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Patented Aug. 30, 1898.

J. E. & W. ARMSTRONG.
WAVE POWER PUMPING APPARATUS.

(Application filed Nov. 11, 1897.)

(No Model.)

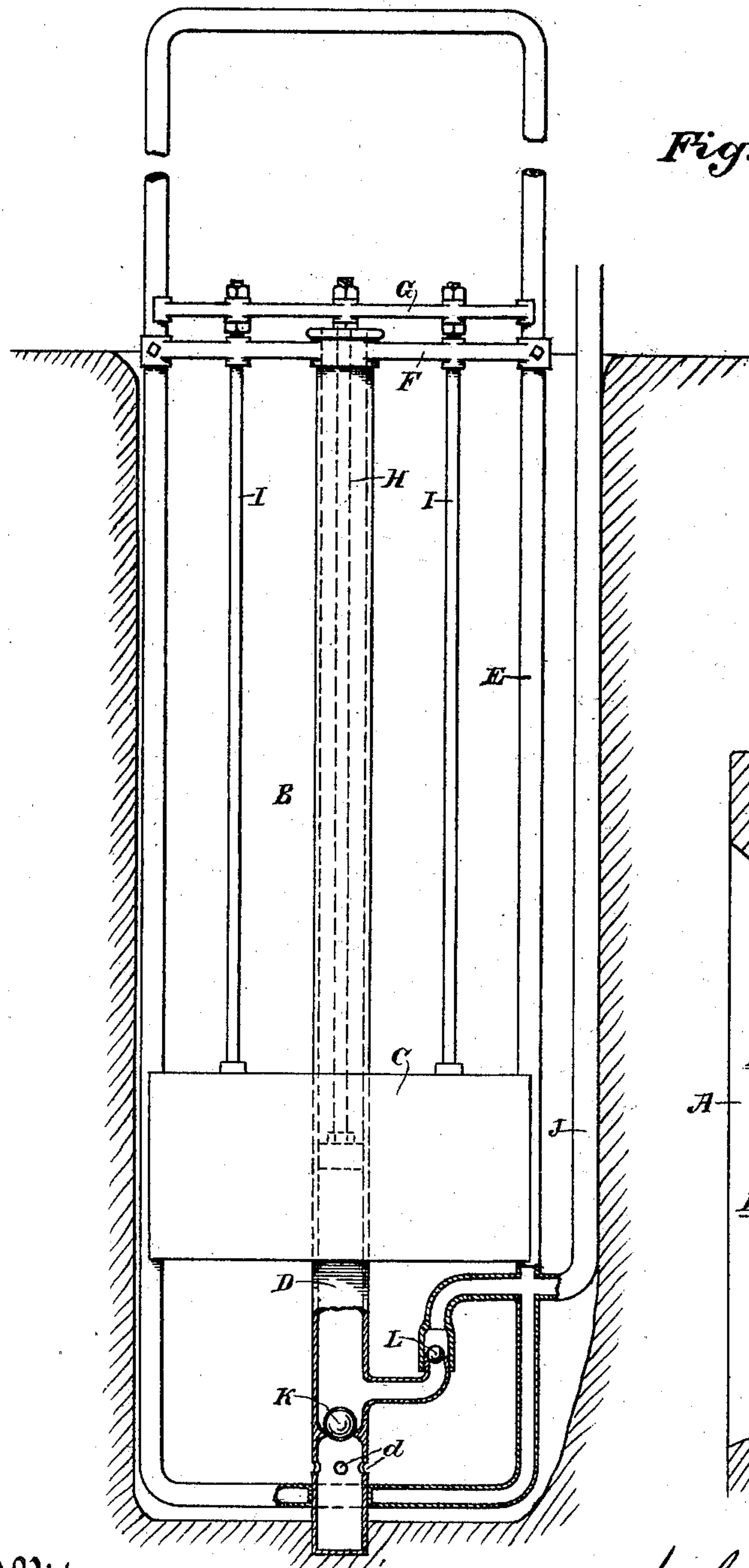


Fig. 1.

