

Description

The present invention relates to an arrangement for the automatic control of the operation and stopping of electrical motorpumps that supply pressurized water or another liquid according to a variable consumption demand.

The on-off operation of an electrical motor-pump to supply the demand for pressurized water or another liquid with variable consumption requires the use of an automatic control system. Evidently, the cost of maintaining a motorpump operating permanently to supply a variable demand which goes from zero to a consumption equal or lower than the pumping flow rate is very high due to the excessive cost of energy and wear of the motor-pump during the time when it is underused. Since the appearance of the electrical motorpumps, various automatic control systems for their operation and stopping have been developed. The first one was the use of an elevated accumulation tank. In this case, the motorpump fills the tank and demand for consumption is supplied therefrom. Pressure is obtained by the height of water over the consumption. The on-off operation of the motorpump is achieved by an electrical level switch, installed in the tank, which activates the motorpump when the water reaches a lower level and stops the motor-pump when the water reaches a higher level. Both levels are predetermined and are detected either by floats or by electrodes.

A control system that represents a substantial improvement is the hydropneumatic tank, since it eliminates the use of expensive structures necessary to support the elevated tank. The system maintains water pressure, not by differences in elevation, but by the force of the compressed air. This system is comprised by a motorpump, a hydropneumatic tank with an air recovery apparatus and a pressure switch. The latter is an electrical switch activated by the pressure of the system. The system operates as follows: when water consumption exists, the pressure of the system goes down until reaching a point where the pressure switch is closed and activates the motorpump. The motorpump supplies the necessary demand. If the demand is greater than the flow rate of the motor-pump at cutoff pressure, the motorpump continues operating. If instead the demand is lower, the pressure of the system increases up to the point when the pressure switch is opened, stopping the motor-pump. If the consumption is steady, the pressure goes down once again and the pressure switch once again activates the motorpump, completing the cycle.

This cycle between two starts would be so brief and the frequency so high that the system would be damaged in a short term in the absence

of a pressurized volume of water that maintains the consumption supplied with a tolerable frequency between starts. The volume of pressurized water, designated as regulation volume, is dimensioned in order that a determined period of time prevails between the starting times of the motorpump and corresponds to the one accumulated by the hydropneumatic tank due to pressure differential, that is, between the switching-on pressure and the cutoff pressure: at the cutoff pressure, the air of the tank has been compressed and the space of the regulation volume has been occupied by water. To the extent that said volume is being utilized to cover consumption its pressure decreases until reaching the switching-on point. When the motor-pump operates, it covers consumption and the surplus is accumulated in the tank until the pressure reaches the cutoff point once again, completing the cycle.

Document US-A-3 295 450 of 1967 discloses a hydropneumatic constant pressure arrangement according to the preamble of claim 1.

This known arrangement is able to solve the problem of affording withdrawal of any desired water quantity from the water lines of an installation without causing the pump to be switched on and off continually.

However, this known arrangement does not resolve other problems found in some known arrangements in general.

In the arrangement disclosed by document US-A-3 295 450 and other arrangements of the same category, since the water is in contact with air and both are subject to pressure, air will finally be dissolved in the water because the system lacks an air recuperator. This may consist in a motor-compressor or an injector activated by the negative pressure of the motorpump suction. The connection in the tank for the air recuperator is placed just over the level reached by the water at cutoff pressure: if the water surpasses it, the air recuperator enters into function.

The hydropneumatic systems as above were surpassed since 1970 by the introduction of the hydrosphere system. This system differs from the hydropneumatic one in that the tank contains a rubber bag that houses the regulation volume and leakage-proof air between the cylinder and the wall of the tank. The hydrosphere system has three important advantages over the hydropneumatic tank: 1) it is smaller, since the air is preinjected at the system connection pressure, which eliminates the additional tank volume required to compress air from the atmospheric pressure to such pressure; 2) it requires no air injector and, since the air is separated from the water by the cylinder, the air is not exhausted by dissolution in the water, and 3) since the water is contained in a rubber cylinder,

the tank is not corroded or rusted internally; however, that part of the metallic tank where the cylinder rests is cooled by the absorption of heat towards the colder water inside the cylinder. The moisture of the external air is condensed on the surface, expediting the rusting of the metal.

