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⑤④ **Liquid pump.**

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⑤⑧ References cited:
EP-A-0 048 224
DE-B-1 277 020
DE-C- 170 219
FR-A- 972 722
FR-A-1 419 825
GB-A- 443 565
GB-A- 492 530

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Description

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.

These pumps provide for an elastic organ consisting of pieces of tubing of traditional elastic material, rubber and india rubber (EP—A—0048224), or of spring powered pistons, or of compressed air capsules.

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 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.

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

In fact, there are patents, like GB—A—443 565, wherein the mass of the oscillating systems consists in the liquid itself and the resilient element of the oscillating system consists in an air bag. This means that such systems must be controlled because said bag must oftenly replenished.

Furthermore, when an air chamber, springs and pistons are provided like in patent GB—A—492 530, the liquid oscillation takes place due to the compression of said air or said spring. Said system shows the inconvenience of being little practical or subject to quick wear.

Furthermore, there are pumps providing, instead of the valves, a conical passage and an elastic expansion chamber, like in FR—A—1 419 825, said chamber contains a body of alveolar elastic rubber with closed cells. Beyond the fact that said pumps is electromagnetic and not manual, the delivery pressure will be overcome by the system according to the present invention. In fact, the elastic organ consisting of alveolar material, coated with a layer of non-alveolar material, thus allowing the use of a wide range of alveolar material, being kept free and fluctuant, allows a perfect, even and regular stress of hydrostatic kind, and thus improves the duration of the material.

All of the above cited limitations and negative effects of the prior art are completely overcome in the pump according to the invention provided with a hydraulic plunger and an elastic pressure accumulator organ inside the pump body to be compressed with a consequent reduction of volume during the compression phases performed by the plunger on the liquid mass, with a consequent storing of elastic energy that said organ gives back to the system at the end of the

compression performed by said plunger determining a push on the surrounding water mass towards a outlet opening, and a consequent reduction of pressure, due to the movement of the water mass, that will allow the opening of a valve for the inlet of the water inside the pump body for a new pumping cycle, wherein said elastic organ consists in one or more free floating bodies made of alveolar elastic material enclosed in elastic non-alveolar coverings for protection.

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

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

Figures 2 and 3 show cross section of variants of the elastic organ.

Figure 4 shows the section of the hydraulic plunger in detail.

Figure 5 shows the design for the bushing with a rectangular guide and centering opening.

In detail, the figures show container A equipped 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 as polyethylene with a cellular structure, or neoprene with a cellular structure or the like, enclosed in elastic protective casing 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 tubing D to connect to the body of the pump Q, 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 and hold the rimmed 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 the 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.

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 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.

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 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 resulting from the elastic energy imparted to the balls in the compression phase.

Therefore the liquid will be pushed towards the outlet by the elastic return of alveolar balls G at the original volume when the pressure of hydraulic plunger N is released, so that the liquid, flowing out through outlet P determines a lowering of the pressure in correspondence to the valve L, thus allowing further water quantities to flow in container A, and expelling the same quantity of liquid through outlet P through the opening left above gasket O of hydraulic plunger N once the same has risen again.

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 consideration, the mass of elastic alveolar material may be concentrated in a different number of balls rather than four, for instance, in one ball only as in Fig. 2, or in balls shaped differently (lengthened or non-spherical) as in Fig. 3, identical in function, or in several bodies of any shape.

The bodies of elastic material with an alveolar structure are enclosed in covering of non-alveolar elastic material, of the same chemical nature or not, both to protect the principle elastic material from chemical attack of the liquid and to prevent the danger that over time the liquid penetrates in the cavities of elastic mass, thus lowering its capacity to change volume.

It is evident furthermore that the wear and tear of the plunger N and the lip of gasket O reduces the flexibility and usable length of the large lip of the gasket O; when the lip becomes 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 may be obviated by rotating them to another position around the pins U of said guides, so that a new, unconsumed part is presented to the plunger. This rotation may be effected several times before guides 5 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.

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.

Other advantages of the floating balls are the lack of parts 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-deformable material which can bear any pressure hydrostatically. In this way, the machine has a long life with a minimum need for replacement part since the wearable parts are re-usable several times.

