F. M. NELSON.

WAVE MOTOR.

APPLICATION FILED JULY 20, 1911.

1,018,678.

Patented Feb. 27, 1912.

2 SHEETS—SHEET 1.

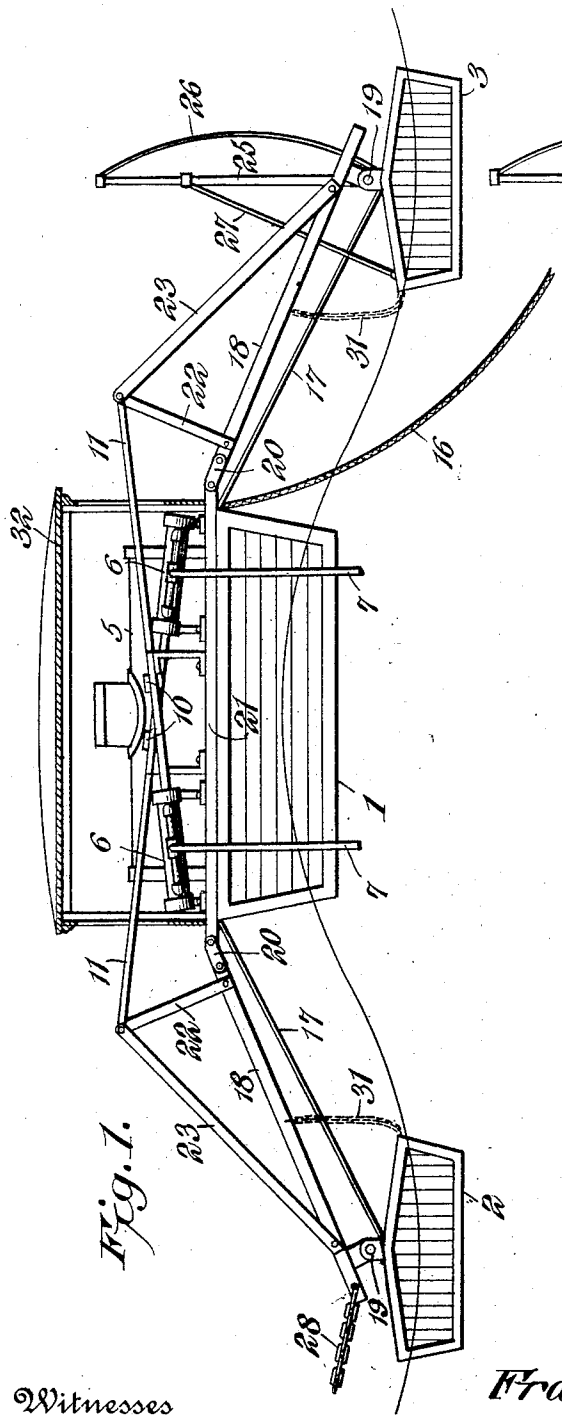

Fig. 1.