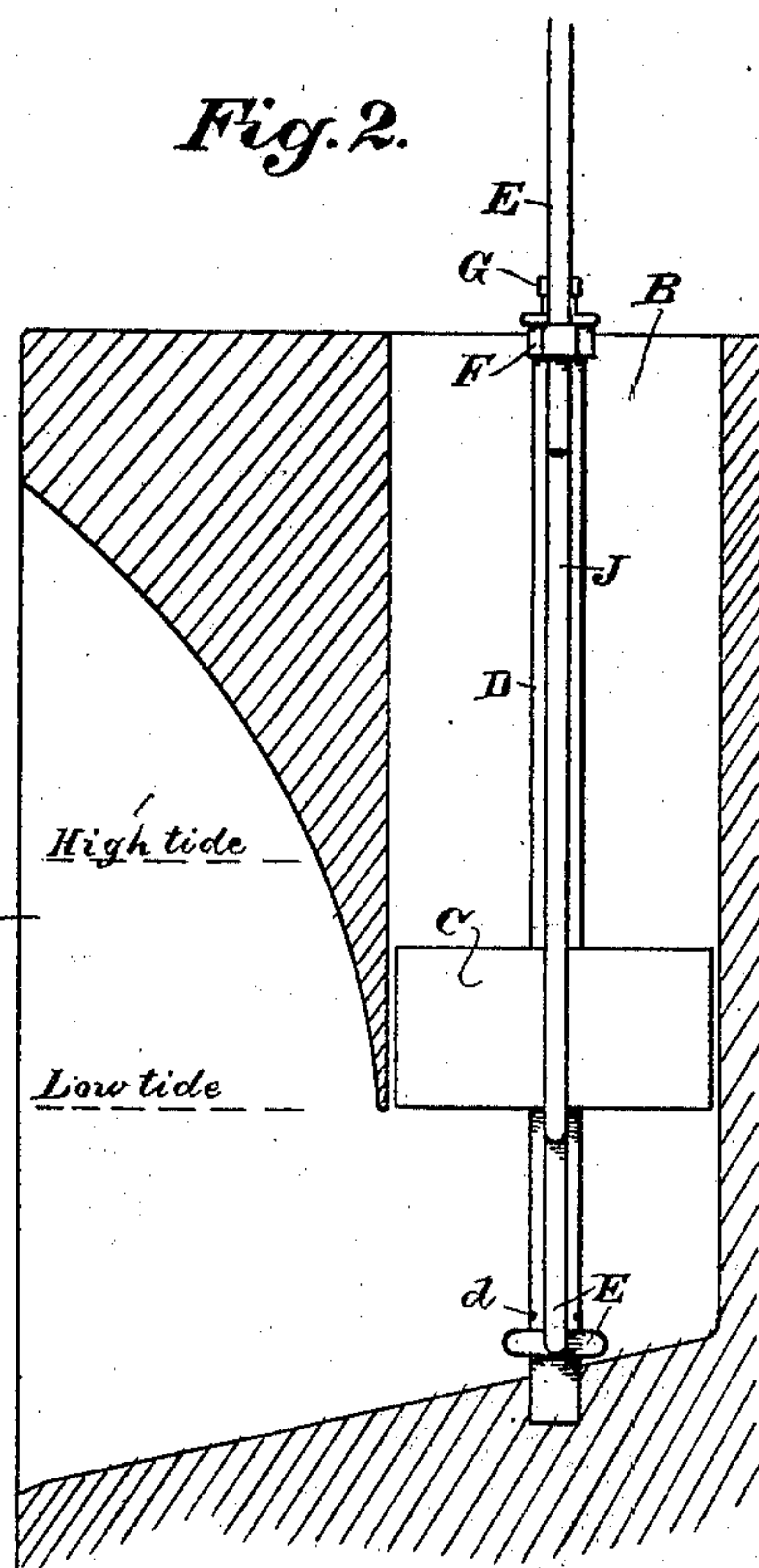


Fig. 2.

Witnesses,
J. H. Starnes
H. F. Oscheck

Inventors,
John E. Armstrong
William Armstrong
By Dewey & Co. atty

UNITED STATES PATENT OFFICE.

JOHN E. ARMSTRONG AND WILLIAM ARMSTRONG, OF SANTA CRUZ,
CALIFORNIA.

WAVE-POWER PUMPING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 610,013, dated August 30, 1898.

Application filed November 11, 1897. Serial No. 658,115. (No model.)

