July 28, 1931. J. GALLAGHER 1,816,044

WAVE MOTOR

Filed April 4, 1930 2 Sheets-Sheet 1

Fig. 1.

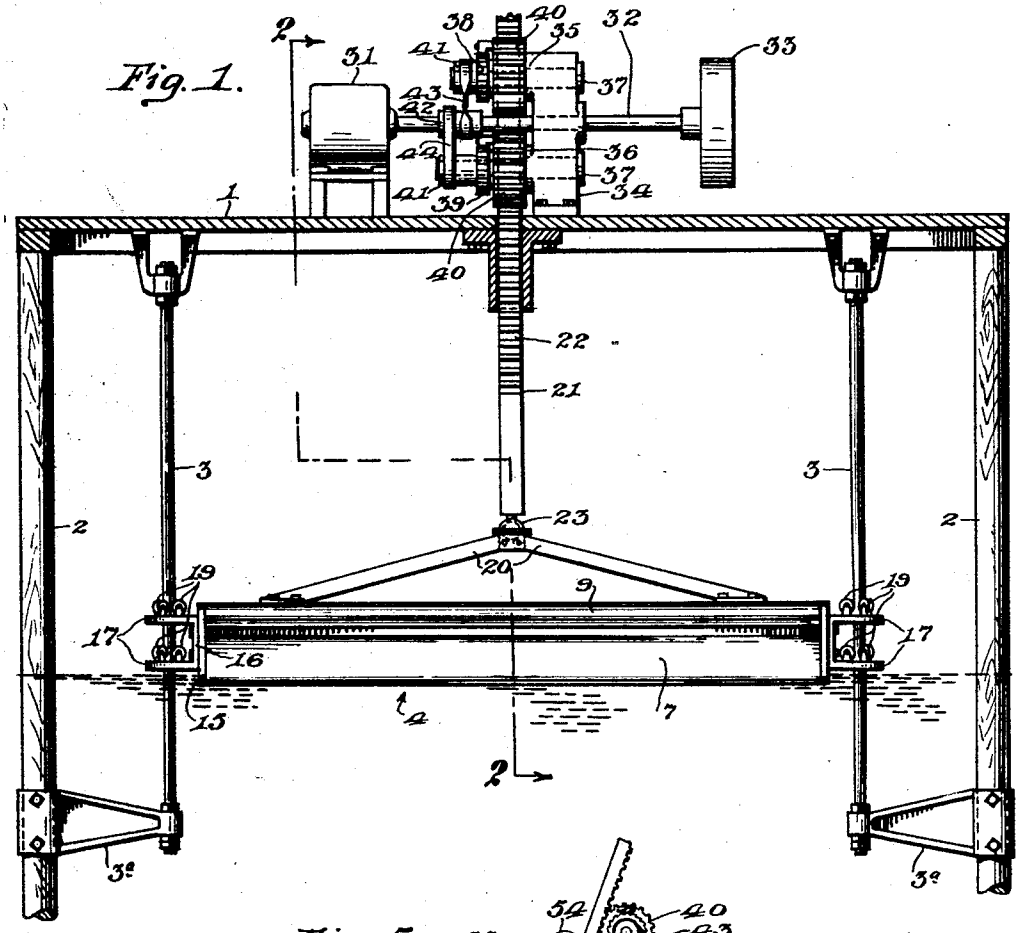
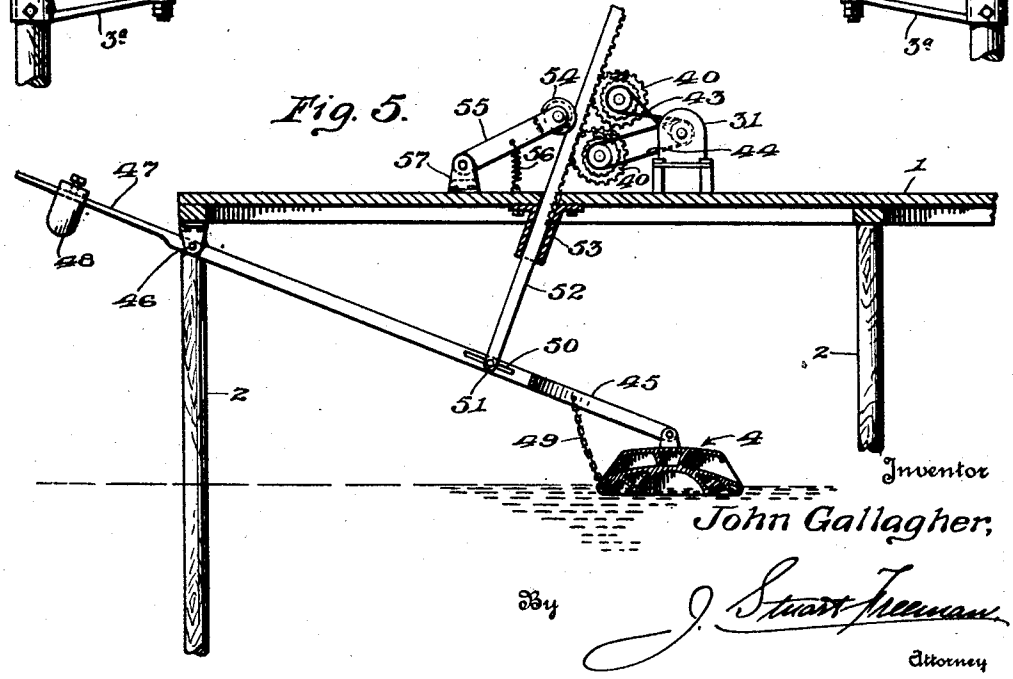


