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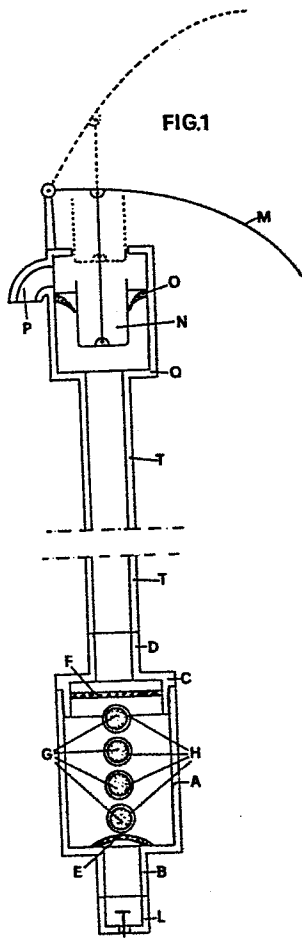
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54 **Liquid pump.**

57 Liquid pump provided with an elastic organ consisting of one of more blocks of elastic material with an alveolar structure and of a hydraulic plunger.

FIG.1



Liquid pump

The invention concerns a preferably hand operated liquid pump.

- Known liquid pumps function based on the creation and preservation of an oscillating motion in the liquid in the tubing connecting the initial location of the liquid with the point where said liquid must be transferred.
- 10 These pumps provide for an elastic organ consisting of pieces of tubing of traditional elastic material, rubber and india rubber, or of spring powered pistons, or of compressed air capsules.
- 15 However, each of these solutions has disadvantages and limitations. The elastic material tubing limits the high pressure levels, and so the capacity and maximum lift possible at levels compatible with the mechanical resistance of the elastic materials
- 20 used. The spring powered pistons can operate for limited periods only due to the wear and tear on the piston gaskets, and the compressed air capsules require frequent maintenance to renew the air pressure.

- 2 -

Currently some of these pumps provide on the top for the presence of a piston of various types and of lights whose opening and closing are effected directly or indirectly by the movement of the piston itself.

All of the above cited limitations and negative effects are completely overcome in the pump according to the invention, characterized by the presence of an elastic organ consisting of one or more blocks of elastic material with an alveolar structure and of a hydraulic plunger, with large size double lipped gaskets which can be used twice since they can be turned over once one part has been worn where said plunger is in turn moveable on re-usable rotating sliding guides and on one or more re-usable rings for guiding and centering. Said plunger is in turn operated by means of a connecting rod guided by a re-usable centering bushing.

The invention is shown in a preferred exemplifying and non-limiting embodiment in the attached drawings, in figures 1, 2, 3, 4, 5, 6.

Figure 1 shows a lateral cross section of a manually operated pump with an elastic organ consisting of several balls.

Figures 2, 3, and 4 show cross sections of some

variants of the elastic organ.

Figure 5 shows the section of the hydraulic plunger in detail.

5

Figure 6 shows the design for the bushing with a rectangular guide and centering opening.

In detail, the figures show container A equipped
10 with threaded top C, respectively provided with connection tubings B and D; on the inside of container A there are four balls G of alveolar elastic material, such polyethylene with a cellular structure, or neoprene with a cellular structure or
15 the like, preferably but not necessarily enclosed in elastic protective casings H; the small bars or the like, E and F, prevent the spheres from obstructing tubings B and D, a check valve L being applied to tubing B and tubing T being applied to
20 tubing D to connect to the body of the pump Q, equipped with large size double-lipped gasket O, with hydraulic plunger N at the outlet P with one or more small washing openings X in its bottom, the manual operation lever M, the pans R to position
25 and hold the rimmed gasket gasket O, the three, four or more circular or polygonal cylindrical guides S rotating to allow any adjustment, to prevent wear and tear, around the bolts U with threaded ends protruding from the body of the pump where

the tightening nuts V are screwed on, the two or more guiding and centering rings Z coaxial with plunger N and supported by guides S, rotating around the plunger to allow any adjustment to prevent wear and tear, and the bushing with guiding and centering rectangular opening W of the connecting rod Y, where the bushing is symmetrical and so may be fixed in various positions so as to expose parts not yet worn to the sliding action.

