No. 781,113. PATENTED JAN. 31, 1905.

D. G. WEEMS.

WAVE MOTOR.

APPLICATION FILED MAY 6, 1904.

2 SHEETS—SHEET 1

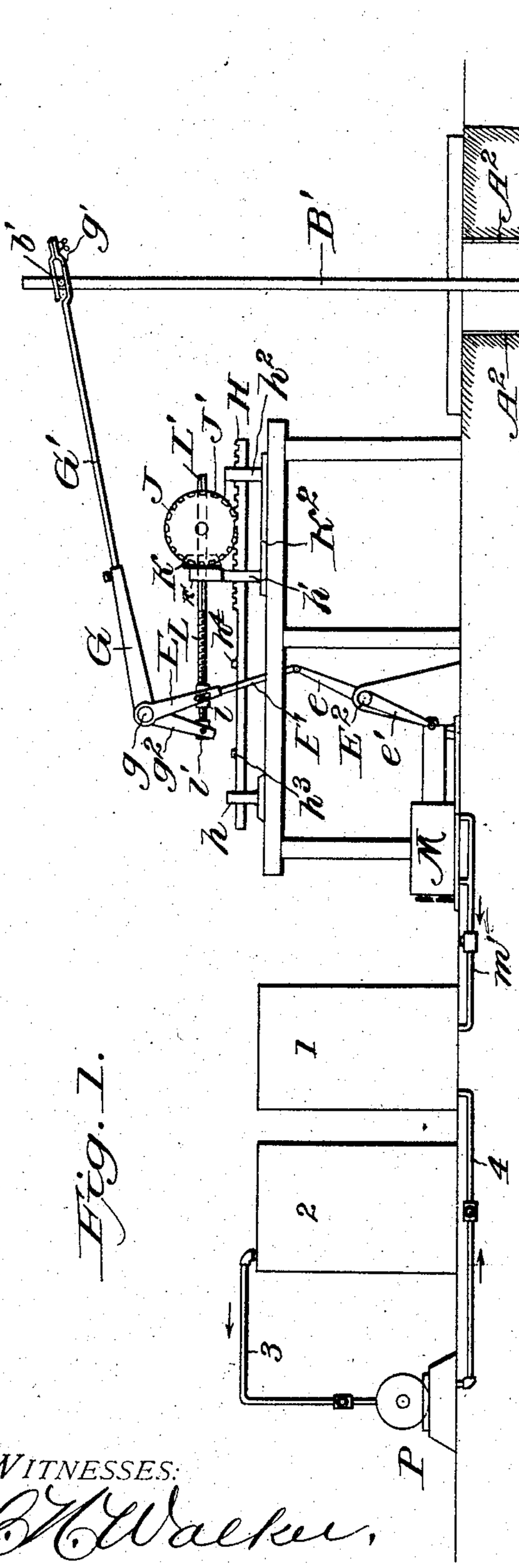


Fig. 1.