Claims

1. A liquid pump of the kind provided with a hydraulic plunger (N) and an elastic pressure accumulator organ (G) inside the pump body (A) to be compressed with a consequent reduction of volume during the compression phases performed by the plunger on the liquid mass, with a consequent storing of elastic energy that said organ (G) gives back to the system at the end of the compression performed by said plunger (N) determining a push on the surrounding water mass towards the outlet opening (P), and a consequent reduction of the pressure, due to the movement of the water mass, that will allow the opening of the valve (L) for the inlet of the water inside the pump body for a new pumping cycle, characterized in that said elastic organ (G) consists in one or more free floating bodies made of alveolar elastic material enclosed in elastic non alveolar coverings for protection.

2. A liquid pump according to claim 1, comprising a container (A) provided with a threaded top (C) with connection tubings (B and D), characterized in that inside said container (A) a plurality of balls (G) of elastic alveolar material are provided; some small bars or the like (E and F) prevent said balls from obstructing said tubes (B and D); a check valve (L) is applied to lower tubing

(B) and a tubing (T) is applied to upper connection tubing (D) for the connection of the pump body (Q), provided with a gasket (O), with an outlet (P), a hydraulic plunger (N) and a manual operation lever (M); container (A) is immersed in the liquid to be pumped, and when the pump body (Q), the upper tubing (T) and the container (A) are full of liquid, acting onto the hydraulic plunger (N) by means of lever (M) the liquid under pressure is pushed, through upper tubing (T) inside container (A); this liquid under pressure compresses said balls (G) resulting in an accumulation of elastic potential energy; once the compression phase is complete the plunger is raised to release the gasket (O), the compressed balls expand to expell a volume of water from the container equal to the one put previously, and that is equal to the volume variation of the compressed balls, and sends said volume in upper tubing (T) with kinetic energy resulting from the elastic energy imparted to the balls in the compression phase.

3. A liquid pump according to claim 1 characterized in that said elastic organ consists of a single ball.

4. A liquid pump according to claim 1 characterized by the fact that the alveolar elastic body of the elastic organ is shaped in a non spherical structure.

5. A liquid pump according to 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 danger that over time the liquid penetrate in the cavities of the elastic mass, thus lowering its capacity to change volume.

6. A liquid pump as claimed in the preceding claims, characterized in that the hydraulic plunger (N) plunges into a wide lipped gasket (O), held and guided by cylinders (S) which may be rotated to prevent wear and tear.

7. A liquid pump as claimed in the preceding claims, characterized by guiding and centering rings (Z) for the plunger (N), coaxial with the plunger itself and adjustable by rotation to prevent wear and tear.

8. A liquid pump as claimed in the preceding claims, characterized by a bushing (W) to guide and laterally center a connecting rod (Y), reusable several times if mounted in different positions so as to use different sliding points.

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

Patentansprüche

1. Flüssigkeitspumpe versehen mit einem hydraulischem Schwimmer (N) und einen elastischem Element (G) für die Stauung des Druckes

innerhalb des Pumpengehäuse (A), welcher zusammengedrückt wird mit einer sich ergebenden Volumenreduktion im Laufe der Kompressionsphasen von Seite des Schwimmers auf die Flüssigkeitsmasse, mit einer sich ergebenden Aufspeicherung der elastischen Energie, welche das genannte Element (G) dem System wiedergegeben wird am Ende der vom genannten Schwimmer (N) ausgeführten Kompression, bewirkend auf diese Weise einen Auftrieb auf die umliegende Wassermasse zur Austrittsöffnung (P), und einer sich ergebenden Druckreduktion abhängig von der Bewegung der Wassermasse, welche Bewegung die Öffnung des Ventils (L) für die Beaufschlagung des Wasser im Pumpengehäuse für einen neuen Pumpenzyklus ermöglichen wird, dadurch gekennzeichnet, dass das genannte elastische Element (G) aus einem oder mehreren Schwimmkörpern bestehend ist, welche mit elastischen alveolärem Material realisiert sind und in elastischen nicht alveolären Schutzkästen enthalten sind.

