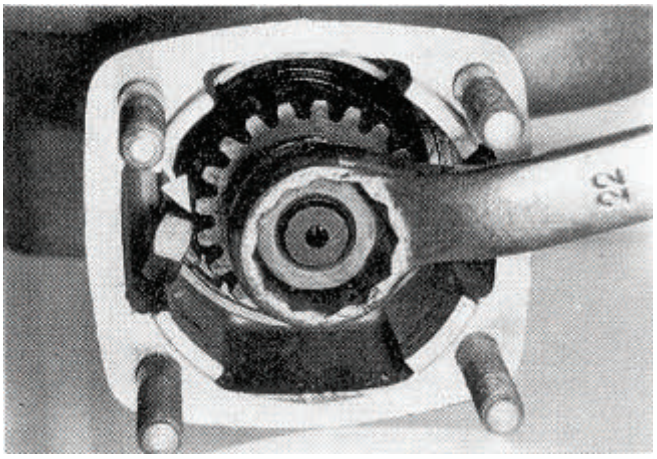
ASSEMBLY AND DISSASSEMBLY

The workshop manual explains very well how to work on the reardrive. But here are some extra tips.

After removing the cover from the casing, I first make a tooth contact pattern check on the old gears for two reasons. First it doesn't harm to get some practice. Second, you need to know if it was correct in the first place. When choosing shims, the manual tells you to compare the numbers printed on the old and the new gearset. but when it was completely wrong to begin with, that doesn't make sence anymore.



The nut on the pinionshaft is very tight, so you need a special tool to keep it from rotating. A usefull trick from "1000 tricks fuer schnelle BMW's" is shown in this picture.

As usuall on the BMW, everything is a tight fit. So, in case of doubt, heat helps.

As you can see in this picture, it doesn't need to be high tech. You can also see that you can work al-

most anywhere, although you do need a stable and clean worktable.

Heat is good, but watch out with heating bearings directly. They are easilly overheated, which reduces the steels hardness.

To remove the large needle bearing for the crown wheel, heat the case and hold it upside down, it just falls out. The small bearing of the pinion has a tighter fit. Here it helps to strike the casing on a block of wood after heating. The shock will free it.

You need a special tool to unscrew the large pinion clamping ring. I made one from a suitable piece of steel tube. Normally it has four studs of 6x6 mm, but in my case the ring was butchered into a custom shape. So I had to make a custom shaped tool. When it is very tight, heat helps again.

The bearings from the crown wheel are easilly removed, just follow the manual. The pinion bearings are more difficult though. The double ball bearing can be pulled of with a standard bearing puller if you want to use a new one. But when you want to reuse it, you must somehow let the puller only act on the inside bearing race. I managed by cutting a suitable flat ring into an U shape. But even then I had to clamp the puller in a vice to prevent the legs from spreading out. I didn't manage to remove the inner race of the pinion's needle bearing. So I bought a new bearing instead.

I mounted the bearings with the 10 ton press of our local garage. That is a lot safer, easier and quicker then bodging with amateur tools. You can use suitable sockets as press tools, only for the double ball bearing you need a stout steel tube with 20 mm inside diameter.

When you are mounting the bearings, make absolutely sure that they are perfectly seated. No dirt should be catched in between. Also make sure that the large screwthread of the ring that clamps down the pinion is still intact. In my case it worked alright, until it catched on some irregularity, stopping about 1 mm from the double ball bearing. It took some time before I understood what was wrong, in the mean time throwing up my shim job, because of the inconsistent postion of the pinion. That nearly drove me mad.

