CARL F. W. BORGWARD GMBH

AUTOMOBIL- UND MOTOREN-WERKE

RE

Assembly and Adjustment of the "Isabella" Rear Axle (Group 060 60)

F I L E
PKW 1
FILE GROUP
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N U M B E R

Bremen, 10.12.59

Special Tools

1. "C" spanner (commercial) WK 138 45/50.
2. Drive flange drift WK 81.
3. Driving flange drawer WK 56.
4. Drive flange socket spanner WK 112.
5. Torsionmeter.
6. Differential nut socket spanner WK 139.
7. Differential assembly en measurement/ gauge WK 137.
8. Chock gauge with holder WK 144.
9. 110 ft/lb (15 m/kg) Torque wrench.
10. Spanner for special nut on axle shaft WK 150.

Assembly and Adjustment of Input Shaft Unit

(Sequence Fig. 1)

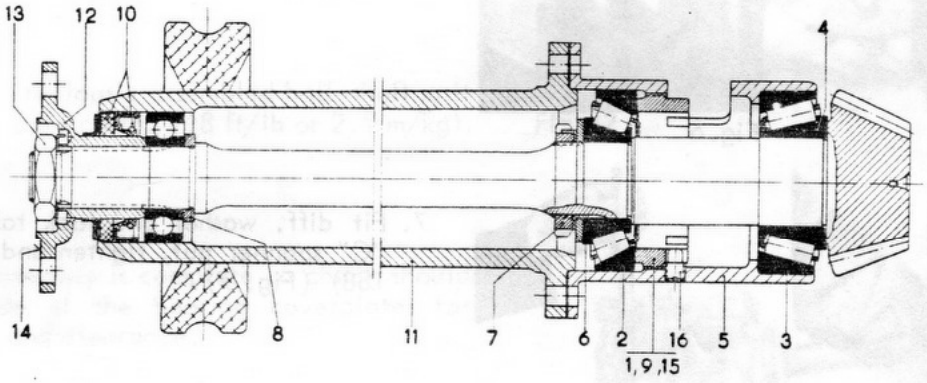


Fig. 1

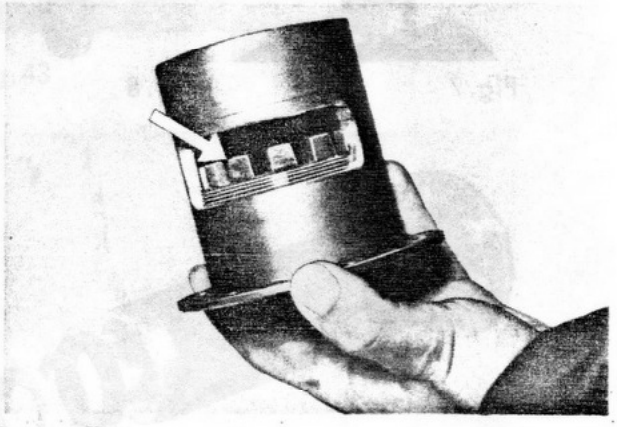


Fig. 2

1. Screw castellated (adjusting) nut a few turns into the housing (Fig. 2).

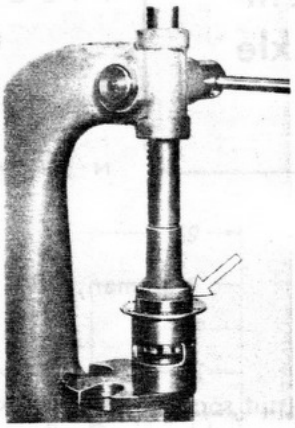


Fig.3

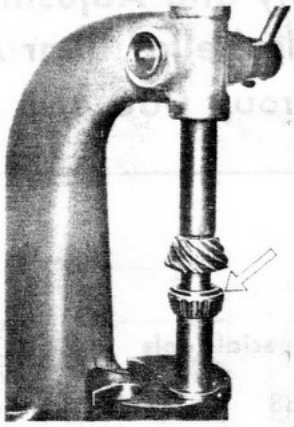


Fig.4

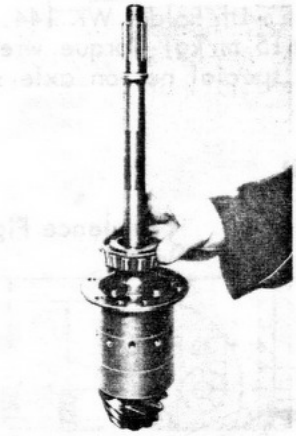


Fig.5

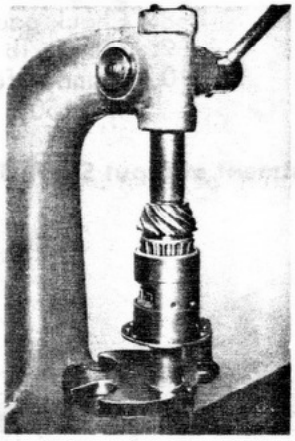


Fig.6

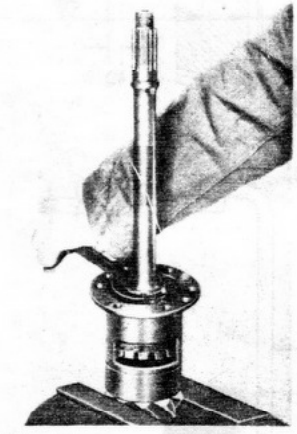


Fig.7

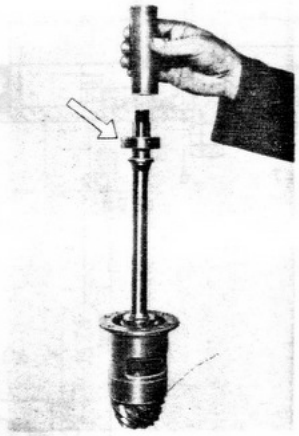


Fig.8

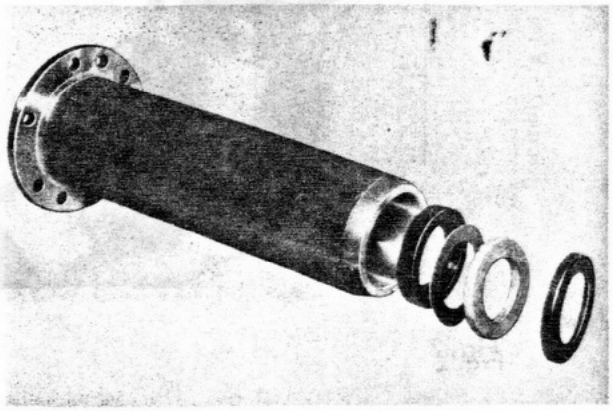


Fig.9

2. Press outer ring of taper roller bearing 30 306 into the ball-race housing (Fig.3). (Use suitable press).

3. Press outer ring of taper roller bearing 503 961 / FAG, 330 353 / SKF into the housing. The bearing rings being fitted with the taper surfaces outwards. (Use suitable press).

4. Press taper roller race 503 961 (FAG), 330 353 (SKF) onto the pinion shaft (Fig. 4). (Use suitable press).

5. Insert in bearing housing (Fig. 5).

6. Press taper roller race 30 306 on pinion shaft (Fig. 6). (Use suitable piece of tube).