The purpose of the invention is to provide an arrangement which has the following advantages over both the hydropneumatic constant pressure systems, such as the one disclosed in document US-A-3 295 450, and the hydrosphere systems:

1. It eliminates possible leaks of leakage-proof air, which is one of the greatest deficiencies of the hydrosphere system.
2. The regulation of the cutoff pressure is performed automatically, which avoids operating problems due to deficiencies in regulation or deregulation and, furthermore, it permits the use of motorpumps within pressure limits impossible with the hydrosphere system.
3. It has a much smaller accumulation tank, which makes it cheaper and permits its installation in smaller spaces.
4. Due to its smaller size, it may be manufactured with materials which have an excellent resistance against the aggressiveness of the environment, principally against rusting and corrosion, which substantially increases its useful life.

According to the invention this purpose is attained by an arrangement as defined in claim 1.

The invention will be better understood from the reading of the description which follows, made with reference to the accompanying sheet of drawings whose sole figure is a longitudinal section of the main components of the arrangement according to the invention.

The arrangement shown in the figure comprises interdependent functional components. Such components are generally housed in an external body 14 having a three-outlet connector 11 and a hydropneumatic tank 50.

Before describing the operation of the system as a whole, we shall analyze in the first place the operation of each component in particular, with reference to the figure.

Flow Sensor Device: this component device is located in a three-outlet connector 11. The latter has a lower outlet 12 connected to a motorpump drive, a lateral outlet 13 connected to a consumption and an upper outlet attached to the external body 14. The flow sensor element is a sensor piston 15, which is a separator having a split ring 16 fitted in its contour. The sensor piston 15 is moveable with a sensor shaft 17 within a protector cylinder 18. The latter is of a basket type with longitudinal supports that permit the passage of the flow through them and outwards, and maintains the sensor piston 15 on its axis. The sensor piston 15

at its lower point is inserted in a bearing cylinder 19, in such a way that the split ring 16 seals the space between the bearing cylinder 19 and the sensor piston 15, except in the area of separation produced by the split ring 16, which is a well defined opening through which a flow rate passes, which will be called "Qg", equivalent to what is consumed by a partially open consumption. Therefore, the section of the opening is critical in order that exactly such flow rate may pass therethrough. When the consumption is higher, the sensor piston 15 is displaced upwards by the force of the flow pressure demanded in its area, and this flow passes to a place called "pressure zone of the system". The force required to displace the sensor piston 15 upwards is negligible: it only needs to overcome the contrary force exercised by a thrust piston 21 which forces the sensor piston 15 downwards, as will be analyzed below.

Drive Device: This component is comprised of a drive piston 21 which is displaced along a drive cylinder 22 and is hermetically adjusted to said cylinder 22 by means of a thrust V-seal 23. The seal 23 prevents the pressure of the system from entering the cylinder 22 and permits instead the transfer of the pressure from the cylinder 22 to the system when the pressure goes down in the latter. The drive piston 21 is joined longitudinally with the sensor piston by the sensor shaft 16. When the motorpump flow pressure forces the sensor piston 15 upwards, the upper limit is defined by an upper stop 24. The section of the drive piston 21 less the section of the sensor shaft 17 is added to the section of the sensor piston 15, and therefore the pressure of the system exerts on the upper side a force greater than that exerted on the lower side of the sensor piston 15, that is, the drive piston 21 forces the sensor piston 15 downwards against the thrust of the motorpump. When the flow demanded by the consumption decreases to the flow rate Qg equivalent to that of a partially open consumption, the sensor piston 15 is located in the bearing cylinder 19 at a lower limit imposed by a lower stop 25. At Qg, the force of the drive piston 21 overcomes the thrust force of the motorpump. This limit coincides with the point where the pressure of the system activates the pressure switch to stop the motorpump. This mechanism will be analyzed below.

Pressure Transfer Device: This component comprises a transfer chamber 31, a piston collar 32, a piston cone 33, a transfer V-seal 34 and a pressure switch connection conduit 35. When the sensor piston 15 reaches its lower position, the piston collar 32, which is a segment having a diameter smaller than that of the sensor shaft 17, emerges outside the transfer V-seal 33 and the pressure of the system comes in through this sepa-

ration towards the transfer chamber 31.

The pressure is immediately communicated through the connection conduit 35 to the pressure switch. On the other hand, the internal pressure of the transfer chamber 31 can never exceed the pressure of the system, since any higher difference will be transferred towards the system through the transfer of V-seals 34 and the drive V-seal 23. However, these seals 23, 34 will retain the higher pressure of the system outside the transfer chamber until, as explained, the piston collar 32 has gone beyond the transfer V-seal 34. When the motorpump is activated and displaces the sensor piston 15, the sensor shaft 17 enters the transfer V-seal 34, expanding it softly by means of the piston cone 33 until it is perfectly adjusted.

