

Kent & East Sussex Railway

Operating Department Mutual Improvement Class

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Safety Valves

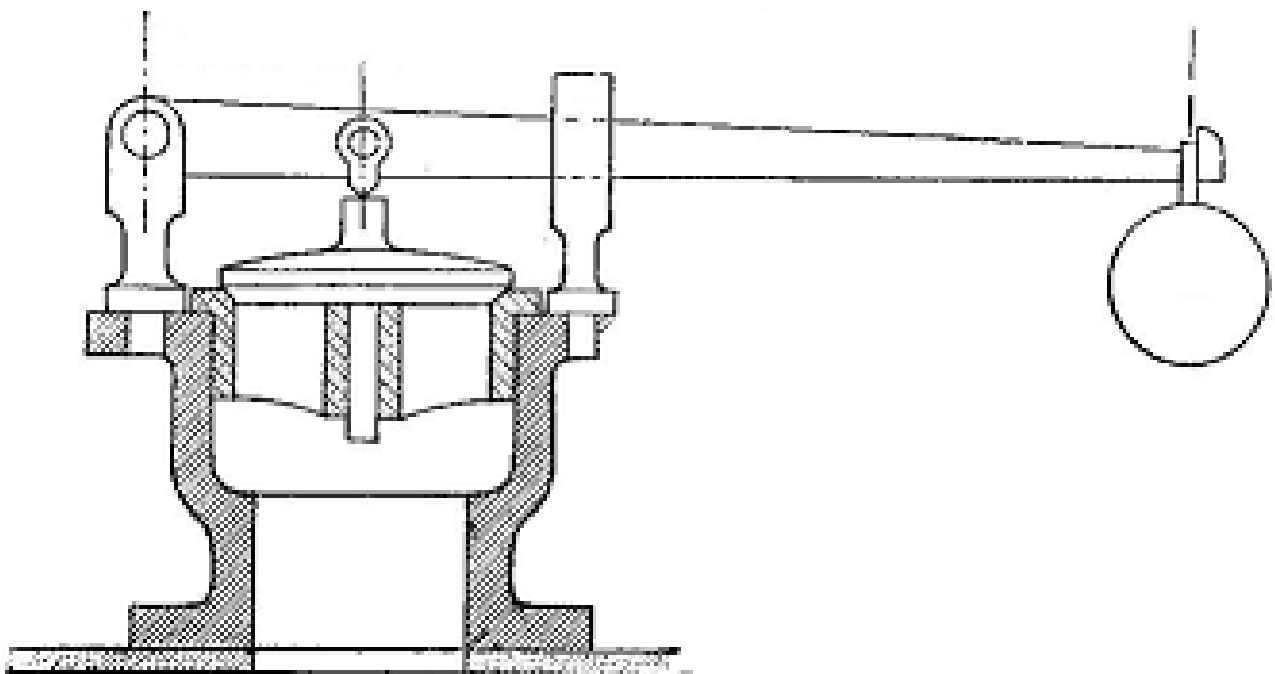


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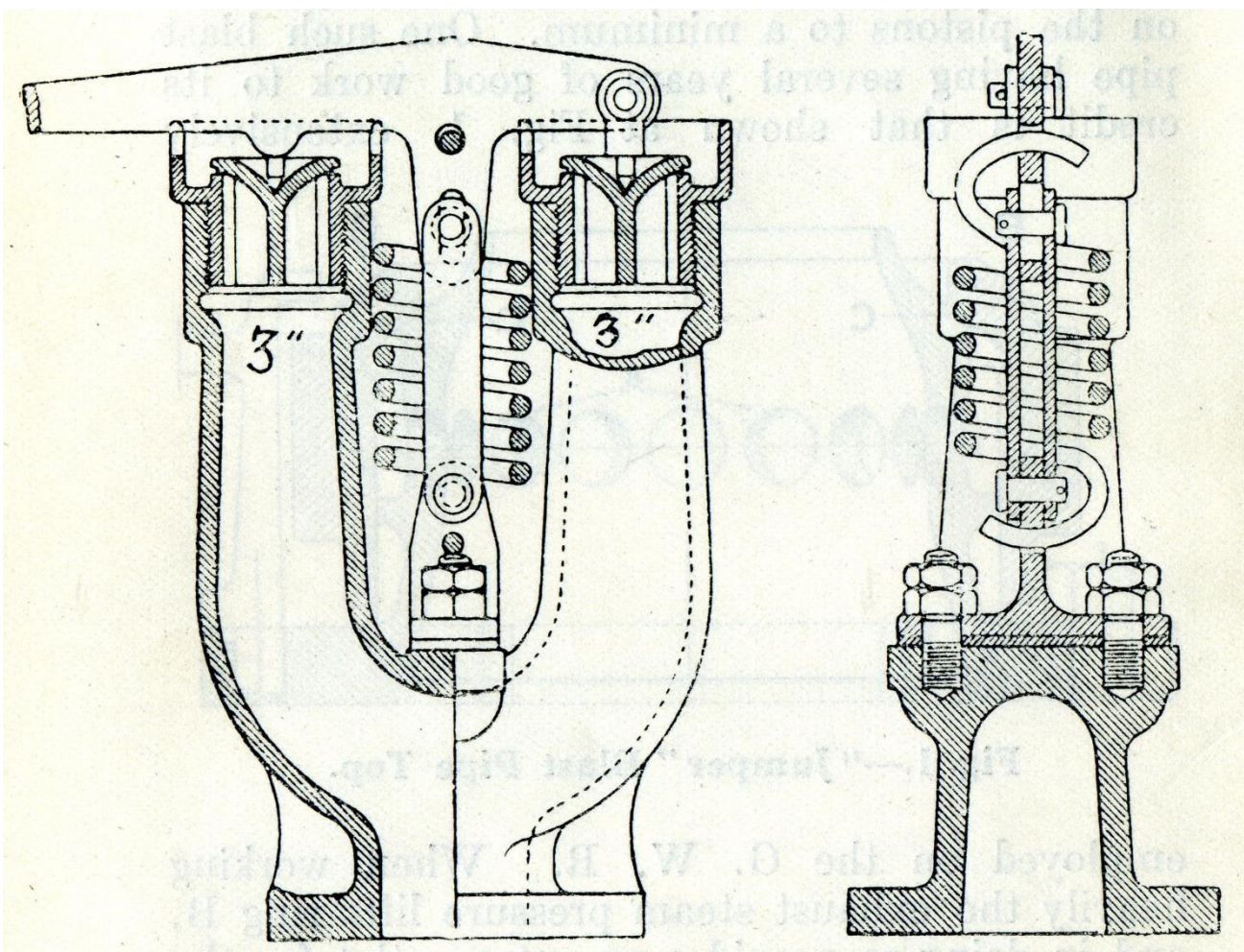
All steam locomotive boilers are fitted with safety valves. The function of these valves is to ensure that the pressure in the boiler does not rise above the permissible working pressure by automatically discharging steam from the boiler. Each locomotive must have a minimum of two safety valves fitted. The safety valves are directly connected to the boiler with no intervening pipework and are unable to be isolated from the boiler in anyway. In the UK there were two common types of safety valves. On older locomotives Ramsbottom and Salters safety valves were used but on later designs Ross "Pop" safety valves were incorporated as these were deemed to be a better design in terms of operation and efficiency. In the earliest form, the safety valve comprised of a long lever with a weight on the end, that applied enough force near it's fulcrum to keep the valve closed until maximum pressure was reached.



These safety valves however were easily tampered with and it was not uncommon for crews to lean or place weights on the levers to increase the maximum pressure allowing their locomotives to perform better. This sometimes led to fatal