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GENERAL WORKSHOP MANUAL
DRIVEN FRONT AXLE
MT10/MT11 SERIES

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TABLE OF CONTENTS

	SECTION	PAGE
FORWORD	203	4
DRAWING OF THE AXLES	204	5
TECHNICAL DATA	205	7
TYPES		7
WHEEL BRAKE		8
ANTIFRICTION BEARINGS		9
SEALS		9
TORQUE RATINGS	206	10
WHEEL HUB AND AXLE HOUSING		10
DRUM WHEEL BRAKE		10
DIFFERENTIAL CARRIER HEAD		11
ADJUSTMENT DATA	207	12
WHEEL HUB, STEERING KNUCKLE		12
DRUM WHEEL BRAKE		12
DIFFERENTIAL CARRIER HEAD		12
GENERAL SERVICE INSTRUCTIONS	209	13
WHEEL HUB AND AXLE HOUSING		13
DRUM WHEEL BRAKE		13
DIFFERENTIAL CARRIER HEAD		13
GENERAL SPECIFICATIONS		13
WHEEL HUB		
WHEEL HUB AND AXLE HOUSING SECTIONAL VIEW	210	14
PARTS OF WHEEL HUB AND AXLE HOUSING	211	15
REMOVING AND REINSTALLING THE WHEEL DISK	212	16
REMOVING AND REINSTALLING THE BRAKE DRUM	213	16
REMOVING AND REINSTALLING THE COVER AND THE TOOTHED HUB	214	16
REMOVING AND REINSTALLING THE WHEEL HUB	223	17
DISASSEMBLING AND REASSEMBLING THE WHEEL HUB	224	17
REMOVING AND REINSTALLING THE SPINDLE AND THE BRAKE SUPPORT	226	18
REMOVING AND REINSTALLING THE BRAKE DISK, TRUEING UP THE BRAKE DISK	227	19
INSTALLATION INSTRUCTIONS FOR PARTS OF ANTI-BLOCKING SYSTEM	229	19
FRONT AXLE HOUSING		
REMOVING AND REINSTALLING THE TIE-ROD, ADJUSTING THE TOE-IN AND THE WHEEL TURN ANGLES	241	20
REPAIRING THE TIE ROD	242	21
REMOVING AND REINSTALLING THE STEERING KNUCKLES, REMOVING AND REINSTALLING THE DOUBLE JOINTS, ASSEMBLING THE BRAKE SUPPORT AND THE SPINDLE	243	22
ASSEMBLING THE KNUCKLE PIN BUSHES AND THE SEALING RINGS ON THE STEERING KNUCKLE	244	24
ASSEMBLING THE STEERING ARMS, AND THE TIE-ROD ARMS	245	25
ASSEMBLING THE DOUBLE-JOINT (AXLE-SHAFT REPLACEMENT)	246	26
REMOVING AND REINSTALLING THE INNER BEARING AND SEALS OF THE SPINDLE	247	28
REMOVING AND REINSTALLING THE BEARING AND SEALS OF THE KNUCKLE CARRIER	248	29
DRUM WHEEL BRAKE		
DRAWING OF THE DRUM WHEEL BRAKE	260	29
PARTS OF THE DRUM WHEEL BRAKE	261	29
REMOVING AND REINSTALLING THE BRAKE SHOES	262	30
REPAIRING THE BRAKE SHOES AND THE BRAKE DRUM	263	30
REMOVING AND REINSTALLING THE BRAKE SUPPORT AND THE CHAMBER BRACKET ASSEMBLING THE SPRING SUPPORTING PIN	264	32
REMOVING AND INSTALLATION OF THE BRAKE LEVER AND THE BRAKE SPANNER	265	32
REPAIRING THE BRAKE SPANNER BEARING SUPPORT	266	32
MANUAL SLACK ADJUSTER AND ITS ASSEMBLING	267	34
AUTOMATIC SLACK ADJUSTER “MOM”TYPE	268	35
DIFFERENTIAL CARRIER ASSEMBLY		
DIFFERENTIAL CARRIER ASSEMBLY SECTIONAL VIEW	310	36
PARTS OF THE DIFFERENTIAL CARRIER ASSEMBLY	311	36

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	SECTION	PAGE
REMOVING AND REINSTALLING THE DIFFERENTIAL CARRIER ASSEMBLY AND THE DIFFERENTIAL	312	37
REMOVING AND REINSTALLING THE COMPANION FLANGE, REPLACING THE OIL SEAL	313	37
REMOVING AND REINSTALLING THE DIFFERENTIAL, ADJUSTING THE BACKLASH AND THE CONTACT PATTERN	314	38
DISASSEMBLING AND REASSEMBLING THE DIFFERENTIAL	315	39
REMOVING AND REINSTALLING THE BEARING CAGE, ADJUSTING THE AXIS DISTANCE	316	41
DISASSEMBLING AND REASSEMBLING THE BEARING CAGE	317	42
OIL FILL-UP, RUN, CHECK	395	45

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FOREWORD

This publication "GENERAL REPAIR INSTRUCTIONS" was prepared for workshops and contains all the necessary assembly instructions as well as data to be checked and adjusted during repair, with the knowledge of which repair and adjustment of the MARMON-HERRINGTON MT10/MT11 type driven front axles.

For technical data on the specific type versions of the **M-H MT10/MT11** type driven front axles refer to the publication **"TECHNICAL DATA"**, while for the spare parts of that **"PARTS CATALOG"** grouped according to the Type.

The **"GENERAL REPAIR INSTRUCTIONS"** contain sections divided into the technical data and the service instructions of the axle. The sections of the service instructions contain the disassembly and reassembly operations of the individual assembly unit, stating the special tools to be used.

The serial numbers of the figures are started from the beginning in each section. The item numbers of the figures for an assembly unit are referred to in each section dealing with the assembly procedures.

For service operations it is recommended to use the tools shown in the figures in order to assure proper assembly of the individual units. The figures show each essential service operation stating the designation of the tool and its service position. The tools are partly available from commerce and partly can be fabricated in the workshop according to the tool blueprint ordered on basis of tool list supplemented to the **"GENERAL REPAIR INSTRUCTIONS"**.

The manufacturer shall not be liable for warranty claims on damages resulting from negligence of the general service practice required for normal service operations but not contained in this Manual.

For replacing assembly units or individual parts use ONLY **genuine M-H made products**.

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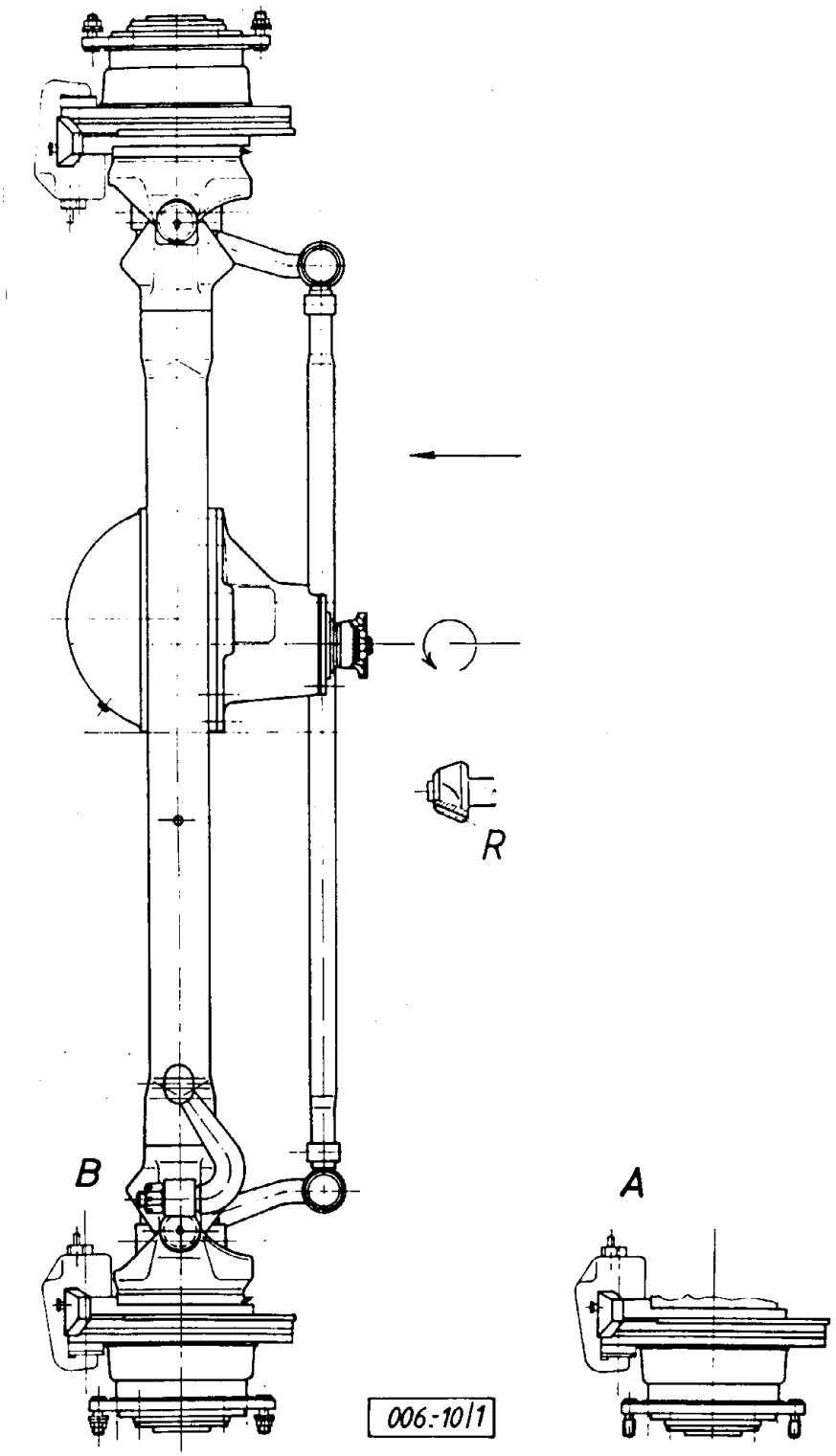
DRAWINGS OF THE AXLES

EXAMPLES



WHEEL BRAKE
Disk wheel brake (installed by the orderer)

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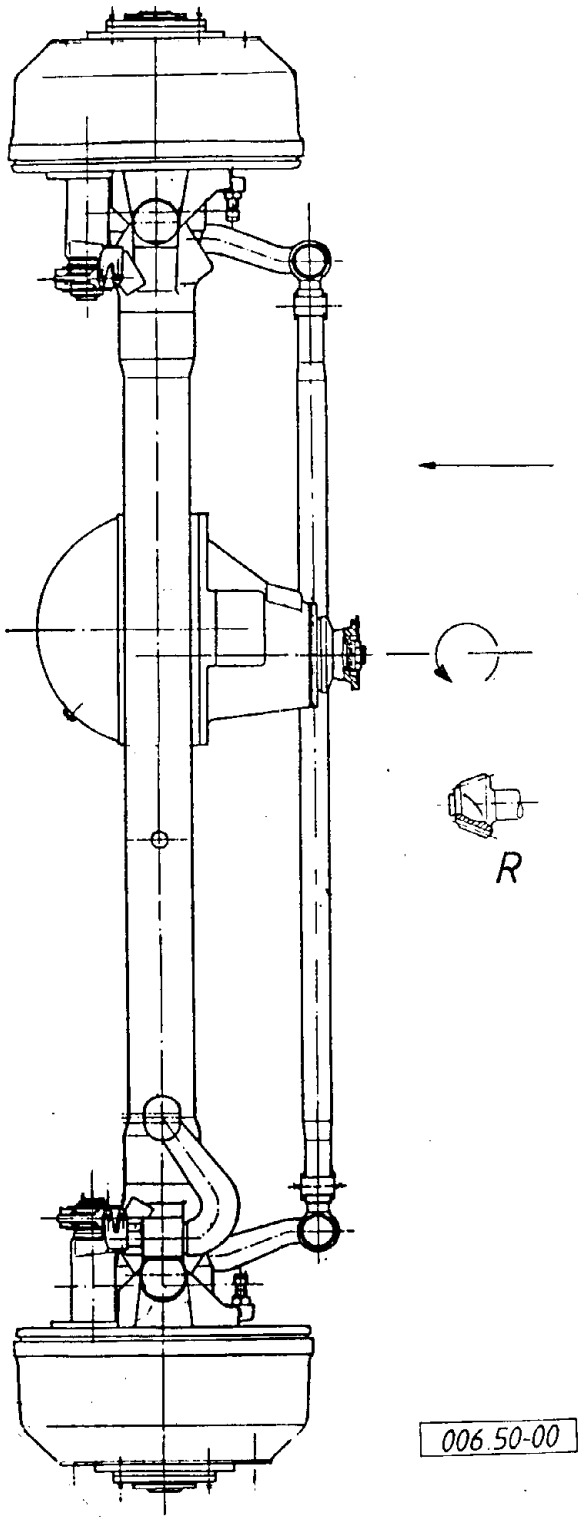

WHEEL BRAKE
Simplex internally acting drum brake

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TECHNICAL DATA

DESIGNATION	UNITS	TYPE
		MT10/MT11
SYSTEM OF THE DRIVEN FRONT AXLE:		
Single-reduction driven front axle with axle housing of welded steel plate and hypoid toothing drive pinion-gear pair in the differential.		
DIMENSIONS:		
WHEEL TRACK	mm	1990*
a./ Rubber tire		9x20”*
b./ Rolling radius	mm	482*
c./ Sinking depth	mm	150, 876*
Max. Width	mm	2448*
RATIOS:		
Drive gear - pinion tooth number		37/9 ; 39/9; 37/8; 39/8; 37/7; 39/7; 41/7; 43/7; 39/6; 41/6; 43/6 *
Ratio		from 4.111 to 7.167 *
For detailed technical data marked by asterisk (*) at the type versions required by one orderer refer to publication **“TECHNICAL DATA”** related to the type versions.		

