No. 626,452. Patented June 6, 1899.

J. E. & W. ARMSTRONG.

WAVE POWER PUMPING APPARATUS.

(Application filed Sept. 20, 1898.)

(No Model.)

Fig. 1.

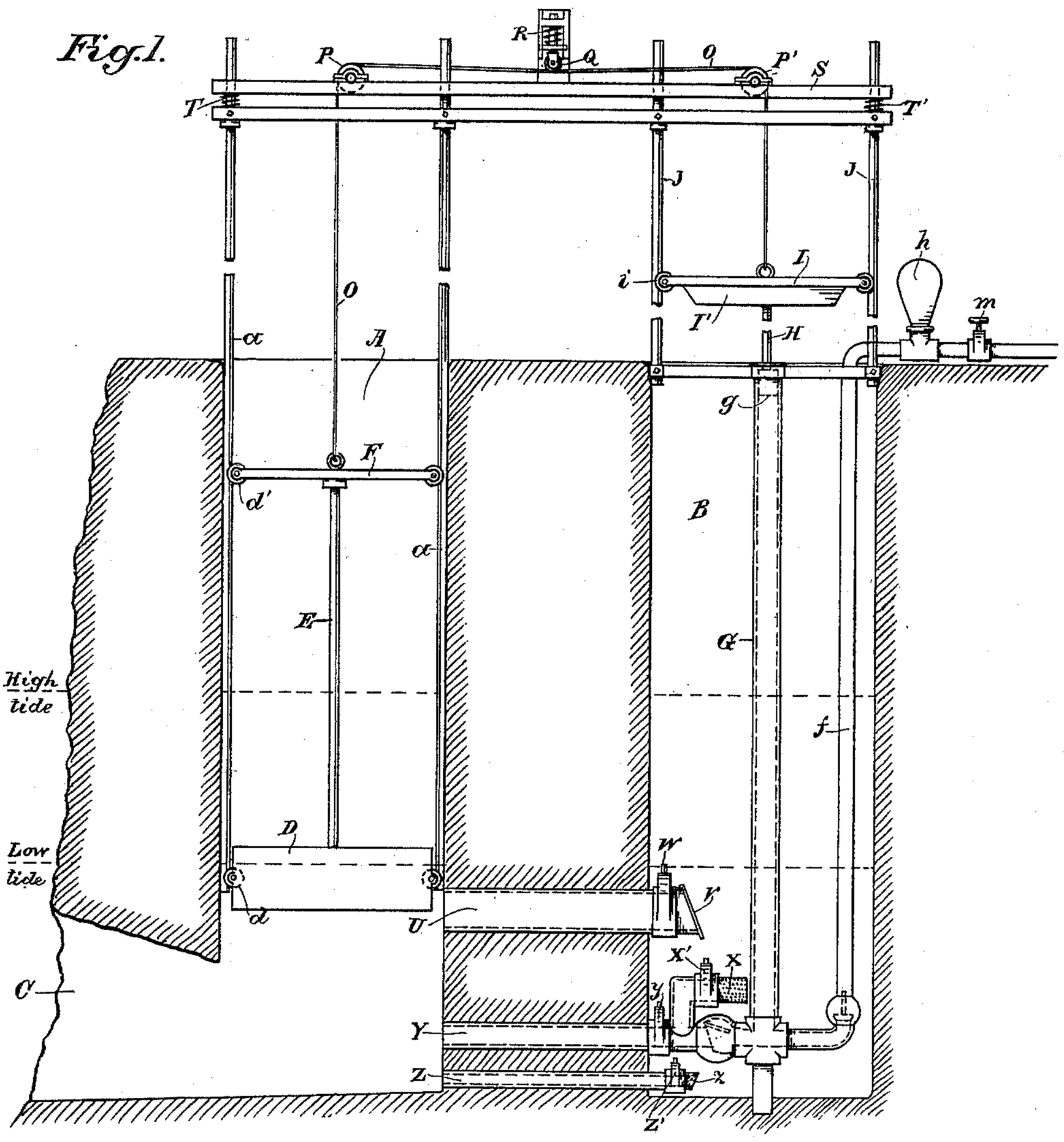
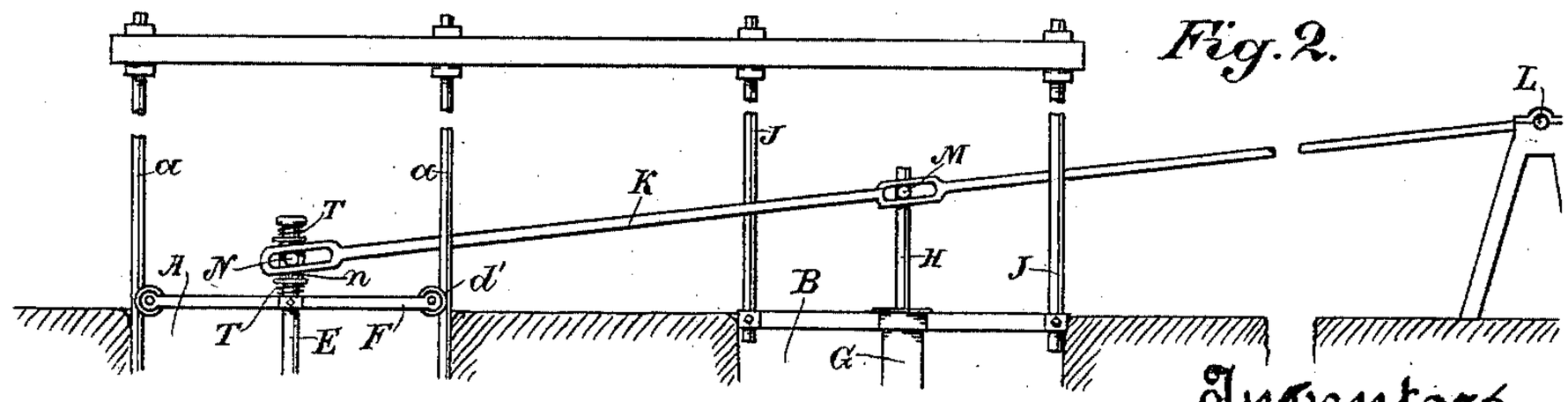


