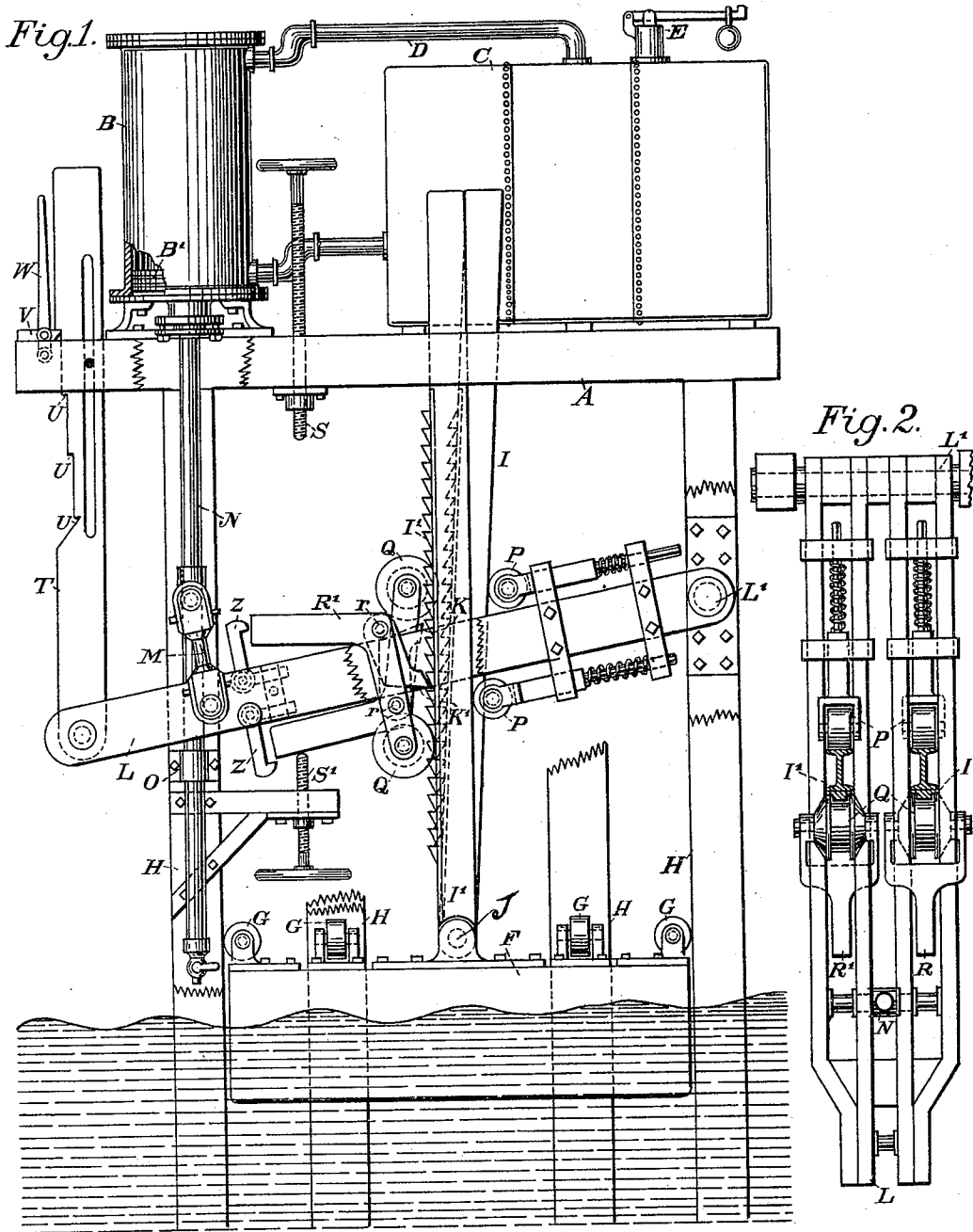


(No Model.)

H. SCHOMBERG.
WAVE AND SWELL MOTOR.

No. 587,511.

Patented Aug. 3, 1897.



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UNITED STATES PATENT OFFICE.

HENRY SCHOMBERG, OF LOS GATOS, CALIFORNIA.

WAVE AND SWELL MOTOR.

SPECIFICATION forming part of Letters Patent No. 587,511, dated August 3, 1897.

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To all whom it may concern:

Be it known that I, HENRY SCHOMBERG, a citizen of the United States, residing at Los Gatos, county of Santa Clara, State of California, have invented an Improvement in Wave and Swell Motors; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to an apparatus which is especially designed to utilize the rising-and-falling movement of the water of the ocean, either in the form of waves or a regular rising-and-falling swell.

It consists of vertically-guided floats capable of a rising-and-falling motion and a mechanism connected therewith whereby the rise and fall of the floats will operate to store the power thus developed for further use.

It also consists in details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a side elevation of my apparatus and partial section of the operating-lever. Fig. 2 is a plan with transverse section of the rack-bars.