2. Flüssigkeitspumpe nach Patentanspruch 1, meiteinschliessend einen Aufnehmer (A) versehen mit einer geschnittenen Krone (C) mit Anschlussröhren (B und D), dadurch gekennzeichnet, dass innerhalb des genannten Aufnehmer (A) eine gewisse Anzahl von Kugeln (G) aus elastischem alveolärem Material vorgesehen ist; einige Stäbe (E und F) oder ähnliches bewirken dass die genannten Kugeln die genannten Röhre (B und D) verschliessen; ein Überwachungsventil (L) am unteren Rohr (B) angebracht ist und ein Rohrsystem (T) am oberen Anschlussrohr (D) angebracht ist, für die Verbindung mit das Pumpengehäuse (Q) versehen mit einer Dichtung (O), mit einem Austritt (P) einen Schwimmer (N) und einem Hebel (M) für Handaktivierung; der Aufnehmer (A) in die Flüssigkeit, die gepumpt werden soll, eingetaucht ist, und wenn das Pumpengehäuse (Q), das obere Rohr (T) und der Aufnehmer (A) mit Flüssigkeit voll sind, wird die unter Druck stehende Flüssigkeit durch das obere Rohr (T) im Aufnehmer gedrängt, indem man den hydraulischen Schwimmer (N) mit dem Handhebel (M) in Bewegung setzt; diese unter Druck stehende Flüssigkeit die genannten Kugeln (G) komprimiert und dies stellt sich in einer Aufspeicherung elastischer potentieller Energie heraus; wenn einmal die Kompressionsphase vervollständigt ist, der Schwimmer hochgehbt wird um die Dichtung (O) zu befreien, die komprimierten Kugeln sich ausbreiten um aus dem Aufnehmer ein Wasservolumen gleich dem vorher hineinstecktem auszuwerfen, und gleich der Volumenänderung der komprimierten Kugeln, und das genannte Wasservolumen im oberen Rohr (T) schicken, mit der kinetischen Energie die sich aus der elastischen Energie ergibt, welche die Kugeln in der Kompressionsphase erteilt ist.

3. Flüssigkeitspumpe nach Patentanspruch 1, dadurch gekennzeichnet, dass der genannte elastische Element aus einer einzigen Kugel besteht.

4. Flüssigkeitspumpe nach Patentanspruch 1, dadurch gekennzeichnet, dass das elastische

aveoläre Gehäuse vom elastischen Element die Form einer nicht kugelförmigen Struktur hat.

5. Flüssigkeitspumpe nach dem vorherigen Patentansprüchen, dadurch gekennzeichnet, dass das elastische alveoläre Material jeglicher Form in Kästen aus elastischem nicht alveolärem Material derselben chemischen Natur oder nicht enthalten ist, in beiden Fällen für den Schutz des elastischen hauptsächlichsten Material gegen jeglichen chemischen Überfall von Seite der Flüssigkeit und um die Gefahr zu verhindern, dass im Laufe der Zeit die Flüssigkeit in den Hohlräumen der elastischen Masse eindringen könnte, in diese Weise seine Fähigkeit das Volumen zu ändern senkend.

6. Flüssigkeitspumpe nach dem vorherigen Patentansprüchen, dadurch gekennzeichnet, dass der hydraulische Schwimmer (N) innerhalb einer Dichtung (O) mit weiten Rändern gleitet, die Dichtung von Zylindern (S) gehalten und geführt, welche gedreht sein können um die Abnutzung und den Bruch derselben zu verhindern.

7. Flüssigkeitspumpe nach dem vorherigen Patentansprüchen, dadurch gekennzeichnet, dass dieselbe Ringe (Z) für den Schwimmer (N) führt und zentriert, welche mit demselben Schwimmer koaxial sind und durch Rotation regulierbar sind, um Abnutzung und Bruch zu verhindern.

8. Flüssigkeitspumpe nach den vorherigen Patentansprüchen, gekennzeichnet von einer Büchse (W) die eine Verbindungsstange (Y) seitlich führt und zentriert, welche mehrmals verwendet sein kann falls in verschiedene Stellungen installiert, so dass dieselbe verschiedene Gleitpunkte benutzen kann.

9. Flüssigkeitspumpe nach den vorherigen Patentansprüchen, gekennzeichnet von einer oder mehreren Reinigungsöffnungen (X) auf das obere Ende des Schwimmers (N), um so im Hohlraum des Schwimmers eine bestimmte Turbulenz zu schaffen um die Deposition von in der Flüssigkeit vorhandenen Unreinheiten zu verhindern.