7. Fit diff. washer and lock tab; screw on "C" spanner nut, tighten and secure (WK 138) (Fig. 7).

8. Fit distance piece with chamfer towards the flange and press on ball-race 6205 (Fig. 8). (Use suitable piece of tube).

9. Tighten down adjusting nut in bearing housing. (Final adjustment takes place in the last phase).

10. Insert oil seal, felt washer and felt washer holder in end of housing extension (Fig.9). (Use suitable press).

11. Press housing extension with paper joint onto pinion bearing housing, using two guide bolts (Fig. 10).

12. Fit driving flange. (First fitting rubber bearing for housing extension).

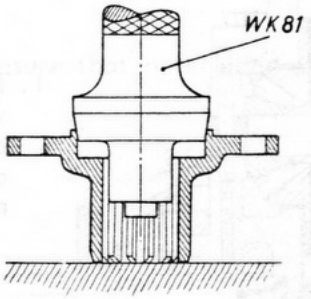


Fig. 11

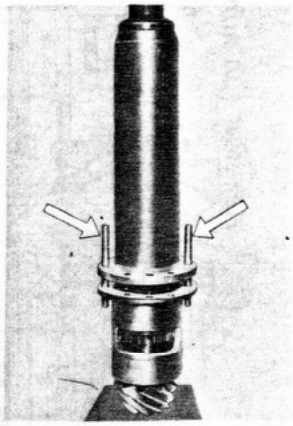


Fig. 10

13. Screw on hexagonal nut 000 992 01 00 with locking washer, tighten and lock. Use only correct nut with above Part No.

14. See flange turns true. When dismantling, mark the splines so that it can be correctly re-assembled. Should the drive be changed the flange should be drifted off and machined true in position on the shaft (Figs. 11 and 12).

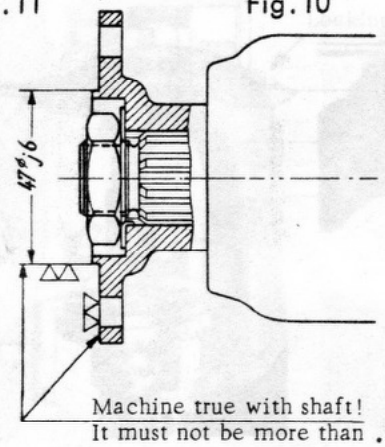


Fig. 12

Machine true with shaft!
It must not be more than .001' (0,015 m/m) out of true either axially or radially

15. Carry out fine adjustment. Loosen adjusting nut slightly. Turn pinion with torsionmeter fitted to flange, so that adjusting nut is drawn slowly up against the bearing (Fig. 13).

The adjusting nut is then taken up until a torque of .72 ft/lb (10 cm/kg) is necessary to overcome the bearing pressure when the pinion is turned. (Fig. 14). To effect the correct adjustment, the use of a torsionmeter is absolutely essential.

