No. 889,693. PATENTED JUNE 2, 1908.

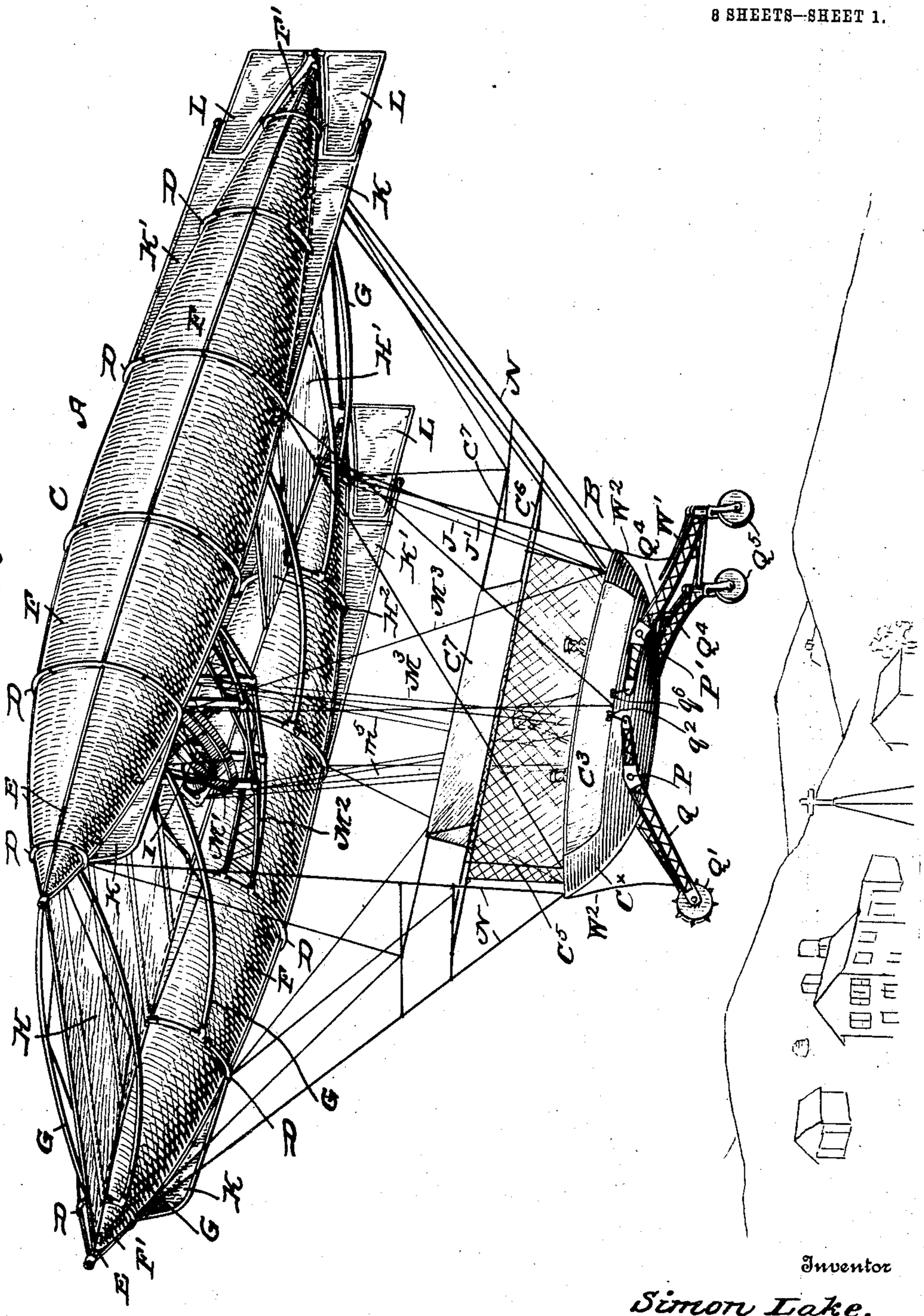
S. LAKE.

AIR SHIP.

APPLICATION FILED DEC. 20, 1907.

8 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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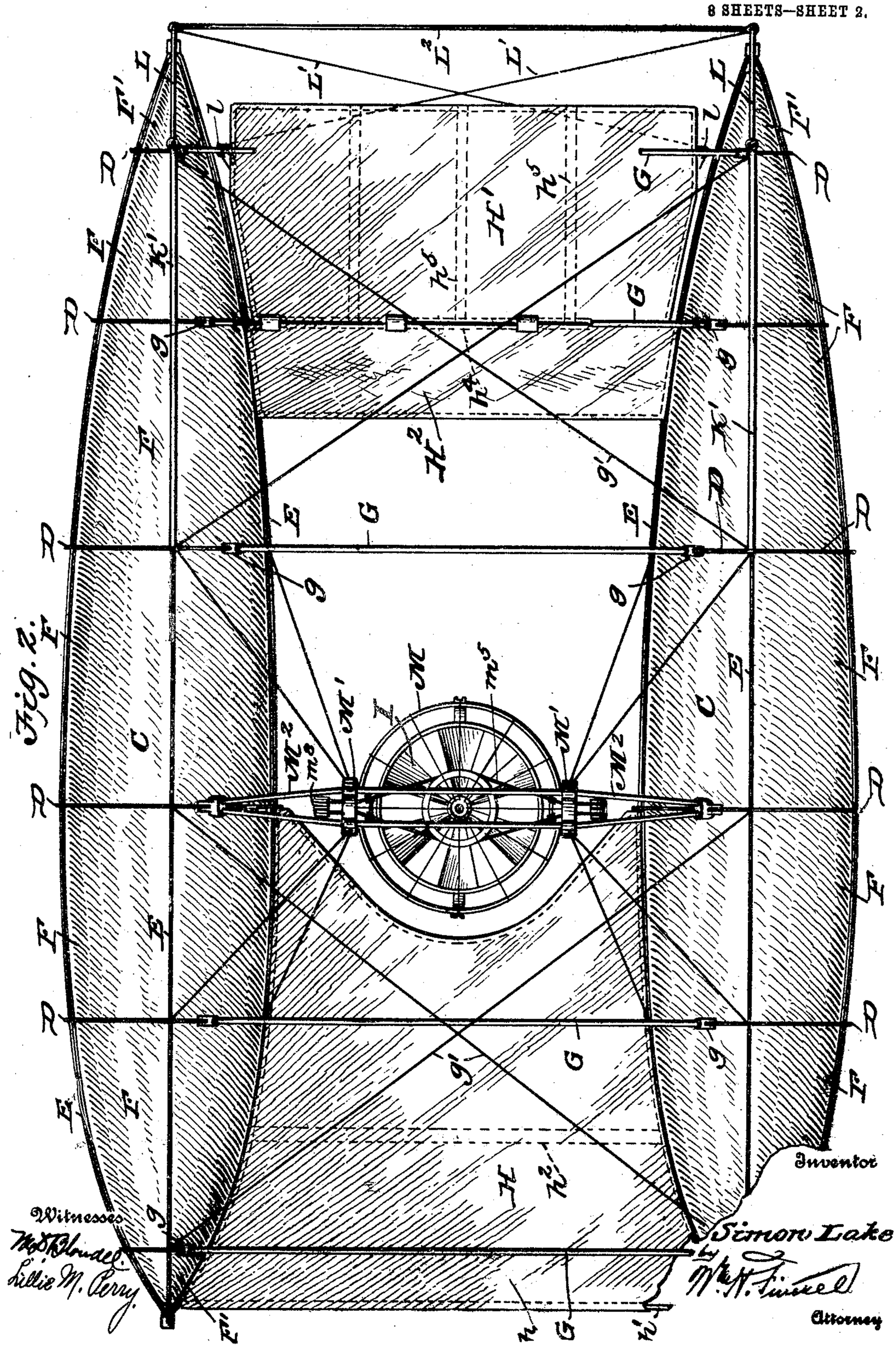
8 SHEETS—SHEET 2.

Fig. 2.



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8 SHEETS—SHEET 3.

Fig. 3.

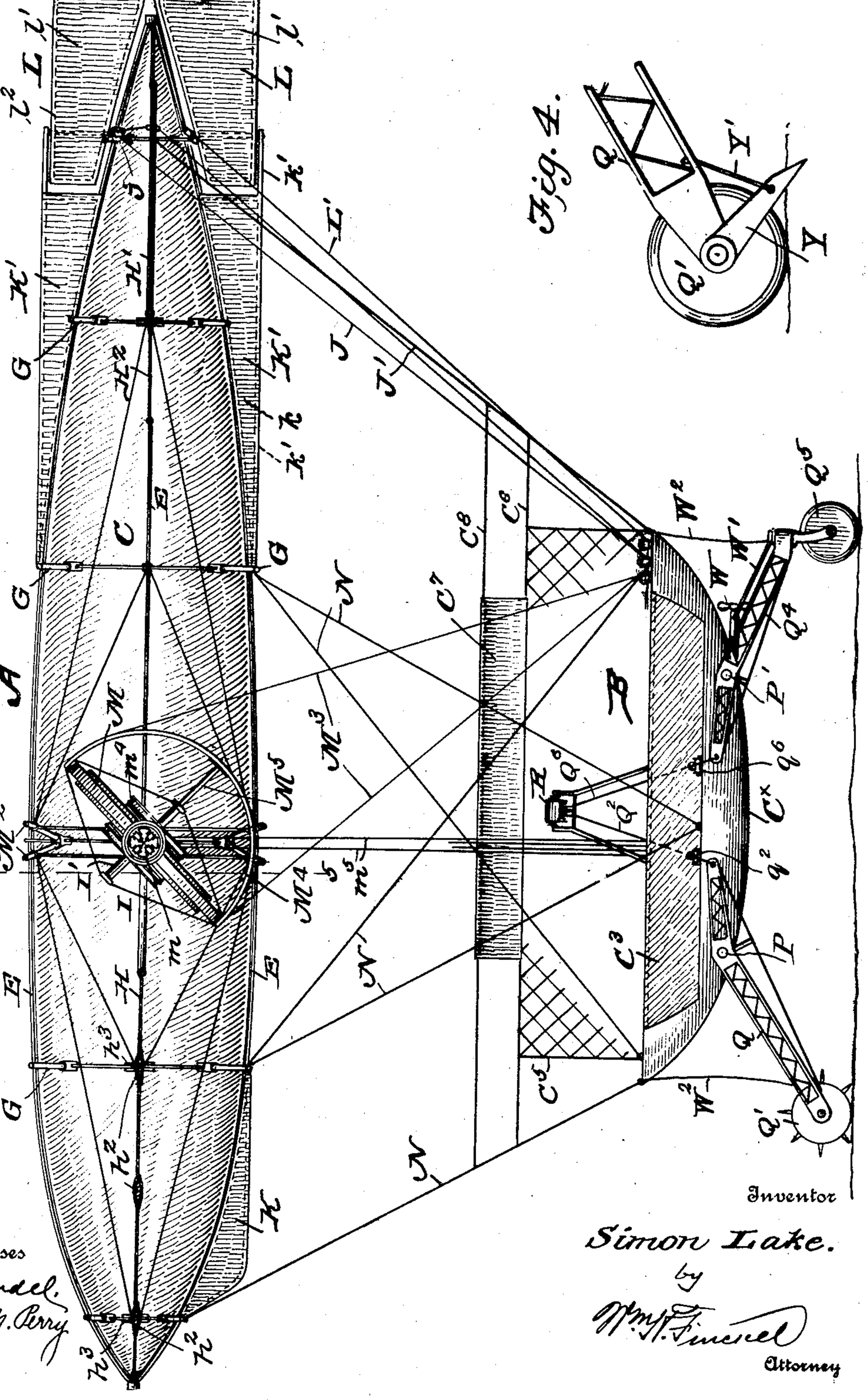

Fig. 4.