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TECHNICAL DATA

DESIGNATION	UNITS	TYPE
		MT10/MT11
GENERAL DATA:		
Camber		1°
Knuckle pin inclination		5°
Nominal axle load	kg	5500
Max. Input torque	Nm	2176-4110*
Max. Input speed	1/sec r.p.s.	50
Axle mass without oil fill	kg	429-523*
WHEEL HUB CONSTRUCTION:		
"A" = Hub centering, for installing wheel disk	mm	Flange: -0.290
Qty. of wheel bolts		10
"B" = Hub centering, for installing wheel disk	mm	Flange: -0.2 Wheel nut hex. distance: 30
Qty. of wheel bolts		8
"C" = Suitable for installing wheel disk	mm	Flange diameter: -0,2
Parts of ABS system		*
Impulse generating ring		*
WHEEL BRAKE		
DISK WHEEL BRAKE *		
Wheel brake (to be installed by the Buyer)		disk brake 410864 -L * 410865 -R *
Max. operating pressure	bar	140
Brake disk torque	Nm	12500
(48.3 km/h; u = 0.3)		
DRUM WHEEL BRAKE *		
System: The wheel brake is of simplex system internally acting drum brake.		
Brake drum diameter	mm	420
Max. trued-up brake drum diameter	mm	423
Brake lining width	mm	140
Brake shoe clearance (at adjustment)	mm	0.3 - 0.6
Min. brake lining thickness measured at brake shoe center (marked by upper edge of recess on side of brake lining)	mm	7.0

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TECHNICAL DATA

DESIGNATION	UNITS	TYPE
		MT10/MT11
GENERAL DATA:		
SLACK ADJUSTER *		With manual slack adjuster, automatic slack adjuster *
Slack adjuster installation radius, **"C"**	mm	155
Distance of slack adjuster bushing bore center from seating plane of the chamber bracket, **"A"**	mm	75
Max. camshaft torque/brake drum torque (? = 0.35)	Nm	945/9351
ANTI-FRICTION BEARINGS		
IN WHEEL HUB:		
Outer: Taper roller bearing		32015 X MGM
Inner: Taper roller bearing		33116 A MGM
IN AXLE HOUSING:		
Cylindric roller bearing		RNU 2208 EC
ON STEERING KNUCKLE:		
Axial taper roller bearing		353166-C/HA3
ON DRIVE PINION:		
Taper roller bearings		31309 CL 7C SKF
Cylindric roller bearing		UC 1306 TM FAG (FAG 087180)
ON DIFFERENTIAL:		
Taper roller bearings		32015 X MGM
KNUCKLE PIN BUSHINGS		006.10-3110-039
STEERING KNUCKLE BUSHING SEALS		GLACIER PM-5060-DX
In wheel hub		1HH1 110x140x17-NB STEFA DENSO
In steering knuckle		ASL 50x65x8-NB SIMMERWERKE
In seal retainer		50x65x6 KV 3440 SIMMERWERKE
In steering knuckle carrier		A 49, 5x80x8-NB SIMMERWERKE
In differential		CC 65x100x10,00-NBR STEFA
On knuckle pin		006.10-3110-038
On brake spanner		A 42x55x8-NB AFIT

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TORQUE RATINGS

DESIGNATION	SECTION/FIGURE ITEM NO.	TYPE
		MT10/MT11
NOTE: Nm to ftlb = Nm ÷ 1.3558 (Ex. 600 Nm ÷ 1.3558 = 443 ftlb)		
WHEEL HUB AND AXLE HOUSING	210/1 and 210/2	Nm
Wheel nuts	20	As specified by the Orderer.
Cover to toothed hub hex. bolts	1	19.6 - 25.4 installed with thread locker
Brake disk to wheel hub hex. flanged bolts	210/1:12	205 - 225 installed with thread adhesive
Brake drum mounting hex. bolts	210/2:12	39 - 49
Toothed hub to wheel hub hex. bolts	21	129 - 156 installed with thread locker
Outer shaft-end nut	26	588 - 637
Inner shaft-end nut, per Section 223	28	196
Hex. flanged bolts attaching brake support and spindle to steering knuckle	31	205 - 225 installed with thread adhesive
Dust cover plate to steering knuckle hex. bolts	35	6 - 8
Dust cover plate to brake support hex. bolts	42	30 - 40
Cover to steering knuckle hex. bolts	47	30 - 40
Knuckle pin lock wedge flanged nut	56	40 - 60
Castle nuts securing steering arm and tie-rod arms	68	478 - 664
Stop bolt jamnut	-	60 - 80
Castle nuts of tie-rod ball joint heads	-	230 - 320
Tie-rod clamp		
- Castle nuts	-	M16x1.5 55 - 69
- Self-lock nuts	-	M12x1.25 75 - 90
DRUM WHEEL BRAKE	260/1	Nm
Dust shield mounting bolts	21	30 - 40
Chamber bracket mounting bolts	5	120 - 140

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TORQUE RATINGS

DESIGNATION	SECTION/FIGURE ITEM NO.	TYPE
		MT10/MT11
DIFFERENTIAL CARRIER HEAD	310/1	Nm
Differential carrier to axle housing flanged bolts	-	88 - 98 installed with thread locker
Drive pinion self-lock nut	1	450 - 500
Bearing cage to differential carrier hex. flanged bolts	14	70 - 80
Hex. bolts attaching lock plates of differential case bearing adjusters	22	15 - 20
Differential case halves clamp bolts	25	49 - 59
Self-lock nuts of drive gear to differential case bolts	38	260 - 290
Bearing shackles to differential carrier hex. bolts	41	326 - 380 installed with thread locker

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ADJUSTMENT DATA

DESIGNATION	UNITS	TYPE MT10/MT11
NOTE: mm to inch = mm ÷ 25.4 (Ex. 0.15 mm ÷ 25.4 = .006 inch)		
WHEEL HUB		
Axial play of wheel hub bearings **(adjusted by the shaft-end nuts)**	mm	0.01 - 0.04
Axial play of the steering knuckle	mm	0.0 - 0.3
Shim thickness	mm	0.4; 0.6;1.0; 1.2; 1.4
Toe-in	mm	1.5 + 1.0 - 1.5
Max. inner wheel turn angle		40°
DRUM WHEEL BRAKE		
Shoe clearance (during adjustment)	mm	0.3 - 0.6
Axial play of camshaft	mm	0.1 - 0.5
DIFFERENTIAL CARRIER HEAD		
Drive pinion to drive gear backlash (KLINGELNBERG toothing	mm	from ratio $\frac{37}{9}$ = 4.111 to $\frac{41}{7}$ = 5.857:0.20-0.30 from ratio $\frac{43}{7}$ = 6.143 to $\frac{43}{6}$ = 7.167:0.18-0.25
Rolling torque after preloading the drive pinion bearings (during check the oil seal is not installed)	Nm	0.98 - 2.65
Adjustment by the distance rings.	mm	13.95 to 14.525 mm in 0.025 mm steps and
Distance ring dimensions:		14.55 mm one. together 25 off distance rings
Theoretical distance between the drive pinionface and the drive gear centerline	mm	84.55
(“AXIS DISTANCE”)		
Adjustment by shims under the bearing cage.		
Shim thicknesses:	mm	0.15; 0.2; 0.3; 0.5; 1.0

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GENERAL SERVICE INSTRUCTIONS

This section contains the assembly operations and adjustment data considered by us to be most important and which during service of the axle should thoroughly be observed and followed.

WHEEL HUB AND AXLE HOUSING

Adjust axial play of the wheel bearings so, after tightening the shaft-end nuts to obtain **0.01 - 0.04 mm**.

For adjustment refer to the Section **223**.

Fill up the wheel hub with grease as specified in Section **223**.

Assure **0.0 - 0.3 mm** axial bearing clearance between the steering knuckle and the knuckle carrier mounted in the steering knuckle.

For adjustment refer to Section **243**.

For adjustment of the **1/8" ± 1/16"** toe-in and the maximum wheel turn angles refer to Section **241**.

DRUM WHEEL BRAKE

If the brake linings are worn to the permitted limit **(7.0 mm as indicated by the upper edge of the recess on side of the brake lining)** replace the linings according to the instructions.

Check the brake shoe surface in contact with the shoe anchor pin and the shoe rollers.

Adjust the specified shoe clearance **(0.3 - 0.6 mm)** by means of the brake lever.

After adjustment the brake lining may not interfere with the brake drum.

From the sealing rings of the brake spanner only that at the brake spanner head may not pass over the surplus lubricant during greasing. The sealing ring at the brake spanner head protects the brake drum against the grease. **Make sure to install the sealing ring in proper position.**

True up the brake drum ONLY to the permitted maximum diameter.

DIFFERENTIAL CARRIER HEAD

Install the drive gear bearings with preload. Assure such a preload, that in case of installing new bearings, a rolling torque of **0.98 - 2.65 Nm**, while at used bearings that of **0.5 - 1.3 Nm** (the half that of the new bearing) shall be obtained. During check the sealing ring **(4)** is not installed.

For adjustment refer to the Section **317**.

The differential gears should rotate freely without jamming.

Install the taper roller bearings supporting the differential without clearance.

For proper contact pattern and specified backlash refer to the Section **314**.

DRIVE GEAR TO PINION BACKLASH:

From ratio **$\frac{37}{9}$ = 4.111 to $\frac{41}{7}$ = 5.857 0.2 - 0.3 mm,**

from ratio **$\frac{43}{7}$ = 6.143 to $\frac{43}{6}$ = 7.167 0.18 - 0.25 mm.**

GENERAL SPECIFICATIONS

For purpose of labor safety during service operations performed on the axle removing the individual assembly units make sure to assure safe backing, fixing or suspension.

Install only clean and sound parts free of burr and dents. Before installation wipe the mating surfaces of the parts clean and apply thin coat of oil.

For assembly operations use ONLY plastic or lead-insert hammer, not steel hammer.

Before installing the oil seals make sure to check if the sealing lip is sound and apply specified grease between the sealing lip and the dust protection edge. Install the O-rings also with grease.

When installing the taper roller bearings take care of the pairing according to the original packing or to the manufacturer's specification.

THE FOLLOWING THREAD ADHESIVE, LOCKING AND SURFACE SEALING MATERIAL ARE USED AT THE AXLE, E.G.:

Thread adhesive	LOCTITE 277
Thread locker	LOCTITE 242
Surface Sealant	DOWN CORNING NO. 732

Before installation apply the LOCTITE 242 and 277 concentrically to approx. 4-5 threads on the threaded surface of the bolt.

Clean and degrease the surfaces before applying the air-curing oil-resistant sealant type DOWN CORNING NO. 732. Apply a continuous strip of min. **3 mm** diameter to the specified surface.

The time between applying the sealant and assembling the parts together may not exceed 10 mins.

Instead of the above adhesive locking and sealing material other equivalent grade ones may also be used.