Fig. 5.



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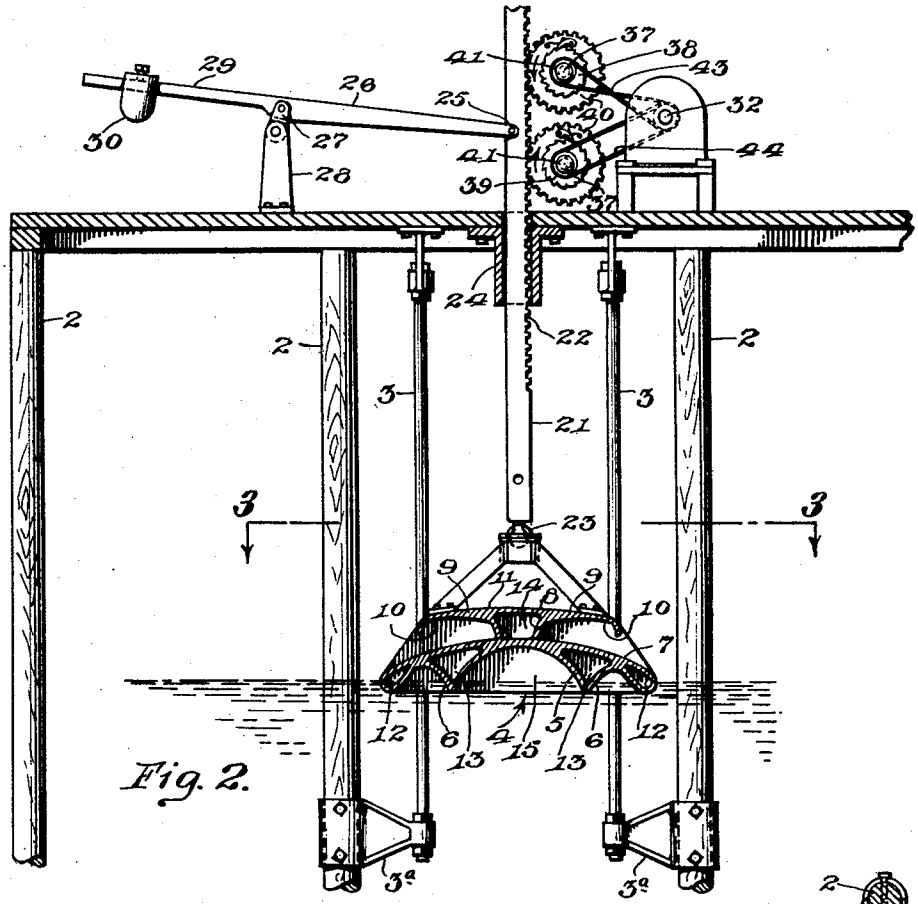


Fig. 2.