Pressure Switch (not shown): Since this set is so widely known, the analysis and operation of its parts will not be described. As far as concerns the operation of the arrangement, the pressure switch will reach its cutoff pressure only when the pressure of the system enters the transfer chamber and, as discussed, this only happens when the sensor piston 15 reaches its lower point. This function is most important since the pressure regulating the cutoff of the pressure switch is not relevant, provided it is lower than the motorpump pressure when the latter impels a flow rate as small as Qg. The switching-on pressure of the pressure switch is reached when the pressure of the system reaches such level, which corresponds to a partially open faucet. Only at this point the pressure of the system is transmitted to the pressure switch which cuts off the motorpump.

Air-Pump Activator: This component comprises an actuator piston 61 which is longitudinally displaced by an actuator cylinder 62 which is hermetically adjusted in the actuator piston 61 by means of an actuator ring-seal 63. The upper limit of this displacement is imposed by an upper stop 64 for the actuator cylinder. The lower displacement limit is located at an intake port 74 which will be discussed below. The actuator piston 61 is moved from the hydropneumatic tank 50 by the force of the higher pressure of the liquid inside the tank 50, when the motorpump is turned off and a consumption exists which decreases the pressure of the system generating a differential. When instead the motorpump starts operating, the pressure in the system increases over that of the hydropneumatic tank and the pressure differential forces the actuator piston 61 to displace itself towards the hydropneumatic tank until it reaches the upper stop 64 of the actuator cylinder 62. The large relative area of the actuator piston 61 makes it most sensible to the pressure differentials which are produced and permits the actuator to absorb great forces.

Air-injection Pump: The objective of this component is to replace air lost by dissolution in the pressurized water within the hydropneumatic tank 50. It comprises an injector piston 71 which travels inside an injector cylinder 72. An injector V-seal 73 adjusts the injector piston 71 to the injector cylinder 72, preventing transmission of the pressure of the system inside the injector cylinder 72, but permitting the passage of compressed air upwards when the air pressure exceeds the system pressure. Injected air goes up towards the hydropneumatic tank 50 due to its lower density. The actuator piston 61 and the injector piston 71 are jointed by their shafts and the force of the former activates the latter. In its displacement downwards towards the lower stop coinciding with the intake port 74 it compresses air which gradually enters the system as it acquires the same pressure. The importance that the lower displacement stop coincides with the intake port is due to the fact that in this way no free air-containing volume remains, and air may be compressed at pressures greater than the highest pressure reached by the system.

In its upwards displacement, the vacuum produced within the injector cylinder 72 is filled in by external air which enters through the intake port 74. The air arrives at this point through a valve consisting in a valve membrane 75 which has a passage port 76. Normally the valve membrane 75 obstructs a closing cone 77 defining an intake port of external air, due to the thrust exerted by the actuator piston 61 when it goes down with the help of a valve spring 78. Only when a vacuum is produced due to the upwards displacement of the injector piston 71, the force of the valve spring 78 is overcome and the membrane 75, being separated from the closing cone 77 by the difference in pressure, admits the entry of air from outside the system through an intake conduit 79, which is a tunnel that communicates the valve with the outside.

Transfer Device: The purpose of this component is to permit the entry of water to the hydropneumatic tank 50 with no passage limitation and to enable the limitation of its outflow according to a determined flow rate. For the entry of water to the hydropneumatic tank 50 the latter has intake ports 81. In turn, for the outflow of water from the hydropneumatic tank 50 the latter has a flow regulator 82 which is inserted within an outlet conduit 83 that discharges into outlet ports 84. These last two components are part of the actuator piston. The intake ports 84 are open only when the actuator piston 61 reaches the upper limit of the actuator cylinder 62. This only happens when the motorpump is operating and the demand for consumption does not increase in that phase: the