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6 SHEETS—SHEET 4.

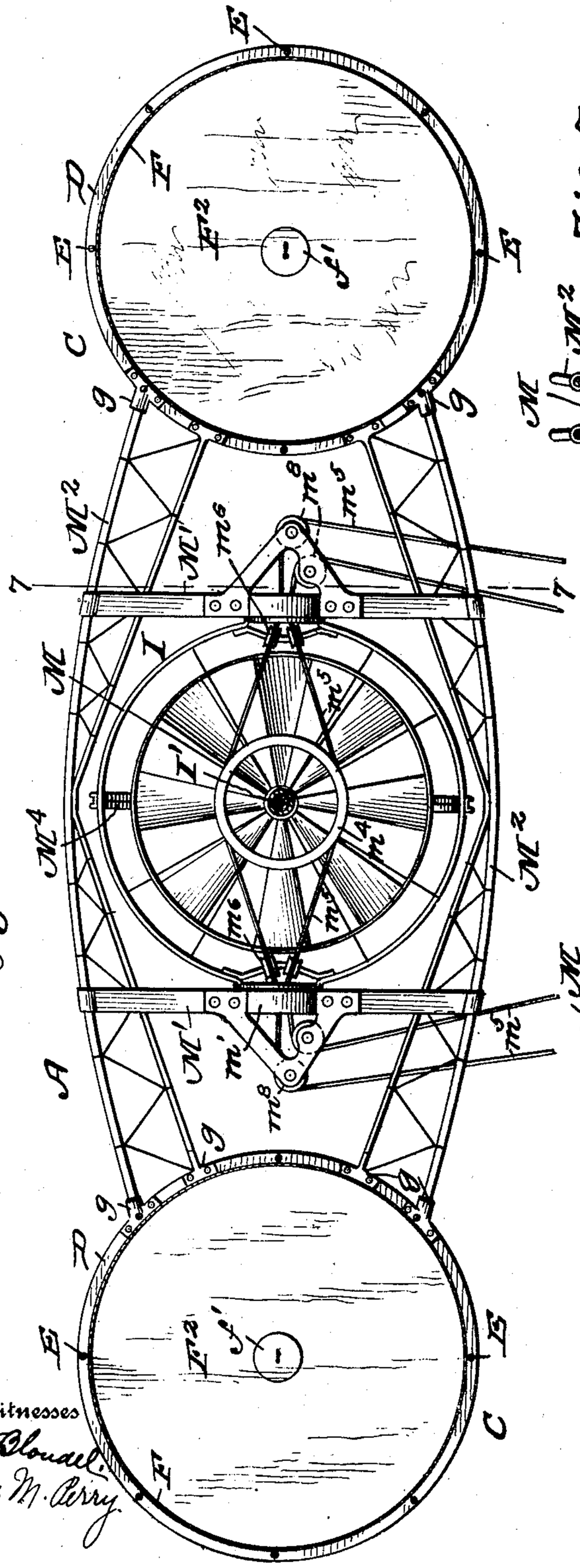

Fig. 5.

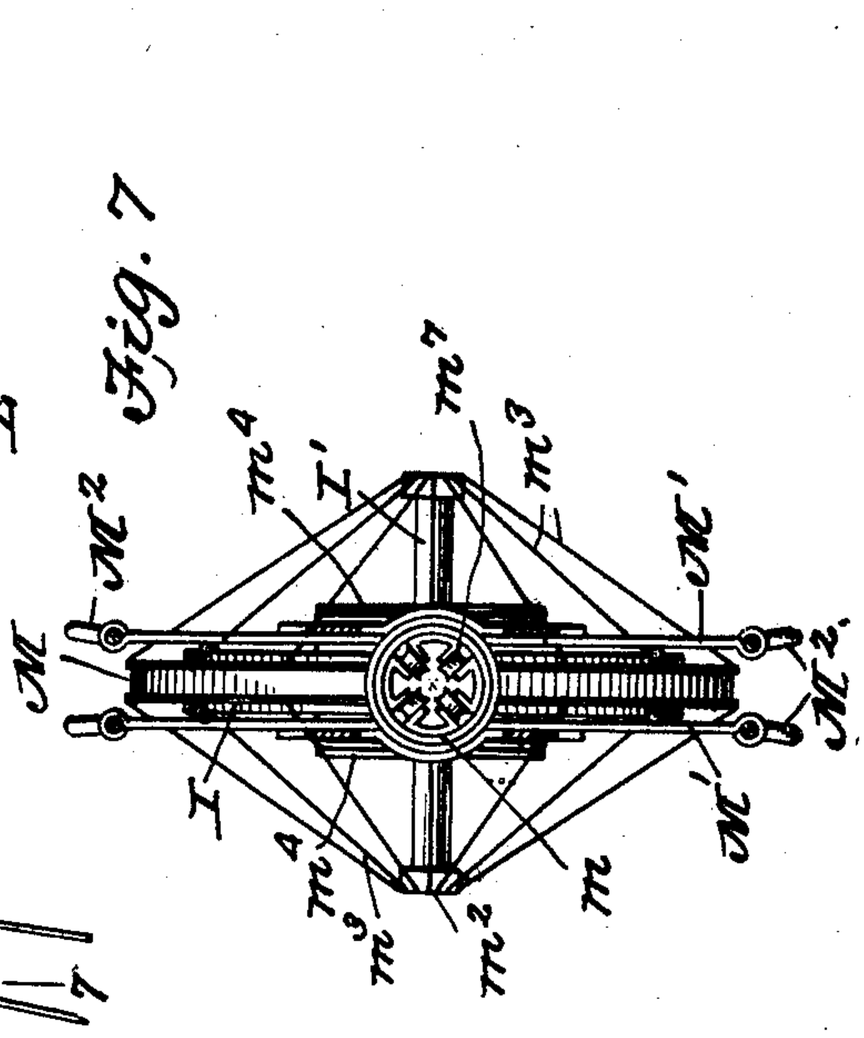

Fig. 7

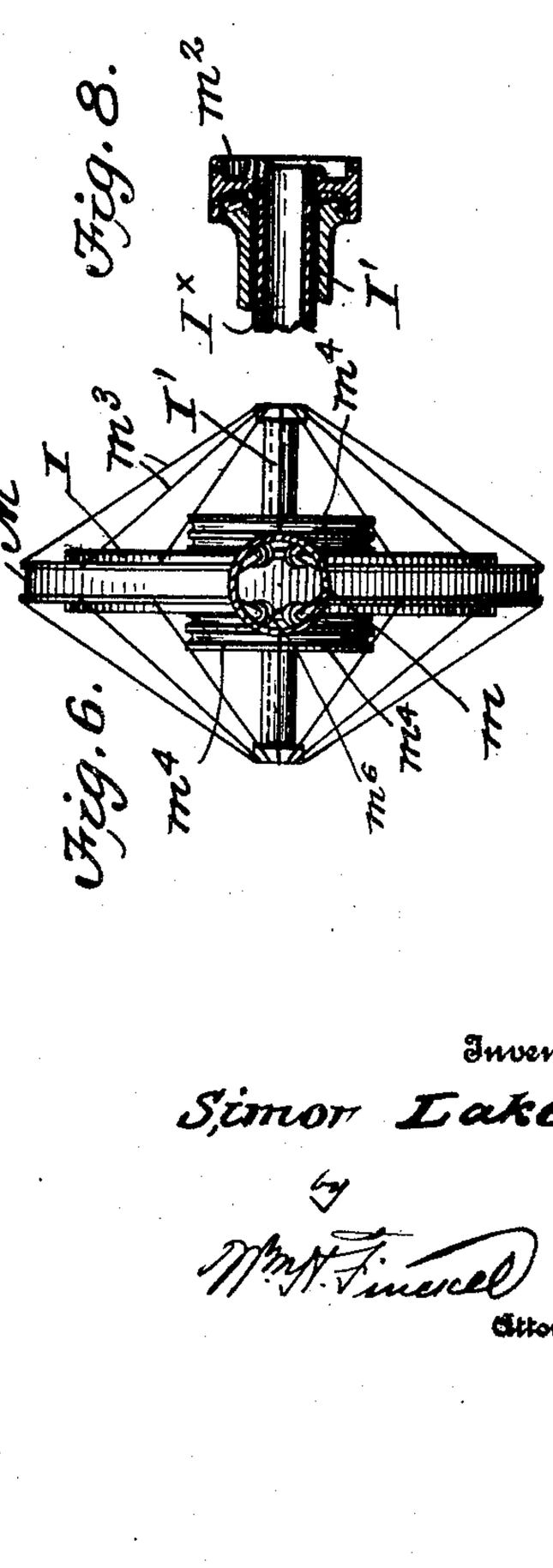

Fig. 8.

Fig. 6.

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8 SHEETS—SHEET 5.

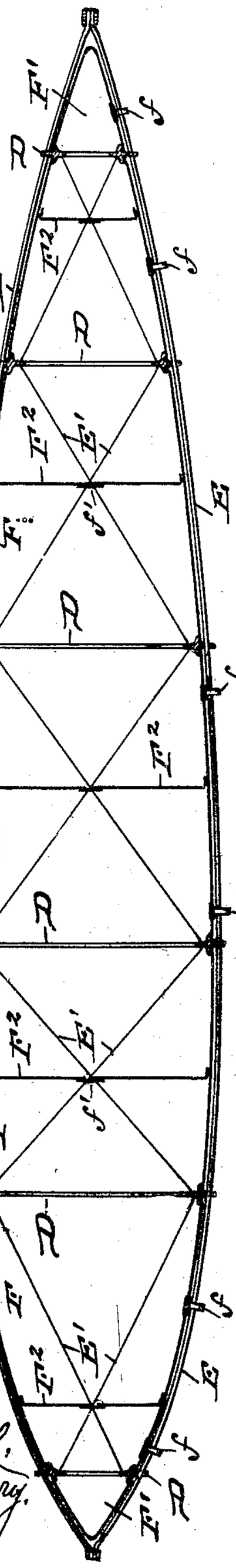

Fig. 9.

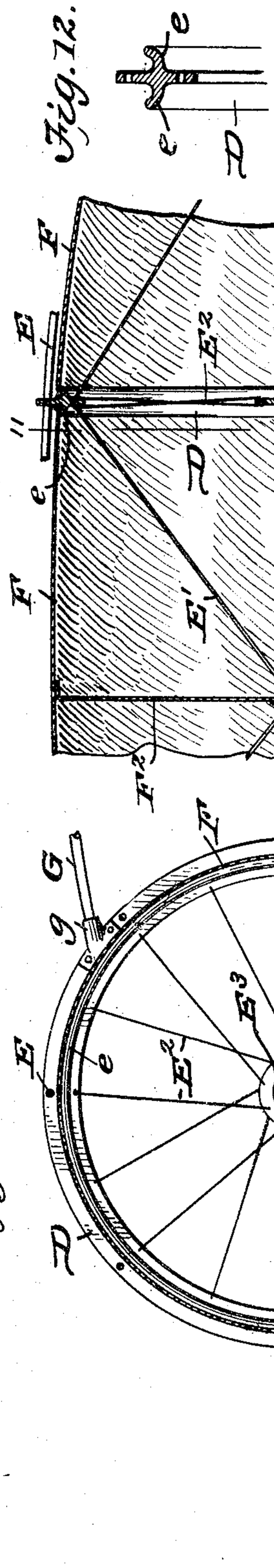

Fig. 12.

