

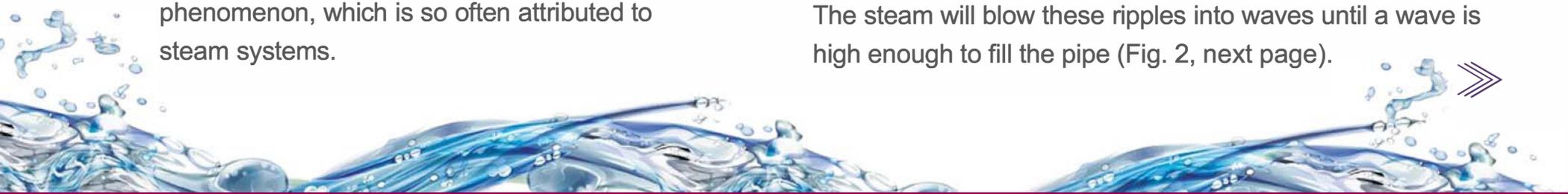
INSTANT KNOWLEDGE – WHAT IS THIS PHENOMENON CALLED WATERHAMMER?

For many years waterhammer was regarded as being an inherent problem associated with all steam systems. But why was this so? Is waterhammer really to be expected in all steam systems?

The simple answer is no. Any system which is properly designed and operated will never experience this phenomenon, which is so often attributed to steam systems.

HOW IT IS CAUSED IN STEAM SYSTEMS

Water is, for all intent and purposes, incompressible. In a steam system, normal steam flow is at probably some 35 m/s (68.90 ft/min). If water (condensate) collects in the bottom of a badly aligned pipe (Fig. 1, next page) then this steam velocity will cause ripples on the surface of the water. The steam will blow these ripples into waves until a wave is high enough to fill the pipe (Fig. 2, next page).

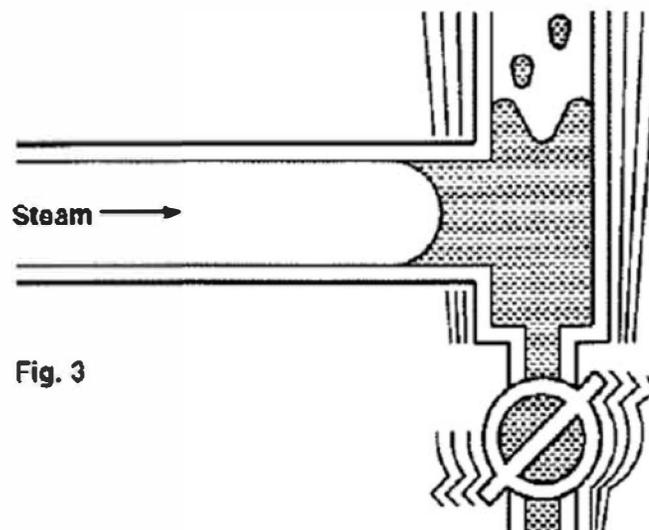
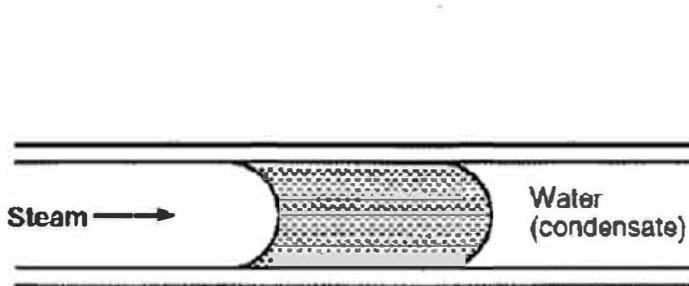
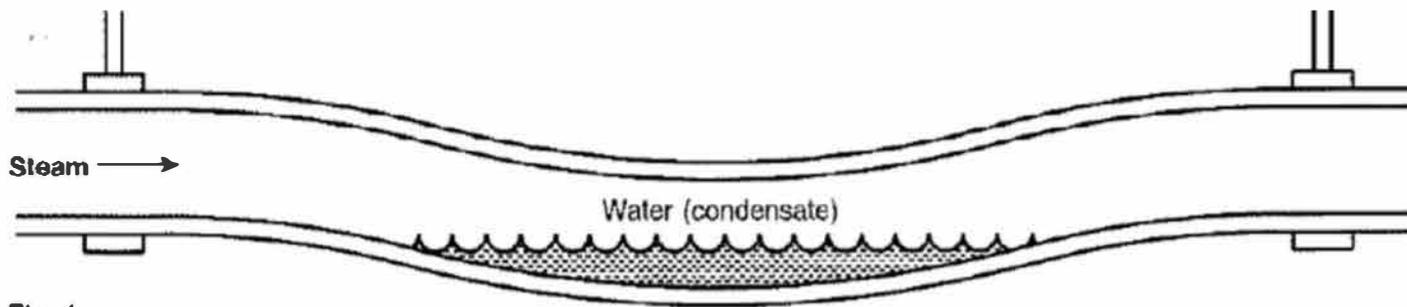


There is then an incompressible liquid piston traveling along the pipe at steam speed.