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WHEEL HUB AND AXLE HOUSING SECTIONAL VIEWS

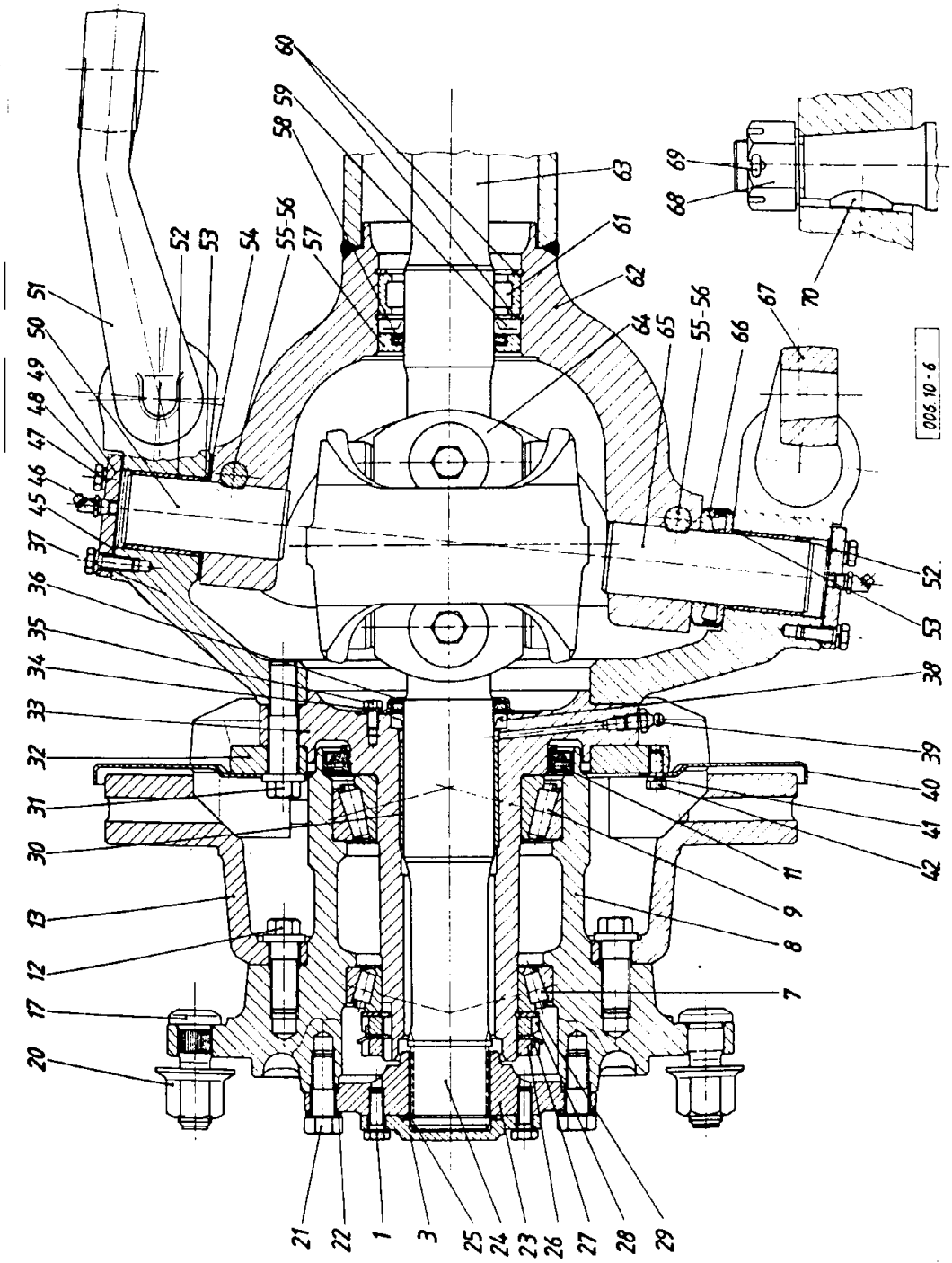

Fig. 1.: DISK BRAKE WHEEL HUB AND AXLE HOUSING SECTIONAL VIEW

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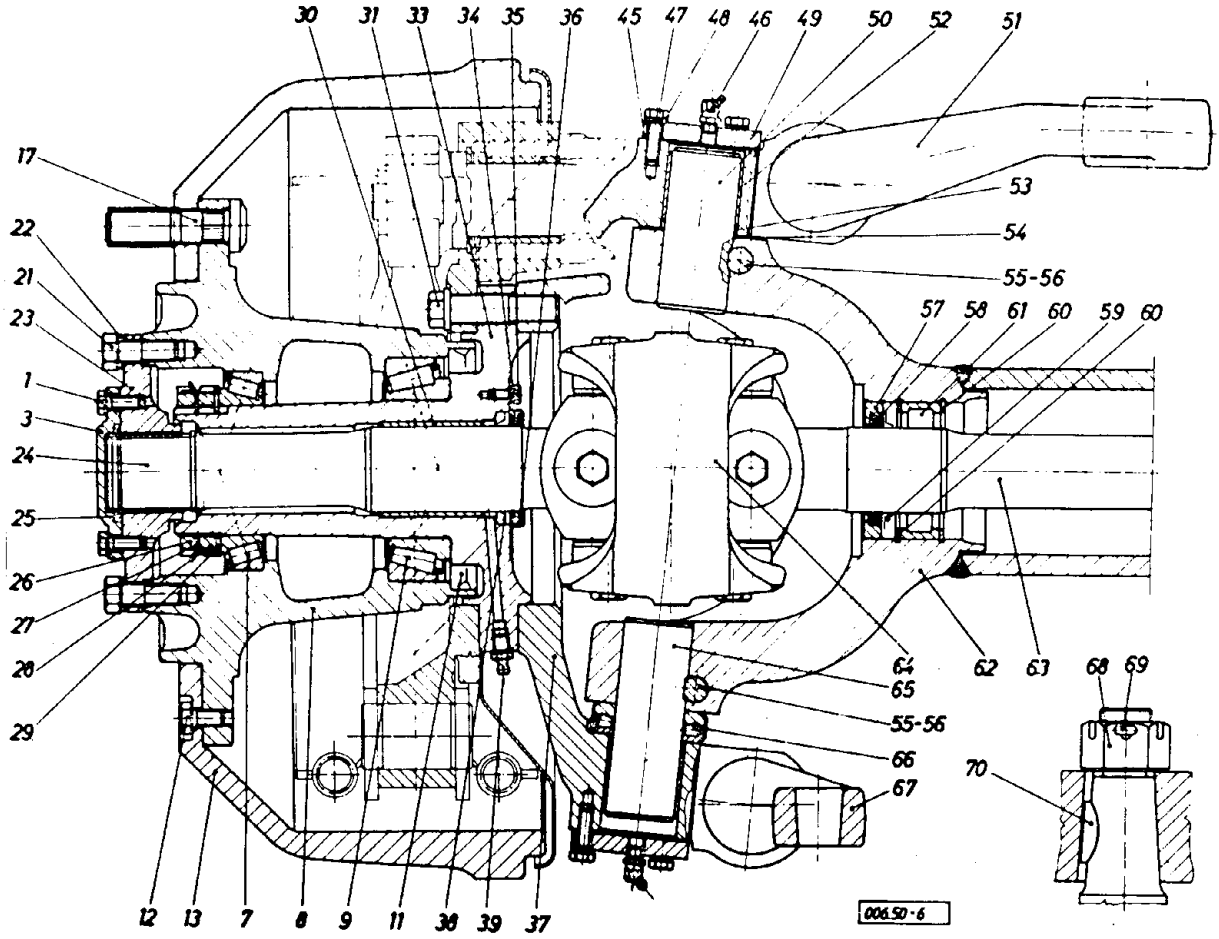

Fig. 2.: DRUM BRAKE WHEEL HUB AND AXLE HOUSING SECTIONAL VIEW

SECTION 211

PARTS OF THE WHEEL HUB AND AXLE HOUSING DISK BRAKE/DRUM BRAKE

1 — Hex. bolt
—
3 — Cover
—
7 — Taper roller bearing
8 — Wheel hub
9 — Taper roller bearing
—
11 — Sealing ring
12 — Hex. flanged bolt/Hex. bolt
13 — Brake disk/Brake drum
—
17 — Wheel bolt
—
20 — Wheel nut/ —
21 — Hex. bolt
22 — Washer
23 — Toothed hub
24 — Outer axle shaft
25 — Snap ring
26 — Outer shaft—end nut
27 — Lock plate
28 — Inner shaft—end nut
29 — Bearing retainer
30 — Bushing
31 — Hex. flanged bolt
32 — Brake support/ —
33 — Spindle
34 — Lock washer
35 — Hex. bolt
36 — Dust shield with sealing ring
37 — Steering knuckle
38 — Sealing ring
39 — Grease fitting
40 — Brake cover plate/ —
41 — Lock washer/ —
42 — Hex. bolt/ —
—
45 — Gasket
46 — Ball grease fitting
47 — Hex. bolt
48 — Lock washer
49 — Cover
50 — Knuckle pin, upper
51 — Steering arm
52 — Knuckle pin bushing
53 — Sealing ring
54 — Shim
55 — Lock wedge
56 — Flanged nut
57 — Seal retainer
58 — Sealing ring
59 — Oil ring
60 — Snap ring
61 — Cylindric roller bearing
62 — Knuckle carrier
63 — Inner axle shaft
64 — Double joint head
65 — Knuckle pin, lower
66 — Axial bearing
67 — Tie—rod arm
68 — Castle nut
69 — Cotter
70 — Woodruff key

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SECTION 212

REMOVING AND REINSTALLING THE WHEEL DISK

REMOVING THE WHEEL DISK

With wheels in loaded condition loosen the wheel nuts, then jack up the axle, back out the wheel nuts and remove the wheels.

REINSTALLING THE WHEEL DISK

After positioning the wheel disk diagonally tighten the wheel nuts as specified.

SECTION 213

REMOVING AND REINSTALLING THE BRAKE DRUM

REMOVING THE BRAKE DRUM

After removing the wheel disk back out the **2** off hex. bolts attaching the brake drum to the wheel hub, then by **2** off **M12** bolts of at least **40 mm** thread length driven into the threaded bores for this purpose in the brake drum flange pull out the brake drum and remove.

REINSTALLING THE BRAKE DRUM

Aligning the bores position the brake drum to the wheel hub. Install the hex. bolts attaching the brake drum and tighten to **39 - 49 Nm** torque.

SECTION 214

REMOVING AND REINSTALLING THE COVER AND THE TOOTHED HUB

Remove the hex. bolts **(1)** and separate the cover **(3)** by driving an **M8** bolt into bore in the cover.

Remove the snap ring **(25)** and unscrew the hex. bolts **(21)**.

By means of the bolts shown **(Fig. 1.)** pull off the toothed hub **(23)**.

When reinstalling the toothed hub apply oil-resistant surface sealant to the inner seating flange — behind the bores — as described in the **"GENERAL SERVICE INSTRUCTIONS".**

Push the toothed hub over the splines of the outer axle shaft **(24)** to bottom out.

Secure the toothed hub to the wheel hub by means of hex. bolts **(21)** with washers **(22)**. Apply thread locker sealant to the bolts and tighten to **129 - 156 Nm** torque.

Pull the outer axle shaft forward and secure with snap ring **(25)**.

As described in the **"GENERAL SERVICE INSTRUCTIONS"** apply oil-resistant surface sealant to the seating flange of the cover — behind the bores — and secure by hex. bolts applied with thread locker and tightened to **19.6 - 24.5 Nm.**

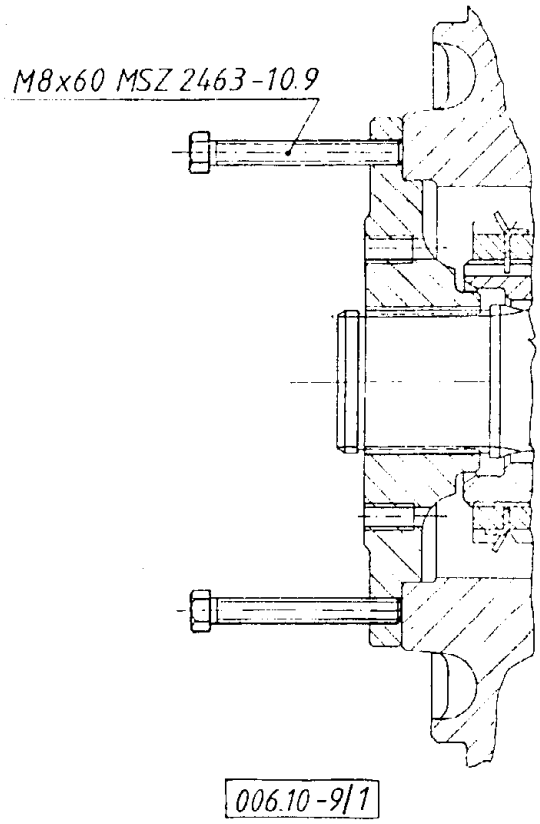

Fig. 1.: PULLING OFF THE TOOTHED HUB

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SECTION 223

REMOVING AND REINSTALLING THE WHEEL HUB

Remove the disk brake.

After removing the cover **(3)** and the toothed hub **(23)** unsecure the shaft-end nuts **(26 and 28)**.

The shaft-end nuts can be removed by means of the tools shown **(see Fig. 1.)**.

Before removing the shaft-end nuts MAKE SURE to suspend the wheel hub safely.

Following this remove the suspended wheel hub from the steering knuckle.

Fill up the wheel hub subassembled according to Section **224** with grease specified in the **"OPERATOR'S MANUAL",** as shown in **Fig. 2.**

(Apply grease to the space marked **1** after adjusting the axial clearance of the wheel hub.)

Concentrically pull the wheel hub filled with grease over the spindle coated with grease on the bearing journals.

Install the cone of the outer taper roller bearing **(7)** and screw on the inner shaft-end nut.

Adjust the axial play of the wheel hub bearing support to **0.01 - 0.04 mm**.

By means of the wrench shown in **Fig. 1.** tighten the inner shaft-end nut **(28)** — while continually rotating and axially moving the wheel hub — so, the wheel hub shall turn hard. By this means proper connection of the bearings is assured.

