No. 787,181. PATENTED APR. 11, 1905.

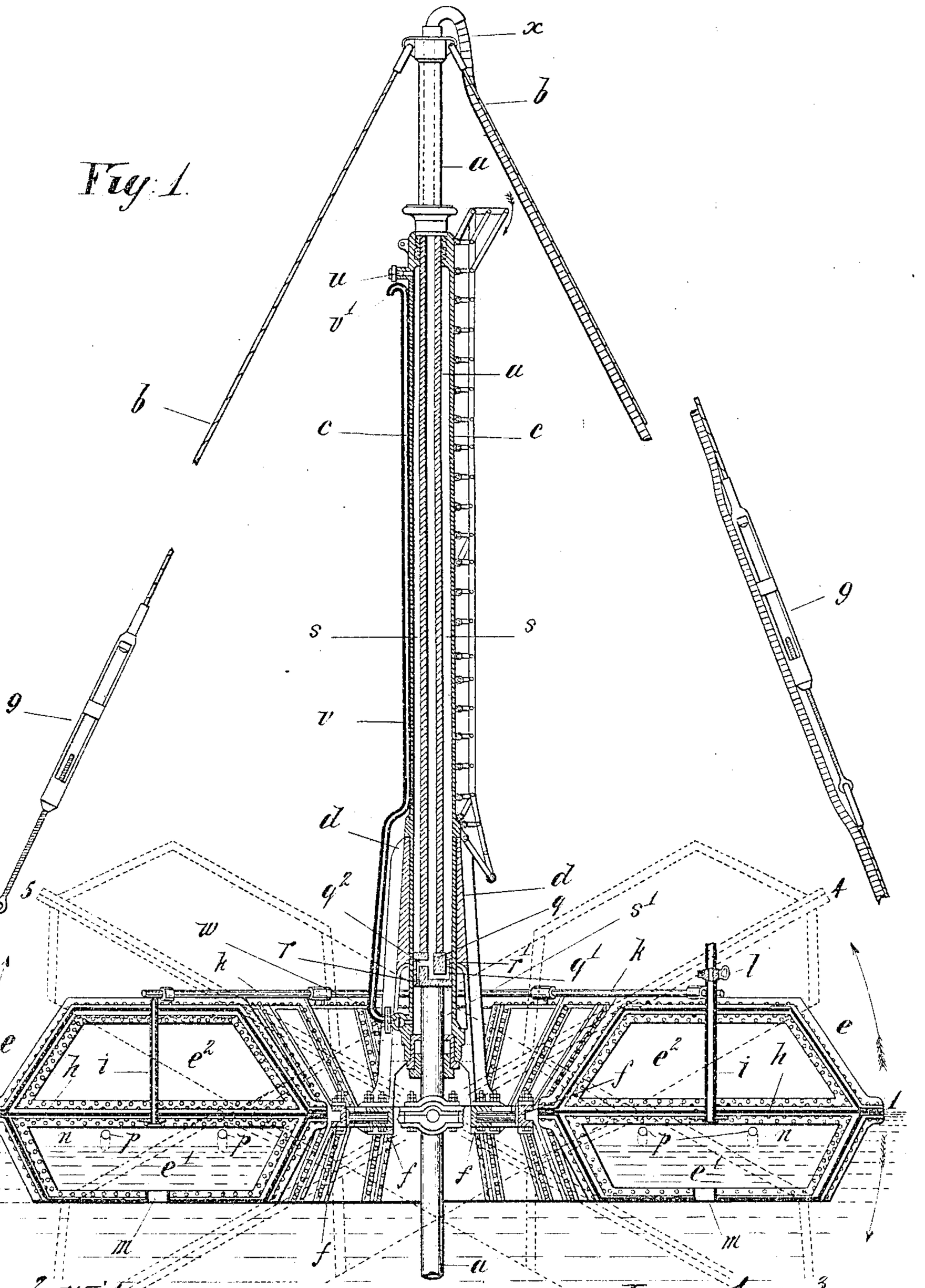
J. HUTCHINGS.

WAVE MOTOR.

APPLICATION FILED JAN. 30, 1905.

3 SHEETS—SHEET 1.

Fig. 1.