higher pressure produced by the motorpump forces the actuator piston 61 towards the upper stop 64 of the actuator cylinder 62 and the water enters the hydropneumatic tank 50. Should the consumption increase, the pressure of the system goes down and the actuator piston 61 is displaced, obstructing the outlet ports 84. This also happens when the motorpump is not operating: as soon as it stops, even though no consumption exists, the actuator piston 61 goes down due to the vacuum that exists in the injector cylinder 72; the actuator piston 61 obviously moves downwards when consumption exists, which generates differences in pressure between the hydropneumatic tank and the system. The reason for which the intake ports open only when the actuator piston reaches its maximum level is precisely to force the actuator piston 61 to achieve such level in order that the injector pump may suck the greatest possible amount of air. The outlet of water from the hydropneumatic tank takes place by means of a system that forces the actuator piston 61 to go down to its minimum level to compress air within the injector pump. The outgoing flow rate must be higher than Q_g to prevent the pressure of the system, with a consumption of approximately Q_g , from decreasing to the switching-on pressure and producing a very high frequency between startings of the motorpump due to the impossibility of the regulation volume to supply this type of flow. If the flow rate is regulated through the flow regulator for a consumption lower than that required by a totally open consumption, this second consumption is immediately supplied by the starting of the motorpump. In fact, the pressure of the system immediately goes down to the switching-on pressure due to the impossibility of the hydropneumatic tank to supply it through the flow regulator which is only sized to permit the passage of a smaller flow rate, and the motorpump is immediately activated to supply this sudden increase in consumption. The reaction of the motorpump is so fast that the pressure decrease is practically not perceived in the consumption. Also, the pressure in this case is the one permitted by the motorpump and not the pressure that would be reached if the cutoff pressure were regulated too low. Since a sudden increase in consumption may be supplied by activating the motorpump and releasing the connection pressure, its regulation may be as low as permitted by the difference in elevation between the pressure switch and the consumption with the lowest geodesical height. A low connection pressure has the following important advantages: 1) it virtually eliminates loss due to drips and leakages as such losses are subjected to low pressure; and 2) it takes better advantage of the volume of the hydropneumatic tank due to increase in the regulation volume caused by the

higher pressure differentials between the switching-on and cutoff pressures. The flow regulator may also be regulated for greater flow rates. In this way, if a consumption occurs, the motorpump will be driven only when the pressure of the system, including the pressure of the hydropneumatic tank 50, is reduced to the switching-on pressure.

After separately analysing the operation of the various functional components, the interdependent operation of these components must be analyzed. To this effect, the operation will be analyzed in relation to the type of consumption. Thus, it may be indicated that three possible consumption conditions may exist:

1. Consumption greater than, or equivalent to, that corresponding to an open faucet. In this case, the motorpump will operate continuously, the flow sensor will be in the open position and the pressure switch will keep a pressure below the cutoff pressure, even if the pressure of the system increases: as seen above, the pressure of the system will only be communicated to the pressure switch when the flow sensor is inserted in the bearing cylinder 19, which condition only occurs when consumption goes down to Q_g or less. On the other hand, the actuator piston 61 will remain at its upper limit and the hydropneumatic tank 50 will consume part of the flow rate delivered by the motorpump when replacing its regulating volume in case the pressure of the system increases gradually due to a reduction in consumption. Finally, the air-injection pump will have already sucked air from outside.

2. Consumption lower than or equivalent to that corresponding to a partially open faucet. This consumption is usually produced by leakages or drips in the distribution system when a faucet has remained partially open. If the motorpump has been operating when such consumption is reached, the sensor piston 15 is inserted in the bearing cylinder 19 due to the lower flow rate required, and the pressure of the system is transmitted to the pressure switch through the transfer system. Since the pressure has exceeded the cutoff pressure of the pressure switch, the motorpump stops. From that time, consumption is supplied through the flow regulator with the regulation volume stored in the hydropneumatic tank. The actuator piston goes down to its lower limit over the intake port 74 of the air-injection pump and the air within this pump is compressed until it reaches the pressure of the system, after which it leaves the system from above and subsequently reaches the hydropneumatic tank 50. The consumption continues to be supplied by the regulation volume until the pressure of the system goes down

to the switching-on point of the motorpump. It is possible that drips and leakages will absolutely stop when the pressure of the system reaches such a low level that it may be exceeded by, for example, the expansion force of the elastic seals of a faucet, which have been leaking at a higher pressure. If drips and leakages disappear before arriving at the switching-on pressure, the pump does not start if an additional consumption is not sensed. When instead the switching-on pressure is reached, the motorpump operates until replacing the regulation volume which has been used up, and stops when the pressure of the system increases to the one required to drive Qg. At this point, the motorpump remains shut down until the next cycle or until a greater consumption occurs. Whenever the pressure of the system reaches the switching-on pressure, the pressure switch connects and activates the motorpump. The sensor piston 15 is separated from the bearing cylinder 19 and the sensor shaft 17 obstructs the transfer V-seal 34, preventing the pressure to be transmitted to the pressure switch until the sensor piston 15 is inserted once again in the bearing cylinder 19. The actuator piston 61 goes up to its highest point permitting the free entry of the flow to the hydropneumatic tank, with the only limitation of the capacity of the latter. Vacuum is formed within the cylinder of the air injection pump, and this vacuum is filled in with outside air. The cycle is completed when the motorpump stops.