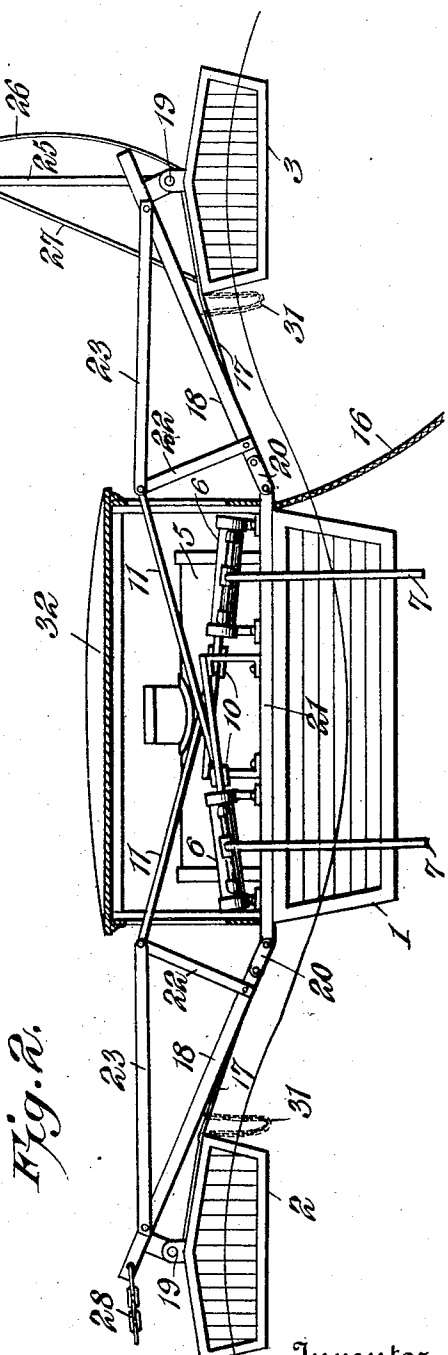

Fig. 2.

Witnesses

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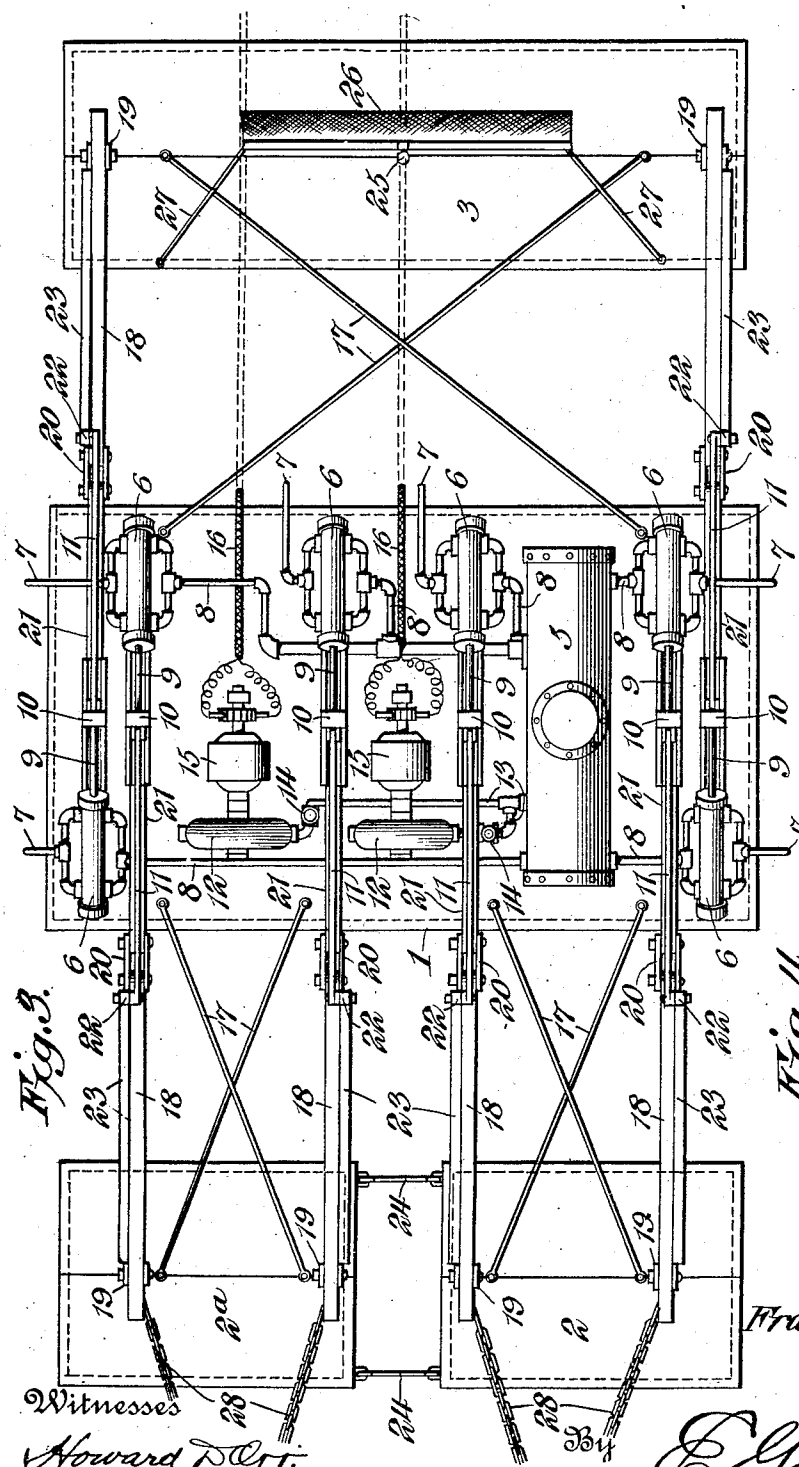

