No. 625,101. Patented May 16, 1899.

H. C. ESSINGTON.

WAVE MOTOR.

(Application filed Dec. 28, 1898.)

(No Model.) 2 Sheets—Sheet 1.

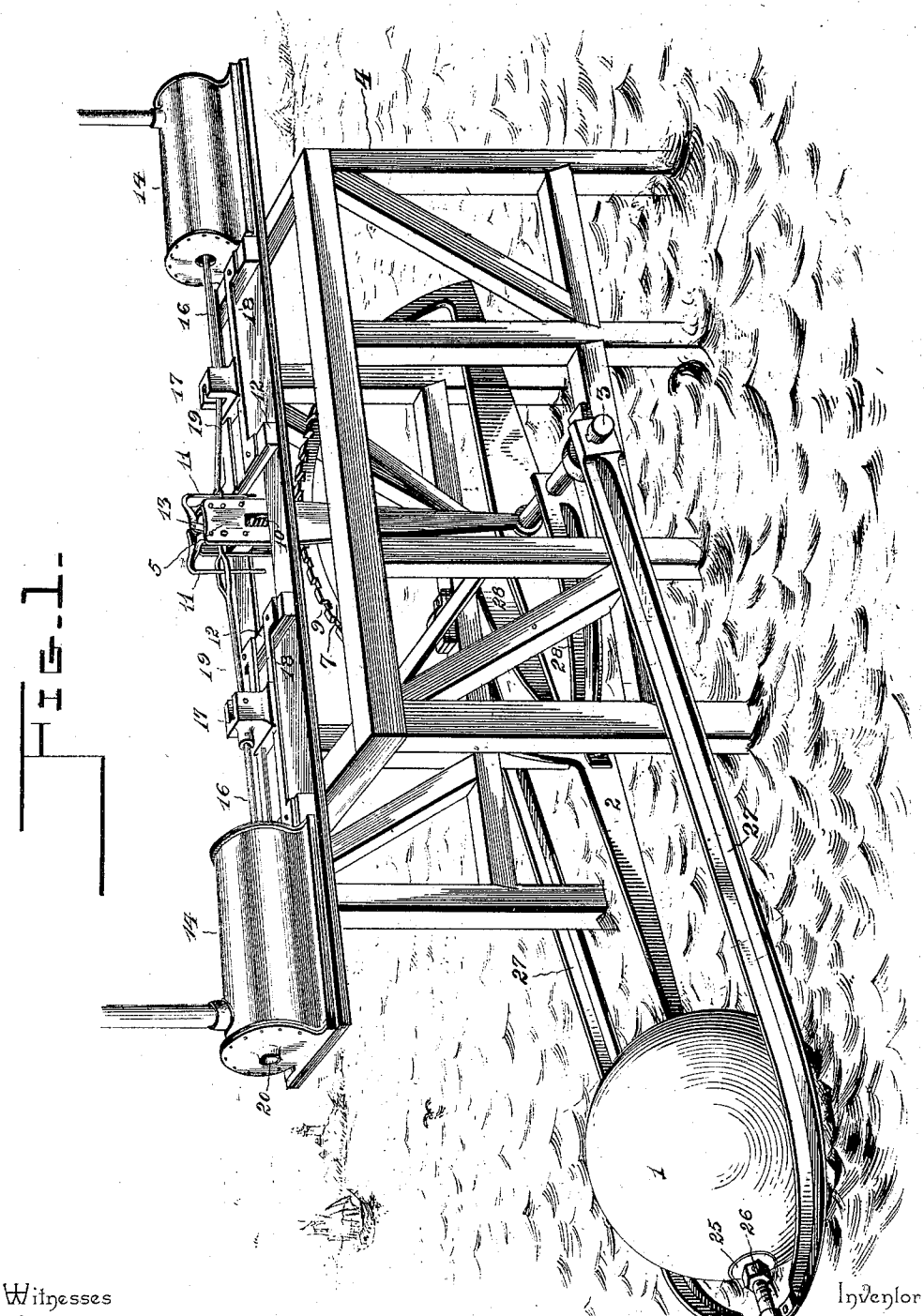


Fig. 1.

Witnesses
John F. Dunkerwick
C. C. Hoff

By his Attorneys.
Henry C. Essington.
C. A. Snow & Co.