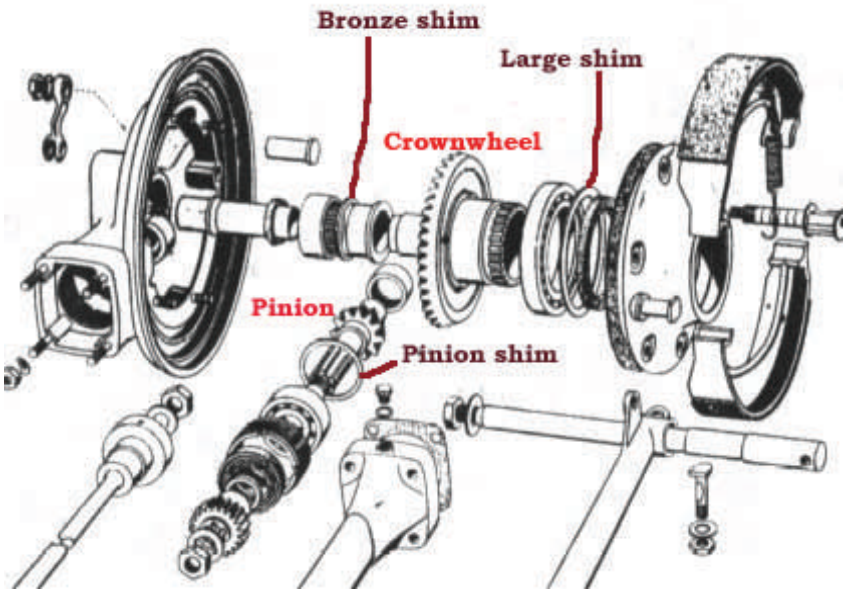
When installing the cover on the casing, the manual says to heat it first, so that it slides over the large crownwheel bearing when you tighten down the six screws. But apart from the bearing recess, the cover also has a centering ring that fits easilly in the case opening. But now the cover is hot and the case is cold, so it binds during installing. Thus it takes longer and before the cover is fully seated it cools enough to grip the bearing and clamp it very tight while you tighten the screws. That is not healty for a bearing. I see three solutions. Keep the cover hot while mounting with a butane burner. Or heat the case together with the cover. But I choose to mount the crownwheel first in the cover, using heat to let it slide in. While it cools of, I press it down with my thumbs to make sure that the shim(s) are fully flatened. Then I mount the cover plus crownwheel in the casing. Finally I heat the whole assembly again, until I can press on the crownwheel with my hands to let it seat in its normal position.

Wait with mounting the oilseals until you are completely ready with the shimming job. They are easilly damaged and they hinder when you are feeling for the tooth play.

On assembly you need something to protect the oilseal from the wheeldrive splines. A very good tip from the Rabenbauer website is to cut an empty Coke can in two halves. It has the perfect diameter and taper. Cut it with normal scissors and dress the edge until it is smooth. Oil the seals well when installing.

According to Rabenbauer's website again, the pinion oil seal should be mounted with the open end facing out, towards the driveshaft. This is also visable on those beautifull drawings that show the cardandrive with cutouts to demonstrate the innards. It was not visable in the parts diagram or the workshop manual. When mounted this way it prevents oil migrating from the driveshaft to the rearwheeldrive. Other leaks are probable along the threads of that large clampring and along the splines of the driveshaft coupling. Use some sealant to prevent this.

/2 REARWHEEL DRIVE



Installing new gears in your rearwheel drive isn't the easiest job on your /2. So I'd like to give some pointers to help you allong. Or to help you, when you farmed it out, with advice on checking the job of the professional. This document is not here to replace the workshop manual. You will need the manual for the normal procedure and for the technical data.

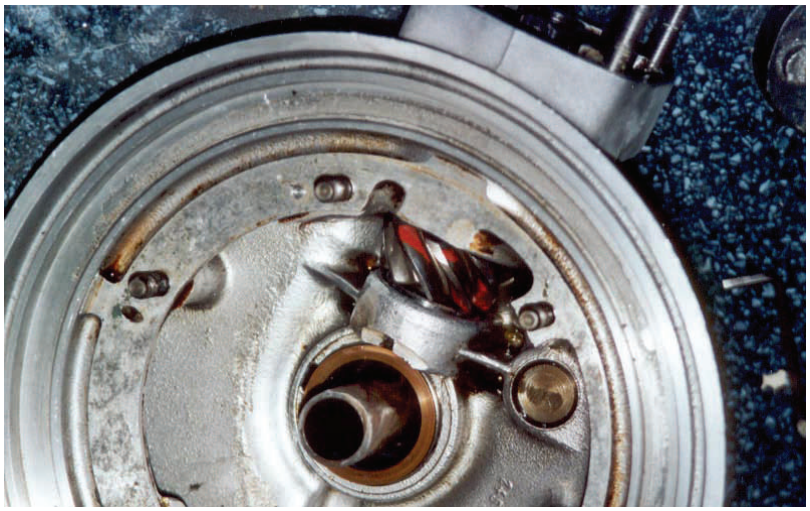
SHIM JOB

This is the most important, difficult and time consuming part of all. With the correct shim thicknesses you make sure that the gearwheels are properly contacting each other. Again, look in the workshop manual for the precise procedure. Here are some tips to help the amateur along. When you feel insecure about the whole business, or you don't have the proper tools, it is not a shame to bring it to a BMW mechanic. But when you get it back, I would pull the cover off and make a quick tooth contact patern check, just to be sure.