3. No consumption. The motorpump has already stopped and cannot operate again, the pressure of the system is maintained and no consumption of the regulation volume exists.

The first thing that must be pointed out in the interaction of the just analyzed components is that the arrangement according to the invention is distinguished from the hydropneumatic systems, including the hydrosphere system, since in the first system the motorpump starts and stops successively when consumption fluctuates between zero flow rate and Qg. With consumption exceeding Qg, the motorpump continues operating. In the second system, this phenomenon occurs when consumption is between a flow rate over zero and Qg, that is, the flow rate of the motorpump at cutoff pressure. With consumptions exceeding Qg, the motorpump continues operating. In both cases, the motorpump remains inactive with zero consumption.

In the second place, the functioning of the flow regulator must be pointed out. It enables the passage, from the hydropneumatic tank to consumption, of a flow rate lower than the one equivalent to a consumption corresponding to a completely open faucet. Thus, the motorpump is instantaneously

activated when any consumption is higher than that permitted by the flow regulator. In this way, the switching-on pressure of the pressure switch may be regulated as low as the consumption pressure at the highest elevation. This type of regulation permits a decrease in consumption caused by the possible and undesired losses due to drips and/or leakages.

The two indicated factors have incidence in the reduction in the size of the hydropneumatic tank and the consequent reduction in cost.

In the third place, the air-injection system is most beneficial, since it eliminates air leakages and keeps the air pressure at the switching-on pressure of the system.

Finally, the miniature size of the arrangement according to the invention permits its manufacture with low cost and materials resisting to corrosion and rust such as, for example, plastics.

Summing up, the arrangement according to the invention comprises the following basic elements:

Flow Sensor Device: a set installed in a motorpump drive to detect the variation in consumption demand.

Drive Device: a set which forces the flow sensor against the motorpump drive until the cutoff pressure is transmitted to the pressure switch.

Pressure Transfer Device: a set that communicates the pressure to the pressure switch only when the rising pressure reaches the one corresponding to Qg, but permanently permits the transmission of the pressure from the pressure switch to the system with any decrease in the pressure of the system.

Pressure Switch: pressure-activated electric switch.

Hydropneumatic Tank: watertight tank.

Air-Pump Actuator: a set which uses the force of the liquid when entering and leaving the hydropneumatic tank.

Air-Injection Pump: a set that receives the force of the air-pump actuator to pump outside air to the hydropneumatic tank in every on-off operation cycle of the motorpump and replaces any air that is dissolved.

Transfer Device: a set which permits the entry of water to the hydropneumatic tank without limitation of passage, but which permits the limitation of its outflow pursuant to a determined flow rate.

The above described arrangement thus solves the following technical problems:

1. Eliminates one of the greatest deficiencies of the hydrosphere, which is constituted by possible air leakages.
2. Expedites the regulation of the pressure switch.
3. Permits the use of motorpumps within characteristic limits.

4. Enables the decrease in pressure of the system when no consumption exists, except that produced by leaks and/or infiltrations, which extends the frequency between two startings of the motorpump; such undesired consumption may even disappear due to the lower pressure exerted upon the system.

5. Due to the greater pressure differentials, the regulation volume increases. This enables the use of a quite reduced hydropneumatic tank, which represents a lower cost and allows the device to be installed in smaller spaces.

6. The smaller hydropneumatic tank may be manufactured with materials with high resistance against the aggressiveness of the environment, which substantially increases its useful life.

