

(No Model.)

4 Sheets—Sheet 1.

H. P. HOLLAND.
WAVE POWER MOTOR.

No. 460,812.

Patented Oct. 6, 1891.

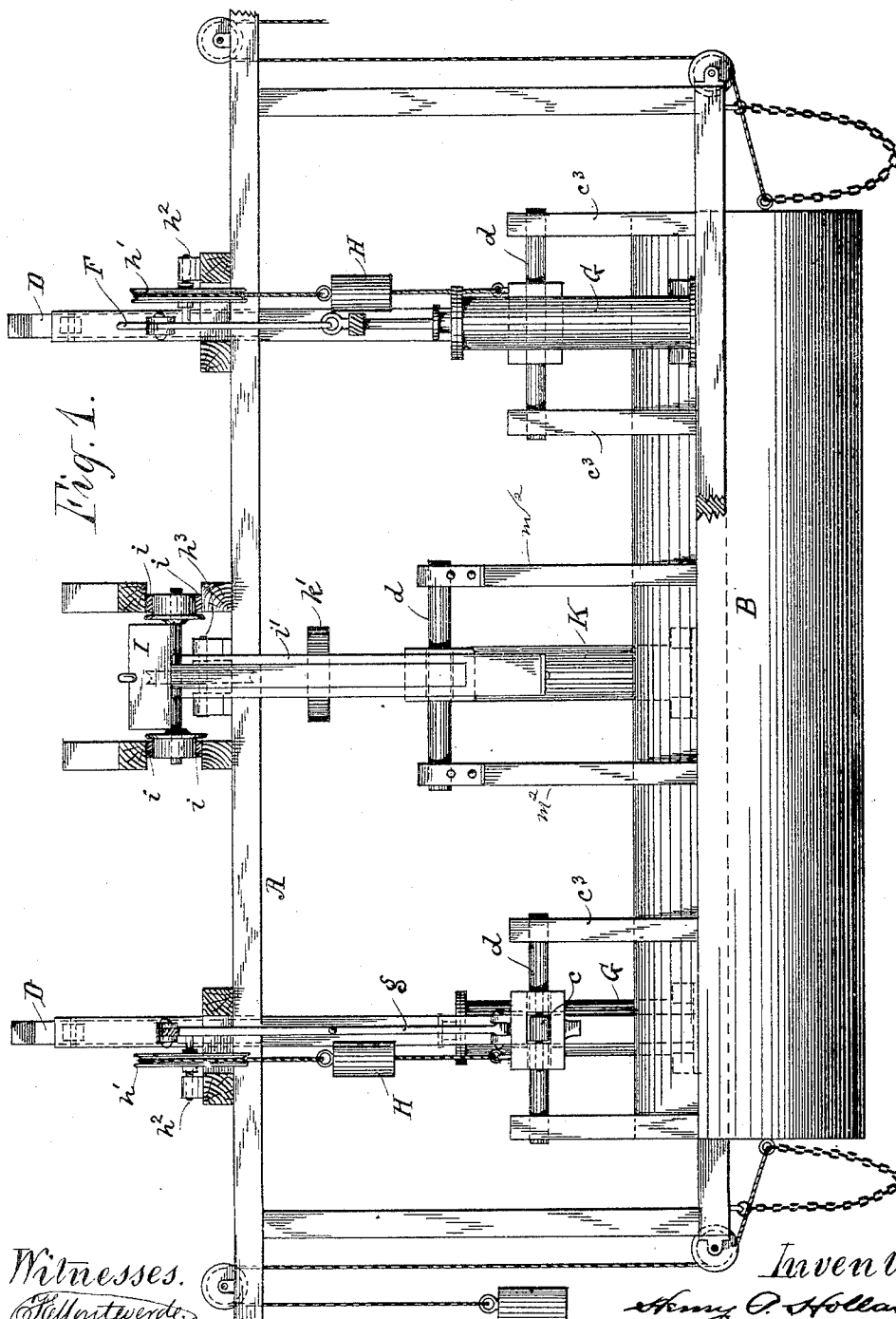


Fig. 1.