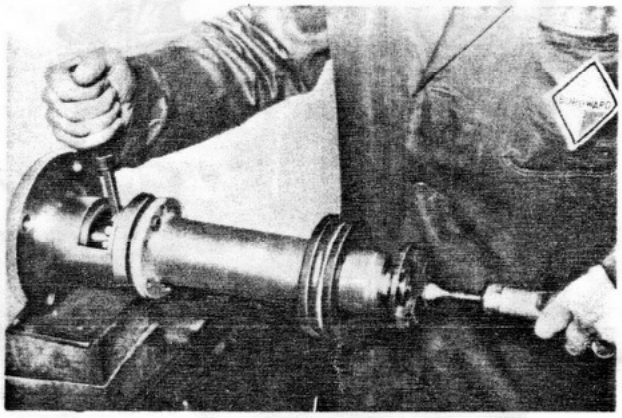


Fig. 13

Important! When re-assembling an used bearing, the resistance of the original assembly must be adhered to. With the torsionmeter fitted to the centre, the necessary torque can be applied to overcome the bearing resistance. Under no circumstances may the figure for a bearing that has been run in exceed .36 ft/lb (5 cm/kg) on re-assembly.

16. Secure adjusting nut. For this purpose, you will find a number of holes tapped in the housing, so that the nut may be locked in the required position.

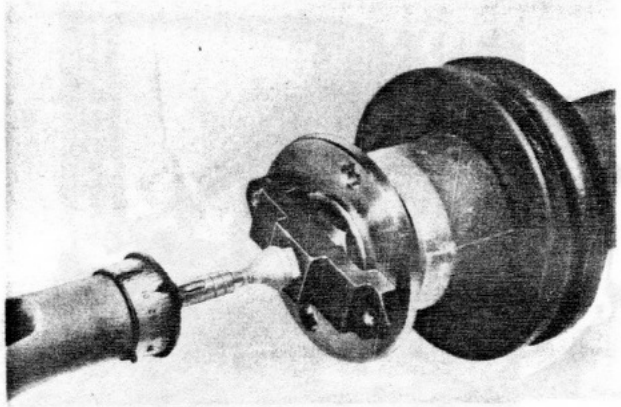


Fig. 14

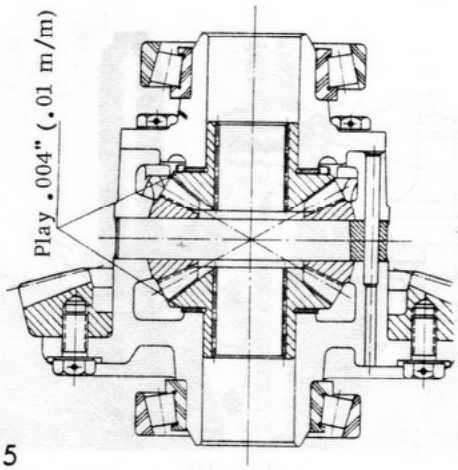


Fig. 15

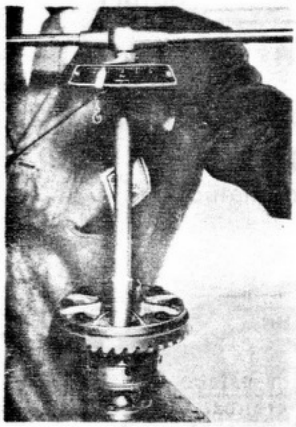


Fig. 16

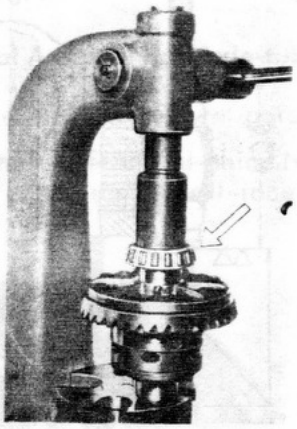


Fig. 17

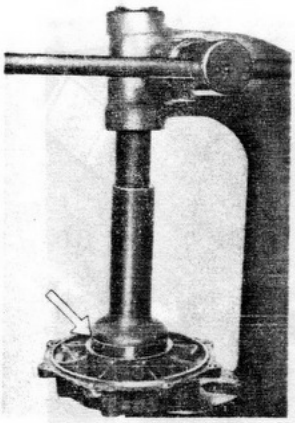


Fig. 18

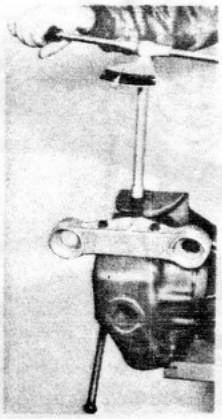


Fig. 19

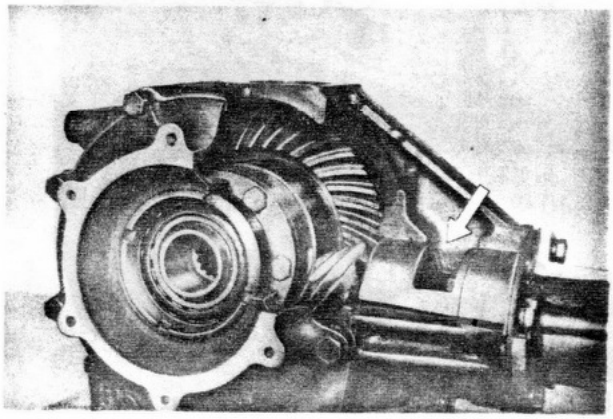


Fig. 20

Assembly and Adjustment of the Differential Unit

(Fig. 15)

1. Insert sun and planet gears with fitting washer in differential housing (max. clearance .004" or 0.1 m/m). Insert differential bolts and secure with cylinder pins.

2. Screw together diff. housing and lock the screws with wire. (Tightening torque 18-22 ft/lb or 2 1/2 - 3 m/kg).

3. Fit crown-wheel and secure with screws No. 000 991 41 00, tightening down crosswise to a torque of 52 ft/lb (7.2 m/kg). Lock the screws with wire (Fig. 16).