10

The invention functions as follows: when container A is immersed in the liquid to be pumped and when the body of the pump Q, tubing T and container A are all filled with liquid, operation of the hydraulic plunger N by means of lever M sends pressurized liquid through tubing T into container A; this liquid under pressure compresses the balls G which, thanks to being made of elastic material with an alveolar structure, that is with internal cavities, can be distorted to effect an overall reduction in volume and the accumulation of elastic potential energy, where the variation in volume of the balls is related to the pressure of the liquid, to the elastic properties of the basic material used in construction, to the ratio between the empty and filled spaces in the alveolar structure and to the initial volume of said balls.

25

Once the compression phase is complete, the plunger

is raised to release gasket O, the compressed balls expand to expel a volume of water from the container equal to that put in previously, and that is equal to the variation in volume of the compressed balls, and sends said volume in tubing T with a kinetic energy equal to the elastic energy imparted to the balls in the compression phase.

The liquid running through the tubing T continues its motion for a time, aspirating a certain quantity of liquid from the check valve L and expelling an equal quantity of liquid from the opening P, through the opening left above the gasket O of the hydraulic plunger N once it is raised.

When the kinetic energy of the liquid is exhausted and the pumping effect is finished, another liquid compression, expansion and pumping cycle is repeated, and so on; the small amount of liquid which flows through the small washing openings X is negligible in terms of the pump's operation and serves to maintain a certain turbulence inside the cavity of the plunger, preventing the deposit of any sand or other impurities present in the liquid.

In a variation due to shape and size considerations, the mass of elastic alveolar material may be concentrated in a different number of balls rather than 4, for instance in one ball only as in fig.

2, or in balls shaped differently (lengthened or non-spherical) as in fig . 3, or shaped as hollow cylinders with the container folded as in fig. 4, identical in function, or in several bodies of
5 any shape.

The blocks of elastic material with an alveolar structure may be enclosed in coverings of non-alveolar elastic material, of the same chemical
10 nature or not, both to protect the principle elastic material from any chemical attack of the liquid and to prevent the danger that over time the liquid penetrate in the cavities of the elastic mass, thus lowering its capacity to change volume.

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It is evident furthermore that the wear and tear of the plunger N and the lip of gasket O takes away from the flexibility and usable length of the large lip of the gasket O; when the lip becomes
20 too worn the gasket O may be mounted in such a way as to operate on the other not yet worn lip. When it becomes excessive, wear and tear of the three, four or more guides S may be obviated by rotating them to another position around the pins U of said
25 guides, so that a new, unconsumed part is presented to the plunger; This rotation may be effected several times before the guides S need to be replaced, and is performed by loosening the nuts V which, once the guides are rotated, are then tightened to

hold the guides in the new position, by means of a small elastic deformation in the body of the pump Q.

- 5 It is also evident that the wear and tear of the plunger and the guides is kept to a minimum by the presence of one or more guiding and centering rings Z coaxial with the piston with the function of always keeping the piston oriented in the axial direction and of a fissured guide and centering bushing W with the function of laterally guiding the connecting rod to prevent any lateral oscillation being transferred to the piston and disturbing its good axial orientation; when rings Z show too much wear and tear in the most worked points, they are rotated to another position.

Since the rings are held in position by the guides 5, they are rotated by loosening and then re-tightening them as necessary.

When the bushing W shows too much wear and tear, this is obviated by mounting it in another position so as to expose different still unworn surfaces to the sliding.

A marked advantage of the invention is the fact that the overall elastic property may be obtained exactly as desired by selecting the initial volume of the

balls, their number, the ratio between hollow and filled spaces, and a more or less elastic base material.

