No. 822,203. PATENTED MAY 29, 1906.

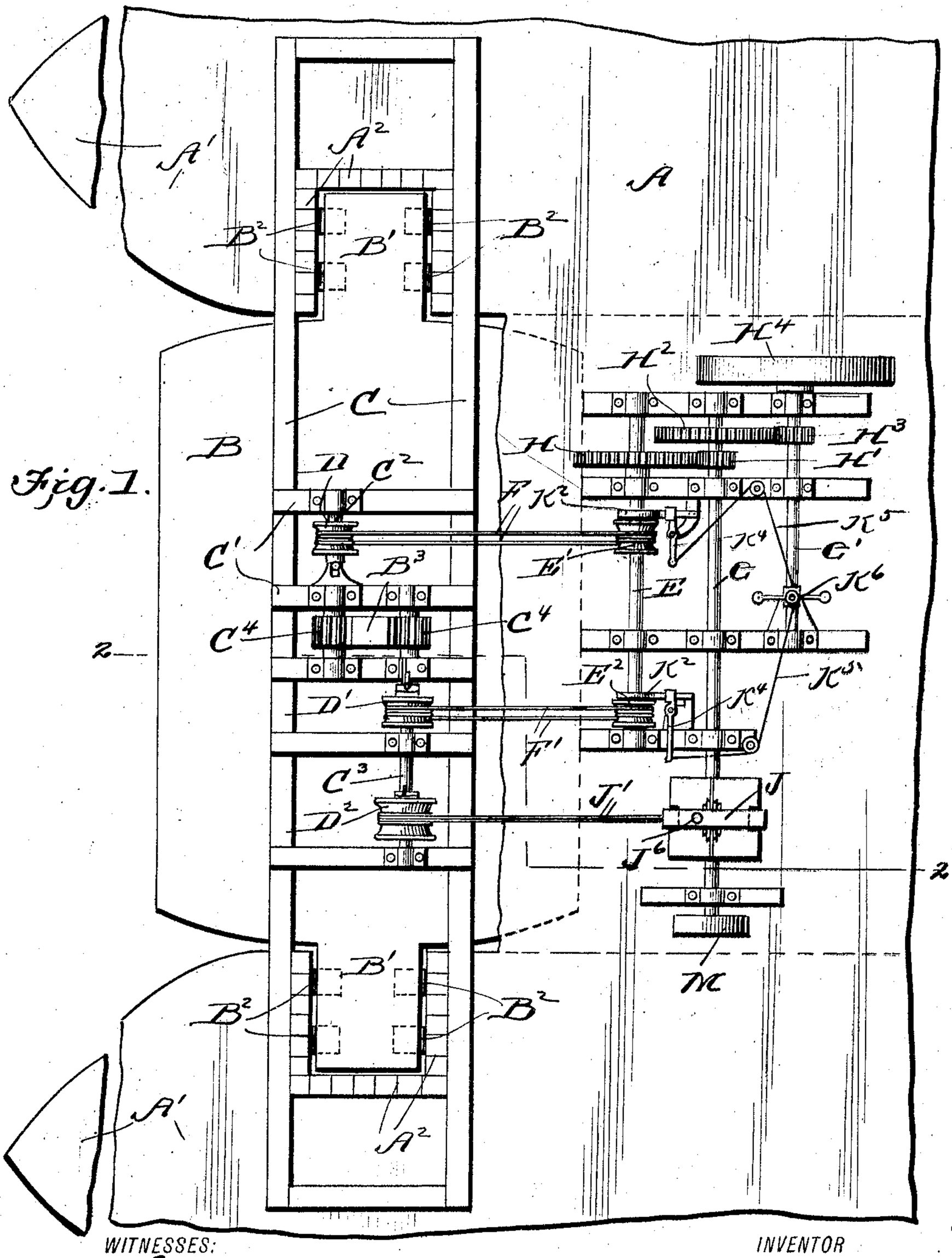
J. A. J. FLEMING.

WAVE MOTOR.

APPLICATION FILED JULY 7, 1905.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 3.