4. Press taper roller bearing 30 210 with the taper outwards onto its seat on the diff. housing (Fig. 17). (Use suitable press).

5. Screw castellated nuts a few turns into diff. housing and cover of diff. unit (WK 139).

6. Press outer ring of taper roller bearing 30 210 into housing and cover (Fig. 18). (Use suitable press).

7. Screw mounting on to rear axle casing (Torque 36 ft/lb or 5 m/kg). Secure screws with wire (Fig. 19).

8. Assemble diff. unit and pinion unit. Stick gasket 055 061 04 00 on face of housing cover. Fit cover on rear axle casing, screw in and tighten holding screws (Torque 18 ft/lb or 2 1/2 m/kg). (Both castellated nuts for pinion adjustment are loosened).

Important! When fitting pinion, observe position of bearing housing. As shown in Fig. 20, it must be fitted in the axle casing with the opening upwards.

9. Tighten up adjusting nut with plenty of side play using WK 139, loosen again and screw in lightly by hand until there is about .040" (1 m/m) side play (Fig. 21).

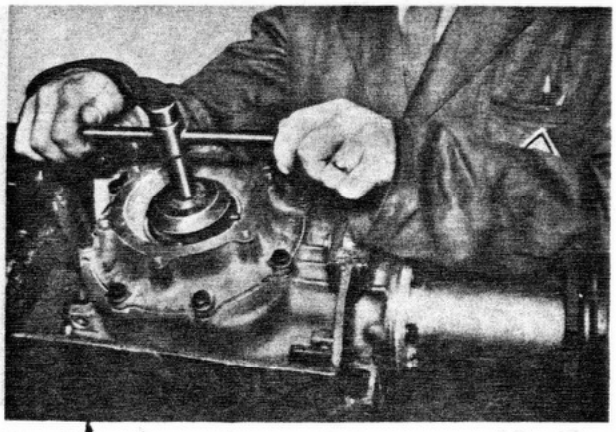


Fig. 21

10. Fix basic measurement "A" by use of the special shims under the ball-race housing (Fig. 22). Taking care that every time a measurement is taken, the screws holding down the housing neck are tightened down, as only in this way can the correct result be obtained.

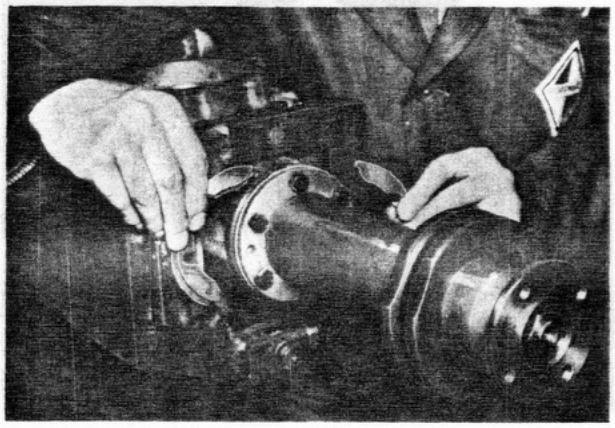


Fig. 22

11. To measure the distance between the end face of the pinion and the ground surface of the diff. housing the gauge WK 137 is used (Fig. 23).

12. Ascertain the smallest amount of clearance by turning the drive on the differential housing and mark it (use micrometer clock gauge and holder WK 144).

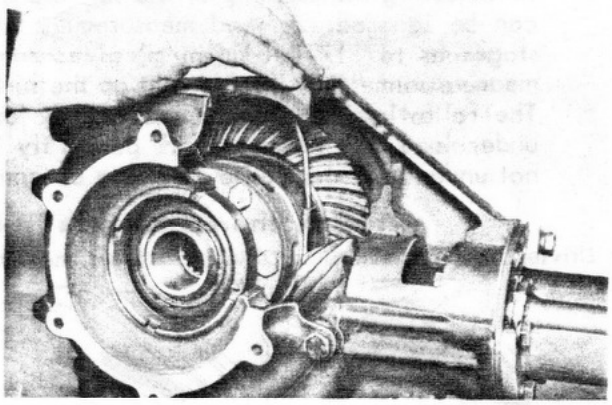


Fig. 23

13. Screw in castellated nut on crown-wheel side until play at the marked point amounts to .005" (0.12 m/m). Tools needed: - micrometer clock gauge with holder WK 144, adjusting nut socket spanner WK 139 (Fig. 24).

When taking measurements, hold driving flange in the hand, otherwise no accurate reading can be made.