Fig. 10.

Fig. 11.

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8 SHEETS—SHEET 6.

Fig. 73.

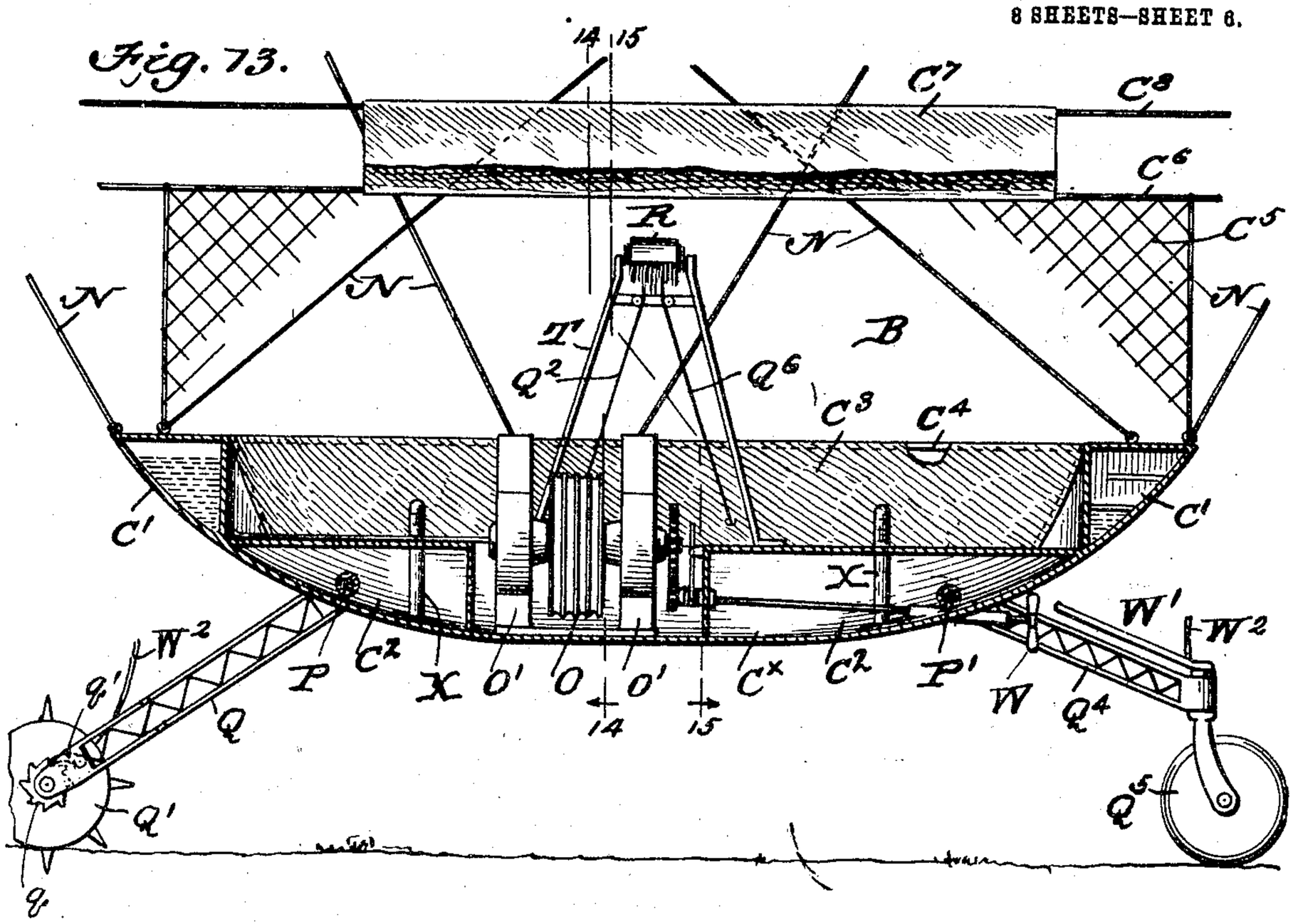


Fig. 14.

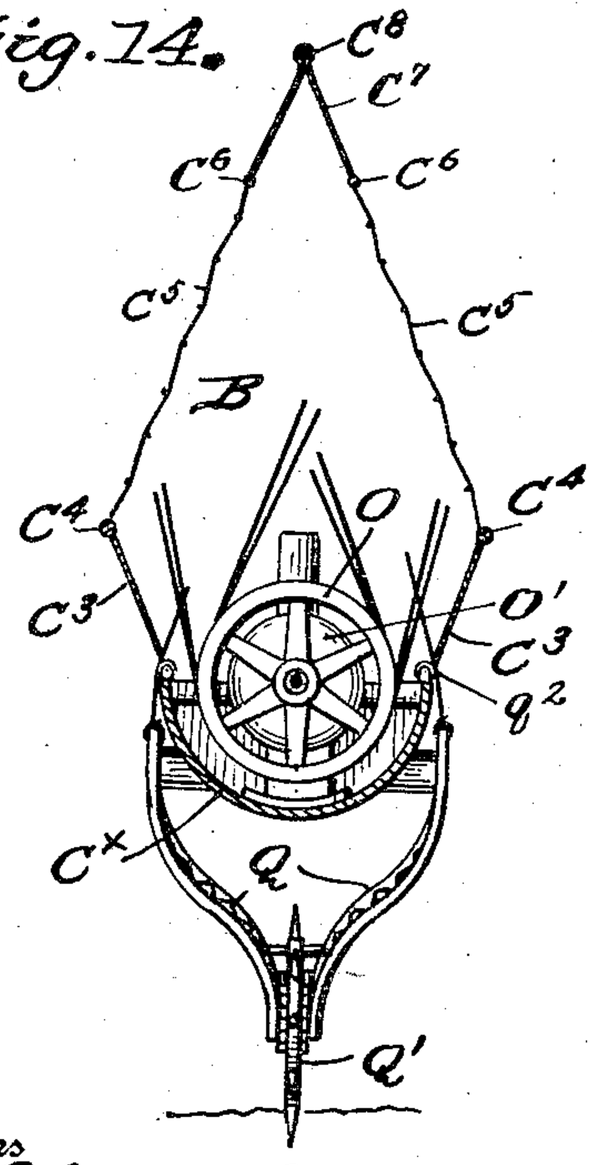
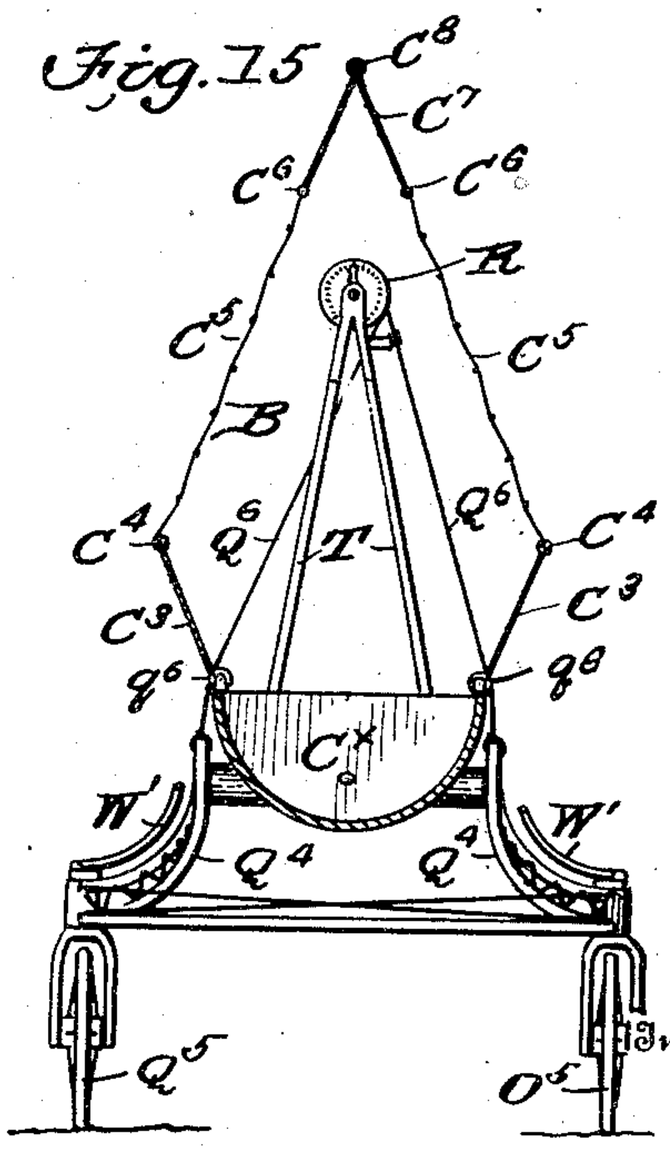


Fig. 15



Witnesses

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8 SHEETS—SHEET 7.

Fig. 19.

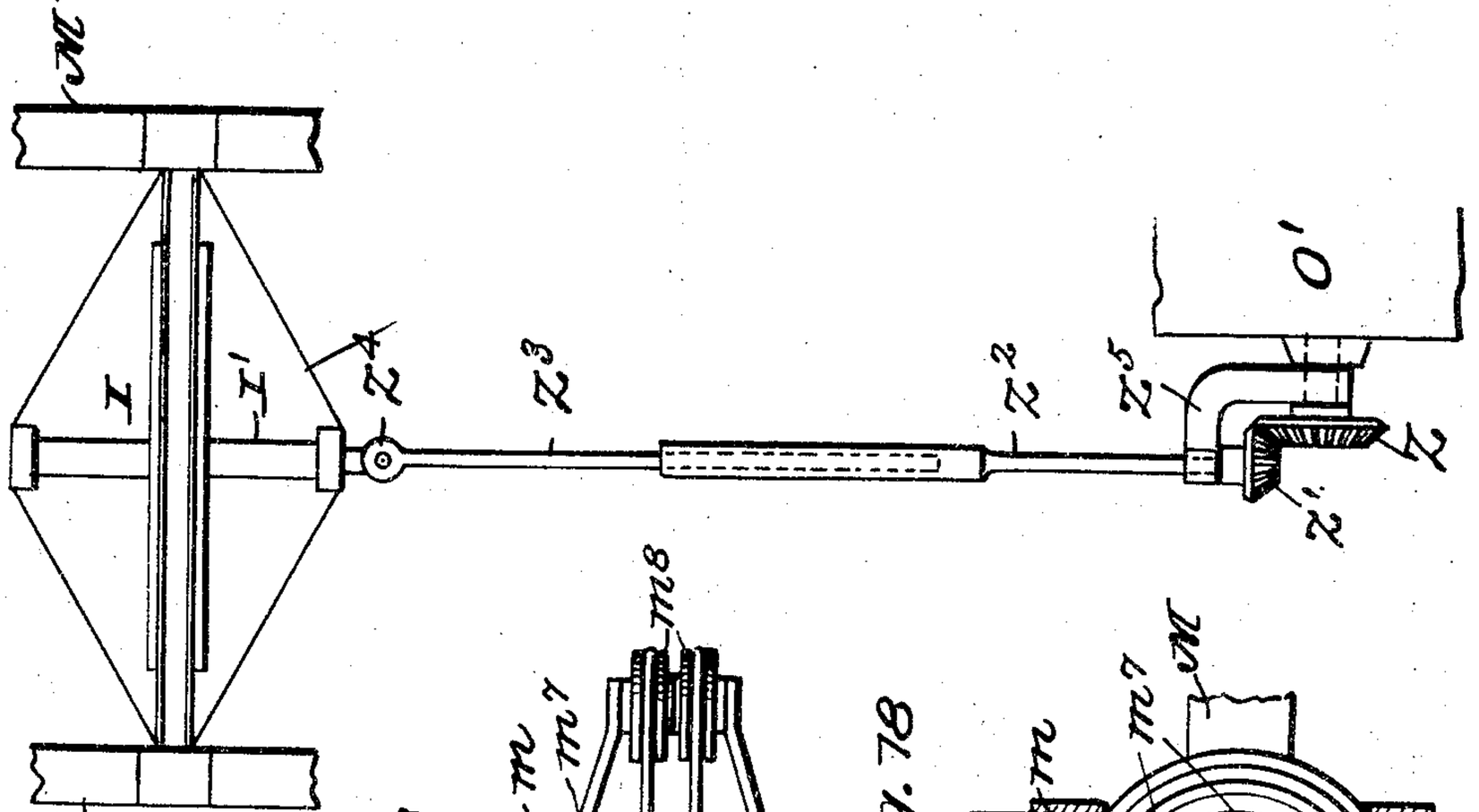


Fig. 17.

