(No Model.) 3 Sheets—Sheet 1.

F. L. PYLE & J. McDONALD.

WAVE MOTOR.

No. 596,124. Patented Dec. 28, 1897.

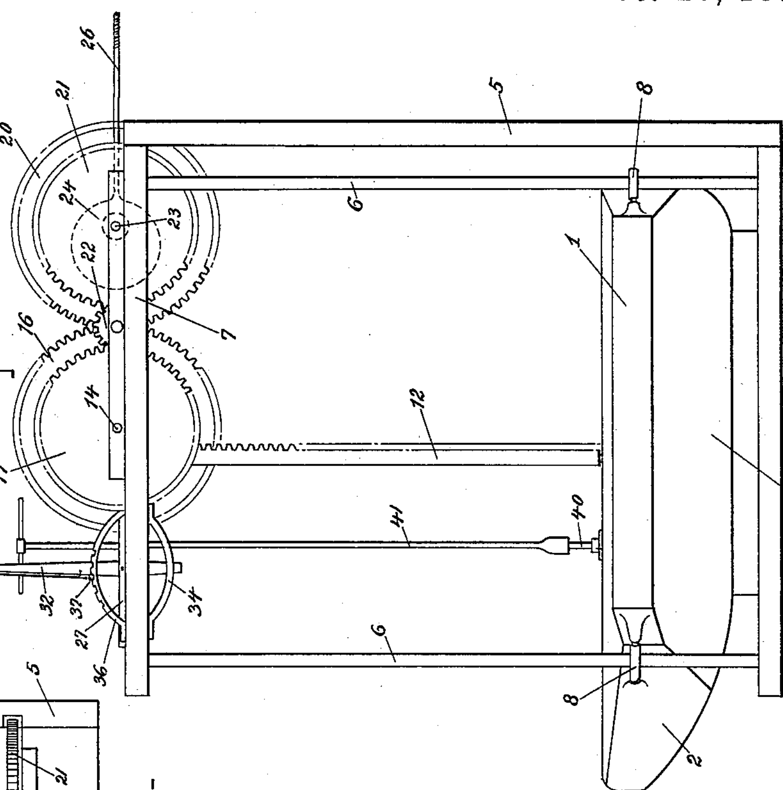

FIG. 1.

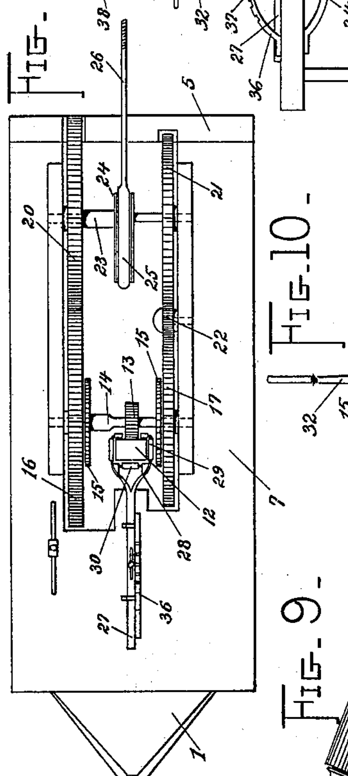

FIG. 2.

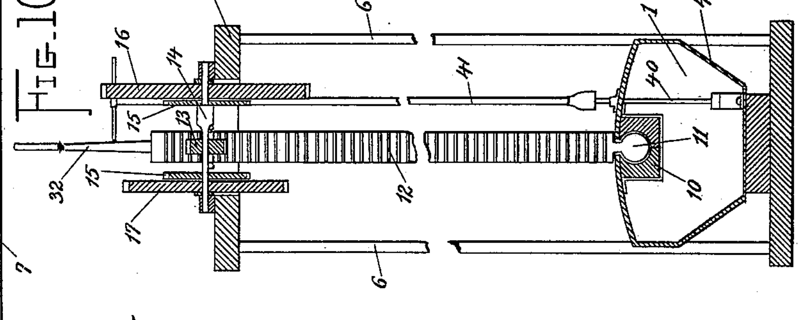

FIG. 10.

