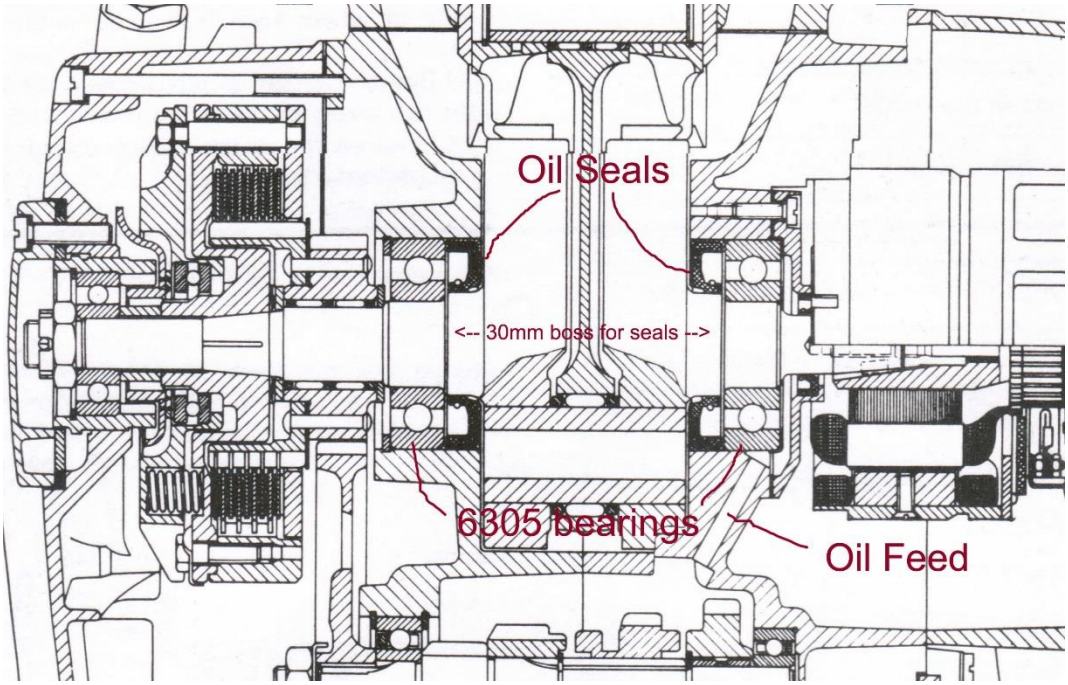
Fitting a Supa5 Crank in a 4 speed 250 MZ motor

History:

Traditionally all MZ250 motors including the 175 and 300 variants employed a crankshaft where the main bearings were lubricated by oil from the gearbox so that only the big end and small end depended on petroil lubrication. This always seemed to me be a very elegant design but MZ abandoned it with the advent of the Supa5 motor and all later ETZ derivatives– possibly because low gearbox oil levels could starve the main bearings of lubrication, especially on the dynamo side. As part of this redesign the crankshaft was modified so 4spd and 5spd cranks are not directly interchangeable though the extremities are identical; both share the same clutch on one side and dynamo rotor on the other. The differences lie closer to the flywheel. The table shows the bearing and seals sizes for both motors:

	Type	Internal bore	External Diameter	Width
4spd	6305	25	62	17
4spd	Seal	30	62	10
5spd	6306	30	72	20
5spd	Seal	25	72	7



The schematic (From the TS250 Workshop manual – hopefully no longer copyright) shows the bearing and seal layout for a 4spd engine. You can see the seals are inboard against the flywheel cheeks and the bearings are outside the seals. On the clutch side the bearing is fully exposed to gearbox oil, on the dynamo side the bearings is sandwiched between two seals and there is an oil feed from the gearbox with a drain hole lower down (not shown in the picture).