- 5 Other advantages are the lack of points in relative motion and the fact that the balls cannot be damaged by high liquid pressures; in fact, once the excessive pressure has crushed the hollow spaces, the balls are in effect made of compact, non-de-
- 10 formable material which can bear any pressure hydrostatically. In this way, the machine has a long life with minimum need for replacement parts since the wearable parts are re-usable several times.
- 15 Moreover, the elastic organ may be constructed with a minimum transverse bulk, at the least no greater than that of the tubing, allowing several elastic organs and so several independent pumps even in wells of small diameter.
- 20
- Of course, while the principle of the invention remains the same, the forms of realization and the particulars of construction may be widely varied from that described and illustrated, without going
- 25 beyond the bounds of the invention.

Claims:

1. Liquid pump equipped with an elastic organ consisting of a container with several balls inside
5 made of alveolar elastic material like cellular structure polyurethane or neoprene, or the like, enclosed in elastic, non-alveolar coverings for protection, and with a hydraulic plunger.
- 10 2. Liquid pump as claimed in claim 1 characterized by the elastic organ consisting of container A equipped with threaded top C, respectively provided with connection tubings B and D; on the inside of container A there are several balls G of alveolar
15 elastic material; the small bars of the like, E and F, prevent the spheres from obstructing tubings B and D, a check valve L being applied to tubing B and tubing T being applied to tubing D to connect to the body of the pump Q, equipped with
20 gasket O, with outlet P, hydraulic plunger N, and the manual operation lever M; container A is immersed in the liquid to be pumped and when the body of the pump Q, tubing T and container A are all filled with liquid, operation of the hydraulic plunger N
25 by means of lever M sends pressurized liquid through tubing T into container A; this liquid under pressure compresses the balls G which, thanks to being made of elastic material with an alveolar structure, that is with internal cavities, can be dis-

torted to effect an overall reduction in volume and the accumulation of elastic potential energy; once the compression phase is complete, the plunger is raised to release gasket O, the compressed balls expand to expel a volume of water from the container equal to that put in previously, and that is equal to the variation in volume of the compressed balls, and sends said volume in tubing T with a kinetic energy equal to the elastic energy imparted to the balls in the compression phase.

3. Liquid pump as claimed in the preceding claims characterized by an elastic organ consisting of a single ball of alveolar elastic material.

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4. Liquid pump as claimed in claims 1 and 2 characterized by the fact that the alveolar elastic material of the elastic organ is shaped in a non-spherical structure.

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5. Liquid pump as claimed in claims 1 and 2, characterized by the fact the alveolar elastic material of the elastic organ is shaped as a hollow cylinder and covers the container A.

6. Liquid pump as claimed in the preceding claims characterized by the fact that the alveolar elastic material of any shape is enclosed in coverings of non-alveolar elastic material, of the same chemical