The object of my invention is to provide a mechanism whereby the rise and fall of a suitable float produced by the action of the swell or waves is applied so as to compress air or lift water into a tank which forms a storage and regulator, from which the air or water may be applied to drive an engine or any desired machinery at a regular rate of speed. The power is so applied that the least rise and fall observable in the locality where the apparatus is placed will produce a sufficient stroke in the pump to operate it properly, and in conjunction with this I have shown disengaging mechanism operating automatically, so that with an excessive rise and fall the mechanism will be so operated that no more than a full stroke of the pump will be produced and the intermediate mechanism will be protected from injury which would otherwise be caused by the excessive motion.

In carrying out my invention any suitable structure may be employed which projects over the sea, where the apparatus is to be located. This structure may preferably be a wharf, as shown at A, supported upon vertical piles and capable of carrying the pump-

ing-cylinder B, which is preferably located upon the wharf, a receiving compressing-tank C, into which air is pumped through a pipe D.

The tank may also be provided with a suitable safety-valve E, and may also have gages to show the pressure developed therein. Beneath the wharf is located a float F, which may be made in any suitable or desired form. This float has guiding-rollers G upon its sides or angles, and these rollers are adapted to follow the vertical timbers H, which thus insure the vertical movement of the float and prevent its being swept out of position by the forward or backward movement of the waves. To this float are fulcrumed the vertical rack-bars I I, turnable about the pivot-pins J, so that the upper ends of the rack-bars are free to swing backward and forward about the pivot-pins. Upon the front edges of these bars are the rack-teeth I', as shown, and the teeth of one rack-bar present their engaging edges upwardly, while the other one presents its teeth downwardly, so that one may operate upon the pawl mechanism when rising and the other when falling.

The pawls K K' are fixed to a lever L and operated as will be hereinafter described. This lever L is fulcrumed, as shown at L', to a suitable stationary support, which may be one or more of the piles supporting the wharf, if convenient. The opposite movable end of the lever is connected by a link or connecting-rod M with a piston-rod N, slidable in suitable guides, as at O, and extending up into the cylinder B, where it carries the piston or plunger B' upon its upper end. The movement of the lever L about its fulcrum acts to reciprocate the piston within the cylinder, and by any suitable arrangement of valves air or liquid may be pumped by the action of the piston in the cylinder. In order to actuate this lever, the pawls K K' are made to engage alternately with the teeth I' of the rack-bars, so that when the float is rising one of the rack-bars will engage with its pawl, and when the float is falling the other one will correspondingly engage, so that each reciprocation of the float will act to move the lever L, upon which the pawls are fixed, as shown.

The length of the lever L and the relative distance of the rack-bars and the piston

from the fulcrum are such that the smallest movements of the float will be multiplied by the leverage, so that a sufficient movement of the piston will be given at all times to make it operative.

If the movement of the waves or swell is too great, the teeth of the rack-bars are disengaged from the pawls when they arrive at a certain point, as follows: The pawls are permanently fixed to the lever, and the rack-bars are pressed against the pawls by spring-actuated rollers P, which normally press against the rear edges of the rack-bars, but which will yield so as to allow the rack-bars to move backward and allow the teeth I' to pass over the points of the pawls as the rack-bars reciprocate. Upon each side of the rack-teeth is a smooth surface formed on each rack-bar, and against these smooth surfaces the rollers Q are adapted to travel. These rollers are journaled in the ends of bell-crank levers R R', these levers being fulcrumed, as shown at r, so that they may be moved about their fulcrum-points. At suitable distances apart are the stops S S', which in the present case are shown in the form of adjustable screws passing through nuts, one below the floor A of the wharf or at other suitable point above the lever and the other suitably supported at such a distance below the lever L that when the screws S S' are properly adjusted they will allow the lever to reciprocate, so as to move the piston B' only the full length of its stroke within the cylinder.

If the action of the swell is sufficient to move the lever a greater distance than is necessary, the upward movement of the lever will cause the arm of the bell-crank lever R to strike the end of the screw or stop S, and this will turn the lever about its fulcrum, so that the roller Q', journaled upon it, will force the rack-bar I backward, compressing the springs of the bearing-rollers P until the teeth of the rack-bar are entirely clear of the pawl, and this then allows the float and the rack-bar to rise freely as high as the wave will carry it without any further action upon the lever L and its connected parts. When the float sinks, if it passes below a point which will complete the downward stroke of the piston, the other bell-crank lever R' will strike the lower screw or stop S' and in like manner will force its rollers Q to press the descending rack-bar back, so as to disengage it from its pawl and thus check the further downward movement of the lever. In this manner the movement of the lever is always automatically maintained within the proper limit of the stroke of the piston.

As the rack-bars I are made of such length as to accommodate any rise and fall of the tide, it will be seen that whenever such rise or fall occurs the bell-crank levers R R' will be in the same manner actuated by the stops S S' and disengage the rack-teeth from the pawls, thus allowing the rack-bars to move up or down as much as the rise or fall of the tide

required, while maintaining them in such position with relation to the pawls that any rise and fall of the waves or swell will still continue to actuate them.