Back out the shaft-end nut and tighten again to **196 Nm** torque, then turn back by approx. **35º - 45º.**

Position the lock plate, install the outer shaft-end nut and tighten to **588 - 637 Nm** torque.

By means of dial indicator as shown in **Fig. 3.** check if the specified **0.01 - 0.04 mm** axial play is obtained.

In case of improper bearing clearance perform correction by turning the shaft-end nut and repeat the check procedure.

If the **0.01 - 0.04 mm** axial play is adjusted secure the shaft-end nuts by the lock plate **(27).**

SECTION 224

DISASSEMBLING AND REASSEMBLING THE WHEEL HUB

(Replacing the bearing cups and the sealing ring.)

By means of a simple pry remove the sealing ring (11) from the removed wheel hub and remove the inner taper roller bearing cone.

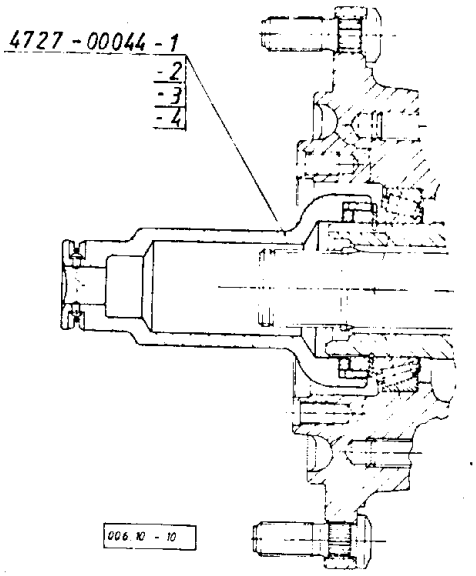

Fig. 1.: ASSEMBLING THE SHAFT-END NUTS

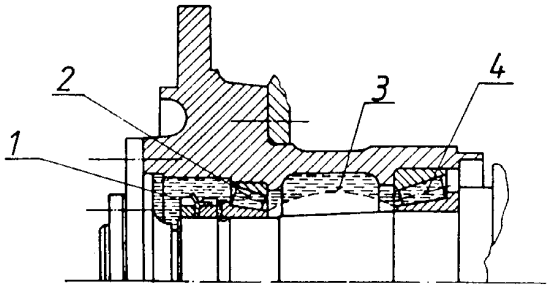

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Fig. 2.: GREASE CAPACITY OF THE WHEEL HUB

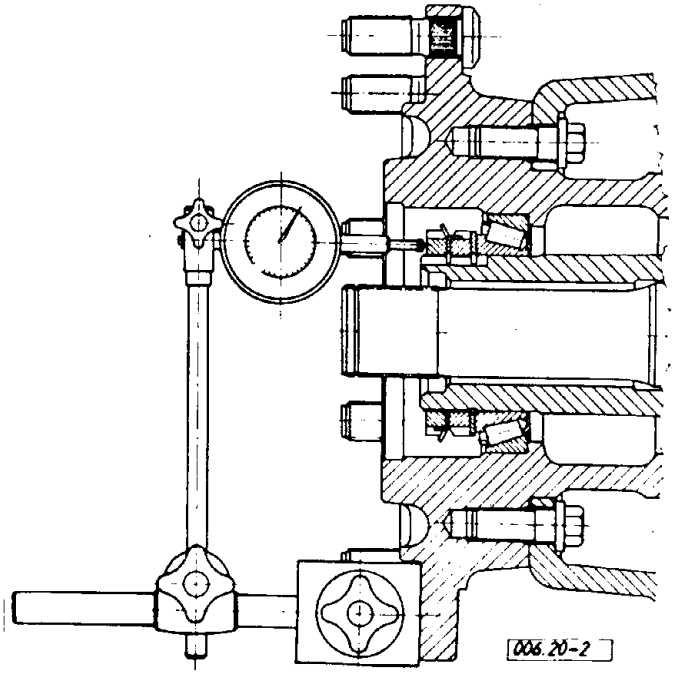

Fig. 3.: MEASURING THE WHEEL HUB BEARING CLEARANCE

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By means of the tools shown drive out the cups of the taper roller bearings **(see Fig. 1.).**

REASSEMBLING THE WHEEL HUB

First drive in the cups of the outer taper roller bearings by means of the tool shown **(see Fig. 2.).**

Insert the cone of the inner taper roller bearing **(9)** into bore of the installed cup.

As described in the **"GENERAL SERVICE INSTRUCTION"** apply thin coat of oil-proof sealant to seat of the oil seat.

Drive the sealing ring into the seat until the tool bottoms out **(see Fig. 3.).**

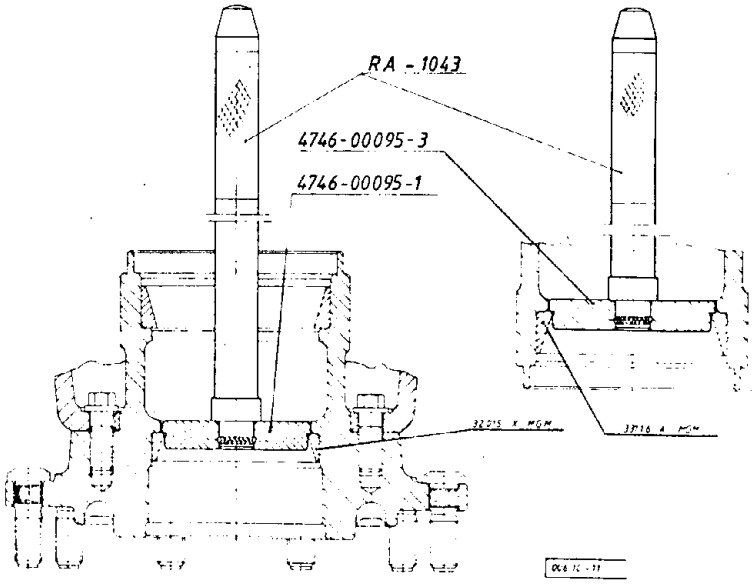

Fig. 1.: DRIVING OUT THE TAPER ROLLER BEARING CUPS

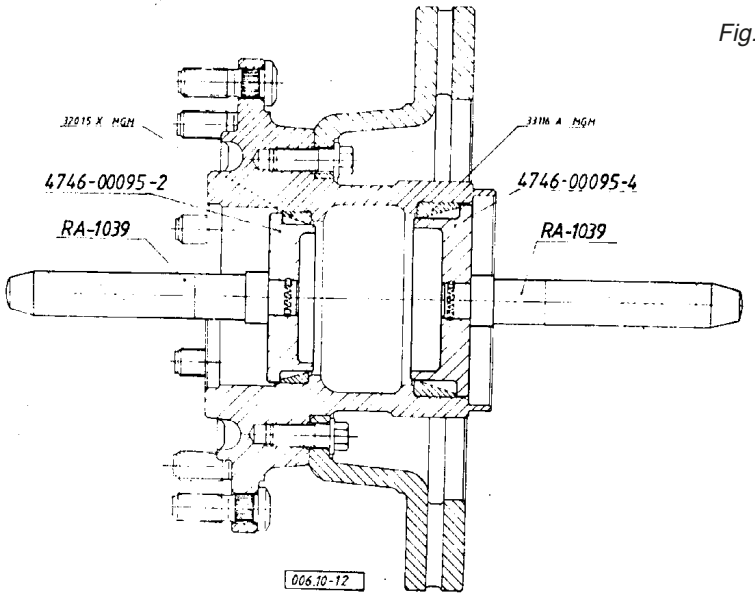

Fig. 2.: DRIVING IN THE TAPER ROLLER BEARING CUPS

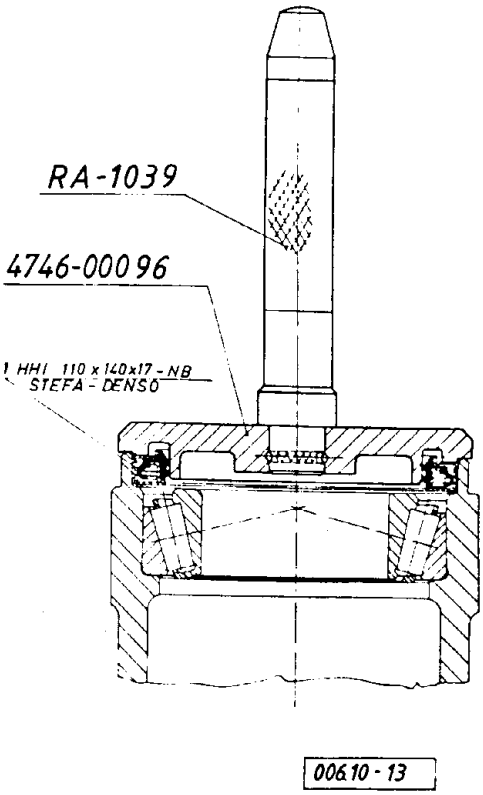

Fig. 3.: DRIVING IN THE SEALING RING

SECTION 226

REMOVING AND REINSTALLING THE SPINDLE AND THE BRAKE SUPPORT

After removing the wheel hub **(Section 223),** the spindle **(33)** and the brake support **(32)** can be removed from the steering knuckle **(37)** by backing out the hex. flanged bolts **(31).**

Installed the proper (RH-LH) spindle and the brake support to the steering knuckle by applying thread locker to the hex. flanged bolts and tightening to **205 - 225 Nm** torque.

Tighten the hex. bolts **(42)** attaching the brake cover plate **(40)** to **30 - 40 Nm** torque.

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SECTION 227

REMOVING AND REINSTALLING THE BRAKE DISK, TRUEING UP THE BRAKE DISK

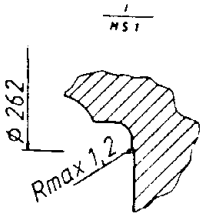
When the brake disk **(13)** is to be replaced remove the hex. flanged bolts **(12)** installed with thread locker and pull the brake disk off the wheel hub.

During reinstalling the new brake disk tighten the hex. flanged bolts applied with thread locker to **205 - 225 Nm** torque.

True up the machining allowance of the brake disk working surface to the dimension shown in **Fig. 1.**

(1) - Up to **ø 262** the surface should be smooth and plane.

Use special care to check the dimension marked by * in **Fig. 1.**



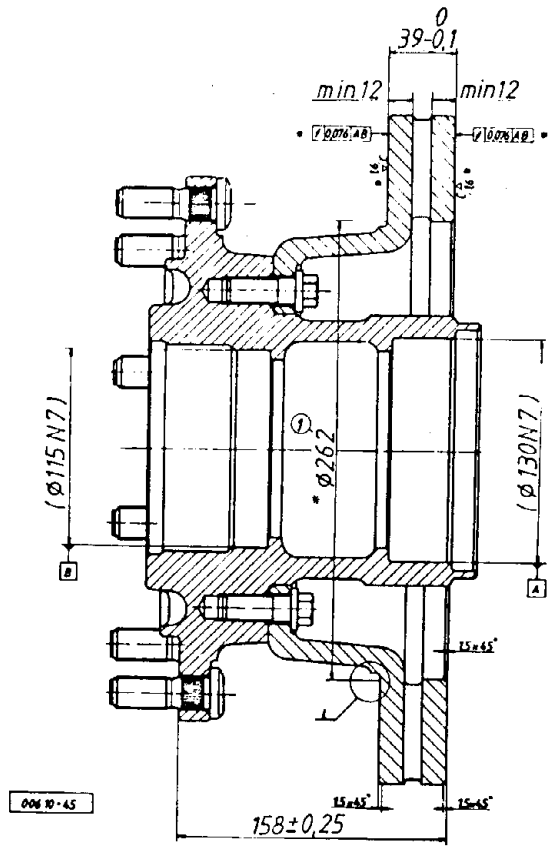


Fig. 1.: TRUE-UP DIMENSIONS OF THE BRAKE DISK

SECTION 229

INSTALLATION INSTRUCTIONS FOR PARTS OF ANTILOCKING SYSTEM

This section contains the constructional elements of the antilocking and anti-skid systems (ABS and ASR), that can be installed by the customer into each axle type as well as the installation instructions.