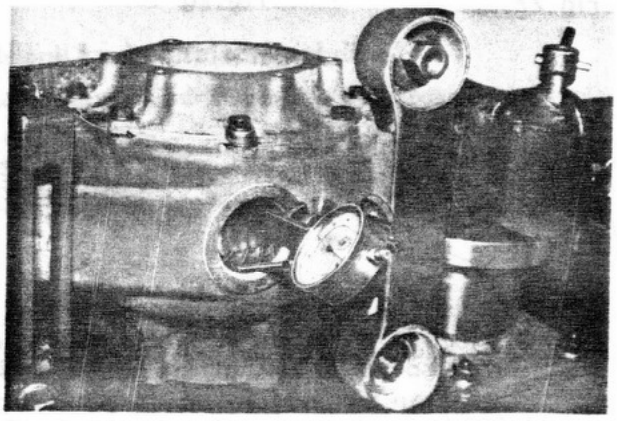


Fig. 24

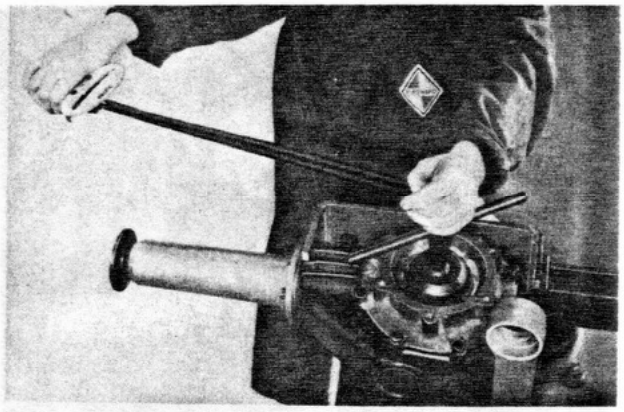


Fig.25

14. Tighten castellated nut on opposite side to a torque of 87 ft/lb (12 m/kg). The side clearance at the marked spot should then be .006" (0.15 m/m). If this is not the case, the nut must be re-adjusted to suit. Tools: - WK 139 and torque wrench (see Fig.25).

15. Check tightening torque on both adjusting nuts (87 ft/lb or 12 m/kg). Check side clearance all round. The maximum permissable is .008" (0.2 m/m) (WK 139, torque wrench, clock gauge and holder WK 144).

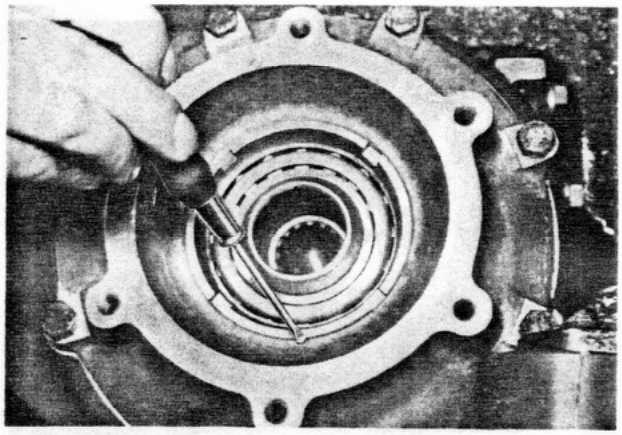


Fig.26

16. Secure adjusting nuts against further movement by drilling and tapping size M 4 (Fig. 26). Before commencing however, protect the driving gear and bearing from drill chippings with a suitable cover.

17. In adjusting the meshing of the sun and planet gears, the meshing impression of the teeth can be ignored. An end measurement of .138" (3.5 m/m) rising by .002" (.05 m/m) stages to .177" (4.5 m/m) gives more than adequate accuracy of adjustment. The basic measurement "A" is brought up on the surface of the crown-wheel rim.
The following meshing impressions for both driving and reverse faces of the teeth both under load and unloaded are purely for information. The impressions of both faces when not under load should be used as a comparison following adjustment (Figs. 27 - 34).

Teeth Impressions of a Gleason Crown-wheel and Pinion

Driving face, under load

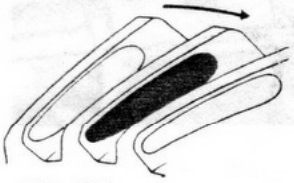


Fig.27

Driving face, not under load

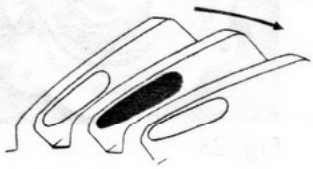


Fig.28

Reverse face, not under load

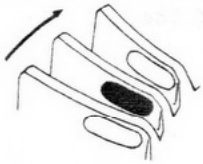


Fig.29

Reverse face, under load

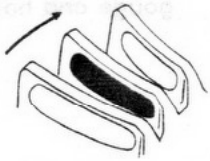


Fig.30

Teeth Impressions of a Klingelnberg Crown-wheel and Pinion

Driving face, under load

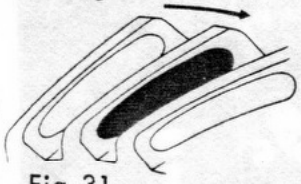


Fig.31

Driving face, not under load

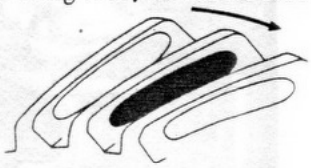


Fig.32

Reverse face, not under load

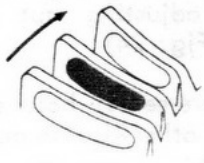


Fig.33

Reverse face, under load

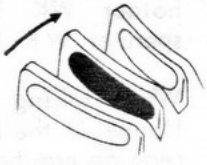


Fig.34

18. After fitting a new crown-wheel and pinion set, an initial running-in period of a dozen miles or so (c.20 km) at not more than 30 m.p.h. (50 k.p.h.) is indispensible. As far as possible, the vehicle should be kept pulling. Thereafter for the next 600 miles or so (1,000 km), limitation of maximum speed is strongly recommended.