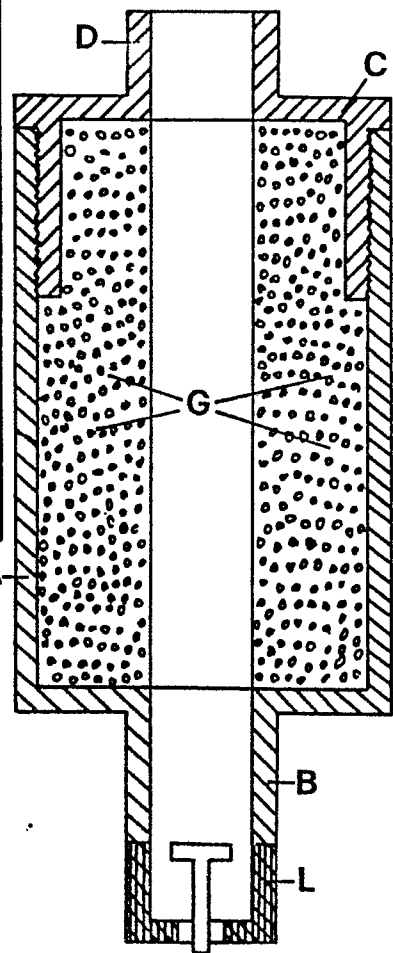
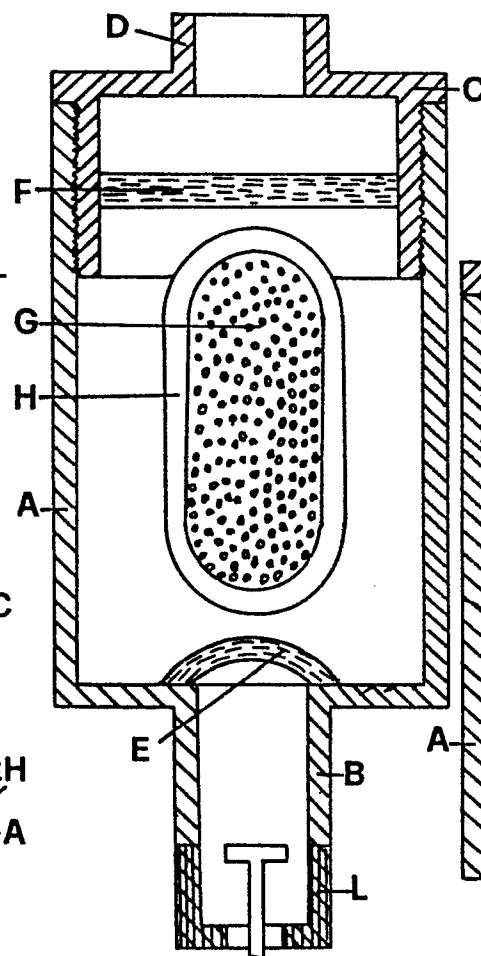
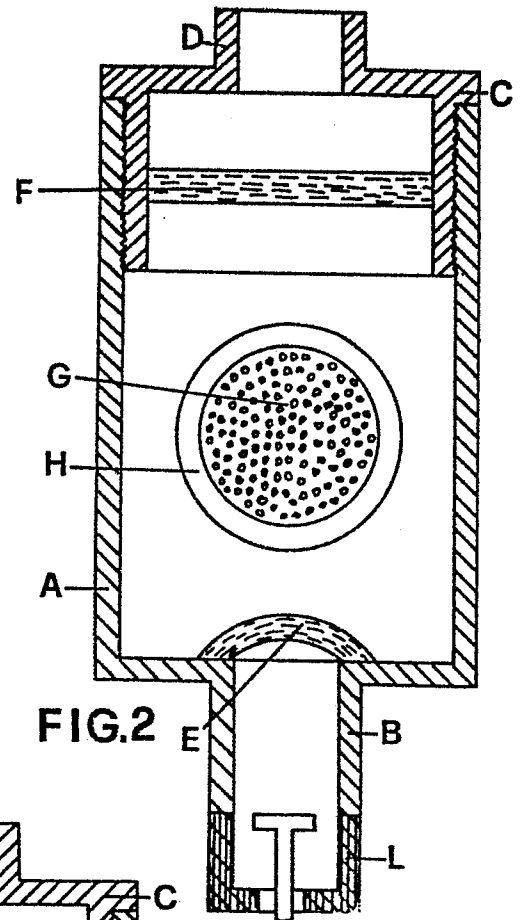
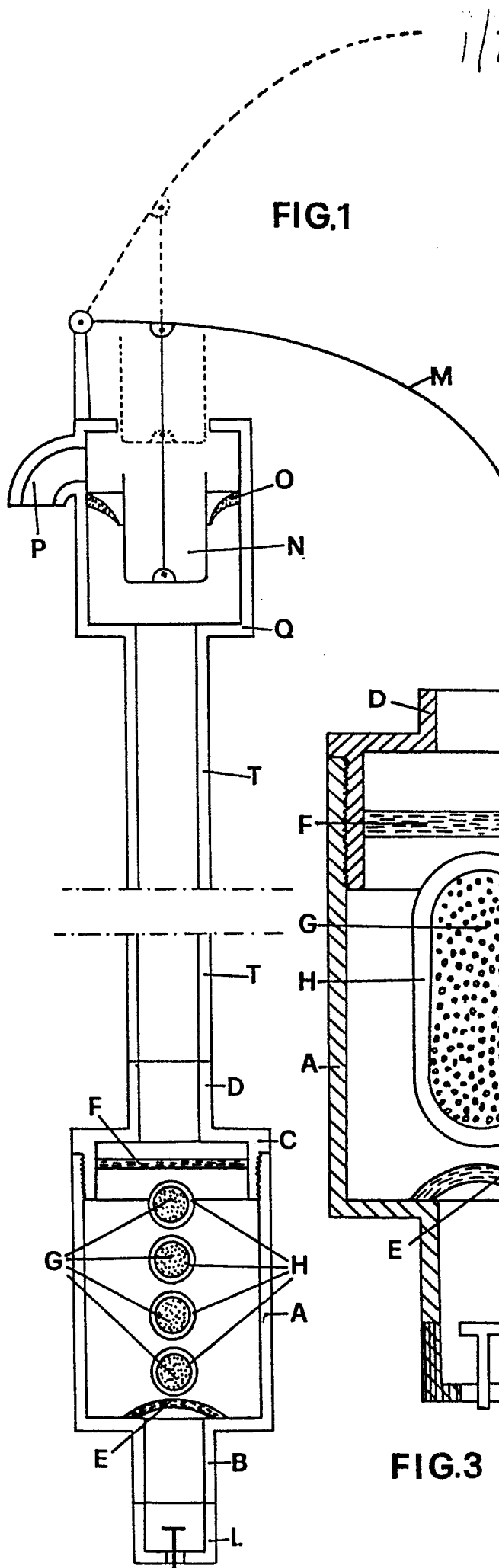
nature or not, both to protect the principle elastic material from any chemical attack of the liquid and to prevent the danger that over time the liquid penetrate in the cavities of the elastic mass, thus lowering its capacity to change volume.