Fig. 3.

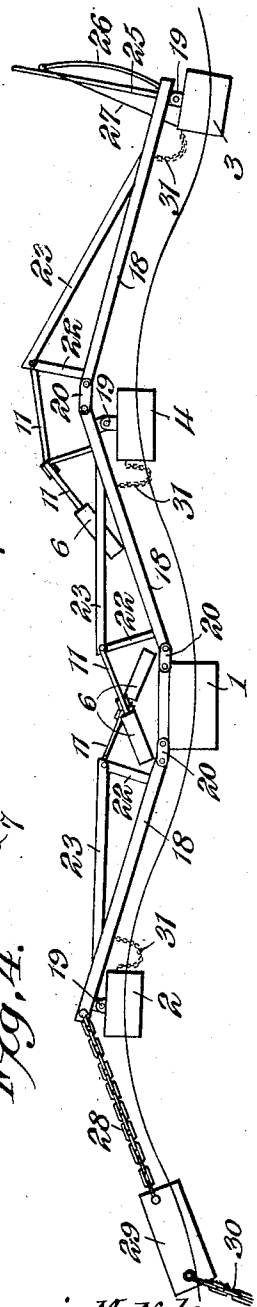

Fig. 4.

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UNITED STATES PATENT OFFICE.

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WAVE-MOTOR.

1,018,678. Specification of Letters Patent. Patented Feb. 27, 1912.

Application filed July 20, 1911. Serial No. 639,689.

To all whom it may concern:

Be it known that I, FRANCIS M. NELSON, a citizen of the United States, residing at Westville, in the county of Adair and State of Oklahoma, have invented a new and useful Wave-Motor, of which the following is a specification.

This invention has reference to improvements in wave motors, and its object is to provide a structure of this character wherein the power is derived to all practical purposes solely from the up and down movements of the water in the form of waves.

In accordance with the present invention a plurality of floats, preferably not less than three in number, but any greater number if desirable, are connected together at such distances apart as to be responsive to the customary length of waves at the locality where the device is installed, and the power so generated is transformed by suitable mechanism into other forms of energy capable of transmission to a point of utilization.

In accordance with the present invention the floats employed are connected together flexibly, so as to respond readily to the rise and fall of waves, but have no connection with any fixed structures further than where necessary one or more anchors are employed to hold the device from moving with water or air currents. The rise and fall of the floats are utilized by means of rocking members to store energy as by the pumping of air or water for the driving of engines, which in turn are caused to actuate dynamos and the current generated by the latter may be carried to any point of utilization, such as an adjacent shore to be from there distributed to various points where needed.

The invention will be best understood from a consideration of the following detailed description, taken in connection with the accompanying drawings forming a part of this specification, with the understanding, however, that the showing of the drawings is largely indicative without attempt to show any exact proportions or arrangement of the parts, and, therefore, the invention is not limited to any strict conformity with the showing of the drawings, but may be varied and modified in numerous ways, so long as the changes do not mark a departure from the salient features of the invention.

