No. 738,996. PATENTED SEPT. 15, 1903.

F. J. HAGEN.

WAVE MOTOR.

APPLICATION FILED APR. 17, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

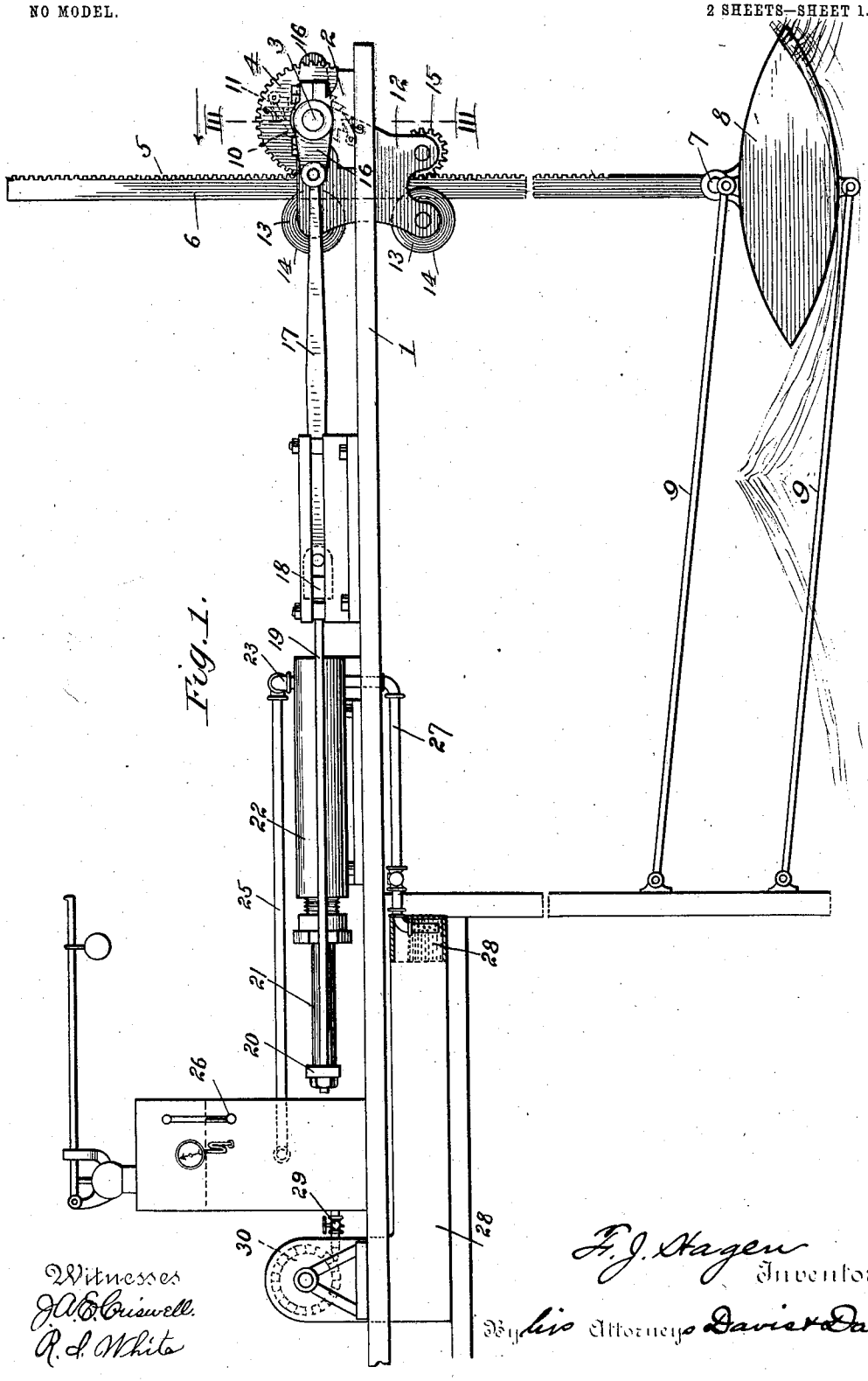


Fig. 1.

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

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NO MODEL. 2 SHEETS—SHEET 2.