Fig. 2.



Witnesses,
H. Smee
H. F. Ascheck

Inventors,
John E. Armstrong
William Armstrong
By Dewey Strong & Co.
Attys

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. 626,452, dated June 6, 1899.

Application filed September 20, 1898. Serial No. 691,448. (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 apply the force of the rising and falling waves or swell for the operation of a pump or pumps; and it consists in the parts and the constructions and combinations of parts, which we will hereinafter describe and claim.

Figure 1 is a view of our apparatus, showing one form of connecting and actuating mechanism. Fig. 2 shows another form of device for connecting the float and the pump.

The object of our present invention is to separate the float-chamber from the pump-well, so that the latter is not subjected to the violent fluctuations and agitation caused within the float-chamber by the sudden inrush of the sea, and at the same time to so connect the float and the pump in their independent chambers that the latter would be actuated by the movements of the former.

A and B are two wells or chambers, which may be of artificial construction, or, as here shown, sunk in the rock of a cliff which abuts upon the sea at a point where there is considerable swell or waves.

The bottom of the well A is connected with the sea by a passage C, which is low enough to be constantly submerged by the water at any stage of the tide.

Within the chamber A a float D is loosely arranged having a centrally-disposed rigid rod E, extending upwardly to near or quite the top of the well. Upon the sides of the float B are arranged rollers *d*, which are adapted to travel in contact with guides *a*, suitably fixed in the well A. Across the upper end of the rod E is fixed a yoke F, also having rollers *d'* journaled at its ends and traveling in contact with the guides A, so that the float will be caused to rise and fall in proper line and without being dashed against the sides of the chamber.

Within the well B is fixed a pump-column G, having within it a plunger *g*, and a plunger-rod or pitman H extends upwardly from the plunger and has at its upper end a cross-head I, with rollers *i* at opposite ends traveling in contact with guides J, which serve to maintain the plunger and its rod axially in line within the pump-column.

In order to connect the float in one well with the pump in the other, and thus transmit motion caused by the movements of the float to the pump-plunger, we have shown intermediate connections which unite the two rods E and H. In one construction we have shown a lever-arm K, one end of which is fulcrumed, as shown at L, at a point considerably distant from the pump-rod and essentially in a line through the pump and float rods. This lever is slotted, and a pin M from the pump-rod enters the slot which is opposite the pump-rod and a pin N enters the slot which is opposite the float-rod, the pins being respectively fixed to the pump-rod and the float-rod and the slots being of sufficient length to allow the pins to move along the slots, while the lever K is moved in an arc of a circle caused by the rise and fall of the float D. The pin or pins N are fixed in a sleeve *n*, which is slidable upon the float-rod, and springs T surround the rod above and below the sleeve, against which their adjacent ends abut. The opposite ends abut against fixed stops on the rod, and any sudden or violent movements of the float in either direction will compress one of the springs and gradually transmit the movement through the lever to the pump rod and plunger. It will be seen that by this construction a direct connection is made between the pump-rod and the float-rod, so that the pump-plunger will be moved in unison with the floats. In the other construction we have employed a rope or cable O, the opposite ends of which are connected with the rods E and H, and the central portion of the rope passes over guide-pulleys P P', one being situated in line above the float-rod and the other in line above the pump-plunger rod. The rope extends across between the pulleys P and P', and a tightening-pulley Q is mounted upon a vertically-movable frame, so that the pulley presses upon the transverse portion of the

rope, and by means of a spring R any desired pressure may be brought upon this portion of the rope. The pulleys P and P′ are journaled in a framework S, extending across above the wells A and B, and this framework is here shown mounted upon springs T′ of sufficient strength to support the framework and the weight of the float and other connected parts. The cross-head I of the pump-plunger rod has attached to it a weight I′ sufficient to promptly depress the pump-plunger whenever the float rises in the opposite chamber, and the weight of the float is sufficient to cause it to sink, and thus raise the pump-plunger whenever the water recedes in the float-well. By increasing the weight to more than equal that of the float the latter may be raised so high as to be thrown out of action.