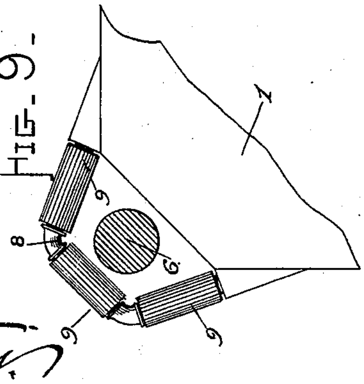

FIG. 9.

WITNESSES

John F. Deupferwiel

C. D. Kesler.

INVENTORS.

Frank L. Pyle.

Joe McDonald.

By John Wedderburn

Attorney

(No Model.) 3 Sheets—Sheet 2.

F. L. PYLE & J. McDONALD.

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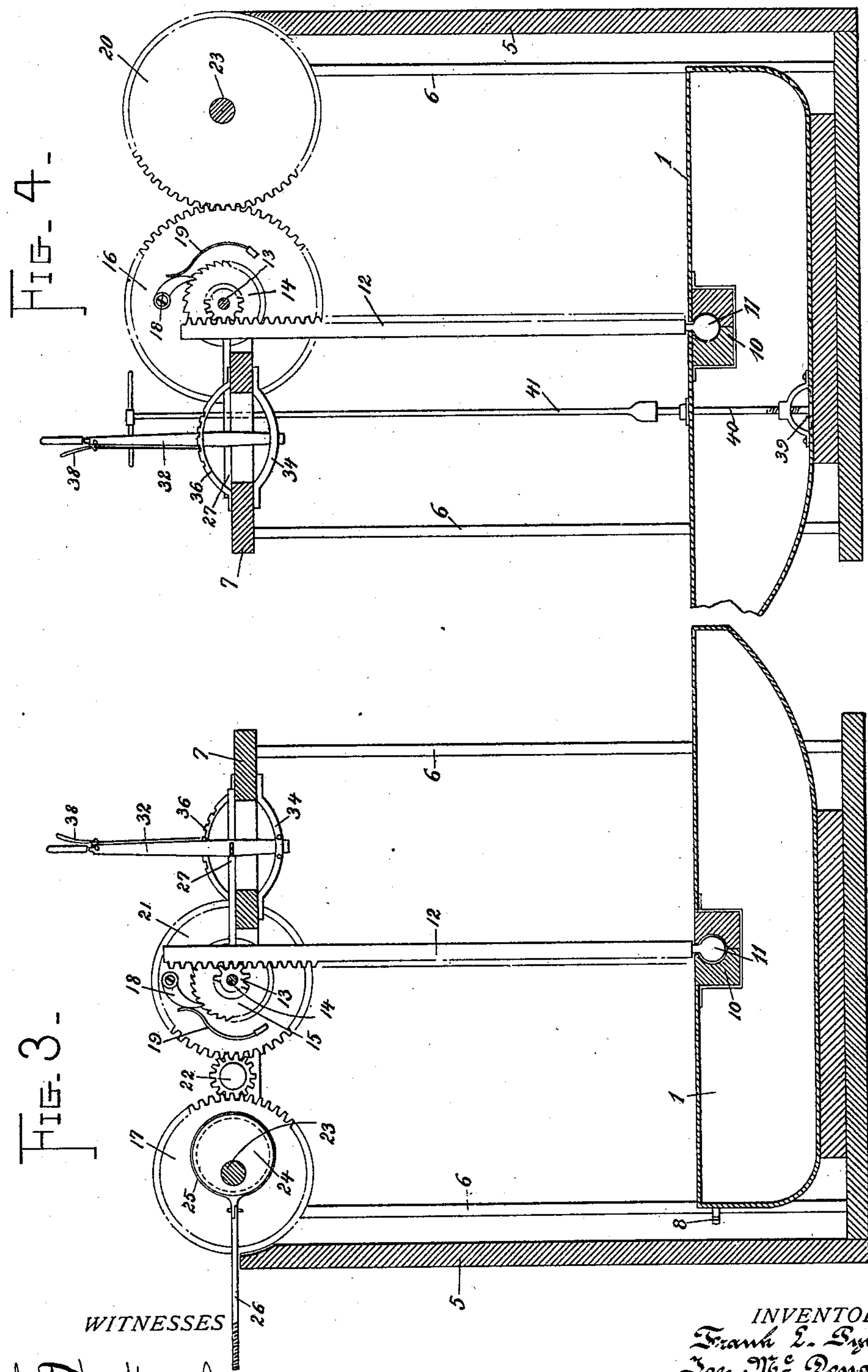