Revendications

1. Pompe pour liquides du genre pourvu d'un flotteur hydraulique (N) et d'un élément (G) élastique pour l'accumulation de la pression à l'intérieur du corps (A) de pompe qui viendra comprimé, avec une conséquente réduction de volume au cours des phases de compression de part du flotteur sur la masse liquide, avec un conséquent cumul d'énergie élastique qui ledit élément (G) rendra au système à la fin de la compression exécutée par ledit flotteur (N), en déterminant une poussée sur la masse d'eau environnante vers l'ouverture (P) de sortie, et une conséquente réduction de la pression due au mouvement de la masse d'eau qui permettra l'ouverture de la soupape (L) pour l'entrée de l'eau dans le corps de la pompe pour un neuf cycle de pompage, caractérisée en ce que ledit élément (G) élastique est composé par un ou plusieurs corps flottants réalisés en matériel élastique alvéolaire renfermés dans gaines élastiques pas alvéolaires de protection.

2. Pompe pour liquides suivant la revendication 1, comprenant un récipient (A) pourvu d'un sommet (C) taraudé avec tubes de raccord (B et D), caractérisée en ce que à l'intérieur dudit récipient (A) il est prévu un certain nombre de billes (G) en matériel élastique alvéolaire; quelques barreaux (E et F) ou semblables font en sorte que lesdites billes obstrueraient lesdits tubes (B et D); une soupape de contrôle (L) est appliquée au tube inférieure (B) et un système de tubes (T) est appliqué au tube (D) de raccord supérieur (D) pour l'assemblage avec le corps (Q) de la pompe pourvue d'une garniture (O), avec une sortie (P), un flotteur (N) et un levier (M) pour la mise en activité manuelle; le récipient (A) est plongé dans le liquide qu'il doit être pompé, et lorsque le corps (Q) de la pompe, le tube (T) supérieur et le récipient (A) sont pleins de liquide, en actionnant le flotteur hydraulique (N) au moyen du levier (M) manuel le liquide sous pressions vient poussé, à travers du tube (T) supérieur, dans le récipient (A); ce liquide sous pressions comprime lesdites billes (G) et ceci résulte dans un cumul d'énergie élastique potentielle; lorsque la phase de compression est complétée, le flotteur vient soulevé pour libérer la garniture (O), les billes comprimées s'étendent pour éjecter du récipient un volume d'eau égal à celui-là précédemment introduit, et égal à la variation de volume des billes comprimées, et envoient ledit volume d'eau dans le tube (T) supérieur par l'énergie cinétique résultant de l'énergie élastique donnée à les billes dans la phase de compression.

3. Pompe pour liquides suivant la revendication 1, caractérisée en ce que ledit élément élastique consiste en une unique bille.

4. Pompe pour liquides suivant la revendication 1, caractérisée en ce que le corps élastique alvéolaire de l'élément élastique a la forme d'une structure pas sphérique.

5. Pompe pour liquides suivant les revendications précédentes, caractérisée en ce que le matériel élastique alvéolaire de n'importe quelle forme est renfermé dans gaines de matériel élastique pas alvéolaire de la même nature chimique ou non, en tous les deux cas pour la protection du matériel élastique principal contre n'importe quelle agression chimique de part du liquide et pour prévenir le danger que, en passant le temps, le liquide puisse pénétrer dans les cavités de la masse élastique en baissant ainsi sa capacité de varier le volume.

6. Pompe pour liquides suivant les revendications précédentes, caractérisée en ce que le flotteur (N) hydraulique coule à l'intérieur d'une garniture (O) de larges bords, tenue et dirigée par cylindres (S) qui peuvent être tournés pour prévenir l'usure et la rupture de ladite garniture.

7. Pompe pour liquides suivant les revendications précédentes, caractérisée en ce que elle même dirige et centre bagues (Z) pour le flotteur (N), coaxiaux avec le même flotteur et réglables par rotation pour prévenir usure et rupture.

8. Pompe pour liquides suivant les revendications précédentes, caractérisée par une boîte

d'essieu (W) qui dirige et centre latéralement une tige (Y) de jonction qui peut être utilisée plusieurs fois si montée en positions différentes en sorte qu'on puisse faire usage de différents points de glissement.