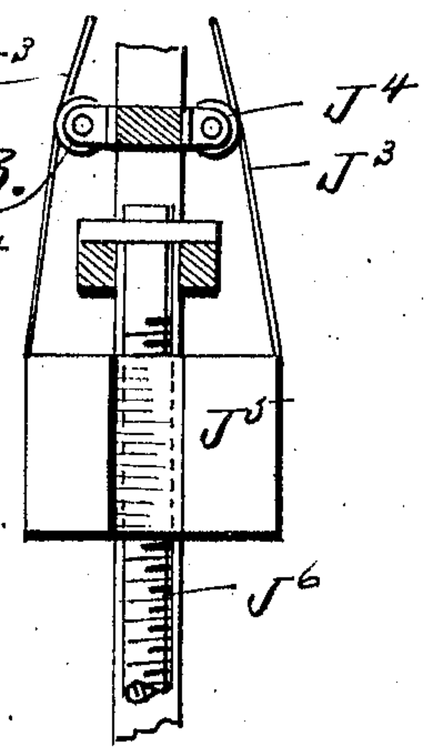

Fig. 2.

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3 SHEETS—SHEET 3.

Fig. 4.

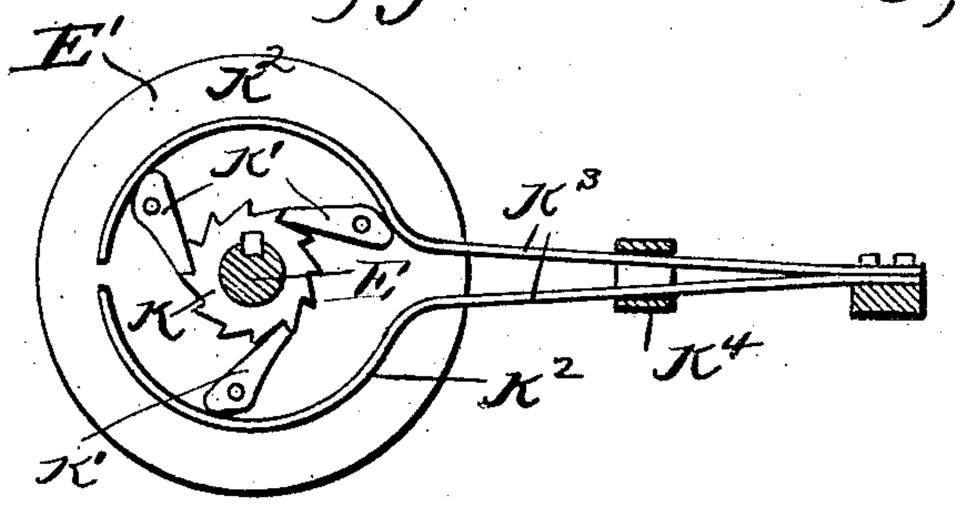


Fig. 5.

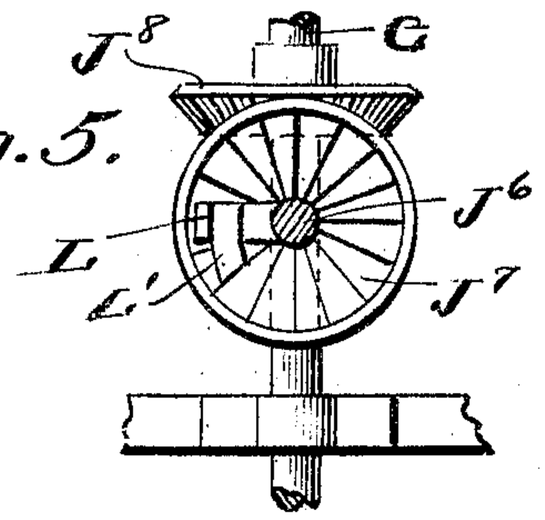


Fig. 6.

