No. 854,082. PATENTED MAY 21, 1907.

T. DANFORD.

WAVE POWER MOTOR.

APPLICATION FILED JULY 2, 1906.

3 SHEETS—SHEET 1.

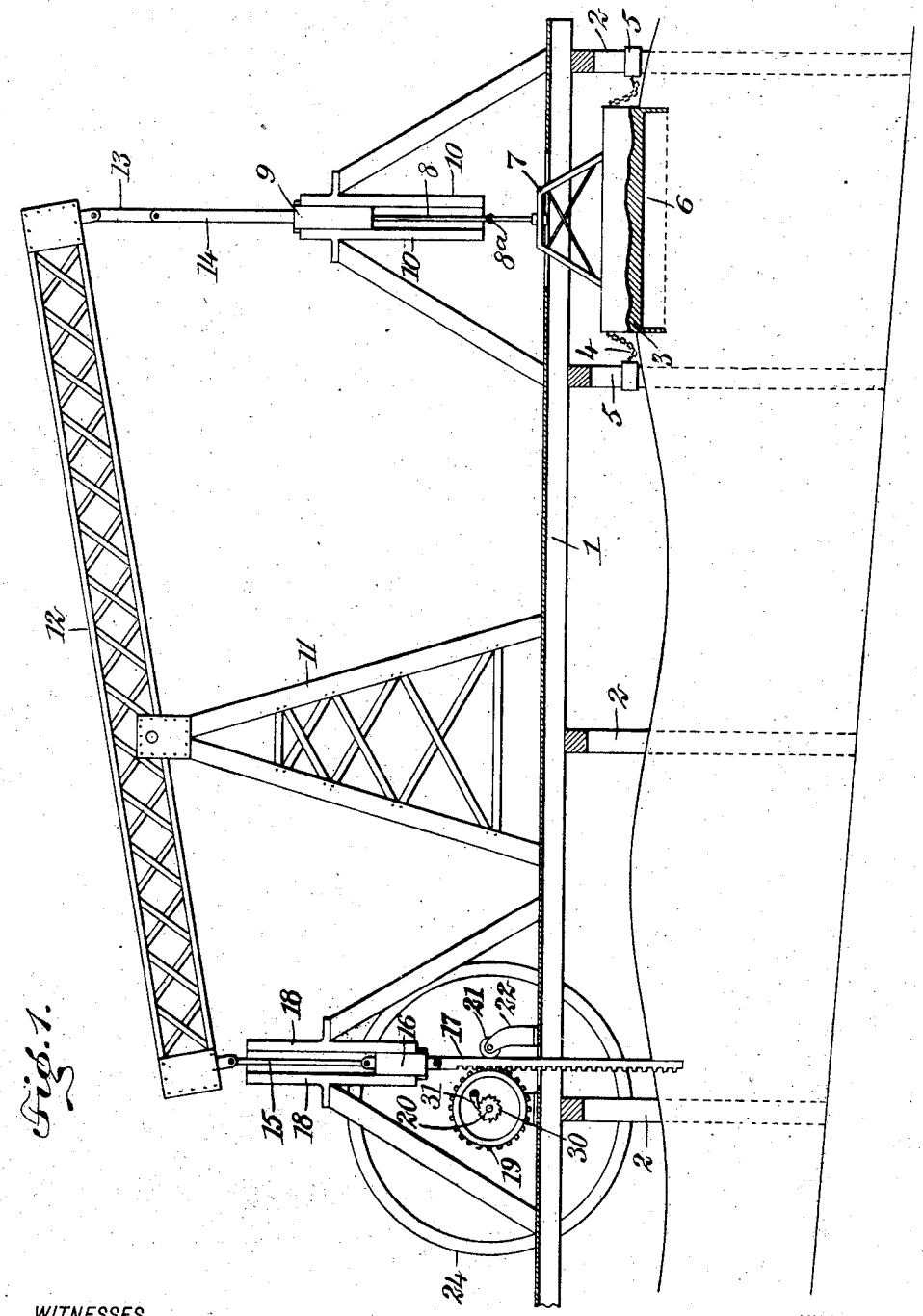


Fig. 1.

