

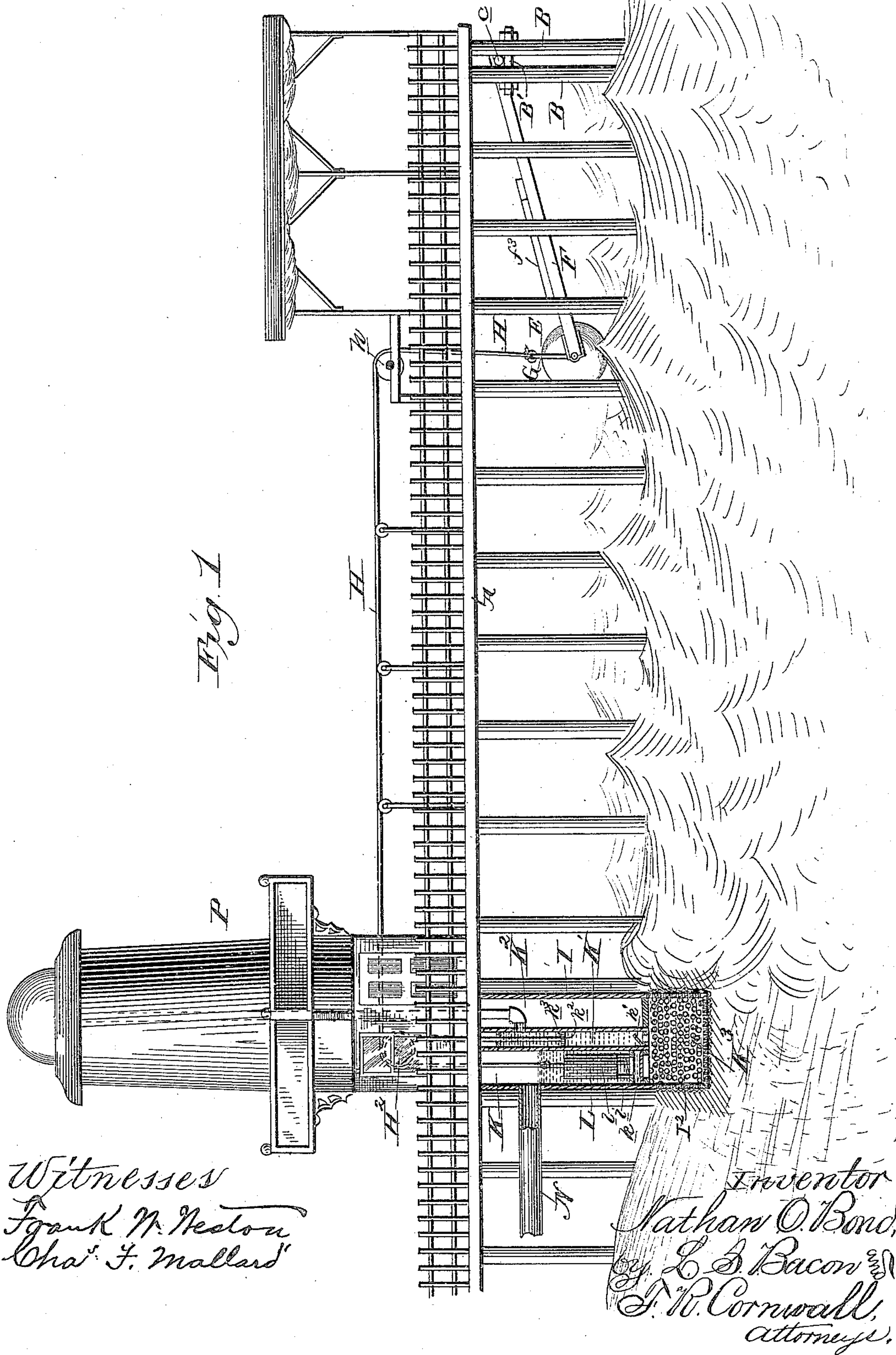
(No Model.)

2 Sheets—Sheet 1.

N. O. BOND.
TIDE AND WAVE POWER APPARATUS.

No. 446,422.

Patented Feb. 17, 1891.