A note on orientation: You can position the pinion to the front and to the back, which means to the front and the back of the motorbike when the rearwheeldrive is installed

First, what shims should you buy? Hugget and Rabenbauer offer complete sets of shims with a small discount. That looks expensive at first, but you might end up with an almost complete set anyhow, when you are finished. The pinion shim is the only one where you have a chance of guessing the right size. According to H.J Mai in "1000 tricks fuer schnelle BMW's" the number that is printed on the gears indicates the size of this shim. So a +10 means a 0.10 mm shim between the bearing outerrace and the casing. BMW tells you to compare the number on the old gearset with the new set. Take the difference in account when you calcuate the shim. Now order the shim you just calculated and one size smaller and one size larger. There are also two shimsizes available that can be mounted between the bearings innerrace and the pinion shaft for negative numbers.

The bronce shim on the crown wheel is more difficult to guess. But you might be able to determine if it needs to be larger or smaller then the shim that was available, and then order all the sizes on that side of the spectrum. You can also make your own on a lathe when you have altered fosfor bronce in this size available. The shims that go under the large crownwheel ball bearing are virtually impossible to guess. So order a complete set of these.



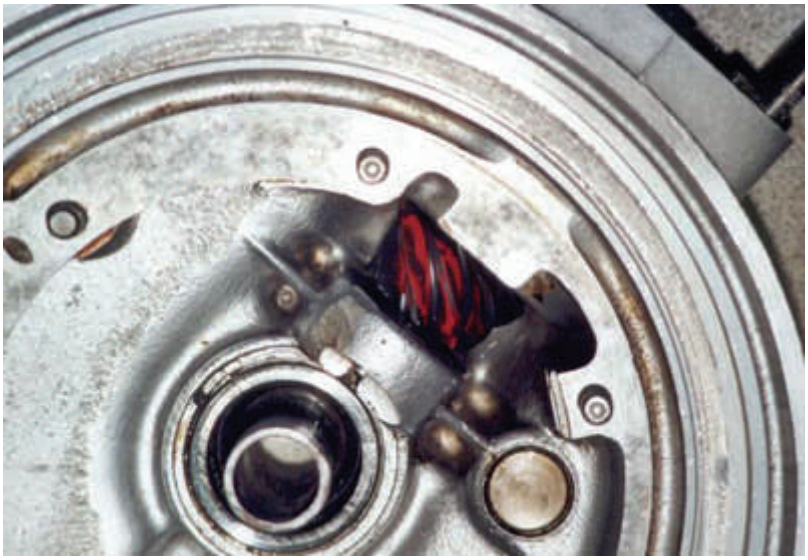
When I made a tooth contact pattern check on the old gearset, I found this. This is obviously very wrong. When I removed the pinion from the casing, I found a 1.2 mm shim, while the number on the gearset was +25. There were very obvious surface cracks on the corners of the teeth where those patterns are. Nonetheless it was still running quiet.

BTW, this was the only part that I didn't dismantle when I restored the bike. That was pretty stupid of course. When you restore a wreck, it is of no use to assume that anything is correct.

For the pattern check I used simple oil based household paint with some thinner. Smear it in a very thin layer on both sides of two or three teeth of the crownwheel. Then turn the pinion once in the normal di-

rection, and turn it backwards, so you get patterns on both sides of the pinion teeth. When the patterns on both sides of the tooth are spread apart as in this picture, it means that the pinion position is incorrect. According to the theory you will find both patterns on either the frontside or the backside of the piniontooth, when the crownwheel position is incorrect, but in my experiments I couldn't confirm this. It's easier to check the crownwheel position with the toothplay.

