June 2, 1925

B. ROLDAN G.

1,540,364

WAVE MOTOR

Filed July 30, 1924

3 Sheets-Sheet 1

Fig. 1.

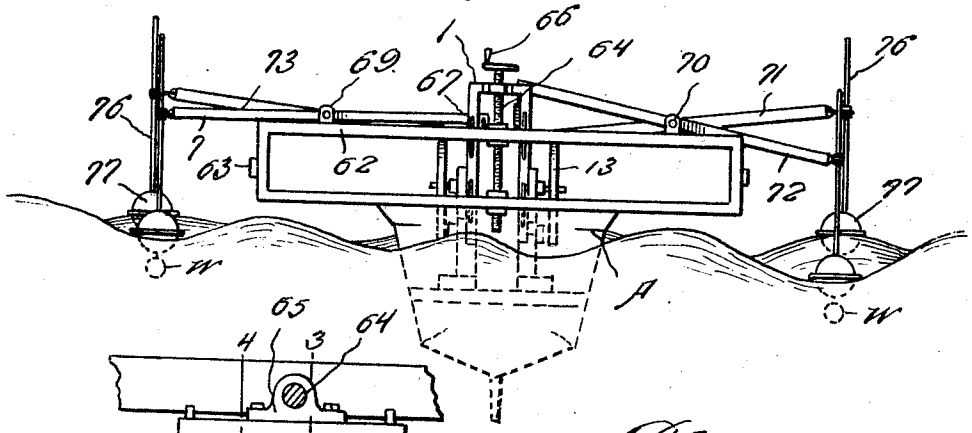


Fig. 2.

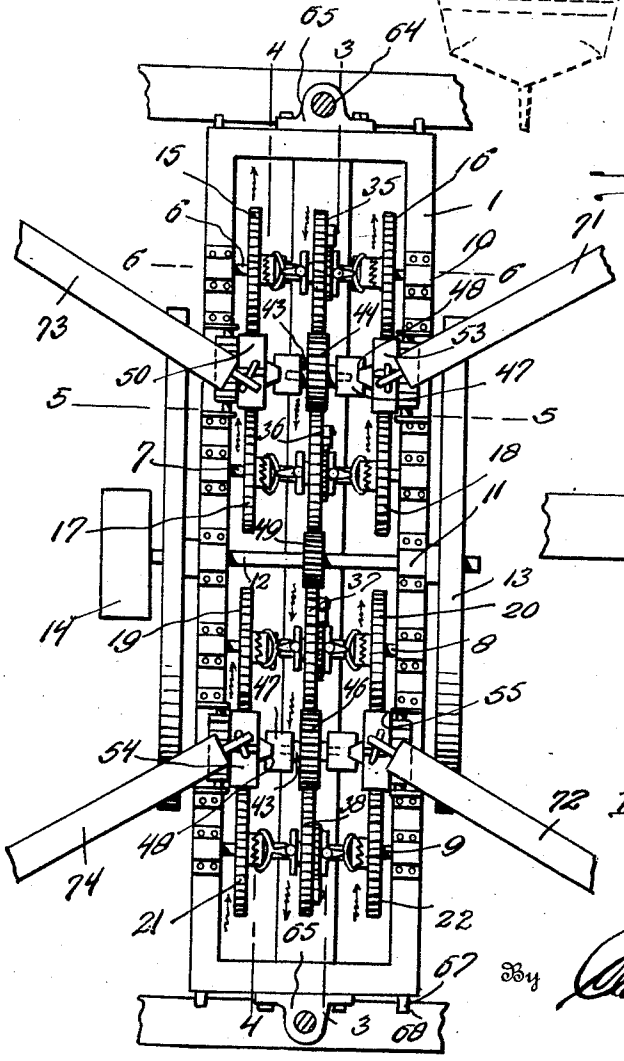
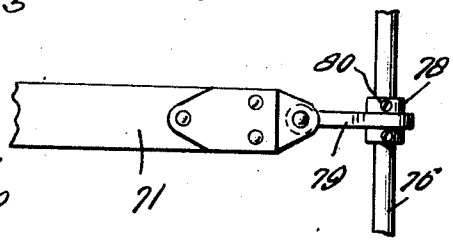


Fig. 3.