Claims

1. Constant pressure hydropneumatic arrangement to automatically control the starting and stopping of electrical motorpumps that supply the demand for water or another liquid, with variable consumption, comprising:

- a flow sensor device to detect the variation in demand for consumption, which includes a sensor piston (15) located facing the outlet conduit (12) of the motorpump within a bearing cylinder (19), and activated by a driving piston (21) communicated to the water or another liquid pressure on the consumption side, said driving piston (21) being located within a pressure transfer chamber (31) communicated with a pressure switch which is electrically connected to the motorpump; and
- a hydropneumatic tank (50) having an inlet,

characterised in that said pressure transfer chamber (31) is also communicated to the water or another liquid pressure on the consumption side by means of the driving piston (21) and communicated from the water or another liquid pressure on the consumption side only in the point of maximum displacement of the driving piston (21);

and in that the hydropneumatic tank (50) includes an actuator piston (61) of an air-injection pump directly coupled with said hydropneumatic tank (50) and connected to the outside air;

said tank (50) also being provided with a water or another liquid-flow regulator (82) for the flow from the hydropneumatic tank (50), and with a water transfer arrangement for the flow to-

wards the hydropneumatic tank (50).

2. Hydropneumatic arrangement according to claim 1, characterised in that said sensor piston (15) is provided with a sensor ring (16) fitted in its contour, said sensor ring (16) being cut in a point of its contour so as to define an opening for the passage of a flow rate equivalent to that of a partially open consumption.
3. Hydropneumatic arrangement according to claim 2, characterised in that the driving piston (21) is provided with a drive V-seal (23).
4. Hydropneumatic arrangement according to claim 1 or 2, characterised in that the said sensor piston (15) is provided with a sensor shaft (17) having a piston collar (32) in its end which is a segment with a diameter smaller than the internal diameter of a transfer V-seal (34).
5. Hydropneumatic arrangement according to claim 4, characterised in that the diameter of said sensor shaft (17) and the diameter of said piston collar (32) are connected by a sensor cone (33) presenting a conical area.
6. Hydropneumatic arrangement according to claim 1, characterised in that said actuator piston (61) is located in an actuator cylinder (62), which is located at the inlet of said hydropneumatic tank (50), and is provided with an actuator ring-seal (63).
7. Hydropneumatic arrangement according to claim 1, characterised in that said injection pump includes an injector piston (71) moveable within an injector cylinder (72) and provided with an injector V-seal (73).
8. Hydropneumatic arrangement according to claim 7, characterised in that said injector cylinder (73) is provided with an air-admission valve (75) at its end.
9. Hydropneumatic arrangement according to claim 1, characterised in that, said hydropneumatic tank (50) is provided with intake ports (81).

Patentansprüche

1. Hydropneumatische Konstantdruckvorrichtung zur automatischen Steuerung für das Anlassen und Abstellen von elektrischen Motorpumpen, die den Bedarf an Wasser oder einer anderen Flüssigkeit bei unterschiedlichem Verbrauch

4. Enables the decrease in pressure of the system when no consumption exists, except that produced by leaks and/or infiltrations, which extends the frequency between two startings of the motorpump; such undesired consumption may even disappear due to the lower pressure exerted upon the system.

5. Due to the greater pressure differentials, the regulation volume increases. This enables the use of a quite reduced hydropneumatic tank, which represents a lower cost and allows the device to be installed in smaller spaces.

6. The smaller hydropneumatic tank may be manufactured with materials with high resistance against the aggressiveness of the environment, which substantially increases its useful life.

Claims

1. Constant pressure hydropneumatic arrangement to automatically control the starting and stopping of electrical motorpumps that supply the demand for water or another liquid, with variable consumption, comprising:

- a flow sensor device to detect the variation in demand for consumption, which includes a sensor piston (15) located facing the outlet conduit (12) of the motorpump within a bearing cylinder (19), and activated by a driving piston (21) communicated to the water or another liquid pressure on the consumption side, said driving piston (21) being located within a pressure transfer chamber (31) communicated with a pressure switch which is electrically connected to the motorpump; and
- a hydropneumatic tank (50) having an inlet,

characterised in that said pressure transfer chamber (31) is also communicated to the water or another liquid pressure on the consumption side by means of the driving piston (21) and communicated from the water or another liquid pressure on the consumption side only in the point of maximum displacement of the driving piston (21);

and in that the hydropneumatic tank (50) includes an actuator piston (61) of an air-injection pump directly coupled with said hydropneumatic tank (50) and connected to the outside air;

said tank (50) also being provided with a water or another liquid-flow regulator (82) for the flow from the hydropneumatic tank (50), and with a water transfer arrangement for the flow to-

wards the hydropneumatic tank (50).

2. Hydropneumatic arrangement according to claim 1, characterised in that said sensor piston (15) is provided with a sensor ring (16) fitted in its contour, said sensor ring (16) being cut in a point of its contour so as to define an opening for the passage of a flow rate equivalent to that of a partially open consumption.