Witnesses
Frank M. Weston
Chas. F. Mallard

Inventor
Nathan O. Bond,
by L. B. Bacon &
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attorneys.

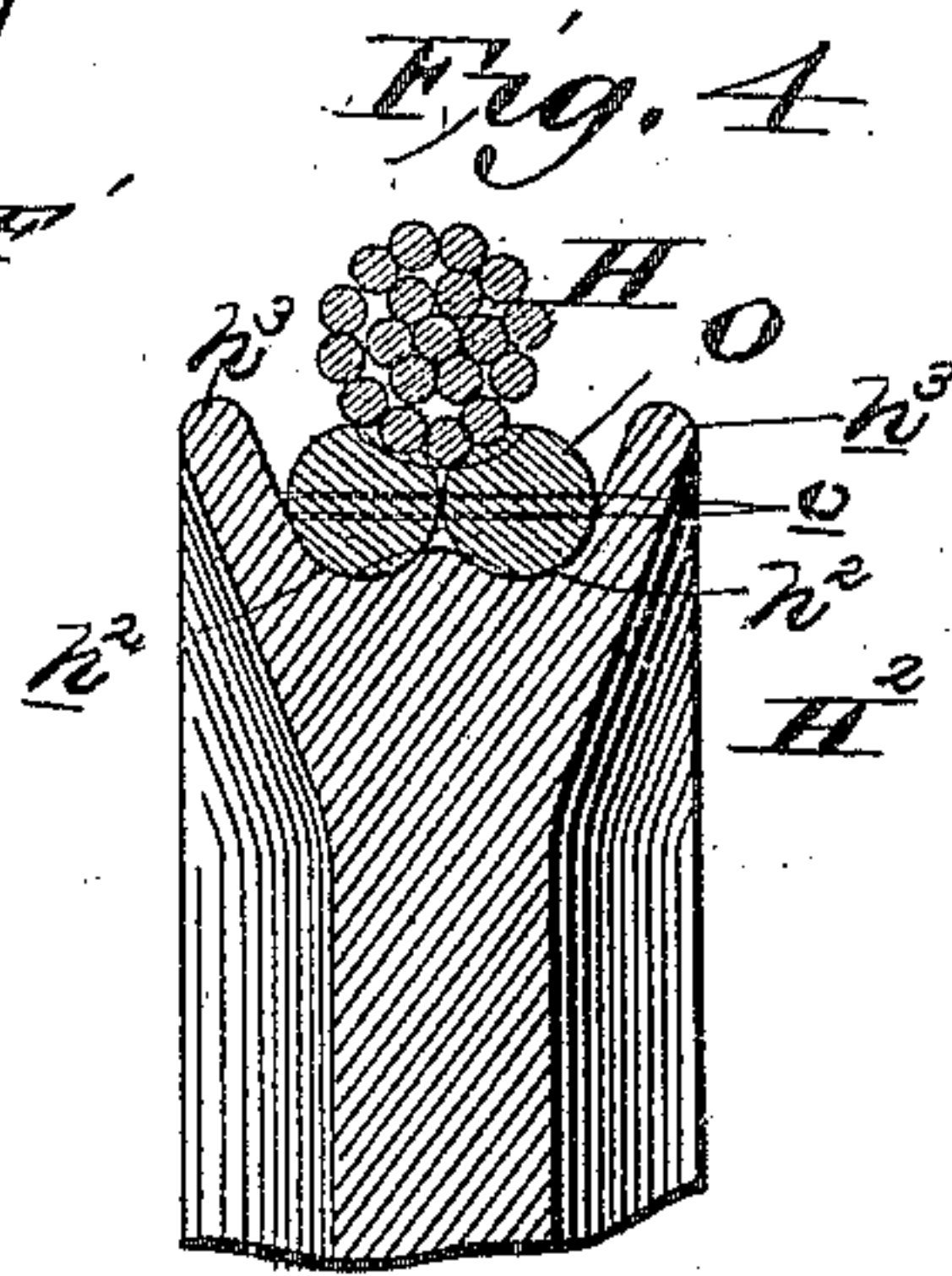
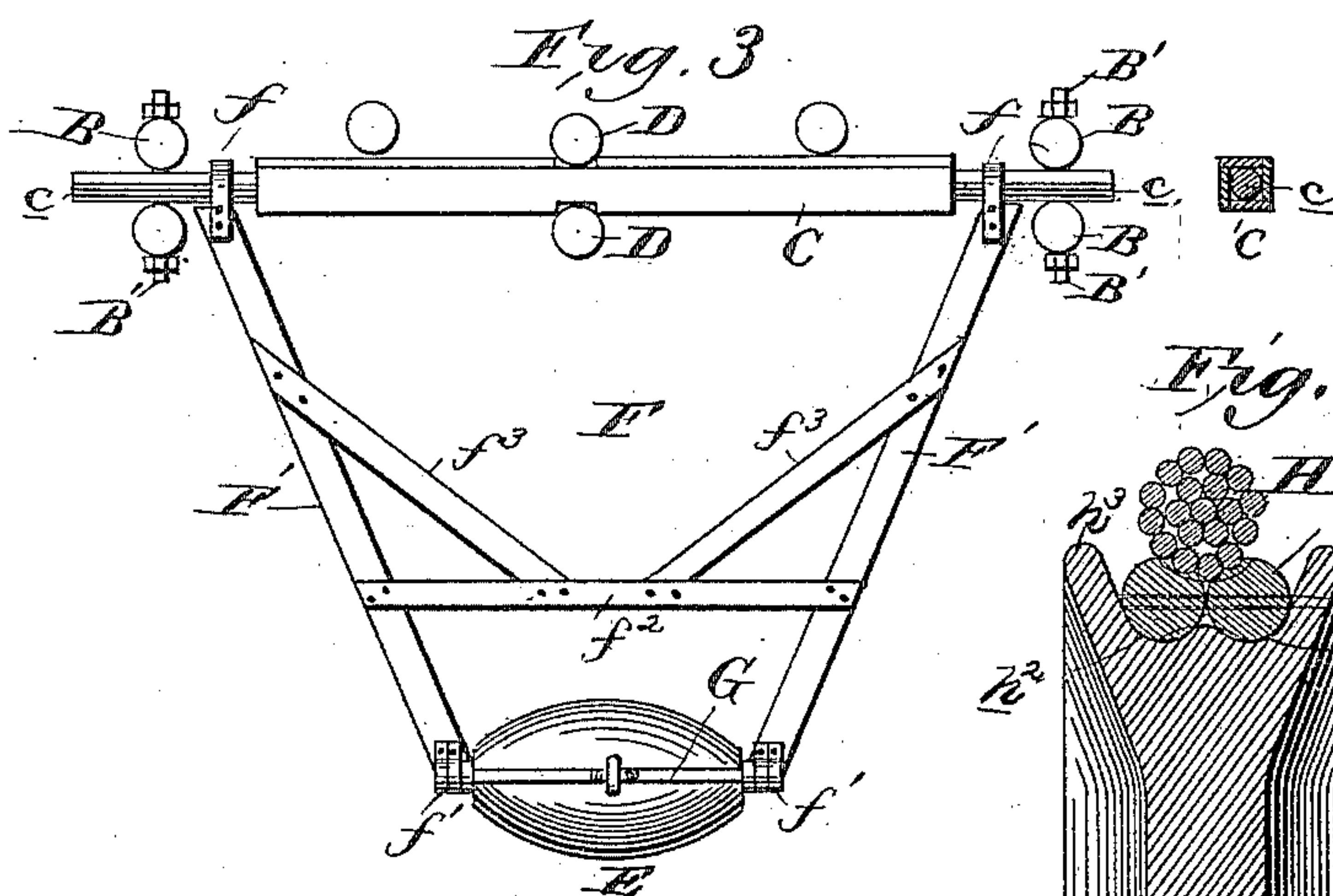