WITNESSES

John F. Deufurriel
C. D. Kesler

INVENTORS,
Frank L. Pyle.
Joe McDonald.
By John Wedderburn
Attorney

(No Model.) 3 Sheets—Sheet 3.

F. L. PYLE & J. McDONALD.

WAVE MOTOR.

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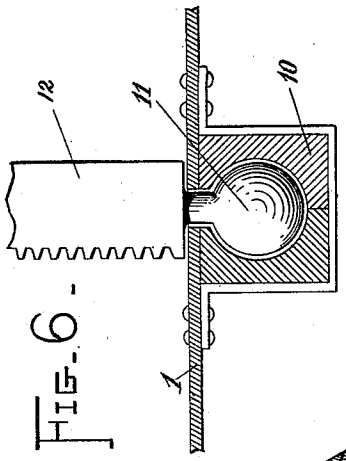

FIG. 6.

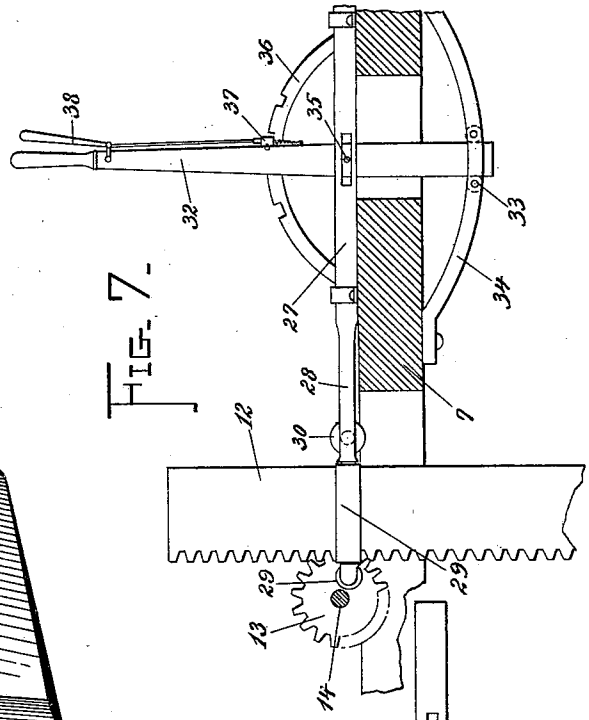

FIG. 7.