Half-Shaft Assembly

Preparatory Assembly of Half-Shaft

1. Press oil seal in rear axle ball-race housing. Ensure that outer edge of oil seal is first lightly moistened with oil. (Use suitable press).

2. Insert radial ball-race in ball-race housing (Use suitable press).

3. Heat ball-race housing first in oil-bath to 194° - 212° F (90° - 100° C).

   Before heating and fitting ball-race housing to half-shaft, measure as in para 1, page 8. If the radial race cools off rapidly on the half-shaft, the housing can fall temporarily from .004" - .008" (0.1 - 0.2 m/m). This can give an inaccurate reading!

4. Fit distance piece on half-shaft with chamfer towards shaft shoulder. Slip on housing which has been heated to about 212° F (c.100° C) quickly, before it can cool off.

5. Screw on special nut, tighten (WK 150) and lock against further movement (Fig. 35).

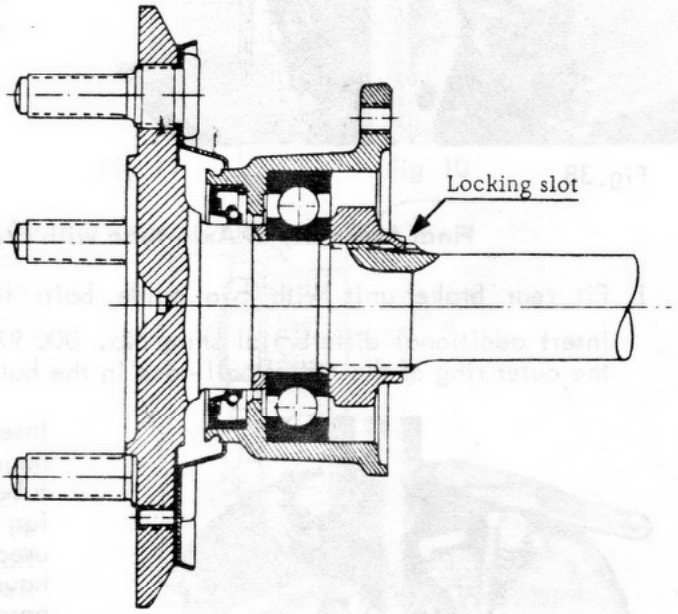


Fig.35

Preparatory Assembly of Axle Tube

1. Fit radius rod to axle tube.

2. Using guide bolts, fit inner bearing cover-plate to outer face of axle casing. (See Fig.36).

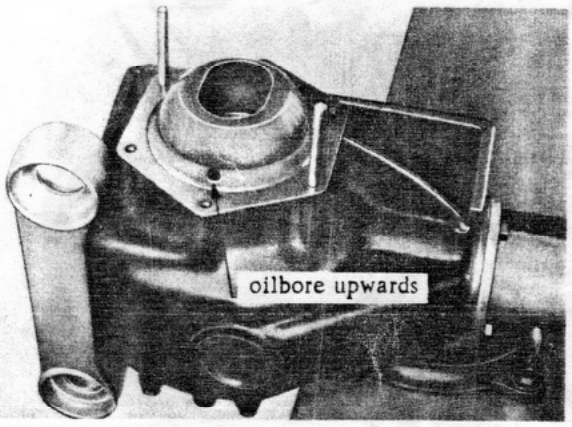


Fig.36

3. Fit axle tube with outer bearing cover-plate concentricly and tighten down with four screws, having previously fitted shims as may be necessary (Fig. 37).

Important! Before assembling the bearing cover-plates, ensure that they are quite clean and coat them with a lubricant containing Molybdenum Disulphide (Molyspeed, Molyslip etc.)

4. Fit shims until the axle-tube can be moved freely to and fro by hand, but without any play.

000 975 1900	.004" (0.1 m/m)	shim
000 975 1901	.008" (0.2 m/m)	shim
000 975 1902	.020" (0.5 m/m)	shim

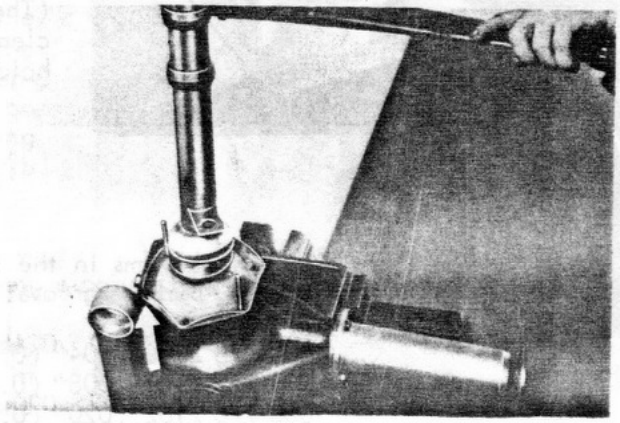


Fig.37

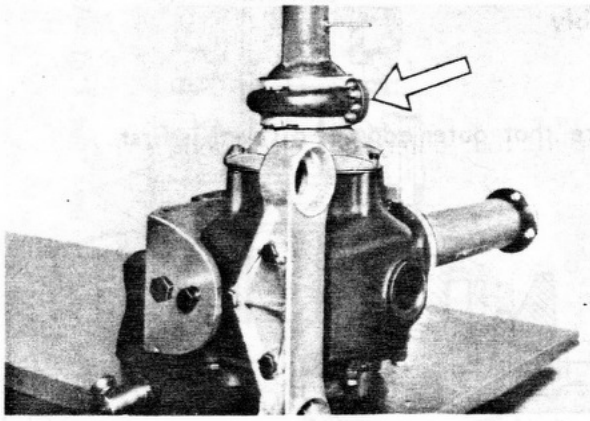


Fig.38

5. Smear surfaces of sealing collar, axle-tube and outer bearing cover plate with sealing compound, screw together rubber collar and secure round outer bearing cover on axle-tube with clip.

