

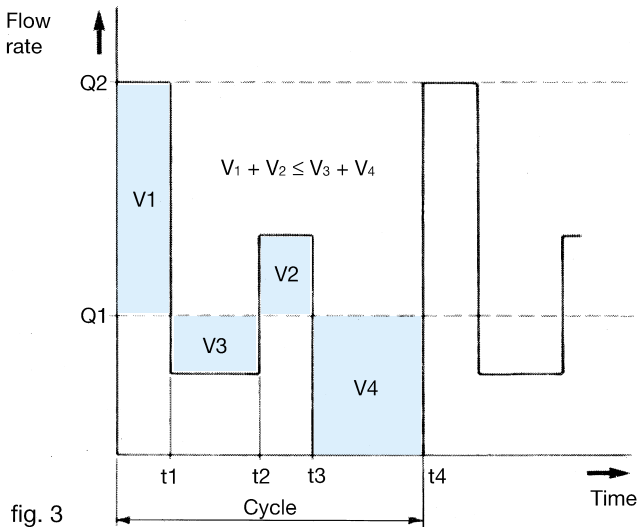
2.1 Fluid power storage

In the case of hydraulic circuits where a large flow rate is required for a short period, alternating with a low or no flow condition, the use of an accumulator allows smaller pumps and motors to be used, thus reducing both installation and operating costs.

The operation cycle shown in fig. 3 would require a pump having a capacity Q_2 . If an oleo-pneumatic accumulator is used, it is possible to store oil during the time periods $(t_2 - t_1)$ and $(t_4 - t_3)$ when requirement is very low or zero, and to reutilize it during t_1 and $t_3 - t_2$, when the required flow rate is higher than pump capacity Q_1 .

This pump must be selected in order to have the volumes $V_1 + V_2 \leq V_3 + V_4$.

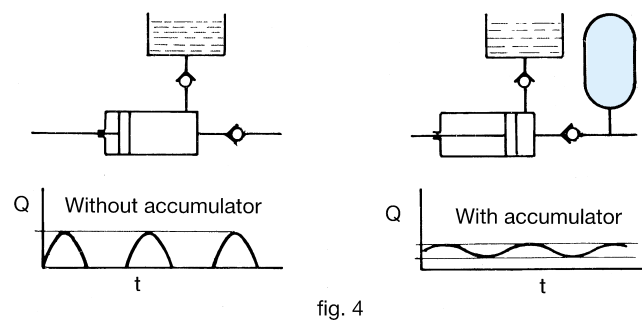
There are many potential applications including thermoplastic extruders, transfer lines in steel mills, rolling mills, machine tools, hydraulic presses etc.



2.2 Pulsation damper

By virtue of their design both piston and diaphragm pumps create pulsation or pressure peaks during operation, this being undesirable and detrimental for both the smooth operation and operational life of components.

The fitting of a bladder accumulator near the pressure line of the pump, will damp the pulsations to an acceptable level (fig. 4). Typical applications are: dosing pumps, pumps with a small number of pistons, etc.



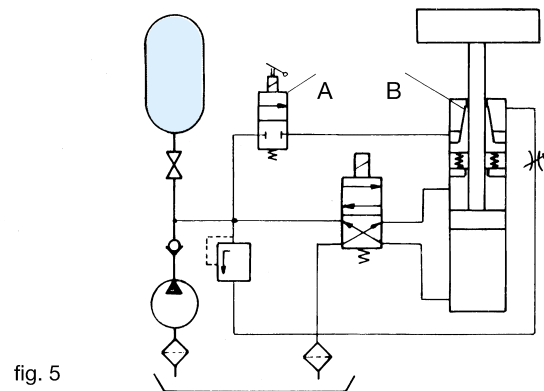
2.3 Emergency energy reserve

In the case of a sudden power loss, e.g. pipe or joint failure, pump breakdown etc. the accumulator can provide sufficient energy to complete an operational cycle or to allow actuators, valves etc. to re-set to a "safe" position, and so prevent damage to equipment or product.

Besides, the availability of such an emergency power source, is essential in case where a hydraulic power supply is required for closing a safety door, electrical switch, safety valve, emergency brakes etc.

Another typical application is the emergency supply of fuel oil to power plant burners.

Fig. 5 illustrates that a failure at "B" causing a loss of energy can be offset operating manually the electro valve "A" thus utilising the potential energy of the accumulator.



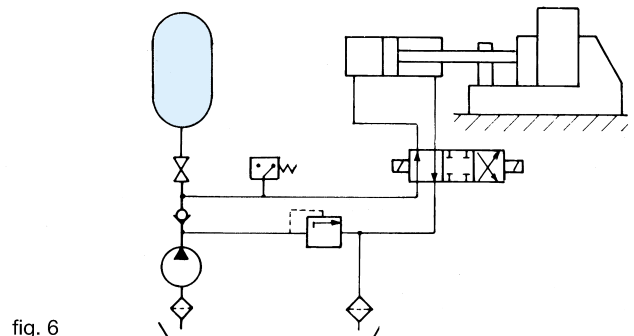
2.4 Volume compensator

In a closed hydraulic circuit a rise in temperature can cause an increase in pressure due to thermal expansion.

An accumulator installed in the line will protect the valves, gaskets, pressure gauges etc. Common applications are found in refineries and pipelines.

2.5 Pressure compensator

When a constant static pressure is required for a long period, an accumulator is indispensable as it will compensate for pressure loss due to seepage through joints, seals etc. as well as balancing pressure peaks which may occur during the operating cycle. Typical applications are found in closing systems, fig. 6, loading platforms, curing presses, machine tools, lubricating systems, etc.



