(No Model.)

W. MULHOLLAND.

DEVICE FOR UTILIZING WAVE FORCE.

No. 458,060. Patented Aug. 18, 1891.

Fig: 1.

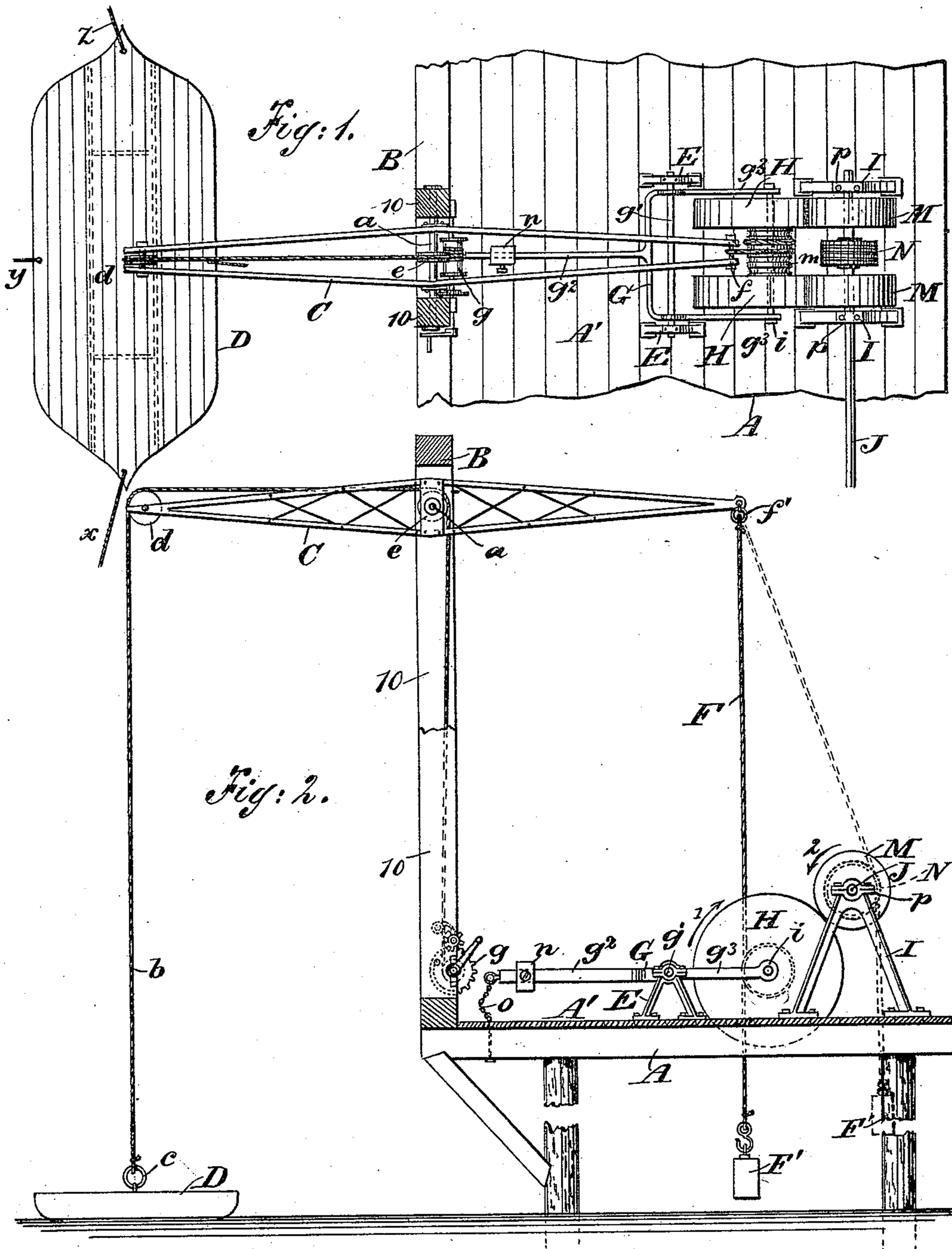


Fig: 2.

Fig: 3.

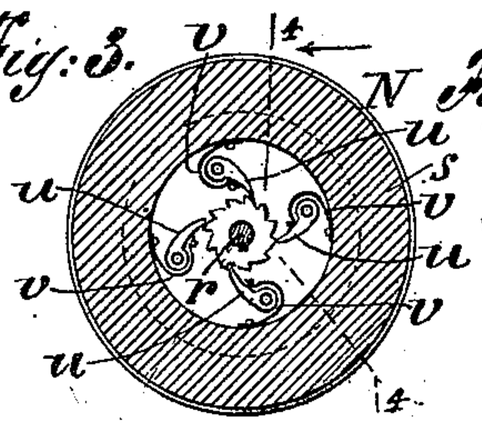
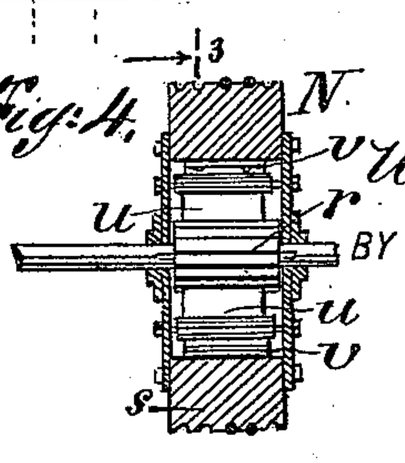


Fig: 4.