WITNESSES

P. C. Hoff

INVENTOR

Tad Danford

BY Munn & Co.

ATTORNEYS

THE NORRIS PETERS CO., WASHINGTON, D. C.

No. 854,082. PATENTED MAY 21, 1907.

T. DANFORD.

WAVE POWER MOTOR.

APPLICATION FILED JULY 2, 1906.

3 SHEETS—SHEET 2.

Fig. 2.

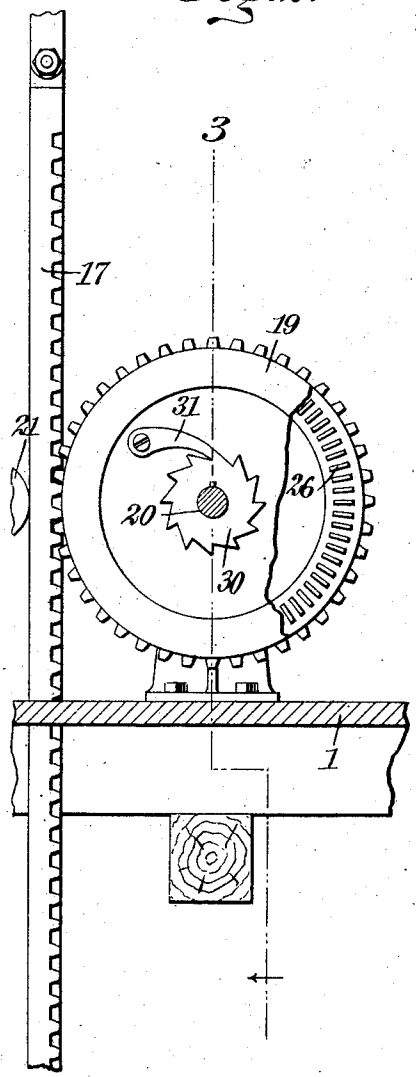
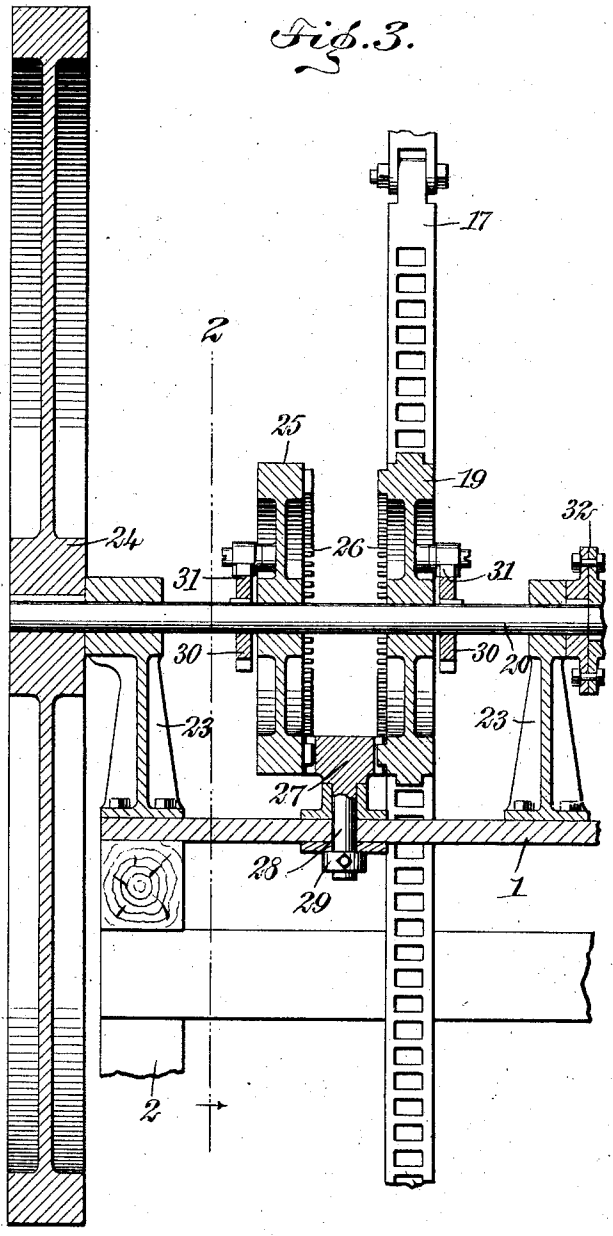


Fig. 3.