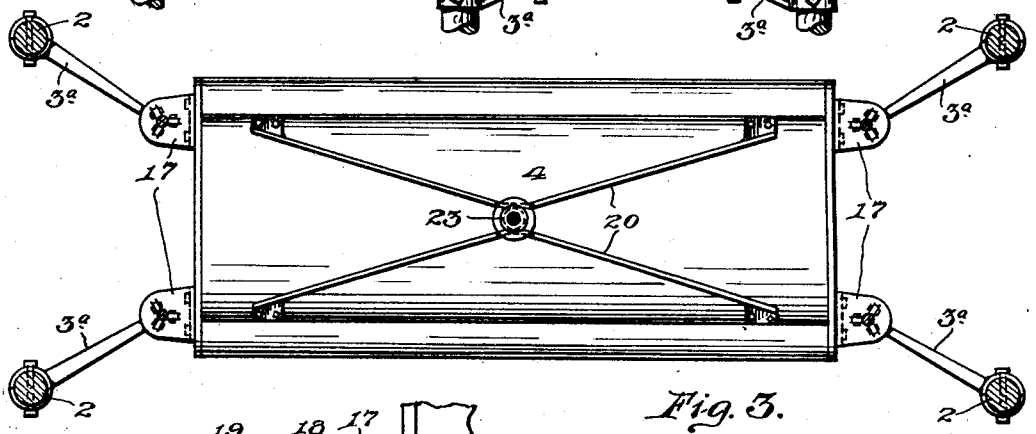


Fig. 3.

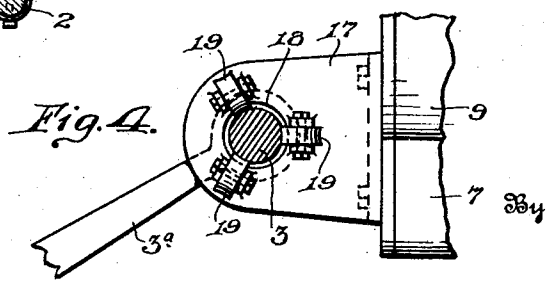


Fig. 4.

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UNITED STATES PATENT OFFICE

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WAVE MOTOR

Application filed April 4, 1930. Serial No. 441,449.

The object of the invention is to provide improvements in prime movers broadly, but more especially in motors which are so designed as to be actuated by the intermittent motion of the waves of the sea.

Another object is to provide improvements in floats, that is, the wave-engaging means whereby the movement of the surfaces of the waves is conveyed to means such as an electric generator, air compressor, or other desired energy-generating or energy-storing device.

A further object is to provide improvements in means for guiding the rise and fall of the improved float in a rectilinear path, while the device actuated by such movement is driven while the float is both ascending and descending with the wave surfaces.

Still another object is to provide means for minimizing the friction between the float and the guide members, and at the same time providing means for positively though flexibly connecting said float to the motor-driving element, such as a rack bar which must reciprocate in a predetermined path, due to its cooperation with gears which in turn are connected through the media of ratchets with the power-generating or storing device.

With these and other objects in mind, the present invention comprises further details of construction and operation which are fully brought out in the following description, when read in conjunction with the accompanying drawings in which Fig. 1 is a front elevation of one embodiment of the invention as operatively mounted with relation to a wharf or pier which is shown in section; Fig. 2 is a vertical section on the line 2—2 of Fig. 1; Fig. 3 is a horizontal section on the line 3—3 of Fig. 2; Fig. 4 is an enlarged detail of one of the anti-friction connections between the float and one of the guide members; and Fig. 5 is a view similar to Fig. 1 but showing a modified embodiment of the invention.