In the drawings:—Figure 1 is a more or less diagrammatic view with some parts in section, showing an arrangement embodying the present invention in one phase of operation. Fig. 2 is a view similar to Fig. 1 but showing another phase of operation. Fig. 3 is a plan view of the structure shown in Fig. 1. Fig. 4 is a diagrammatic view on a smaller scale than the other figures, showing an arrangement wherein more than three floats may be utilized.

Referring to the drawings, there is shown a float 1, which in practice is of sufficient size for the purpose, and this float is accompanied by other floats 2, 3, respectively, where but three floats are employed, and where more than three floats are employed other floats may be included, and in Fig. 4 a float 4 is shown as installed between the float 1 and the float 3. These examples are sufficient to illustrate the invention and to show how four or more floats may be employed instead of three.

In the construction shown, the float 1, which may be in the form of a barge or other sufficiently bulky vessel to sustain the necessary machinery, has mounted thereon a tank 5 and pumps 6, the number of pumps depending upon the size of the installation. Since the pumps are all alike, a description of a single pump and its action will be sufficient. Each pump 6 is shown as a double-acting pump, although this is not mandatory, and is provided with an intake pipe 7 which may be so arranged as to dip into the water sustaining the float to a depth insuring the intake end of the pipe as being always covered. The delivery side of the pump is connected by a pipe 8 to the tank 5. Each pump has a piston rod 9 connected to a slide 10, and this slide is connected by a pitman 11 to an actuator to be described, the construction being such that as the floats rise and fall the piston rod is reciprocated and the pump will draw water from the supporting body of water and deliver the same into the tank 5, which tank may contain a sufficient body of air so that as the water is pumped into the tank the air becomes compressed until a desired pressure is established in the tank. While not so shown, it will be understood, of course, that suitable devices, such as safety blow-offs and the like, are provided to prevent undue pressure accumulating within the tank. It will also

be understood that while but a single tank is shown, a battery of tanks may be employed, or the single tank may be relatively larger or smaller than indicated in the drawings, but as these are all matters for the constructing engineer, it is unnecessary to enlarge upon them.

Mounted on the float 1 are turbines 12, two being shown, but it will be understood that a single turbine or more than two may be used as found expedient. These turbines are connected by a pipe 13 to the tank 5, and in the pipe 13 at appropriate points are valves 14 individual to the turbines, so that the water in the tank may be utilized to drive either or both turbines, as desired. The turbines are shown as directly connected to dynamos 15, and the delivery side of these dynamos may be connected to conductors in the form of a cable 16 which may be carried to the shore wherefrom current may be distributed to any point of utilization. The cables may, of course, be carried to the shore in any way desirable.

In the drawings, and especially in Fig. 3, the float 1 and the float 3 are shown as of about the same length, while the float 2 is shorter than the float 1, and there is a companion float 2^a separate from the float 2 and together approaching the length of the float 1. This is simply illustrative of different means whereby the purposes of the present invention may be accomplished and indicate some of the many modifications of which the invention is susceptible.

The floats 2 and 3 are joined together to the float 1 by connectors 17 which may be crossed to maintain the general relative positions of the floats and prevent side movement, but these connectors are so disposed that the up and down movements of the floats are not interfered with.

Each float 2 and 3 carries one or more connecting rods or bars 18 connected at one end by a joint 19 to the float preferably at a middle point thereof, and at the other end the bar is connected by a flexible link 20 to the corresponding end of a beam 21 on the float 1, these connections being such as to permit the free rise and fall of the floats to accommodate the action of the waves without the floats changing their general relation other than by rise and fall.