WITNESSES

H. C. Abbott

Wm. Hall

INVENTOR

Tad Danford

BY Munn & Co.

ATTORNEYS

THE NORRIS PETERS CO., WASHINGTON, D. C.

No. 854,082. PATENTED MAY 21, 1907.

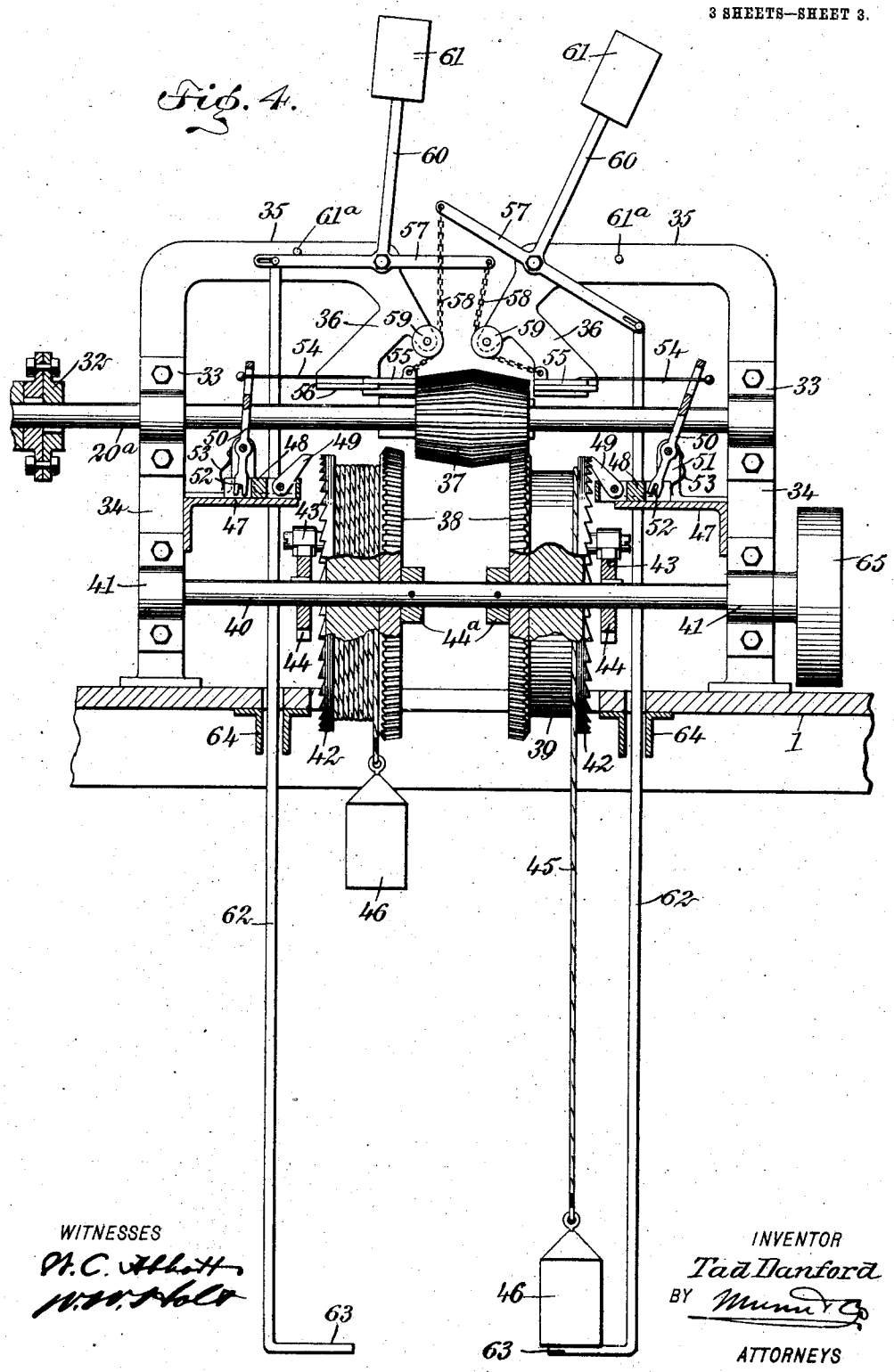
T. DANFORD.