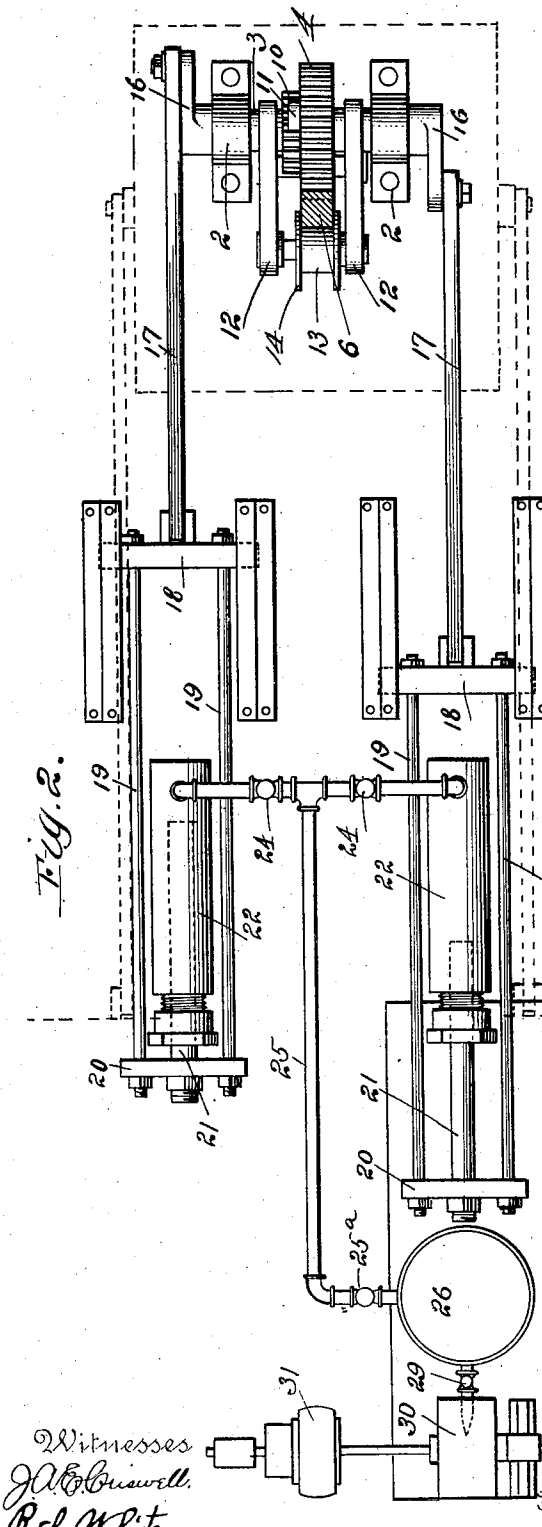


Fig. 2.

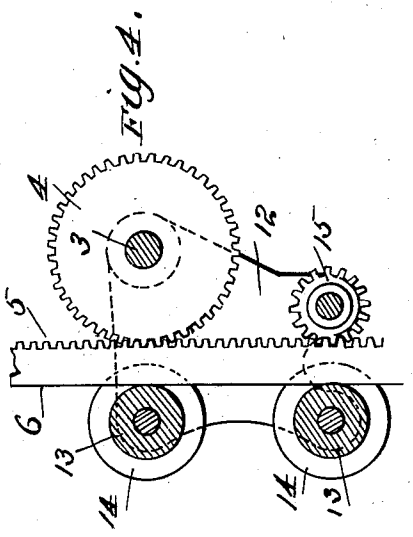


Fig. 4.

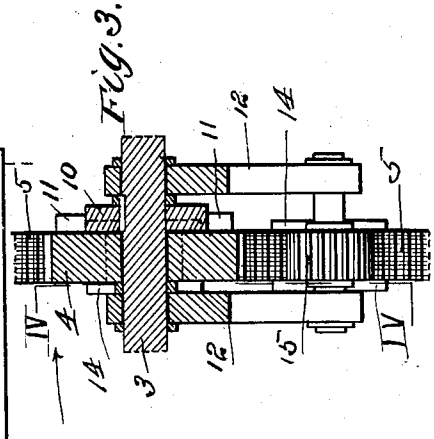


Fig. 3.