6. Dismantle assembled axle-tube, and hold together outer and inner bearing covers together with shims with a nut and bolt.

Final Assembly of Axle-tube with previously assembled Half-Shaft

1. Fit rear brake unit with two guide bolts to the bearing housing of the half-shaft.

   Insert additional differential shim No. 000 975 2103 (.039" or 1 m/m thick) in front of the outer ring of the radial ball-race in the ball race housing of the half-shaft.

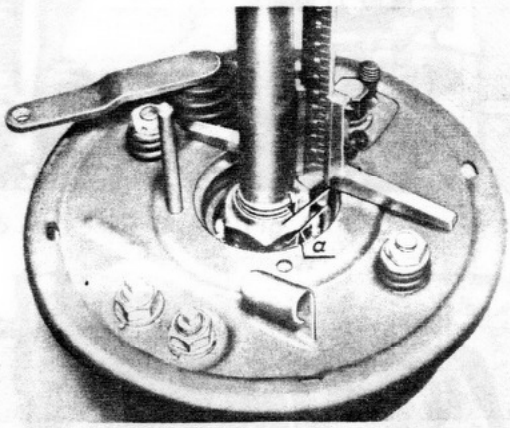


Fig.39

Insert depth gauge and measure "a" from the housing and "b" from the collar of the axle-tube flange. These measurements are important for the selection of the shims which are to be used, and which must be placed in the bearing housing before the final assembly of the preparatorily assembled half-shaft and the axle tube (Figs. 39 and 40).

Measurement "a" must equal that obtained as in para 3, page 7. Should any difference be found, change the shims until the measurement equals that obtained as in para 3, page 7. (Bearing housing removed by pressing off!)

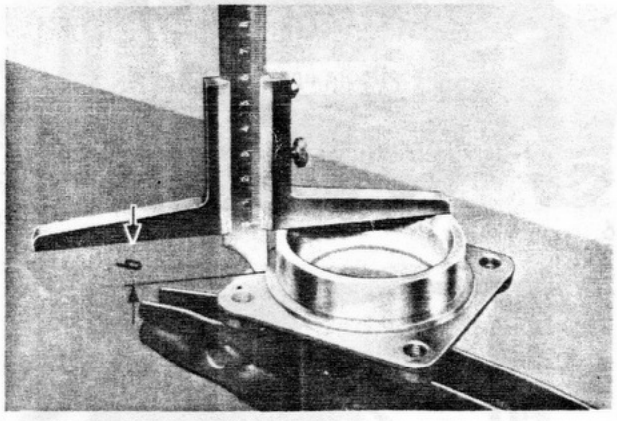


Fig.40

From the measurements obtained, it will be found that: -

a - b + .004" (0.1 m/m) = x, where

x = thickness of the differential shim fitted.

(The figure of .004" (0.1 m/m) serves as a clearance to allow for the tightening of the holding-down bolts).

2. Insert the necessary differential shims in the bearing housing and smear the radial ball-race with ball-race or general-purpose grease.

000 975 2100	.004" (0.1 m/m)	shim
000 975 2101	.008" (0.2 m/m)	shim
000 975 2102	.020" (0.5 m/m)	shim
000 975 2103	.039" (1.0 m/m)	shim

3. Fit gasket 000 982 2100 to axle tube flange.

4. Insert return spring in the hole of the half-shaft.

5. Fit entire axle tube assembly over shaft (Fig. 41). Screw in securing screws and tighten (25 ft/lb or 3.5 m/kg).

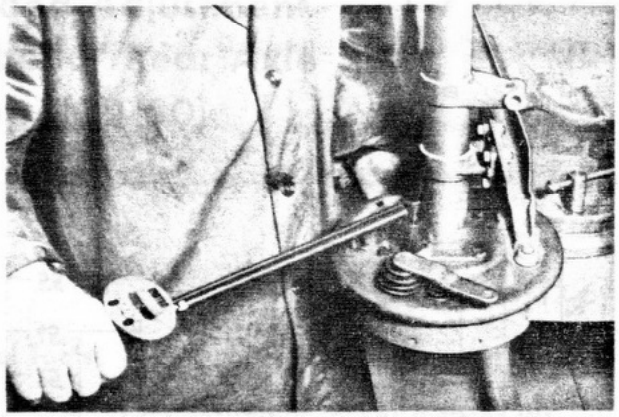


Fig.41

6. Stick gasket 055 082 17 00 to flange of half-shaft ensuring that the oil hole is correctly positioned (Fig. 42). Fit brake drum on half-shaft flange.