WAVE POWER MOTOR.

APPLICATION FILED JULY 2, 1906.

3 SHEETS—SHEET 3.

Fig. 4.



WITNESSES

P. C. Abbott

W. W. Holt

INVENTOR

Tad Danford

BY Munn & Co.

ATTORNEYS

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

TAD DANFORD, OF GRANBY, COLORADO.

WAVE-POWER MOTOR.

No. 854,082. Specification of Letters Patent. Patented May 21, 1907.

Application filed July 2, 1906. Serial No. 324,350.

To all whom it may concern:

Be it known that I, TAD DANFORD, a citizen of the United States, and a resident of Granby, in the county of Grand and State of Colorado, have invented a new and Improved Wave-Power Motor, of which the following is a full, clear, and exact description.

This invention contemplates the production of means to utilize the power developed by the force of the waves and swells of the ocean.

Among other objects of the invention is to provide a machine of this character in which suitable provision is made for the unequal levels of the water caused by the rising and falling of the tide, combined with a power transforming mechanism to reduce the quick, impulsive and variable movement of the parts initially driven by the motor, to a constant uniform, rotary motion.

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

Figure 1 is a longitudinal view, partly in section, of the motor as supported on a pier; Fig. 2 is an enlarged partly sectional side elevation of a detail of construction shown in Fig. 1, substantially on the line 2, in Fig. 3; Fig. 3 is a vertical, central section on the line 3 of Fig. 2, viewed in the direction of the arrow, only a fragment of the motor being shown in this section, and Fig. 4 is a continuation of the section shown in Fig. 3.

The numeral 1 indicates a pier projecting into the ocean or other body of agitated water, supported on piles or columns 2. Between four of these columns at the forward end of the pier, a float 3 is held in such a manner as to be capable of free movement in any direction within the limits of chains 4 secured to its corners and to the columns through sleeves 5, the sleeves and chains admitting of the float moving vertically and from side to side, but keeping it from being smashed against the pier. The float 3 is formed with an air chamber 6 on its under face, rendering it more buoyant and susceptible to the action of the waves or swells.

Mounted on top of the float is a framework 7 adapted to pass through an opening in the pier flooring and pivotally connected to a rod 8 at 8^a, having fixed to its upper end a crosshead 9 slidable in suitable guides 10 supported from the pier. A frame 11 rising from the pier at one side of the mechanism just described pivotally supports at its upper end a walking beam 12 connected at its forward end to the crosshead 9 through the intermediary of a link 13 pivotally joined to an arm 14 extending from said crosshead. The opposite end of this beam carries a depending link 15 pivotally supported and joined to a crosshead 16, from which a rack-bar 17 pivoted to it, downwardly extends. The crosshead 16 is mounted to vertically slide in guide-ways 18, also supported in any desired manner from the pier. The rack-bar 17 is made of sufficient length to compensate for the varying levels of the ocean caused by the tides, and is held in mesh with a gear 19 journaled on a shaft 20 by means of a roller 21 revolubly mounted in the upper end of a standard 22 supported from the pier. The shaft 20 is journaled in suitable supports 23 fixed to the pier as shown in Fig. 3, and carries fixed to it at one end a large, heavy flywheel 24 designed to act in storing up the energy developed by the movement of the float.

A gear 25 journaled at one side of the gear 19, both of which carry teeth 26 in opposed relation on one face, mesh with a gear 27 made as an integral part of the upper end of a shaft 28, the latter being journaled vertically in the floor of the pier and held from longitudinal movement by reason of a collar 29 fixed to its lower end. At the outside of the gears 19 and 25 are fixed ratchet wheels 30 to the shaft 20, which are engaged by suitable pawls 31 pivotally mounted to and carried by their respective gears.