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No. 738,996. Patented September 15, 1903.

UNITED STATES PATENT OFFICE.

FERDINAND JOSEF HAGEN, OF NEW YORK, N. Y.

WAVE-MOTOR.

SPECIFICATION forming part of Letters Patent No. 738,996, dated September 15, 1903.

Application filed April 17, 1903. Serial No. 153,056. (No model.)

To all whom it may concern:

Be it known that I, FERDINAND JOSEF HAGEN, a citizen of the United States, residing in the borough of Manhattan, county, city, and State of New York, have invented certain new and useful Improvements in Wave-Motors, of which the following is a specification, reference being had therein to the accompanying drawings, in which—

Figure 1 is a side elevation of the apparatus; Fig. 2, a plan view thereof; Fig. 3, a detail vertical sectional view on the line III III of Fig. 1, and Fig. 4 a detail vertical sectional view taken on the line IV IV of Fig. 3.

This invention relates to that class of wave-motors in which the force of the waves is utilized to lift a float and the weight of the descending float is utilized to drive a pumping apparatus by which water is pumped into a storage-tank and maintained therein under a high pressure, water from said tank being utilized to drive a suitable water-motor.

The main object of the invention is to provide a simple apparatus of the class described which will automatically adjust itself to the variations of the tide without reducing the effectiveness of the apparatus.

A further object of the invention is to provide a pump-driving mechanism which will shift automatically to maintain itself in proper operative position with respect to the float-carrying rod.

Other important objects and advantages will appear hereinafter.

Referring to the various parts by numerals, 1 designates a portion of a pier or other support upon which the bearings 2 are mounted. In these bearings is journaled a very strong shaft 3, upon which between the bearings is loosely mounted a large gear 4. This gear meshes with a rack 5, secured to the vertical float-carrying rod 6. The lower end of this rod is pivotally secured at 7 to the center of the upper surface of a large float 8. This float may be constructed of any suitable material and may be of any desired shape; but it is preferred to form it convex on its lower and upper surfaces in order that the lifting force of the waves may be utilized to the fullest extent and so that any water reaching the top of the float will drain therefrom very quickly. To maintain the float horizontal at all times and throughout all its vertical movement, the forward ends of swinging links 9 are secured thereto, the rear ends of these links being pivotally secured to the pier or other suitable support. Two pairs of these links are employed, one pair being at each side of the float and one link of each pair being secured to the top of the float, the other being secured to the bottom thereof.

Rigidly mounted on the shaft 3 at the side of the gear 4 is a ratchet-wheel 10, and on the said gear 4 are a series of pawls 11, which are yieldingly held in engagement with said ratchet by means of suitable springs, the ratchet-wheel and pawls being so arranged as to rotate the shaft only during the descent of the float-carrying rod 6, the pawls slipping on the ratchet when said float-carrying bar is raised.

To maintain the rack 5 in engagement with the gear 4, two swinging side frames 12 are mounted on the main shaft 3, one on each side of the gear 4. These frames extend forward of the float-carrying bar 6, and journaled therein, near the forward edge thereof, are flanged guide-rollers 13, whose flanges 14 embrace the sides of the float-carrying bar, the two rollers being separated from each other vertically a considerable distance. Journaled in these side frames at a point in front of the lowermost guide-roll is a gear-wheel 15, which engages the rack 5 and aids in maintaining said rack in mesh with the gear-wheel 4. It will be thus seen that the said rack will be maintained in engagement with the gear-wheel 4 no matter what be the inclination of the said rack, the frames 12 swinging on the main shaft 3 to accommodate themselves to the varying inclination of the float-carrying bar. It will also be seen that the float will be automatically shifted during the variations in the height of the water caused by the rising and falling of the tide.

