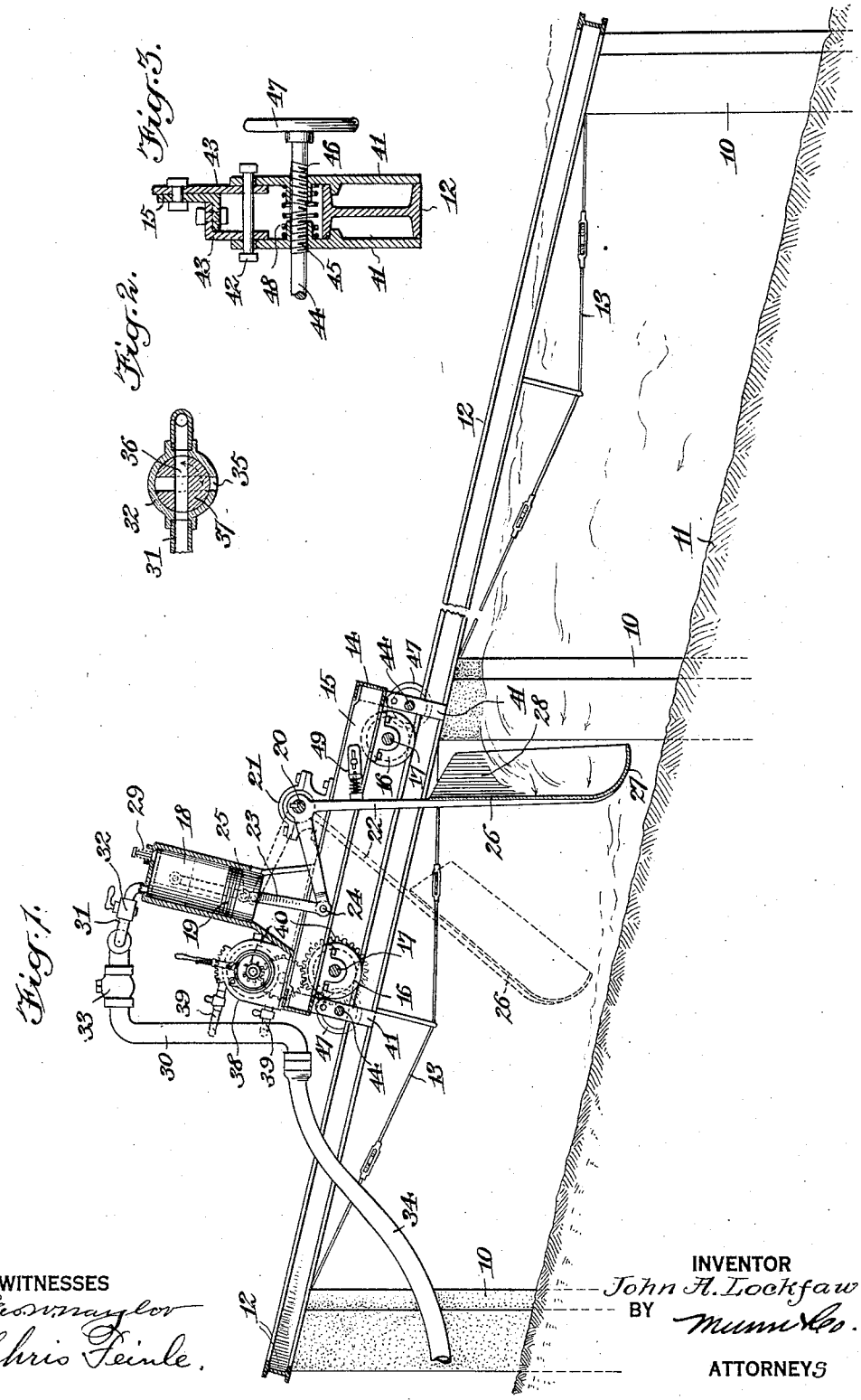
Nov. 8, 1932. J. A. LOCKFAW 1,887,316

WAVE MOTOR

Filed Aug. 20, 1931 2 Sheets-Sheet 1



WITNESSES
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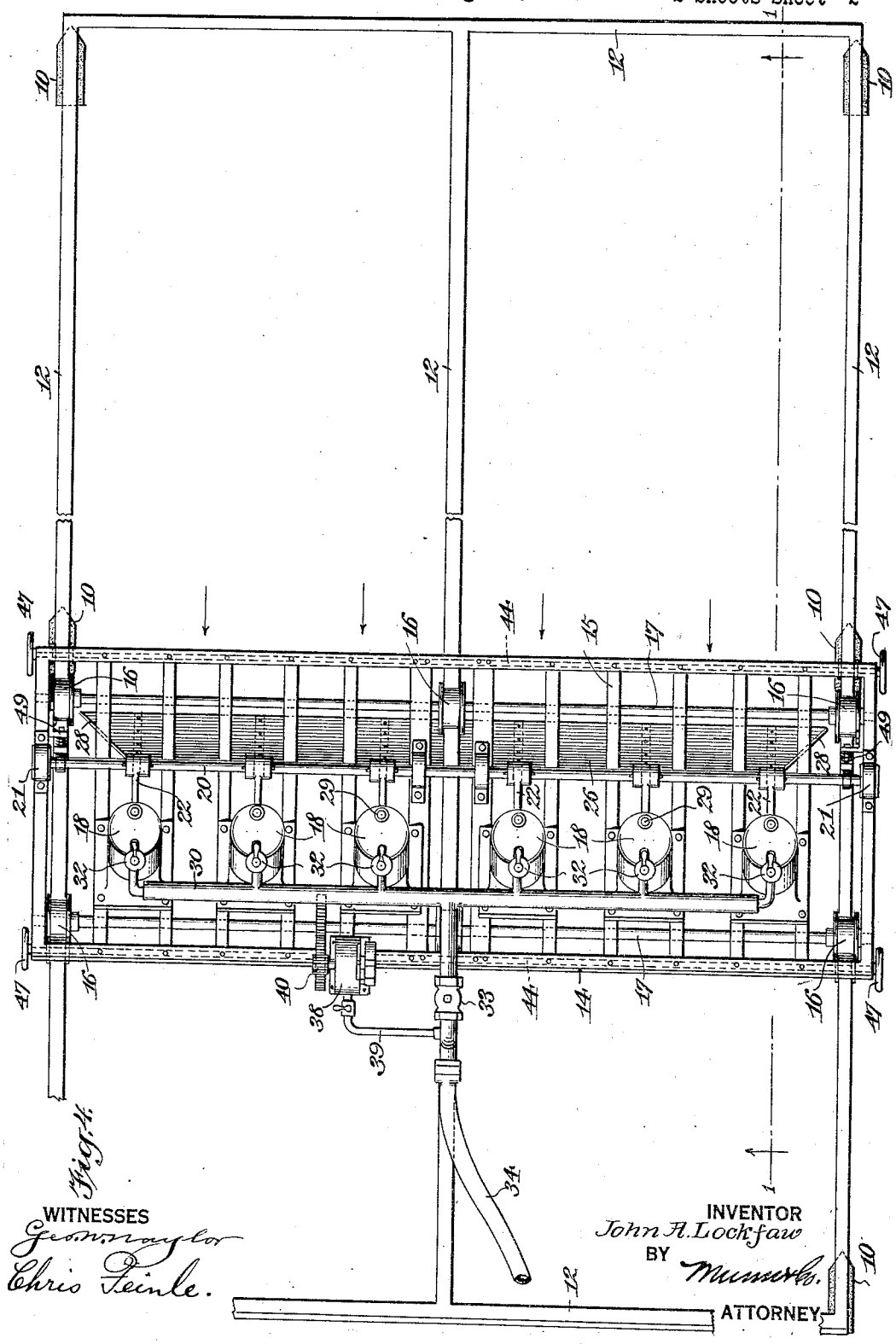


Fig. 1.

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UNITED STATES PATENT OFFICE

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WAVE MOTOR

Application filed August 20, 1931. Serial No. 558,397.

This invention relates to an apparatus in the class of wave-motors and which is designed and adapted to be operated by the energy derived from the surf, or the waves or swells which roll or break over a shore or sloping beach, for the purpose of producing or developing therefrom a power medium to be used for the performance of work of the kind where power is wanted.

The invention has for its general object the provision in an apparatus of the indicated character of improved construction in order to derive a maximum of power from the energy of the waves or swells of a sea or ocean.

Another object of the invention is to make provision in an apparatus of the indicated character to compensate for tidal changes.

A further object is to make provision in an apparatus of the indicated character to compensate for variation in the force and rapidity of waves and swells breaking over the beach.

With the foregoing and other objects in view, the invention resides in the provision, relative disposition and the operation of the parts constituting the apparatus hereinafter fully described and illustrated in the accompanying drawings, in which:—

Figure 1 is a sectional view of the apparatus embodying the features of the invention, the section being taken on the line 1—1 of Figure 4;