If it is desired to reduce the stroke of the piston, it is done by means of a regulating-bar T, which is connected with the end of the lever L. This regulating-bar has teeth or notches U made at intervals along its edge, and these notches may be engaged by a movable pawl V, which in the present case is shown as actuated by a lever W. Now if the stroke is to be shortened this bar T is raised and the pawl caused to engage with either of the notches U, and this will correspondingly raise the outer end of the lever, and the bell-crank lever R will strike the upper stop S sooner and thus disengage the rack-bar and allow it to continue its movement without acting upon the lever, and the lower stop S' can be correspondingly adjusted for the down-stroke.

It will be manifest that although I have described the apparatus as applied to the pumping of air it may also be made to pump water to an elevation from which it can afterward be used; but in the present case the air being condensed to any desired amount in the receiver C can afterward be employed to propel an engine or other machinery.

Whenever it is found necessary or desirable to entirely stop the movement of the lever and its connected parts, it may be done by means of dogs or catches Z, which may be hooked over the outer ends of the bell-crank levers R, so that the rollers Q are kept in continuous contact with the rack-bars, and the latter are thus kept out of contact with the pawls. This allows the float and rack-bars to rise and fall without acting upon the lever L and its connected mechanism.

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

1. The combination with a vertically-guided rising-and-falling float, of rack-bars having their lower ends pivoted to the float so as to be movable about the pivot-points, a lever fulcrumed transversely having pawls fixed thereto so as to engage the teeth of the rack-bars alternately, spring-actuated rollers pressing against the backs of the rack-bars to hold the teeth normally in contact with the pawls but yielding to allow them to pass over the teeth as the rack-bars reciprocate, and means for automatically forcing the rack-bars out of engagement with the pawl-teeth.

2. The combination with a guided rising-and-falling float, of toothed rack-bars pivoted to the float so that the upper ends have a movement about the pivot-pins, a lever fulcrumed and extending transversely across the line of travel of the rack-bars, spring-actuated rollers carried by said lever normally pressing the toothed edges of the rack-bars forward, pawls fixed upon the lever adapted to engage the teeth of the rack-bars, bell-cranked levers

fulcrumed upon the transverse lever, stops fixed at points above and below so as to engage one arm of each of the bell-crank levers alternately as the main lever reaches the end of its stroke in either direction, rollers carried by the opposite ends of the bell-crank levers and pressing against the rack-bars so as to force them out of contact with the pawls and allow the rack-bars to continue without further action upon the main lever.

3. The combination with a guided rising-and-falling float of rack-bars pivoted thereto having teeth upon one edge adapted to alternately engage pawls as the float rises and falls, a transverse lever fulcrumed at one end extending across the line of travel of the rack-bars and having said pawls fixed thereto so that the teeth of the rack-bars move over the pawls as the float rises and falls, spring-actuated rollers mounted upon the rear part of the lever pressing against the backs of the rack-bars so as to maintain them in yielding contact with the pawls, bell-crank levers having rollers mounted at one end and traveling upon smooth surfaces of the rack-bars at each side of the teeth, adjustable screws or stops fixed at the opposite end of the travel of the main lever with which the bell-crank levers contact when the end of the stroke is reached whereby the rack-bars are forced out of engagement with the pawls and allowed to continue their movement without further action upon the lever, and a cylinder, the piston-rod of which is connected with the reciprocating lever to act as described.

4. The combination with a vertically-guided rising-and-falling float, of rack-bars having the lower ends pivoted thereto, a transverse lever with fixed pawls adapted to engage the teeth of the rack-bars so that the lever is alternately raised and lowered with the alter-

nate movements of the rack-bars, spring-actuated rollers pressing upon the backs of the rack-bars to keep the teeth yieldingly engaged with the pawls, bell-crank levers carrying rollers which travel against smooth surfaces of the rack-bars, the opposite ends of the said levers adapted to engage adjustable stops whereby the rollers are pressed against the rack-bars so as to force them temporarily out of engagement with the pawls to allow them to continue their movement without further action upon the lever and holding dogs or devices adapted to engage the arms of the bell-crank levers whereby the rollers press continuously upon the rack-bars so as to keep them permanently out of contact with the pawls and stop the movement of the lever.

5. The combination with a vertically-guided rising-and-falling float, of pivoted swinging rack-bars attached thereto, a transverse lever, with pawls fixed thereon adapted to engage the teeth of the rack-bars as they rise and fall, spring-actuated rollers by which the teeth of the rack-bars are kept in yielding contact with the pawls, disengaging devices carried upon the lever whereby the racks are disengaged from the pawls at the limit of the stroke of the lever in each direction, and a device for shortening the stroke of the lever consisting of an arm T connected with the movable end of the lever and slidable vertically and a pawl V adapted to engage said arm and hold it so that the movement of the lever may be limited.

In witness whereof I have hereunto set my hand.

HENRY SCHOMBERG.

Witnesses:

S. H. NOURSE,
JESSIE C. BRODIE.