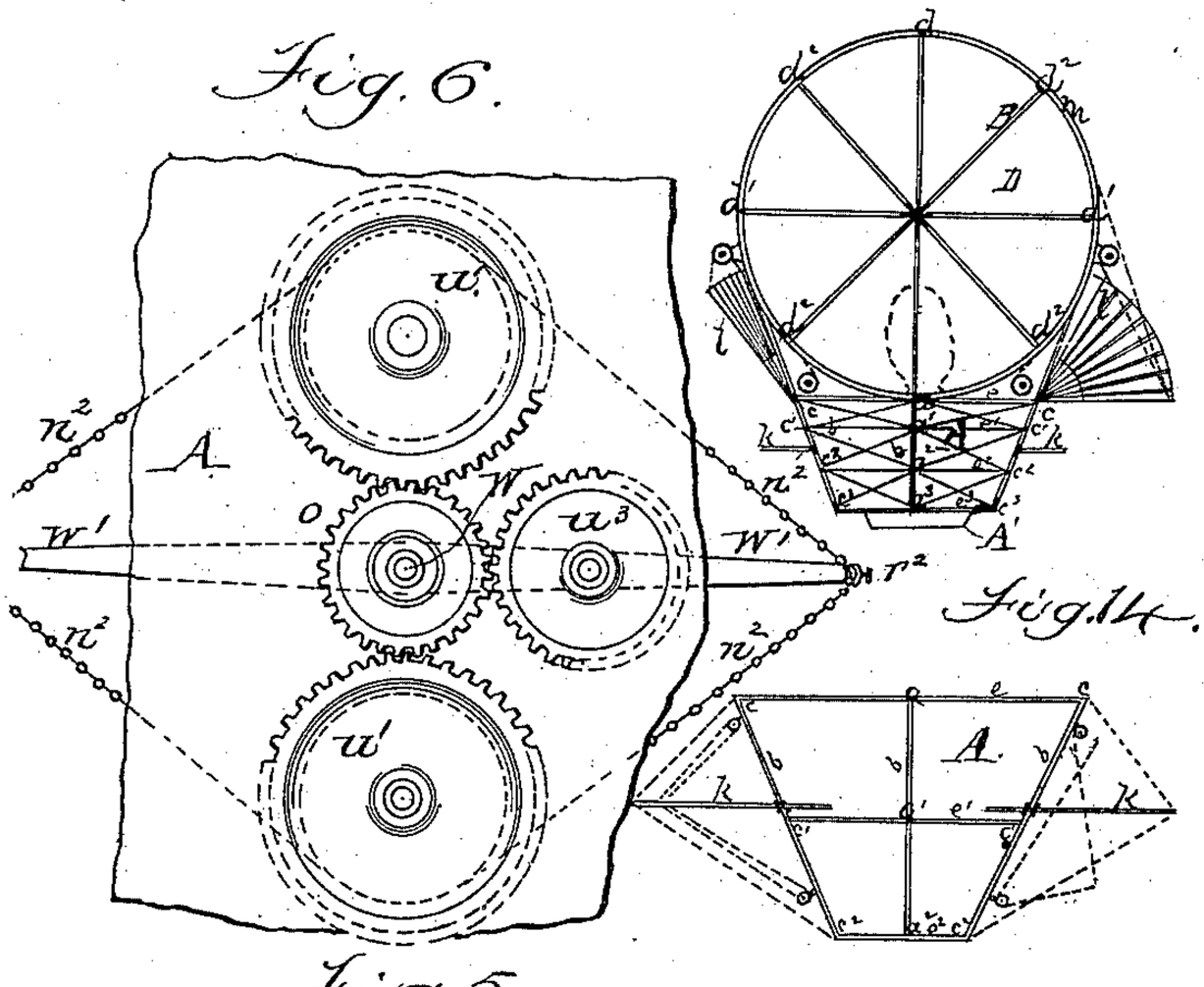


Fig. 6.

Fig. 14.

Fig. 8.

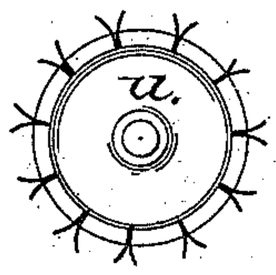


Fig. 7.

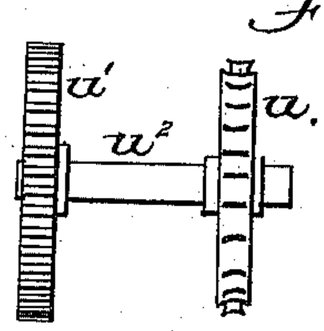


Fig. 5.

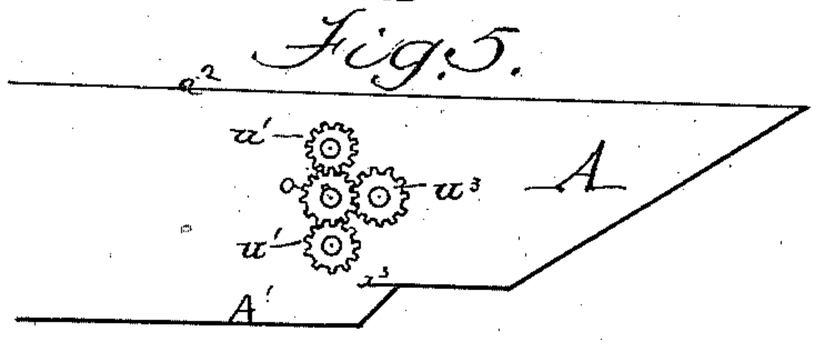
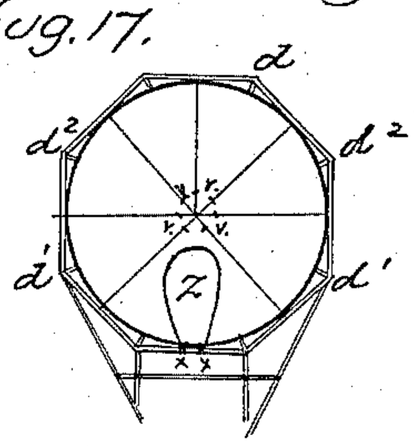


Fig. 12.