Referring to Figs. 1 to 4 inclusive of the drawings, there is represented a pier, wharf, or other types of platform 1, which is supported by any necessary number of piles 2, and from which extend downwardly a plurality of spaced guide rods 3, which may also comprise supporting piles if desired, but which at their lower ends are preferably supported in spaced relation with adjacent piles by means of laterally extending brackets 3^a. These guide rods it has been found preferable to arrange in the shape of a rectangle, each guide being positioned at one of the corners of such geometrical figure, and within which figure is positioned a float 4.

This float is of unusual design and is preferably elongated, in the form of an oblong structure, the under surface of which is broken up into a central deeply concave surface 5, upon the laterally opposite sides of which are relatively shallow concave surfaces 6, while the float above these concave surfaces is characterized by a substantially continuous convex water-shedding surface 7, broken only at its central portion by an upward extension 8, from which there extend in laterally opposite directions flanges 9, having concave under surfaces 10 and connected above by a convex water-shedding surface 11. In cross section, as shown in Fig. 2, it will be seen that the buoyancy of this float is increased by providing its lower portion with marginal air-tight chambers 12, and with air-tight chambers 13 of substantially triangular cross section between the central and the laterally disposed concave surfaces, in addition to a superimposed air-tight chamber 14 extending longitudinally through the upward extension 8, it being understood that the end portions of all of the recesses defined by said concave surfaces, and the ends of said air-tight chambers, are closed by walls 15.

Secured to each of the opposite end walls 15 are spaced U-shaped brackets 16, providing vertically spaced parallel flanges 17, provided with enlarged apertures 18, through which the guide rods 3 are adapted to freely pass, as the float moves vertically with respect thereto. Each of said bracket flanges is furthermore provided with a plurality of suitably shaped circumferentially positioned anti-friction rollers or the like 19, which define a circumference of less diameter than that of the aligned apertures 18, but which

contact sufficiently loosely with the particular guide rod extending therebetween to permit a relative tilting in or angular oscillation of the float with respect to a horizontal plane, in order to conform within predetermined limits to the change in direction of the surface of waves passing therebeneath.

From the uppermost surface of the float 4 there arises a suitable framework composed of upwardly converging brackets 20, which at their uppermost adjacent central portions connect in any suitable manner with an upwardly extending bar 21, carrying rack teeth 22, through the medium of a suitably constructed universal joint 23, to permit said bar to reciprocate in a straight line as defined by the depending guide 24, carried by the platform 1, even though the float itself assumes various angular positions. The bar 21 extends above the platform 1, and may, if desired, be pivotally connected at 25 to a lever arm 26, which is supported by a link 27, carried by a fixed bracket 28, and upon its opposite free end portion 29 said lever being provided with an adjustable weight 30, to variably counteract any desired portion of the dead weight of the combined float and rack bar.

Upon the platform 1 there may be mounted any desired form of power-generating or power-storing device, such as is represented by the electric generator 31, having a shaft 32, which preferably carries a fly wheel 33, in order to insure as continuous a rate of rotation of said shaft as possible. A standard 34 is also carried by the platform 1 and is provided with bosses 35 and 36, which in turn support studs 37 upon which are mounted ratchets 38 and 39, gear wheels 40, and sprocket wheels or pulleys 41, while said generator shaft 32 carries a pair of sprocket wheels or pulleys 42. Extending between the sprocket wheel or pulley 41 upon the stud of the boss 35 and the corresponding sprocket wheel or pulley 42 upon the shaft 32 is a preferably crossed sprocket chain or belt 43, while extending between the other of said sprocket wheels or pulleys 41 and its corresponding sprocket wheel or pulley 42 is a straight sprocket chain or belt 44.