At one end of each rod 18 there is an upstanding post 22 and the upper end of this post is connected by a brace 23 continued toward the end of the rod carried by the joint 19. The end of the post 22 to which the brace 23 is connected is in turn connected to a respective pitman 11 leading to a pump 6.

Each float 2, 2^a and 3 is shown as provided with two bars 18 and each bar is connected to a respective pump on the float 1. To hold the floats 2 and 2^a in proper relation one to the other, they are secured together at the adjacent ends in spaced relation by spacing links 24 jointed to the respective floats, so as to permit independent movement of these floats for limited distances.

In the particular showing of the drawings the float 3 is provided with a mast 25 carrying a sail 26, this mast being supported against the stress of the sail by braces 27. The ends of the bars 18 where mounted on the floats 2 and 2^a are connected by chains 28 or other suitable flexible means to a buoy 29, and the latter is connected by a chain 30 to an anchoring means which may consist of an ordinary anchor, but such anchor is not shown in the drawings. Since the waves follow the general course of the wind, the sail 26 will constrain the series of floats to line up with the wind with the buoy 29 to the windward, thus maintaining the floats in proper relation to the waves.

In the arrangement shown in Fig. 4 pumps 6 may be mounted on the bars 18 conecting the float 4 with the float 1, and these pumps are controlled by the bars 18 connected to the float 3. It will be understood that in this instance the pump or pumps 6 controlled by the float 3 will be connected up to the tank 5 by flexible connections permitting the float 4 and the parts carried thereby to rise and fall with respect to the float 1 under the action of the waves.

Should an unusually heavy wave strike the windward float 2 or 2^a, there is a possibility of the float rocking excessively, since the bars 18 are pivoted to an intermediate point on the floats, allowing the latter to rock under the action of the waves while rising and falling. To prevent such excessive movement there are provided connections 31 in the form of chains or other suitable flexible means which will permit moderate rocking of the floats without excessive rocking thereof, and the floats 3 and 4 may be likewise provided with chains 31.

It will be observed that the power storing and utilizing machinery is carried mainly on the float 1 which is an intermediate float, and is made large enough for the purpose, and also to provide room for attendants, wherefore it may be provided with a deck house 32, as indicated in Fig. 1.

By employing a large float in connection with a smaller float and utilizing the large float for the carrying of the storing and power transforming machinery, the large float while rising and falling with the rise and fall of the water in the waves does not rock on the waves as do the smaller floats, but the rocking movements of the smaller floats are not utilized, since these floats may quite readily rock on an axis transverse to the direction of movement of the waves, so that it is only the rising and falling movement of these smaller floats which is utilized.

It is because of the practically unchanging position of the intermediate float except for its rise and fall and the flexibility of the other floats whereby only the rise and fall thereof is utilized that the full force due to the changing elevation of the water surface is converted into power at the pumps, since there is no material loss due to any tipping of the floats whereby they are brought into more or less conformity even though rising and falling on the waves. The rocking of the floats has only a negligible effect toward neutralizing the rise and fall of the floats for the generation of power.

Of course, the pumps may deliver directly to the turbines, although an air bell is customarily incorporated in the transmission line, and in the particular instance shown the tank 5 constitutes an air bell, but this tank may be of such size as to act as a storage tank when a greater amount of water is supplied by the pumps than is being utilized at the turbines, wherefore the pressure in the tank may rise and this pressure may be utilized for driving the turbines when the wave action is less pronounced than usual, and by making the parts of sufficient capacity the tank 5 may store enough surplus power to drive the turbines for a considerable time tiding over times of small power supplied by the waves, the tank being replenished when the waves are of greater size, at which times, or when the waves are of normal size, the turbines may run constantly without depleting the storage tanks.

What is claimed is:—

1. In a wave motor, a main float, other floats adjacent the main float and of smaller size than the main float, connecting members between the smaller floats and the main float, and flexibly joined to each, and power means on the main float joined to the connecting members between the floats for actuation thereby.