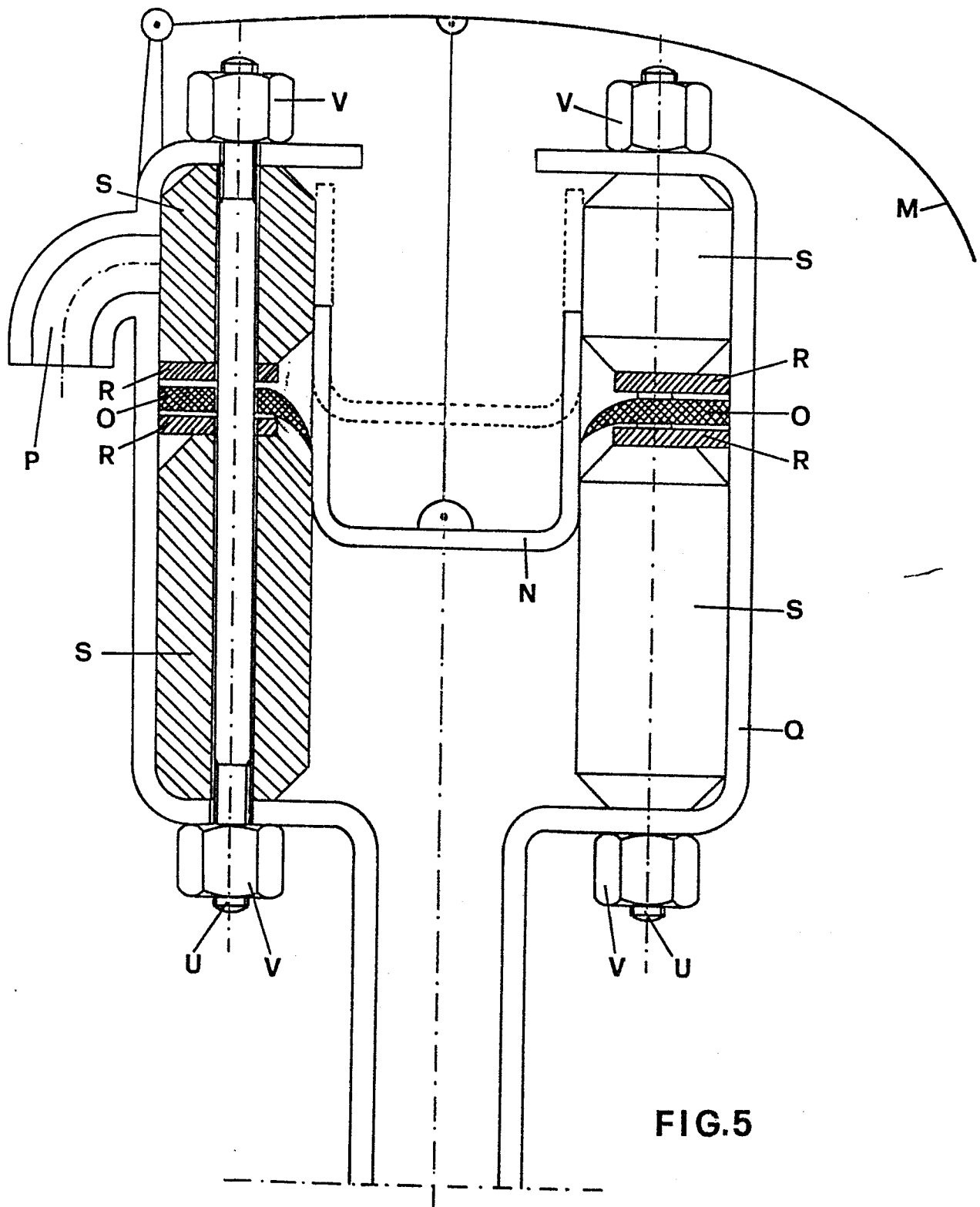
7. Liquid pump as claimed in the preceding claims characterized by hydraulic plunger N, inside the wide lipped gasket O, held and guided by cylinders S which may be rotated to prevent wear and tear.