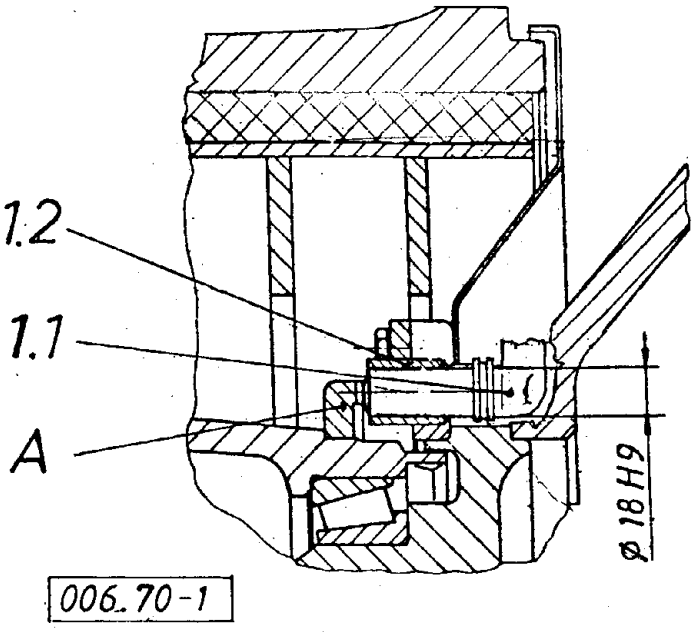
The models given in **"TECHNICAL DATA"** contain the items (A,C) necessary at the installation of the anti-block and anti-skid systems **(1).**

1. INSTALLABLE ELEMENTS OF THE ANTI-LOCK AND ANTI-SKID SYSTEMS

1.1 Revolution sensor:
A 335545231 Robert Bosch GmbH
or ZB 9010-I/83315 KNORR-BREMSE
or WABCO 441 032 001 0

1.2 Spring bushing:
C 335 002-431 A Robert Bosch GmbH
or 4B 69698 KNORR-BREMSE
or WABCO 899 760 510 4

Note: The revolution sensor and the spring bushing must be of the same make.



A. TOOTHED PULSE GENERATING RING

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2. INSTALLATION INSTRUCTION

Before installing the spring bushing coat the **18H9** bore of the revolution sensor holder with copper paste or silicone grease (e.g. Molykote FP 186, Unirew N3) in order to prevent corrosion.

Insert the spring bushing from the middle of axle into the **18H9** bore until stop **(1.2).**

Put the revolution sensor **(1.1)** into the spring bushing and push it until it reaches the generator ring and the wheel hub. This setting has to be performed every time the hub will be disassembled.

During operation maximum clearance between the revolution sensor and the generator ring may be **0.8 mm.**

When leading the wire of the revolution sensor out of the axle brake mechanism be sure not to bend it with a radius less than **R50 mm.** Fasten the wire at distances of **50 mm** exposed to heat load inside the brake mechanism.

Check the runout of the toothed pulse generating ring on the wheel hub. Maximum permissible runout of toothing in direction of revolution sensor shaft is **0.2 mm.**

NOTE: Tachometer to be built in only with spring bushing of the same manufacturing. Besides Bosch and Knorr tachometer, a tachometer of other production, interchangeable with the above is allowed to be built in. If the impulse ring is changed, before pressing the new impulse ring is to be headed uniformly to **150 Cº** and pushed up to stop on the wheel hub.

TOOTHING CAN NOT GET DAMAGED!

FRONT AXLE HOUSING

SECTION 241

REMOVING AND REINSTALLING THE TIE-ROD, ADJUSTING THE TOE-IN AND THE WHEEL TURN ANGLES

REMOVING THE TIE-ROD

Remove the cotters and back out the castle nuts, then remove the linkages from the taper bore of the tie-rod arms by pressing out the ball stud with the tool shown **(Fig. 1.).**

REINSTALLING THE TIE-ROD

Reinstall the tie-rod in reverse order of removal.

After performing the proper adjustments tighten the castle nuts of the ball pins to **230 - 320 Nm** torque.

When installing the tie-rods adjust the toe-in, as well.

ADJUSTING THE STEERING GEOMETRY OF THE AXLES

(Fig. 2. and 3.)

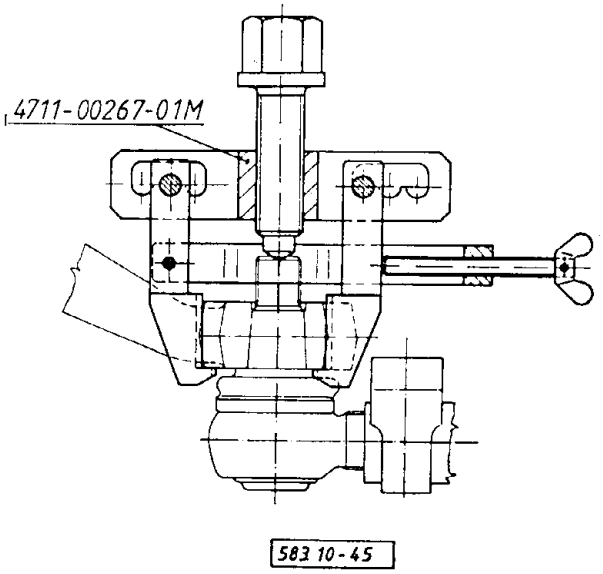

Fig. 1: PRESSING OUT THE BALL STUDS

1. MEASURING, ADJUSTING TOE-IN

Toe-in **(Fig. 2.)** means the difference between the dimensions **"A"** and **"B"** as measured at the height of the wheel center in front and rear on the wheel disk flange. The value "B" measured at the front is smaller.

Measure the dimension "A" and mark the measurement place, then turn the wheel over by 180º and measure the dimension "B" at the marked place.

TOE-IN = A - B = 1/8" ± 1/6"

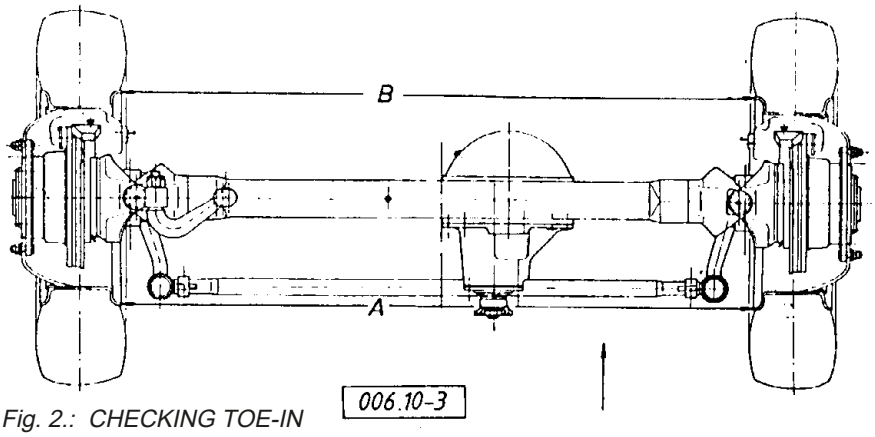

Fig. 2.: CHECKING TOE-IN

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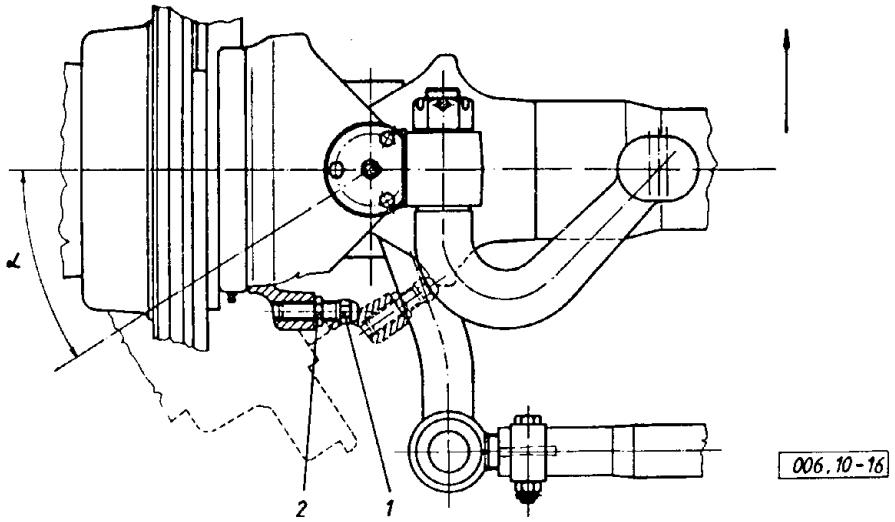

FIG. 3.: ADJUSTING THE MAX. INNER WHEEL TURN ANGLE

WARNING!

Perform toe-in measurement with axle installed to the vehicle and not jacked up.

After loosening the tie-rod clamp nuts adjust the toe-in by turning the tie-rod to required direction.

After adjustment the tie-rod tube slit and the stem of the tie-rod clamps should face downward, under angle of ±**45º** from the vertical plane. If required remove one ball joint head, turn off the tie-rod by **180º** and turn off the ball joint head by **360º** to proper direction to assure the slit shall be in lower position.

After proper adjustment tighten the castle nuts of the ball studs to **230 - 320 Nm** and the tie-rod clamps to the **55 - 69 Nm** torque, then cotter secure the castle nuts.

At self-lock nut the tightening torque is **75 - 90 Nm**. After this check the toe-in again.

2. ADJUSTING MAX. INNER WHEEL TURN ANGLE

1 — Stop bolt
2 — Jamnut

Upon reaching the max. inner wheel turn angle (?) specified in the "TECHNICAL DATA", adjust the stop bolt so, to bottom out against the axle body (Fig. 3.).

WARNING!

By means of the pressure relief valve adjust the power steering gear so, the servo effect shall terminate 2.0 - 3.0 mm before the stop bolts bottom out against the axle body.

Secure the stop bolt by tightening the hex. jamnut to 60 - 80 Nm torque.

Perform adjustment of the max. inner wheel turn angle on both sides.

When adjusting the inner wheel turn angles the double joint may not interfere with the knuckle carrier and the steering knuckle.

The outer wheel turn angle is a resultant value.

SECTION 242

REPAIRING THE TIE-ROD

THE TIE-ROD

1 — Tie-rod
2 — Ball joint head
3 — Hex. bolt
4 — Self-lock nut

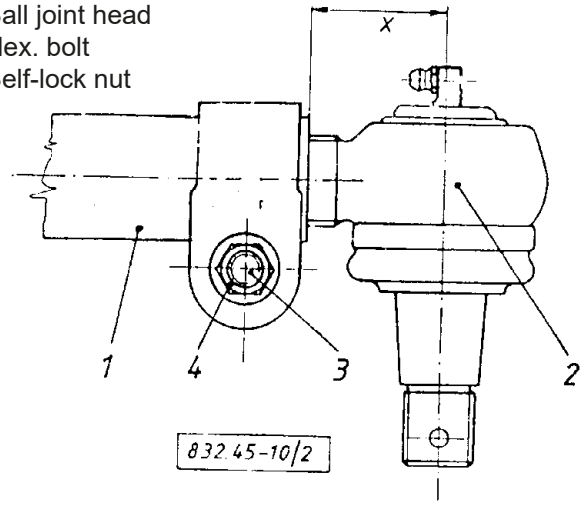

Fig. 1.: TIE-ROD

REPAIRING THE TIE-ROD

Loosen the self-lock nut **(4).** Screw the ball joint head out of the tie-rod end.

The ball joint head may be replaced as a unit only.

When reassembling the tie-rod make sure to check if the distance (X) between the tie-rod end and the ball stud centerline is nearly identical on both sides.

After installing the tie-rod to the tie-rod arms and adjusting the specified toe-in tighten the self-lock nuts of the shackles to **75 - 90 Nm** torque. Tighten the castle nut to **55 - 69 Nm** and cotter secure.

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SECTION 243

REMOVING AND REINSTALLING THE STEERING KNUCKLES, REMOVING AND REINSTALLING THE DOUBLE JOINTS, ASSEMBLING THE BRAKE SUPPORT AND THE SPINDLE

REMOVING THE STEERING KNUCKLES

After removing the wheel hub, remove the cover **(49)** of the knuckle pins **(50 and 65).**

Remove the hex. flanged nuts **(56)** from the lock wedges **(55)** and drive out the wedges.

Properly backing up the steering knuckle drive out the knuckle pins by the driver shown **(Fig. 1.).**

If required start moving the knuckle pin first by driving inward.

Following this catching safely pull the steering knuckle **(37)** off the knuckle carrier **(62)** and the outer axle-shaft, then remove the shims **(54).**

By means of the mandrel shown secure the axial bearing **(66)** until pulling off the steering knuckle **(Fig. 2.).**

REMOVING THE DOUBLE JOINT

After removing the steering knuckle carefully pull the double joint out of the differential gear splines and the pinion carrier seals.

ASSEMBLING THE BRAKE SUPPORT AND THE SPINDLE

In case of replacement of the brake support **(32)** and the spindle **(33)** tighten the hex. flanged bolts **(31)** applied with thread locker to **205 - 225 Nm** torque.