Witnesses.
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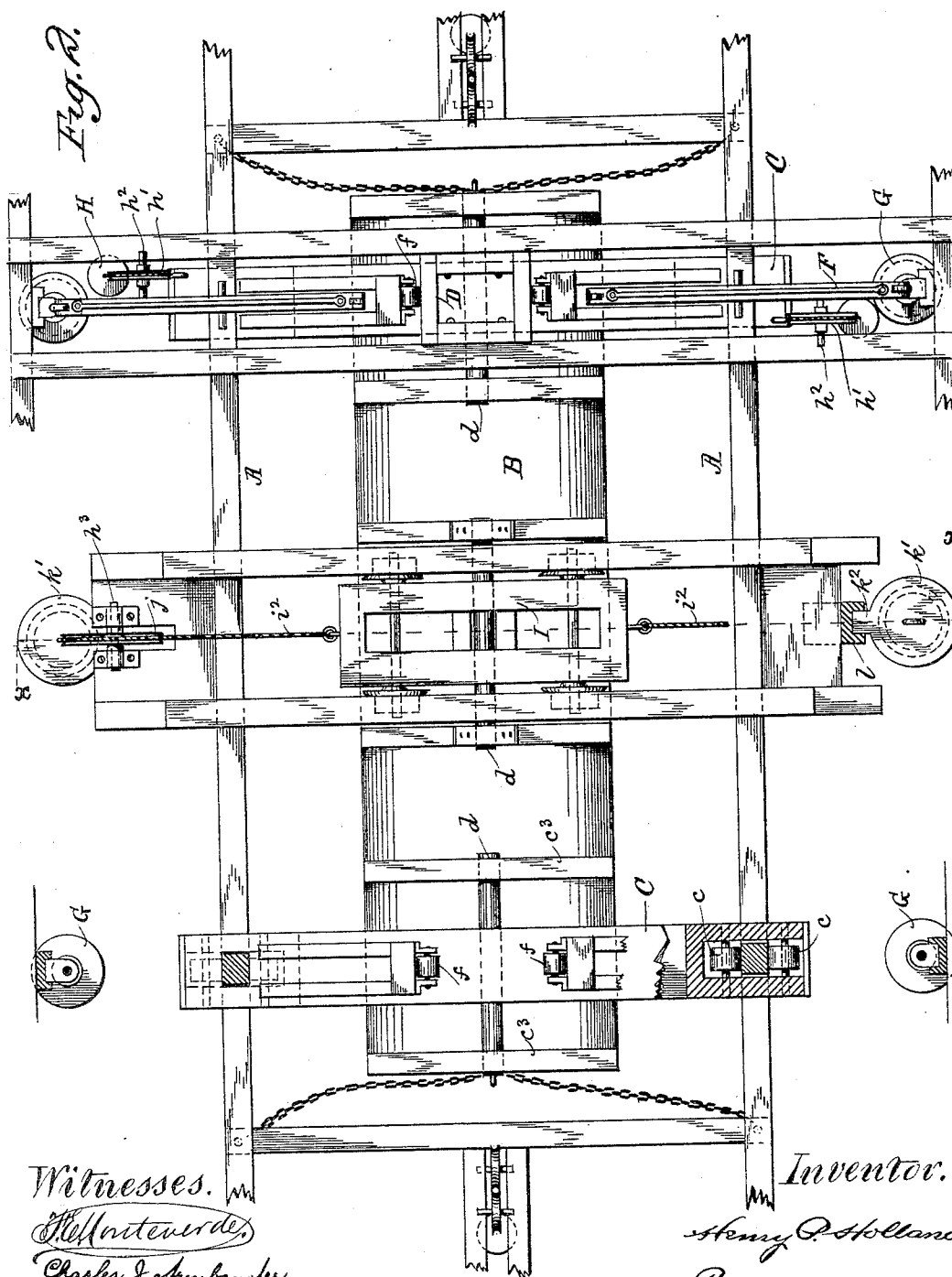