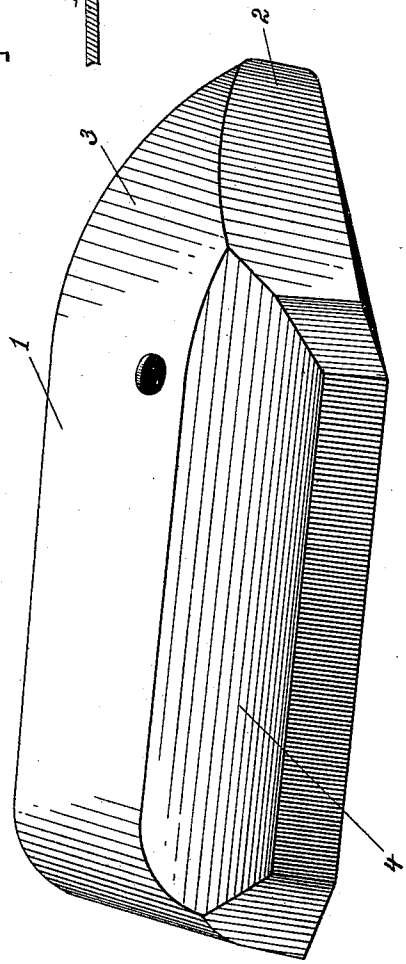

FIG. 5.

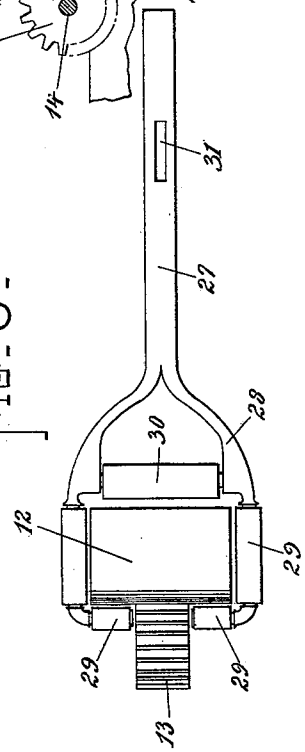

FIG. 8.

WITNESSES

John F. Seufferwil.

C. D. Keeler.

INVENTORS

Frank L. Pyle.

Jos. McDonald.

By John Wedderburn

Attorney

UNITED STATES PATENT OFFICE.

FRANK L. PYLE AND JOE McDONALD, OF SIMI, CALIFORNIA.

WAVE-MOTOR.

SPECIFICATION forming part of Letters Patent No. 596,124, dated December 28, 1897.

Application filed January 11, 1897. Serial No. 618,726. (No model.)

To all whom it may concern:

Be it known that we, FRANK L. PYLE and JOE MCDONALD, citizens of the United States, residing at Simi, in the county of Ventura and State of California, have invented certain new and useful Improvements in Wave-Motors; and we 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.

This invention relates to wave-motors, and is designed to utilize the power of waves and transmit the same to a distance where it may be employed for driving any kind of machinery.

One of the aims of the present invention is to provide improved mechanism whereby the up and down movements of the float are both utilized for actuating the driving mechanism in the same direction or without reversing it.

Another aim of the invention is to provide a specially-constructed float whereby the full power of the waves is taken advantage of, and to provide in connection with such float means whereby the proper amount of water-ballast may be admitted to the interior of said float for regulating the extent to which the float is submerged.

Other objects and advantages of the invention will appear in the course of the ensuing description.

The invention consists in an improved wave-motor embodying certain novel features and details of construction and arrangement of parts, as hereinafter fully described, illustrated in the drawings, and incorporated in the claims.

In the accompanying drawings, Figure 1 is a side elevation of the improved wave-motor. Fig. 2 is a plan view of the same. Fig. 3 is a longitudinal section through the framework, said section being taken between the opposing pairs of gear-wheels, looking in one direction. Fig. 4 is a similar section looking in the opposite direction. Fig. 5 is a reverse perspective view of the float. Fig. 6 is a detail section showing the connection between the float and rack-bar, and Fig. 7 is an enlarged detail section showing the means for moving the rack-bar into and out of action. Fig. 8 is a plan view of said mechanism. Fig. 9 is a detail plan view of one corner of the float, showing the antifriction-rollers which contact with one of the guide-posts; and Fig. 10 is a cross-section taken in line with the pinion-shaft.

Similar numerals designate corresponding parts in the several figures of the drawings.