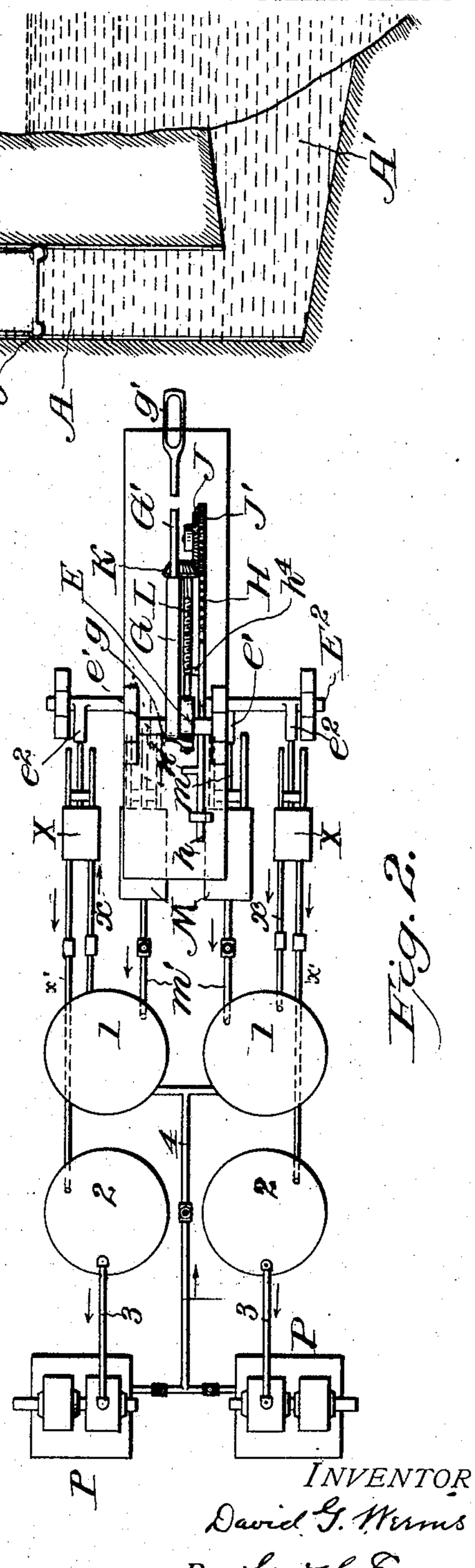


Fig. 2.

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Fig. 3.