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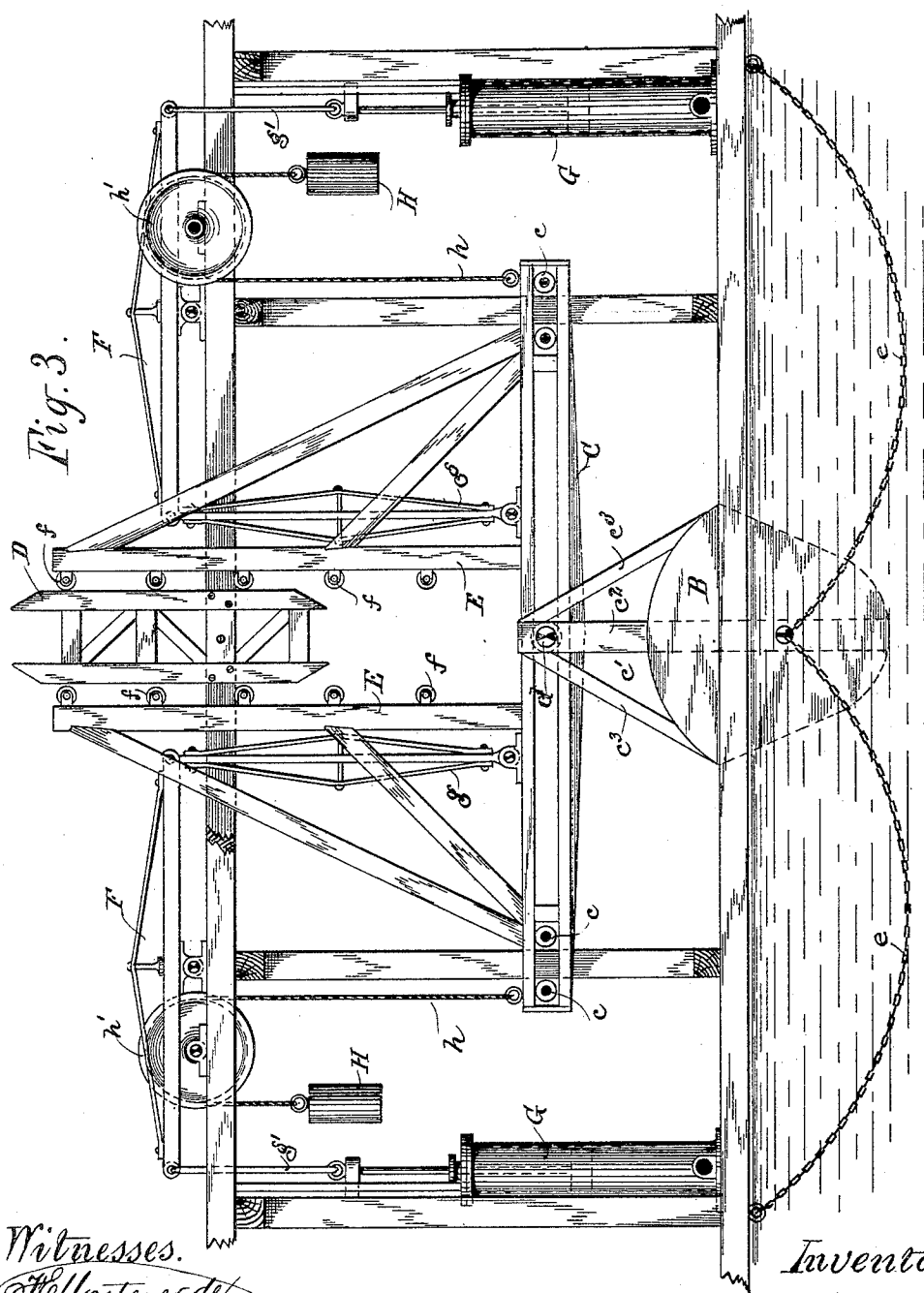
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