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(71) Applicant: **Cefis, Giovanni**
Via Dante Alighieri, 1
Città di Castello (Perugia) 06012(IT)

(72) Inventor: **Cefis, Giovanni**
Via Dante Alighieri, 1
Città di Castello (Perugia) 06012(IT)

(74) Representative: **Mascioli, Alessandro, Prof.Dr.**
c/o A.N.D.I. Associazione Nazionale degli Inventori Via Lima, 35
I-00198 Roma(IT)

(54) **Liquid pump.**

(57) Pumping of a liquid by the creation and maintenance of an oscillatory motion of that liquid in the tubing (T) connecting the original location of the liquid with point (L) to which it must be transferred.

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Liquid pump

This invention concerns a pump for liquids constructed so as to achieve an oscillating system in which the mass consists of the mass of liquid itself.

Currently, volumetric (that is, piston, membrane, case-work pumps) and fluidodynamic (that is, centrifuge, axial pumps) are known to be capable of supplying the broadest range of lift and delivery. However all of these pumps have in common the following problem: the pressure at the inlet may not be lower than the vapor pressure of the liquid in question (Torricelli's principle).

Clearly this limitation places constraints on the position of the pump with respect to the liquid: indeed, as is well known, in the case of water the pump may never be placed at a theoretical height greater than 10.33m above the free surface. In practice, the actual limitation is much lower.

In order to achieve lift above this height limit, suction pumps may not be used. Rather, only sucking and forcing pumps or pressure pumps may be employed placed

near the water or even submersed in it. Thus the difficulties of installation and maintenance as well as the inconveniences encountered with these pumps in the presence of deep wells are clear, with the difficult availability of large size non-electric motors which may not be arranged at will.

The above limitations and consequent functional problems are completely overcome with the pump covered by this industrial invention patent. This patent is based on the creation and maintenance of an oscillatory motion of the liquid in the tubing connecting the original location of the liquid with the point to which it must be transferred. During the various phases of the oscillation the pressure of the liquid in the various points of the tubing varies cyclically, passing alternately from higher to lower pressures than the liquid would have in absence of the oscillations. By designing the oscillating system with suitably rigid elastic organs, so as to achieve oscillations of suitable frequency and amplitude, a pressure cycle is achieved with an amplitude such that the minimum pressure achieved periodically at the starting point of the tubing is lower than that of the liquid to be pumped. However, the maximum pressure achieved at the end point of the tubing is higher than that of the surroundings.

Therefore, by opening and closing certain valves placed between the tubing and the starting and arrival points in correspondence with the phases of the pressure cycle described above, liquid enters the tubing at one end and exits at the other. Obviously, this transfer of liquid through the tubing occurs through the energy of the oscillation. This oscillation in turn must be continually fed through the administration of work by an external energy source, of any tipe.

An exemplifying but non-limiting variant of the invention is represented in the enclosed drawing of its lateral section.

In particular, the drawing shows tube T of the pump equipped at its upper end with the liquid exit port L, placed at the height H above the free surface of the water, and with hydraulic piston A operated manually by lever P or by some other mechanical and/or motor arrangement able to supply energy for the operation. The piston's seal is guaranteed by the presence of gasket G, and its course is such that at the maximum dead point it disengages from gasket G so as to freely connect tube T and port L. At the other points on its course, it is inserted in gasket G so as to separate

port L from tube T and to push on the liquid. At its lower end immersed in the liquid, tube T is equipped with the crop end of elastic tube B (rubber, caoutchouc or the like) and with unidirectional valve V to allow water to enter but not leave the tube.

Clearly, the crop end of elastic tube B may be replaced by other suitable elastic organs, such as spring connected pistons, air chambers, membranes, etc. Moreover, exit port L, gasket G and valve V may be made differently, and the liquid itself may be other than water.

The invention functions as follows: water tube T is filled up to the level of piston A and the water is placed in oscillation throgh the alternating motion of piston A.

As already mentioned, the oscillating elastic system consists of the mass of water in the tube and elastic organ B.

When the amplitude of oscillation exceeds a certain threshold, the depression created at the bottom of the tube at the maximum dead point of the oscillation is suffucient each time to draw a certain quantity of

water into the tube through valve V. When the height of the water in the tube is such that the upper level of the water at the maximum dead point of the oscillation is above gasket G (piston uncovering), a certain quanti ty of water passes gasket G to arrive at the overflow of port L. In this way, water enters the tubing at valve V and exits from port L at height H at the expense of the energy supplied by the oscillating motion of piston A operated by lever P.

This is not limited to any particular value of H.

Of course, while the principle of this invention remains intact, the form of its realization and the particulars of construction may be varied widely with respect to that described and illustrated here, without going beyond the bounds of the invention.