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WILLIAM MULHOLLAND, OF LOS ANGELES, CALIFORNIA.

DEVICE FOR UTILIZING WAVE FORCE.

SPECIFICATION forming part of Letters Patent No. 458,060, dated August 18, 1891.

Application filed April 4, 1891. Serial No. 387,599. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM MULHOLLAND, of Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Device to Utilize Wave Force, of which the following is a full, clear, and exact description.

The object of this invention is to provide simple and efficient mechanism whereby the reciprocal movement of water-waves may be converted into rotary motion and power be conserved for useful purposes.

To this end my invention consists in the peculiar construction of parts and their combination, as is hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a plan view of the device secured on a platform, shown broken away in the direction of its length, and connected with a floating object—that is, one of the parts moored in a body of water near to the platform or wharf. Fig. 2 is a side elevation of the mechanism mounted on a platform shown in section and flexibly connected to a float in an adjacent body of water. Fig. 3 is an enlarged detached sectional view of one of the details of construction, taken on the line 3 in Fig. 4; and Fig. 4 is a transverse section of the detail shown in Fig. 3, taken on the line 4 4 in said figure.

There is a wharf or horizontal platform A, stably erected on the shore of the body of water that is to furnish wave force, said wharf having a proper length and breadth for its service, and elevated sufficiently to secure efficiency in action for the mechanism located upon it.

Upon the wharf A a gallows-frame B is erected vertically near the outer edge of the flooring for the support of a walking-beam C, that is pivotally supported on the cross-bolt *a*, that is inserted through two parallel standards 10 of said frame between which the beam vibrates.

A floating vessel D, of any preferred form, having sufficient area to insure its effective action, is provided, and it has a flexible connection with the walking-beam C, afforded by the rope or chain *b*, which is attached by one end, as at *c*, to the float D, and thence vertically extended to engage the sheave-wheel *d*, that is pivotally supported on the outer end of the walking-beam, thence horizontally and inwardly to another sheave-wheel *e* on the beam C on its pivot-bolt *a*, and thence downwardly to have its remaining end portion wrapped upon and attached to the barrel or drum of a winch *g*, that is of ordinary construction and is located between the standards 10 a convenient distance from the flooring A′ of the wharf A.

At a suitable distance from the standards 10 two bracket-frames E of similar form are secured on the wharf A, properly spaced apart and so relatively located with regard to the inboard end of the walking-beam C that the plane indicated by a depending rope or chain F, that is affixed, as at *f*, to the end of the beam, will be equally removed from said bracket-frames.

A tilting frame G is loosely supported to vibrate on the bracket-frames E by a shaft *g′*, that is transversely secured on or in two parallel limbs g^3 of the frame, which consists, essentially, of an arm g^2, having a proper length, and bifurcated at the inner end so as to produce the limbs g^3 named.

Two similar friction-drums H are mounted on the cross-shaft *i*, that rotatably engage the end portions of the limbs g^3, said drums by their location permitting the grooved pulley *m* to be placed upon and secured to the cross-shaft mentioned between the drums, and thus adapted to receive the rope F, which is wrapped around the pulley one or more times, engaging its grooves *m*, and thence extends downwardly through an aperture in the wharf-flooring A′, a weight F′ of sufficient dimensions to insure effective action being attached to and suspended from the lower end of the rope or chain F.

The arm g^2 on the tilting frame G is provided with a sliding weight *n*, that may be adjustably secured at any point necessary to secure a balance of the frame and parts mounted on it.

A guard-chain *o* is attached by its ends to the end of the arm g^2 and to the flooring A′, having a suitable length to curb an improper vibration of the tilting frame G, allowing it

to drop sufficiently to remove the drums from friction-wheels that will be described.

Two bracket-stands I, of similar form and larger dimensions than the frames E, are provided, which are secured on the wharf-flooring behind the frames mentioned at such a relative distance as will permit them to afford a proper support for the shaft J and parts secured on it, which shaft is located in boxes *p* on the stands, free to revolve in a plane that is horizontal and at right angles to the long arm g^2 of the tilting frame G.

Upon the shaft J two friction-wheels M are placed and secured between the bracket-stands I, said wheels, having less diameter than the friction-drums H, are elevated a proper distance above them and at a suitable distance removed to allow the upward vibration of the tilting frame G to enforce a contact of the drums with the wheels and a downward movement of said drums to break the contact between their peripheral surfaces.