consequences when boilers failed and exploded because of the higher than expected pressures. Various experiments were tried with springs but it was found that these too could be irregularly adjusted by the crew and were not really suitable. However in the UK three main types of safety valve were developed and used:

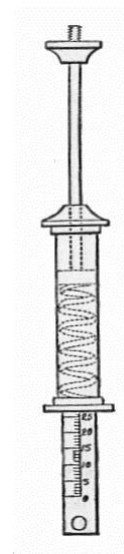
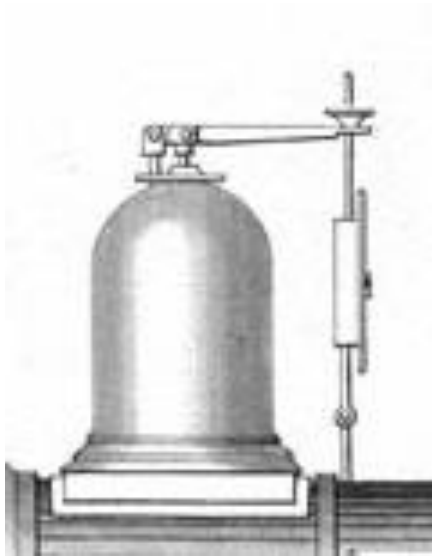
Ramsbottom Safety Valves

In 1856 John Ramsbottom invented a type of safety valve that partially prevented crews from interfering with its operation. This design is characterised by two vertical outlet tubes, which are capped by two inverted cones. The individual valves are placed along the centre line of the boiler and are separated by a single vertical coil spring in the middle. This spring is connected to a lever (which protrudes into the cab) that holds both valves shut. If any improper force is applied to the lever, it will increase the pressure on only one valve but release the pressure on the other (due to the lever being pivoted between the valves) making it lift at a lower pressure. The disadvantage of these valves is that they are “progressive” in the way they open and shut. This means they have to be set to start to lift early to ensure that the pressure does not exceed the maximum permissible pressure. These valves also have a habit of “dribbling” until the pressure is well below normal working pressure.



