“The leaching of Zinc”

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I quote from a trusted reference source: -

“Leaching is the selective corrosion in which one element is removed from a solid solution alloy. The gradual loss of zinc from brass **(dezincification)** is perhaps the most well-known example of this type of corrosion, other……….”

“In each case, initial corrosion dissolves both components of the alloy, but the more noble metal, copper in this case, is then precipitated from the solution at the surface. This leads to increased solution of the parent alloy due to galvanic effects and hence further deposition of copper. ***The overall effect is to reduce the surface and underlying regions of a component to a spongy mass of material with significantly reduced mechanical strength, leading to possible collapse under normal working stresses***.”

….. and that’s exactly what happened to me!

After many years’ service my five-inch loco’s boiler failed (but not due to dezincification) and I replaced it, seemingly giving the old gal back her youth. She steamed so easily and driving was effortless once again, although until I got used to it, more opening of the fire door to stop her blowing off! But then, during a busy public running she abruptly slowed to a crawl on our gradient after the tunnel. Calamity! …. with regulator wide open I was reduced to a fraction of the usual power.

There was clearly an obstruction in the steamways somewhere. First suspect was the regulator itself, a usual disc and tube arrangement …. so out it came, with once again the expected difficulties that come with working in the confines of a scale smokebox with room for only part of a twelve-inch-to-the-foot hand, and spanners that turn union nuts just twelfth of a turn at a time. The suspect item was examined, cleaned, (no scaling), and a couple of minor bits showing some wear re-made. Back in it went, and many hours later the loco was ready for steaming. Onto the track … no change! Still only minimal power.

Now, a big advantage of being a member of a Club is the huge amount of experience of others that you can draw upon. And so it was to be …. exhaust passages blocked? Valve timing slipped? But surely not affecting all four cylinders? Desperation crept into my mind, but having laid her on her side and running on air, mechanically she was given the all-clear by a couple of our members who had taken an interest.

Only one thing left …. the superheater. Out it had to come accompanied by the usual skinned knuckles, and it was given a blast on the airline. All seemed clear, but in the opinion of two learned colleagues there was some resistance felt when blown into 'manually'; and I had to agree.

Unusually for a GWR 'King', my failed boiler had only a single large fire tube, and I specified similar for the new boiler into which the co-axial superheater fits. This comprises a half inch bore copper tube silver soldered into a combined wet & dry header. No means of taking things apart, so only one thing for it … the hacksaw. Slicing the firebox end off revealed all, and a very sorry turn of events it was. The tube had a brass, yes, brass, longitudinal separator. I guess the principle being that when running, the pressure differential on the brass strip will press it onto the tube wall creating steam-tight separate passages for wet and dry steam. Over an inch or two of its length this strip had broken into a number of small pieces, several of which are in my photo. In daylight they were more the colour of copper, and could be snapped in the fingers quote easily …. fitting perfectly the text book description of ***"… reduced mechanical strength leading to possible collapse".***

So, there it was, these bits of dezinctified brass together with others that I lost before taking the photo, had conspired to bend, break and lodge together causing a considerable reduction in the flow of steam.

It could, and did, happen to me!

At the beginning of this tale I said that my boiler had failed, and you might have wondered how? The answer is in the photo below, taken through the firehole door with the boiler full of water and pressurised to a couple of bar. Tiny jets of water can be seen at failed joints of a couple of tubes and the backplate. When I bought the loco, both the seller and I had assumed that the boiler had been entirely silver soldered, but it transpired that all those years ago the firebox tube plate and tubes had in fact been 'Comsoled' by the original maker.

Attempts to re-solder the joints by one of our most experienced members who kindly helped out proved futile, mainly because of the difficulty in getting enough heat in such a confined space, and problems in cleaning the copper surfaces adequately. So a new boiler it had to be.