Referring to the drawings, 1 designates the float of the improved motor, which is made hollow and constructed from a sheet material, such as galvanized iron or steel. This float is closed at top and bottom and upon all sides and its general shape is rectangular; but at its forward end it is brought to a point, as indicated at 2, and also sloped upward on its under side, as indicated at 3, to resemble an ordinary batteau or pontoon.

In setting up the motor the pointed end of the float is presented to the incoming waves in order that the latter may act with greater effect to raise the float. The lower longitudinal corners of the float are also beveled, as indicated at 4, in order to enable the waves to act laterally thereon. The rear end of the float is arranged in close proximity to a sea-wall or other vertical obstruction 5, which causes the waves to rebound and compact upon each other beneath the float, so as to increase their lifting force. The float is anchored between and guided in its movements by a series of vertical posts 6, which extend from a superposed platform or dock 7 downward to the bed of the stream. The float is provided at each corner or at points corresponding to the position of the posts 6 with bail-shaped frames or bent rods or axles 8, which surround the posts 6. Upon these frames or axles 8 is journaled a series of rollers 9, adapted to bear against the post 6 upon one or more sides, so as to relieve the friction of the float as it moves up and down on said posts. The float is provided at the top and near its center with a socket-piece 10, having an approximately hemispheroidal cavity in which is received the spherical or bolt-shaped head 11 at the lower extremity of a vertically-disposed rack-bar 12, toothed upon one side only. This rack-bar passes slidingly through the platform or dock 7 and meshes with a spur-pinion 13 on a transverse shaft 14, having fast thereon at each side of said pinion ratchet-wheels 15, the teeth of which

are reversely disposed. Mounted loosely on the shaft 14 outside of the ratchet-wheels 15 are large spur gear-wheels 16 and 17, the one 16 being larger in diameter than the one 17. Upon the inner adjacent surface of said spur-wheels are pivotally-mounted pawls 18, held in engagement with their respective ratchet-wheels by springs 19. These pawls are reversely disposed and adapted to operate alternately according to the direction in which the rack-bar 12 is moved.

The larger spur-gear 16 meshes with another spur-gear 20 of corresponding size, and the smaller spur gear-wheel 17 is operatively connected to another gear 21 of corresponding size by means of the interposed pinion 22. The gears 16 and 20 are thus caused to rotate in opposite directions, while the gears 17 and 21 rotate in the same direction. The gear-wheels 20 and 21 are mounted fast on a transverse shaft 23 and spaced apart sufficiently to enable an eccentric 24 to be mounted on the shaft 23 between said gear-wheels. Extending around the eccentric 24 is a strap 25, to which is connected a rod or bar 26, which is adapted to be operatively connected to the piston of an air-pump, whereby air may be compressed in a suitable tank and carried through suitable piping to the point where it is desired to convert the same into power for driving machinery of any character. As the rack-bar 12 moves upward it rotates the shaft carrying the ratchet-wheels and actuates through the medium of one of the pawls one of the gear-wheels 16 or 17, as the case may be, and in the downward movement of said rack-bar this pawl slips past the teeth of this ratchet-wheel while the opposite pawl is engaged with its ratchet-wheel, thereby imparting motion to the other gear-wheel on the pinion-shaft. It will thus be seen that the shaft carrying the eccentric will always be rotated in the same direction during both the upward and downward movement of the float and the rack-bar actuated thereby. Continuous motion is thus imparted to the eccentric in the same direction.

