

(No Model.)

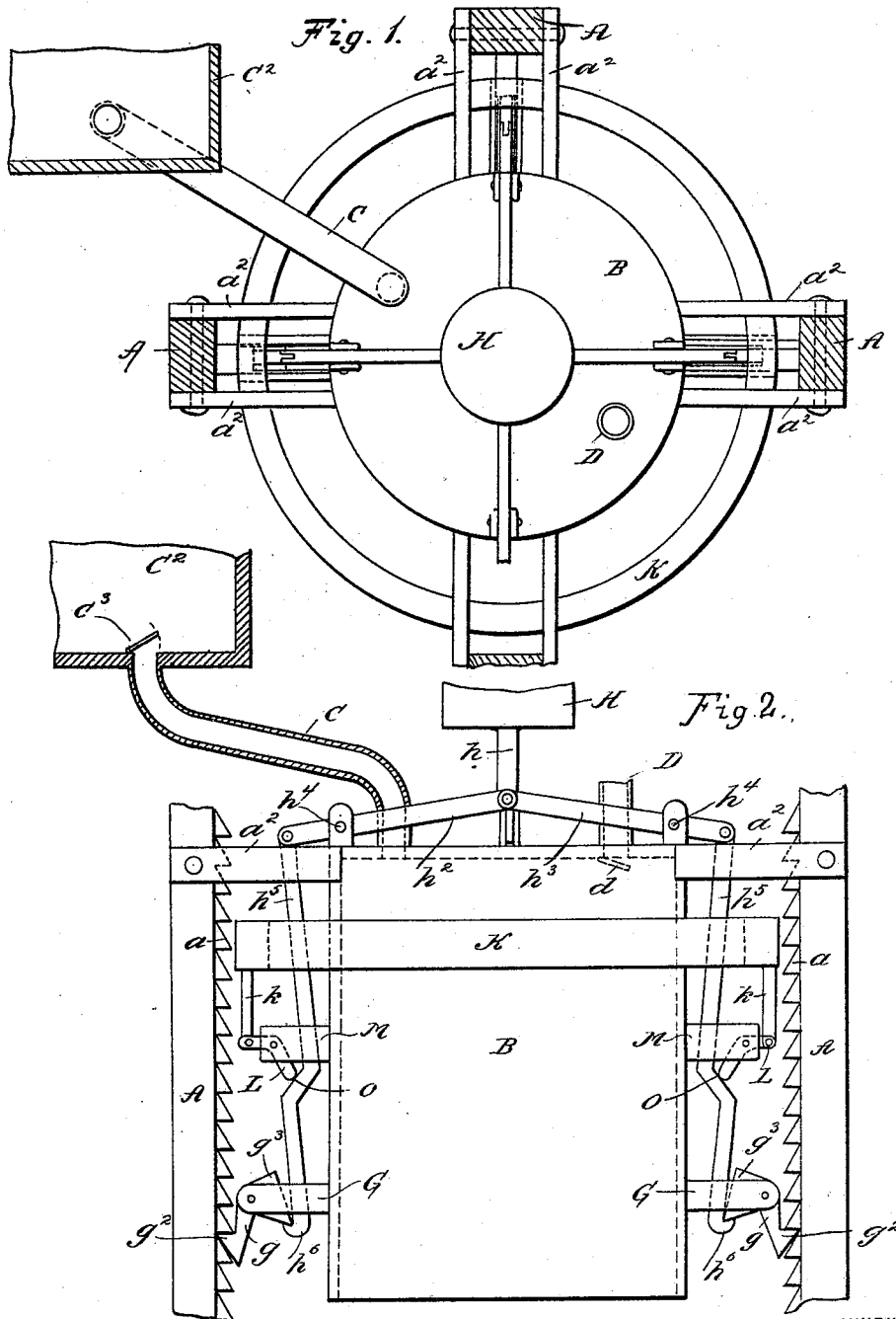
2 Sheets—Sheet 1.