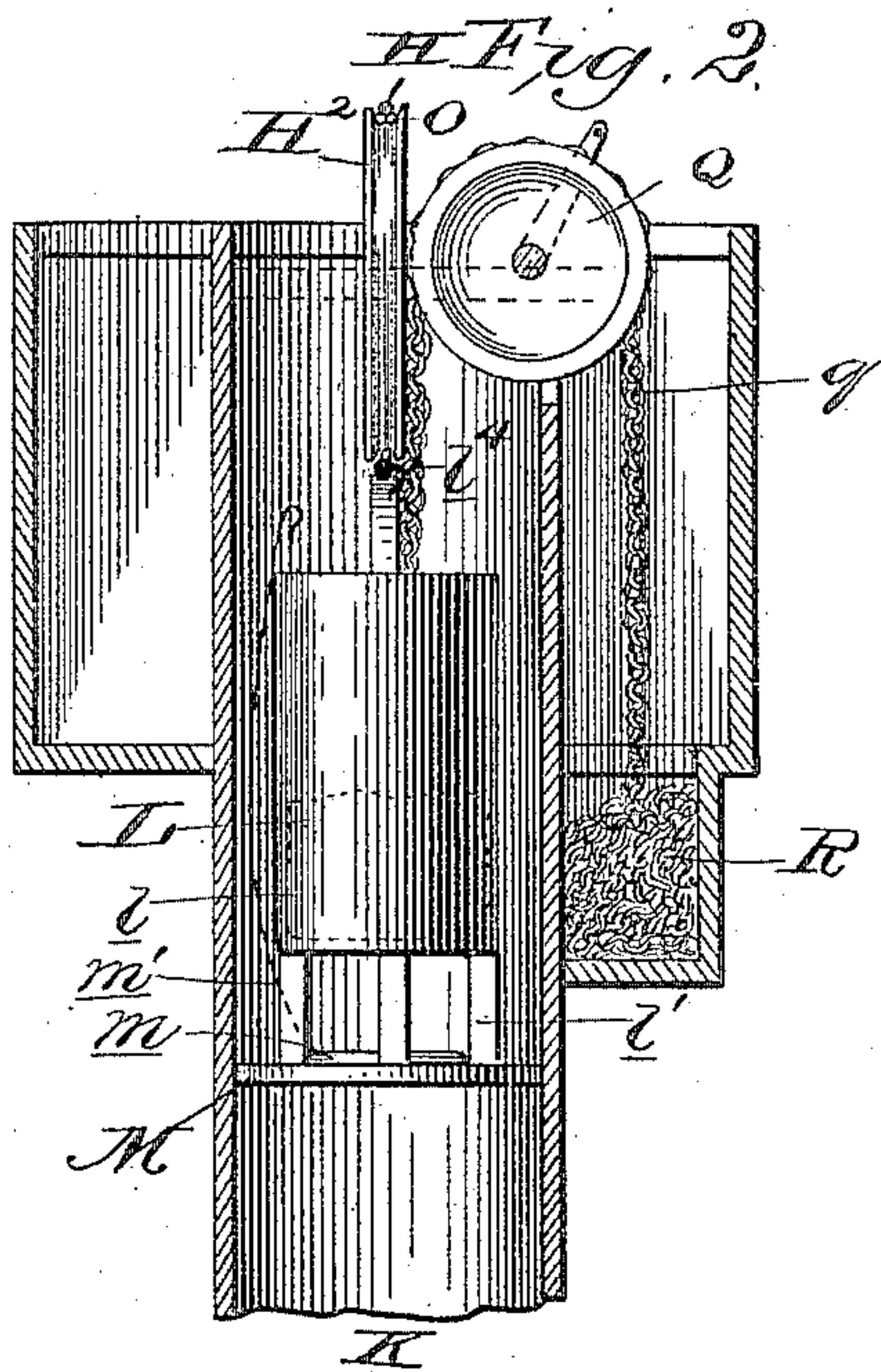
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UNITED STATES PATENT OFFICE.