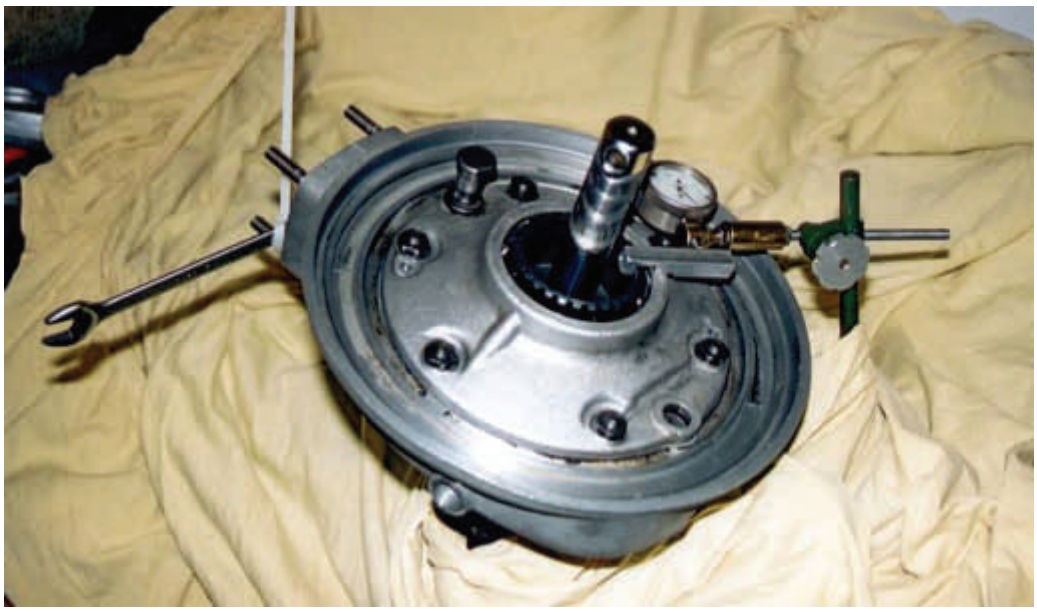
For a Klingenberg gearset, as used in most BMW rearwheel drives, the pattern should be in the middle of the tooth, maybe with a slight bias to the front, but definately not touching the edge at the back. I know that the sidecar gears of the R25 use Gleason gears. You can see the difference in the shape of the pinion teeth. Klingenberg has a tooth that is wider in the front and narrower to the back. The Gleason teeth are the same width front and back. A good pattern looks like this:



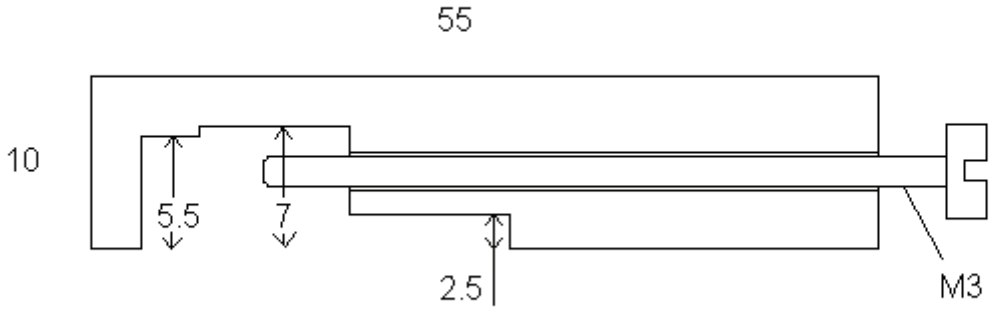
I did use a bit too much paint in this picture, wich makes it less conclusive. With a thin smear, it is very obvious what is good and wrong.

The paint is easilly washed off with some petrol. You must probably make several patern checks before everything is correct. I also make one final check, when everything is ready, just before I mount the drive on the bike. In that case, the crownwheel with bearing and oilseal is installed in the right position in the cover. You can now pull the cover and reinstall it whithout heating. Because I had troubles with the threads of the large pinion clamping ring, I got very confusing results, but when the threads were restored, it proved to be a very straightforward affair.