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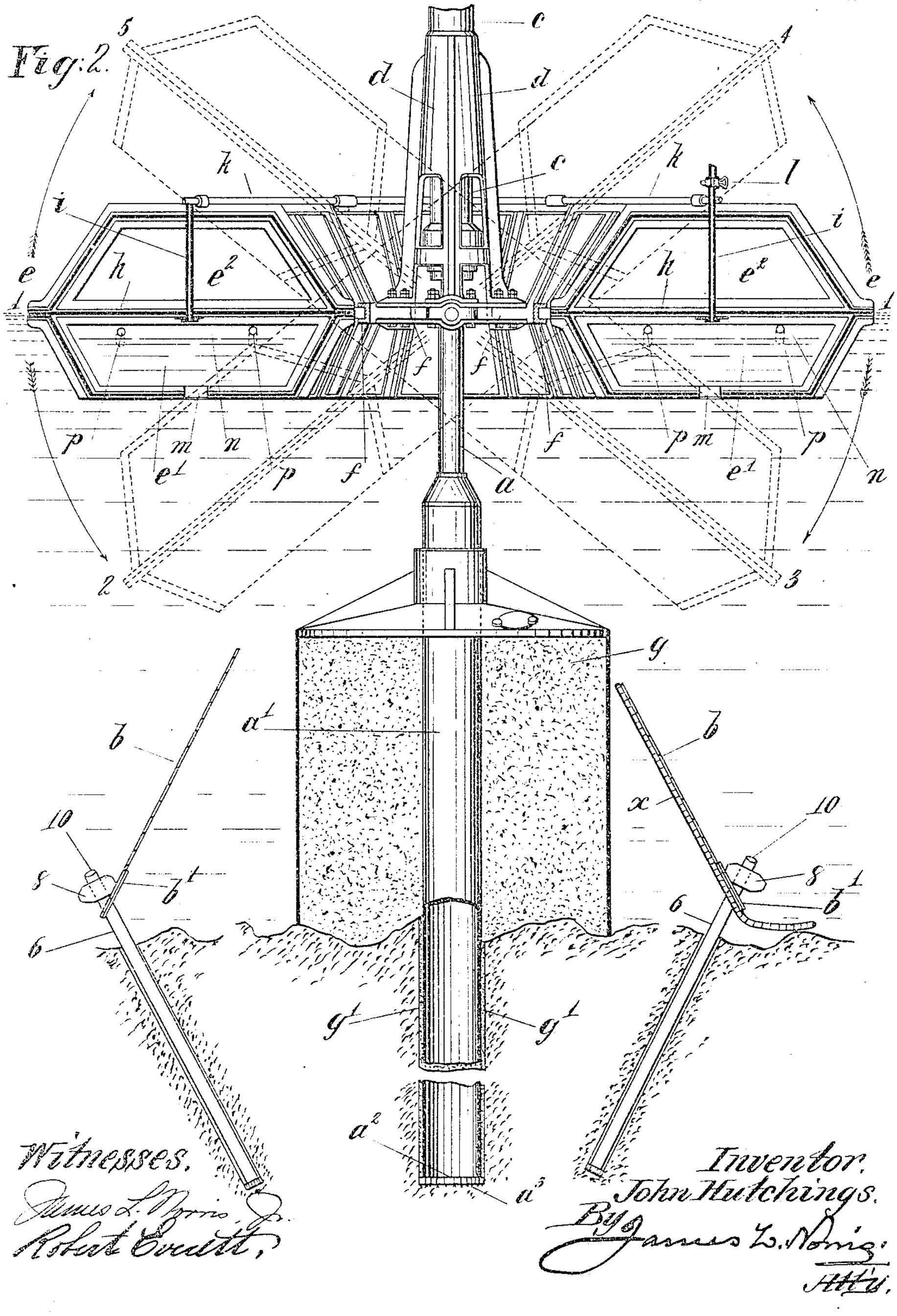
3 SHEETS—SHEET 2.

Fig. 2.