With this construction, it will be readily observed that as the float 4 rises and falls with the motion of waves beneath it, the rack bar 21, in constant engagement with the gear wheels 40, operates upon its upward stroke through the pawl of the ratchet wheel 39 to rotate the shaft 32 in a clockwise direction (as viewed in Fig. 2), while upon its downward stroke said rack bar operates through the pawl of the ratchet wheel 38 and crossed sprocket chain or belt 43 to continue the rotation in the same clockwise direction. It is to be understood that while this float and associated mechanism will continue to operate in accordance with the vertical wave motion beneath the platform 1, if desired said float may be drawn upwardly into a position adjacent to the under side of said platform, thus removing the float from contact with the waves which may be either necessary or advisable during a storm or for purposes of repair or the like.

Referring to Fig. 5, a modification of the invention comprises the use of the float 4 beneath the platform 1, but carried upon the lower end 45 of a lever which is pivotally supported at 46 by the platform and extends beyond said pivotal point to form a lever 47, which carries an adjustably positioned weight 48, operative to counterbalance any desired portion of the dead weight of the float and connected arm 45, said float and arm being preferably connected loosely by means of a chain or the like 49, adapted to prevent the float from tilting in the event of transverse wave motion into a totally inoperative position.

The arm 45 is furthermore provided with an elongated slot 50 in which slides a bolt or pin 51, carried by the lower free end of a rack bar 52 which reciprocates through a guide 53 in accordance with the rise and fall of said float. Upon the upper surface of the platform in this case, there are provided the electric generator 31 or other form of power-generating or storing mechanism, together with the gears 40 and associated sprockets, chains or belts, etc., said gears being in constant mesh with the teeth of said rack bar. Instead of depending solely upon the guide 53 to insure cooperation between said rack bar and said gears, an idler 54 bears against the opposite surface of said bar and is carried by an arm 55, yieldingly positioned by means of a spring 56 and pivotally supported by a bracket 57 fixed with respect to said platform. The operation of this device is the same as that hereinbefore described, the difference being that the motion of the float is not restrained to a rectilinear path, which in Fig. 2 is shown to be vertical, but instead oscillates substantially about the pivotal support 46 of the supporting arm 45. However, it is to be understood that while two embodiments of the invention have been herein described, numerous modifications may be made in their details of construction and operation, without departing from the scope of the appended claims.

Having thus described my invention, what I claim and desire to protect by Letters Patent of the United States is:

1. A wave motor, comprising a float having a concave under surface, a convex upper surface, and an upward extension from said upper surface containing an air-tight chamber and provided with laterally extending flanges having concave under surfaces.

2. A wave motor, comprising a float having a concave under surface, a convex upper

surface, an upward extension from said upper surface provided with laterally extending flanges having concave under surfaces, and air-tight chambers in the periphery of the float, between its concave and convex surfaces, and within the central portion of said upward extension.

3. The combination of a platform and spaced supports therefor, with brackets carried by said supports, parallel guide rods fixed at their opposite ends to said platform and to said brackets, a float movable with respect to said guide rods, a rack-carrying bar connected to and movable with said float, power mechanism also fixed with respect to said platform, means operative to transform the rectilinear motion of said float and bar into suitable motion for said mechanism, and variable means to adjustably counterbalance any desired portion of the dead weight of said float.

4. The combination of a platform and spaced supports therefor, with brackets carried by said supports, parallel guide rods fixed at their opposite ends to said platform and to said brackets, a float movable with respect to said guide rods, a rack-carrying bar connected to and movable with said float, power mechanism also fixed with respect to said platform, means operative to transform the rectilinear motion of said float and bar into suitable motion for said mechanism, brackets carried by said float, sets of anti-friction means carried by said last-named brackets and engaging said rods, a universal joint connecting said float with said bar, to prevent flexing of said bar when said float tilts under the irregular action of waves, and variable means to adjustably counterbalance any desired portion of the dead weight of said float.

In testimony whereof I have affixed my signature.

JOHN GALLAGHER.