The next shim is the bronce ring between the crownwheel and the needlebearing. It is not just a shim, but also acts as an axial load bearing. The correct thickness is determined via the toothplay. To meassure the toothplay I use this setup:



The wheelaxle, combined with a steel tube of 20 mm inner diameter (the same as used to press the pinion ball bearing) is used to clamp the rearwheel drive in a vice. The pinion is blocked by mounting a 14mm ring spanner on the pinion shaft and then tying the spanner to one of the studs. To meassure the crown-wheel movement, I made a simple aluminium adapter that clamps on the wheel splines. Now you can meassure the toothplay. It should be between 0.15 and 0.20 mm, when meassured at the outerdiameter of the crownwheel. In this picture the casing is closed, but you can also meassure with the cover removed. Anyway, you should be sure that the crownwheel is resting on the bronce ring and the casing is not hot. Here are the dimensions of my clamping adapter:



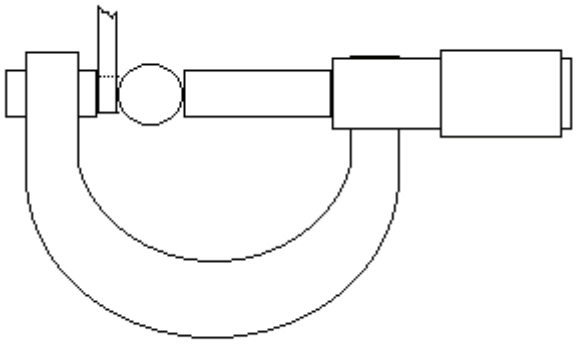
When you have all the available bronce shims, you probably still haven't enough. Those shims come in steps of 0.1 mm, while the toothplay has only a variation of 0.05 mm. And I was under the impression, that changing the shimheight by 0.1 mm was changing the toothplay about 0.15mm. You you will probably need to grind a shim down to the right size. You do this with some fine emerypaper on a glassplate. Check regularly with a micrometer that you are keeping both sides parallel. Check often, because bronce grinds down surprisingly fast. Clean the shim before you put it back in the rearwheel drive, you don't want silicone carbide in there.

The last shim is the shim under the large ball bearing of the crown wheel, that regulates the axial play of the crownwheel in the casing. This play should be about 0.05 mm, a very little bit. The workshopmanual describes how you can meassure this with a depthgauge and two prisms. But even when you have those meassuring tools, it won't be easy. A vernierscale, like on those depth gauges has an accuracy of 0.05mm (+/- 0.025 mm). You must make two meassurements and subtract these from each other. With a little bit

of bad luck you are 0.05 mm out. I don't have those tools, so I went for a trial and error method.

I removed the pinion, so it wouldn't interfere with the crownwheel. Then I choose a rather thick shim and mounted the crown wheel + bearing + shim + gasket in the cover and pressed it all the way in, until the cover had cooled off. Now I mounted the cover on the casing, feeling all the time if the crownwheel still turns. When it binds, you can play with different sizes of bronce rings or large bearing shims, until it just turn, with all the screws tightened. Now you have zero play. It's not so easy, becasue there is a gradual scale between tight and just turning. Anyway, you should end up with the correct bronce shim and a large bearing shim that allow free rotation of the crownwheel, while a combination of shims that are together just 0.05 mm thicker results in slightly tight rotation.

