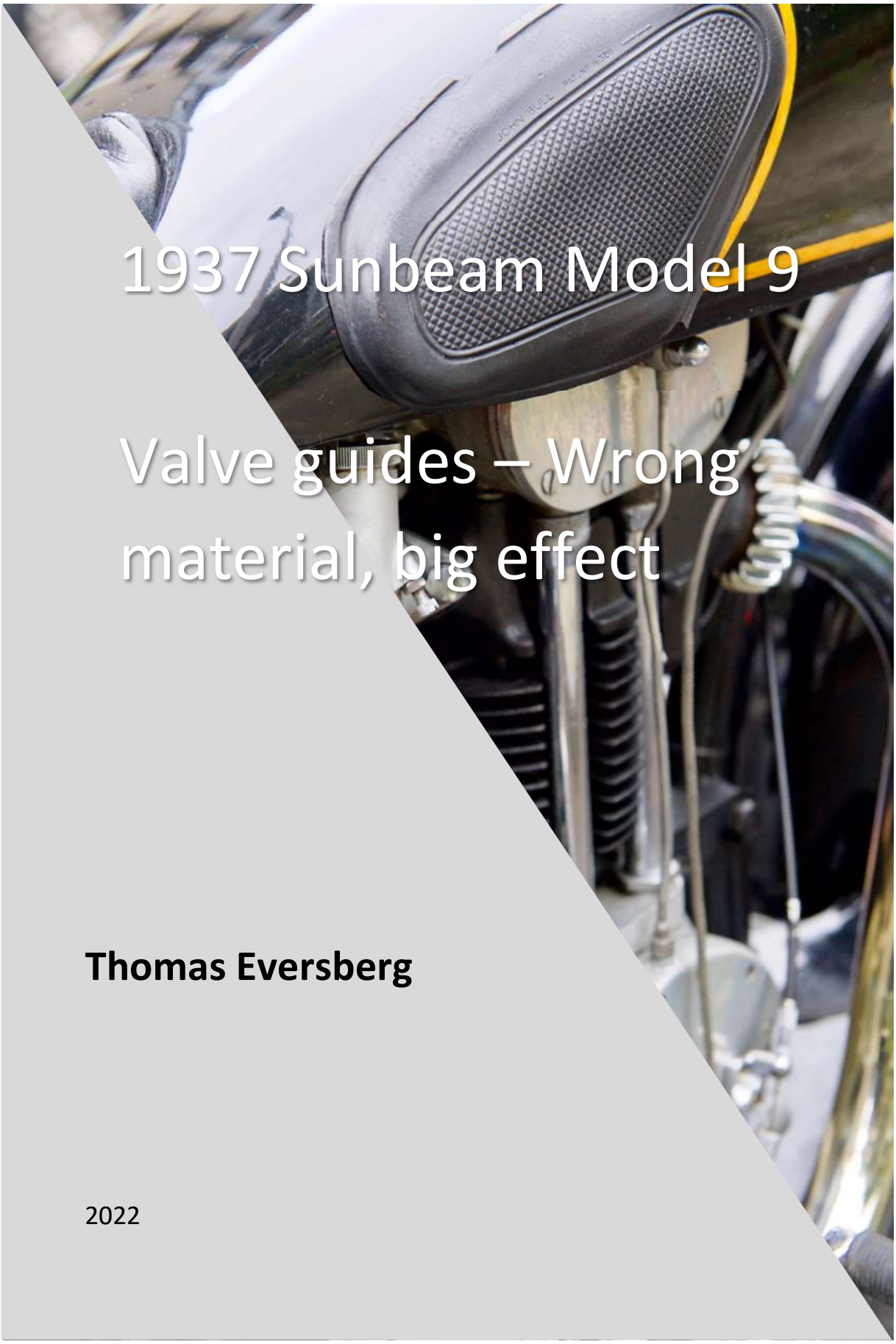


1937 Sunbeam Model 9

Valve guides – Wrong material, big effect

Thomas Eversberg

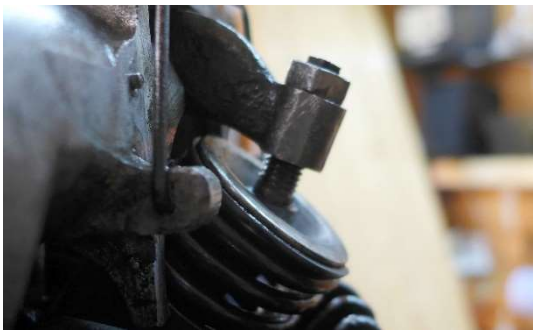
2022

Content

In summer 2022 my wife and I were in the Alps with my 1937 Sunbeam Model 9. The plan was for an 18-day tour that turned into three days. What happened?

