G. CONSTANTINESCO.

PUMP.

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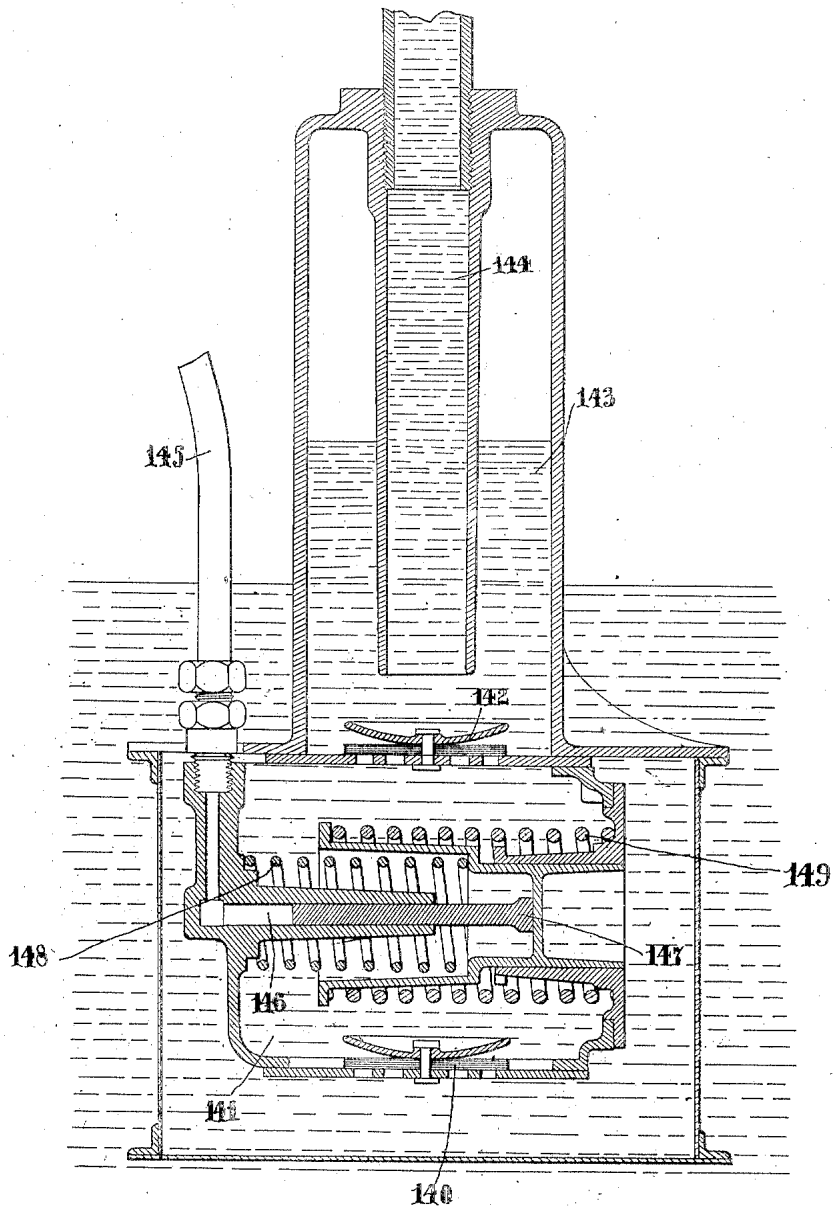
1,372,943. Patented Mar. 29, 1921.



INVENTOR

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GOGU CONSTANTINESCO, OF WEYBRIDGE, ENGLAND, ASSIGNOR OF ONE-HALF TO WALTER HADDON, OF LONDON, ENGLAND.

PUMP.

1,372,943. Specification of Letters Patent. Patented Mar. 29, 1921.

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To all whom it may concern:

Be it known that I, GOGU CONSTANTINESCO, a subject of the King of Great Britain and Ireland, residing at "Carmen Sylva," Beechwood avenue, Oatlands Park, Weybridge, in the county of Surrey, England, formerly of the Haddon Engineering Works, Honeypot Lane, Alperton, in the county of Middlesex, England, have invented certain new and useful Improvements in Pumps, of which the following is a specification.

The present invention relates to pumps and particularly pumps adapted to be driven by liquid wave transmission systems of the type described in British Letters Patent No. 9029 of 1913 and No. 12438 of 1914.

In U. S. A. application Serial No. 164909, from which this case is a division, there are described percussive tools so arranged that the maximum blow for a given expenditure of energy can be obtained. The conditions necessary for this in a reciprocating implement of the type described are that the natural time period of the reciprocating part which is supported in a mean position by springs should be equal to the time period of the oscillations of the liquid in the transmission line by which the tool is operated. Further, in order to produce a maximum blow by means of the percussive tool it is necessary that the reciprocating part of the tool should strike the obstacle at the position at which this reciprocating part would if at rest be in equilibrium under the action of the springs and the mean pressure of the transmission line supposed to act statically. In the case of a pump the maximum effect will be produced when the mean position of the piston under the action of the springs and the mean pressure in the wave transmission line is half way along the total travel of the piston when the tool is being operated.