Fig. 17.



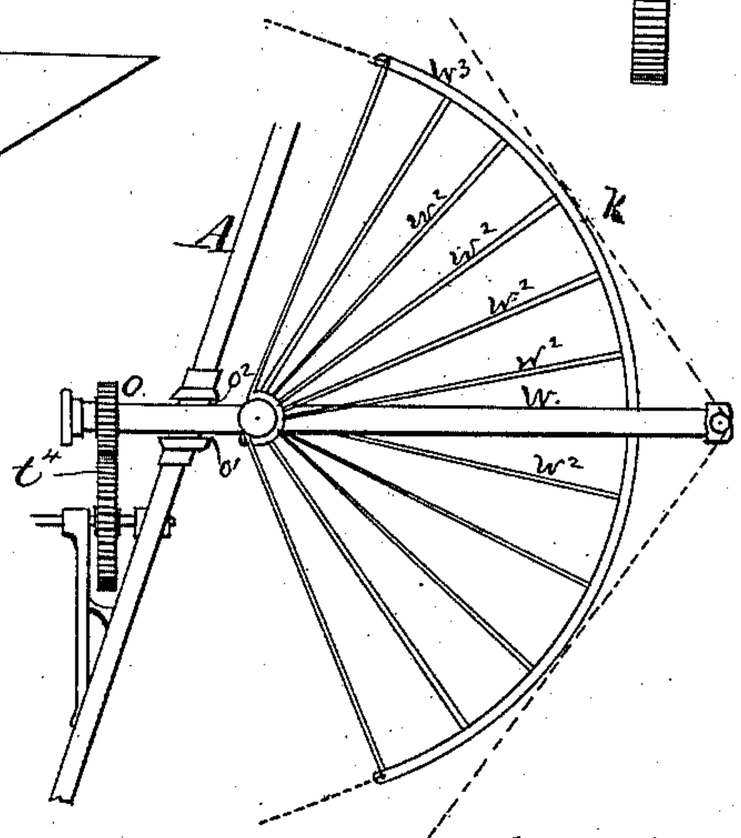
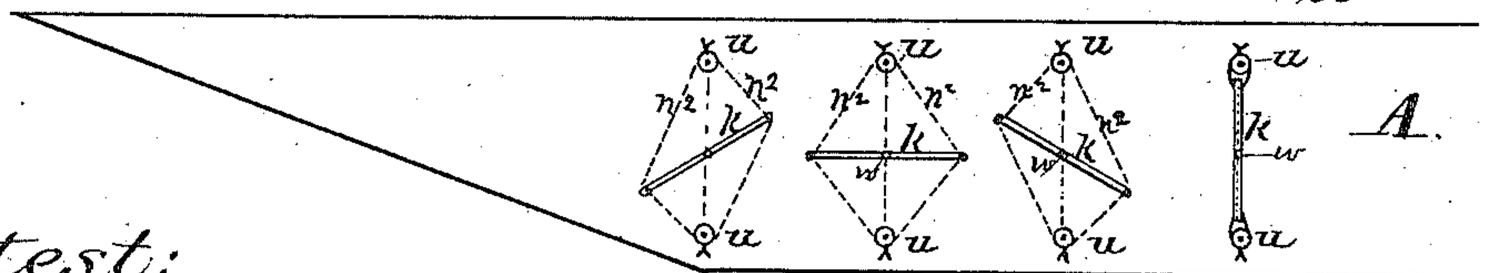


Fig. 4.



Attest;

T. Walter Fowler.

Henry Glassie

Inventor;

Eugene F. Falconnet

By Henry Glassie

his Attorney.

(No Model.)

3 Sheets—Sheet 3.

E. F. FALCONNET.

VESSEL FOR AERIAL NAVIGATION.

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Fig. 9.

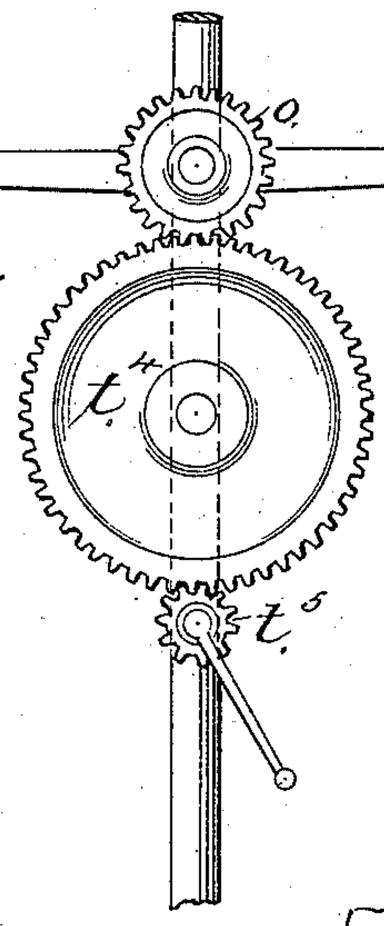


Fig. 13.