Between the friction-wheels M a detent-wheel N is located, which also serves as a motion-transmitter, if desired.

The construction of the device is shown in Figs. 3 and 4, and consists of a hub *r*, that is cylindrical and centrally perforated to fit upon the shaft J, whereon it is mounted and affixed centrally between the wheels M, the peripheral surface of the hub having longitudinally-extending channels formed in it at spaced intervals of a proper shape to permit ratchet-teeth to stand between the channels, which teeth extend from end to end of the hub. An annular rim *s* is the other principal portion of the detent-wheel N. It is given a proper diameter internally to afford space for the introduction of the similar pawls *u* between the hub *r* and the rim. The pawls *u* are held in place with their toes in engagement with the teeth on the hub *r* by the similar springs *v*, that are secured at their ends to the pawls, and also to the inner surface of the wheel-rim *s*. There are four pawls *u* shown in Fig. 3; but this number may be decreased to three, or increased to any number that will work freely, these pieces being evenly spaced apart to enable the concentric support of the rim to be effected by the pawls and their springs. The periphery of the rim *s* is grooved for the engagement of the rope or chain F, if this should be desired.

To prepare the device for service, if the body of water is influenced by tidal force, the float D is anchored opposite the mechanism on the wharf by leading cables *x y z* from its bow, stern, and midships, as represented in Fig. 1, and the slackness of the rope *b* taken up on the winch *g* to suit the height of the water. It will be evident that the recession of the waves will lower the float D and elevate the inner end of the walking-beam C. This will draw on the rope F and rotate the drums H in the direction of the arrow 1, the weight F′ causing the rope to remain taut and transmit the force produced by the descent of the float, which may be weighty and yet buoyant. The draft upon the rope F will cause the tilting frame G to vibrate and produce a forcible contact of the drum H with the wheels M, so as to transmit rotary motion from the drums to the shaft J, by reason of the frictional contact enforced between these parts, the teeth on the hub *r* releasing the pawls *u* when the wheels M are rotated in the direction of the arrow 2, (shown in Fig. 2,) and interlocking with them to retain the shaft from retrograde movement. Upon the return of the waves the float D will be elevated and the tilting frame rocked downwardly, the weight F′ drawing the rope F taut at the same time that it moves the drums H away from the friction-wheels M, so that the ebb and flow of the waves will cause a periodical rotation of the shaft J always in one direction. The shaft J may be connected to any mechanism it will drive, or be attached to a proper conserver of energy for after use.

A series of devices similar to that described may be provided and arranged in series by extending the wharf A, and all may be connected to one main shaft J for utilization of the power thus obtained, which is the result of wave force and gravity conjunctively employed.

When the fluctuation of the waves is comparatively feeble, the rope F may be placed directly upon the grooved periphery of the rim *s* and the weight F′ allowed to depend, as indicated by dotted lines in Fig. 2, the rope, if wound on the detent-wheel, as therein shown, being adapted to rotate the shaft periodically when actuated by its direct connection with the walking-beam and float.

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

1. The combination, with a float in water liable to wave agitation, a wharf along the water edge, a gallows-frame on the wharf, a walking-beam supported to vibrate on the gallows-frame with one end projected above the float, and a flexible connection between said end of the beam and the float, of a tilting frame on the wharf having a bifurcated end, friction-drums rotatably supported on the forked end of the tilting frame between its limbs, a grooved pulley on the cross-shaft that supports the friction-drums, a rope which connects the inner end of the beam with the grooved pulley, a weight on the lower end of said rope, friction-wheels rotatably supported having their peripheries adapted to receive the impinge of the friction-drums, and a detent-wheel on the shaft which supports the friction-wheels, substantially as described.

2. In a device to utilize wave force, the combination, with a tilting frame, which is supported to vibrate from a horizontal plane on a wharf near water when actuated by a float in the water, of rotatable friction-drums on the tilting frame, friction-wheels supported to rotate when in contact with the friction-

drums, a main shaft whereon the friction-wheels are secured, and a detent-wheel adapted to prevent a retrograde movement of the shaft when it is rotated by wave action on the float, substantially as described.

3. The combination, with a float in water subject to wave action, a wharf near the water, a walking-beam supported on a frame to vibrate thereon and extend one end over the water, a rope or chain extended from the float to a winch on the frame which supports the walking-beam, and a rope or chain on the inner end of the walking-beam, of a tilting frame, friction-drums on one end of said frame supported to rotate, a grooved pulley on the shaft which sustains the friction-drums engaged by the rope on the inner end of the walking-beam, a weight on said rope, a main shaft, friction-wheels supported to rotate on said shaft and be engaged by the friction-drums when the tilting frame is rocked, and a detent-wheel on the main shaft between the friction-wheels, substantially as described.

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Witnesses:

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