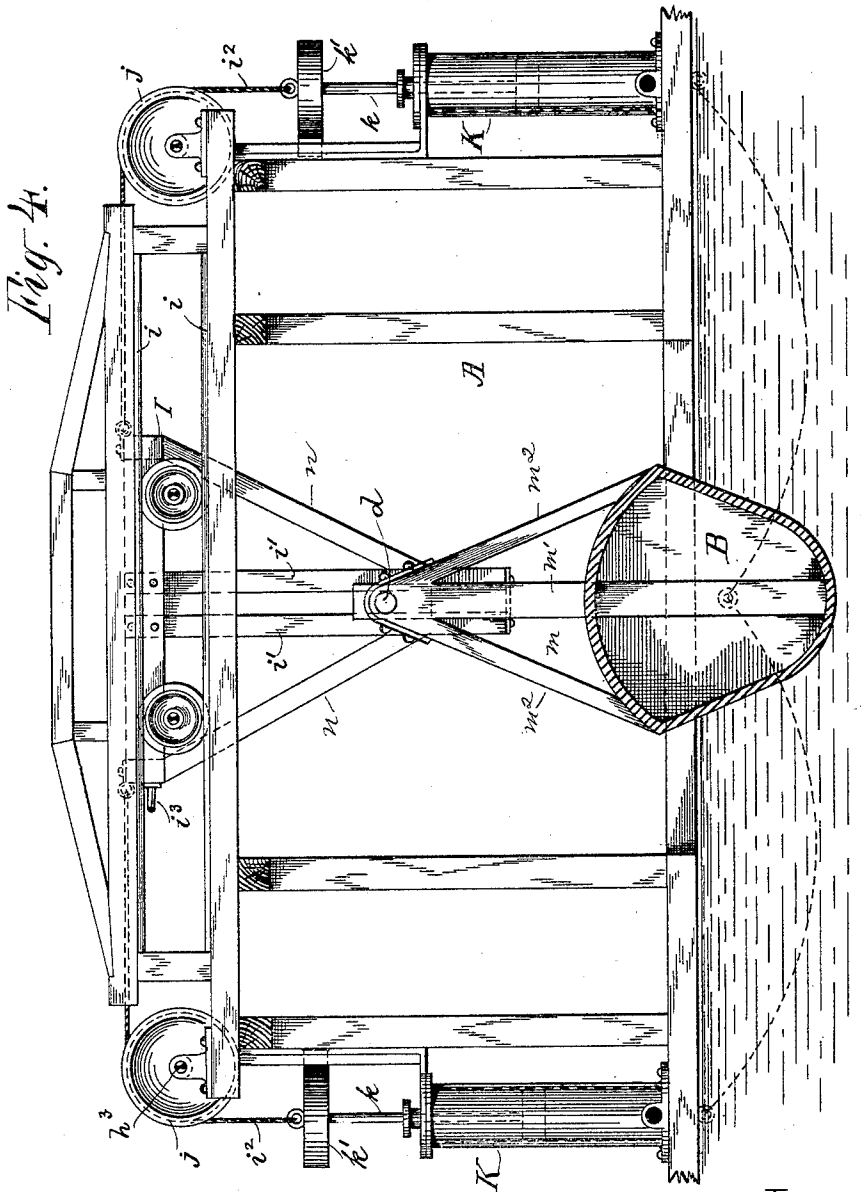
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Patented Oct. 6, 1891.