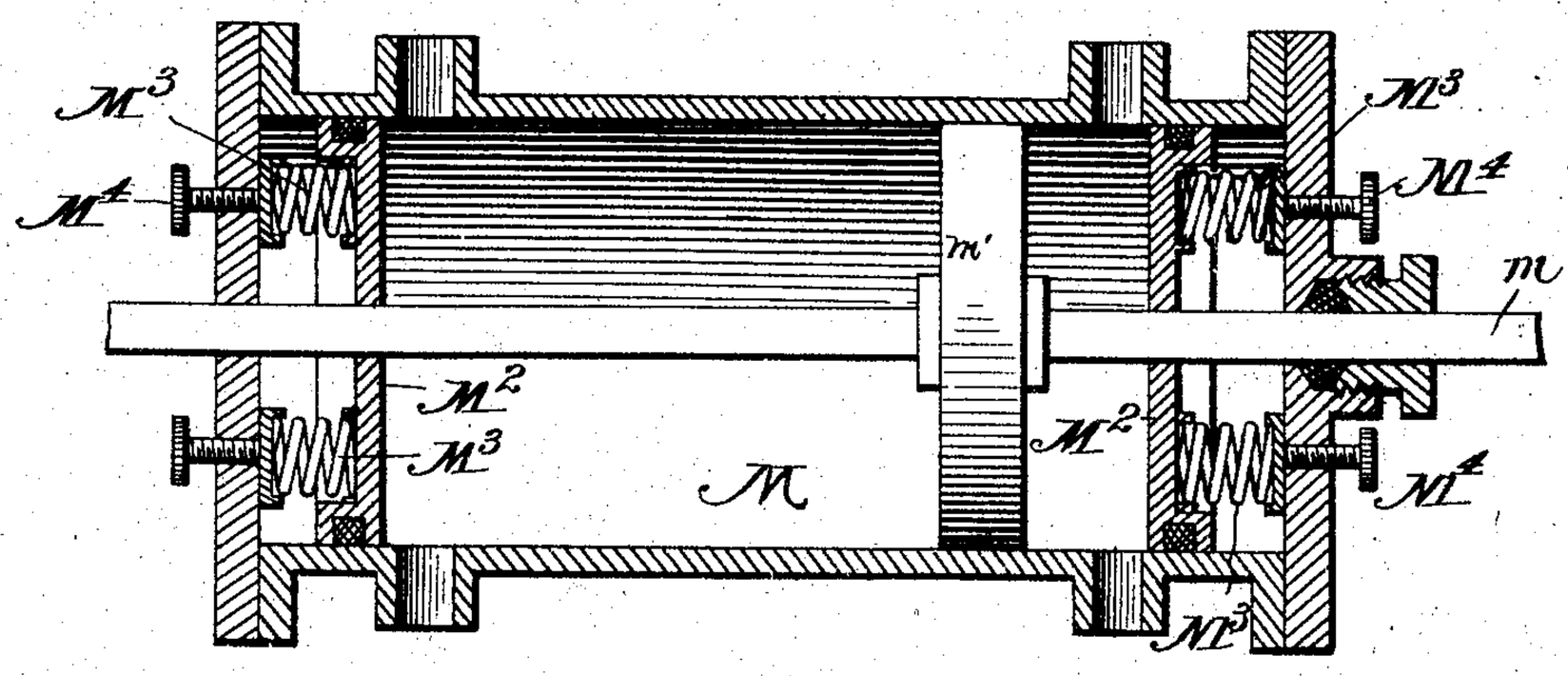
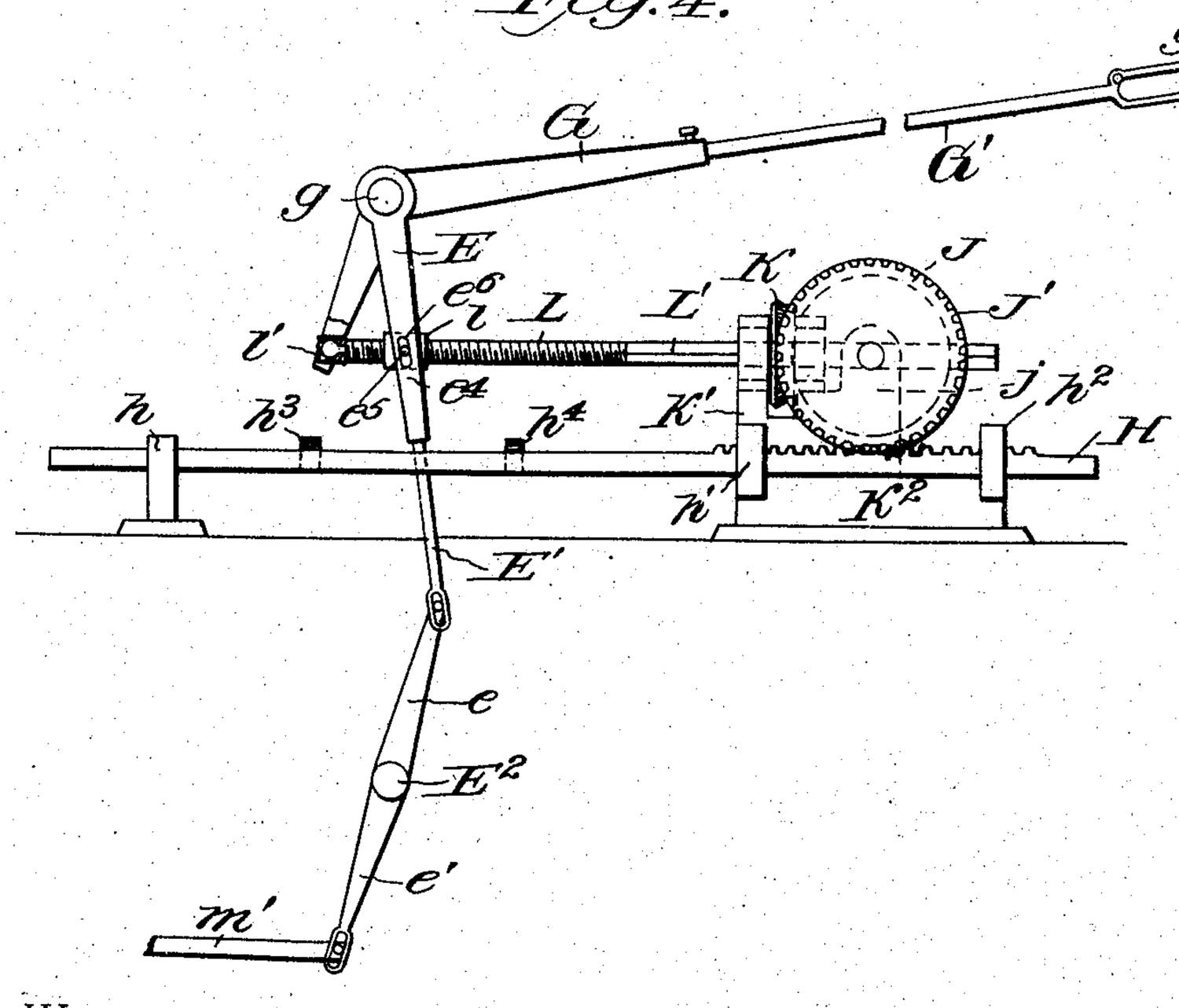



Fig. 4.

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# UNITED STATES PATENT OFFICE.

DAVID G. WEEMS, OF BONANZA, COLORADO.

## WAVE-MOTOR.

SPECIFICATION forming part of Letters Patent No. 781,113, dated January 31, 1905.