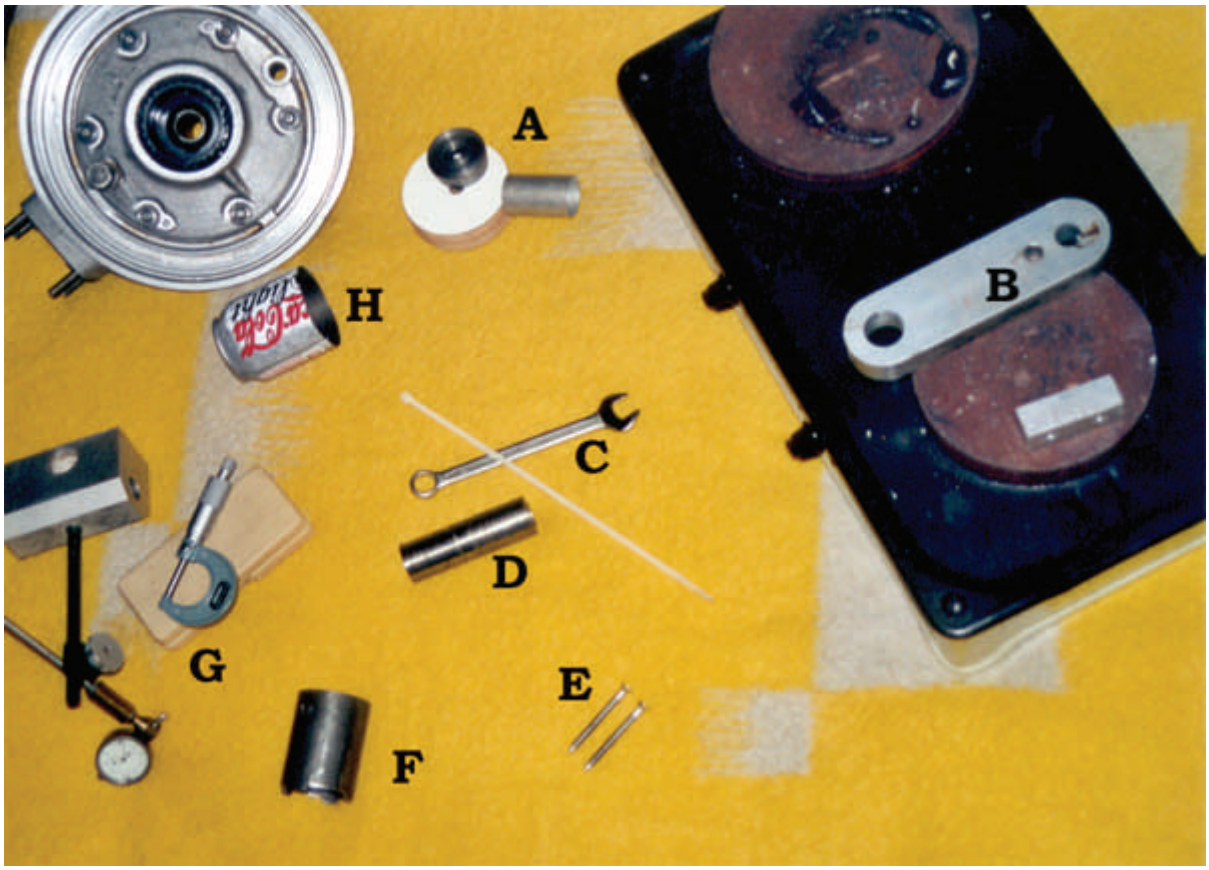
You probably need a shim that is again not in the normal series. You can't grind these, becaus they are too large and thin. You must stack two shims of smaller sizes, until you get at the right combination. For this, you need to know exactly how thick they are. The advertised sizes are just an approximation, and you must meassure them with a micrometer. But these shims have a burr, you can feel it with a fingernail, that interferes with the meassurement. You can use an accurate steel ball (from a ball bearing) to help you:



The burr isn't a problem when you install the shims, because there is room enough. When you think you have all the correct shimsizes, make a last contact pattern check and toothplay meassurement, with everything installed, exept the oilseals, just to be sure.

back

TOOLS



A Mandrels for pressing in the oilseals.

B Heating device with extra supports to position the parts.

C 14 mm ringspanner and ty-wrap to block the pinionshaft during measurements.

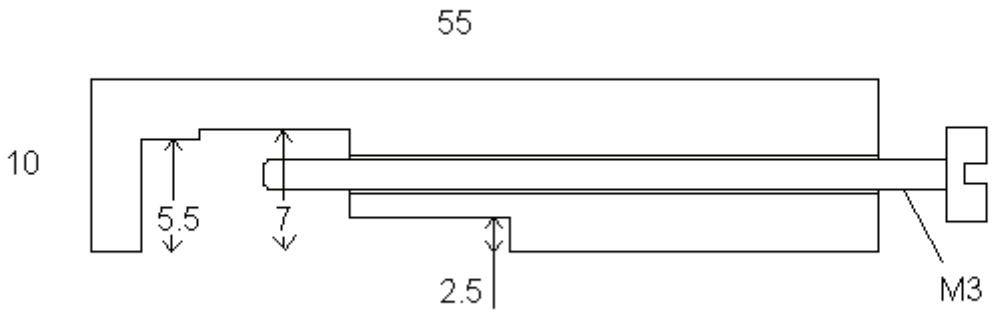
D Steel tube for pressing in the pignon ball bearing, and together with the rearwheel axle to support the rearwheeldrive in a vice. 95mm long. Inside diameter is 20 mm. Outside diameter is 30 mm.

E M6 screws to pull the cover from the casing.

F Special spanner for the pignon clamping ring. 4 Studs of 6x4 mm equilly devided over the circumference. Outside diameter 52 mm. Length about 15 cm. Drill a hole in the other end, so you can turn the tool with a

round bar.

G Meassuring tools, including clamp:



H Large oilseal protector, cut from an empty beverage can.

back