Secured rigidly to the ends of the shaft 3 are cranks 16, said cranks extending diametrically in opposite directions and being connected by pitmen 17 to cross-heads 18, mounted in suitable guideways. These cross-heads are connected by piston-rods 19 to the cross-heads 20, which carry the plunger-pistons 21, said plunger-pistons working in the pump-cylinders. By extending the cranks

in opposite directions, as shown, the pump-pistons will work alternately to force water into the storage-tank. Connected to the exit end of the pump-cylinders is a pipe 23, provided with suitable check-valves 24 and connected between the check-valves by pipe 25 to the storage-tank 26, the inlet-ports of said pumps being connected by a pipe 27 to the tank 28, containing a supply of fresh water. Connected to the lower end of the storage reservoir or tank 26 is a nozzle 29, which directs the water against the blades of a suitable water-motor 30, which is suitably mounted, the water after driving the motor passing down into the tank 28 to be again forced by the pumps into the storage-tank. An electrical generator, such as 31, may be directly mounted on the shaft of the motor, or the power may be otherwise utilized, as desired. It will of course be understood that the water is forced by the pumps into the storage-tank against air contained therein until the suitable pressure is obtained. A safety-valve is connected to the storage-tank to prevent an excess pressure therein.

From the foregoing it will be readily seen that I provide an exceedingly simple and effective wave-motor in which the power exerted on the pumps will be uniform and that there can be no sudden and excessive power exerted on the pumps or on any other part of the apparatus, any sudden and excessive lifting of the floats not affecting in any way the pumping apparatus except to put the float in position to operate the pumps by its descent. It will be further seen that the apparatus is such that it may be very strongly built and that the danger of disarrangement or breaking of the parts by storms or unusually large waves is practically eliminated.

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

1. In a wave-motor the combination, of a support, a main shaft mounted thereon, a gear loosely mounted on said main shaft, a clutch mechanism connected to said gear and adapted to rotate the shaft when said gear is moved in one direction only, a float-carrying bar, a rack on said float-carrying bar, a frame loosely mounted on the main shaft, guide-rolls mounted in the said frame and adapted to maintain the rack in mesh with the gear on the main shaft, a float secured to the lower end of the float-carrying bar, and a pumping apparatus connected to and operated by the main shaft.

2. In a wave-motor the combination, of a support, a main shaft mounted thereon, a gear loosely mounted on said shaft, a ratchet-wheel rigidly mounted on said shaft, a series of pawls carried by the gear and yieldingly pressed into engagement with the gear on the main shaft, a frame loosely mounted on the main shaft and carrying guide-rolls to maintain the rack in mesh with the gear on the main shaft, a float secured to the lower end of the float-carrying bar, and a pumping apparatus connected to and operated by the main shaft.

3. In a wave-motor the combination, of a support, a main shaft mounted thereon, a gear loosely mounted on said main shaft, a clutch mechanism connected to said gear and adapted to rotate the shaft when said gear is moved in one direction only, a float-carrying bar, a rack on said float-carrying bar, and a freely-swinging means mounted on the main shaft and adapted to maintain the rack in mesh with the gear on said shaft, links pivotally connected at their forward ends to the float and at their rear ends to a suitable rigid support to maintain said float horizontal, and a pumping apparatus connected to and operated by the main shaft.

4. In a wave-motor the combination, of a support, a main shaft mounted thereon, a gear loosely mounted on said main shaft, a clutch mechanism connected to said gear and adapted to rotate the shaft when said gear is moved in one direction only, a float-carrying bar, a rack on said float-carrying bar, a freely-swinging means mounted on the main shaft and adapted to maintain the rack in mesh with the gear on said shaft, a float pivotally connected to the lower end of the float-carrying bar, said float being convex on its upper and lower surfaces, links connected at their forward ends to the float and at their rear ends to a suitable rigid support to maintain said float horizontal in all its movements, and a pumping apparatus connected to and operated by the main shaft.

5. In a wave-motor the combination, of a support, a main shaft mounted thereon, a gear loosely mounted on said shaft, a ratchet-wheel rigidly mounted on said shaft, a series of pawls carried by the gear and yieldingly pressed into engagement with the ratchet on the main shaft, a frame loosely mounted on the main shaft and carrying guide-rolls to maintain the rack in mesh with the gear on the main shaft, a float secured to the lower end of the float-carrying bar, a pair of cranks connected to the main shaft, said cranks extending in opposite directions, and a pair of pumps operated by said cranks.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 16th day of April, 1903.

FERDINAND JOSEF HAGEN.

Witnesses:

EDWARD INGERLATH,

EDMUND A. KOLB.