REINSTALLING THE DOUBLE JOINT AND THE STEERING KNUCKLE

Carefully push the inner longer axle-shaft **(63)** of the double joint thru the sealing ring of the knuckle carrier **(62)** and the bore of its cylindric roller bearing **(61),** then aligning the splines with those of the differential gear push the axle-shaft further to bottom out against the differential, making sure not to damage the gasket **(58)** and the sealing ring **(59).**

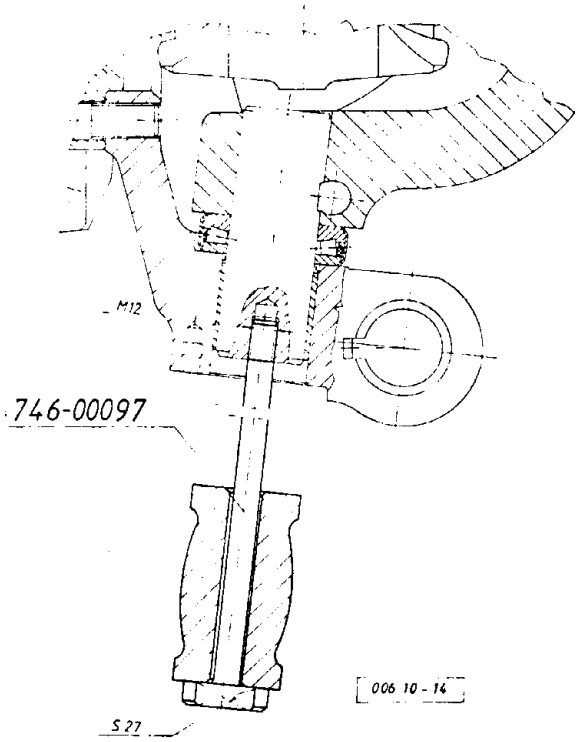

Fig. 1.: DRIVING OUT THE KNUCKLE PINS

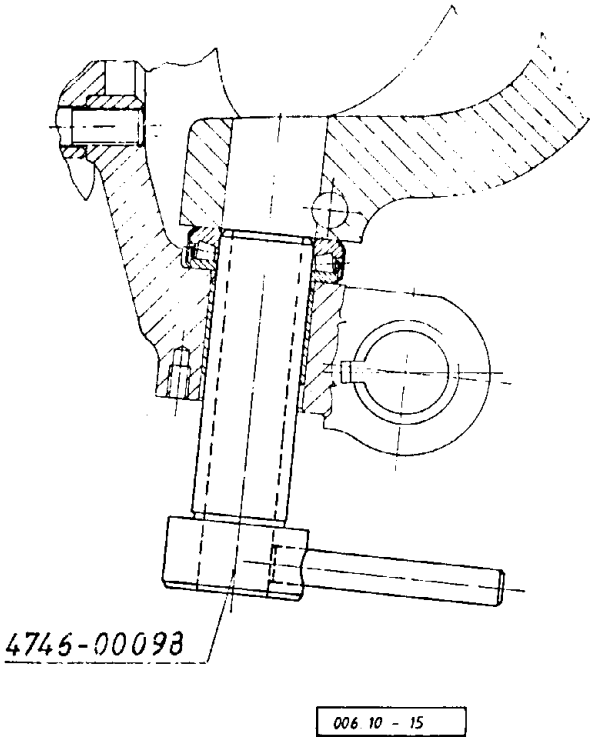

Fig. 2.: ASSEMBLING THE AXIAL BEARING OF THE LOWER KNUCKLE PIN

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Pull the service sleeve shown over the outer axle shaft (24) for playing the inner seals of the spindle past over the outer axle shaft splines **(Fig. 3.)**

Carefully push the relevant steering knuckle subassembled with inner seals over the service sleeve on the outer axle-shaft, taking care not to damage the sealing rings, then pull the service sleeve off the axle-shaft end.

Align the bore in the upper knuckle pin of the steering knuckle with that in the lock wedge of the knuckle carrier.

Pilot the bores by means of the service mandrel shown **(see Fig. 4.).**

Fill up the inter-roller space of the axial bearing with specified grease before assembling.

By means of the lower service mandrel fit the axial bearing **(66)** to place shown in **Fig. 2.,** then push the service mandrel in to bottom out.

Push up the steering swivel to bottom out so, not to turn off. By means of feeler gage measure the distance between the plane of the knuckle carrier **(62)** and the steering knuckle **(37)** then from the shims **(54)** select a pack of thickness **0.1 - 0.3 mm** less than the measured value.

Pull out the upper service mandrel so, to be able to insert the selected shim pack, then aligning the bores push back the service mandrel.

Lower the steering knuckle to normal position and install the magnetic pedestal dial indicator. Moving the steering knuckle up and down check if the clearance is **0.0 - 0.3 mm.**

For accuracy perform the measurement several times.

In case of proper clearance install the relevant knuckle pins **(50 and 65)** in place of the service mandrels and secure by lock wedges **(55).** Screw the hex. flanged nuts to the lock wedges and tighten to **40 - 60 Nm**.

Install the covers **(49)** together with gasket **(45)** over the knuckle pins. Tighten the hex. bolts with lock washers to **30 - 40 Nm** torque.

Screw one ball grease fitting **(46)** into each cover and fill up the knuckle pin bearings with grease.

Apply properly adhering chassis protection paint to the inner end of the knuckle pins and the inner surface of the connecting knuckle carrier.

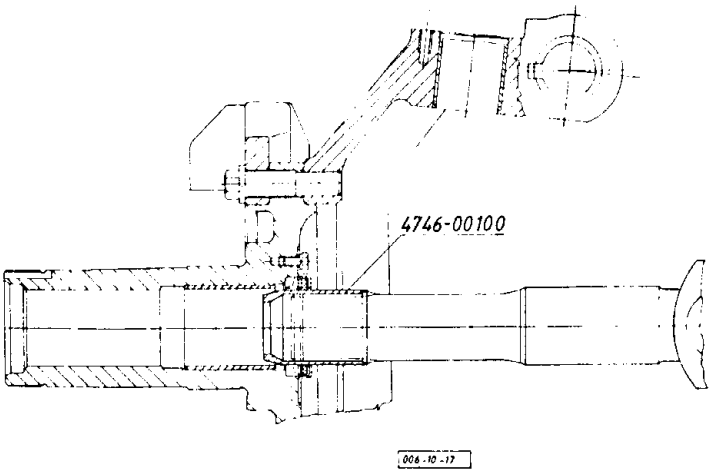

Fig. 3.: REINSTALLING THE STEERING KNUCKLE

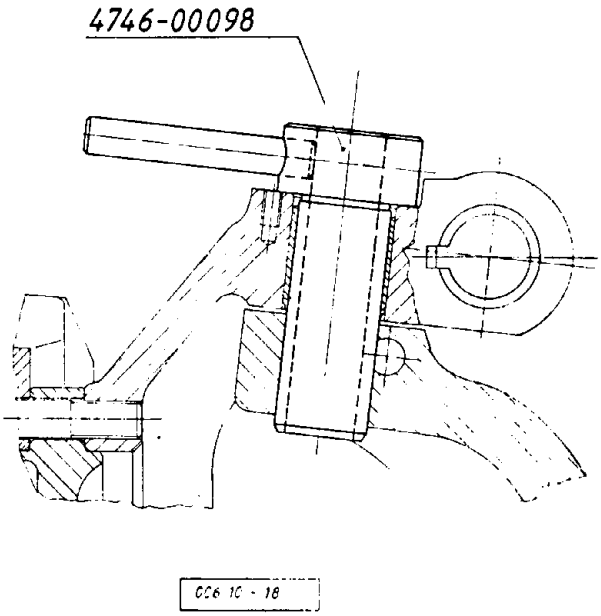

Fig. 4.: PILOTING THE BORE IN THE UPPER KNUCKLE PIN

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SECTION 244

ASSEMBLING THE KNUCKLE PIN BUSHINGS AND THE SEALING RINGS ON THE STEERING KNUCKLE

REMOVING THE KNUCKLE PIN BUSHINGS

Remove the sealing rings **(53)** by means of a simple pry.

By means of puller arranged from items shown pull out the knuckle pin bushings **(52)** on both sides (see **Fig. 1.**).

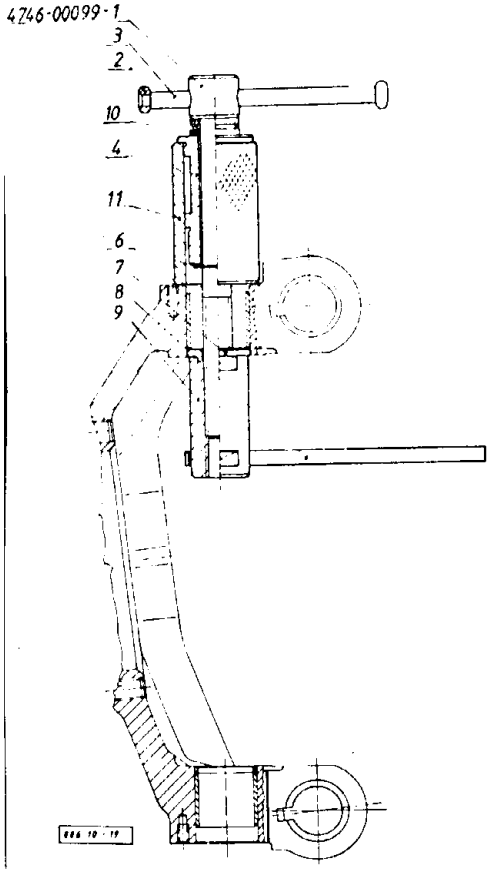

Fig. 1.: PULLING OUT THE KNUCKLE PIN BUSHING

REINSTALLING THE KNUCKLE PIN BUSHINGS AND THE SEALING RINGS

When pressing in the knuckle pin bushings make sure to check if the slot of the bushings faces toward the area indicated in Fig. 2. both at the upper and lower bushing. Apply grease to outer surface of the bushings.

1 — The slot in the upper and lower bushings should face toward the indicated area **(Fig. 2.)**.

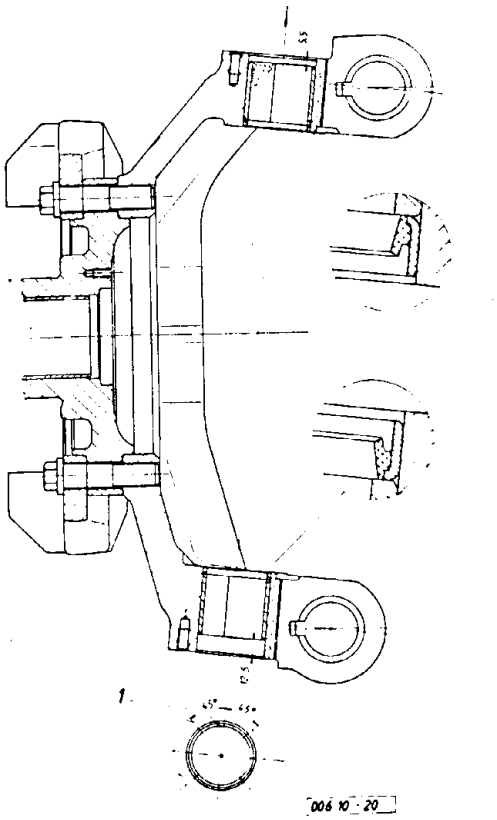

Fig. 2.: POSITION OF THE KNUCKLE PIN BUSHINGS AND THE SEALING RINGS

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By means of the device arranged from the items shown press in the bushings both to the upper and lower side **(Fig. 3.)**.

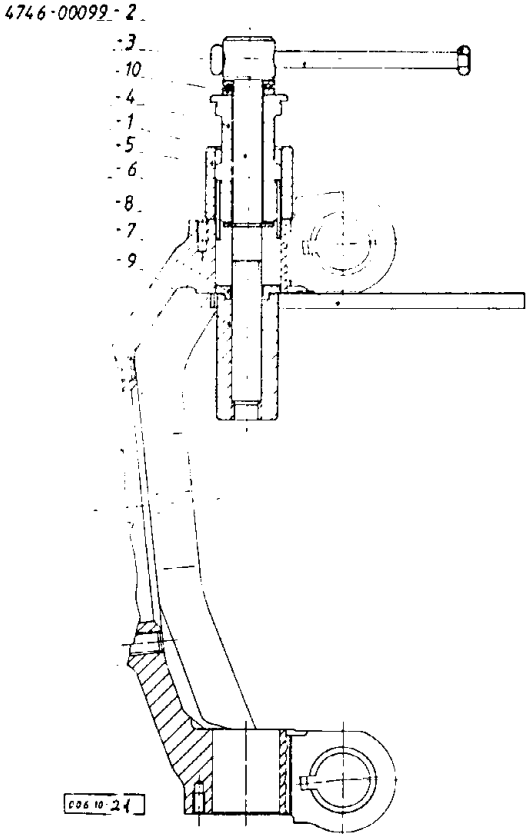

Fig. 3.: PRESSING IN THE KNUCKLE PIN BUSHINGS

By means of the tools shown in **Fig. 4.** drive in the sealing rings beside the bushings. Make sure to install the sealing rings as shown in detail drawing of **Fig. 2.**

The sealing rings may not extend from plane of the steering knuckle.