Application filed May 5, 1904. Serial No. 206,445.

*To all whom it may concern:*

Be it known that I, DAVID G. WEEMS, a citizen of the United States, and a resident of Bonanza, in the county of Saguache and State of Colorado, have invented certain new and useful Improvements in Wave-Motors, of which the following is a specification.

My invention relates to that class of motors in which a float is so placed as to be actuated by the waves and in turn actuate an air-compressing mechanism.

The objects of the invention are to provide a wave-motor with means for taking up or relieving sudden jars to the machinery due to the varying force of the waves; to automatically regulate the stroke of the transmitting-lever, so that the stroke of the pumps may be regular as the tide may rise or fall; to cushion the piston of the air-pump against breakage, and to provide a novel and useful combination of air tanks and pumps. These objects I accomplish by the construction shown in the accompanying drawings, in which—

Figure 1 is a side elevation of my improved apparatus, partly in section. Fig. 2 is a plan thereof. Fig. 3 is a sectional view of an air-pump. Fig. 4 is an enlarged elevation of the automatic adjusting mechanism to regulate stroke of lever according to rise and fall of tide.

A represents a vertical well formed in a bluff or structure situated or built at a point where the sea breaks with the required force. The opening A′ from the well A to the sea is below the low-water line. In the well A is located suitable guides $A^2$, on which travel the rollers *b* of the float B. The float B is provided with a rod B′, which extends up through the well and above the upper end thereof the required distance.

G designates a transmitting-lever in the form of a bell-crank and pivoted at *g* to rock vertically. The horizontally-extending arm of the lever G is provided with a flexible extension G′, provided at its free end with a slotted piece *g′*, in which works a pin *b′* on the float-rod B′. This slotted piece *g′* may be opened, as shown, when it is desired to disconnect rod B′ from the lever G.

The bell-crank G is provided with a loose transmitting-arm E, depending from the axis *g* and serving to automatically regulate the stroke of the pump-pistons, as will be described. This loose arm E is provided at its lower end with a flexible extension E′, pivotally connected at its lower end to the upwardly-projecting arm *e* of a rock-shaft $E^2$, provided with four depending pump-actuating arms *e′ e′ e² e²*. The loose arm E is provided with a pivotally-supported nut *l*, the nut being mounted in a fork $e^4$ by means of trunnions $e^5$, entering slots $e^6$ in said fork.

L is a long screw-shaft having a universal connection at one end *l′* with the lower end of the lever-arm $g^2$ and extending through the nut *l*. The other end of the screw-shaft is in sliding connection with a beveled gear K, mounted in a suitable bearing K′ at the upper end of a frame $K^2$. The hub of the gear K is provided with a square opening, and the end L′ of the shaft is correspondingly shaped, so that the gear K will rotate the shaft and yet allow it to slide therethrough. The gear K meshes into a larger bevel-gear J, mounted in bearings *j* also on the frame $K^2$, and the other face of the gear J is formed with pins or cog-teeth J′, which mesh into a longitudinally-reciprocating rack H, mounted in bearings *h h′* $h^2$ on the lower portion of frame $K^2$. The rack H is provided with two shoulders $h^3$ $h^4$, between which the arm E E′ vibrates without normally striking either one. Should the tide begin to fall, however, the float B will descend and pull down the long arm of lever G and throw its arm $g^2$ to the left, and this will cause the loose arm E to strike the shoulder $h^3$, slide rack H to the left, rotate gear J to the right, gear K in the direction of the arrow, and the gear K will rotate the screw-shaft I and cause nut *l* to pull lever-arm E to the right, and so adjust it at the proper angle for actuating the rock-shaft E and pump-pistons. A rise in the tide will cause a reverse operation of the adjusting mechanism, as the

lever-arm E will then strike the other abutment or shoulder $h^4$ and move the rack to the right. The flexible members G′ and E′ cushion the mechanism against breakage by violent action of the waves.