2. In a wave motor, a plurality of floats, connecting members between the floats hinged at each end to a respective float and provided with a lateral offset portion, a pump carried by one of the floats, and a connection between the pump and the lateral offset member of the respective connecting member between the floats.

3. In a wave motor, a main float, other floats on opposite sides of the main float and spaced therefrom, connecting members between the floats hinged at the ends to the respective floats, and power means on the main float connected to and receiving motion from the respective connecting members between the floats.

4. In a wave motor, a main float provided with power generating means responsive to pressure and pressure producing means also on the main float, and auxiliary floats on opposite sides of the main float, said auxiliary floats being connected to the main float by bars hinged at the ends to the respective floats, and connections between said bars and the pressure producing means on the main float.

5. In a wave motor, a main float provided with power generating means responsive to pressure and pressure producing means also on the main float, and auxiliary floats on opposite sides of the main float, said auxiliary floats being connected to the main float by bars hinged at the ends to the respective floats and connections between said bars and the pressure producing means of the main float, the connections between the connecting bars and the auxiliary floats being at points substantially intermediate of the width of the auxiliary floats.

6. In a wave motor, a main float, other floats on opposite sides of the main float, bars connecting the main float and auxiliary floats, each bar being pivotally connected to a corresponding side of the main float and an intermediate point of the corresponding auxiliary float, and power generating means on the main float connected for actuation to the said bars.

7. In a wave motor, a main float, power storing means on the main float, power utilizing means on the main float, auxiliary floats on opposite sides of the main float, connections between the auxiliary floats and the power storing means for actuating the latter, means for anchoring one end of the series of floats, and a wind responsive means carried by a series of floats remote from the anchoring means.

8. In a wave motor, a main float, power generating and utilizing means thereon, auxiliary floats of smaller size than the main float on opposite sides thereof, bars connecting the auxiliary floats at intermediate points of said floats to the main float at the corresponding sides thereof, said bars being pivotally connected at the ends to the respective main and auxiliary floats and each bar having a lateral offset portion, and connections from the offset portion to the power generating means on the main float for driving the latter.

9. In a wave motor, a main float, power generating and utilizing means thereon, auxiliary floats of smaller size than the main float on opposite sides thereof, bars connecting the auxiliary floats at intermediate points of said floats to the main float at the corresponding sides thereof, said bars being pivotally connected at the ends to the respective main and auxiliary floats and each bar having a lateral offset portion, and connections from the offset portion to the power generating means on the main float for driving the latter, the series of floats being provided at one end with anchoring means and

at the other end with wind-responsive means for holding the series of floats in operative relation to the progression of the waves.

10. In a wave motor, a main float provided with pumps, storage means into which the pumps discharge, pressure responsive means connected to the storage means, and electric generators connected to the pressure responsive means for actuation thereby, auxiliary floats on opposite sides of the main float, bars each pivoted at one end to a middle portion of a respective auxiliary float and at the other end to the corresponding side of the main float, each bar having a lateral offset, and a pitman connection between the offset of the respective bar and a respective one of the pumps for the actuation of the pump by the relative rise and fall of the auxiliary and main floats.

11. In a wave motor, a main float provided with pumps, storage means into which the pumps discharge, pressure-responsive means connected to the storage means, and electric generators connected to the pressure responsive means for actuation thereby, auxiliary floats on opposite sides of the main float, bars each pivoted at one end to a middle portion of a respective auxiliary float and at the other end to the corresponding side of the main float, each bar having a lateral offset, and a pitman connection between the offset of the respective bar and a respective one of the pumps for the actuation of the pump by the relative rise and fall of the auxiliary and main floats, the series of floats being provided at one end with anchoring means yieldable to the rise and fall of the floats and at the other end with a sail adapted to hold the series of floats in proper relation to the progressive movement of the waves.

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

FRANCIS MARION NELSON.

Witnesses:
GEO. W. NELSON,
U. F. NELSON.