By reason of the construction just described, the motion of the float 3 causes the rack bar to be reciprocated, turning the gear 19 in opposite directions, causing it to turn the shaft 20 by the pawl and ratchet mechanism as the rack moves upward, but itself turning on the shaft when moved in the opposite direction. The power of the rack bar is, however, not lost when the gear 19 is allowed to revolve on its shaft but is, through said gear and the gear 27, transmitted to the gear 25, causing it to revolve in the same direction as the gear 19 did on the reverse movement of the rack bar. It is thus seen that the reciprocations of the rack bar continually turn the shaft 20 in the same direction.

The shaft 20 alines with a shaft 20^a with which it is positively connected by means of a coupling 32, and might be regarded as the same shaft, only in view of its extended

length by reason of its leading to a power house, it is preferable to construct it as shown. The shaft 20ª is journaled in bearing boxes 33 carried by standards 34 rising from the floor of the power house, said standards having opposed overhanging ends 35 and downwardly projecting angular extensions 36 for supporting mechanism hereinafter described. Between the standards 34 is a pinion 37 having a double bevel adapted to mesh with either of beveled gears 38 fixed to opposed sides of drums 39 revolubly mounted on a shaft 40 journaled in suitable bearing boxes 41 fixed to the standards 34 just below the bearing boxes 33. The drums 39 on their opposite faces from the beveled gears 38 have fixed to them ratchet wheels 42 and pivotally mounted pawls 43, said pawls normally engaging ratchet wheels 44 in fixed relation to the shaft 40. These ratchet wheels prevent the longitudinal movement of the drums on the shaft 40 in one direction, whereas collars 44ª fixed to said shaft prevent longitudinal movement of the drums in the opposite direction. As shown, the gears 38 and ratchet wheels 42 provide flanges at each side of the drums, preventing ropes or other flexible connections 45 from slipping therefrom as they are wound upon them, said ropes sustaining at their lower ends weights 46.

Projecting inwardly from each standard 34 intermediate the bearing boxes 33 and 41 are brackets 47 containing suitable guide-ways in their upper faces, in which are slidably mounted blocks 48 carrying at their outer ends pivotally mounted pawls 49 designed to alternately engage with the ratchet wheels 42 fixed to the outer faces of the drums 39. The opposite ends of the blocks 48 are connected to levers 50 pivoted between ears 51 extending from the brackets 47. These connections between the blocks 48 and levers 50 are formed by providing the levers with lower forked ends embracing pins 52 passing transversely through the blocks, the blocks being forced normally inwardly by springs 53 secured to some fixed point on the brackets 47, and holding, when in inward position, the pawls 49 in engagement with the ratchet wheels 42.

The upper ends of the levers 50 are slotted to receive rods 54 having balls at their outer ends to prevent disengagement from said levers, and are fastened at their inner and opposite ends to blocks 55 slidably mounted on flanges 56 at the lower ends of the angular inturned portions 36. These blocks 55 are connected to levers 57 through the intermediary of chains 58 passing around sheaves 59 journaled to the angular inturned portions 36. The levers 57 are pivoted to the overhanging ends 35 on the standards 34 and each carries a vertical arm 60 extending from said pivotal connection. To the upper end of each arm 60, a weight 61 is fixed, said weights being held in vertical position until turned in angular relation by stop pins 61ª projecting from one side of the overhanging ends 35 of the standards 34. The outer ends of the levers 57 are slotted, from which are pivotally suspended bars 62 having inturned feet 63 at their lower ends at some distance below the flooring from which the gear mechanism is supported, said bars passing through suitable guides 64 secured to the under side of the flooring to keep the feet of the bars in alinement with the weights 46.