NATHAN O. BOND, OF FAIRFAX COURT-HOUSE, VIRGINIA, ASSIGNOR OF ONE-HALF TO FREDERICK W. PRATT, OF WASHINGTON, DISTRICT OF COLUMBIA.

TIDE AND WAVE POWER APPARATUS.

SPECIFICATION forming part of Letters Patent No. 446,422, dated February 17, 1891.

Application filed June 27, 1890. Serial No. 356,924. (No model.)

To all whom it may concern:

Be it known that I, NATHAN O. BOND, a citizen of the United States, residing at Fairfax Court-House, in the county of Fairfax and State of Virginia, have invented certain new and useful Improvements in Tide and Wave Power Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in tide and wave power apparatus; and it consists in the construction and arrangement of the parts thereof hereinafter described and claimed.

The object of my invention is to provide an approved apparatus for raising water or for transmitting power for other purposes operated by the movement of the surface of a body of water. I obtain this object by the construction illustrated in the accompanying drawings, forming a part of this specification, wherein like letters of reference indicate corresponding parts in the several views, in which—

Figure 1 represents a side view, partly in section, of my improved apparatus. Fig. 2 is a detail vertical section of the plunger, casing, and storage-box. Fig. 3 is a top plan view in detail of the float and its connecting-arms, and Fig. 4 is a detail view of a portion of the pulley.

In the drawings, A represents a pier having at its outer end piles B, arranged in close proximity to each other. Extending through these piles B and across the intervening space are supporting rods or bearings B', on which rest the trunnions or cylindrical ends *c* of a rock-shaft C, extending across the pier from one set of piles to the other. This shaft C is preferably made as shown in Fig. 3, with four strips of wood secured with their ends alternately overlapping each other, leaving a central space, in which the trunnions are secured. The center of the shaft is preferably cut away, and in the recesses are placed the sides of two binding or retaining piles D, which prevent the shaft from moving longitudinally.

E represents a float, preferably elliptical in shape, having stub axles or trunnions, and

with its attachments forms a heavy weight. This float is made of heavy metal.

F represents a frame having outwardly-diverging side supporting-bars F', with elev- 55
ises *f* on their outer ends, through which the trunnions *c* pass, the inner ends extending inward toward each other and formed with bearings or shackles *f'*, through which the 60
trunnions on the float pass. The frame is braced by cross-beam and side braces *f*² and *f*³ to prevent the side bars from spreading.

On the trunnions of the float is pivoted a swinging bail G with a suitable eye, through 65
which passes and is secured a cable H, passing up through the floor of the pier over a pulley *h*, from whence it is carried horizontally over suitable pulley-wheels to the water-elevator, which consists of a well or casing I, 70
extending from the floor down, and has its lower end capped and formed with a series of perforations with a casing of wire-netting I² surrounding the same. This perforated end of the well is embedded in the sand be- 75
neath the water to prevent the action of the waves from forcing the sand and other matter in the well, the water percolating through the sand and apertures and entering the well.

The interior of the well is divided, prefer- 80
ably, into four compartments K, K', K², and K³, the former two being cylindrical and have suitable valves *k* *k'* at their bottoms.

In the cylinder K is placed a weighted plunger L, formed with a cylindrical recep- 85
tacle *l* and downwardly-extending arms *l'*, to the lower end of which is attached a circular valve-seat M, supporting a valve *m*. This valve *m* has attached thereto a link or cord *m'*, extending to the top of the cylindrical 90
receptacle *l*, and when the valve is not required the cord is drawn up and attached to the eye of the bail *l*⁴, thus permitting the water to pass through the opening in the valve-seat and rendering the valve useless. The 95
end of this plunger L has a bail *l*⁴, to which the end of the cable H is attached after passing over a pulley H², mounted in a suitable frame above the floor. This plunger is arranged to be at its lowermost point when the 100
float is on the crest of the wave.

N is a discharge-pipe leading from the cylinder K to any suitable place.

In the cylinder K' is placed a plunger *k*²,

having a valve k^3 on its lower end. This plunger is attached to a double rope or cable O, which passes over the pulley H^2 beneath the cable H. The cable O is preferably 5 doubled and banded together by suitable webbing o , its length being such as to raise the plunger k^2 to its highest point of ascent.

P is a tank above the pier, into which a discharge-pipe leads from the cylinder k^2 . 10 This tank is intended to be used for storage purposes, from which the water may be drawn for sprinkling, &c. The pulley H^2 is formed with two grooves h^2 , in which the cable O rests, and flanges h^3 for retaining the same 15 in place, as shown in Fig. 4.

To vary the weight of the plunger L, I place a pulley Q at right angles to pulley H^2 , back of the same, over which passes a chain q . Below the floor is formed a storage-compartment R, in which the chain is stored, and 20 from which it passes over the pulley Q down into the receptacle in the plunger L, the amount deposited therein being governed by the necessary weight required to force the 25 piston k^2 up, and when necessary to draw the float up close under the floor.