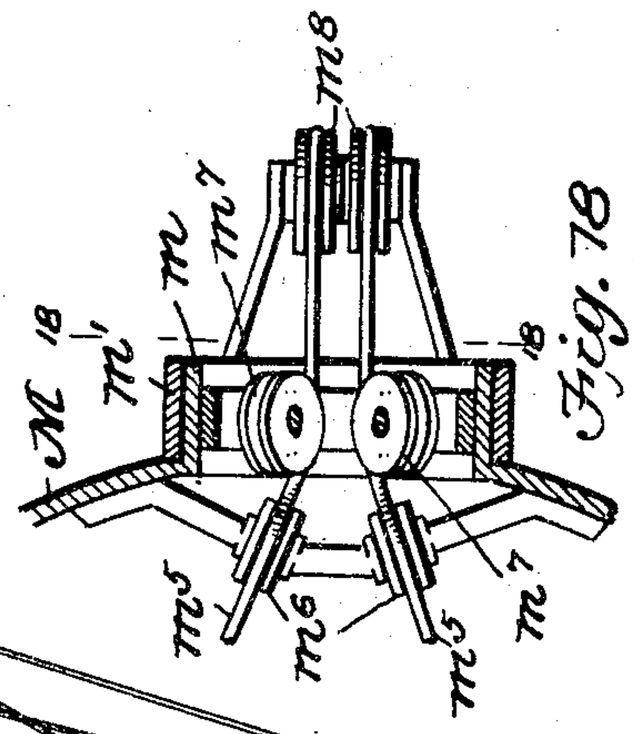


Fig. 18

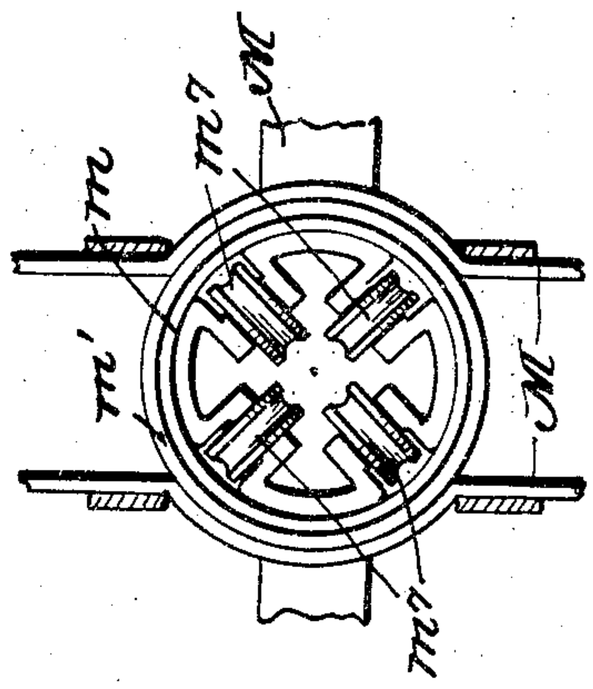
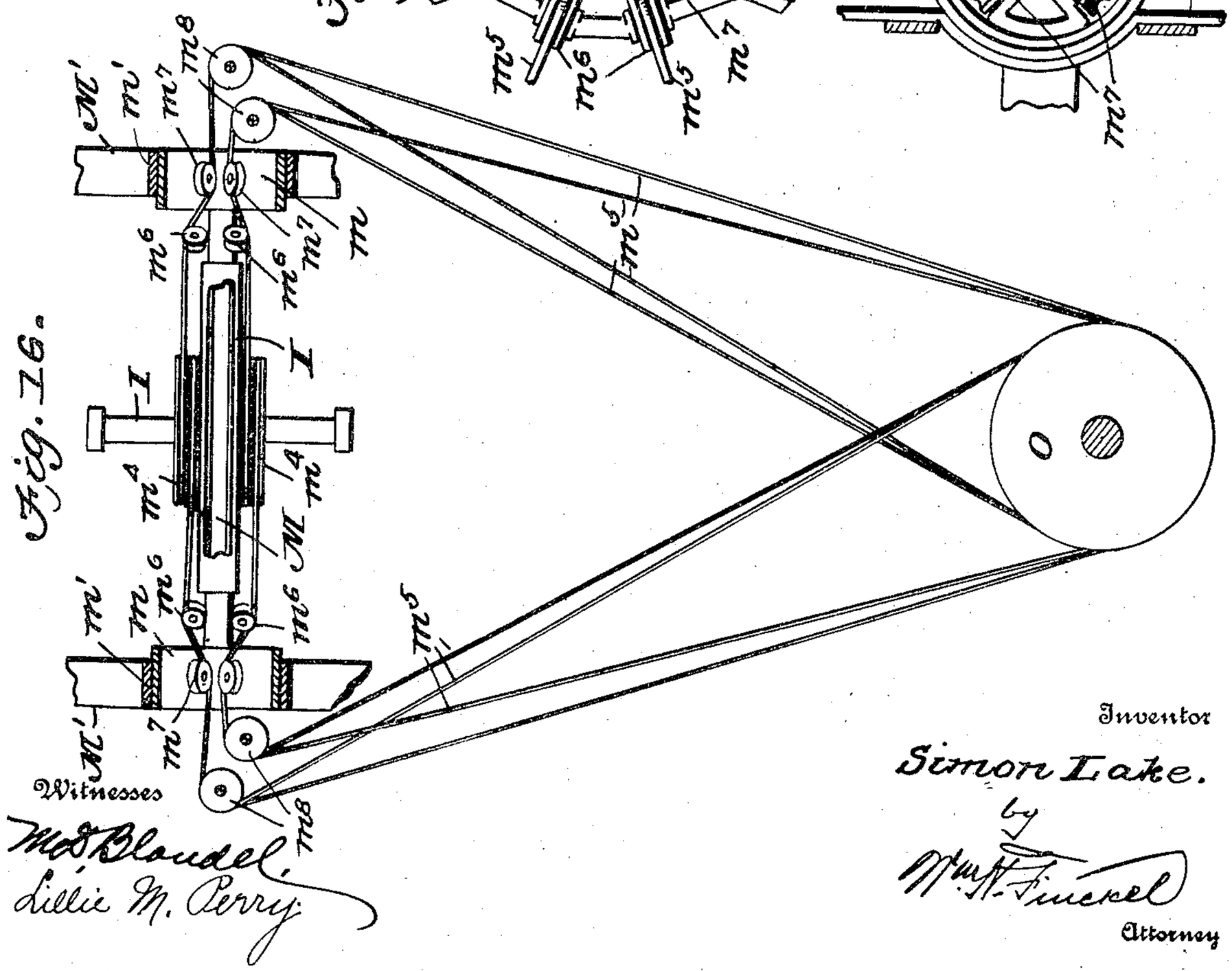


Fig. 16.



Witnesses

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8 SHEETS—SHEET 8.

Fig. 20

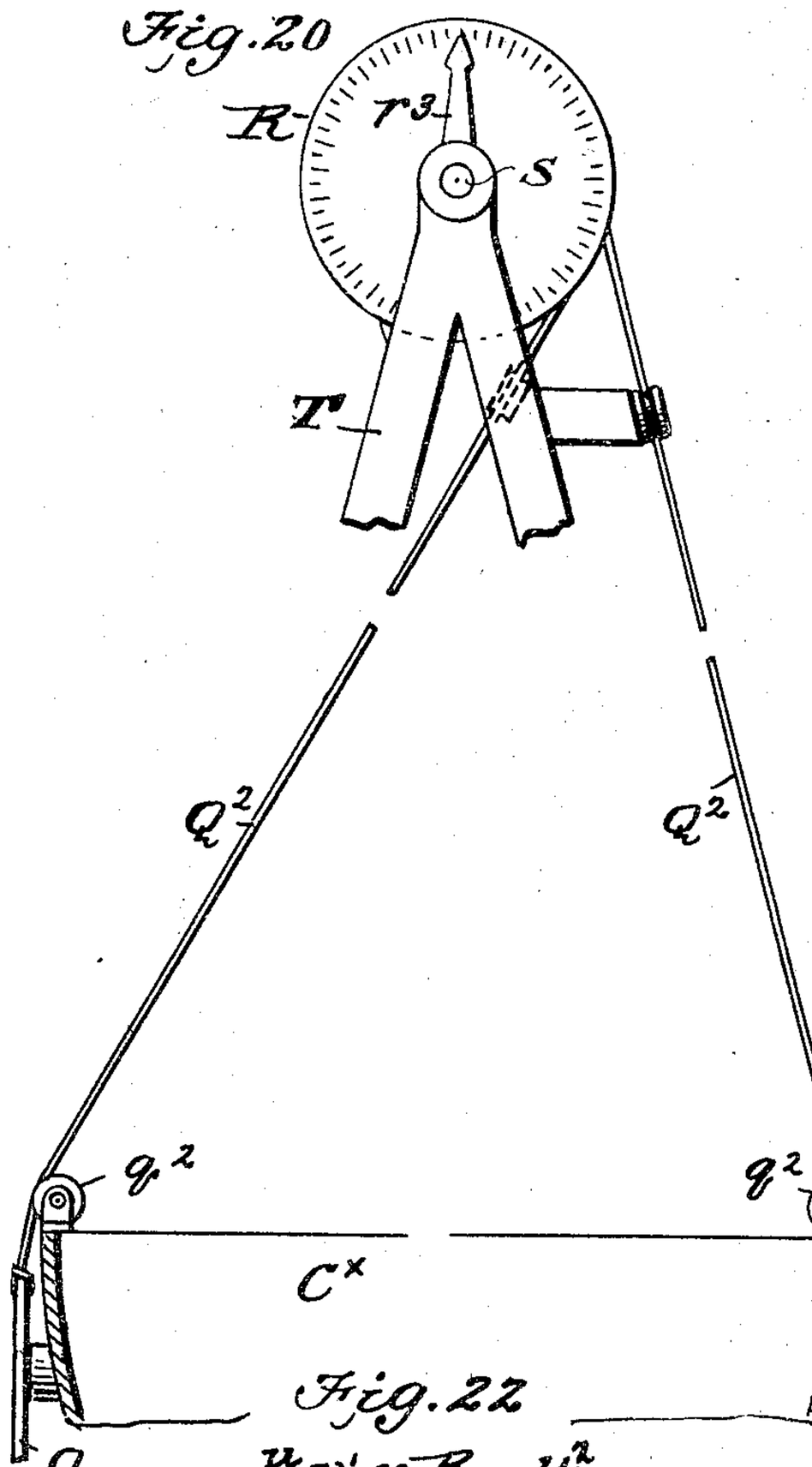


Fig. 21.