Inventor

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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FIG. 2.

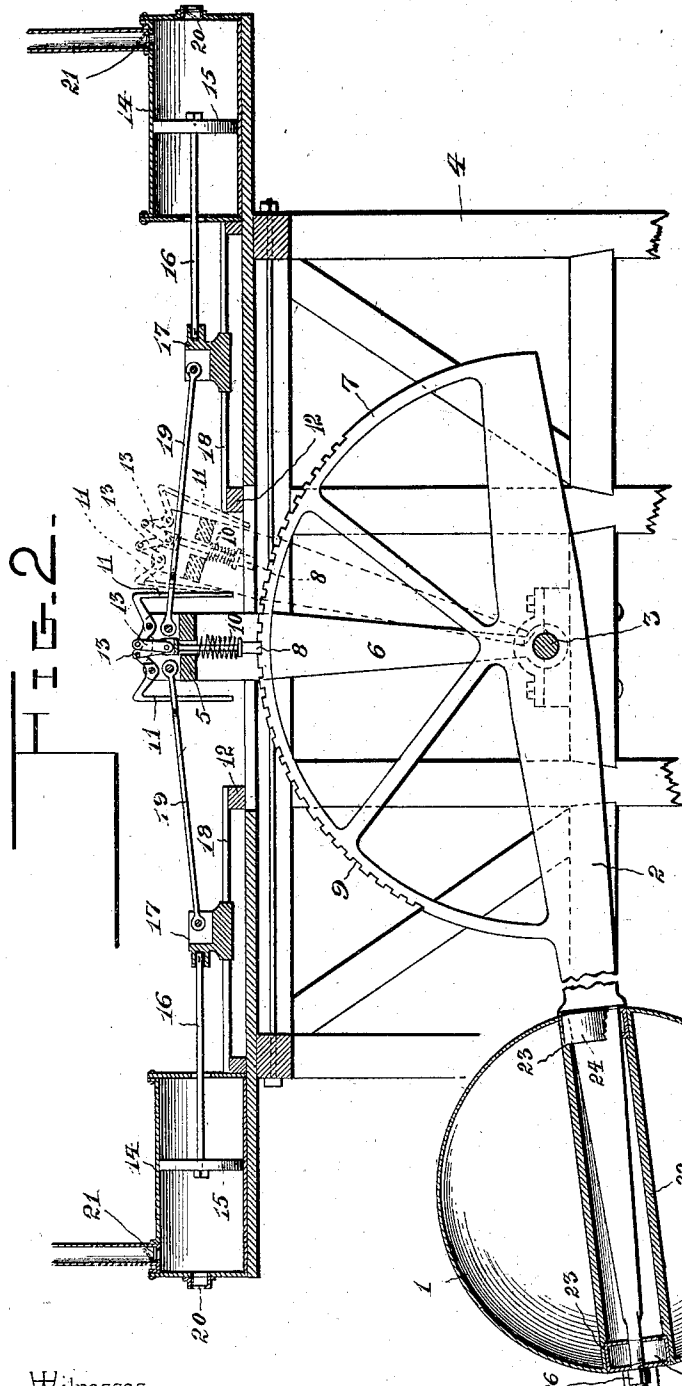
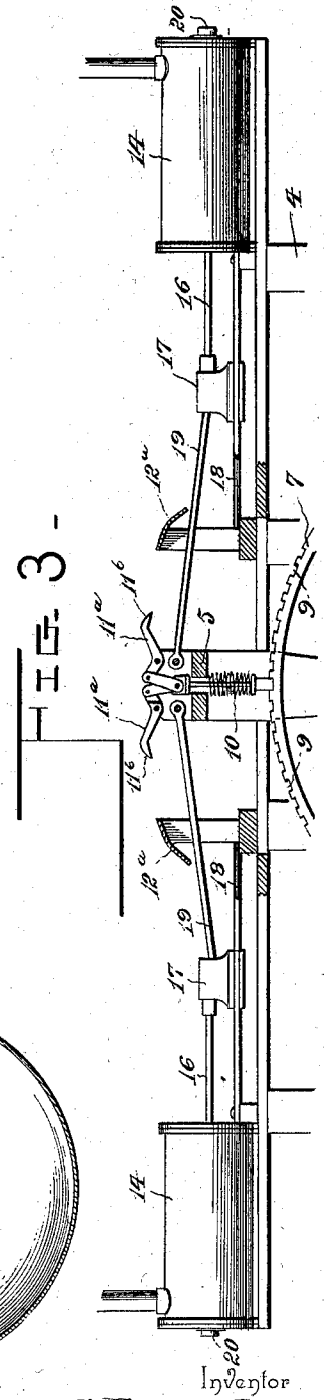


FIG. 3.