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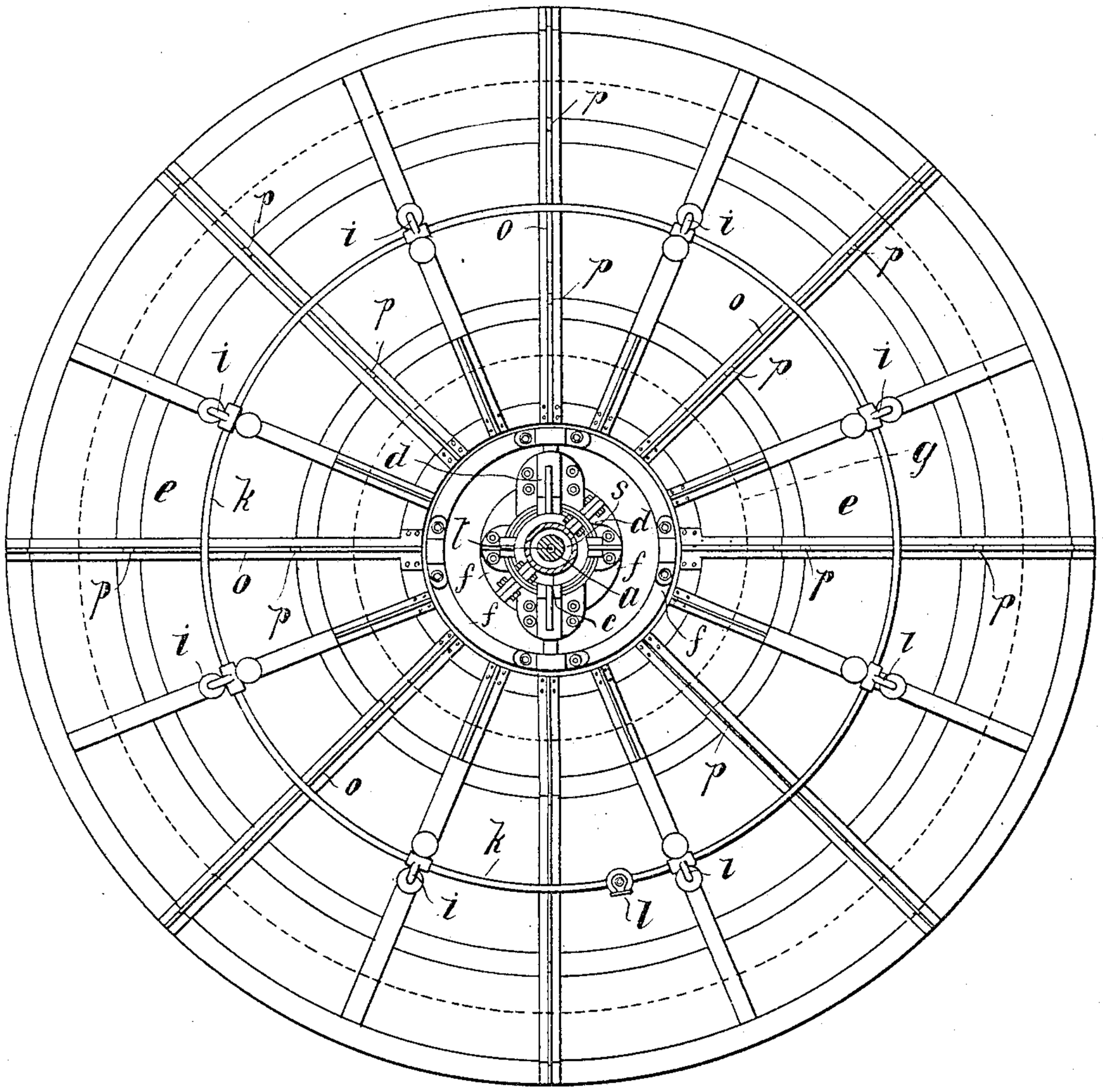
3 SHEETS—SHEET 3.

Fig: 3.



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UNITED STATES PATENT OFFICE.

JOHN HUTCHINGS, OF LONDON, ENGLAND.

WAVE-MOTOR.

SPECIFICATION forming part of Letters Patent No. 787,181, dated April 11, 1905.

Application filed January 30, 1905. Serial No. 243,358.

To all whom it may concern:

Be it known that I, JOHN HUTCHINGS, engineer, a subject of the King of Great Britain, residing at 210 Moorgate Station Chambers, in the city of London, England, have invented certain new and useful improvements in and relating to means and apparatus for generating motive power from the movements of tides, waves, or the like, of which the following is a specification.

In the generation of motive power it is customary to burn coal, wood, petroleum products, or other materials, such as gases, for driving engines or other motors or machinery or the like. By this invention I provide means for obtaining motive power wherewith to drive engines, motors, or the like from the movements of tides or waves in the ocean, in inland seas, river estuaries, or tidal rivers.