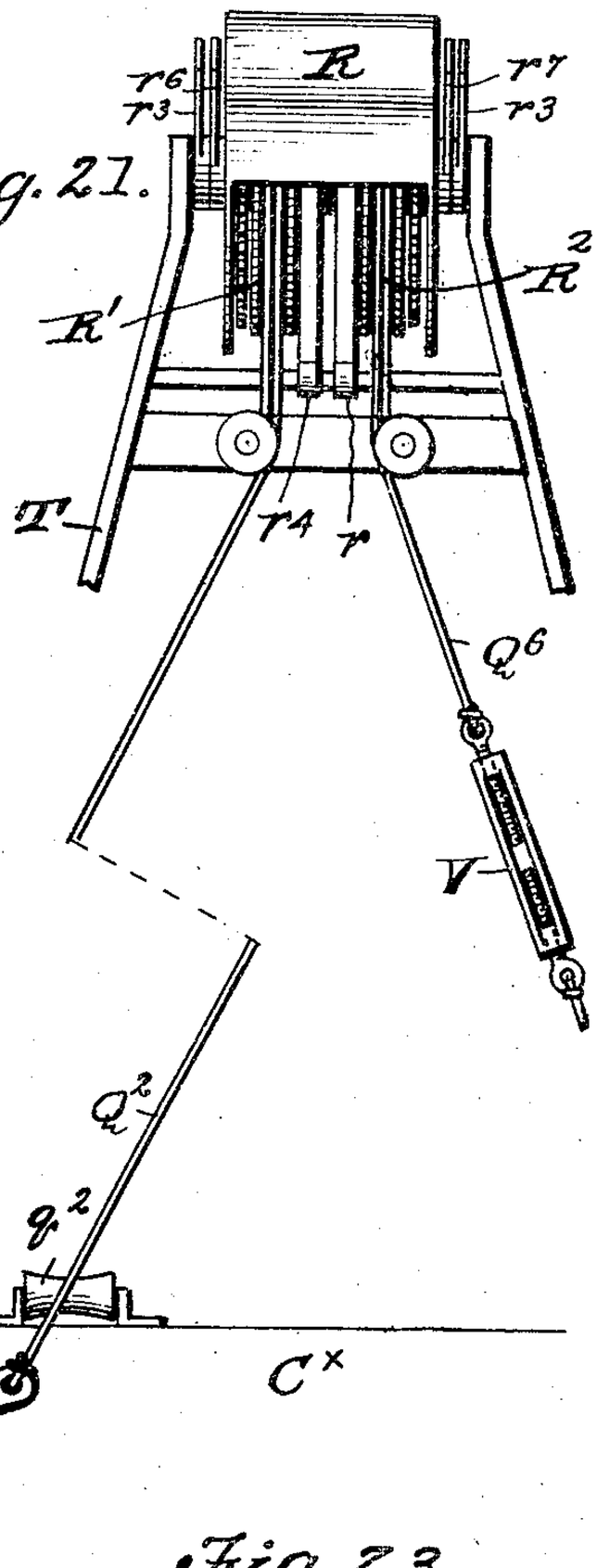


Fig. 22

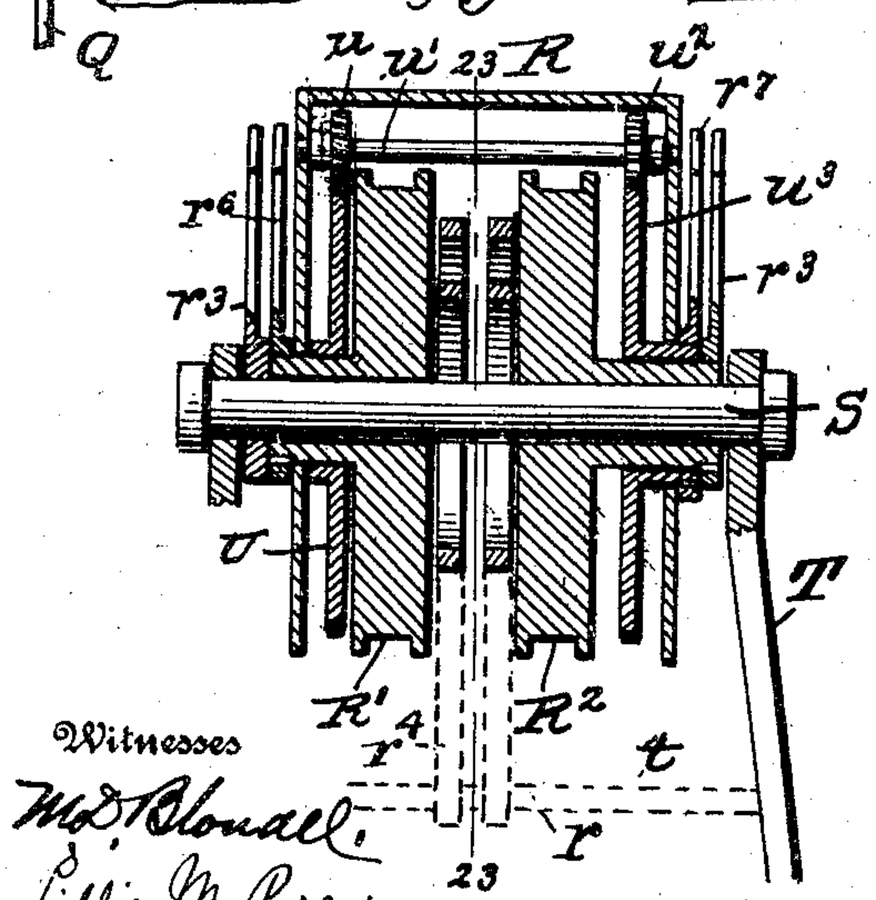
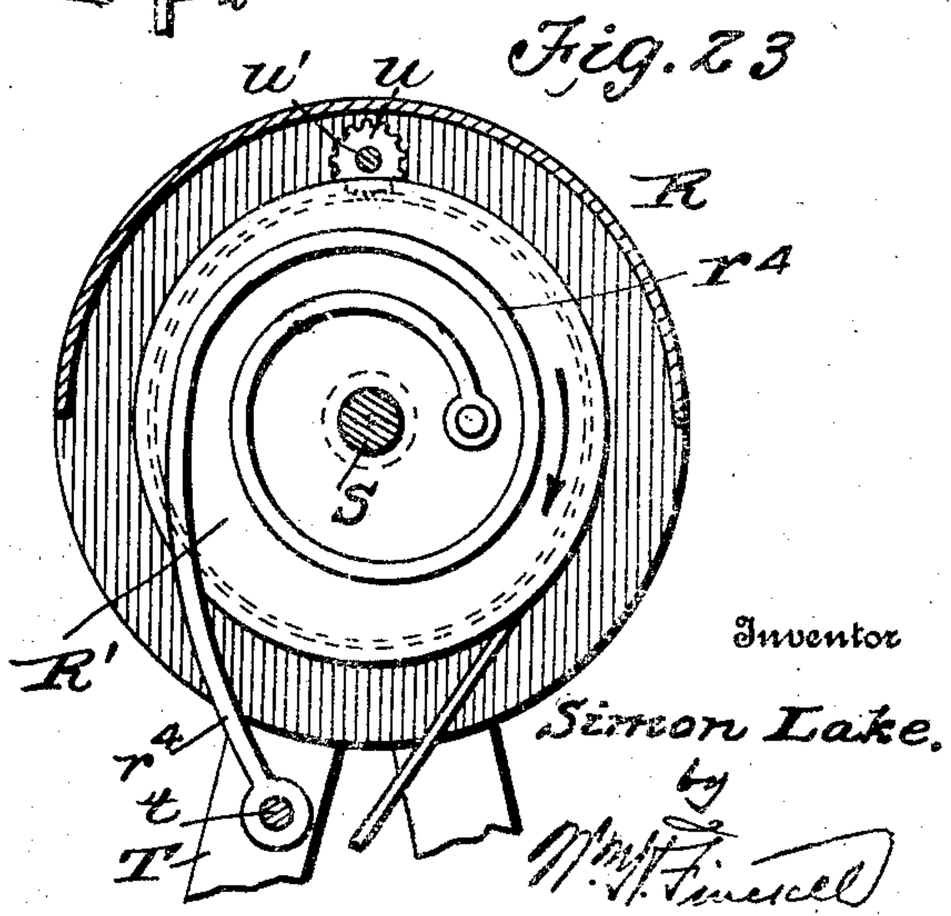


Fig. 23



Witnesses

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UNITED STATES PATENT OFFICE.

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AIR-SHIP.

No. 889,693. Specification of Letters Patent. Patented June 2, 1908.

Application filed December 20, 1907. Serial No. 407,344.

To all whom it may concern:

Be it known that I, SIMON LAKE, a citizen of the United States, and a resident of Bridgeport, in the county of Fairfield and State of Connecticut, temporarily residing in London, England, have invented a certain new and useful Improvement in Air-Ships, of which the following is a specification.

The objects of this invention are, to provide an air-ship of great stability, which will permit of safe and easy descents in case of failure of its propelling or steering mechanisms, and with which ascents may be made from an inclosed or restricted area, and which is also well adapted to combat the influences of the winds or air currents when suddenly contacting therewith in rising above the wind barriers; and also, to provide a cushioning and weight measuring device adapted for the combined purpose of relieving the ship of sudden jars or shocks should it come violently into contact with the earth when making a landing, and of serving as an indicator by which the operators are enabled to ascertain and regulate the proper launching condition. Also, to provide an air ship which will readily adjust itself to face the wind when on the ground, or when making a landing, or when navigating in the air, unless the propulsive power is of sufficient strength to navigate against the wind or with the wind at a greater velocity than the speed of the air ship, so that when making a landing the ship will retain its position, which last is a condition not commonly attainable with the ordinary balloons or dirigible airships possessing sufficient buoyancy to lift the entire structure.

With these briefly stated objects in view, the invention comprises an upper buoyant section and a lower section carried by the buoyant section, the said buoyant section comprising a buoyant float or floats carrying one or more aeroplanes of sufficiently large area to sustain the weight of the said lower section when the upper section is inclined from a horizontal position and propelled at a sufficient velocity to cause the passing currents of air to impinge against the aeroplanes and keep the entire structure afloat, thereby permitting of navigation while in the air, and preventing a too rapid descent should the propelling mechanism or steering devices get out of order. This upper section is not intended, however, to be of sufficient capacity to float the entire structure, but only to sustain itself and to float above the lower section whose elevation is caused by a propeller or fan which is operated by a motor carried by the lower section and which, when set in motion, will enable the entire structure to rise and be capable of navigation through the air. Besides the motor for operating the propeller, the said lower section is also intended for carrying the crew and the necessary mechanism for operating the rudders to direct the ship in its course. The said lower section also carries the cushioning and weight measuring devices. The lower section is preferably constructed in the shape of a boat, which will float upon the surface of the water and thereby provide safety for the crew should the propelling mechanism get out of order and the ship carried by the wind out of its course and a descent made upon a body of water.

The invention also comprises certain details of construction, combination and arrangement of parts as will be hereinafter described and claimed.

The terms "aeroplanes" and "planes" are herein used interchangeably to indicate one and the same thing, namely, the devices H, H′, H².