If by reason of sudden influx of water there is a tendency of the float to rise very rapidly, and thus unduly slacken the rope O, the springs R and T will be elongated, being relieved of the weight which ordinarily holds them compressed, and will thus take up any slack in the rope which may be produced, while the weight connected with the pump-plunger will ordinarily be sufficient to keep the rope taut. In this manner the reciprocations of the float will be transmitted directly to the pump-plunger and its rod.

Water is admitted into the well B from the well A through a connecting passage or channel, as shown at U, the inner end being provided with an inwardly-opening valve V and with a gate W. The gate is actuated by a rod extending up to the top of the well within reach of an operator and may be more or less opened or closed, as desired. The valve V always opens inwardly whenever water rushes through the passage U, thus keeping the well B filled approximately to the same height as the water rises in the well A. The valve V closes when the water sinks in the well A and prevents the escape from B, thus providing a sufficient amount of water at all times in the chamber B to supply the pump. The pump-suction is here shown in the form of an elbow-tube X, having a protecting-screen to prevent the entrance of foreign substances, and a gate X′, by which it may be entirely closed, if desired, and the usual inlet and discharge valves. The elbow-pipe X branches from a pipe Y, which extends straight through the wall between the chambers A and B, and this pipe is also provided with a controlling-gate *y*, so that it may be closed, if desired, to allow the suction to pass in through the elbow-tube X, or if this tube be closed by its gate X′ and the gate *y* opened the suction will take place directly through the pipe Y from the exterior chamber.

In order to cleanse the chamber B of any sand, pieces of kelp, or other foreign substance which may enter from time to time, a pipe or passage Z extends through the wall between the two chambers close to the bottom. This pipe has a gate Z′, which remains normally closed, but may, like the others, be opened, by connection with the top, when desired. An outwardly-opening valve *z* is fixed in the pipe Z, and when the chamber B has been charged with water through the pipe U the gate Z′ may be opened at low tide, and the wash, through the pipe Z, will carry out any sediment or collected foreign substance. Water raised by the pump will be forced out through the conducting-pipe *f* and conveyed to any desired point. In connection with this pipe is a large air-chamber *h* of sufficient capacity to nearly or quite contain all the water which may be forced out by the pump-plunger at a single impulse. The object of this is to relieve the pump and pipes from the strain which would be caused by the rapid movement of the float and the pump-plunger under the sudden impulse of a wave, so that the parts may not be injured by the sudden pressure upon the heavy column of water in the conveying-pipe, the inertia of which would prevent its moving as rapidly as the pump-plunger.

A gate *m* in the conveying-pipe serves to prevent the return of water when it is necessary to disconnect the parts for repairs.

This construction by placing the pump and operative mechanism in an entirely separated and protected chamber allows the operator to have access to it for repairs or other purposes without being endangered by the constant dash of the waves which take place in the outer float-chamber.

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

1. Independent vertical wells, one of which has a direct connection with the sea and a guided float adapted to rise and fall therein by the movement of the waves, a pump fixed in the other well, connections between the float and the pump-plunger, a supply pipe or passage connecting the two chambers at a point above the bottom having a valve opening inwardly into the pump-chamber whereby water supplied by the rise in the outer chamber is prevented from returning.

2. Independent wells, one of which has an open communication with the sea, and a guided float adapted to rise and fall therein by the action of the waves, a pump fixed in the other well, connections between the float and the pump-plunger, an inlet-pipe connecting the two chambers above the bottom, a valve whereby water is admitted from the float to the pump-chamber and prevented from returning therethrough, a second pipe at the bottom of the pump-chamber having an outwardly-opening valve, and controlling-gates whereby the water may be retained in the well and discharged to flush and clean the latter.

3. Independent wells, one of which has an open connection with the sea and a guided float adapted to rise and fall within the well by the movement of the waves, a pumping

mechanism fixed in the other well, gate-controlled passages between the two for the admission of water to the pump-well and the discharge therefrom, a gated inlet-pipe connecting the pump with its own well, and a second pipe connecting the pump directly with the outer well and having a controlling-gate.

4. Independent wells, one of which has an open communication with the sea, a guided float adapted to rise and fall therein by the movement of the waves, a pump fixed in the second well, a supply-passage between the two wells and provided with a valve, a connection between the pump-plunger and the float whereby the two act in unison and gated passages admitting water into the pump-chamber, a discharge-pipe leading upwardly from the pump and having an air-chamber approximately equal to the capacity of the pump whereby pressure caused by sudden movements of the pump is relieved.

In witness whereof we have hereunto set our hands.

JOHN E. ARMSTRONG.
WILLIAM ARMSTRONG.

Witnesses:
S. H. NOURSE,
GEO. H. STRONG.