The accompanying drawings, Figures 1 and 2 section and sectional elevation, respectively, and Fig. 3 a plan, will illustrate the working of this invention.

The apparatus for effecting the above-mentioned objects mainly consist of the following parts.

A mast of steel or other suitable material *a*, supported by steel or like guy-ropes *b*, Figs. 1 and 2, having affixed a surrounding moving cylinder *c*, a cylindrical carrying-cradle *d*, a pair of gimbal-ring bearings *f f*, each fitted with two trunnions, a combined surrounding circular power-buoy and water-tank *e*, and concrete containing-tank and foundation-support *g* at the base of the steel mast. When the apparatus has been fixed and the water-tank and power-buoy launched into the water, both the water-tank *e'* and the air-buoy e^2 may contain air.

To obtain an equality of pressure in the cylinder *c*, it is necessary that the falling weight of the moving parts should be equal to the buoyancy caused by the air confined in the buoy e^2. This is necessary if an equality of pressure is to be attained in both the upward and downward movements of the cylinder *c*. To effect this adjustment of the balance, the water-tank *e'*, Figs. 1 and 2, should contain sufficient water to cause its submersion until the dividing-plate *h* between the water-tank and power-buoy is on a level with the water-line 1 1. To effect this with minute accuracy, the pipes *i i* are fixed to the dividing-plate *h*, with air-tight joints passing vertically through the air-buoy e^2, thence connected with the certain connecting or equalizing pipes *k k*, which circumscribe the horizontal plane of the top of the air-buoy e^2. Onto these pipes *k k* is fixed a suitable turn cock or valve *l*. By opening this cock or valve *l* air is allowed to escape from the water-tank *e'*, when water is admitted in its place through the bottom apertures *m m* until the dividing-plate *h* is on a level with the water-line 1 1. Thus it will be seen that when the dividing-plate *h* is on a level with the water-line 1 1 a certain amount of air may still be in the upper portion of the water-tank in the position indicated by *n n*. The buoyancy of this air will be equal to the weight of the material forming the combined buoy and water-tank and also the weight of the other constructional material resting upon the buoy, including the cylinder *c*, the cradle *d*, and all the fittings and gimbal-bearings *f f*, and, further, that this weight plus or added to the weight of the water in the tank *e'* will be equal to the buoyancy obtained by the confined air in the buoy e^2 and that by this means of balancing the materials of construction of the moving parts with the buoyancy of the air in the buoy e^2 a pressure is obtained in the compression-cylinder when the buoy rises equal to the pressure obtained when the buoy falls through the weight of material added to the water in the tank *e'*, and that by means of drawing off or pumping air into the water-tank *e'* through the cock or valve *l* and the communicating pipes *i i* and *k k* the equal pressure efficiency caused by the generating moving parts may always be minutely adjusted. The water-tank *e'* and air-buoy e^2 are in the particular embodiment presented divided into eight compartments by vertical partitions radiating from the common center of the mast *a*, fixed by riveted and calked joints (shown on plan, Fig. 3) in the positions indicated at *o*; but any other convenient number of such compartments may be employed. These partitions act as

braces or stays, and the compartments between them are connected in the top portion of the water-tank e' by appropriate passages p p.

The piston-ring q, Fig. 1, is fixed permanently onto the mast a and is provided with passages through it, as shown at q' q^2, which enables communication through automatic valves r r' between the compression chamber or cylinder s s' and the passage t through the vertical center of the mast a. By this arrangement air is compressed (by the movement of the buoy and water-tank) inside the compression cylinder or chamber s s' and is thence forced through the appropriate passages in the piston-way q' q^2 through the valves r r' into the conducting-passage t of the mast. This operation is effected when the power-buoy and water-tank are moved by the action of the water in which they float. Thus when the cylinder c c is lifted upward by the power-buoy e sliding on the mast a the air contained in the lower end s' of the compression-cylinder is compressed and forced through the valve r into the passages q^2 and t of the mast a. During this operation air is drawn into the upper portion s of the compression-cylinder through an automatically-operating intake-valve u, and at the same time the valve r' is automatically kept closed. Similarly when the cylinder c falls in a downward direction, caused by the movement of the power-buoy e, the air contained inside the top portion s of the compression-chamber is compressed and forced through the valve r' into the connecting-passage q', thence into the passage t of the mast a, and during this operation air is drawn into the lower portion s' of the compression chamber or cylinder through a pipe v, entering the upper end v', thence through the automatic valve w into the lower part of the cylinder s, as above mentioned. During this operation the valve r is automatically closed. The air so compressed passes out from the passage t of the mast a into the flexible metallic or like pipe x, which is attached and carried down to any point required for use by or along the steel guy-wire b or its equivalent.