3. Hydropneumatic arrangement according to claim 2, characterised in that the driving piston (21) is provided with a drive V-seal (23).

4. Hydropneumatic arrangement according to claim 1 or 2, characterised in that the said sensor piston (15) is provided with a sensor shaft (17) having a piston collar (32) in its end which is a segment with a diameter smaller than the internal diameter of a transfer V-seal (34).

5. Hydropneumatic arrangement according to claim 4, characterised in that the diameter of said sensor shaft (17) and the diameter of said piston collar (32) are connected by a sensor cone (33) presenting a conical area.

6. Hydropneumatic arrangement according to claim 1, characterised in that said actuator piston (61) is located in an actuator cylinder (62), which is located at the inlet of said hydropneumatic tank (50), and is provided with an actuator ring-seal (63).

7. Hydropneumatic arrangement according to claim 1, characterised in that said injection pump includes an injector piston (71) moveable within an injector cylinder (72) and provided with an injector V-seal (73).

8. Hydropneumatic arrangement according to claim 7, characterised in that said injector cylinder (73) is provided with an air-admission valve (75) at its end.

9. Hydropneumatic arrangement according to claim 1, characterised in that, said hydropneumatic tank (50) is provided with intake ports (81).

Patentansprüche

1. Hydropneumatische Konstantdruckvorrichtung zur automatischen Steuerung für das Anlassen und Abstellen von elektrischen Motorpumpen, die den Bedarf an Wasser oder einer anderen Flüssigkeit bei unterschiedlichem Verbrauch



liefern, umfassend:

eine Strömungssensoreinrichtung zur Feststellung von Schwankungen des Verbraucherbedarfes mit einem Sensorkolben (15), der vor der Auslaßleitung (12) der Motorpumpe innerhalb eines Lagerzylinders (19) angeordnet ist und durch einen Antriebskolben (21), der mit dem Druck des Wassers oder einer anderen Flüssigkeit auf der Verbrauchsseite verbunden ist, in Gang gesetzt wird, wobei der Antriebskolben (21) in einer Druckübertragungskammer (31) angeordnet ist, die mit einem mit der Motorpumpe elektrisch verbundenen Druckschalter in Verbindung steht; und

einen hydropneumatischen Tank (50) mit einem Einlaß, dadurch gekennzeichnet, daß die Druckübertragungskammer (31) ebenfalls mit dem Druck des Wassers oder einer anderen Flüssigkeit auf der Verbrauchsseite mit Hilfe des Antriebskolbens (21) verbunden ist und mit dem Druck des Wassers oder einer anderen Flüssigkeit auf der Verbrauchsseite nur an der Stelle der maximalen Verschiebung des Antriebskolbens (21) verbunden ist;

und daß der hydropneumatische Tank (50) einen Aktuator-Kolben (61) einer Luftinjektionspumpe aufweist, der direkt mit dem hydropneumatischen Tank (50) gekoppelt ist und mit der Außenluft in Verbindung steht;

wobei der Tank (50) weiters mit einem Regler (82) für die Strömung des Wassers oder einer anderen Flüssigkeit aus dem hydropneumatischen Tank (50) und mit einer Wasserüberföhrungseinrichtung für die Strömung zum hydropneumatischen Tank (50) versehen ist.

2. Hydropneumatische Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der Sensorkolben (15) mit einem in seinen Umfang eingepaßten Sensorring (16) versehen ist, wobei der Sensorring (16) an einer Stelle seines Umfanges eingeschnitten ist, sodaß sich eine öföfnung für eine Strömungsrate bildet, die einem eingeschränkten Verbrauch entspricht.

3. Hydropneumatische Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß der Antriebskolben (21) mit einer Antriebs-V-Dichtung (23) versehen ist.

4. Hydropneumatische Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Sensorkolben (15) mit einem Sensor-Kolbenschaft (17) mit einem an seinem Ende liegenden Kolbenhals (32) versehen ist, der ein Segment mit einem Durchmesser bildet, der

kleiner ist als der innere Durchmesser einer Übertragungs-V-Dichtung (34).

5. Hydropneumatische Vorrichtung nach Anspruch 4, dadurch gekennzeichnet, daß der Durchmesser des Sensor-Kolbenschaftes (17) und der Durchmesser des Kolbenhalses (32) durch einen Sensor-Konus (33) verbunden ist, der einen konischen Bereich bildet.