7. Stick bearing cover seal on securing flange of rear axle casing and insert universal joint.

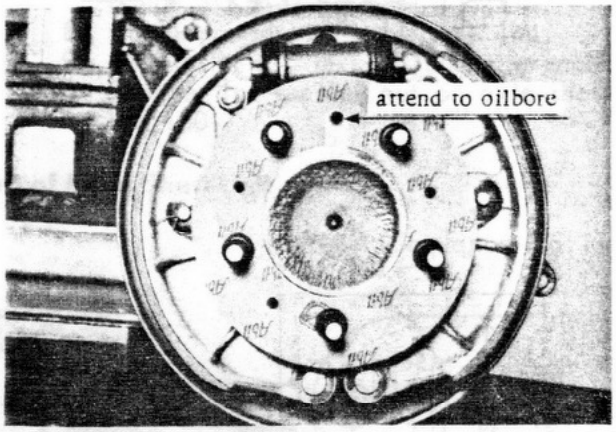


Fig.42

8. Attach previously assembled half-shaft unit to rear axle casing (18 ft/lb or 2.5 m/kg).

9. After assembly is complete, a check should be made of the bearing coverplates for seating and clearance.

The swing-axle should then be lifted and should sink slowly under its own weight to its lowest position (Fig. 43).

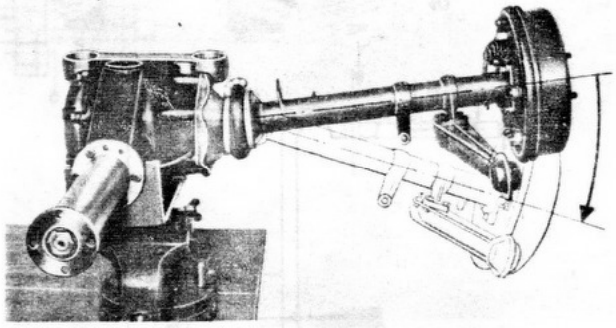
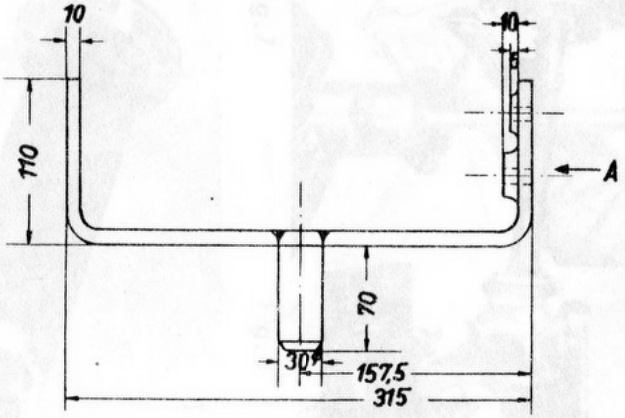
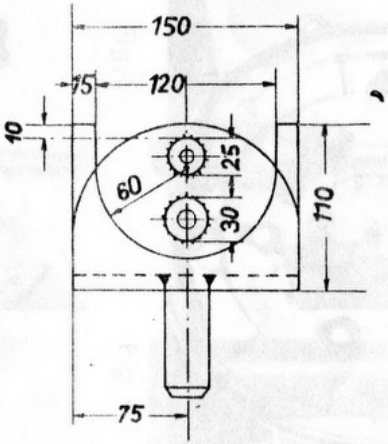


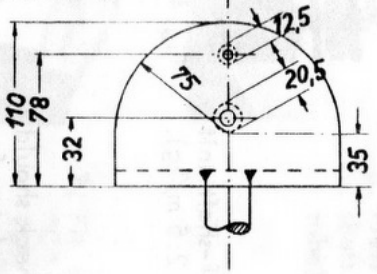
Fig.43

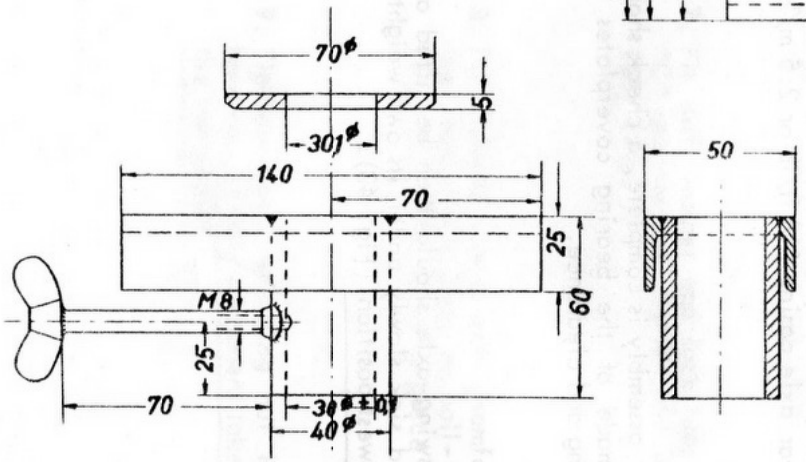


Assembly jig for differential

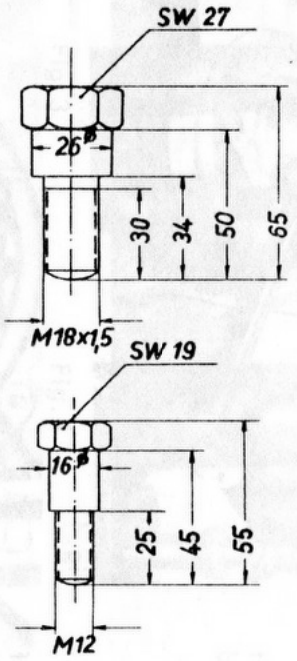


Elevation "A"





Differential assembly jig holder



Fixing screws for assembly jig

Assembly Jig for Differential

(All measurements in m/m)