Figure 2 is an enlarged section of one of the three-way valves;

Figure 3 is an enlarged section of a brake shoe and clamp used for holding the car in adjusted position;

Figure 4 is a plan view.

Referring now more particularly to the drawings, it will be apparent that the apparatus includes an arrangement of pillars or concrete piles 10, which are anchored in the shore or sloping beach 11, over which the surf or waves and swells of the adjacent sea or ocean roll or break. Some of the pillars or piles 10 are positioned well out into the water in order that the apparatus will operate even at low tide. A frame constructed preferably of I-beams 12 is secured in place on the pillars 10 paralleling the slope of the beach 11, as shown most clearly in Figure 1. The I-beams 12 are effectively braced by bracing means 13 to add strength and rigidity. The pillars 10 and frame consisting of the beams 12 constitute the supporting structure or bridge which sustains all of the working parts of the apparatus to be hereinafter described.

The beams 12 which slope downwardly in parallelism to the slope of the beach 11, of which there are three in the present instance, serve as tracks. A car or carriage 14 travels on the track beams 12. The said car may be of any preferred construction and consists of a frame or chassis 15 and traction means consisting of rollers or wheels 16 mounted on axles or shafts 17 secured to the frame 15 on the under side thereof. There are three wheels 16 mounted on each axle 17. Each of the wheels 16 is flanged on both sides. The wheels 16 roll in contact with the upper flanges of the track beams 12, and the flanges on the wheels 16 prevent lateral displacement of the car 14.