Witnesses
John F. Dunkerwick
O. E. Hoyle

By his Attorneys,
Henry C. Essington,
C. A. Snow & Co.

Inventor

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HENRY C. ESSINGTON, OF PHILADELPHIA, PENNSYLVANIA.

WAVE-MOTOR.

SPECIFICATION forming part of Letters Patent No. 625,101, dated May 16, 1899.

Application filed December 28, 1898. Serial No. 700,539. (No model.)

To all whom it may concern:

Be it known that I, HENRY C. ESSINGTON, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Wave-Motor, of which the following is a specification.

My invention relates to wave-motors, and has for its object to provide an apparatus of this class including an automatically-adjustable compensating connection between the driving and driven elements, whereby the driven element is adapted to traverse a uniform terminally-defined path, while the driving element is adapted to traverse a variable path to suit the tidal variation of the surface of the water.

Further objects and advantages of this invention will appear in the following description, and the novel features thereof will be particularly pointed out in the appended claims.

In the drawings, Figure 1 is a perspective view of a motor constructed in accordance with my invention. Fig. 2 is a vertical sectional view of the same. Fig. 3 is a detail view showing a slightly-modified construction of trip mechanism.

Similar reference characters indicate corresponding parts in all the figures of the drawings.

The motor embodying my invention comprises, essentially, an operating element which is mounted for vibratory movement and includes a float 1, adapted to ride upon the surface of the water, and a driven element also adapted for vibratory movement and having connection with the driving element to receive motion therefrom, said driven element being adapted for connection with mechanism to be driven.

As illustrating the essential features of my invention, I have shown in the drawings one embodiment thereof wherein the float 1 is of spherical construction, such as a hollow metallic ball mounted for oscillatory movement by means of a swinging arm 2, connected with a shaft or spindle 3, said shaft in turn being mounted in suitable bearings in a supporting frame or structure 4. The receiving or driven element, to which the driving element is adapted to impart motion, consists of a head 5, adapted for vibratory movement in a uniform path between fixed terminal points, the extent of the path being subject to variation to suit the function of the apparatus and the extent of throw desired for the elements by which motion is communicated to the machinery to be driven. In the construction illustrated said head is carried by and may form a part of an oscillatory arm 6, fulcrumed coaxially with the float-carrying arm, as upon the shaft or spindle of said arm. The means of connection between the arm of the driving element and the vibratory head of the driven element, particularly when the float is mounted for movement as described, may consist of a toothed or notched segment or gear 7, carried by said float-operated arm, and a movable detent or pawl 8, carried by said head and adapted to engage either of a series of seats or notches 9, formed in the segment or gear. This detent or pawl, as illustrated in the drawings, is yieldingly held in engagement with the periphery of the segment, as by an actuating-spring 10, and by moving the detent or pawl in opposition to the yielding force by which it is held in engagement with the segment the latter may be released for independent movement.

It is obvious that as long as the clutch operates to connect the driving and driven elements of the motor they will operate synchronously, the amplitude of vibration of the driven element being proportionate to that of the driving element and the relative lengths of the paths of movement being controlled by the radius of the segment. Owing, however, to the fact that the path of movement of the driving element is variable and is controlled by tidal influences, and as it is desirable that the driven element shall have a uniform path of movement irrespective of variations in the path of movement of the driving element, I have devised compensating means for controlling the clutch whereby connection between the driving and driven elements is effected, such compensating device in the construction illustrated consisting of trip-levers 11, connected with the movable element of the clutch, as the detent or pawl, and stops or trips 12, arranged in the paths,

respectively, of said trip-arms or at the limits of the path of the driven element, whereby when a trip-arm comes in contact with a stop or trip it is moved to disengage the clutch and release the driving element for independent movement, but which automatically releases the movable member of the clutch when relieved of strain, and thus allows the return of the said clutch member to operative engagement to communicate motion in the opposite direction to the driven element.