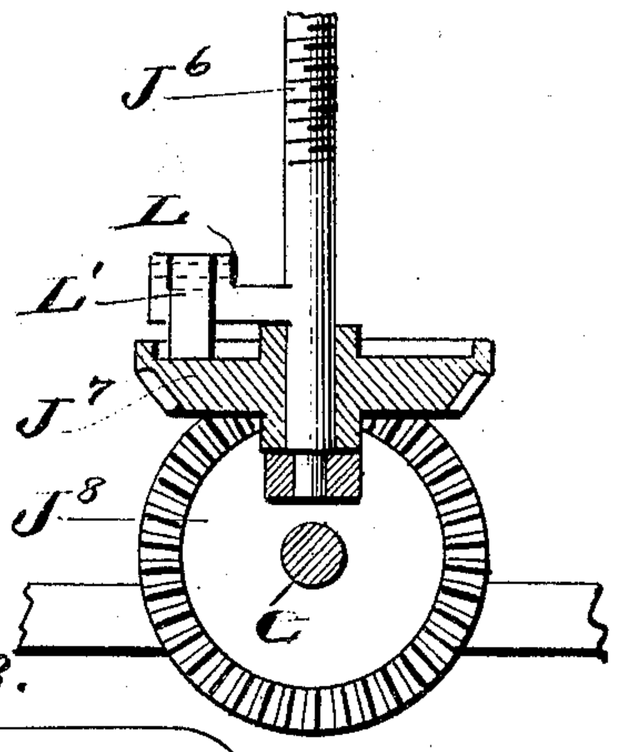


Fig. 7.

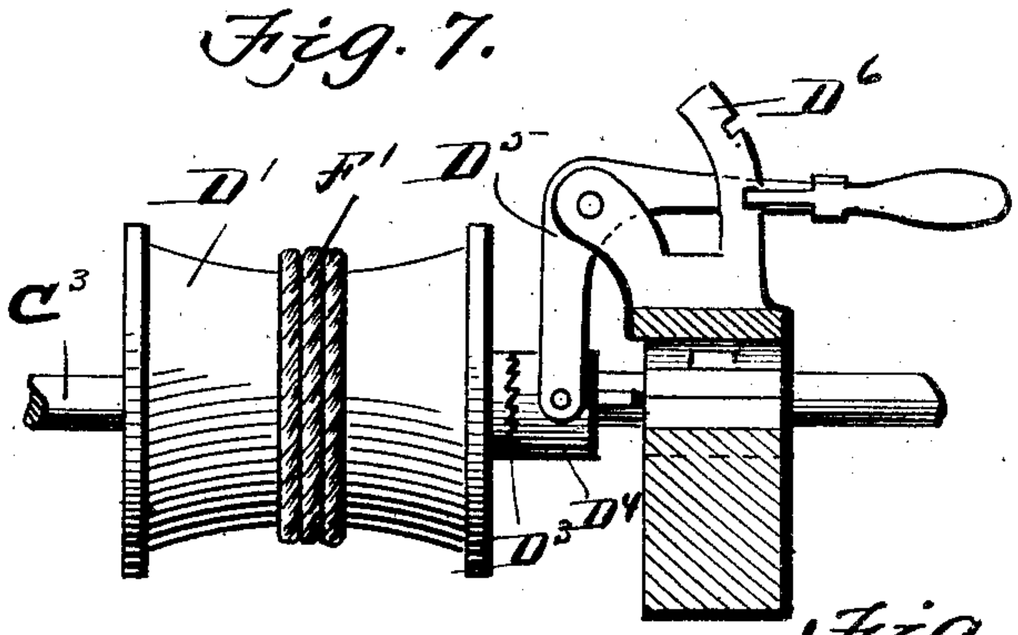
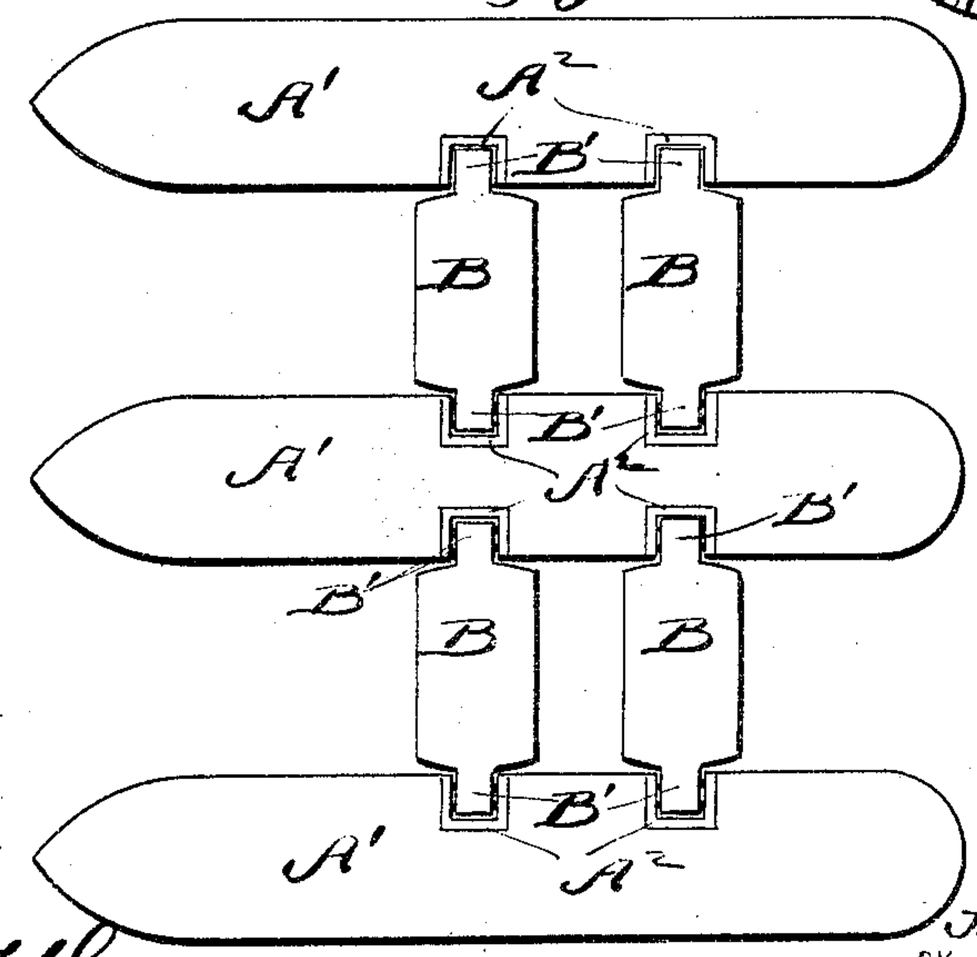