The 5spd crank is very similar, the 30mm boss is wider (20mm) to hold the 6306 bearing and the design of the big end bearing is different. The Supa5 and ETZ250 cranks are almost identical – main difference is that the Supa5 crankpin diameter is 28mm and the ETZ250 is 32mm – (I believe the

later ETZ cranks went back to 28mm but that is of no relevance to this project). There may also be a slight difference on the tapers for dynamo and alternator rotor but again this has no immediate relevance to this project. Obviously the crankcases are different as the Supa5 has no oil feed holes on the dynamo side and the bore for the bearings is 72mm rather than 62mm. Timing side layout shown below, The drive side is a mirror image of this.

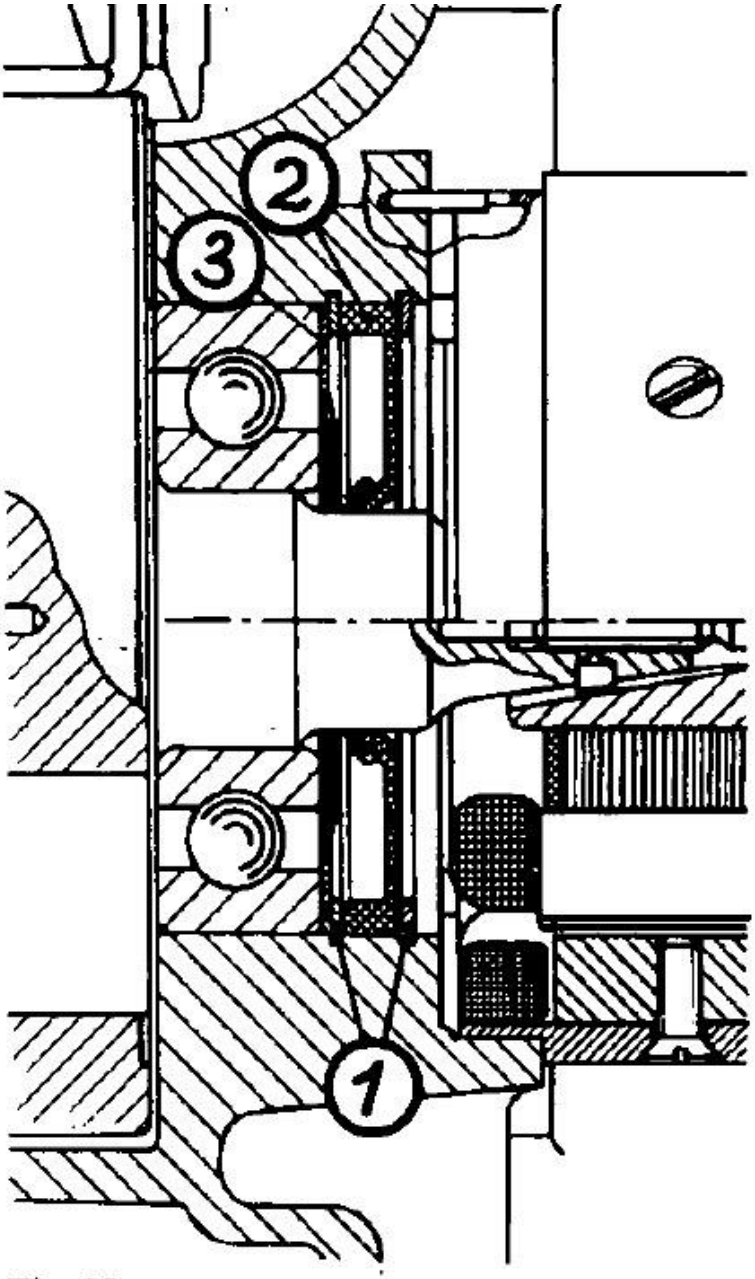


Fig. 16
Mounting the radial seal ring (2) and the oil guide disk (3)
The radial seal ring is retained by the circlip (1). The sealing lips of the radial seal rings at dynamo and clutch side point to the left
The oil guide disk (3) always contacts the outer ring of the bearing.