In the construction illustrated in Figs. 1 and 2 the trip-levers, which extend in opposite directions from the head of the driven element, are connected by means of links 13 with the detent or pawl, and in the paths of the extremities of these trip-arms are arranged stops 12, which are spaced apart an interval designed to control the path of movement of the driven element, and as the trip-arms successively come in contact with said stops the detent or pawl is withdrawn from engagement with the seat or notch of the segment in which it is fitted to allow any excess of movement of the driving element to occur independently of the driven element, such excess of movement being caused by a wave of greater amplitude than that necessary to cause the desired movement of the driven element or by a change in the level of the water due to tidal influences.

In the modified construction illustrated in Fig. 3 the trip-arms 11^a are provided with cam-faces 11^b for contact with cam-faced trips or stops 12^a, arranged in the paths, respectively, thereof and designed to operate substantially as hereinbefore described.

It is also desirable in an apparatus of this class to provide opposing cushioning devices for preventing a rebound of the driven element when the latter is disengaged from the driving element, and hence I may employ oppositely-located cylinders 14, in which operate pistons 15, with the piston-rods 16, carrying cross-heads 17, traversing guides 18, and pitmen 19, connecting said cross-heads with the reciprocatory head of the driven element. The cushioning members shown in the drawings consist, essentially, of pumps having suitable inlet-valves 20 and exhaust-valves 21, and when the apparatus is to be used for pumping liquid or as a compressor the cushioning elements may be utilized as pumps, thus performing a dual function, as will be understood. Under any circumstances the effect of these cushioning elements is as follows: If the driving element receives motion through a path of an extent greater than is necessary to bring one of the trip-arms into contact with the coöperating trip or stop, the detent or pawl will be disengaged from the segment, and further movement of the driving element will be accomplished independently of the driven element. Upon the release of the driving element the tendency of the compressed fluid in the cylinder toward which the driven element has been moving will be to move the driven element in the opposite direction; but such movement will be opposed by the resistance in the other cylinder, and hence the driven element will remain approximately at that point in its path at which the disengagement from the driving element occurred until upon the return vibration of the driving element the pressure of the driven element toward the stop (with which the trip-arm is engaged) is relieved sufficiently by the action of the spring 10 to allow the reëngagement of the detent or pawl with a seat or notch in the segment, when motion in the opposite direction will be communicated to the driven element.

It will be understood, furthermore, that various means may be employed for relieving the float of strains tending to affect the stability of the supporting-frame, and in the construction illustrated I have provided the float with a diametrical sleeve 22, provided with counterbored terminals forming seats 23, in which are fitted relatively-adjustable collars 24 and 25, carried by the oscillatory arm 2, the collar 24 preferably being fixed, while the collar 25 is fitted for axial adjustment upon the arm, which is elongated vertically in cross-section to strengthen it suitably against upward strain, and is held at the desired adjustment by means of a nut 26 or the equivalent thereof. Said manner of mounting the float allows the revoluble movement thereof upon the float-supporting arm, whereby waves coming in contact with the float other than in a direction parallel with the axis thereof will cause the turning of the float upon its axis, and thus will relieve the lateral strain upon the float, while not affecting the upward pressure thereof. This mounting of the float at the terminals of its axis upon the bearing-collars reduces the frictional contact of the float with the supporting-arm and allows the free rotation of the float to efficiently neutralize the side strains applied thereto. Furthermore, the free end of the float-supporting arm is preferably braced against lateral strain by means of a swinging yoke 27, of which the terminals may be rigidly attached to the extremities of the shaft or spindle 3, whereby the yoke vibrates in a vertical plane with the float-supporting arm. Also the float-supporting arm may be strengthened laterally by means of side braces 28, extending rearwardly from intermediate points of the float-supporting arm and attached to the shaft or spindle at opposite sides of the plane of the segment.

It will be understood from the foregoing description that various kinds of machinery may be driven by means of a motor constructed in accordance with my invention, proper connections being established between the driven element and such machinery; but as the construction of the connections will depend upon the apparatus to be driven I have

deemed it unnecessary to illustrate any form thereof other than the described oppositely-located pumping devices, which, however, have the further function, in connection with the apparatus described, of cushioning the strokes of the driven element, and thus preventing the disarrangement of the driven element with relation to the driving element by reason of shocks resulting from an unusually rapid or extended vibration of the driving element.