In the accompanying drawings, illustrating the invention, in the several figures of which like parts are similarly designated, Figure 1 is a perspective view of my air-ship. Fig. 2 is a top plan view of the same, with one corner broken away. Fig. 3 is a central vertical longitudinal section drawn through the upper or buoyant portion of the ship and illustrating the propeller frame carried thereby and the lower or car section in elevation. Fig. 4 is a detail elevation illustrating a modified arrangement of anchoring the ship when on the surface. Fig. 5 is a vertical cross section on a larger scale, drawn on the line 5—5 of Fig. 3 illustrating the propeller in a vertical position. Fig. 6 is a side view of the frame for supporting the propeller. Fig. 7 is a detail section drawn on the line 7—7 of Fig. 5. Fig. 8 is a detail section drawn on a larger scale, through one end of the propeller shaft. Fig. 9 is a vertical longitudinal section drawn through one of the floats of the upper section and illustrating the arrangement of the brace wires and partitions or bulkheads. Fig. 10 is a longitudinal sectional elevation of a portion of one of the floats drawn on a larger scale. Fig. 11 is a cross sectional view drawn on the line

11—11 of Fig. 10. Fig. 12 is a detail section on a larger scale of a portion of one of the ribs of the floats. Fig. 13 is a vertical longitudinal section drawn through the lower or car section of the ship. Fig. 14 is a transverse section drawn on the line 14—14 of Fig. 13. Fig. 15 is a transverse section drawn on the line 15—15 of Fig. 13. Fig. 16 is a diagrammatic view illustrating the arrangement of belts for operating the propeller. Fig. 17 is a horizontal section, on a larger scale, drawn through one of the trunnions of the propeller frame and illustrating the arrangement of guide pulleys. Fig. 18 is a detail section drawn on the line 18—18 of Fig. 17. Fig. 19 is a view illustrating a modified arrangement for operating the propeller. Fig. 20 is a detail transverse section of a portion of the car of the ship illustrating the device for registering the weight of the car by which the ship is adjusted for making an ascent. Fig. 21 is a side elevation of the mechanism of Fig. 20. Fig. 22 is a longitudinal section of the weight measuring device, hereinafter referred to as a balance. Fig. 23 is a transverse section drawn on the line 23—23 of Fig. 22.

A designates the upper buoyant section and B the lower or car section of the ship. The upper section is constructed of two or more double conoidal or cigar shape floats C, each of which is constructed of a series of cylindrical rings D which form the ribs of the float. These ribs have their centers arranged in longitudinal alinement and they are so spaced apart as to obtain a symmetrical structure. These ribs are held apart and in vertical position by light weight battens, or longitudinal brace rods E, which extend throughout the length of the float and are projected through openings formed adjacent to the outer edges of the ribs and are connected to the ribs in any suitable manner and at their ends by bands or by wrapping the said ends with a light wire of great tensile strength. As shown in the drawings, four of these longitudinal braces are employed and these are arranged in the vertical and horizontal planes of the center of the float, although an additional number, than shown, may be employed if necessary.

Truss wires E′ connect the ribs at their inner edges throughout the length of the float and firmly brace them in position and, with the longitudinal brace rods, hold them in a rigid upright position. The rings or rigs may be strengthened axially by an interlacing of wires or cords E^2 which extend from the inner edges to a disk E^3 arranged centrally in each ring, as shown most clearly in Fig. 11.

Each rib is provided upon both sides adjacent to its outer edge, with laterally extending, annular, outwardly bent flanges *e* which provide annular grooves in which are held the opposite ends of suitable fabric sections F F^1 which form the skin of the float. The fabric sections F arranged intermediate the rings are constructed in the form of cylinders or sleeves and their ends are cemented within the annular grooves in such way as to form air and gas tight joints, and are further secured therein by wrapping the ends with fine light weight wire or cord so as to prevent any possible danger of the ends becoming detached. The sections F^1 forming the ends of the float are constructed in the form of conoids and their inner ends are secured within the grooves formed upon the outer faces of the end rings of the float and are secured in place in the same way as the intermediate sections.

The floats are divided into a series of air and gas tight compartments by means of partitions or bulkheads of fabric F^2 which are secured to the skin sections in any suitable way. The purpose of forming the floats with a series of compartments is to prevent the collapse of the entire float should any portion thereof be punctured or otherwise injured in such way as to permit the escape of the gas. The several compartments are inflated through valved tubes *f* projecting through and secured to the skin sections at the lower sides thereof. The partitions are arranged between the floats at the points of intersection of the truss wires E^1 and the openings through which the wires pass are sealed by means of disks *f′* of rubber or fabric and a suitable cement. The floats thus formed are held in parallel relation and to each other by light weight trusses G which are connected to the rib sections by means of clips *g* (Figs. 1, 2 3 and 11) carried at the ends of the truss rods and secured to the ribs by rivets, screws, or the like. The truss rods are securely braced by an interlacing of wire or cord, and suitable diagonally arranged brace wires *g′* connect the ribs of one float with the ribs of the other float so as to provide a thoroughly rigid structure.

Arranged between the floats is a series of flat planes the areas of which are so proportioned one to the other as to give an equal resistance fore and aft of the center of gravity of the vessel and are designed to support the lower or car section of the ship when navigating under the influence of the propeller I or when the ship is falling due to the stoppage of the propeller, as will be fully explained later on. These planes comprise the front plane H which extends from the forward ends of the floats to a point immediately adjacent to the frame of the propeller and is constructed of a central body portion *h*, of fabric and an outer frame of bamboo or light weight metal *h′* to which the edges of the fabric are connected. Suitable cross braces h^2 connect the side members of the frame and are connected to the fabric portion by strips of canvas. At the points of intersection of

the side members and ribs the said side members are securely fastened to the ribs by clips h^3 thereby securely holding the plane in position.

At the extreme rear ends of the floats is arranged a plane H^1 which is hinged at its forward end to a rod or bar h^4 forming the rear frame member of an intermediate plane H^2 which extends from one float to the other from points in the horizontal plane of the axis of the floats. The plane H^1 is raised or lowered by means of lines J and J^1 respectively to act as a horizontal rudder to change the trim of the ship as will be hereinafter described. The lines J for raising the rudder operate over pulleys j carried by the floats, from which pulleys they are extended downwardly to the car section of the ship, and the lines J^1 for lowering the planes are extended direct to the car section. The body portions of these planes are also constructed of fabric. The plane H^1 is braced by cross rods h^5 applied thereto by strips of canvas.

A skeg K is arranged under the forward end of each float, and skegs K′ are arranged above and below the axial centers of each float at the rear end thereof, and these skegs are designed to prevent the escape of the air contacting with the planes when the ship is being propelled through the air until the air has traveled the full length of the structure. The body portions of these skegs are constructed of canvas k whose outer longitudinal edges are connected to light weight rods k' extending horizontally from one of the ribs of each float and their inner longitudinal edges are connected to the longitudinal battens or brace rods E as shown. The rear edges of these skegs are connected to vertically extending rods connecting the rods k' with the battens E.

Vertical rudders L are journaled intermediate their ends to extensions of the rods k' and the rearmost ribs of the floats, and these rudders are arranged in pairs above and below the axial centers of the floats. To their rear ends are attached tiller lines L′ by means of which they are moved either to the right or left to steer or direct the course of the ship. These lines are extended to the lower section of the ship and suitable guide pulleys l are employed to guide the lines and hold them from contact with the horizontal rudder when the latter is operated. The rear ends of the rudders of each float are connected together, and the rudders of both floats are connected by a light weight rod L^2 to cause them to move in unison when the line extending to the rudder of either float is operated. The body portions of the rudders are constructed of a suitable fabric l' and a light weight skeleton frame l^2 to which the ends of the fabric are connected.

At the center of buoyancy and at the center of resistance when the ship is considered as a falling body, and over the center of gravity of the ship as a whole, is arranged the propeller I, which is supported in a circular ring M having hollow trunnions m which are journaled in bearings m' supported by vertically extending bars M^1 whose upper and lower ends are connected to and supported by truss bars M^2 extending from and connecting the ribs of the floats opposite the center of gravity of the upper section.

The propeller I is carried by a shaft I^1 whose ends are journaled in collars m^2 supported by wires m^3 extending from the opposite edges of the ring M and between the ends of the shaft and the collars are interposed anti-friction balls to reduce friction. A hollow shaft $I^\times$ extends through the shaft I and connects the collars m^2. Secured upon each side of the propeller is a double grooved pulley m^4 each groove having a drive belt m^5 operating therein and the belts from the pulleys are extended in opposite lateral directions through the hollow journals and thence to a drive pulley O of a motor O^1. The intermediate lengths of the belts after passing around each grooved pulley extend in converging directions over guide pulleys m^6 carried by the ring M thence around guide pulleys m^7 journaled within the hollow trunnions and thence over guide pulleys m^8 journaled in brackets carried by the vertically extending bars M^1 to the drive pulley O of the motor O^1. The guide pulleys m^7 journaled in the trunnions m are arranged within the axis of the trunnion and the belts converge from the guide pulleys m^6 towards the pulleys m^7 which are grouped around the axis of the trunnion thereby concentrating the belts as near the axis of the ring as is possible to arrange them so that when the ring is swung upon its axis from a horizontal to a vertical position or vice versa or to any angle between these positions the shifting of the belts will be so slight at these points that they will always retain their frictional grip upon the pulleys.

The position and movement of the ring M are controlled by cords or wires M^3 leading from the car or lower section, and secured to the sides of the ring at diametrically opposite points and operating upon a segmental guide strip M^4 carried by the ring, and it will be understood that by drawing upon either cord the ring may be adjusted to change the angle of thrust of the propeller to give a direct upward lift to the ship, or a forward movement as may be required. A hollow stub shaft M^5 extends from the segmental strip M^4 and projects into the hollow shaft I^1 to further strengthen and retain it in position.

Supporting cables N depend from the lower sides of the ribs of the floats and have their opposite ends connected to the lower section B of the ship. This section is preferably in the form of a boat, and is located di-

rectly below the center of buoyancy and center of gravity of the upper section and also below the center of resistance of the planes when the ship is considered as a falling body. The car is designed for carrying the crew for manipulating the ship and also carries the motor O^1 for operating the propeller as well as the fuel and paraphernalia necessary in the operation of such devices.

The car as shown is constructed of a hull $C^\times$ which terminates at each end in a vertical hollow extension C^1 in which are carried the fuel for the motor and also other commodities such as fresh water and food. The said hull is provided with fore and aft air-tight compartments C^2 C^2 so as to add to the buoyancy of the structure should it alight in a body of water. The tops or upper portions form the working platforms of the car. The portions C^3 of the sides of the car are constructed of canvas or other suitable material, and project from the sides of the hull proper in diverging directions and in converging directions from the center towards the bow and stern extensions and the extreme ends are connected to the extensions C' as shown. The upper edges of the canvas sides are connected to bamboo rods or strips C^4 which form the side rails of the car and extending from these rails in converging directions are wire screens C^5 whose upper ends are connected to parallel stringers C^6 extending longitudinally from the forward to the rearward suspending wires N. Above the upper ends of the screens is an inverted **V** shaped canvas canopy C^7 which is arranged directly in the path of the downward thrust of the wind from the propeller when the latter is operating to raise the ship and serves to deflect the wind and permit its escape with as little obstruction as possible without contacting with the deck of the car. The canopy acts as a parachute when the ship is descending and thereby assists the planes to retard its downward movement and also acts as a plane to give direction to the ship when under propulsion.

The upper edge of the canopy is supported by a single strand of wire C^8 which extends lengthwise of the ship and is connected to the forward and rear supporting cables N, and its lower longitudinal edges are connected to the parallel stringers C^6.