M M represent two low-pressure double-acting air-pumps, the piston-rods $m\,m$ of which are connected to the arms $e'\,e'$ of rock-shaft $E^2$, and X X represent two high-pressure double-acting pumps connected to the arms $e^2\,e^2$ of said shaft $E^2$. The pumps M M connect by suitable pipes $m'\,m'$ with two low-pressure tanks I I, while the high-pressure pumps X X connect by supply-pipes $x\,x$ with the low-pressure tanks I I and by discharge-pipes $x'\,x'$ with the high-pressure tanks 2 2, these pipes being valved, as usual, for such purpose. As shown in Fig. 3, the ends of the pump-cylinders are provided inside with cushioned supplemental heads $M^2$, suitably packed and lying beyond the ports. Between the cylinder-heads and the supplemental heads are placed strong buffer-springs $M^3$, the tension of which may be adjusted by means of screws $M^4$, extending inwardly through the cylinder-heads into contact with bearing-plates at the outer ends of the springs. These spring-pressed heads $M^2$ serve to cushion any violent plunging of the pump-pistons $m'$ and also allow the pistons to approach close to the ports to force out all the air.

P P designate the machine to be operated, that shown being designated as an electric generator, and this generator or machine is actuated by a suitable motor, supplied with air from the high-pressure tanks 2 2 by means of pipes 3 3. The air exhausted from said motor will be returned to the low-pressure tanks by a pipe 4.

Various modifications may be made in the above-described apparatus without departing from the scope of my invention.

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

1. In a wave-motor, the combination with a wave-actuated float or plunger and a main lever connected therewith, of an automatic regulator actuated from a member of said lever to regulate the angle of said member, upon the rise and fall of the tide and permit of an even stroke being maintained.

2. In a wave-motor, the combination with a wave-actuated float or plunger and a main lever actuated thereby, of an automatically-adjusted transmitting-arm connected to said lever and mechanism actuated thereby, to change its angle with respect to the main lever as the latter is depressed or raised by the fall and rise of the tide.

3. The combination with the main lever having a rigidly-connected arm and a loose transmitting-arm, of an automatically-operating adjusting mechanism connected to said rigid and loose arms and actuated from the loose arm to change the angle of said loose arm with respect to the main lever.

4. The combination with the main lever having a fixed arm and a loose arm, of a screw-shaft swiveled to the rigid arm, a nut on the loose arm through which the shaft passes, a rack having abutments beyond the normal strokes of the loose arm, and gearing connecting the rack with the screw-shaft for the purpose described.

5. The combination, with the main lever having a fixed arm and a loose arm, of a screw-shaft swiveled to the rigid arm, a nut on the loose arm through which said shaft passes, a gear slidingly connected with the other end of the screw-shaft, a cog-wheel or pinion having gear-teeth meshing with said first gear, and a sliding rack meshing with the cog-wheel or pinion and provided with shoulders or abutments beyond the normal strokes of the loose arm.

6. The combination with the float, of a main lever provided with a flexible member connected with the float-rod, and also having a loose arm terminating in a flexible extension, and means for changing the angle of the loose arm with respect to said lever.

7. The combination with the float, of a main lever connected with the float-rod, means for adjusting the main lever to regulate the stroke of its transmitting-arm, and an air-compressing mechanism operatively connected with said transmitting-arm.

8. The combination with the float, a main lever connected therewith and provided with a transmitting-arm, and means for regulating the stroke of said arm, of an air-compressing pump operated by said arm and having supplemental yielding heads to cushion the pump against breakage from sudden impulses of the said lever.

9. The combination with the float, a main lever connected therewith, and provided with a transmitting-arm, and means for regulating the stroke of said arm, of an air-compressing pump operated by said arm and having supplemental spring-cushioned heads to cushion the pump against breakage from sudden impulses of said lever and screws for regulating the tension of the cushioning-springs.

10. In a wave-motor the combination with a float-actuated lever, having an automatically-adjusted transmitting-arm, of a rock-shaft actuated from said arm and provided with a plurality of pump-operating arms, low and high pressure pumps connected to said arms, low-pressure tanks connected with the low-pressure pumps, high-pressure tanks supplied by the high-pressure pumps from the low-

pressure tanks; and an offtake from the high-pressure tanks to supply a suitable motor.

11. The combination with a wave-motor, comprising a float, a lever actuated thereby and a rock-shaft actuated from said lever, of a plurality of high and low pressure pumps operatively connected with said rock-shaft, a low-pressure tank supplied by the low-pressure pumps, high-pressure tank supplied by the high-pressure pump from the low-pressure tank, a motor supplied from the high-pressure tank and an exhaust-pipe leading from the motor back to the low-pressure tank.

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

DAVID G. WEEMS.

Witnesses:
JOHN SCHMALL,
GEORGE C. BERNER.