F. C. LITTLE.

APPARATUS FOR UTILIZING WAVE POWER.

No. 570,223.

Patented Oct. 27, 1896.



WITNESSES

C. Voroffen

Chas. S. Rogers

INVENTOR

Francis C. Little

Edgar Tate

ATTORNEYS

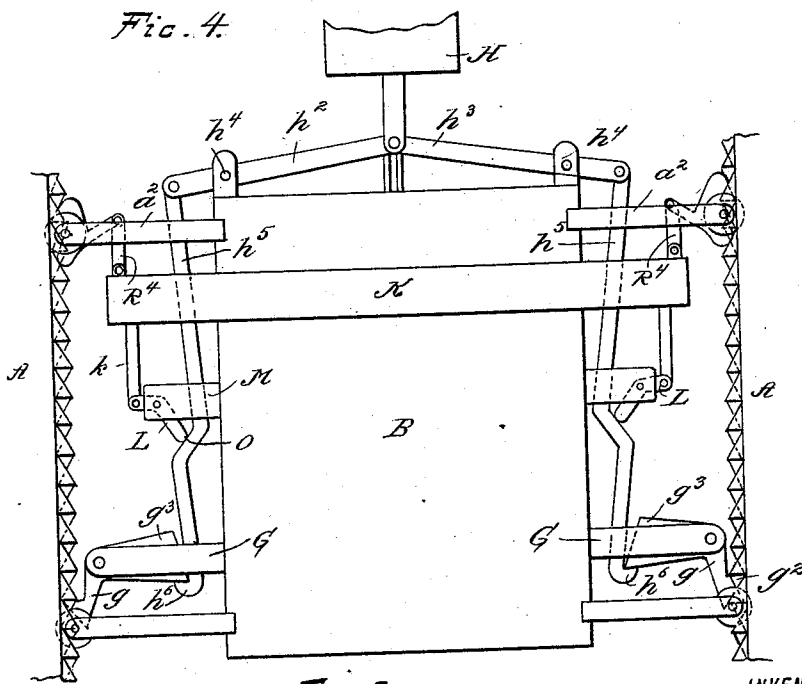
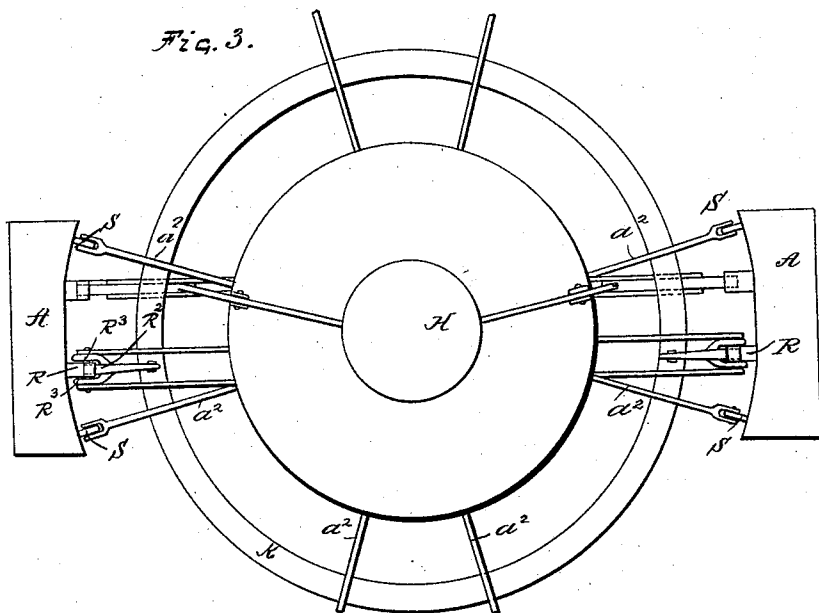
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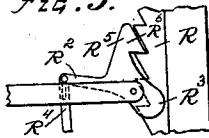
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WITNESSES

C. Tordoff
Chas. Rogers

Fig. 5.