The action of the power house mechanism, which is for the purpose of transforming the quick, impulsive and variable movement of the shaft 20ª to a constant and uniform rotary motion is as follows: Assuming the parts in the position as shown in Fig. 4, the double beveled pinion 37 will drive the drum 39 carrying the unwound rope 45, the pawl 49 engaging with its respective ratchet wheel 42, preventing any unwinding action of the rope in event the power of the shaft 20ª is at any instant insufficient to support the weight 46. The weight 46 connected to the rope which is wound up, will move down as the opposite weight moves upwardly, driving the shaft 40 by reason of its ratchet connection therewith, giving the shaft 40 a uniform, rotary movement, as also a belt wheel 65 fixed to its outer end. When the unwinding action of one of the ropes 45 has continued sufficiently long to let its attached weight 46 contact with its alining foot 64, the latter pulls the bars 62 downwardly, causing its attached lever 57 to turn on its pivot and pull the pawl 49 from engagement with the ratchet wheel 42 at the opposite side of the machine, by reason of the intermediate mechanism. In doing this, the block 55 forming an element of said mechanism, pushes the double beveled pinion 37 over in mesh with the opposite beveled gear 38, said double beveled pinion at the same time pushes the opposite block 55 outwardly and allows the spring 53 to push its adjacent block 48 engaging the pawl 49 and ratchet wheel 42 at this side of the machine. The block 55 which is pushed, brings its attached lever 57 and the weight 61 connected thereto, to respectively a horizontal and vertical position, the opposite weight 61 at the same time assuming an angular position, acting to quickly shift the parts, thereby instantly reversing the gearing and avoiding any perceptible change in the rotation of the shaft 40. The reverse action of the parts will now take place, the rope which has been wound up proceeding to be unwound and the unwound rope being coiled about its drum. This action of winding and unwinding the ropes, reducing the variable power of the motor to a uniform rotation, will automatically proceed as the movement of the float continues.

Although I have described the invention in detail, it is to be understood that the scope thereof is limited by the annexed claims only.

Having thus described my invention I claim as new and desire to secure by Letters Patent:

1. In a wave power motor, a float, means for driving a shaft in one direction by the movement of the float, and means for reducing the variable movement of the shaft to a uniform, constant speed.

2. In a wave power motor, a float, a shaft, gears journaled on said shaft, means connected with the float adapted to drive one of said gears in opposite directions, a gear intermeshing with said gears for driving them in opposite directions, and means connecting said first-named gears with the shaft whereby said gears drive the shaft in the same direction.

3. In a wave power motor, a float, a shaft, a walking beam mounted intermediate the float and shaft and connected to the float, a rack bar carried by the walking beam, a gear journaled on the shaft adapted to drive it as the rack bar moves in one direction, and a second gear journaled on the shaft adapted to drive it in the same direction when the rack bar moves in the opposite direction.

4. In a wave power motor, a driven shaft, a second shaft, drums journaled on the second shaft, means for driving said drums alternately from said first-named shaft, and means actuated by said drums adapted to give said second shaft a uniform, rotary motion.

5. In a wave power motor, a variably driven shaft, a second shaft, and gearing intermediate said shafts for transforming the variable movement of said first-named shaft into a uniform rotary motion.

6. In a wave power motor, a variably driven shaft, a second shaft, drums journaled on the second shaft adapted to drive it in the same direction, and means automatically operated by said drums for alternately driving them from the first shaft.

7. In a wave power motor, a driven shaft, a second shaft, drums journaled on the second shaft, means slidably mounted on the driven shaft for driving the drums alternately in the same direction, means actuated by the drums to shift the slidable means on the driven shaft, and means adapting the drums to turn the second shaft in the same direction.

8. In a wave power motor, a driven shaft, a second shaft, drums journaled on the second shaft, means slidable on the driven shaft to alternately engage and drive the drums, a weight attached to a flexible connection adapted to be wound about each drum while being driven, and means causing the weights to drive the second shaft when the flexible connections attached thereto unwind.

9. In a wave power motor, a driven shaft, a second shaft, drums journaled on the second shaft, means for alternately driving the drums, means for causing the drums to drive the second shaft when moved in one direction, and flexible means carrying weights at their lower ends adapted to be wound about the drums when the latter are moved in the opposite direction.

10. In a wave power motor, a driven shaft, a second shaft, drums journaled on the second shaft, means slidable on the driven shaft adapted to alternately engage the drums and drive them in one direction, flexible connections attached to the drums having weights at their lower ends, and means actuated by the weights for shifting the slidable means on the driven shaft.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

TAD DANFORD.

Witnesses:
GEORGE SAUR,
H. M. TOOHEY.