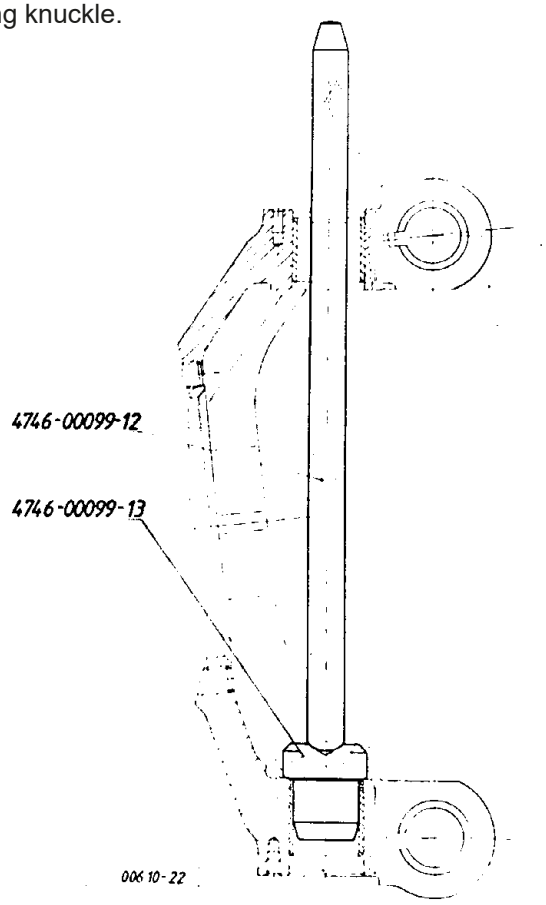

Fig. 4.: DRIVING IN THE SEALING RINGS

SECTION 245

ASSEMBLING THE STEERING ARMS AND THE TIE-ROD ARMS

REMOVING THE ARMS

For removing the steering and tie-rod arms remove the cotters **(69 in Fig. 210/1.)** and unscrew the castle nut. Drive the arms out of the steering knuckle.

REINSTALLING THE ARMS

Position the relevant tie-rod arm (RH-LH) and the steering arm to the seat in taper bore of the steering knuckle and drive in together with the woodruff-key **(70).** Tighten the castle nut **(68)** to **457 - 664 Nm** torque and cotter secure.

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ASSEMBLING THE DOUBLE-JOINT (AXLE-SHAFT REPLACE-MENT)

REMOVING THE AXLE-SHAFTS FROM THE DOUBLE-JOINT

Remove the screw plug from the bearing bushing and remove the snap ring before the bearing bush-ing.

1 — Bearing bushing
2 — Carrying ring
3 — Screw plug
4 — Snap ring
5 — Spider
6 — Pivot pin
7 — Threaded dowel

By means of the puller shown remove the bearing bushings from the carrying ring on both the sides, by screwing the bolt of the puller to place of the screw plug **(see Fig. 1.).**

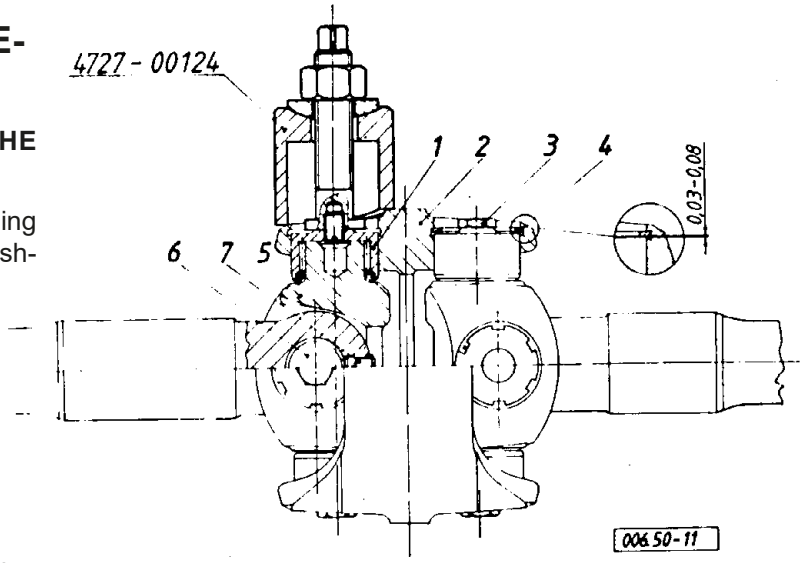

Fig. 1.: PULLING OUT THE BEARING BUSHING

Mark the removed parts to assure reinstallation to their original place.

After removing the bearing bushings remove the axle-shaft together with outer spider from the carry-ing ring.

Pull the bearing bushing out of the outer spider by proper adapter of the puller, then unscrew the dowel pins, from the spider.

Properly backing up the axle-shaft, start the knuckle pin out of the axle-shaft by means of the thrust pin of the tool shown in **Fig. 3.,** then drive out by a man-drel of diameter less than **30 mm (Fig. 2.).**

REASSEMBLING THE DOUBLE JOINT

Reassemble the new axle-shaft in reverse order of removal.

Install the proper axle-shaft into the spider and press in the knuckle pin to center position as shown by **“A”** in **Fig. 3**.

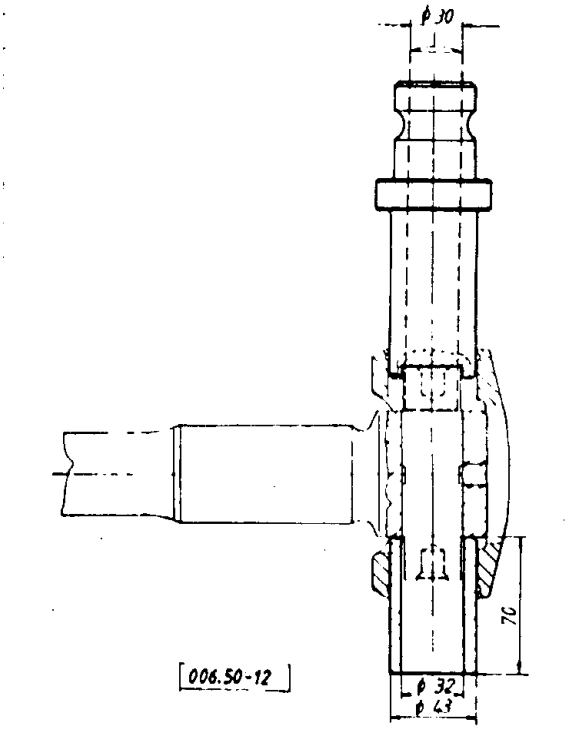

Fig. 2.: DRIVING OUT THE KNUCKLE PINS

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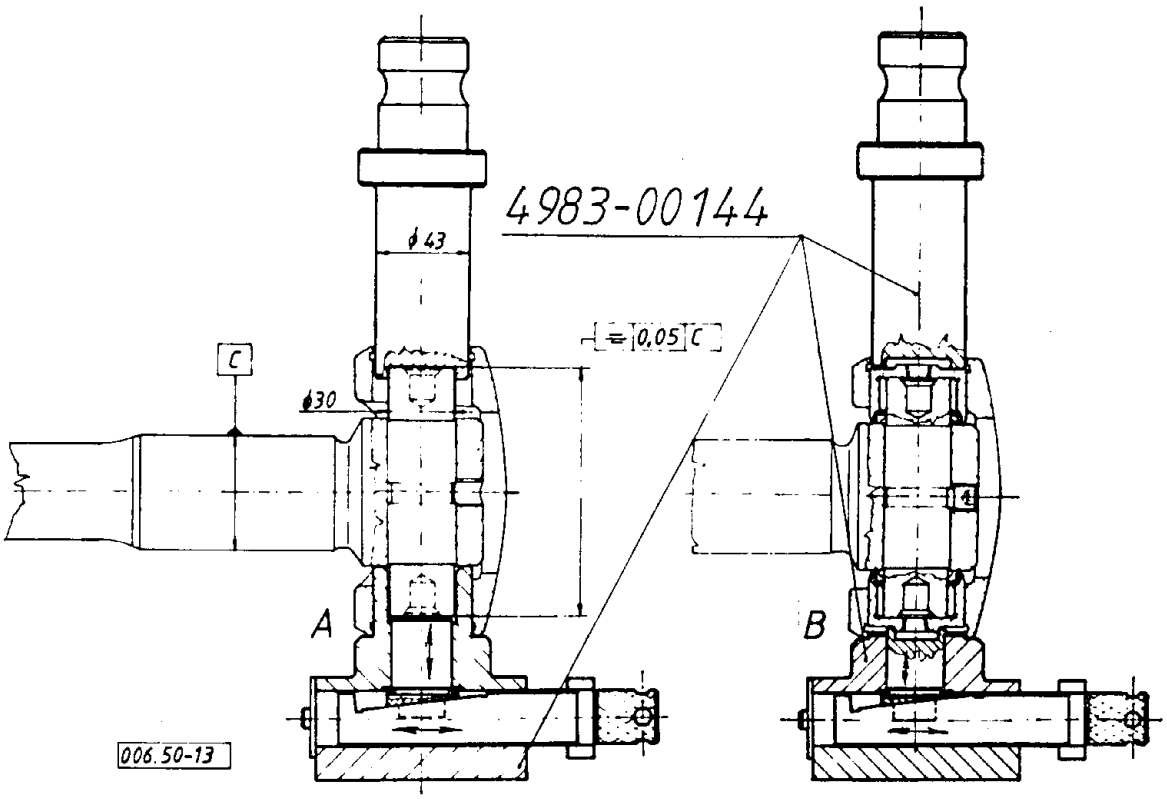

Fig. 3.: INSTALLING THE KNUCKLE PINS AND THE BEARING BUSHINGS

WARNING!

The symmetry tolerance of the knuckle pin face pressed into the axle-shaft relative to the ground bearing place of the axle-shaft is **± 0.05 mm.** Perform check between centers by dial indicator.

Adjustment of the mean position can be performed by rotating the adjusting spindle of the device and by adjusting the movable wedge or its support pin **(Fig. 3.).**

After adjusting the knuckle pin to mean position, secure by threaded dowel **(7).** Apply LOCTITE thread locker to the dowel.

WARNING!

The untreated double joint cannot be greased subsequently. When assembling apply the specified lithium-base grease (LZS-2 EP) to the double joint.

Fill up the roller spaces of the bearing bushings equipped with oil seal, as well as the bores of the knuckle pins and the end of the spider with specified grease.

Adjust the axial play of the knuckle pin and the spider to **0.03 - 0.08 mm,** by installing identical thickness snap rings or using ones different with one size step.

According to detail **"A"** of **Fig. 3.** use proper backing and press the bearing bushing assembly to one side, then install a "standard" **2.075 mm** thickness blue colored snap ring into the groove. By backing up as shown in detail **"B"** of **Fig. 3.,** press the bearing bushing assembly to the other side and here also install the "standard" **2.075 mm** thickness blue colored snap ring into the groove.

If the joint assembly can be turned off easily, the axial play is excessive, so first install the next higher thickness step snap ring instead of the "standard" thickness one. If the joint in spite of this still can be rotated easily, replace the snap ring on the other side also to the next higher thickness step one.

When the joint assembly can be turned excessive hard, the axial play is too low, so replace the "standard" thickness snap rings to a lower thickness step one, as described above.

Insert the spider subassembled with axle-shaft into the carrying ring and backing up properly press in the bearing bushings assembled with oil seal and packed with grease using the thrust pin of the press set **No. 4983-00144.** Install the snap rings as above.

Install the screw plugs into the bearing bushings filled with grease.

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REMOVING AND REINSTALLING THE INNER BEARING AND SEALS OF THE SPINDLE

REMOVAL

Remove the dust protection plate **(36).**

After removing the dust protection plate by means of pry remove the sealing ring **(38)**.

By means of the device shown **(Fig. 1.)** pull the bushing **(30)** out.