The dotted lines 2, 3, 4, and 5 represent the movements of the power-buoy and water-tank during stormy weather, illustrating the wide scope of movement obtained by the use of gimbal-ringed bearings which will allow the tanks and the buoy e free play at any angle from the horizon up to the extreme ever reached, as shown at 2, 3, 4, and 5, Figs. 1 and 2.

The mast a may be of any suitable size and may be fixed to the bottom of the ocean, lake, or river by means of a diamond-drill boring-head being fixed to the bottom a^2 of the tubular mast a, (shown in Fig. 1,) being provided with diamonds or like boring devices a^3, and thereby bored into a rock or other bottom to any desired depth.

The supporting steel guy-wires b of the mast a are fixed by looped ends b', looped around and fixed to the backstay anchor-rods 6. These anchor-rods 6 are fixed and bored into the bottom of the sea or other place to any depth required by means of diamond-drill boring-heads, and when the required depth has been reached by the anchor-rods 6 they are disconnected at 10 from the driving ends above the surface of the water, the projecting end 10 being then preferably fitted with metallic oval-shaped bossed lugs 8, allowing the looped ends of the mast-guys to be easily slipped over them and held firmly. When the loops of the guys have been thus attached, the screwed shackles and swivels 9 are then screwed up, thus tightening and firmly holding the whole of the fixed stationary part of the apparatus.

The concrete cylinder g, provided with elongated rivet-holes to allow of the free expansion of the contained concrete, is fixed around the mast at a' as a base-support. Air is forced into this cylinder when fixed into position for the purpose of forcing the water out, and concrete is then deposited into the cylinder, forced down into it, and also forced down into the clearance-hole g' to hold the mast quite firmly into position in its submarine rock or other socket.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. An apparatus for applying motive power derived from the rise and fall of the waves of the sea and like movements of water and for transmitting such power to the pistons and cylinders of pumps for use in forcing fluids, consisting of a floating vessel subject to movements of the medium it floats in, a mast, fixed at base in the bed of the water-channel and passing up through the float, means—as guy-ropes and anchors—for maintaining the mast in upright position, a piston and piston-valves fixed on the mast, as on a piston-rod; a discharge-passage through said mast for conveying away to any suitable place for utilization the fluid compressed, a cylinder surrounding the piston portion of the mast and packings above and below the piston to make tight joints between cylinder and piston-support, an intake-pipe for air-delivering below the piston and a like intake-pipe delivering above the piston, each provided with non-return valves, gimbal-bearings supporting said floating vessel, and an annular bearing connected to the gimbal and surrounding the mast and cylinder to keep the parts in relative position, and means for adjusting the quantity of water-ballast contained in the water-chamber of the floating vessel for equalizing the upward and downward pressures of the cylinder upon the contained fluid.

2. In an apparatus for generating motive

power from the movements of water a piston supported on a mast as a piston-rod and fitted in a cylinder, valves and intakes for controlling and supplying fluid to be forced, means for rigidly supporting the mast in position in the water, means for delivering and controlling the delivery of the forced fluid in combination with a buoyant vessel connected to and giving reciprocatory motions to the pump-cylinder as that vessel is raised and lowered by the rise and fall of the water in which it floats, gimbal-bearings connecting said buoyant vessel and the cylinder directly, so as to exert the force of the rise and fall of the buoy directly upon the fluid forced and means for adjustably weighting said buoyant vessel.

3. In an apparatus for the generation of motive power from the movements of rising and falling water a piston, a fixed support for said piston, rising through the water, and means for staying said support in fixed position in combination with a buoyant vessel borne upon the rising and falling water, a cylinder fitting said piston and provided with packings which close it above and below the pistons, intakes and valves controlling same, outlets and valves controlling delivery and a cradle connection with gimbals to connect the rising and falling and rocking buoyant vessel with the pump-cylinder to impart to it reciprocations directly and positively.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOHN HUTCHINGS.

Witnesses:

ALFRED GEORGE BROOKES,

JOHN COODE FLORE.