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UNITED STATES PATENT OFFICE.

HENRY P. HOLLAND, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR OF ONE-HALF TO J. A. FISCHER, OF SAME PLACE.

WAVE-POWER MOTOR.

SPECIFICATION forming part of Letters Patent No. 460,812, dated October 6, 1891.

Application filed September 24, 1890. Renewed August 21, 1891. Serial No. 403,282. (No model.)

To all whom it may concern:

Be it known that I, HENRY P. HOLLAND, a citizen of the United States, residing at the city and in the county of San Francisco, and State of California, have invented certain new and useful Improvements in Wave-Power Motors; and I do hereby declare the following to be a full, clear, and exact description of said invention, such as will enable others skilled in the art to which it most nearly ap-
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pertains to make, use, and practice the same. My invention relates to that class of apparatus adapted for utilizing the power afforded by the movement of waves and tides, and which is commonly known as a "wave-power motor."

The object of my invention is to provide improved means by which the regular and irregular horizontal and vertical movements of a body of water will all be utilized without the loss of power and motion.

The above statement sufficiently explains the purpose of my invention and of the apparatus in which I have embodied it; and said apparatus consists, essentially, of a buoyant float having a free motion upon a body of water beneath a pier or like structure and having connections to suitable mechanism upon said structure, whereby its vertical rise and fall and its approximately horizontal swing will set and maintain said mechanism in operation for the production and transmission of power. This feature of my invention, whereby all the movements of the float, whether horizontal or vertical, continuous or interrupted, regular or irregular, will be transmitted for power-producing purposes, distinguishes it from all others with which I am acquainted.

For a clear comprehension of the entire apparatus, reference must be made to the following detailed description and to the accompanying drawings, in which—

Figure 1 is a front elevation with one each of the compressors G and K removed. Fig. 2 is a plan view showing one of the central sheaves, j and its bearing removed, and also showing the upper part of the pier at one end removed and one end of the truss-beam broken away so as to illustrate more clearly the position of its guide-rollers c c. Fig. 3 is

an end elevation. Fig. 4 is a cross-section on the line x x, Fig. 2, showing the interior of the float with its suspension devices in elevation.

A represents a pier built out from the shore and composed, preferably, of horizontal and upright timbers and suitably braced to form a structure of sufficient strength to sustain the power producing and transmitting devices. The interior of the pier is open to permit a free range of movement in all directions of the suspended buoyant float B, which rests in the water, and receives and conveys the various motions of the waves, tides, or surf, as the case may be. This float is a hollow shell constructed of boiler-iron or other suitable material, and having, preferably, the cross-section illustrated in Fig. 4. The float is suspended from truss-beams C, which are illustrated, Fig. 2, each of which is provided at both ends with a pair of friction-rollers c c, which bear upon upright timbers of the pier structure. Secured to each of these truss-beams is a horizontal rod d, upon which is pivoted the suspension-hangers c' of the float B. This hanger consists of central uprights c², which pass down through the shell and are secured to its bottom, and inclined braces c³, attached to the exterior of said shell. The shell is thus allowed to swing freely within the limits permitted by the loose chains e, Fig. 3, connected to it and to the pier. The beams C are thus sustained by the buoyancy of the float, and are permitted to move freely up and down upon the uprights of the pier whenever the motion of the water raises the float. They are further guided, however, by supplemental frames E, Fig. 3, built upon and above them, and provided with rollers f, which bear upon a guide-frame D, attached to the upper part of the pier structure, such guide-frame having the lower end of the timbers composing it inclined, so that the lower rollers f may readily bear upon it when the float is raised sufficiently to cause them to do so.

Upon the upper part of the pier structure and near each end are pivoted a pair of walking-beams F, having at one end a pitman connection g, to the truss-beams, and at the other a rod g', to transmit the power to some special

mechanism of any desired kind. In the present case I have shown the rod g' as jointed to the piston-rod of an air-compressor G; but it is evident that the motion of the rod can be transmitted to a crank-shaft, or to any other well-known means for translating its vertical reciprocation into some other application of power. Should the movement of the float be directly vertical all the truss-beams will be raised together and all the walking-beams and connections operated at the same time. Should one end only of the float be lifted, only the truss-beam at that end will be raised, and the walking-beams connected to that end be operated.

The truss-beams are counterbalanced by weights H, suspended from ropes or cables h , connected to said beams, and passing over elevated sheaves h' on the pier.

If so desired, the sheave rods or axles h^2 may be extended so that the rotary motion thereof may be transmitted and utilized for power purposes.

At any vertical motion of any part of the float two at least of the four pumps shown will be operated.