Start of the project:

The originator of this project several years ago was Ray Cattle and his motivation was primarily that he was given some roller bearings which happened to have the same 30mm inner diameter as the 6306 (Supa5 main bearing) and the 62mm outer diameter of the 6305 (4spd main bearing). He also had a spare set of 4spd crankcases (but no crank) but he did have a 5spd crank so decided to have a go. Ray and I were in regular contact about it for a while but my input was rather negative as I was concerned that using roller bearings on both sides of the crankcase meant there would be no lateral control. This is important in any engine but particularly so with the MZ design where the clutch is on the crankshaft and when operated, pushes the crankshaft to the right. Ray pressed on for a while – as you do but then other things gained priority and the project was shelved before final completion.

Fast forward to February 2016 and Ray had decided to give up motorcycling. He sold all his bikes and was finding homes for his considerable stock of the spares and paraphernalia. Much of this finished up in my workshop including the 4spd/5spd project engine.

Stage Two:

As received the engine was complete apart from the primary drive. There was an MZ alternator fitted but I removed this to take the pictures.

On the drive side you can see the oil seal (30x62x10) is now external. On the 'timing' side you can just about see that the same size oil seal is also external though it is mostly hidden by the securing plate. The oil feed holes from the gearbox have been filled with resin and screws fitted inside the cases as well. There is a red herring in the timing side picture; Ray was also trying to fit an ETZ alternator in place of the dynamo and the cases have been modified to facilitate this. The alternator conversion will not figure further as to make it work correctly requires milling facilities and for me was not a priority. There have been several other articles in MZ Rider over the years for those wishing to do this. Nowadays its probably easier for Mr average (like me) to fit a Powerdyanmo kit than try the mods needed to fit an alternator to crankcase designed to take a dynamo. Fortunately, Ray's mods have not prevented a dynamo being installed.

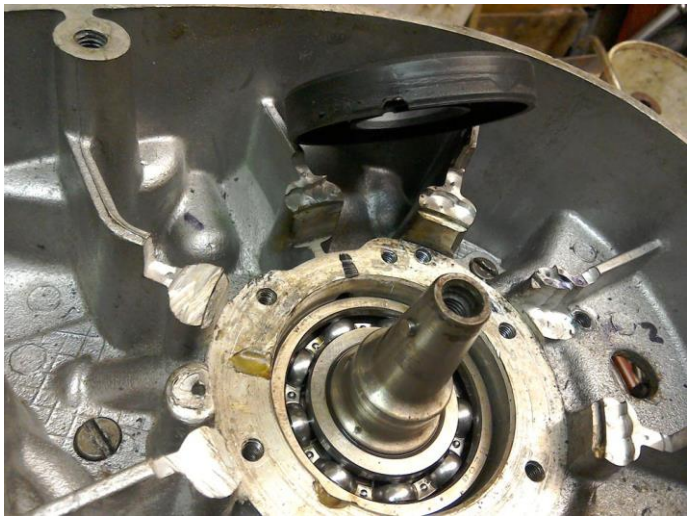
The crankshaft was mounted on two roller bearings 30 x 62 x 16. Though no lateral movement could be detected by hand it was clear that using the clutch would push the whole crank to the right probably making the flywheel cheek rub against the crankcase wall. I also found that the oil seal on the drive side

protruded too far preventing the clutch thrust washer from fitting correctly. Ray had also done a rather neat job of fitting an oil drain from the base of the transfer passage into the main bearing cavity on the drive side.