To all whom it may concern:

Be it known that we, JOHN E. ARMSTRONG and WILLIAM ARMSTRONG, citizens of the United States, residing at Santa Cruz, county of Santa Cruz, State of California, have invented an Improvement in Wave-Power Pumping Apparatus; and we hereby declare the following to be a full, clear, and exact description of the same.

Our invention relates to an apparatus which is especially designed to utilize the motion of the waves and to particularly apply it to produce a reciprocating motion, such as may be useful for pumping purposes. It consists in the parts and the constructions and combinations of parts hereinafter described and claimed.

Referring to the accompanying drawings, Figure 1 is a vertical section through the pump-chamber. Fig. 2 is a similar section taken at right angles to Fig. 1.

In the ordinary construction of wave-motors they are disposed at some point in the open water where the actual movement of a float would be no greater than the rise and fall of the wave or swell.

In our invention we design to increase this motion, so that a comparatively small movement of the waves may be utilized and caused to produce increased results. To effect this, we make a converging chamber A, the open enlarged mouth of which is presented toward the incoming waves or swell. This chamber is preferably formed by excavating into a wall or cliff where the sea approaches such a natural formation, and its size is such as to embrace a vertical space considerably more than the actual amount of rise and fall of the tide, so that at low tide the waves will enter this directing-funnel and will also continue to enter it at the highest tide. The rear end of this converging chamber connects with the lower part of a vertically-disposed well B, within which the float C and connected apparatus are contained. The floor of the chamber A declines outwardly, so that in case any sand or other solid material is brought in by the waves it will as readily flow out when the wave recedes, thus preventing the interior and bottom of the well B from becoming

choked. The float C may be made of any suitable material, as a hollow iron or steel chamber, or it may be made of wood, if preferred. Through the center is a hole, and this hole loosely fits the vertical pump-barrel D, so that it may slide up and down without binding. Exterior to and upon opposite sides of the float are the guide-rods E, which are preferably tubular for a purpose to be hereinafter described. The edges of the float are grooved or channeled sufficiently so that it may slide and be properly guided by these rods, as well as by the intermediate pump-cylinder. The foot of this mechanism and the pump-cylinder are properly supported and stepped in the pump-chamber B, so as to maintain their proper position. The upper end of the pump-cylinder is also connected with the guide-rods upon each side by suitable yokes or braces F, which thus maintains its whole length in proper relation with the guides.

G is a cross-head slidable upon the guides E, and its central portion is connected with the pump plunger-rod H.

Upon each side of the pump-cylinder D are rods I, which connect the cross-head G with the float C, so that whenever the float C rises it acts through the rods I to force the cross-head G upward, and by reason of its connection with the plunger-rod H the latter is also moved up in unison. The lower part of the pump-cylinder D has any suitable openings, as *d*, through which water may be admitted as the pump-plunger rises, and when the wave recedes the whole weight of the float and the moving mechanism acts to force the water which has entered the pump-cylinder outwardly through the discharge-pipe J.

K is a suction inlet-valve of any suitable description, through which the water is admitted into the cylinder and by which it is prevented from passing out at the bottom, and L is a single valve in the discharge-pipe J, which allows the water to pass whenever the plunger moves downward after the cylinder has been filled.

In order to provide a proper air-chamber, so as to steady the flow of the water, we have shown the tubular guides E made hollow and

communicating directly with the discharge-pipe J above its valve by means of a T or other suitable coupling, so that as the water is discharged it will compress the air within the tubes E to any required extent, the tubes thus serving as an air-chamber to relieve shock and steady the flow of the water in a manner usual to air-chambers. The novel feature of this part of the device is connecting the discharge-pipe directly with the tubular guides, and thus making them the air-chamber for the pump.

It will be manifest that the connection of the discharge-pipe may be made at any desired point below the upper end of the guide E, provided it is not so made as to interfere with the reciprocation of the cross-head, and the remainder of the tube will act as the air-chamber. The guides E extend to a considerable distance above the top of the well B, as also does the upper end of the pump-cylinder, so that if occasion requires the float may rise entirely above the well without contact with the fixed parts above. Such a movement of the float may be produced when waves of unusual violence dash into the converging chamber A and by their concentration into the bottom of the well will produce so great and rapid a rise of the float as to throw it entirely above the top of the well. As soon as the float has risen above the top of the well it allows the surplus water to escape beneath the float without forcing it up so as to damage any of the other parts of the machinery.