9. Pompe pour liquides suivant les reven-

dications précédents, caractérisée par une ou plusieurs ouvertures (X) de lavage sur l'extrémité supérieure du flotteur (N), de façon à créer une déterminée turbulence dans la cavité du flotteur pour prévenir le dépôt d'impuretés présentes dans le liquide.

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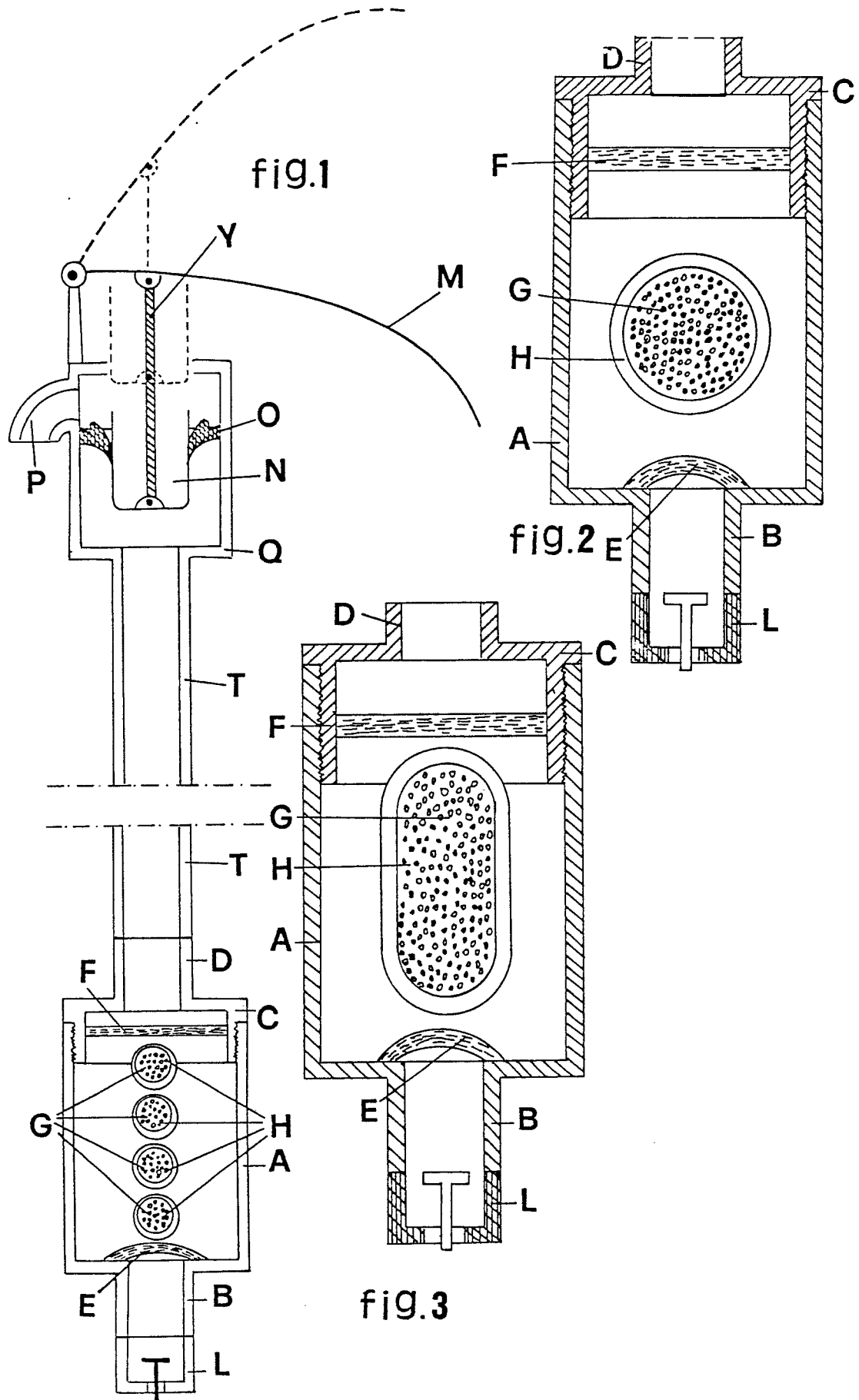
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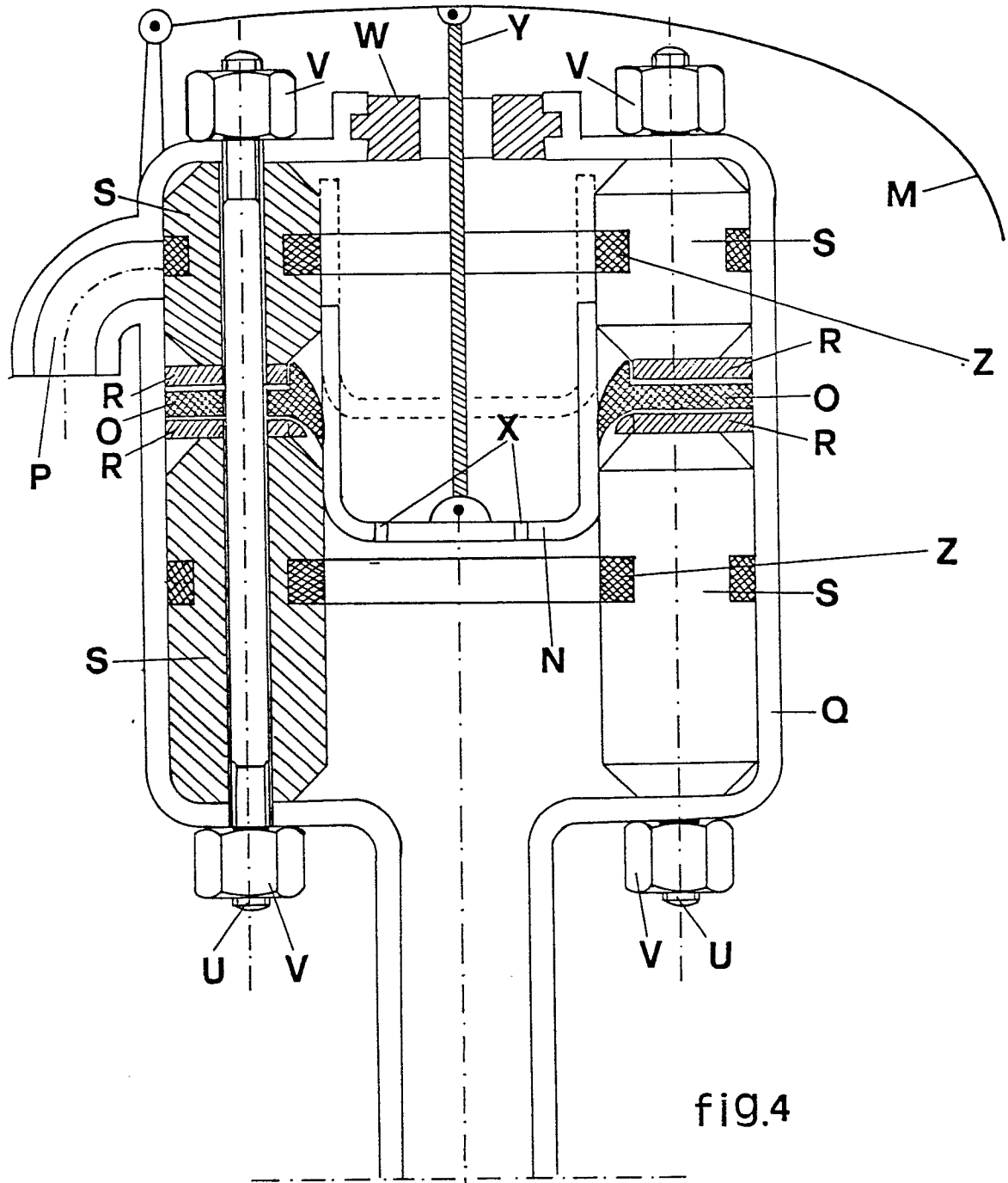


fig.4

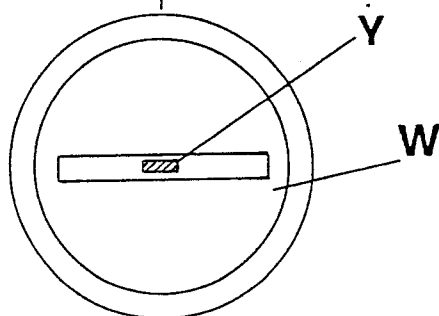


fig.5