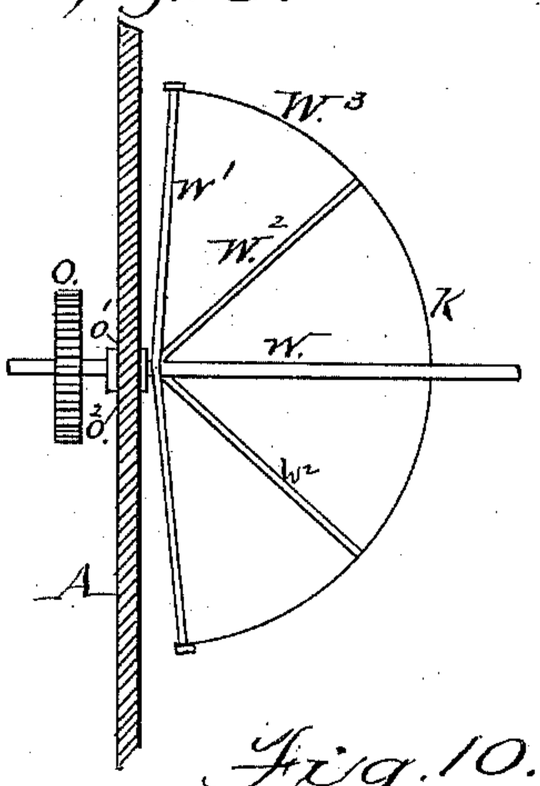


Fig. 18.

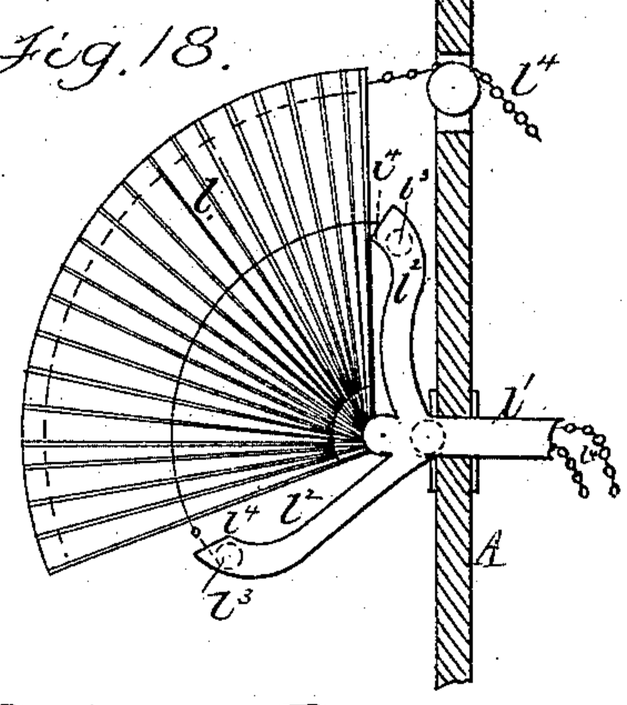


Fig. 10.

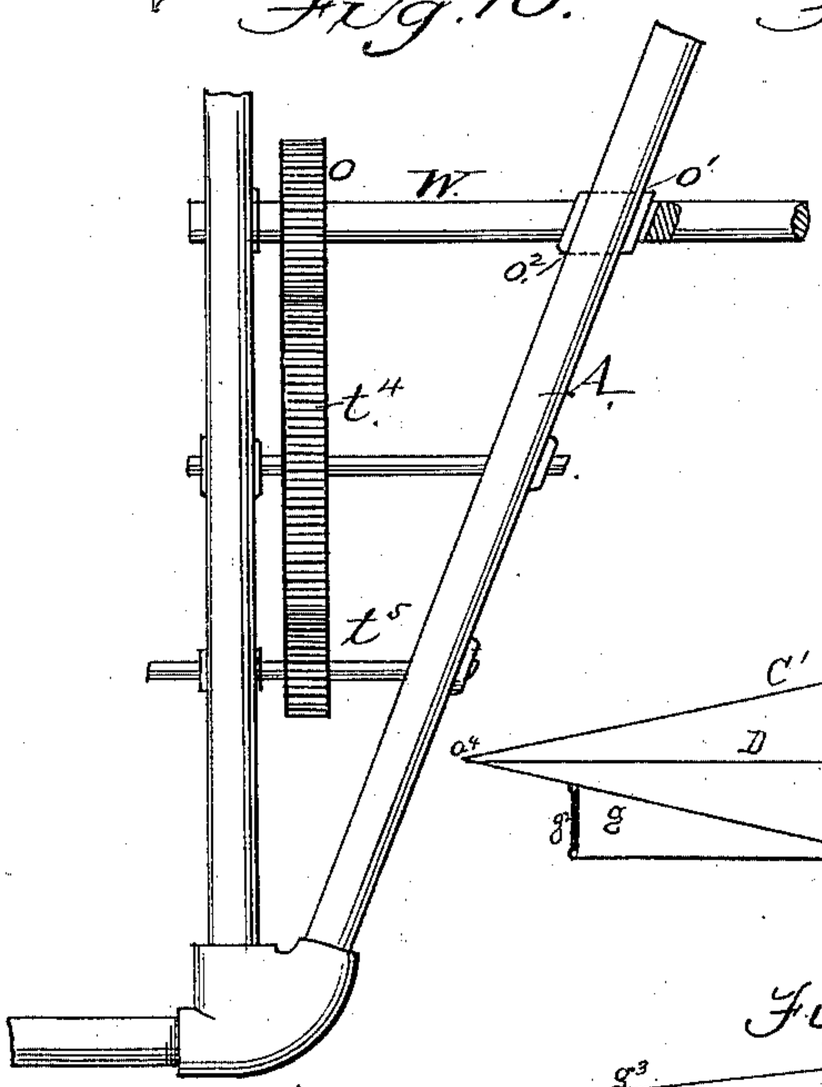


Fig. 17.