In practice the car is made of sufficient length to permit the operators to change their position in a forward or aft direction so as to throw the center of gravity slightly forward or aft of the normal center of the ship for the purpose of giving forward or aft trim to direct the ship's course in an upward or downward direction. Aid in effecting such trim may be had by operating the horizontal rudder H'.

In order to support the lower or non-buoyant portion of the structure when it is resting on the ground, and also to regulate the position or trim of the ship prior to making an ascent and further to provide a cushioning device to avoid severe shocks to the car and its occupants should the car come into violent contact with the earth when effecting a landing, I provide a cushioning and weight measuring device which comprises the following parts: Near the forward end of the car is arranged a shaft P Fig. 13, to the ends of which are connected the tines of a forked arm Q in the outer end of which is journaled a wheel Q^1 having spikes arranged upon its periphery which are designed to penetrate the earth for the purpose hereafter stated. This wheel is provided with a ratchet wheel q which is engaged by a pawl q' carried by the arm so as to permit rotation of the spiked wheel in one direction only, the purpose of which will be apparent from the description of the operation of the ship.

To the extreme inner ends of arm Q are connected cables Q^2 which extend over guide pulleys q^2 located upon the sides of the hull and up and around a drum R^1 of a balance R held in brackets T rising from the deck of the car. Adjacent to the rear end of the car is a similar shaft P^1 to the ends of which are connected rearwardly extending arms Q^4 carrying caster wheels Q^5 at their extreme rear ends. To the forward ends of arm Q^4 are connected cables Q^6 which extend over guide pulleys q^6 and have their opposite ends wound upon and connected to a drum R^2 of the balance R. This balance is designed to take up the weight of the lower structure when the latter is resting upon or comes into contact with the ground and comprises the two pulleys or drums R^1 and R^2 one of which R^2 is connected to a shaft S. Figs, 20 to 23, that is journaled in the brackets T and has one end of a spiral spring r connected thereto whose opposite end is connected to a cross bar t connecting the arms of the brackets T so that as the drum is revolved by the downward pull of the cables when the car is resting upon the ground, the spring will be wound and its tension increased. Carried at each end of the shaft is an indicator hand r^3 which operates round a graduated dial formed upon the ends of the casing of the balance.

The drum R^1 is provided with a central hub and is loosely mounted upon the shaft S, and like the drum R^2, has one end of a spring r^4 connected thereto whose opposite end is connected to the cross bar t of the bracket and operating over this drum are the cables Q^2 extending from the arms Q. The hub of the pulley R^1 is extended through the casing and carries an indicator hand r^6 which operates around the dial to register the weight of the fore end of the car resting upon the ground; and in order to enable the operator in the rear end of the car to ascertain the

amount of weight resting upon the forward wheels as registered by the hand r^6, I provide the pulley R^1 with a gear wheel U or a segmental rack section that is meshed by a pinion u carried at one end of a shaft u' journaled in the casing of the balance and whose opposite end is provided with a pinion u^2 of the same dimension as the pinion u, which is meshed by a gear u^3 of the same size as the gear U and which is loosely mounted upon the shaft S The hub of this gear u^3 projects through the end of the casing and is provided with an indicator hand r^7. By this arrangement, it will be readily understood that the operator in each end of the car may readily ascertain the amount of weight at which the car is resting upon the ground and enables the operators to adjust the car so as to set it at the proper angle prior to starting the motor to make an ascent.

In practice the hands will be of different colors so that they may be readily distinguished.

The cables operating upon the drum R^2 are provided with turn buckles V by means of which their lengths may be increased or decreased so as to regulate the position of the car and likewise the angle of inclination of the upper buoyant structure.

The arms Q and Q^4 not only provide for the regulation of the position of the machine as a whole and for relieving the ship of sudden shocks when effecting a landing, but they also permit of the adjustment of the vessel so that the rear end will be swung around until the forward end faces the wind, thereby facilitating its rise when the propellers are set in motion and of retaining this position until sufficient speed has been attained to make the ship sensitive to the movement of the rudders. When the vessel first strikes the ground, and assuming it does so with its broadside to the wind, the spikes of the forward wheel will penetrate the earth and the rear end of the ship will be swung around upon the caster wheels until its forward end is directed towards the wind, the same as a ship at anchor, and when this position is reached the ship will be prevented from a sliding or running movement by virtue of the engagement of the pawl q' and ratchet q preventing the rotation of the front or spiked wheel, thus, in effect, anchoring the ship. This arrangement also permits the ship to change its position according to the direction of the wind as it shifts from one quarter to another.

A propeller W, Figs. 3 and 13, is carried by the car section for propelling the ship through the water in the event of its making a descent in such a body. The propeller shaft is geared to the motor O' and has a clutch by which the operation of the shaft is controlled. In order to properly steer the ship, tiller bars W^1 may be applied to the caster wheels or either of them so that the rear wheels may be used as rudders and the ship steered through any course. In the event of the ship descending in a body of water, which might occur through injury to its propeller or any of its operating parts, or by being blown out of its course, and in order to permit of the proper adjustment of the ship to make an ascent, after repairs to such parts have been made, I arrange gage glasses X in the forward and after compartments of the boat which will show the approximate buoyancy of the latter and register the amount of force necessary to lift the ship.

In the construction of the floats, the ribs are first arranged in position and the battens or longitudinal brace rods connected thereto. The truss wires are then connected to the ribs throughout the length of the structure, after which the sleeves or fabrics which form the skin of the float are arranged in position and their ends cemented in the grooves of the ribs and securely retained therein by wrapping the ends within the grooves with a light weight wire of great tensile strength. If desirable, a greater number of rods may be employed than shown in the drawings in order to hold the ribs perfectly rigid until the entire structure has been completed, after which as many as desirable may be removed in order to decrease the weight of the float without decreasing its strength. When both floats have been thus constructed they are connected together by the truss rods, the aeroplanes are then arranged in position as before described and the lower or car section connected thereto by the suspension cables. The floats are then inflated with a gas that is lighter than the atmosphere until they are sufficiently buoyant to float the entire upper section and cause it to exert a slight lifting force upon the lower or car section, although they may be made of sufficient capacity to hold enough gas to float the entire structure, including the passengers and stores. But I prefer to make them of only sufficient buoyancy to lift themselves together with the planes, propellers, and steering mechanism, which I consider is essential in all purely power lifting machines, for the reason that if its lifting force should be stopped in mid-air the structure would fall, owing to the weight of the lower section exceeding the buoyancy of the upper section. By constructing the planes of sufficient area, a gradual descent will be made without liability to injury to the occupants or the car itself when coming in contact with the ground, and injury will be further safe-guarded against by the cushioning devices as previously described. It will therefore be seen that with sufficient power, buoyancy is not an absolute essential to such a craft as herein described, and if, through the stoppage of its machinery and consequent loss of power to select a po-

sition to alight when a descent is being made, the car should strike the edge of a building, or tree or mountain, and thereby be temporarily retarded in its descent, and thrown out of its true position, it would right itself the moment it slipped from the obstruction or swing itself as a pendulum owing to the location of the center of gravity, so that the descent would be continued in such a position that the planes and the structure itself offer sufficient resistance to permit a gradual descent and thereby prevent injury to either the car or the occupants. Should a similar accident occur to a ship in which the aeroplanes alone were depended upon to keep the ship afloat when propelled through the air, the planes would of necessity turn edgewise the moment they encountered an obstruction, in which position they would immediately lose their influence and the whole structure would fall through the air with great rapidity and with little prospects of its safety or the safety of the occupants.

In making an ascent with a ship constructed in accordance with my invention, the floats are first inflated and the car and upper structure adjusted to the proper angle, which, of course, has been determined through experiments, so as to maintain a forward direction without any considerable variation in height, the propeller is then started to give a direct downward thrust of the air to cause the ship to rise vertically or as nearly so as may be desired or permissible owing to the space from which the ascent is being made, and after a certain height has been reached, the propeller is then set to the proper angle to give the ship a forward motion, and the inclination of the planes is also set at the same time, so that in coöperation with the propeller the force of gravity is overcome. The ship may thus be propelled over a given course either in a horizontal direction or at a slightly increasing rise, which direction is controlled by the vertical rudders and the angle of the planes combined with the angle of thrust of the propeller. It will be understood that by changing the position of the propeller to direct the thrust of the air directly downwardly or rearwardly, the ship will be caused to travel accordingly. Should, however, it be desired to rise rapidly to a greater height, the horizontal rudder may be adjusted and the occupants of the car may shift their position toward the aft part of the ship so as to incline the upper structure and thus change the center of gravity of the ship, which will further incline the planes and produce a more extensive upward and forward movement.

From the foregoing the advantages of my invention over similar devices will be readily apparent, and it will be further understood that by constructing an air-ship with an upper buoyant section and low center of gravity no difficulty will be experienced in maintaining the proper trim of the ship, and by the employment of the upper buoyant section, which is relied upon to maintain the proper trim unless thrown out of such position by the propeller or rudders, a gradual and safe descent will be made should any of the operating parts be incapacitated.

I desire it understood that I do not limit myself to the exact construction, or the arrangement of the bracing wires and supporting cables, and other minor details of construction, as these may be changed without departing from the scope of the invention. For example in Fig. 4 of the drawings is illustrated a modified arrangement for anchoring the ship when on the surface of the ground, and this consists in pivoting an arm Y to the shaft of the forward wheel which is designed to penetrate the ground when the ship is moved rearwardly. The end of the arm is pointed in order to easily penetrate the earth and its movement is limited by the cable or chain Y^1 which is connected at one end near the outer end of the arm Y and at its opposite end to the supporting arm Q of the wheel.

In Fig. 19 of the drawings I also show a slightly different arrangement for operating the propeller, and this consists in providing the shaft of the motor with a gear Z that is meshed by a pinion Z^1 carried at the lower end of the shaft Z^2 whose upper end terminates in a hollow sleeve in which is slidingly retained the lower end of a shaft section Z^3 that is connected to the shaft of the propeller by a knuckle joint Z^4. The section Z forms a continuation of the shaft section Z^2 and is prevented from rotation in the sleeve of the latter section by a feather and spline connection. The lower end of the section Z^2 is connected to the shaft of the motor by an arm Z^5 which permits the oscillation of the upper end of the shaft due to the swinging position of the outer end of the propeller shaft when the propeller is shifted to direct the thrust of wind from the propeller at any particular angle according to the direction to be given the ship.

In order to increase the buoyancy of the lower or car section when the latter is resting upon a body of water, the wheels Q^1 and Q^5 are made hollow, so that they will float upon the water and have a tendency to elevate the outer ends of the arms, thereby increasing the buoyancy of the car section, but in order to clear the wheels and especially the front wheel Q^1 from the water so as to decrease the frictional surface, to enable the ship to run rapidly over the surface, I provide cables W^2 which connect the outer ends of the arms and extend to the ends of the car section. When the ship is operating upon the surface, the clutch operating the propeller W is thrown into engagement with the pinion carried by

the end of the propeller shaft and the latter thereby geared direct to the motor that operates the propeller I and when so operating the rear wheels Q^5 are used as tillers to steer the ship through any course.

What I claim is:

1. An air-ship, comprising an upper buoyant section, and a car section, aeroplanes carried by the upper section, a propeller arranged at the center of buoyancy of the said upper section, and means for operating the propeller.

2. An air-ship, comprising an upper buoyant section, and a car section suspended from the upper buoyant section and arranged below the center of buoyancy of the said upper section, aeroplanes carried by the upper section, a propeller arranged at the center of buoyancy of the upper section, and means for operating the propeller.