Fig. 8.



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UNITED STATES PATENT OFFICE.

JAMES A. J. FLEMING, OF NEWPORT, OREGON.

WAVE-MOTOR.

No. 822,203. Specification of Letters Patent. Patented May 29, 1906.

Application filed July 7, 1905. Serial No. 268,627.

To all whom it may concern:

Be it known that I, JAMES A. J. FLEMING, a citizen of the United States, residing at Newport, in the county of Lincoln and State of Oregon, have invented a new and useful Wave-Motor, of which the following is a specification.

This invention relates to a motor to be operated by the surf independent of the ebb and flow of the tide, and has for its object the converting of the vertical movement given to a float acted on by the waves into a rotatory motion adapted to be transmitted to a shaft from which power can be transmitted to any desired kind of machinery.

The invention consists of an open well into which the sea waves are admitted and in which a float rises and falls under the impulses of the said waves and of suitable gearing, drums, and cables by which such rising and falling is changed into a rotary motion in one direction and practically continuous.

The invention also consists of the novel features of construction and combination of parts hereinafter described, pointed out in the claims, and shown in the accompanying drawings, in which—

Figure 1 is a plan view of my device. Fig. 2 is a vertical elevation. Fig. 3 is a detail view of a threaded rod and weight, parts being in section. Fig. 4 is a side or end elevation of a drum, showing ratchet-and-pawl mechanism and controlling means, a lever being shown in section. Fig. 5 is a plan view of a pawl and ratchet, a shaft upon which the ratchet is loose being shown in section. Fig. 6 is a transverse section through the ratchet shown in plan in Fig. 5, a portion of the ratchet-shaft being shown in elevation. Fig. 7 is an elevation of a drum and a clutch mechanism. Fig. 8 is a diagrammatic plan of a plurality of piers and floats.