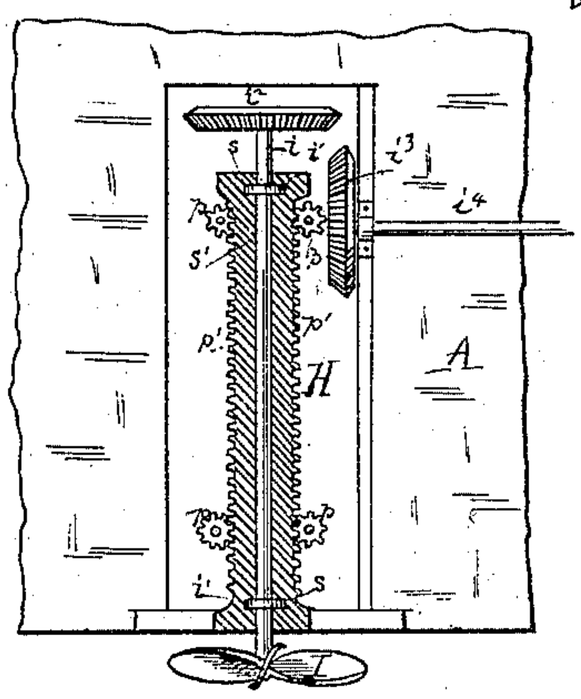


Fig. 15. C

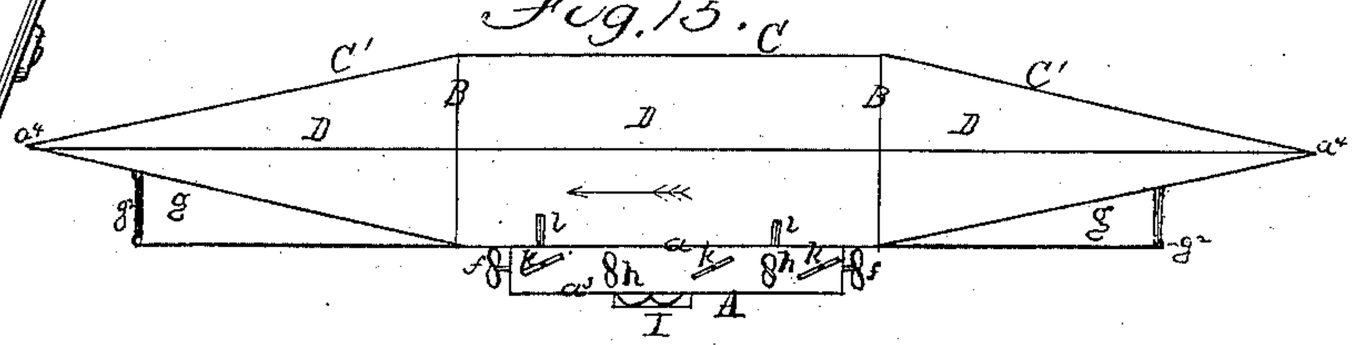
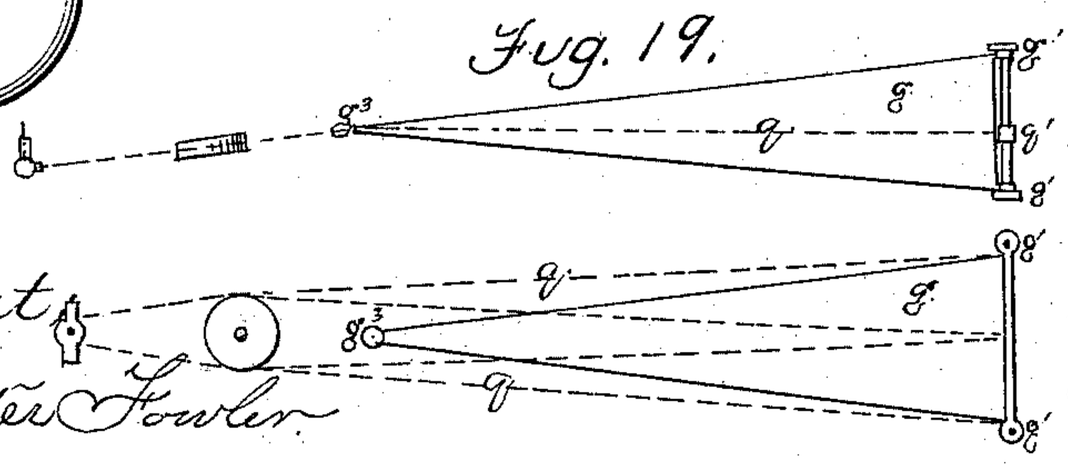


Fig. 19.



Attest,

T. Walter Fowler

Henry Glasse

Inventor;

Eugene F. Falconnet

By [illegible] Glasse

his Attorney

UNITED STATES PATENT OFFICE.

EUGENE F. FALCONNET, OF NASHVILLE, TENNESSEE.

VESSEL FOR AERIAL NAVIGATION.

SPECIFICATION forming part of Letters Patent No. 311,887, dated February 10, 1885.

Application filed November 8, 1883. (No model.)