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Fig. 3.

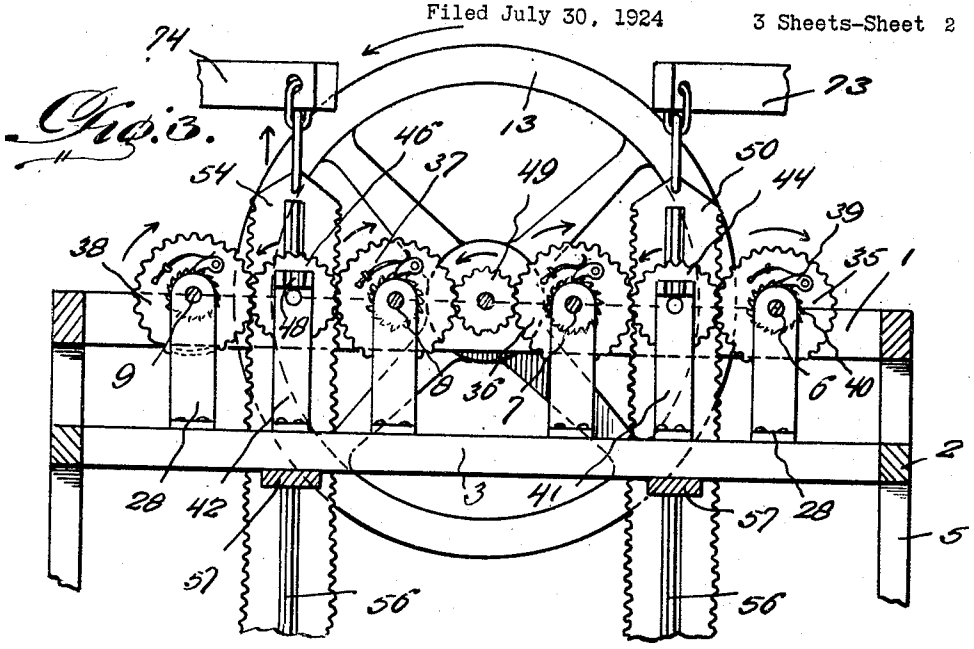
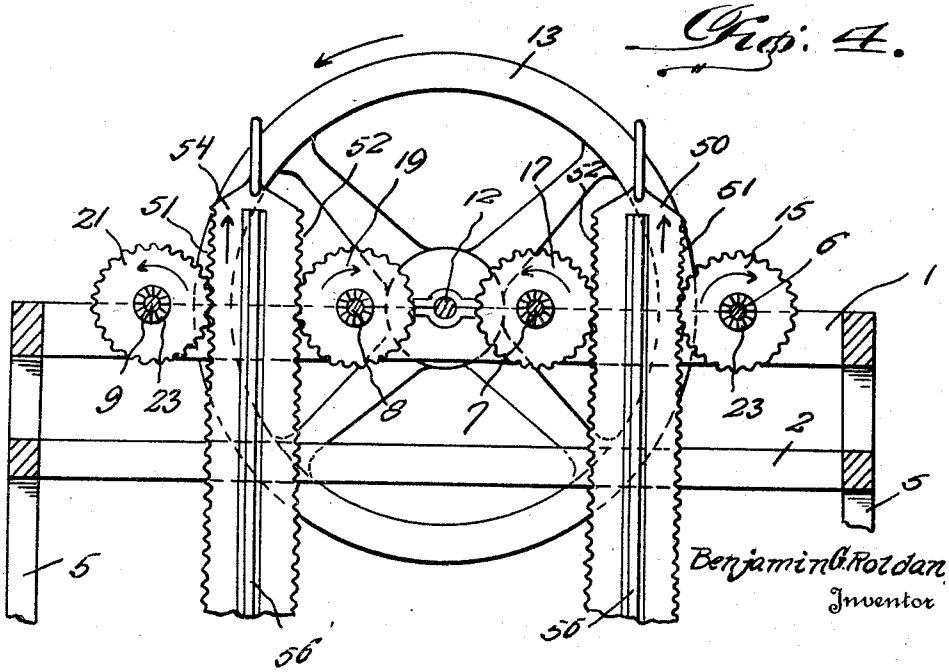


Fig. 4.