The present invention consists in a pump, blower, or the like, comprising a reciprocating piston held in a mean position by means of springs and actuated by alternating liquid currents in a wave transmission line, the pump being so constructed that its piston is in equilibrium under the action of the supporting spring and the mean pressure in the wave transmission line when at the middle point of its stroke.

In the specification No. 12438 of 1914 there are described a number of forms of condensers and resonators consisting of masses held in a mean position by springs and actuated by two wave transmission lines and in the British specification No. 4350 of 1915 reciprocating implements are described which are operated by a single wave transmission line.

The simplest method of obtaining reciprocating motion in this manner is to allow the piston to act against the spring or a capacity comprising a volume of water or other liquid in order to obtain the required stroke.

In this simple method, however, and unless special conditions as regards the strength of the springs and the mass of the reciprocating part are observed, only a portion of the available power can be obtained in work done by the tool, and the working may in certain cases be unsatisfactory owing to the reflection of the waves from an elastic obstacle.

One condition necessary for obtaining the maximum blow from a reciprocating implement is that the natural time period of the reciprocating part, that is to say, in the case of the hammer, of the piston and hammer supported in a mean position by springs should be equal to the time period of the oscillations of the liquid in the transmission line operating the tool.

We have found further that in order to produce the maximum blow by means of a percussive tool, the reciprocating part of the tool should strike the obstacle at the position in which the reciprocating part would if at rest be in equilibrium under the action of its springs and the mean pressure in the transmission line supposed to act statically.

With a percussive tool arranged in this manner the maximum blow for a given expenditure of power in the line is obtained, but on the other hand there also occurs, owing to the sudden arrest of the reciprocating piston, a considerable deformation of the current in the transmission line unless this is considerably greater than the current actually required to operate the tool.

If a single spring is used this condition is obtained when the blow is struck at the position to which the spring is compressed under the mean pressure in the transmission line. It is desirable that the springs should work

only under compression and it is therefore generally necessary to employ two springs, one on each side of the piston.

If we suppose that the mean pressure in the main transmission line is H and Ω the section of the piston, the spring opposing the mean pressure should be of such strength that when the deformation is equal to the full stroke of the hammer the force exerted by the spring will be equal to F′ where $F'=H\Omega$. On the return stroke of the piston the back spring would be fully compressed and the front spring completely released.

When the mean pressure in the line is determined, and the stroke required this relation at once gives the strength of the front spring required for any given section of the piston. The strength of the back spring is given by the condition that there should be resonance between the natural time period of the reciprocating parts and the time period in the transmission line. If the period is about 1,000 per minute the maximum effect will be given when the back spring fully compressed exerts a force F_2 given by $F_2=0.57\ F_1$.

In calculating springs the weight of the reciprocating parts including half the weights of the springs must be such that the natural time period of free oscillation of the system formed by these parts shall be equal to the periodicity in the line.

When these proportions are observed the greatest quantity of liquid will be dealt with by the pump with a minimum of absorption of current from the wave transmission line.

The accompanying drawing is a vertical section of a pump constructed in accordance with the invention.

In the pump illustrated the water is pumped through the inlet valve 140 into the pump chamber 141 and passes out through the delivery valve 142 to the vessel 143 containing air inclosed in its upper end. The delivery pipe 144 passes centrally down in the vessel 143. The wave transmission line 145 is connected to the cylinder 146 in which works the pump piston 147, the pumping portion of the piston being of considerably greater diameter than the diameter of the cylinder 146. The piston 147 is held in a mean position by springs 148, 149, and these springs are so arranged that the reciprocating parts, including the piston, the water contained therein, and half the mass of the springs, are in resonance under the action of their springs with the periodicity in the wave transmission line.

Further, the springs are so arranged that with the piston in its mean position there is a balance between the spring 149 acting on one side of the piston and the spring 148 acting on the other side, together with the mean pressure in the wave transmission line.

Under these conditions the maximum effect will be obtained.

It should be noted that in calculating the period of the resonator the weight of the water in the pump piston must be included.

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

A pump adapted to be driven by a series of periodic variations of pressure and volume traveling along a liquid column, comprising in combination a cylinder open at its ends, a piston adapted to reciprocate in said cylinder, springs acting in opposite directions on said piston, a plunger adapted to actuate said piston, said plunger being subjected to the changes of pressure and volume of said liquid column and being in equilibrium in its mean position under the action of said springs and the mean pressure in said liquid column.

In testimony whereof I have signed my name to this specification.

GOGU CONSTANTINESCO.