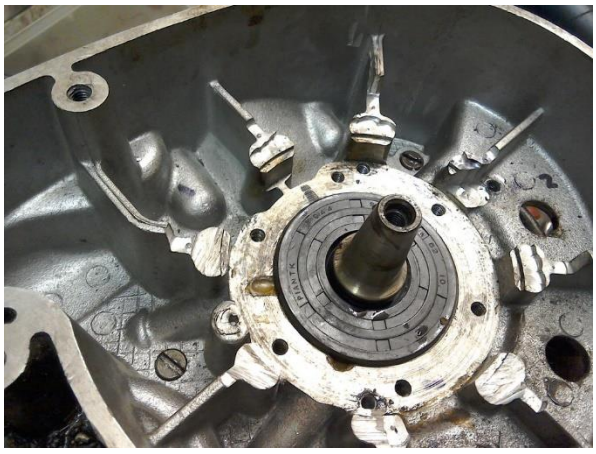
The rebuild:

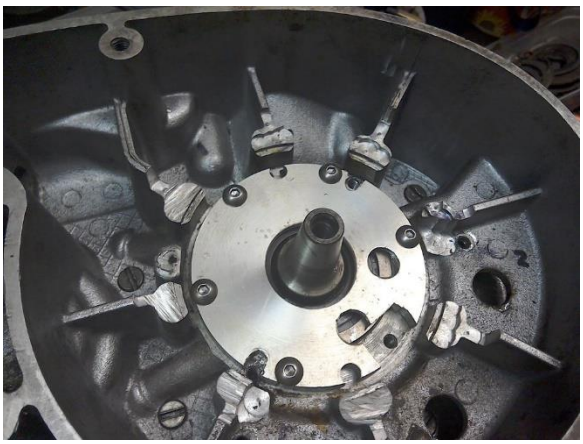
Having considered the matter I decided that I could build on Ray's initial work and complete the project. Studying a bearing catalogue I found that a 6206 bearing had dimensions of 30 x 62 x 16 i.e. exactly the same as the roller bearings already fitted so I ordered a pair. These are slightly smaller than the 6305 bearings fitted as standard to 4spd engines but discussing this with engineering friends they were considered well up to the job particularly as I planned to retain the roller bearing on the drive side.

The problem with the oil seal overlap on the drive side was easily solved. I simply turned the seal round (which then presents the same way as on the 5 spd engines for easy assembly). I found you could tap it in to the point where the original retaining circlip can be fitted. I squirted some oil through the new hole in the transfer port and oil emerged from the bearing so there is clearly still a small gap between seal and bearing; so far so good. This and the oil pipe from the transfer port can be seen to the right. I retained the roller bearing on this side.

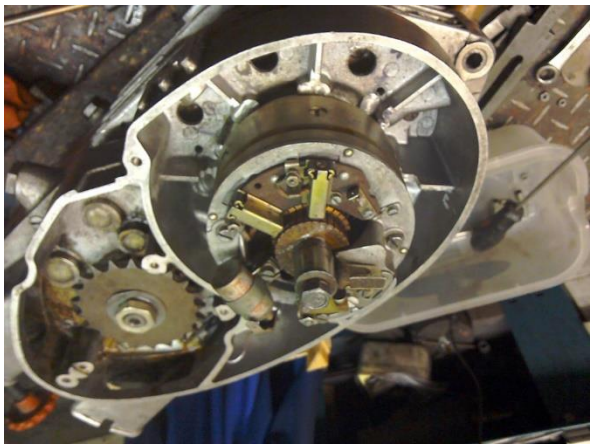


On the timing side I removed the roller bearing outer from the case and the inner track from the crankshaft. At this point I swapped the crank for another with a good big end; it was also from an ETZ250 because that was all I had and at the time I was thinking of using the alternator. The 6206 bearing was placed on the crankshaft and the cases reassembled (after heating the timing side case). Everything now lined up nicely and side float on the crankshaft was controlled by the 6206 deep groove ball bearing. At this point I found that the hole from the transfer port on the timing side case was actually open to the air. I had to dismantle the cases, drill it out to slightly under 6mm and fit a piece of 6mm tubing which was a firm fit. The cases were then reassembled and I was able to check that the oil drain hole was clear of the bearing. My plan was to fit the oil seal tight against the bearing to control movement of the outer race. To make sure there was a clear path for the oilway, I filed a gap in the edge of the seal. As its 10mm wide, a 1.5mm semicircle is not going to affect its performance. You can just about see the drain hole (below the blackmark) and the notch on the oil seal in the picture. The seal protrudes about 1.5mm from the crankcase and to hold it firm a cover is bolted over the top. This cover was very neatly made by Ray and is hollow on the inside to allow for the protusion of the seal. In practise, the standard MZ seal cover could be used but I didn't have one available so was happy to use Ray's creation. The cutout section is not significant to this project, it was connected with the alternator conversion





The final picture shows a dynamo refitted. All the modification are hidden so no one would know about the changes other than the alterations done as part of the brief foray into fitting an alternator. If I started from scratch with fresh crankcases this would not be needed.