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Fig. 5.

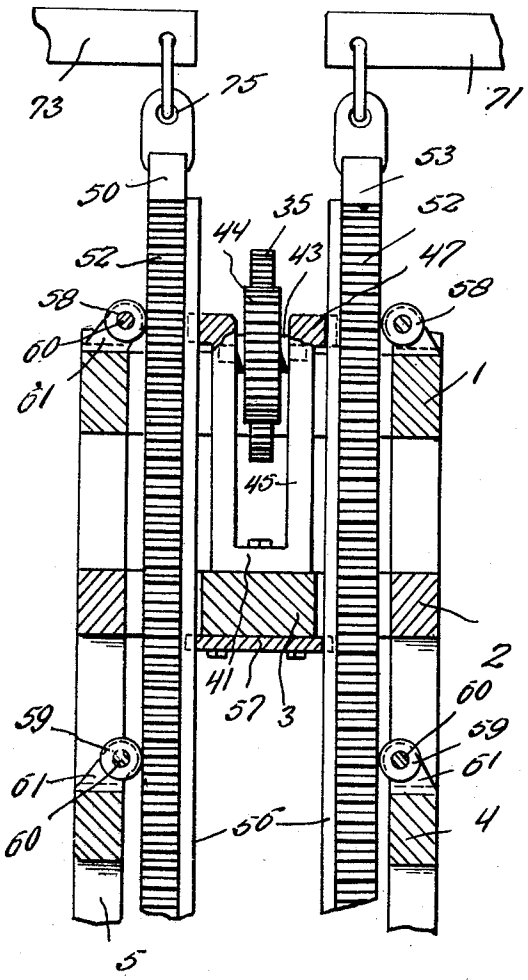


Fig. 6.

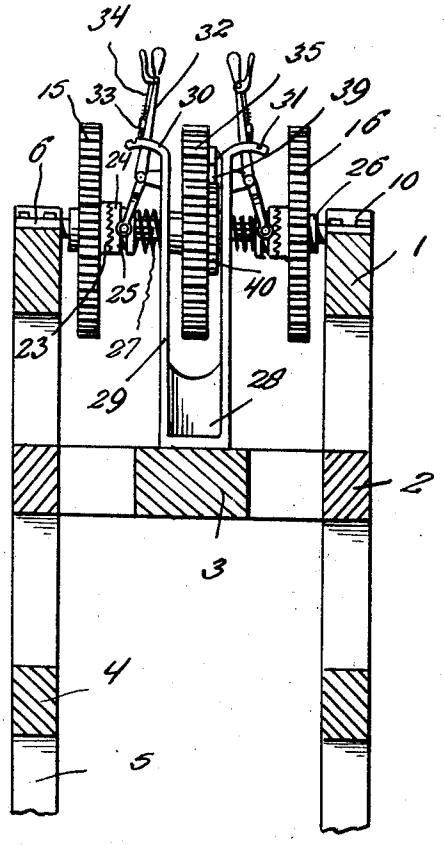
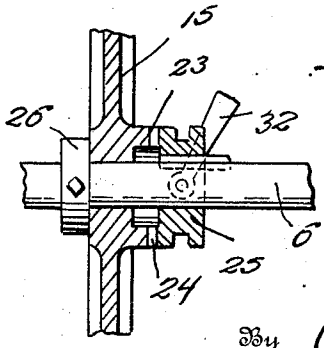


Fig. 7.



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Patented June 2, 1925. 1,540,364

UNITED STATES PATENT OFFICE.

