



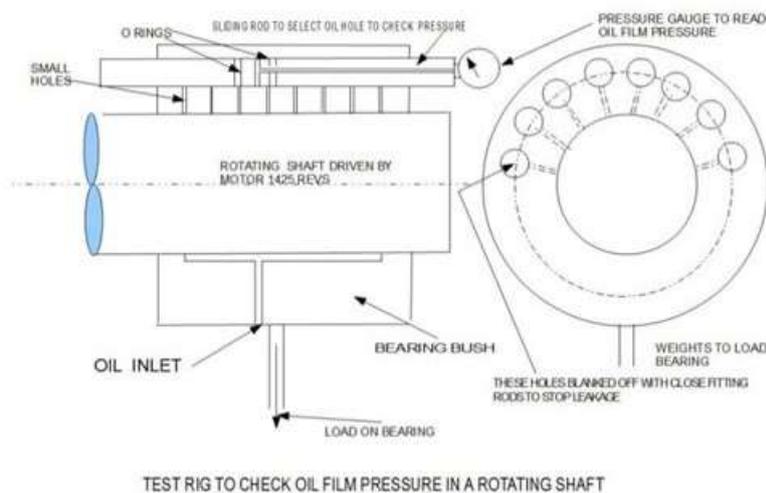
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Axle Box Oil Holes

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Something that annoys / irritates me whenever I read ME or EIM. Nearly all designers of model locomotives put an oil hole in the top centre of the axle boxes on locomotive drawings. This is the worst possible place that oil can be introduced into a plain bearing. Oil should NEVER be added to a plain bearing at the point of the highest loading, which in an axle box is where the locomotive weight bears down on the axles. If you examine the crankshaft of a motor car engine the oil is always put into the big end bearings on the underside of the journal, i.e. the unloaded side.

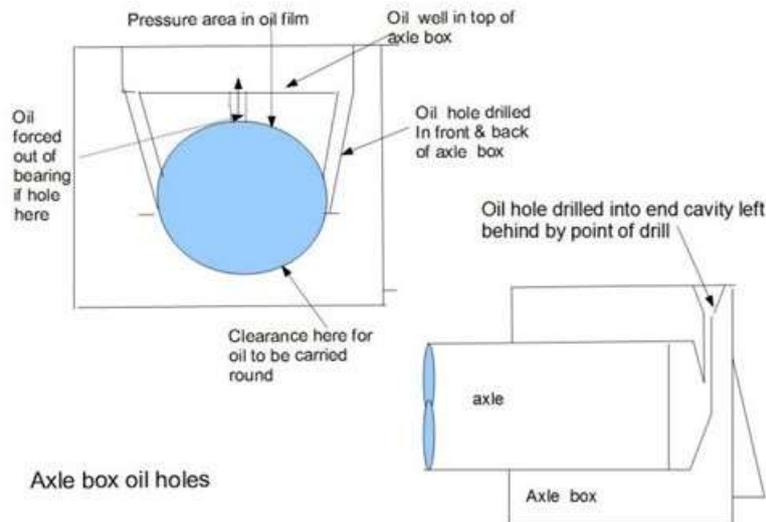
When an oil lubricated bearing is rotated, oil is carried round between the moving surfaces. This is squeezed into the loaded areas of the bearing, keeping the bearing materials from touching each other. This generates pressure in the oil film, and this pressure exerts a force keeping the shaft and the bearing material apart, equal to the load on the bearing. This load in our case will be the weight of the locomotive. This pressure is called, I believe, hydro dynamic pressure, but I am recalling it from my memory.



If an oil hole is drilled in the area of high pressure, it lets oil escape, and the oil film pressure is destroyed. Oil can be observed being pumped OUT of the bearing which will result in metal-to-metal contact and a high rate of wear.

When I was a student at the local engineering Institute there was a rig in the lab to measure the oil film pressure generated in a running bearing. One of the tasks that we were given was to plot the pressure at various points in the bearing, and then calculate the force pushing the bearing and shaft apart. The downwards force on the bearing could be changed by applying weights to the rig. It was always found that the oil film pressure force was equal to the load applied to the bearing My

drawing shows how the oil pressure was measured. By means of a drilled rod that could be moved to line up with tiny holes drilled in the bearing, the oil pressure at that point was read off on a pressure gauge. Oil was fed into the bearing on the non-loaded side [bottom] at zero pressure from a small cup. The drillings that were not being used were blanked off by other close-fitting rods. The rod with the pressure gauge fitted was moved sideways to plot the pressure along the length of the bearing and then switched over with a non-drilled rod to plot another set of holes until all parts of the bearing had been surveyed.



Coming back to our models, it is far better to put oil holes at the front and back of the axle bearing, leaving the area at the top of the axle box as an unbroken area. My own practise is to machine in a small well on the top of the axle box and drill a hole front and back to break into the bearing as shown in my sketch. This provides oil to the unloaded area of the bearing which ever direction the locomotive runs. I do know that there are load forces applied to an axle box from the piston thrust, ie backwards and forwards, but these are much lower than the weight of the locomotive and are intermittent as the locomotive moves the same problems occur when a hole is drilled up the axle and a cross hole is drilled across the axle. This also releases the pressure in the oil film as the axle rotates. Yes, I do know that it is easier to oil the axle boxes but that does not stop wear from poor lubrication. When grease is used as a lubricant a different set of conditions exist and the above does not apply. The same must be said for ball races for these are rolling contact bearings. The lubrication is mostly used to oil the ball race cages, not the contact surfaces. When we come to axle boxes on our tenders the same thing applies to holes drilled in the top of the bearing surfaces. I always drill an oil hole into the hollow space at the blind end of the box which is left behind by the point of the drill. The oil is then able to run down into the clearance underneath the axle, from where it is carried over to the top of the axle. There is then no hole for the oil film pressure to leak from the bearing. The choice of oil is another factor in the lubrication of highly loaded bearings such as our axle boxes. I have always used oil from Halfords, using a gearbox oil with the suffix EP 80. The letters EP mean that it is an oil with additives to give a film that will stand extreme pressures in a bearing without breaking down and allowing the bearing surfaces to touch, causing wear to occur. The figure 80 is the viscosity of the oil, which is an easily poured viscosity to be suitable for use in an oil can, I have had no need to do any repairs to the axle boxes of any of my locomotives over the last thirty years, and they have all done a high mileage. I hope that this is of help and our model engine designers will refrain from oil holes drilled into the top centre of axle boxes in future.