INVENTOR

Francis C. Little
BY
Edgar Tate
ATTORNEYS

UNITED STATES PATENT OFFICE.

FRANCIS CUMMINGS LITTLE, OF PORTLAND, OREGON.

APPARATUS FOR UTILIZING WAVE-POWER.

SPECIFICATION forming part of Letters Patent No. 570,223, dated October 27, 1896.

Application filed April 22, 1896. Serial No. 588,599. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS CUMMINGS LITTLE, a citizen of the United States, and a resident of Portland, in the county of Multnomah and State of Oregon, have invented certain new and useful Improvements in Apparatus for Utilizing Wave-Power, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof, in which similar letters of reference indicate corresponding parts.

This invention relates to apparatus for utilizing the wave-power of the sea; and the object thereof is to provide an apparatus of this class which is adapted to compress the air and to force it into a tank from which it may be taken under pressure and utilized for any desired purpose, such as running of light machinery and for similar purposes; and with this and other objects in view the invention consists in the construction, combination, and arrangement of parts hereinafter described and claimed.

The invention is fully disclosed in the following specification, of which the accompanying drawings form a part, in which—

Figure 1 is a plan view of the apparatus which I employ, parts thereof being shown in section; Fig. 2, a side view, in which parts of the apparatus are also in section; Fig. 3, a plan view of a modified form of construction; Fig. 4, a side view thereof, and Fig. 5 a side view of a detail of the construction.

In the practice of my invention I provide three or more uprights or posts A, but two of which are shown in the drawings, and on the inner side of each of these uprights or posts is a rack-bar a , the teeth of which are projected downwardly, and these uprights or posts are rigidly and firmly secured to the bottom of the sea adjacent to the coast at any desired point. I also employ a hollow float B, which may be composed of any desired material and be of any preferred form, but which is preferably cylindrical in form, and the top of which is closed and the bottom open, and communicating with the top of the float B at one side is a pipe C, which communicates with a tank or other vessel C^2 , and the end of the pipe C, which communicates with the tank C^2 , is provided with a valve C^3 , which opens outwardly or into said tank, and I also employ

another pipe D, which constitutes an air-inlet, and the end thereof, which communicates with the float B, is provided with a valve d , which opens inwardly or into the float.

The posts or uprights A are provided with side bars a^2 , which serve as guides for the float, and which are adapted to hold the same in a central position while permitting of the free vertical movement thereof, and connected with each side of the float, near the bottom thereof, are outwardly-directed arms or projections G, which are arranged in pairs, and between each pair is pivoted a lever g , provided with a head on which is formed a projection g^2 , which is adapted to operate in connection with rack-bars a , and the inner ends of the levers are weighted or enlarged, as shown at g^3 , so as to serve as weights.

I also employ a supplemental float H, which may be composed of any desired material or constructed in any desired manner, and which is provided with a depending rod h , to which is pivotally secured two levers h^2 and h^3 , which project in opposite directions, and which are fulcrumed or pivoted at h^4 to standards secured to the float B, and the outer ends of each of the levers h^2 and h^3 is provided with depending rods or bars h^5 , and the lower ends of these levers are provided with outwardly-directed heads h^6 , which are adapted to operate in connection with the weighted ends of the levers g^3 , and I also employ an auxiliary float K, which is circular in form, and within which the float B is placed, and the rods or bars h^5 are suspended therethrough, and secured to the opposite sides of the float K are depending arms or rods k , to each of which is pivotally secured a crank-lever L, said crank-levers being pivotally connected with and supported by arms or projections M, which are arranged in pairs at each side of the float, and the lower ends of the crank-levers L are adapted to operate in connection with an inclined portion or shoulders or projections O, formed on the rods or bars h^5 .

It will be understood, as hereinbefore stated, that three or more of the uprights or posts A are employed, and that each of these uprights or posts is provided with the arms a , by which the central float B is guided, and, if necessary or desirable, the projections or arms G and M may be duplicated to correspond with the

uprights or posts A, as may also the other features of the construction.