6. Hydropneumatische Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der Aktuator-Kolben (61) in einem Aktuator-Zylinder (62) angeordnet ist, der sich am Einlaß des hydropneumatischen Tankes (50) befindet, und mit einer Aktuator-O-Dichtung (63) versehen ist.

7. Hydropneumatische Anordnung nach Anspruch 1, dadurch gekennzeichnet, daß die genannte Injektionspumpe einen Injektions-Kolben (71) umfaßt, der innerhalb eines Injektions-Zylinders (72) beweglich und mit einer Injektions-V-Dichtung (73) versehen ist.

8. Hydropneumatische Vorrichtung nach Anspruch 7, dadurch gekennzeichnet, daß der Injektions-Zylinder (73) an seinem Ende mit einem Lufteinlaßventil (75) versehen ist.

9. Hydropneumatische Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der hydropneumatische Tank (50) mit Einlaßöffnungen (81) versehen ist.

Revendications

1. Dispositif hydropneumatique à pression constante pour contrôler automatiquement le démarrage et l'arrêt de groupes motopompe électriques qui répondent à une demande en eau ou un autre liquide, selon une consommation variable, comprenant:

un dispositif capteur d'écoulement pour détecter la variation de la demande en consommation, dispositif qui comprend un piston de capteur (15) situé en face du conduit de sortie (12) du groupe motopompe à l'intérieur d'un cylindre porteur (19), et actionné par un piston d'entraînement (21) mis en communication avec la pression d'eau ou d'autre liquide du côté consommation, ledit piston d'entraînement (21) étant situé à l'intérieur d'une chambre de transfert de pression (31) mise en communication avec un commutateur de pression qui est relié électriquement au groupe motopompe ; et

un réservoir hydropneumatique (50) ayant



une entrée,

caractérisé en ce que ladite chambre de transfert de pression (31) est également mise en communication avec la pression d'eau ou d'autre liquide du côté consommation au moyen du piston d'entraînement (21) et mise en communication depuis la pression d'eau ou d'autre liquide du côté consommation seulement au point de déplacement maximal du piston d'entraînement (21);

et en ce que le réservoir hydropneumatique (50) comprend un piston d'actionneur (61) d'une pompe à injection d'air couplée directement audit réservoir hydropneumatique (50) et reliée à l'air extérieur ;

ledit réservoir (50) étant également muni d'un régulateur (82) de l'écoulement d'eau ou d'autre liquide pour l'écoulement à partir du réservoir hydropneumatique (50), et d'un dispositif de transfert d'eau pour l'écoulement en direction du réservoir hydropneumatique (50).

2. Dispositif hydropneumatique selon la revendication 1, caractérisé en ce que ledit piston de capteur (15) est muni d'un anneau de capteur (16) monté dans son pourtour, ledit anneau de capteur (16) étant coupé en un point de son contour de manière à définir une ouverture pour le passage d'un débit équivalent à celui d'une consommation partiellement ouverte.
3. Dispositif hydropneumatique selon la revendication 2, caractérisé en ce que le piston d'entraînement (21) est muni d'un joint d'entraînement (23) à lèvres en V.
4. Dispositif hydropneumatique selon la revendication 1 ou 2, caractérisé en ce que ledit piston de capteur (15) est muni d'un arbre de capteur (17) ayant un collier de piston (32) à son extrémité qui est un segment de diamètre inférieur au diamètre intérieur du joint de transfert (34) à lèvres en V.
5. Dispositif hydropneumatique selon la revendication 4, caractérisé en ce que le diamètre dudit arbre de capteur (17) et le diamètre dudit collier de piston (32) sont reliés par un cône de capteur (33) présentant une surface conique.
6. Dispositif hydropneumatique selon la revendication 1, caractérisé en ce que ledit piston d'actionneur (61) est situé dans un cylindre d'actionneur (62), lequel est placé à l'entrée dudit réservoir hydropneumatique (50) et est muni d'un joint torique d'actionneur (63).

7. Dispositif hydropneumatique selon la revendication 1, caractérisé en ce que ladite pompe d'injection comprend un piston d'injecteur (71) mobile à l'intérieur d'un cylindre d'injecteur (72) et muni d'un joint d'injecteur (73) à lèvres en V.

8. Dispositif hydropneumatique selon la revendication 7, caractérisé en ce que ledit cylindre d'injecteur (73) est muni à son extrémité d'une soupape (75) d'admission d'air.

9. Dispositif hydropneumatique selon la revendication 1, caractérisé en ce que ledit réservoir hydropneumatique (50) est muni d'orifices d'admission (81).