BENJAMIN ROLDAN G, OF CARACAS, VENEZUELA.

WAVE MOTOR.

Application filed July 30, 1924. Serial No. 729,111.

To all whom it may concern:

Be it known that I, BENJAMIN ROLDAN G, a citizen of the Republic of Venezuela, residing at Caracas, in the Republic of Venezuela, have invented certain new and useful Improvements in a Wave Motor, of which the following is a specification.

This invention relates to improvements in wave motors and has for its principal object to provide a simple and efficient means for operating a pump, an air compressor and for generating electric power.

Another important object of the invention is to provide a wave motor of the above mentioned character, which will at all times be positive and efficient in its operation, cooperating gear wheels being associated with a plurality of rack bars for actuating a driven shaft by float operated levers which are connected to the rack bars.

A further object of the invention is to provide a wave motor of the above mentioned character, which includes a means for rendering the driving gear idle or inoperative with respect to the train of driven gears, ratchet means being associated with the train of driven gears for insuring the positive operation thereof.

A still further object of the invention is to provide a wave motor of the above mentioned character, wherein the lever carrying the float members at the outer ends and connected at their inner ends to the rack bars may be adjusted to various angles.

A further object of the invention is to provide a wave motor of the above mentioned character, which is simple in construction, inexpensive, strong and durable and furthermore adapted for the purposes for which it is designated.

Other objects and advantages of this invention will become apparent during the course of the following description.

In the accompanying drawing forming a part of this specification and in which like numerals designate like parts throughout the same:

Figure 1 is an end elevation of the wave motor showing the levers and the supporting frame therefor in side elevation.

Figure 2 is a top plan view of the motor.

Figure 3 is a longitudinal sectional view taken approximately on line 3—3 of Figure 2.

Figure 4 is a similar view taken approximately on line 4—4 of Figure 2.

Figure 5 is a vertical sectional view taken approximately on line 5—5 of Figure 2.

Figure 6 is a similar section taken on line 6—6 of Figure 2.

Figure 7 is a fragmentary enlarged sectional view of one of the clutch members, and

Figure 8 is a detail elevational view of the connection between the outer end of each lever and the float supporting rod.

In the drawings wherein for the purpose of illustration is shown the preferred embodiment of my invention, the numeral 1 designates generally the substantially rectangular shaped frame forming a part of the present invention. Bracing members forming a rectangular structure such as are illustrated at 2 extend between the sides and the ends of the frame adjacent the top thereof. The longitudinally extending bar 3 extends between the end bracing members in the manner as clearly illustrated in Figure 3 of the drawing. Additional bracing bars 4 are associated with the frame at the sides and end thereof and the same are located below the bracing members 2 and the longitudinally extending bar 3. The supporting legs 5 for the rectangular shaped frame are adapted to be secured at their lower ends on any suitable support within a boat or the like illustrated at A.

Extending transversely on the frame 1 and having the ends thereof journaled in suitable bearings provided on the frame are the spaced transmission shafts 6, 7, 8 and 9 respectively. The bearings for the ends of each of the shafts are illustrated at 10 in the drawings with reference more particularly to Figure 2. Also extending transversely on the frame 1 intermediate the ends thereof and journaled adjacent its respective ends in the bearings 11 is the power or driven shaft 12. Suitable fly wheels 13 are mounted on the respective ends of the driven shaft 12 and if desired, a drive pulley such as is illustrated at 14 may be secured to the outer end of the driven shaft in the manner illustrated in Figure 2 and for the purposes hereinafter to be more fully described.