It will be seen that by this construction we have produced a very simple and easily-operated apparatus, the weight of the float being always sufficient to insure the pumping of the water to any desired height, while the sudden shock caused by the influx of the wave will simply act to raise the float and the pump-plunger, so as to admit the water into the cylinder beneath the plunger, while the depression of the float and plunger will take place more slowly, thus giving ample time and power to discharge the water from the pump-cylinder.

If the natural formation of the shore is not such as to favor the construction of the float-well and converging exterior chamber, it may be found feasible to set up the apparatus, consisting of the float, pump-cylinder, the guides, and other parts, at some point where the waves may have direct effect upon the device without any means for increasing the vertical movement of the float. This is easily done by providing any suitable support, as a pile or rock, if the bottom is of a proper character, upon which the foot of the apparatus may rest, and the upper ends of the guides may then be held by diverging guy-ropes, which are properly anchored at a distance from the structure. Waves or swells then passing the apparatus will simply raise the float to a height equal to their own and allow it to subside; but the guide-rods and pump-cylinder,

being of approximately small diameter, will not offer any great resistance to the action of the waves, and the apparatus may thus be placed at points where any larger or heavier structure would be inevitably swept away.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. A wave-power pumping apparatus consisting of a vertical well, having an entrance flaring outwardly therefrom to direct and concentrate the waves into the bottom of the well, a float adapted to rise and fall therein, stationary guides upon opposite sides of the float, a central opening in the float, a centrally-disposed pump-column upon which the float is loosely movable, a plunger in said pump-column, a plunger-rod extending through the upper end thereof, a cross-head with which the plunger-rod is connected, slidable upon the guides and connecting-rods uniting the cross-head with the float.

2. A wave-power pumping apparatus consisting of guides fixed within a vertical well, a pump-column centrally disposed between the guides having a fixed lower end, and yokes or braces by which the upper end is connected with the guides, openings through which water is admitted into the lower end of the pump-column, a discharge-pipe connecting therewith, an inlet-valve in the pump-column and an outlet-valve in the discharge-pipe, a plunger fitting the pump-column, a plunger-rod extending upwardly through the upper end, a cross-head with which said plunger-rod is connected, said cross-head being slidable upon the guides, a float also guided thereon having a central opening by which it fits and loosely slides upon the pump-column, connecting-rods fixed to the float and to the cross-head respectively whereby the vertical movement of the float is imparted to the cross-head and thence to the plunger.

3. In a pumping apparatus of the character described, a rising and falling float having a central opening, a pump-column fixed at the bottom extending upwardly through said opening, hollow guides upon opposite sides by which the movement of the float is also steadied, connections to hold the pump-column in position with relation to the guides, a cross-head slidable upon the guides and with which the plunger-rod of the pump is connected, rods connecting the cross-head with the float whereby reciprocation is imparted to the plunger, inlet-passages and a downwardly-closing valve in the lower part of the pump-column, a discharge-pipe connecting with the pump-column having an upwardly-opening valve therein, connections between the hollow guides and the discharge-pipe above its valve whereby the guides act as an air-chamber for the pump.

4. In a pumping apparatus of the character described, a central vertically-disposed well, a centrally-fixed pump-column having inlet and discharge valves and a discharge-pipe,

hollow parallel guides extending upwardly
parallel with the pump-column, and connec-
tions whereby the upper end of said column
is supported, said guides having also an open
5 connection with the discharge-pipe whereby
they serve as an air-chamber therefor, a float
fitting loosely about the pump-column and
movable between the guides, a cross-head
slidable upon said guides, and rods connect-
10 ing the cross-head with the float, a plunger
within the pump-column and a plunger-rod
connecting it with the cross-head and a sur-
rounding well or chamber within which the

float is movable said well having an opening
at the bottom and a flaring or funnel-shaped 15
chamber opening outwardly therefrom where-
by the waves are directed and concentrated
into the bottom of the vertical well to act
upon the float.

In witness whereof we have hereunto set 20
our hands.

JOHN E. ARMSTRONG.
WILLIAM ARMSTRONG.

Witnesses:

L. J. CAPLATZI,
W. T. MORTON.