The operation will be substantially as follows: As the water-level sinks after each incoming wave the floating cylinder B will sink with it, guided by the arms *a*, and ordinarily the cylinder or float will be free to move downwardly, but not to move upwardly, and when the water-level rises by the reason of an incoming wave the float B is held down by the levers *g* operating in connection with the rack-bars.

The cylinder or float B is full of air when floating freely, as there is a valve *d* opening inwardly from the pipe D, which communicates with the outside atmosphere, and the cylinder or float being held down as the water rises it compresses the air therein, the valve *d* closing to prevent the escape thereof, and the valve C³ opens, allowing the compressed air to pass into the tank C³ whenever the pressure within the cylinder or float becomes greater than the pressure in said tank.

In order to have this apparatus work when the tide is rising or when the waves are of unequal or unusual height, the ratchet-levers would have to be released so as to allow the cylinder to rise a short distance after the valve C³ closes, so that the cylinder or float could adjust itself to the low-water mark of the successive waves, which might not be as low as that of the previous ones, and for this purpose I provide the floats H and K and the rods or bars *h*⁵ and the connected parts *k* and L.

When the water-level sinks below the float H, said float will sink by its own weight, and this operation raises the rods or bars *h*⁵, which thus releases the ratchet-levers *g*, as will be readily understood, from the rack-bars on the uprights or posts, and the cylinder or float B immediately rises to its proper position, but before it reaches said position the float K will rise out of the water and in the downward movement of the float K the levers L will be caused to impinge against the inclined portions or shoulders or projections O of the rods or bars *h*, and this operation will again free the heads *h*⁶ of said rods or bars from the weighted ends of the levers *g*³, and thus free said ratchet-levers from their connection with the rack-bars on the posts or uprights A.

When the water again submerges the floats H and K, they will assume the position shown in Fig. 1, and the said rods or bars *h*⁵ will move downwardly and again engage with the ratchet-levers *g*. This operation will be repeated as long as the apparatus is in operation, and by means thereof it will be apparent that the air will be continually compressed and forced into the tank C² and may be employed for any desired purpose.

The cylinder or float B may sometimes be carried down a few notches by the downrush of the waves on the top thereof in spite of the fact that it is lighter than the water and will float, and to obviate this objection I provide

a modified form of construction, which is shown in Figs. 3, 4, and 5, and which consists of an additional rack-bar R, which is secured to the uprights or posts A, and pawls or levers R², which are provided with double heads or projections R³, and which are connected with vertical rods R⁴, which are pivotally connected with a float K. The teeth on the rack-bar R are directed upwardly and the lever R² is provided with an upwardly-directed head R³, having an outwardly-directed shoulder R⁶, which is adapted to operate in connection with said rack bar or bars, and the ratchet-lever R² is above the float K, and is set when the float K rises, and is released only when said float is out of water.

The vertical rods R⁴, by which the ratchet-levers R² are connected with the float K, are slotted at their upper ends, so as to provide a loose joint or coupling with said lever, in order that the machine may move upwardly, and this lever moves along the teeth without disturbing the float, and the ratchet-lever R² will of course permit of the upward movement of the machine at any time, but will only permit the downward movement thereof while the float K is out of water and therefore at its lowest point, and when the float K is in this position it will pull the ratchet-lever R² entirely free from the rack-bar R, and the first ratchet, or that hereinbefore described, will permit of a downward movement at any time, but will only permit of an upward movement of the float or machine when the float H is out of water and the float K still submerged.

In this construction the uprights or posts A differ in form from that shown in Figs. 1 and 2, and two of the arms *a*² are employed on each side, and said arms are provided with wheels or rollers S, which are adapted to bear on the adjacent sides of the uprights or posts and to form antifriction-guides by which the float or machine is regulated or retained in proper position between said uprights or posts.

The other features of construction are the same as shown in Figs. 1 and 2, and it will be apparent that a number of these machines may be arranged together and located in or inclosed by V-shaped piers which will serve as guards or protectors therefor.