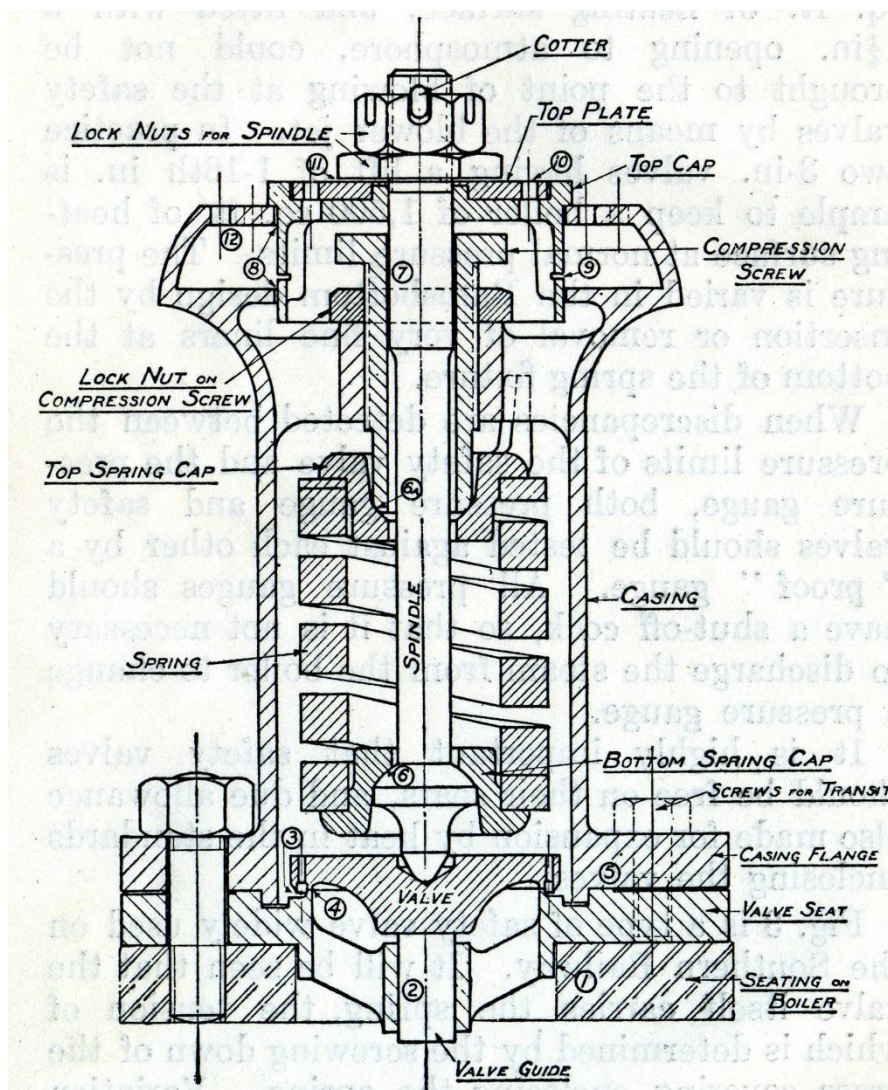
Salter's Safety Valves

Salter's valves which can be described as an indirectly loaded valve, have a spring tensioned lever with the spring contained inside a tube usually with thumb screw adjustment. These springs replace the weights found on early weighted valves. The valves were often fitted with collars to stop the locomotive crews from tampering with the safety valves. These valves were invented prior to the adoption of dial pressure gauges and the brass cases were sometimes graduated to indicate the boiler pressure at which the valve would lift.



Ross "Pop" Valves

The "pop" valve was invented as a way of overcoming the disadvantages of a safety valve that progressively opened and shut, thus wasting steam. These safety valves are arranged in such a way that after the initial "lift" of the valve has occurred there is an increased amount of area in the valve for the steam to act on causing the valve to instantaneously open completely. This allows an escape of a large amount of steam in a "pop" action that led to its name. When the pressure drops, these valves also close instantaneously causing the valve to seat firmly. This stops the valve from "feathering" and wasting steam. Another advantage of these valves, is that they can be set very near to the maximum permissible pressure allowing fireman to keep the boiler at high pressure where necessary without the valves feathering or blowing early.



If a safety valve is suspected to be defective or the boiler pressure rises above the red line marked on the locomotive's pressure gauge it should be reported to the Locomotive Department Person In Charge. Only competent staff must carry out work on safety valves.