Loosely mounted on the transmission shaft 6 adjacent the ends thereof and disposed within the sides of the frame 1 are the gear wheels 15 and 16 respectively. Similar gear wheels 17 and 18 are loosely mounted on the shaft 7 as are also the gear wheels 19 and 20 on the shaft 8 and the gear wheels 21 and

22 on the shaft 9. The gear wheels on the shafts 6 and 7 respectively are spaced from each other but are arranged in alignment for the purposes to be presently described. The gear wheels on the shafts 8 and 9 are also arranged in the same manner and for the same purpose. The hub of each of the gear wheels above described is provided with the ratchet teeth 23 for engagement with the teeth 24 of the slidable clutch 25 which is keyed on the shaft in the manner illustrated in Figure 7. As is apparent from the construction shown in Figure 2, each of the transmission shafts is provided with a pair of slidable clutches designated by the numeral 25 for cooperation with the toothed hubs of the gear wheels mounted on the respective shafts. Collars such as are illustrated at 26 are secured on each of the shafts for engagement with the opposite sides of the hub of the gear wheels for limiting the sliding movement of the gear wheels on the respective shafts.

The clutches 25 are normally held in engagement with the ratchet teeth 23 by the coil 27 whereby the gear wheels are adapted for rotation with the shafts on which the same are mounted.

Extending upwardly from the longitudinally extending bar 3 are the substantially U-shaped brackets 28, four of such brackets being provided for cooperation with each of the transmission shafts. The arms of each of the U-shaped brackets 28 are provided with registering openings for the purpose of supporting the intermediate portion of each of the transmission shafts and furthermore provide a means for cooperation with the coil springs in supporting the same in position on the transmission shafts. The upper ends of the arms 29 of each of the U-shaped brackets extend above the frame 1 and terminate in the outwardly disposed extension 30, the purpose of which will be presently described. A detent or notch 31 is formed in the outer end of each of the extensions as is clearly illustrated in Figure 6. Pivotally supported intermediate its ends on the outer side of each of the arms of each U-shaped bracket is the clutch actuating lever 32. The lower end of each lever engages the respective clutch while the upper end thereof provides a handle for moving the clutch out of engagement with the ratchet teeth of the respective gear wheel for causing the gear wheels to become idle on the shaft. A locking pawl or dog 33 is carried by the upper portion of each lever for engagement with the detent or notch 31 formed in the extension 30 on the upper end of the arms of the U-shaped bracket for holding the clutch out of engagement with its respective gear wheels against the tension of the spring 27. An auxiliary lever and handle designated generally by the numeral 34 is associated with each of the locking dogs for actuating the same in the manner well known in the art.

Mounted on the intermediate portion of the transmission shafts 6, 7, 8 and 9 respectively are the gear wheels 35, 36, 37 and 38 respectively. Each of the last mentioned gear wheels is positioned between the arms of each of the U-shaped brackets and for the purpose of locking the gear wheels 35 and 38 on the respective shafts so that the same will rotate therewith, I provide a pawl and ratchet mechanism designated by the numerals 39 and 40 for the gears 35 and 38 which are loosely mounted on their respective shafts, while the gears 36 and 37 are keyed on their respective shafts. The gear wheels 35, 36 and 37 and 38 respectively are of the same diameter as the other gear wheels mounted on the respective transmission shafts.

Extending upwardly from the longitudinally extending bar 3 between the gear wheels 35 and 36 and 37 and 38 are the substantially U-shaped brackets 41 and 42 respectively. As each of the last mentioned brackets are of the same construction, the description of one is thought to suffice for the description of both. Journaled in the upper portion of each of the brackets 41 and 42 is the shaft 43. A pinion 44 is keyed to the shaft supported between the arms 45 of the U-shaped bracket 41 and is adapted to engage the gear wheels 35 and 36 respectively while a similar pinion 46 is keyed to the shaft 43 supported between the arms of the U-shaped bracket 42 and is adapted to mesh with the gear wheels 37 and 38 respectively. This construction is more clearly illustrated in Figures 2, 3 and 5 of the drawings. The upper ends of the arms 45 of each of the U-shaped brackets 41 and 42 disposed outwardly to provide the lateral extensions 47 and the ends thereof are slotted as illustrated at 48 for the purposes hereinafter to be more fully described.

The centrally located driven shaft 12 has the pinion 49 keyed on the intermediate portion thereof and the same is adapted to mesh with the gear wheels 36 and 37 in the manner as clearly illustrated in Figures 2 and 3 of the drawings. The provision of the gear wheels 35, 36, 37 and 38 respectively and the pinions which mesh with the same provide a train of gears for imparting rotary motion to the driven shaft 12.