The motion produced in the float by the horizontal impact of the waves is transmitted to a rolling truck I, running between upper and lower guide-rails ii at the top of the pier. This truck has connected thereto the upper ends of arms $i' i'$, which extend downwardly with a space intervening to receive a central rod d , said rod sliding vertically therebetween. A suspension-hanger m similar to the end hangers, and consisting of a central upright m' , and inclined braces $m^2 m^2$, is connected to said central rod d , and also connected to the truck through the intermediary of inclined beams $n n$ and arms $i' i'$. To each end of the truck is attached a chain i^2 , which, after passing over a sheave j , Fig. 4, is secured to the weighted piston-rod k of another pump K. The vertical movement of this piston-rod is insured by forming its weight k' with a stud k^2 , which travels in a guide l , forming part of or secured to one of the uprights of the pier, Fig. 2. The horizontal swing of the float is limited, as before noted, by loose chains, and the amount of movement permitted it will depend upon the length of travel required in the truck to produce the requisite movement of the compressor-piston or whatever device may be employed instead of such compressor.

From the outer ends of truck I may extend the piston-rods i^3 , which work in cylinders, (not shown,) so that with each lateral movement of the truck I not only secure the operation of the piston-rod k , but also piston-rod i^3 .

The sheave-axles h^3 may be extended similar to axles h^2 , so that power to be derived from sheaves j may be utilized.

From the above description it will be seen that the conversion of the horizontal movement into power is due to the fact that the

middle support on the float is longer than the two end supports, so that the end pivots d act as fulera for the lever or central hanger m . This, in connection with the fact that the end supports or hangers c' do not have any lateral movement and the central support or hanger m does have such movement, is what allows and causes the horizontal movement to truck I.

By reference to Fig. 2 it will be seen that I have provided six separate air-compressors, two of which at least will be operated by any movement of the buoyant float. A direct vertical lift of the float will operate the four compressors at the ends. A direct vertical lift of one end of the float will operate the pair of compressors at that end. A direct swinging motion of the float will operate the middle pair of compressors through the rolling truck, and a combined vertical and swinging motion will move the pistons of all the compressors simultaneously. There is thus practically no lost motion or power in the apparatus, as in wave-powers generally heretofore used, in which the horizontal impact alone has been utilized.

I am aware that minor changes may be made in the arrangements of parts and details of construction herein shown and described without creating or necessitating a departure from the nature and scope of my invention.

Having thus described my invention, what I claim as new, and desire to secure protection in by Letters Patent of the United States, is—

1. A wave-power consisting of a suspended buoyant float having a free horizontal and vertical motion, in combination with mechanism connected to each end of said float for utilizing its vertical motion of either or both ends for the production of power, and an independent mechanism connected to said float for utilizing its horizontal movement, substantially as set forth.

2. A wave-power motor consisting of a suspended buoyant float having a free horizontal movement, frame attached to the float and connected to the movable truck-frame, and truck working upon the pier-frame and of the cables for receiving the movement of the float through the medium of the truck and transmitting the same for power purposes, substantially as set forth and described.

3. A wave-power motor consisting of a suspended buoyant float having a free vertical motion, in combination with the movable platform, uprights projecting therefrom forming guideways, and pivoted rods secured to the float-platform and connected to the horizontal beams pivoted to the pier-frame, said beams being adapted to receive and transmit the motion of the float and of the counter-balance-weights secured to the platform, substantially as set forth and described.

4. A wave-power motor consisting of a buoyant float suspended within an open pier, platform secured to the outer ends thereof, guide-uprights located thereon, pivoted rods connected to rods pivoted to the pier-frame, said

beams being adapted to transmit the vertical movement of the float, a frame secured to the float, a movable truck provided with depending uprights, forming guides and having
5 pivotal connection with the float-frame, said guides and truck adapted to move together laterally, and cables or chains connected to and adapted to transmit the motion of the

truck for power purposes, substantially as set forth. 10

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

HENRY P. HOLLAND.

Witnesses:

N. A. ACKER.

CHARLES J. ARMBRUSTER.