3. An air-ship, comprising an upper buoyant section, and a lower car section suspended from the upper section below the center of buoyancy of the said upper section, a propeller carried by and arranged at the center of buoyancy of the upper section, aeroplanes carried by the upper section and which are adapted to support the lower section when the propeller is in motion, and means for operating the propeller.

4. An air-ship, comprising an upper buoyant section, a car suspended therefrom and arranged below the center of buoyancy of the said upper section, aeroplanes carried by the upper section, a propeller arranged at the center of buoyancy of the upper section, skegs arranged adjacent to the longitudinal edges of the aeroplanes and adapted to prevent lateral deflection of the air when the ship is navigating, and means for operating the propeller.

5. An air-ship, comprising an upper buoyant section, aeroplanes carried thereby, a propeller arranged at the center of buoyancy of the upper section, and a car suspended from the upper section and arranged below the center of buoyancy of said upper section and below the center of falling resistance.

6. In an air-ship, an upper buoyant section, comprising two elongated floats, aeroplanes arranged between and extending from the floats in the horizontal plane of the centers thereof, a propeller carried by the upper section, a car suspended from the upper section below the center of buoyancy of the said section, and a combined weight measuring and cushioning device carried by the car.

7. In an air-ship, an upper buoyant section, comprising two elongated floats spaced apart and held in parallel position, aeroplanes arranged between and extending from the floats in the horizontal plane of the centers thereof, a propeller carried by the upper section at the center of buoyancy thereof, a car suspended from the upper section below the center of buoyancy of the said section, and a combined weight measuring and cushioning device carried by the car.

8. In an air-ship, an upper buoyant section, comprising two elongated floats, aeroplanes arranged between the floats, means for holding the floats together in parallel position, skegs arranged under the lower forward ends of the floats, skegs arranged at the rear ends and upon the upper and lower sides of the floats in the vertical planes of the centers of the floats, a propeller arranged at the center of buoyancy of the upper section, and a car suspended from the upper section below the center of buoyancy thereof.

9. In an air-ship, an upper buoyant section, comprising elongated double conoidal floats, aeroplanes arranged between the floats, truss bars connecting the floats, skegs arranged adjacent to the aeroplanes to prevent a lateral deflection of the air contacting with the aeroplanes, a propeller arranged at the center of buoyancy of the upper section, and a car suspended from the upper section below the center of buoyancy thereof.

10. In an air-ship, an upper buoyant section, comprising elongated floats adapted for holding a gas that is lighter than the atmosphere, aeroplanes arranged between the floats, vertically arranged skegs carried by the floats adjacent to the longitudinal edges of the planes, vertical rudders arranged adjacent to the rear ends of the skegs at the rear ends of the floats, a propeller arranged at the center of buoyancy of the said upper section, and a car suspended from the said upper section below the center of buoyancy thereof.

11. In an air-ship, an upper section, comprising elongated parallelly arranged floats containing a gas that is lighter than the atmosphere, an aeroplane arranged at the forward ends of the floats, an aeroplane hinged adjacent to the rear ends and adapted to serve as a horizontal rudder, a fixed aeroplane adjacent to the forward end of the said rear aeroplane, skegs carried by the floats adjacent to the longitudinal edges of the aeroplanes, vertical rudders arranged at the ends of the skegs at the rear ends of the floats, means for controlling the position of the vertical rudders, and a car suspended from the said upper section below the center of buoyancy thereof.

12. In an air-ship, an upper buoyant section, comprising elongated floats containing a gas that is lighter than the atmosphere, bulkheads arranged in the floats to provide a series of gas-tight compartments, aeroplanes arranged between the floats and lengthwise thereof, skegs carried by the floats in the vertical planes of the centers thereof, rudders arranged at the ends of the skegs at the rear ends of the floats, a propeller arranged in the upper section at the center of buoyancy

thereof, means for controlling the position of the propeller, a car suspended from the upper section below the center of buoyancy thereof, and cushioning devices carried by the car.

13. In an air-ship, an upper buoyant section, comprising elongated floats containing a gas that is lighter than the atmosphere, bulkheads arranged in the floats to provide a series of gas-tight compartments, aeroplanes arranged between the floats lengthwise thereof, skegs carried by the floats in the vertical planes of the centers thereof, rudders arranged at the ends of the skegs at the rear ends of the floats, a propeller arranged in the upper section at the center of buoyancy thereof, means for controlling the position of the propeller, a car suspended from the upper section below the center of buoyancy thereof, means for registering the weight of the car when the latter is resting upon the ground, and means for ascertaining the weight of the car when the latter is resting upon a body of water.

14. In an air-ship, an upper buoyant section, comprising elongated double-conoidal floats, arranged in parallel position, an aeroplane arranged at the forward ends thereof, an aeroplane hingedly supported adjacent to the rear ends of the floats, a fixed aeroplane at the forward end of the said hinged aeroplane, skegs carried by the floats, vertical rudders arranged at the ends of the skegs at the rear ends of the floats, means for controlling the position of the hinged aeroplane, means for controlling the position of the rudders, a propeller journaled in the upper section, means for operating the propeller to direct the thrust of air therefrom in a direct downward position, rearwardly, or at an angle intermediate the vertical and rearward direction of thrust, a car suspended from the upper section below the center of buoyancy thereof, and a combined weight measuring and cushioning device carried by the car.

15. In an air-ship, an upper buoyant section comprising elongated floats arranged in parallel position, truss bars connecting the floats, aeroplanes arranged between the floats, truss bars connecting the floats and extending therefrom from points adjacent to the centers of gravity of the floats, bars supporting journal bearings connecting the last mentioned truss bars, a ring journaled in the bearings, a propeller carried by the ring, a car suspended from the upper section below the center of buoyancy thereof, a motor carried by the car, means for transmitting motion from the motor to the said propeller, and means for controlling the position of the said ring.

16. In an air-ship, an upper buoyant section, comprising elongated floats, partitions or bulkheads arranged therein which divide the floats into a series of compartments adapted to contain a gas that is lighter than the atmosphere, aeroplanes arranged between the floats in the horizontal plane of the centers of the floats, skegs arranged adjacent to the longitudinal edges of the aeroplanes, vertical rudders arranged adjacent to the skegs at the rear ends of the floats, means for operating the rudders, an aeroplane arranged horizontally between the floats adjacent to the rear ends thereof and adapted to serve as a rudder, means for operating said aeroplane as a horizontal rudder, truss bars connecting the floats, a ring supported by the truss bars projecting from the floats at points opposite the center of gravity thereof, a propeller carried by the ring, a car suspended from the floats below the center of buoyancy thereof, a motor carried by the car, driving belts connecting the motor and the propeller, and guide pulleys for the belts.

17. In an air-ship, an upper buoyant section, comprising longitudinally arranged floats containing a gas that is lighter than the atmosphere, aeroplanes held between the floats, an aeroplane hinged adjacent to the rear ends of the floats and adapted to form a horizontal rudder, skegs carried by the floats, vertical rudders at the ends of the skegs at the rear ends of the floats, truss bars connecting the floats, journal bearings supported by the truss bars projecting from the floats at points adjacent to the centers of gravity thereof, a ring having hollow trunnions journaled in the bearings, a propeller carried by the ring, belt pulleys carried by the propeller, a car suspended from the upper section, a motor carried by the car and having a drive pulley, belts operating over the drive pulley and extending through the trunnions and around the pulleys of the propeller, guide pulleys arranged in the said trunnions, and guide pulleys adjacent to the pulleys in the said trunnions.

18. In an air-ship, an upper section comprising elongated floats each of which is constructed of a series of ribs whose centers are arranged in longitudinal alinement, fabric sections connecting the ribs to provide gas tight sections, longitudinally arranged battens or brace rods connecting the ribs of the floats exteriorly of the fabric sections, truss wires connecting the ribs inside of the fabric sections, truss bars connecting the floats to hold them in parallel position, aeroplanes arranged between the floats, skegs carried by the floats adjacent to the longitudinal edges of the aeroplanes, a propeller arranged at the center of buoyancy of the said upper section, and a car suspended from the said upper section below the center of buoyancy thereof.

19. In an air-ship, a buoyant section, comprising elongated floats each of which is constructed of a series of ribs having laterally projecting, annular, grooved flanges adjacent to their outer edges, fabric sleeve sec-

tions arranged intermediate the adjacent faces of the ribs and having their ends secured to said grooved flanges, cone shaped fabric sections forming the ends of the floats and having their inner ends secured to the grooved flanges of the end ribs of the floats, battens or brace rods connecting the ribs of each float exteriorly of the sleeve sections, truss wires connecting the ribs interiorly of the sleeve sections, truss bars connecting the floats to hold them in parallel position, aeroplanes arranged between the floats, a car suspended from the upper section below the center of buoyancy thereof, and a combined cushioning and weight measuring device carried by the car.

20. An air - ship, comprising an upper buoyant section, a car section suspended from the upper buoyant section below the center of buoyancy thereof, aeroplanes carried by the upper section, a propeller arranged at the center of buoyancy of the said upper section, means carried by the car section for operating the propeller, arms journaled intermediate their ends to the car section, wheels carried at the outer ends of the arms, and a balance connecting the inner ends of the arms which is adapted to register the weight of the said lower section to facilitate the adjustment of the ship prior to making an ascent.

21. An air - ship, comprising an upper buoyant section, a car section suspended from the upper section below the center of buoyancy thereof, aeroplanes carried by the upper section, a propeller arranged at the center of buoyancy of the said upper section, means carried by the lower section for operating the propeller, a combined cushioning and weight measuring device carried by the car section, which comprises arms pivotally held intermediate their lengths to the ends of the car, a balance carried by the car, cables extending from the balance to the inner end of the arms, and buoyant wheels carried at the outer ends of the arms.

22. An air - ship, comprising an upper buoyant section, a car section suspended from the upper section below the center of buoyancy thereof, aeroplanes carried by the upper section, a propeller carried by the upper section, means carried by the lower section for operating the propeller, an arm pivoted intermediate its length to the forward end of the car, a wheel journaled in the outer end of the arm which is adapted to rotate in one direction only, arms pivoted intermediate their lengths to the rear end of the car, caster wheels carried at the outer ends of the arms, a balance carried by the car, and cables extending from the balance and connected to the inner ends of all of the aforesaid arms.

23. An air - ship, comprising an upper buoyant section, a car suspended from the upper section below the center of buoyancy thereof, aeroplanes carried by the upper section, a propeller adjustably held at the center of buoyancy of the said upper section, means carried by the lower section for operating the propeller, and a canopy arranged above the car for the purpose specified.

24. In an air-ship, an upper buoyant section, aeroplanes carried by the upper buoyant section, a propeller arranged at the center of buoyancy of the said section, a car suspended from the said section below the center of buoyancy, and a gable-shaped canopy arranged above the car in the path of the downward thrust of the propeller.

25. A float for an air-ship of the kind described, constructed of a plurality of rings or ribs each of which is provided upon its opposite sides with annular flanges having peripheral grooves, sleeve sections arranged between the intermediate rings or ribs and having their ends securely held within the grooves to provide gas-tight joints, cone-shaped sections forming the ends of the float and having their inner ends connected to the flanges of those rings or ribs which are arranged at the ends of the floats, longitudinal battens connecting the rings or ribs, truss wires connecting the rings or ribs, partitions arranged in the float to provide a series of compartments, and valved tubes connected to the sleeves through which the compartments may be inflated.

In testimony whereof I have hereunto set my hand this 11th day of December A. D. 1907.

SIMON LAKE.

Witnesses:
MERCER D. BLONDEL,
H. D. JAMESON.