In the drawings, A represents a suitable base or platform, in advance of which project two parallel piers A′, though a greater number can be employed when a plurality of floats are to be used—as, for example, in the construction outlined in Fig. 8. Between the parallel piers A′ is formed a space which I will term the "well," and as these piers are to be built out in the surf it will be obvious that the waves will rise and fall between the walls of the said piers. On their opposing faces the piers are vertically recessed and the walls of the recesses lined with timbers A^2. In the well between the tiers works one or more floats B, and to guide the floats in their vertical rise and fall each float is provided with wings B′, which project into the pier-recesses. To prevent chafing of the timbers lining the recesses, I provide the sides of the wings B′ with antifriction-rollers which travel on the timbers, as shown at B^2. Each float is provided with a vertical rack-stem B^3, having rack-teeth on opposite edges.

Extending from pier to pier is a horizontal frame C, provided with cross-timbers C′. Journaled in bearings on the cross-timbers C′ are shafts C^2 and C^3. The shafts also carry pinions C^4, which engage, respectively, opposite sides of the rack B^3. The shaft C^2 carries a drum D and the shaft C^3 drums D′ and D^2.

On the platform A are mounted three shafts E, G, and G′, all parallel to the shafts C^2 and C^3. The shaft E carries drums E′ and E^2. The drums D and D′ are loose on their shafts and are coupled to the same by means of a clutch mechanism, as shown in detail in Fig. 7. Each of these drums D and D′ has a ratchet D^3 at one end, which is adapted to be engaged by a sliding toothed clutch D^4, operated by a bell-crank pivoted lever D^5, which operates in the usual manner on a segment D^6. The drums E′ and E^2 are also loose on the shaft E and are connected to the shaft by a pawl-and-ratchet mechanism that will be described in detail later and which is shown in Fig. 4.

Cables F and F′ run over the drums D and E′ and D′ and E^2, respectively. The shaft G is the power-shaft of the device and is geared to the other shafts as follows: A large gear-wheel H meshes with a pinion H′, carried by the shaft G, the gear-wheel H being on the shaft E, and a gear-wheel H^2 on the shaft G meshes with a pinion H^3 on a fly-wheel shaft G′, which carries a fly or balance wheel H^4.

A tower J on the platform A carries mechanism controlled by a cable J′, which winds and unwinds on the drum D^2 and runs over a pulley J^2, hung in the tower J. The cable branches in the tower, as shown at J^3, and the branches J^3 run over rollers J^4 and are connected to opposite sides of a weight J^5. A spirally-threaded shaft J^6 is vertically journaled in the tower and passes through a threaded perforation or bore in the weight J^5, the weight rising and falling on the shaft, and movement of the weight rotating the shaft. At the base of the shaft J^6 is loosely journaled a ratchet-faced bevel gear-wheel J^7, which

meshes with a bevel gear-wheel J^8, carried by the shaft G. The threaded shaft, which for convenience will be termed the "worm-shaft," carries a horizontal arm L, to which is pivoted a pawl L', that engages the upper ratchet-face of the bevel-gear J^7.

A drive-pulley M is also carried by the shaft G.

It will be obvious that the rack-stem B^3 has a reciprocating motion rising and falling with the float B, to which it is pivotally connected to avoid strain by reason of one end of the float rising more rapidly than the other, and that the pinions C^4 will be rotated first in one direction and then the other. To give continuous rotation in one direction to the shafts E, G, and G', the following devices are employed: The drums E and E^2, as previously stated, are loose on their shaft E. A ratchet K is fixed on the shaft E, adjacent each drum, and pawls K' are pivoted to the drums and engage the ratchets K. A split spring-band K^2 is adapted to bear on the pawls K' and throw them out of operation or into operation, as may be desired, and each band has converging arms K^3, which pass through a slot in a lever K^4. By sliding the slotted end of the lever toward the drums the arms K^3 are pressed closer together and the bands tighten against the outer ends of the pawls, lifting their inner ends out of engagement with their respective ratchet. It will now be obvious that by reversing the rotation of the drums E' and E^2 the pawls on one drum will engage their ratchet during rotation in one direction and slip during reverse rotation of the drum, and that the pawls on the opposite drum will be in engagement while the pawls on the other drum are slipping, and as the drums are driven from the drums D and D', and these drums are on separate shafts driven from opposite sides of the rack-stem B^3, that the drums E' and E^2 will rotate in opposite directions, and that the same direction of rotation will be given the shaft E.