To all whom it may concern:

Be it known that I, EUGENE F. FALCONNET, a citizen of the United States, residing at Nashville, in the county of Davidson and State of Tennessee, have invented certain new and useful Improvements in Vessels for Aerial Navigation, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to certain new and useful improvements in handling and steering that class of vessels for aerial navigation that are designed to be propelled, steered, and handled by propulsive machinery arranged within the vessel through externally-adjusted appliances; and it consists in adjusting in and protruding through from the sides of the hull, on both sides, opposite to each other, adjustable side fins for deflecting the course and steering aerial vessels vertically while in flight; also, in providing machinery for handling and changing the position of such fins, either separately, in groups of two or more, or of the whole simultaneously; also, in the manner of connecting such side fins to machinery arranged within the vessel through revolving cylindrical axles passing inward from without through the sides of the hull.

It also consists in the method of deflecting the course of and steering aerial vessels vertically while in flight by the aid of side fins secured on the outside and adjusted and handled by machinery arranged within the vessel: also, in the method of handling and using such side fins, and in the mode of constructing side fins for deflecting the vertical course of aerial vessels.

It further consists in the method of changing the vertical and lateral course of aerial vessels while in flight, by the combined employment of side-protruding adjustable fins, side-protruding adjustable lateral steering-fan, long fin-shaped adjustable rudder-blades, and adjustable end screws.

It also consists in the construction, arrangement, and combination of a train of machinery within the hull for handling and adjusting the fins arranged on the sides of aerial vessels.

Figure 1 is the side elevation of a complete aerial ship, showing the hull with cabin projecting below and bulk-heads rising above the same, the intersected gas-field, longitudinal and diagonal supporting-cords, the side and end screws, the fin-shaped rudder-blades and supporting-frame, central raising and lowering screw, side-adjusted fans and side-adjusted fins for deflecting the vertical course of the vessel. Fig. 2 is a vertical longitudinal section of one deck of the hull of the vessel, and the cabin protruding below, showing a train of one form of machinery for simultaneously adjusting the series of fins on one side of the vessel. Fig. 3 is an elevation of another form of gear-connection for handling the side fins. Fig. 4 is an elevation of the external side of the vessel's hull, showing a vertical deflecting-fin set at various angles, the axle-shaft by which it is supported, the endless chain by which it is handled, and a rag-wheel for carrying the chain. Fig. 5 is an interior elevation of a fragment of one deck of the vessel's hull, showing another arrangement of the gear-connection for adjusting and handling the side fins. Fig. 6 is an elevation of the same train of machinery enlarged. Fig. 7 is an elevation of one set of gearing-wheels and shaft for adjusting the side fins. Fig. 8 is a plan of a rag-wheel which carries the chain for handling the side fins. Fig. 9 is an interior elevation of another form of connecting-gear for handling side fins. Fig. 10 is a vertical cross-section of a fragment of the hull of the vessel, showing the same machinery. Fig. 11 is a side elevation of a side fin, constructed to open and close like a fan, and secured to a revolving cylindrical shaft having branching arms, or a yoke protruding from the side of the hull, showing the cable or chain by which it is opened and closed, and the gear-wheel by which it is revolved on its axis. Fig. 12 is a side elevation of another style of fin, constructed to open and close like a fan, mounted on the side of the hull, showing the connecting-gear by which it is revolved on its axis. Fig. 13 is a side elevation of a rigid fin properly mounted on the side of the vessel, showing the internal connecting-gear by which it is adjusted in position. Fig. 14 is the cross-section of a vessel's hull, showing the antipode fins mounted in position, one set vertically and the other horizontally. Fig. 15 is a side elevation of an aerial vessel, showing the side fans for carrying

the vessel downward. Fig. 16 is a vertical section of an aerial ship, showing the side fins set horizontally and the side fans in place, one closed and the other open, for throwing the vessel around in that direction. Fig. 17 is a vertical elevation of the raising and lowering central screw. Fig. 18 is a cross-section of a fragment of the vessel's hull, showing a side elevation of an adjustable side fan. Fig. 19 is the fin-shaped rudder-blades, with the supporting frame and cables by which they are handled. Fig. 20 is a set of projecting beams and a side screw for propelling the vessel longitudinally.

Similar letters of reference indicate corresponding parts.

A is the hull of the vessel, constructed on a general frame of metal consisting of longitudinal central chords, *a a' a² a³*, longitudinal gunwale-chords *c c' c² c³*, as well as thwarts and other longitudinal chords, (not shown,) cross-girders *e e' e² e³*, uprights, stanchions or posts *b b*, and diagonal and other braces and supports, all by central intermediate elbows, sleeve, and terminal angle-blocks secured at their several intersections into one substantial firm frame.

A' is a cabin constructed partly within and protruding part of its depth below the hull A, on a light substantial frame like that of the hull, the stanchion or post from which may be carried down into and be made to form a part of the cabin's frame. The frame of the cabin A' and hull A are so intimately united that the two might be called one frame.