No adjustment possible

After passing Faschinajoch and Silvretta Pass, I realised that the engine was heavily oiled. Later at home, I discovered that the oil supply pipe in the head was overflowing on the inlet side because of a too small clearance between valve and guide. The assembly accepted much less oil than normal. This was annoying but it would not damage the valve assembly. However, at a 14% climb towards a hotel high above Sölden, the engine lost power and exhaust gases were forced through the carburetor. The exhaust valve had extreme clearance of a few millimeters, so it did not open sufficiently. In addition, the hardened valve cap had fallen out (I found it later between the fins of the cylinder head) and the clearance became even larger. An adequate clearance adjustment was no longer possible and the geometry between valve stem and rocker arm tappet was no longer symmetrical. We had to return and drive another 100 miles without the valve cap (the valve tip was later slightly deformed but could be flattened again).



At home I found that the surface hardening of the exhaust side follower was breached and worn. Through emails and phone calls with Chris Odling, I learned that an oil feed to the exhaust valve guide is not necessary. Such engines run "oily" and one can feel it on the oily soot with fingers. On the later Sunbeam motorcycles like mine from 1937, it was common that only the inlet valve was lubricated. And bronze, often used for modern machines, is not a suitable material because one would have to allow too much clearance not to jam the valve stem. And exactly that happened with my exhaust guide. A few weeks before our trip, I needed new valve guides and asked my local engine shop to make two. The inlet valve and its guide are lubricated through a small feed in the rocker box by an adjustable taper valve (half a turn of the screw is just fine). The exhaust valve is not, though. The engineers meant well and used a "material that requires little lubrication". In fact, they had installed a bronze guide contrary to the information on the drawing. The exhaust valve was jamming, giving excessive resistance through the rocker arm and pushrods, and wearing out the cam follower (note that the coefficient of thermal expansion for Bronze is about 50% larger than that for iron so that the bore diameter respectively decreases). This in turn increased the gap between the cam follower and rocker arm. Valve clearance grew dramatically, necessarily changing the geometry at the valve tip, which was then deformed on one side. Instead of bronze, the valve guides should be made of SG cast iron (grade 250) with a 1/1000-inch fit in the cylinder head. The clearance in the guide on the inlet side should be 1.5 thou and 2.5 thou on the exhaust side. The guides in the club shop do not distinguish between these two values, though. As a rule of thumb, one should feel the clearance by inserting the valve into the guide and just feeling a very tiny movement on the valve disk at the inlet. At the exhaust port, one should feel the valve move noticeably. The clearance specifications refer to cast iron. At least for my 1937 Model 9 the inlet guide needs an oil feed hole in the correct position.

Chris had reworked my cam followers and had them hardened so that everything is in order again. He also gave information for making my own guides, which I report here (if it's not already somewhere):

After machining on the lathe, one needs to heat treat the valve guide by heating it to a dull red (not a bright cherry red) and quenching it in water. One should drop it into a column of water so that the bore of the guide is quenched and hardened evenly. In the process, the guide will "grow" a bit after this heat treatment. The diameter of the press fit is then polished and inserted. The finished bore of the valve guide must be smooth and clean. A drill cannot do this. It should either be reamed or honed to the proper size. Normally, the valve guide bore has an inside diameter of 0.375" and the valve stem is ground in with clearance. However, there are variations. For example, Chris' and also my tulip valves from GS Valves have a stem diameter of 0.373". They are made of a modern austenitic stainless steel and are nitrided. For original valves, one should check the stem diameters for ovality and diameter over length.

Acknowledgements

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