The operation of the device is as follows: The float B will rise and fall with the incoming and going out of the waves, and the vertical movement of the stem B^3 will rotate the pinions C^4. The drums D and D' being rotated from their shafts C^2 and C^3, which are rotated through the mediums of the pinions C^4, the drums E' and E^2 will be rotated by the cables F and F'. The gear-train described will impart this rotation to the shafts G and G'. The drum D^2 will also raise and lower the weight J^5 through the winding and unwinding of the cable J', the weight being raised as the float rises and falling by reason of its own weight as the float descends. The falling motion of the weight will be retarded by the spiral worm-shaft J^6, which is rotated by movement of the weight, and during the downward movement of the weight the worm-shaft is connected by its pawl L' to the ratchet of the bevel gear-wheel J' and is performing work by aiding in driving the shaft G. During upward movement of the weight J^5 the pawl L' will slip on the ratchet J^7. This is necessary, as the worm-shaft J^6 is then rotating in a direction the reverse of that of the shaft G.

It will be obvious that the float or floats alone are sufficient to drive the mechanism during their upward movement, but while falling the weight of the float alone would be insufficient to hold the machinery driven at a fixed speed, and, furthermore, that the rise and fall of the floats is irregular and not at a constant either as to height of rise or speed of their vertical movement. To give to the device, therefore, a more constant speed than could be had with the floats only, I employ the fly-wheel H^4 and the weight J^5, the latter performing work during its fall as the float falls and the fly-wheel carrying the shaft G over the period of inaction at the moment of the float reaching its highest or lowest point of travel. The piers are so placed that the device can be operated at various stages of tide. A governor K^6 is connected by cables K^5 to the levers K^4, and when the speed becomes excessive the governor will draw upon the levers so as to tighten the bands K^2 on the pawls K' and lift them from engagement with ratchets K^2, thus permitting them to slip until the speed has been reduced, when the governor, which may be of any ordinary make, will return the levers to their proper position or if connected by single cables, as shown in the plan view in Fig. 1, the governor will permit the cables K^5 to slacken and the spring-arms H^3 will serve to force the levers to their normal positions.

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

1. A wave-motor comprising a float, a double rack-pinion, parallel shafts, pinions on the shafts adapted to mesh with said rack, a drum on each of said shafts, a shaft parallel to the pinion-carrying shafts, drums loose thereon, ratchets adjacent the drums, pawls on the drums engaging the ratchets during rotation in one direction and slipping during reverse rotation, and cables running over the drums on the pinion-carrying shafts and the drums on the ratchet-carrying shaft.

2. A wave-motor comprising a float, a rack-bar carried by the float, shafts adjacent the rack-bar, pinions thereon meshing with the bar, drums on the shafts, a drive-shaft, means for transmitting rotation of two of the drums on the first-mentioned shafts to the drive-shaft, a tower, a pulley, a cable running over said pulley and one of the drums on one of the first-mentioned shafts, a weight suspended by the free end of the cable adapted to rise and fall with the float, and means for

transmitting downward movement of the weight into rotary motion in the drive-shaft.

3. The combination with a float and a drive-shaft rotated by rise of said float, of a weight, a drum rotated by rise and fall of the float, a cable running over the drum and connected to the weight, the weight rising and falling synchronously with the drum, said weight having a threaded aperture, a vertical, spirally-threaded shaft working in the threaded aperture of the weight and rotated by rise and fall of the weight, and means for connecting the said shaft to the drive-shaft during the fall of the weight, as and for the purpose set forth.

JAMES A. J. FLEMING.

Witnesses:
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O. C. GRAVES.