Extending vertically within the frame and adapted for cooperation with the gear wheels 15 and 17 respectively is the rack bar 50. The opposite longitudinal edges thereof have the teeth 51 and 52 formed therein for engagement with the teeth in the gear wheels 15 and 17 respectively in the manner clearly illustrated in Figure 4. A similar rack bar 53 is disposed between the

gear wheels 16 and 18 respectively and the teeth in the longitudinal edges in the rack bar 53 engage the teeth in the gear wheels 16 and 18. A similar rack bar 54 has the teeth in the opposite longitudinal edges thereof engaging the teeth in the gear wheels 19 and 21 whereby the rack bar 54 is adapted for vertical movement between the gear wheels 19 and 21 and in the same manner the rack bar 55 has its teeth in the opposite longitudinal edges thereof engaging the teeth in the gear wheels 20 and 22 respectively.

For the purpose of guiding the rack bars in their vertical movements between the respective gear wheels of the transmission shaft, the inner opposed faces of the rack bars are provided with the longitudinally extending ribs 56, the same operating in the slots 48 formed in the outer ends of the extensions 47, the latter being provided on the upper ends of the arms of the U-shaped brackets 41 and 42. A pair of guide plates 57 are secured to the under side of the longitudinal bar 3 and extends transversely thereof, the ends of each of the plates extending beyond the edges of the bar and are slotted in the manner shown more clearly in Figure 5 for cooperation with the ribs on the inner opposed longitudinal faces of the rack bars.

Engaging the outer longitudinal faces of the rack bars are the roller bearings 58 which are supported on the top of the frame 1 and similar roller bearings 59 are supported on the bracing members 4 which extend longitudinally between the supporting legs 5. The roller bearings also provide a guide means for the rack bars in a vertical movement and each of the roller bearings comprises a plurality of rollers which are loosely mounted on the shaft 60, the ends of which are journaled in suitable brackets 61. The roller bearings may further provide a means for lubricating the outer longitudinal sides of the rack bars to permit the easy vertical movement of the rack bars within the frame.

Arranged transversely on the respective ends of the frame is a substantially rectangular shaped frame 62. As each of the frames is of the identical construction, the description of one is thought to suffice for the description of both. The transversely extending frames are secured at their respective ends to each other by means of a cross strip 63. The frames are adapted for vertical adjustment of the ends of the main frame by means of the screw 64 which extends through the longitudinal side members of each of the auxiliary frames 62 and through the lugs 65 carried by the ends of the frame 1. A handle 66 is provided on the upper end of each of the screws for rotating the same whereby the auxiliary frames may be raised or lowered with respect to the main frame, the purpose of which will be presently described. Cooperating guide means 67 and 68 respectively are associated with the ends of the main frame and the longitudinal members of the auxiliary frames in the manner clearly illustrated in Figure 2 of the drawings whereby the auxiliary frames may at all times maintain a substantially horizontal position with respect to the main frame and the supporting legs therefor.

Extending across the top of the auxiliary frames adjacent the ends thereof and journaled in suitable brackets 69 are the shafts 70. The levers 71 and 72 are supported intermediate their ends on the shaft 70 and the inner ends of these levers are connected to the upper ends of the rack bars 53 and 55 respectively while the levers 73 and 74 which are supported intermediate their ends on the shafts 70 adjacent the opposite ends of the auxiliary frames and on the opposite side of the main frame 1 are connected at their inner ends to the upper ends of the rack bars 50 and 54 respectively. The connection between the inner ends of each of the levers and the upper end of the respective rack bars is illustrated generally at 75 in Figure 5 of the drawings.