THE DAMAGE IT CAN DO

This whole pocket of water, picked up by the steam and carried forward in solid column, is taken to some point down the line where there may be a change of direction or

obstruction such as a valve (Fig. 3). The water is brought to a sudden halt and the energy which it has by virtue of its movement (kinetic energy) is suddenly converted into pressure energy. This sudden pressure may do a lot of damage. Waterhammer can damage steam traps, valves, steam meters, reducing valves, make joints leak and can even fracture pipes.



HOW TO PREVENT IT

Waterhammer must never be tolerated. If it is due to the condensing of steam during distribution in steam pipes it can be eliminated. Proper alignment of the piping system ensures a continuous fall in the direction of flow and this must be combined with an adequate number of good drain points. It is particularly important to drain any low points in the system and make sure that steam traps are working properly.



Fig.4

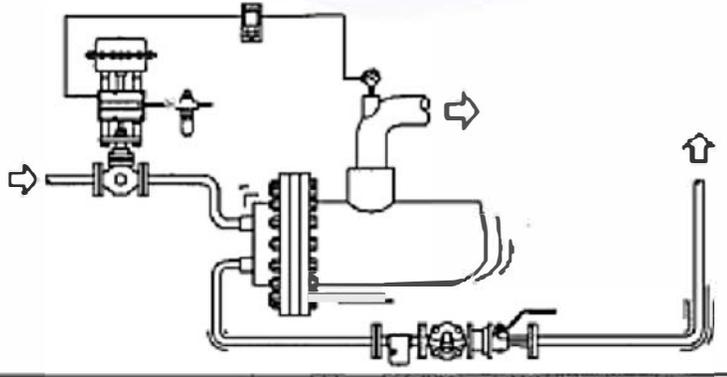
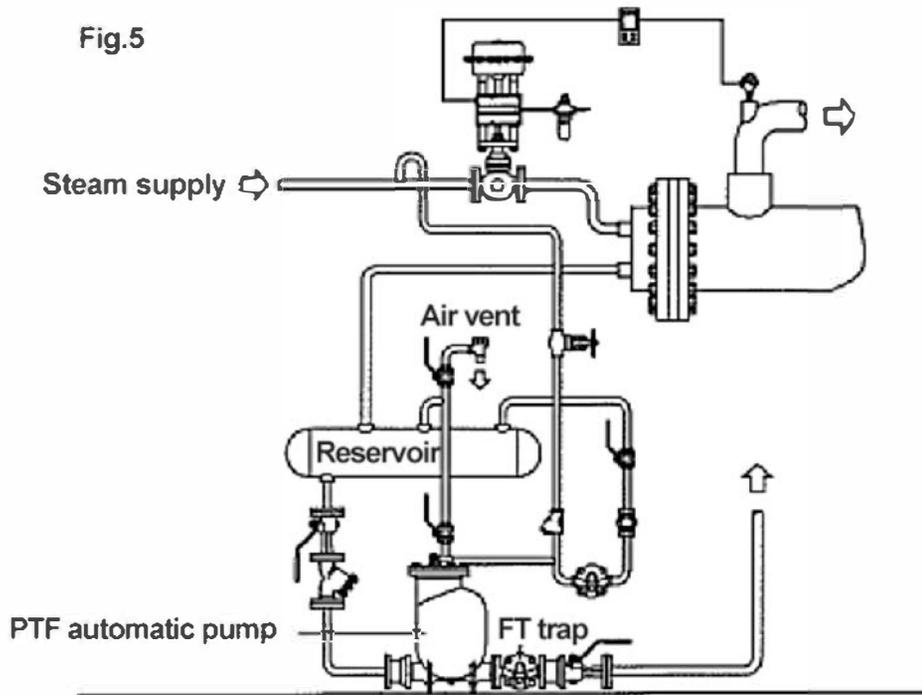


Fig.5



Waterhammer may also occur in process plants if the pressure in the steam falls below that at the trap outlet so that condensate discharge stops. This will almost certainly happen if condensate is lifted after the trap into a high level return line and the steam inlet to the plant is throttled by temperature control valve. As condensate builds up in the steam space, the process temperature will fall causing the control valve to open wide and steam to rush into waterlogged plant producing severe waterhammer (Fig. 4). Here the cure is to discharge condensate by gravity from the steam trap to a receiver vented to atmosphere and then lift the discharge separately to high level by means of a pump. Even here it is still possible for the steam space to waterlog should the steam supply be throttled enough for a vacuum to form. This can usually be dealt with by fitting a vacuum breaking valve on the plant.

A vacuum breaker will however admit air and this in itself is not a desirable situation. It is better to try to remove the condensate under both pressure and vacuum conditions and this can be achieved by using a pump-trap combination (Fig. 5). By equalizing the pump exhaust back into the steam space, condensate will always flow into the pump body. Steam pressure can then remove it through the steam trap.



“ It is clear from these examples that there is no reason for waterhammer to be a problem in any steam system... A properly designed and operated steam system is proven to be the most effective and safe method of conveying heat to a product or process. ”

It is clear from these examples that there is no reason for waterhammer to be a problem in any steam system. Old sagging pipework should be attended to, while boiler crown valves for example can be automatically actuated by a slow opening device which will ensure the very gradual warm up of the complete steam system. A properly designed and operated steam system is proven to be the most effective and safe method of conveying heat to a product or process. ■

FOR MORE INFORMATION

Have a question about waterhammer? Contact your [local Spirax Sarco representative](#) to identify potential problems and help select appropriate protection measures.