2.6 Counter balancing

The balancing of a force or weight can be achieved by using hydraulic pistons driven by an accumulator, thus avoiding the use of counterweights with attendant dimensional and weight saving. Typical applications are in machine tools (fig. 7), hoists etc.

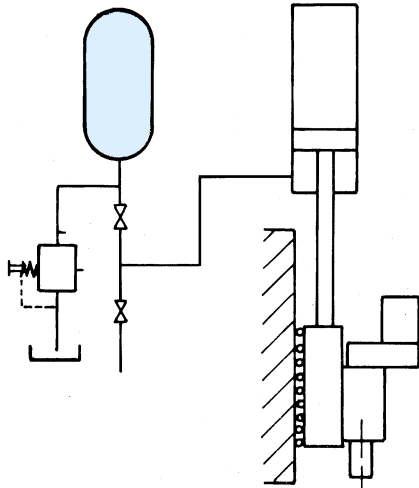


fig. 7

2.7 Hydraulic line shock damper

Rapid valve closure can produce shock waves (water hammer) resulting in overpressurisation of pipes, joints, valves etc. The use of a suitable accumulator can neutralize or significantly reduce the shock. Typical applications are water (fig. 8), fuel and oil distribution circuits, washing equipment etc.

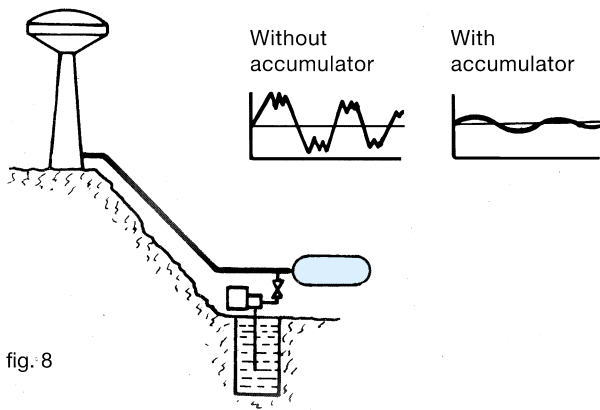


fig. 8

2.8 Shock absorber

Mechanical shocks in hydraulically driven equipment can be absorbed by accumulators. Possible applications are in drive and suspension systems for fork-lifts, mobile cranes, agricultural and civil engineering machinery etc. (fig. 9)

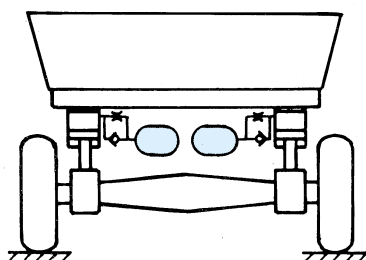


fig. 9

2.9 Hydraulic spring

The accumulator can be used with advantage as an alternative to mechanical springs, e.g. deep drawing (fig. 10). The thrust can be easily controlled with great accuracy over a wide range of pressures by oil pressure control without the need of springs or supports.

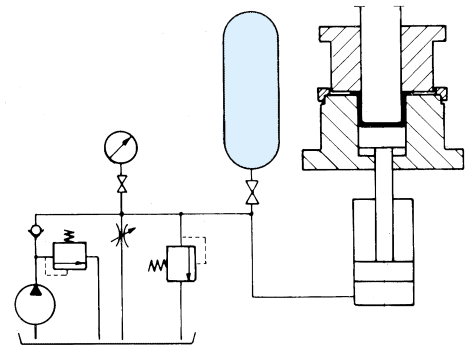


fig. 10

2.10 Fluid separator (transfer barrier)

Fundamentally the accumulator separates two fluids (in the case of hydraulic applications nitrogen and oil). However, the accumulator can be used when pressure has to be transferred between two incompatible fluids, hence the name TRANSFER. Fig. 11 is a simplified diagram for a fatigue test of a vessel "S" using water. The initial pressure pulse is generated by piston pump "P" using oil. An equal volume and pressure is transferred to the water into the vessel by the accumulator. Many similar applications are found in the petro-chemical industries.

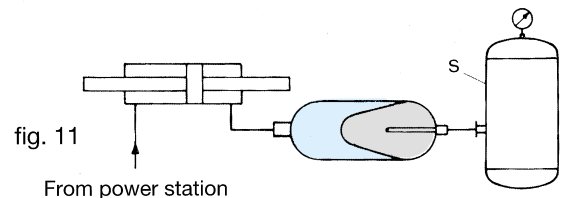


fig. 11

Fig. 11A shows a typical application of TRANSFER between a liquid and a gas by using an **accumulator with additional gas bottles**. This application is especially convenient in those cases where the amount of liquid required is quite large compared to the small difference between the operating pressures. To reduce the total capacity, therefore the number of accumulators required, the volume of available gas is increased by connecting the accumulators to additional gas bottles (refer to Section 3.11).

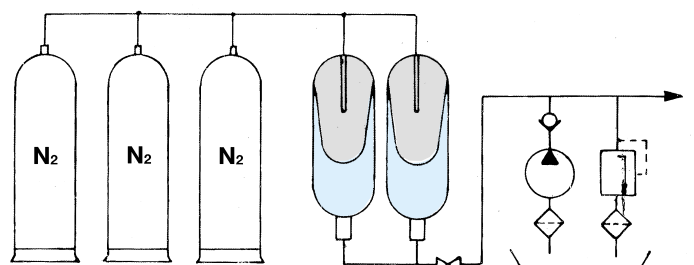


fig. 11A