To quickly load the plunger with the chain, I place a crank on the pulley Q, which pulley may be provided with suitable gripping-teeth, and by turning the same either load or 30 unload the plunger.

In operation my apparatus works as follows: The float resting on the water is held in one position by the frame and permitted 35 a vertical movement only. As it rises and falls on the surface the plunger is likewise raised and lowered, in the former case by the weight of the float and in the latter by its own weight. As the plunger ascends the water above the valve is raised and the plunger 40 k^2 is lowered. When the plunger L falls, it carries the plunger k^2 , with its load of water, up, which is discharged into the tank above. When it is necessary to increase the weight 45 of the plunger, the chain is drawn from the storage-compartment and deposited in the plunger. This operation may be continued until the weight of the plunger is sufficient to draw the float up out of the water. At pe- 50 riods it will be unnecessary to utilize the small pump, in which case the cable O is detached and the pump permitted to rest, the weight of the plunger L being at the same time diminished. This change in the weight 55 is also necessary when a large amount of water is to be raised in the large cylinder. When it is desired to utilize the small pump independent of the working of the large pump, it is only necessary to draw the valve in the 60 weighted plunger up, permitting the water to pass through the valve-opening without being raised by the upward movement of the plunger L.

It will of course be understood that in lieu 65 of one of the cylinders K' , I may employ two or more, as the varying weight of the plunger

L may be regulated to raise two plungers. It will thus be seen that a very strong, durable, and effective apparatus is produced.

In shaping the float as described I overcome the side impact of the waves to a great extent, and by the particular manner of mounting the float the same is held rigidly in place.

I am aware that many minor changes in the 75 construction and arrangement of the parts of my apparatus can be made and substituted for those herein shown and described without in the least departing from the nature and principle of my invention. 80

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an apparatus of the kind described, the combination, with a frame and its sup- 85 ports, of an elliptical float attached thereto, a cylinder, a weighted plunger therein, a plunger actuated by said plunger, and a connection between the float and the weighted plunger, substantially as described. 90

2. The combination, with the supporting-piles, of a frame having diverging side bars, a rock-shaft supported by the piles to which the frame is hinged, a float journaled in the frame between the side bars, and a cable con- 95 nected with the float, substantially as described.

3. The combination, with the float and means for retaining the same in place, of a casing having its lower end buried in the 100 sand and perforated, cylinders in the casing, a weighted plunger in one of the cylinders, a connection between the plunger and float, and a plunger in the other cylinder operated by the other plunger, substantially as de- 105 scribed.

4. The combination, with the float, of a weighted plunger, a plunger operated by said plunger, and a removable weight for the weighted plunger, substantially as described. 110

5. The combination, with a float, of a plunger actuated thereby, having a changeable weight thereon, and means for varying the weight, substantially as described.

6. The combination, with the float, of a cas- 115 ing, a cylinder in the casing, a plunger in the cylinder, having a receptacle thereon, a storage-compartment, and a weight arranged to be transferred from the storage-compartment into the receptacle on the plunger, substan- 120 tially as described.

7. The combination, with the plunger, a pulley above the same, a storage-compartment, and a chain passing over the pulley, whereby the chain may be transferred from 125 the compartment to the plunger, substantially as described.

8. The combination, with a float, of the cylinders, a weighted plunger in one cylinder, a grooved pulley, a plunger in the other cylin- 130 der, a webbed connection between the two plungers passing over the pulley, and a cable

between the float and the weighted plunger, substantially as described.

9. The combination, with the float, of a casing having its lower end perforated and in-
5 cased in wire-netting and buried in the sand, plungers in the casing, a connection between the float and one of the plungers, and a tank above the casing, substantially as described.

10. The combination, with a float, of a plun-
10 ger having a receptacle thereon and removable weights in the receptacle, substantially as described.

11. The combination, with the rocking bar and its support, of the piles engaging the same near its center, side bars diverging in- 15
wardly from the shaft, and an elliptical hollow float secured in the side bars, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

NATHAN O. BOND.

Witnesses:

D. G. STUART,
F. R. CORNWALL.