8. Liquid pump as claimed in the preceding claims characterized by the guiding and centering rings Z or the plunger N, coaxial with the plunger itself and adjustable by rotation to prevent wear and tear.

9. Liquid pump as claimed in the preceding claims characterized by the fissured bushing W to guide and laterally center the connecting rod Y, re-usable several times mounted in different positions so as to function with different sliding points.

10. Liquid pump as claimed in the preceding claims, characterized by one or more washing openings X on the bottom of plunger N, to create a certain turbulence in the plunger cavity to prevent the deposit of impurities present in the liquid.







European Patent
Office

EUROPEAN SEARCH REPORT

0096145

Application number

EP 82 83 0257

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Y	EP-A-0 048 224 (CEFIS) * Page 4, line 12 - page 5, line 17 *	1,2	F 04 F 7/00
Y	FR-A-1 419 825 (GUINARD) * Page 1, column 2, lines 19-27; page 2, column 1, lines 9-14 *	1,2,4,6	
A	GB-A- 492 530 (DICKINSON) * Page 5, lines 85-127 *	1,2,4,5,6	
A	FR-A- 972 722 (OLAER-MARINE) * Page 3, column 1, line 41 - column 2, line 2 *	1-3	
A	DE-C- 170 219 (BEAU)		TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
A	GB-A- 443 565 (GILKES)		F 04 F F 04 B
A	DE-B-1 277 020 (WENK)		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 31-08-1983	Examiner BAATH C.
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