The hull A is divided by horizontal partitions, decks, or floors *e e' e² e³* into compartments, and by vertical partitions into rooms, and is provided with machinery and motor power for impelling the driving-screws *h*, the end screws, *f*, and handling the steering-rudders *g*, the side fans, *l*, and side fins, *k*, and for other purposes, and with other conveniences and necessaries for such vessels. The cabin A' is also divided into compartments by suitable partitions, and is provided with doors, windows, and other means of ventilation, as well as the appliances and conveniences usual in cabins. Entering in through the bottom of the cabin is a well in which is arranged a carriage, H, for carrying a central screw, I, and the machinery for handling the carriage H and impelling the central screw, I. Protruding from the sides of the hull at intervals fore and aft are wheel houses or beams *j*, arranged in pairs, for supporting, and in which the side propelling-screws, *h*, are mounted; also the adjustable fans *l* and the side fins, *k*, and in the ends of the hull are shifting ways in which the end screws, *f*, are mounted and by which their position may be changed. Secured to and forming part of the upper longitudinal chords, *a* and *c*, of the hull, which extend fore and aft to the nodes a^4 at intervals from stem to stern, is a series of bulk-heads, B, that rise to the height of the gas-field, furnishing by their varying diameters the radical points for giving the outline shape to the vessel—that is to say, a central cylindrical body, C, terminating fore and aft in long cylindrical cones C' made sharp at the ends. The bulk-heads B are constructed, preferably, of metal tubing within an octagonal, hexagonal, circular, or other formed periphery, *m*, which serves as a strengthening-rib, and comprises vertical, lateral, and diagonal chords, girders, or posts and braces, all secured at their several intersections by central, intermediate, elbow, sleeve, and terminal angle-blocks, and if necessary, a cable may be introduced within the tubing to bind together and strengthen the whole. The bulk-heads B are stayed longitudinally by longitudinal chords *d d' d²*, which, extending from bow to stern, passing over are secured to the periphery of the several bulk-heads B. Besides serving as the lateral and vertical supports of the vessel, the bulk-heads B furnish seats for and aid in supporting the several gas-bags D forming the gas-field, and securing them in place.

D are gas bags or receptacles, constructed to fit when inflated, between the bulk-heads B, longitudinally, the chords *a* and *d* vertically, and the chords *d' d'* laterally, and by suitable lashings they are secured to the several chords, bulk-heads, and cross-girders with which they are brought in contact, and overlaid with a substantial netting, which may also be lashed down to aid in securing such bags in place, and, if necessary, the entire vessel may be overlaid with a thin metal roof to protect the gas-bags from the weather and from fire. The gas-field D is to be large enough to give buoyancy, to give equipoise on the earth, to the ship and cargo, is internally divided into cells or sections by partitions provided with automatic valves *v*, and is provided with an internal air-sack, *z*, as shown by dotted lines in Fig. 16, communicating, through valves *x*, with the outer air, to aid expansion and contraction of the volume of the gas. The side screws, *h*, are constructed of any desired size, and of any material that will best serve the purpose, with several blades having the most efficient wind for rapid travel, and by an axle-shaft, *h'*, are mounted in suitable bearings in the outer ends of the beams *j*, projecting from the sides of the hull, and are actuated by propulsive machinery arranged within the vessel through connecting-gearings passing out through or along the line of the beams *j*, to go in either direction with equal facility, and are employed for propelling the vessel forward either end front. The central screw, I, which may be of the same material, form, and size of the side screw, *h*, or of any other form, size, and material, is mounted on an axle-shaft, *i*, having journal-protuberances *i'*, which serve as journal-bearings, and work in boxings *s* in the bore *s'* of the carriage H, and carrying at the opposite end a pulley or gear wheel, i^2, by

which it is revolved on its axis, and is employed for raising the vessel vertically from equipoise on the earth into mid-air, and returning it again vertically to earth when it is desired to alight. With a view to housing the screw I when it is not desired for use, the carriage H, in which it is mounted, may be mounted in ways to be raised and lowered by gear-wheels *p*, gearing with a toothed rack, *p'*, formed on the outer side of the carriage H, and actuated by propulsive machinery within the vessel. When not required for use, the carriage H is raised up into its housing, throwing the screw impelling machinery out of gear; but when it is to be used the screw I is lowered below the cabin, bringing the gear-wheel i^2 to gear with the gear-wheel i^3, connected by a shaft, i^4, with propulsive machinery within the hull, through which means it is made to revolve rapidly on its axis in either direction. In lieu of cogged gear, the screw I may be impelled by an endless belt and pulley-wheels. The end screw, *f*, which may be of the same material and form of the side screws, or of any other that will serve the purpose, is mounted on a longitudinal shaft, *f'*, intersected by a universal joint and journaled in bearings secured in a bracket, f^2, and in a shifting carriage, f^3, in the end of the vessel's hull, and is employed for propelling the vessel forward, and, when obdurate, as an aid to steering the vessel. When employed for the purpose of steering, the carriage in which the end screw is journaled is thrown by machinery to the right or left, so that the screw will be out of line longitudinally with the line of the vessel, and when made to revolve in that position the end of the vessel is thrown forward in the new line of travel, carrying the end of the vessel around. Having gained the new course the screw is returned to its normal position and employed as a propeller.