Conclusion:

Firstly I must confess that the engine has not been fired up as it is destined for a TS250 rebuild project targetted for winter 2016/17 (using a frame from the 'Hoard'). However, given the minimal changes actually made in the end I can see no reason why it should not work. Starting from scratch and armed with the knowledge gained this is a very easy project with minimal cost. A pair of 6206 bearings and a pair of 25 x 62 x 10 oil seals is all you need (plus a 5spd crank obviously). Mods to the crankcases are limited to the blocking of the original oil feed holes from the gearbox and fitting drain tubes from transfer port to the main bearing housing. I am not sure that latter mod is essential but it's quite easy to do. Both mods can easily be reversed if it does not work. If I was going to retain a roller drive side bearing then on reflection it would probably be better to use a 7206 bearing for the timing side. This has the same dimensions as the 6206 but is an angular contact bearing designed to cope better with side thrust. MZ were happy to control this with a pair of ordinary deep groove bearings so a pair 6206s should be more than adequate.

I suppose The big question is why bother. Not sure I can answer that sensibly; for me playing around with MZ engines is a hobby (some unkind souls might say a sickness) and this is not the first special I have built. In general it's easier and cheaper to get hold of 5spd type cranks (especially the ETZ type) whereas 4spd cranks are quite expensive for some reason. One possible benefit is that crank seals could now be replaced without the need to totally dismantle the engine ala Supa5 and ETZ. Also if using a roller drive side bearing, splitting the cases is easy as the drive side bearing just slides out. Anyway, I enjoyed myself and perhaps the truth is closer to the famous mountaineer who was asked why he climbed a particular mountain; to which he replied – because it was there!

My thanks to Ray for giving me a chance to play with this engine. Now how do I go about building a 500 twin?

Update June 2018

Subsequent to writing this article, I acquired a second pair of crankcases from a TS250. I rebuilt the engine into these cases largely because I was unhappy about the machining that had ben done to rays original cases for the alternator conversion. I felt that the dynamo stator was no longer properly supported. With this rebuild, I did not bother to drill drain holes from the base of the transfer ports as I could not see that they were needed. Neither the 4 speed motors nor TS125/15 motors have such drain tubes. In all other respects the engine was built as per the above description and I plan to try it out shortly in a TS250 I am rebuilding.

One other interesting fact I discovered later was that the ES250/1 motors used a supa5 style crankshaft and the same bearing/seal configuration that I Ray and I chose. So there should e no reason why it won't work.

Update April 2020

In early 2019 I finally fitted the engine into into its intended home, the TS250 4sp built from the hoard. The good news was that it started and ran without any issues. The not so good news is that the gearbox whined like a banshee making it thoroughly unpleasant to ride. So the Supa5 engine was replaced and the hybrid engine sat under the bench until March 2020.

I had just bought a Supa 5 based Trail bike rolling chassis and needed an engine to check out various things. The hybrid engine was all that was available so in it went. The bike is not yet raod legal so riding has been limited to a a few laps of the garden but it is constantly being started to test out exhaust options and the electrical system and performs perfectly. The gearbox issue has not manifested itself so far but I think it was most apparent in 3rd & top whereas only 1st & nd are usable within the limits of my garden. My plan is to strip the engine to examine the gear cluster just in case it was an assembly problem. Failing that I have an old ES250/2 engine which is known to have a good 4 spd cluster and a transplant will be attempted.