Claims:

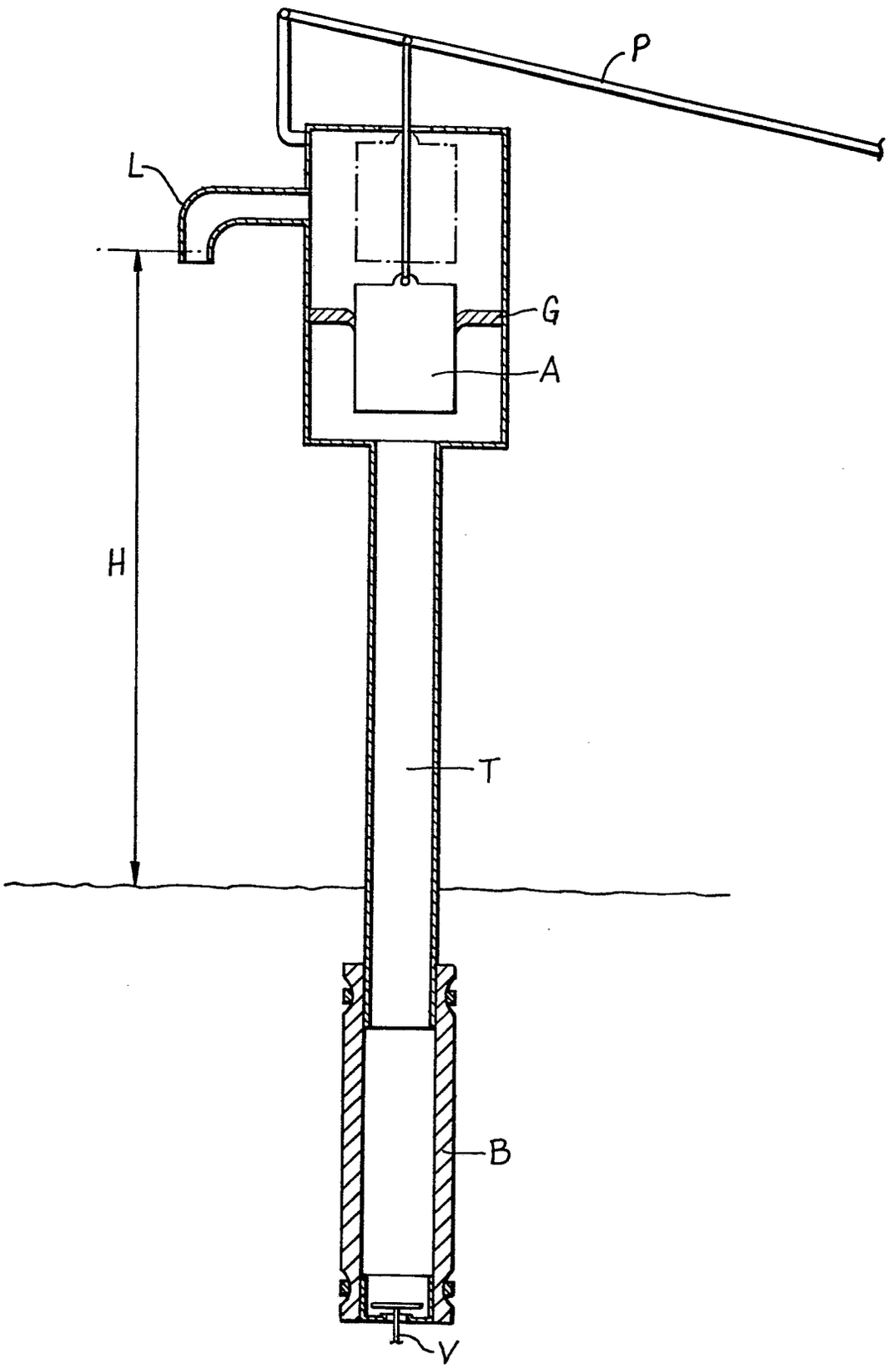
1. Liquid pump characterized by the creation and maintenance of an oscillatory motion of the liquid in the tubing connecting the original location of the liquid with the point to which it must be transferred, where the mass of oscillating system consists of the mass of liquid itself, such that during the various phases of oscillation, the pressure of liquid in the various points of the tubing varies cyclically, passing alternately from higher to lower pressures than the liquid would have in the absence of the oscillations; in this way, the minimum pressure achieved periodically at the starting point of the tubing is lower than that of the liquid to be pumped, while the maximum pressure achieved at the end point of the tubing is higher than that of the surroundings; therefore, by opening and closing certain valves placed between the tubing and the starting and arrival points in correspondence with the phases of the pressure cycle described above, liquid enters the tubing at one end and exits at the other; this transfer of liquid through the tubing occurs at the expense of the energy of oscillation through the application of work by an external energy source, of any tipe.

2. Liquid pump according to claim 1, characterized by

a tube equipped at its upper end with a piston operated manually by a lever or through any other mechanical and/or motor arrangement wich can supply energy for the operation; this tube is also equipped with a liquid exit port placed at any height above the free surface of the water, with a tube of elastic material immersed in the water at its lower end, and with a unidirectional valve to allow water to enter but not leave the tube.

3. Liquid pump according to claim 1 characterized by the presence of elastic organs like spring connected pistons, air chambers, membranes and the like.

4. Liquid pump according to claims 1, 2 and 3 and according to the example described in the text and illustrated in the enclosed drawing.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EUROPEAN SEARCH REPORT

Application number
EP 81 83 0165

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	GB - A - 2 033 000 (SELWOOD) * page 4, lines 10-34; figure * --	1,2,3
X	DE - C - 673 252 (PROSPER) * page 2, lines 20-69; figures 1 and 2 * --	1,2,3
X	FR - A - 435 032 (DUQUENNE) * page 2, lines 19-61; figures 1 and 3 * --	1,2,3
X	GB - A - 443 565 (GILKES) * page 2, lines 53-87; figures 1-3 * ----------	1,2,3

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

F 04 F 7/00

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

F 04 F

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29-10-1981	HEINLEIN