My improved wave-power apparatus may be operated by the waves of any large body of water, and suitable piers may be employed in connection therewith, to which the uprights or posts may be attached, and the apparatus is simple in construction and operation and well adapted to accomplish the result for which it is intended; and my invention is not limited to the exact form, construction, and arrangement of parts herein shown and described, and I reserve the right to make all such alterations in and modifications of the same as fairly come within the scope of the invention.

Having fully described my invention, I

claim as new and desire to secure by Letters Patent—

1. In an apparatus designed for utilizing the wave-power of the sea, and for compressing air, the combination of vertical posts or uprights, a hollow float arranged between the same, the top of which is closed and the bottom open, an air-supply pipe communicating therewith, and provided with an automatic valve which opens inwardly, and a compressed-air pipe communicating therewith, and with an air-tank and provided with a valve which opens outwardly, said float being adapted to rise and fall with the motion of the waves, substantially as shown and described.

2. In an apparatus for utilizing the wave-power of the sea, by compressing air, the combination with suitable uprights or posts, of a hollow float which is mounted between said uprights, and which is held in position by guides connected therewith, and the top of which is closed and the bottom, open, of an air-supply pipe which communicates therewith, an air-discharge pipe also communicating therewith, and with an air-tank, and means connected with said float and said uprights or posts by which the float is adapted to rise and fall with the motion of the waves, substantially as shown and described.

3. In an apparatus for utilizing the wave-power of the sea, by compressing air, the combination with suitable uprights or posts, of a hollow float which is mounted between said uprights, and which is held in position by guides connected therewith, and the top of which is closed, and the bottom open, of an air-supply pipe which communicates therewith, an air-discharge pipe also communicating therewith, and with an air-tank and means connected with said float and said uprights or posts by which the float is adapted to rise and fall with the motion of the waves, said float being also provided with a supplemental float which is arranged thereover, and with which are pivotally connected levers which extend in opposite directions, and which are fulcrumed to standards secured to the float, said levers being pivotally connected at their outer ends with depending rods or bars, the lower ends of which are provided with heads which are adapted to operate in connection with ratchet-levers which are adapted to operate in connection with rack-bars, formed on the uprights, or posts, substantially as shown and described.

4. In an apparatus for utilizing the wave-power of the sea, by compressing air, the combination with suitable uprights or posts, of a hollow float which is mounted between said uprights, and which is held in position by guides connected therewith, and the top of which is closed, and the bottom, open, of an air-supply pipe which communicates therewith, an air-discharge pipe also communicating therewith, and with an air-tank and means connected with said float and said uprights or posts by which the float is adapted to rise and fall with the motion of the waves, said float being also provided with a supplemental float which is arranged thereover, and with which are pivotally connected, levers which extend in opposite directions, and which are fulcrumed to standards secured to the float, said levers being pivotally connected at their outer end with depending rods or bars, the lower ends of which are provided with heads which are adapted to operate in connection with ratchet-levers which are adapted to operate in connection with rack-bars, formed on the uprights or posts, and an auxiliary float which incloses the main float, and which is provided at its opposite sides with depending arms or rods with which are pivotally connected crank-levers which are pivotally supported by arms or projections, secured to said float and which are adapted to operate in connection with shoulders or projections formed on the rods or bars which are connected with the supplemental float, substantially as shown and described.

5. In an apparatus designed for utilizing the wave-power of the sea, by compressing air, the combination with vertical posts or uprights, of a hollow float arranged between the same, the top of which is closed, and the bottom open, and the top of which is provided with means for supplying air thereto, and with an air-tank which communicates therewith, and means connected with said float and said uprights for regulating the movement of the float, and for causing the same to rise and fall with the waves, substantially as shown and described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of the subscribing witnesses, this 10th day of March, 1896.

FRANCIS CUMMINGS LITTLE.

Witnesses:

F. MCKERCHER,
MICHAEL O'DONNELL.