Being a counterpart of each other, a description of one will serve as a description of both rudder-blades *g*. The rudder-blades *g* are long light fin-shaped blades made tapering from a broad end, carrying a wheel, *g' g'*, upon each corner, by which it is moved in its ways in the horizontal beams of the frame g^2 g^2, extending down from the under side of the tapering ends of the vessel to a pivot joint, g^3, by which it is secured to the under side of the vessel amidships, near the waist, and one edge is made to conform to the outline form of the tapering ends of the ship, and it is handled by tiller ropes, cables, or chains, *q*, passing over pulley-wheels *q'* in the vertical supports of the frame g^2, and at intervals inboard to suitable steering machinery. The rudder-blades *g* are employed for laterally deflecting and changing the vessel's course, the outer ends being thrown to the right and left in its ways in the frame g^2 by the steering-cables *q*. The fans *l* are made of a light frame of blades covered with light flexible material secured by their inner ends in a multiple knuckle-joint by a key, and laterally stayed by cables or chains passing through the same, and is made to open and close like a fan. The fan *l* may be secured to fixed protuberances formed on the sides of the hull A, to beams passing through from within the hull, or to revolving cylindrical hollow shafts *l'*, provided with hollow branching arms l^2, carrying pulley-wheels l^3, journaled in suitable bearings in the hull, and is opened and closed by cables or chains l^4, secured to the sides of the fan and passing to machinery arranged within the vessel. The fans *l* may, if preferred, be rigidly secured by one side to the hull, and opened thence by means of the cables or chains, or may be opened both ways from a common center. When opened from one side, the fan may be housed in a suitable recess in the side of the hull, so that when not in use it is wholly out of the way; and besides being used as aids to steering, the winds being fair, the fans may be used as sails, or the winds being adverse, they may be used as checks to speed. The fans *l* are ranged along the side of the hull at intervals, and when needed for steering one or more fans are thrown out on the side toward which it is desired to go. The vessel being clogged on that side is immediately brought about.

k is a revolving adjustable fin of any desired size, and constructed of any suitable material, observing that lightness and durability should be coupled with great tensile strength, and either rigid, or to open and close like a fan. The fin *k* is secured to and made to form part of a plain revolving shaft, *w*, having axle-bearing *o'*, by which it is journaled in a journal-boxing, o^2, in the side of the hull, and carrying on the inner end a gear-wheel, *o*, by which it is revolved on its axis, and on the outer end a rigid frame covered with thin metal or other material, of which *w'* is a cross-beam extending nearly at right angles to the main shaft *w* to the full diameter of the fin, and w^2 are diverging ribs radiating to the periphery, and w^3 is a peripherical band or hoop, which binds the whole together and secures the outer edge of the fin. It is obvious that any other form of frame may consistently be adopted, so that the fin will have the necessary dimensions and strength, and, as stated, may be made to open and close like a fan, in which event the revolving shaft *w* is replaced by a hollow cylindrical shaft, *k'*, having hollow branching arms k^2, provided with grooved pulleys, a journal-axle, *o'*, and mounting on the inner end a gear-wheel, *o*, by which it is revolved on its axis, and a multiple knuckle-joint, *m'*, between the branching arms. The fin is constructed on a series of thin metal blades, *n*, keyed together at the inner end in the knuckle-joint *m'*, and the free ends united together by chains or cables passing through them laterally, and the whole covered by any suitable flexible material. The fan, like the fin, is opened and closed by cables or chains secured to the edges, and passing thence by way of the hollow branching arms k^2 through

the cylinder *k'* to the interior of the vessel, where they are handled by machinery or otherwise. Any number of these side fins, *k*, requisite to successfully deflect the vertical course of the vessel may be ranged at intervals fore and aft, opposite to each other, along the sides of the vessel, and be so connected that they will act simultaneously, in groups or singly, as occasion may demand, and are handled by suitable trains of machinery within the vessel, which, as shown in Fig. 2, may consist of a longitudinal shaft, *t*, extending along on the inside of the hull A, and secured in bearings t^3, and provided at intervals with endless worms or screws *t'*, and carrying a spur-wheel, t^5, by which it is revolved. In this train of machinery the gear-wheel *o*, on the inner end of the shaft *w* or *k*, gears with the endless screw *t'* on the shaft *t*, which, being revolved in the proper direction, sets the fins simultaneously at the angle or in the position desired, the trains of gear-connections shown in Figs. 3, 9, 10, and 12 embracing driving gear-wheels which gear with the gear-wheel *o* on the end of the shaft *w* or *k* and a spur-wheel, t^5. I prefer, however, the mode of mounting and handling the fin and the train of machinery shown in Figs. 4, 5, 6, 7, and 8, in which *o* is the gear-wheel on the revolving shaft *w* supporting the fin, and *u' u'* are gear-wheels secured on the inner end of the revolving shafts u^2 u^2, journaled in and passing out through suitable bearings in the side of the hull A; and *u u* are rag-wheels secured on the outer ends of the shafts u^2 u^2, and placed against the outside of the hull in juxtaposition with and on opposite sides of the fins *k*, so that a chain or cable, n^2, extending from the antipode ends of the cross-beam *w'* will pass over each rag-wheel, as shown in Figs. 4 and 6. w^3 is a general impelling gear-wheel. In the outer ends of the cross-beams *w'*—one each—is a grooved pulley-wheel, *r*, which runs on the cable or chain n^2, and the cable or chain is kept from being displaced by an arbor, *r'*.

In lieu of the grooved wheel *r*, a clutch or set-screw, r^2, may be introduced into the ends of the cross-beams *w'*, by which the chain or cable n^2 may be gripped and held fast, so that as the fin *k* is revolved on its axis—the rag-wheels *u* being simultaneously revolved, one on each side of the fin—the chain n^2 is carried forward until the fin has assumed the position desired by this arrangement, as it is apparent that the fins *k* are better braced and secured and may be made to stand a greater strain upon them.