A motor or power medium producing or developing means is arranged on the car 14. The said means is adapted to be operated by the motion and force of the waves or swells which break upon the beach 11. The said means includes a plurality of air pumps each consisting of a cylinder 18 and a piston 19 which operates in the cylinder 18. The cylinder 18 is secured in place on the frame 15 of the car 14. A rock shaft 20 is mounted in bearings 21 on the car frame 15. Crank arms 22 are keyed to the shaft 20, there being one crank arm for each piston 19. The crank arm 22 is connected with the related piston 19 by a pitman 23 pivotally connected, as at 24, with the crank arm and pivotally connected, as at 25, with the piston. An impact member or apron 26 is secured to the crank arms 22. The apron 26 is scoop-shaped, the lower edge thereof being curved forwardly, as at 27, and the opposite side edges being disposed or directed at an angle forwardly and laterally, as at 28. The apron 26 receives the force of the waves or swells breaking upon or rolling over the beach 11. It will therefore be apparent that the energy

or force of the waves or swells rolling or breaking over the beach will operate the pistons 19 through the intervention of the crank arms 22 and pitmen 23 to compress air which enters the cylinders 18 on the suction strokes of the pistons 19 as the water recedes. It is to be understood that the apron 26 under its own weight will return to a substantially vertically disposed position. Each pump cylinder 18 has an inlet check valve 29 by which air enters the cylinder on the suction stroke of the piston. An air line 30 is connected with the tops of the cylinders 18 by branches 31, each of which has connected therein a three-way valve 32. The air line 30 also has connected therein a check valve 33 to prevent back pressure within the cylinder 18. The air line 30 includes a flexible section 34 which, it is to be understood, leads to a suitably large storage tank or holder into which the air will be forced from the cylinders 18, and said air will be kept ready in the tank or holder as a power medium for the performance of different kinds of work. In the present instance, use is made of six pumps. When the waves or swells are strong all of the pumps will be operated, and when the waves become weaker one or more of the pumps may be cut out by operating its three-way valve in order to bleed the air to the atmosphere, the casing of the valve having a bleed hole 35 with which the passage 36 of the valve member 37 may register for that purpose. This provision is made because relatively weak waves may not be forceful enough to operate all of the pumps simultaneously. In accordance with another feature of the invention, and in order to compensate for changes in tidal conditions, the car 14 may be moved to different adjusted positions in relation to the supporting structure or bridge, so that the apparatus will operate when the tide is high or low. To this end there is provided an air motor 38 on the car which is operated by air taken from the air line 30 by a connection 39. Suitable driving means 40 interposes the shaft of the motor 38 and one of the axles 17 of the car. It will therefore be understood that the motor 38 may be started to move the carriage 14 to any desired position.

In order to hold the car 14 in the different adjusted positions, there are provided combination brake and clamp devices arranged on the car 14 and which co-operate respectively with the track beams 12. Each of the devices consists of brake shoes 41 loosely supported by a bolt 42 carried by attachments 43 on the car frame 15. A shaft 44 extends transversely of the car frame 15 at each end thereof through the shoes 41, and is provided with right-hand threads 45 and left-hand threads 46 in threading engagement with the shoes 41. The shaft 44 has a hand wheel 47 for rotating the same. It will therefore be understood that by manipulating the wheels 47 the brake shoes 41 may be brought into and out of clamping engagement with the track beams 12. In this manner the car 14 may be held in different adjusted positions.

If desired, a spring 48 may be employed in conjunction with each pair of brake shoes 41 to aid in separating them when it is desired to release the car for movement. It is to be understood that any other suitable means may be provided for holding the car 14 in different positions. The apron 26 may be cushioned on its return movement by shock absorbers or the like 49 on the car 14 to co-operate with the crank arms 22.

From the foregoing it will be apparent that the motion and energy of the waves or swells rolling over or breaking upon the beach will impose themselves on the apron 26, and through the intervention of the crank arms 22, pitmen 23 and the pistons 19 will deliver charges of air under pressure from the cylinders 18, through the air line 30 into a suitable storage tank or holder (not shown), where it may be kept ready for use. It will also be apparent that the moving parts of the apparatus arranged on the car 14 may be brought to the most advantageous positions to compensate for changes in tidal conditions, so that the apparatus will operate for a maximum period of time. It will also be apparent that one or more of the pumps may be readily put out of use according to the force and rapidity of the waves or swells.

I claim:

In a wave motor, a stationary supporting structure positioned on a beach and which inclines downwardly toward the body of water whose waves roll in on the beach, a car which travels on said structure in the direction of the inclination thereof, air pressure developing means on said car which is operated by the motion and force of the waves, driven means including an air motor on said car connected with and operated by said air pressure developing means to move the car into different positions in relation to said structure so as to change the position of the air pressure developing means in relation to the body of water, and means to hold the car in the different positions.

JOHN A. LOCKFAW.