Cooperating with the outer ends of the several levers are the vertically extending rods 76 on the lower ends of which are carried the float or buoyant members 77. For the purpose of adjustably securing the rods in the outer ends of the levers, the collars 78 are associated with each of the rods on opposite sides of the apertured plates 79 extending outwardly from the outer end of each of the levers and suitable set screws 80 secure the collars in locked engagement with each of the rods 76 in the manner clearly illustrated in Figure 8 of the drawings.

The operation of my improved wave motor may be briefly stated as follows—The auxiliary frames 62 are adjusted on the main frame so that the levers may be disposed at the desired angle, depending of course on the conditions of the water as well as the tide. With the parts arranged as shown in the drawings, when the waves strike the floats 77, the same will cause the rods to move upwardly causing the inner ends of the levers to move downwardly and simultaneously imparting a downward movement on the rack bars whereby certain of the gear wheels which have the teeth meshing with the teeth on the downwardly moving rack bars will be rotated thereby and causing the rotation of the train of driven gears to impart a rotary motion to the driven shaft 12. It is also to be understood that when the floats and rods descend after the waves recede, the upward movement of the inner ends of the levers associated with the de-

scending rods and floats will raise the respective rack bar and further transmit rotary motion to the driven shaft 12 through the train of gears and the transmission shaft.

The rise and fall of each float while causing a corresponding oscillatory movement of the driving gear through the medium of the reciprocating rack bar associated therewith also causes a rotary movement in one direction of the driven shaft. The ratchet mechanism associated with the gear wheels 35, 36, 37 and 38 respectively will insure the rotation of the transmission shaft in one direction whereby the positive operation of the driven shaft and the fly wheels carried thereby will be maintained.

It is also to be understood that each float has a weight W associated therewith so that each of the floats will be of a weight equal to twice the weight of its respective rack bar whereby the same will operate efficiently at all times and the proper balance between the floats and the rack bars will be maintained.

Whether the operation of the float is simultaneous or successive, the accumulated impulse is imparted to the device being driven by the pulley wheel 15, each float receiving a motion which commensurates with the maximum movement of the waves.

It will thus be seen from the foregoing description, that a wave motor has been provided which utilizes the movement of the waves in providing a means for operating machinery or generating electric power in a simple and efficient manner, the parts being so arranged as to enable the same to be readily accessible without the loss of any considerable length of time and labor.

While I have shown the preferred embodiment of my invention, it is to be understood that various changes in the size, shape and arrangement of parts may be resorted to without departing from the spirit of the invention and the scope of the appended claims.

Having thus described the invention, what I claim is:—

1. In a wave motor, a frame comprising an upper rectangular portion, a lower rectangular portion, legs connected to the portions at their corners, bars extending between the legs parallel to and below the longitudinal sides of the lower rectangular portion, a third bar disposed between the ends of the lower portion, a plate attached to the lower surface of said third bar and having notched ends extending beyond the sides thereof, a U-shaped bracket supported on the upper surface of said third bar and having offset outwardly disposed notched ends, bearing rollers supported on the sides of the upper portion and on the first mentioned bars, rack bars having ribs slidably received in the notches and having their opposite surfaces in engagement with the rollers, means for taking power from the rack bars, and wave operated means for reciprocating the rack bars.

2. In a wave motor, a frame comprising an upper rectangular portion, a lower rectangular portion, legs connected to the portions at their corners, bars extending between the legs parallel to and below the longitudinal sides of the lower rectangular portion, a third bar disposed between the ends of the lower portion, a plate attached to the lower surface of said third bar and having notched ends extending beyond the sides thereof, a U-shaped bracket supported on the upper surface of said third bar and having offset outwardly disposed notched ends, bearing rollers supported on the sides of the upper portion and on the first mentioned bars, rack bars having ribs slidably received in the notches and having their opposite surfaces in engagement with the rollers, means for taking power from the rack bars, wave operated means for reciprocating the rack bars, a pair of auxiliary frames, one at each end of the first mentioned frame extending transversely thereof, said wave operating means including levers pivoted on said auxiliary frames and connected with said rack bars, and floats connected with the outer ends of said levers.

In testimony whereof I affix my signature.

BENJAMIN ROLDAN G.