Various changes in the form, proportion, and the minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having described my invention, what I claim is—

1. A wave-motor consisting of driving and driven elements, respectively having variable and fixed paths of movement, connections including a clutch, between said elements, trip mechanism for disengaging the clutch to release the driving element, at the limits of movement of the driven element, and cushioning devices for the driven element, consisting of opposite cylinders and coöperating pistons connected with the driven element, substantially as specified.

2. A wave-motor consisting of oscillatory driving and driven elements, respectively having variable and fixed paths of movement, and provided with interlocking clutch-faces of which one is constructed to form a plurality of engaging points in a series concentric with the axis of its movement, and means for disengaging said interlocked faces at the limits of movement of the driven element, substantially as specified.

3. A wave-motor consisting of driving and driven elements, respectively having variable and fixed paths of movement, connections, between said elements, consisting of an oscillatory segment carried by one of the elements, and a detent or pawl carried by the other element, to engage one of the seats in said segment, and trip mechanism to disengage the detent from its seat when the driven element reaches the limits of its path of movement, substantially as specified.

4. A wave-motor consisting of a driving element having an oscillatory float-carrying arm, and capable of a variable path of movement, and a driven element having a terminally-fixed path of movement, a segment actuated by said float-carrying arm and provided with spaced seats, a yielding detent carried by the driven element for engagement with one of said seats, and trip mechanism for disengaging the detent from its seat at the limits of the path of movement of the driven element, substantially as specified.

5. In a wave-motor, the combination with a driven element, of a movable driving element consisting of an arm and a spherical float having a diametrical bearing-sleeve revolubly mounted upon said arm, and connections between said driving and driven elements, substantially as specified.

6. In a wave-motor, the combination with a driven element, of a movable driving element consisting of an arm having spaced bearing-collars, and a superficially-rounded float having bearings for the reception of said collars, and connections between said driving and driven elements, substantially as specified.

7. In a wave-motor, the combination with a driven element, of a driving element having a movable arm, relatively adjustable collars carried by said arm, and a spherical float having an axial sleeve mounted upon said collars for revoluble movement, and connections between the driving and driven elements, substantially as specified.

8. In a wave-motor, the combination with a driven element, of a driving element having a movable arm, relatively adjustable collars carried by said arm, and a spherical float having an axial bore terminally counterbored to form seats to receive said collars, and connections between the driving and driven elements, substantially as specified.

9. A wave-motor consisting of a driving element having an oscillatory float-carrying arm, a driven element having a limited path of movement and provided with an arm mounted coaxially with the float-carrying arm, a clutch connection between the float-carrying arm and the driven element, and trip mechanism for disengaging the clutch to release the float-carrying arm at the limits of movement of the driven element, substantially as specified.

10. A wave-motor consisting of a driving element having a float-carrying arm, a driven element having an arm mounted coaxially with the float-carrying arm, a segment carried by the float-carrying arm and provided with peripheral seats, a yielding pawl carried by the driven element for engagement with one of said seats, and trip mechanism for disengaging said pawl, to release the float-carrying arm, at the limits of movement of the driven element, substantially as specified.

11. A wave-motor consisting of a driving element having an oscillatory float-carrying arm, a swinging yoke connected with the free end of said arm and mounted coaxially therewith, a driven element having a limited path of movement, a clutch connection between the float-carrying arm and said driven element, and trip mechanism for disengaging the clutch to release the float-carrying arm, substantially as specified.

12. A wave-motor consisting of a driving element having an oscillatory float-carrying arm provided with a toothed segment, a spindle, mounted in suitable bearings, and lateral braces connecting the body portion of said

arm with the spindle, a yoke terminally connected to said spindle and centrally connected to the extremity of the float-carrying arm, a driving element having a limited path of movement and provided with an oscillatory arm mounted upon said spindle, a pawl carried by said driven element for engaging the toothed segment, and a trip mechanism for disengaging the pawl from the segment at the limits of movement of the driven element, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

HENRY C. ESSINGTON.

Witnesses:
JOHN H. SIGGERS,
E. G. SIGGERS.