Mounted upon the platform or dock 7 is a shifting bar 27, one end of which is forked to constitute a bent shaft which partly embraces the rack-bar 12. The ends of the fork-arms 28 are bent inward and provided with rollers 29, which bear against the rack-bar 12 on opposite sides of the teeth, as shown in Fig. 8. Within the crotch of the fork is arranged a third roller 30, which bears against the rear side of the rack-bar. The shifting fork is provided at a suitable point with a slot 31 for the reception of the shifting lever 32, which passes through said slot and is fulcrumed at its lower end between spaced rollers 33 in a bracket 34, secured to the under side of the platform 7, as shown in Fig. 7. Where the lever 32 passes through the shifting fork 27, it is provided with a pivot in the form of a pin or bolt 35, which enters openings in the shifting fork at opposite sides thereof. Secured to the upper side of the platform 7 is a segmental rack 36, with which a catch 37 engages, the said catch being connected with a thumb-piece 38 at or near the upper end of said lever. By operating said thumb-piece and releasing the catch 37 the lever 32 may be rocked for moving the rack-bar 12 either into or out of engagement with the pinion with which it meshes when the motor is in operation.

The float 1 is provided in its bottom with an opening which is controlled by means of a valve 39, the stem 40 of which projects upward through the float and extends slightly above the same, where its end is squared to receive a wrench, consisting of a rod 41 of the requisite length, provided at its lower end with a socket-head to fit over the stem of the valve 10, the said rod projecting up through the platform 7, where it has a handle, by means of which it may be turned for opening or closing the valve. By means of this valve any desired supply of water may be admitted to the inside of the float for properly ballasting the same, it being desirable to vary the amount of ballast according to the height and force of the waves, in order to get the best results and in order to prevent the float and its supporting-posts from becoming injured when the sea is running high.

It is intended to employ a series or battery of these motors and to arrange them in a row just in front of the sea-wall 5, above referred to, and to utilize the power derived therefrom by transmitting the same to the shore through individual pipes or through one and the same pipe. It is desirable to arrange the motors at a sufficient distance from the shore to get the best effect from the waves and secure the greatest power, and for this reason the motors are generally located beyond the point where the waves break.

It will be apparent that the several parts of the motor above described are susceptible of changes in the form, proportion, and minor details of construction, which may accordingly be resorted to without departing from the spirit or sacrificing any of the advantages of the invention. Under certain conditions, and where the sea is very rough, it may be desirable to dispense with the sea-wall. It will be apparent that the motor will operate without the sea-wall.

Having thus described our invention, what is claimed as new is—

1. In a wave-motor, the combination with a series of spaced posts, of a float mounted between said posts and provided at its edges with laterally-projecting frames or bent axles embracing said posts and having angularly-disposed antifriction-rollers journaled thereon, substantially as and for the purpose described.

2. In a wave-motor, the combination with a suitable float, and a vertically-extending rack-bar connected thereto, of a pinion meshing therewith and actuated thereby, ratchet-

wheels mounted on opposite sides of said pinion and having reversely-disposed teeth, spur-gears mounted loosely on said shaft outside of the ratchet-wheels, spring-actuated pawls mounted on the inner adjacent sides of said spur-gears and engaging said ratchet-wheels, and a counter-shaft provided with spaced spur gear-wheels directly and indirectly meshing with the spur-wheels on the pinion-shaft, an eccentric on said counter-shaft, and a reciprocating rod connected to and driven by said eccentric, substantially as and for the purpose described.

3. In a wave-motor, the combination with a suitable float, and a rack-bar extending upward therefrom, of power-transmitting mechanism operatively geared to said rack-bar and driven thereby, and a shifting device comprising a bent shaft carrying rollers which bear against said rack-bar on all sides, said device being adapted to move the rack-bar bodily into and out of engagement with said gearing, substantially as and for the purpose described.

4. In a wave-motor, the combination with a suitable float, and a rack-bar actuated thereby, of a system of gearing operatively connected to and driven by said rack-bar, a shifting fork loosely embracing said bar and comprising a bent shaft provided with angularly-disposed antifriction-rollers, and a shifting lever connected to said fork for reciprocating it and moving said rack-bar into and out of action, substantially as and for the purpose described.

In testimony whereof we have signed this specification in the presence of two subscribing witnesses.

FRANK L. PYLE.
JOE McDONALD.

Witnesses:
J. W. DIDDLE,
C. E. HOAR.