It has long been recognized by aeronauts and persons considering the subject of aerial navigation, that two kinds of steering are absolutely necessary and essential—steering laterally, to the right and left, and vertical steering, steering upward and downward—in changing from one air-current to another in sailing over mountains, plains, &c., and that this latter kind of steering cannot be effected economically by throwing out ballast for ascending or permitting the gas to escape to descend, nor can it be economically accomplished by stopping the forward course and by the employment of the side screws, nor the vertical screw. To meet this difficulty, and to enable the aeronaut to deflect the course of his vessel vertically, I have devised and introduced the side fins. Arranging them on the two sides of the vessel, the action on both sides will be equal and uniform. Suppose there be three fins on a side and the forward end of each is dipped below the horizontal plane of its axis, the fin being set at a pitch, the entire series will form the lines of a screw, which as it is rushed forward will force the vessel downward. The angle of the fins being reversed, so that the direction will be upward, the vessel will be gradually carried upward, &c., in the meantime by the rudder-blades, end screws, and side fans. Employing one, more, or all, the vessel may be steered laterally.

Though in my drawings I show, and in my specification I set out, the form, construction, and general appointments of aerial vessels, the mode of constructing, mounting, securing, and operating side fans and adjustable steering-rudders for deflecting the lateral course of aerial vessels, the mode of constructing, mounting and operating side propelling and end propelling and steering screws, for propelling and steering aerial vessels, and the mode of constructing, mounting, adjusting, and operating a central screw for raising and lowering aerial vessels vertically, I do so merely to show the relation of the several parts to each other in making up a perfect and complete ship. As on the 8th of November, A. D. 1883, I filed, and now have pending in the United States Patent Office, applications for Letters Patent on these specific features, numbered respectively, 111,240, 111,238, 111,237, and 111,236, I do not claim them herein.

Having now described my invention, that those skilled in the art to which it pertains can adapt it, what I esteem as new, and desire to protect by Letters Patent, is—

1. Series of adjustable fins attached to revolving shafts journaled and secured in and projecting from the sides of the hull on both sides of the vessel at intervals from bow to stern, for vertically deflecting and steering aerial vessels in flight, substantially as shown and described.

2. For simultaneously adjusting and holding at appropriate angles for vertically steering and deflecting the course of aerial vessels in flight, series of side fins ranged at intervals along both sides of the hull from stem to stern, and trains of engaging and gearing machinery arranged within the vessel, substantially as shown and described.

3. In vessels for aerial navigation, series of adjustable fins attached to revolving axle-shafts secured in bearings in and protruding

through the sides of the hull on both sides at intervals from bow to stern, in combination with revolving shafts, engaging gearings, and internally-placed propulsive machinery, the whole arranged and constructed for deflecting and steering the vessel vertically, substantially as described.

4. In vessels for aerial navigation, adjustable side fins secured to revolving shafts arranged in bearings in and passing from within out through the side of the vessel, and stayed by guys and lateral supports, substantially as shown and described.

5. In vessels for aerial navigation, adjustable revolving fins formed on revolving thafts secured in suitable bearings in the sides of and passing through to within the hull of the vessel at intervals from bow to stern, and handled by internally-arranged machinery, substantially as shown and described.

6. Adjustable revolving fins formed on a revolving shaft provided with suitable journal-bearings, and carrying a gear-wheel for handling and revolving the same on their axis, substantially as shown and described.

7. In vessels for aerial navigation, adjustable revolving fins arranged at intervals along the two sides of the ship, and secured in place by a revolving shaft passing to within the vessel, in combination with trains of internally-arranged propulsive machinery, substantially as shown and described.

8. In vessels for aerial navigation, adjustable revolving fins arranged along the sides of the hull at intervals on both sides, opposite to each other, and secured in place on a revolving axle-shaft that passes through the side to within the vessel, and provided with a gear-wheel on the inner end, in combination with chains n^2 and rag-wheels $u\,u$, the latter secured on a shaft, $u^2\,u^2$, journaled in boxings in the side of the hull, and carrying at the opposite ends gear-wheels $u'\,u'$, gearing with gear-wheel o, all constructed, arranged, and operated substantially as shown and described.

9. In combination, fin k, revolving shaft w, cross-beams w', grip-clutches r^2, chains n^2, rag-wheels $u\,u$, revolving shafts $u^2\,u^2$, gear-wheels $u'\,u'$, gear-wheel $o\,w^3$ in a fin-like device ranged along the sides, for deflecting the vertical course of vessels for aerial navigation, substantially as shown and described.

10. In combination, fin k, revolving shaft w, journal-bearings o^2, gear-wheel o, shaft t, and endless screw t' in a train of machinery for simultaneously arranging and adjusting the series of side fins employed in deflecting the vertical flight of vessels for aerial navigation, substantially as shown and described.

11. In vessels for aerial navigation, adjustable side fins, k, and vertical raising and lowering central screw, I, for effecting the altitude and changing the position of such vessels vertically, substantially as and for the purpose shown.

12. The side fins, k, mounted on revolving shafts and handled by propulsive machinery within the vessel, in combination with side fans, l, steering-rudder blade g, and adjustable end screw, f, for steering and deflecting the vertical and lateral course of vessels for aerial navigation, substantially as shown, and for the purpose described.

13. In aerial vessels propelled, handled, and steered by external appliances through machinery within the vessel, the combination of side propelling-screws, h, series of fins k, attached to revolving shafts w, journaled in and projecting from the sides of the hull A on both sides at intervals from bow to stern, and internally-arranged gearing machinery, the whole constructed and arranged for propelling forward and deflecting and steering the vessel vertically, substantially as shown and described.

14. Trains of engaging gearing machinery arranged within the vessel for simultaneously adjusting and holding at appropriate angles series of side fins ranged at intervals from bow to stern along both sides of the hull, and adapted for steering and deflecting the vertical course of vessels for aerial navigation while in flight, substantially as shown and described.

In testimony whereof I affix my signature in presence of two witnesses.

EUGENE F. FALCONNET.

Witnesses:

J. B. COLEMAN,

HENRY NIXON.