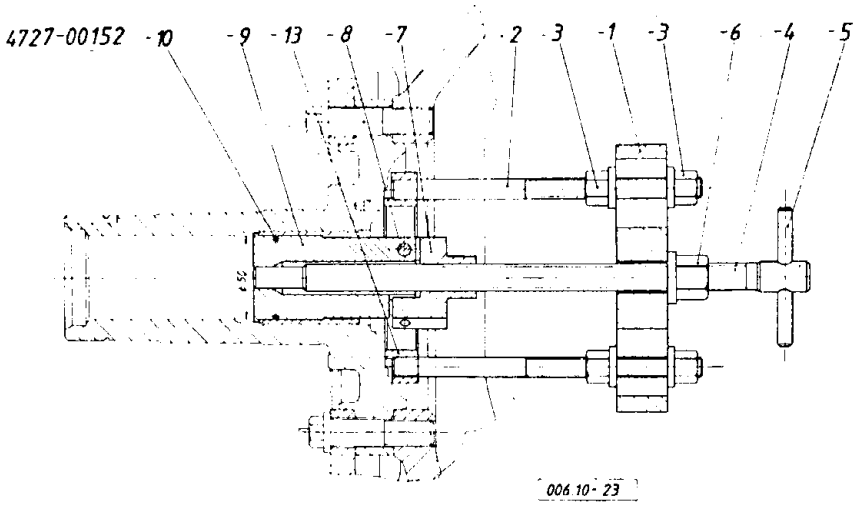

Fig. 1.: PULLING OUT THE BUSHING

REINSTALLING THE INNER BEARING AND THE SEALS TO THE STEERING KNUCKLE

First press the bushing into its seat to bottom out **(see Fig. 2.).**

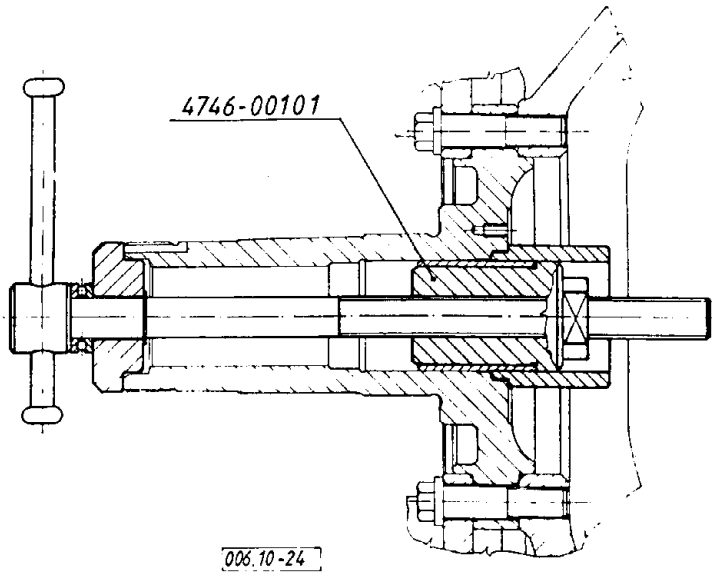

Fig. 2.: PRESSING IN THE BUSHING

By means of the tool shown drive the new sealing ring into its seat **(Fig. 3.).**

By means of lock washers **(34)** and hex. bolts **(35)** install the dust protection plate **(36)** supplied with pressed in sealing ring and tighten the bolts to **6 - 8 Nm** torque.

Fill up the space between the dust protection plate **(36)** and the sealing ring, as well as and the tips of the sealing rings with grease.

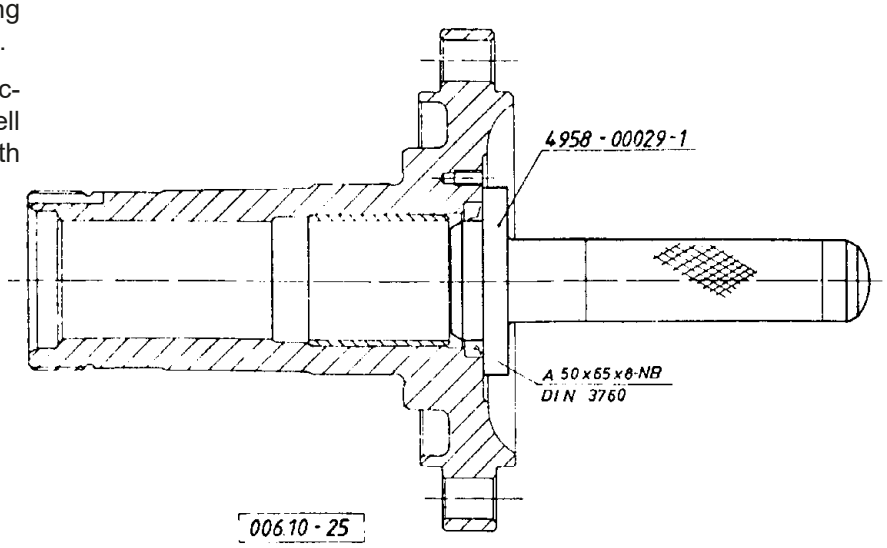

Fig. 3.: DRIVING IN THE SEALING RING

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SECTION 248

REMOVING AND REINSTALLING THE BEARING AND SEALS OF THE KNUCKLE CARRIER

REMOVAL

By means of the puller pull out the seal retainer **(57)** with the sealing ring **(58)** and then the inner oil seal **(59),** as well. **(See in Fig. 1. of Section 247).**

Remove the snap ring **(60)** in front of the cylindric roller bearing **(61)** and also pull out the cylindric roller bearing by means of the above puller.

REINSTALLATION

Install the inner snap ring **(60).**

Drive in the cylindric roller bearing by means of the tools shown **(Fig. 1.).**

Install the outer snap ring before the cylindric roller bearing and drive in the oil seal by means of the same tool, then drive in the seal retainer **(57)** with the sealing ring **(58)** so, the sealing ring shall be inside.

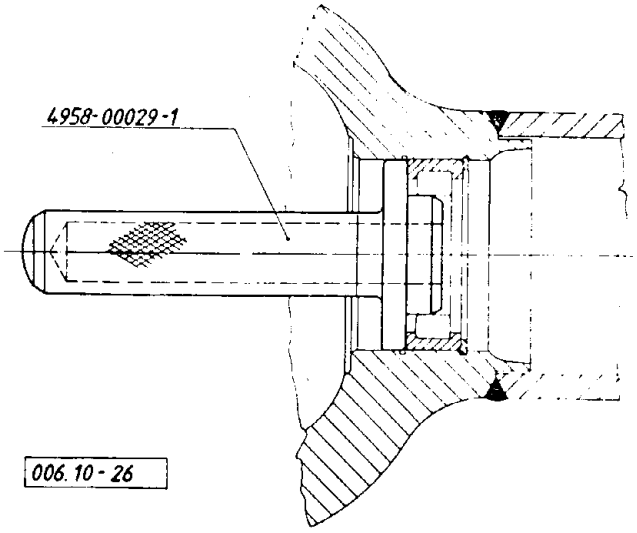

Fig. 1.: DRIVING IN THE CYLINDRIC ROLLER BEARING

SECTION 260

DRUM WHEEL BRAKE

DRAWING OF THE DRUM WHEEL BRAKE

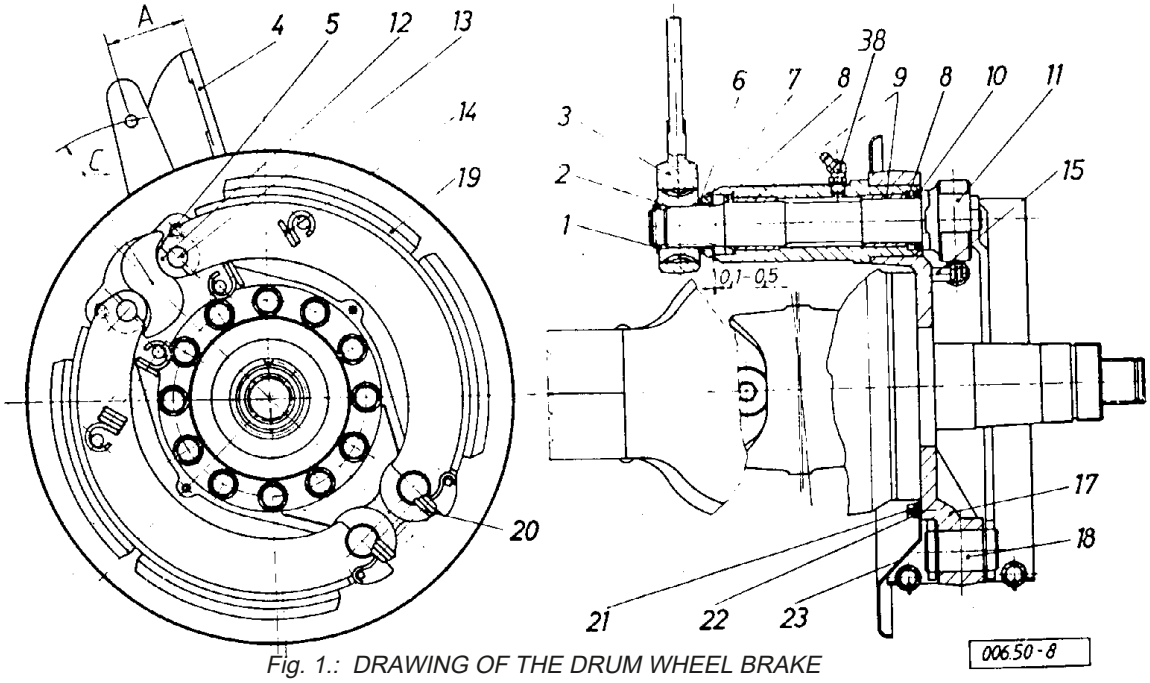

Fig. 1.: DRAWING OF THE DRUM WHEEL BRAKE

SECTION 261

PARTS OF THE DRUM WHEEL BRAKE

1 — Snap ring
2 — Washer
3 — Brake lever
4 — Chamber bracket
5 — Hex. flanged bolt with lock washer
6 — Shims
7 — Spacer
8 — Sealing ring
9 — Bearing bushing
10 — Distance washer
11 — Brake spanner
12 — Roller
13 — Roller pin
14 — Brake shoe return spring, long
15 — Spring support pin
—
17 — Brake support
18 — Brake shoe anchor pin
19 — Brake shoes
20 — Brake shoe return spring, short
21 — Hex. bolt
22 — Lock washer and washer
23 — Brake cover plate
—
38 — Ball grease fitting

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SECTION 262

REMOVING AND REINSTALLING THE BRAKE SHOES

REMOVING THE BRAKE SHOES

Remove the brake drum **(13 in Fig. 1. of Section 210).**

Pry the brake shoes **(19)** away. Remove the rollers **(12)** together with the roller pins **(13).**

Unhook the shoe return springs by means of a spring hooking device, then remove the brake shoes.

REINSTALLING THE BRAKE SHOES

Position the brake shoes to the pressed in shoe anchor pin **(18)** and the brake spanner head. Hook the return springs **(14 and 20)** to the brake shoes. Use the spring hooking device.

Pull the rollers **(12)** over the roller pins **(13)** then pry the brake shoes away, then insert the rollers so, they shall seat both in the brake shoe rib and in the brake spanner involute profile.

SECTION 263

REPAIRING THE BRAKE SHOES AND THE BRAKE DRUM

DO NOT operate the axle with brake drum trued-up exceeding the permitted diameter and brake lining worn below the permitted limit. Exceeding the permitted limits the brake spanner may turn over making the brake application impossible.

The permitted minimum brake lining thickness is indicated by the upper edge of the recess in the brake lining side. (This value is **vmin = 7.0 mm** as measured at center of the brake shoe)

Replace the brake linings if damaged or worn below the permitted limit.

Replacement of the brake lining and true-up of the brake shoe may be performed only in brake shoe pairs.

The brake shoes equipped with new linings should be in compliance with the dimension specifications and technical requirements shown in **Fig. 1.**

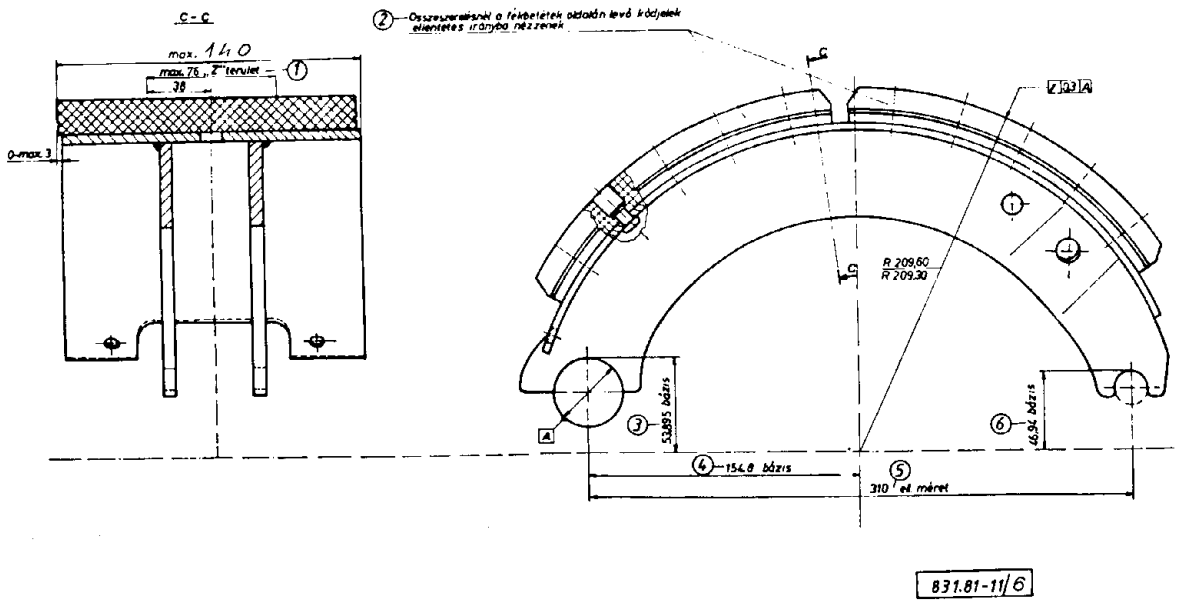

Fig. 1.: DATA FOR TRUEING UP THE BRAKE SHOES EQUIPPED WITH NEW LININGS FOR 420 mm DIA. BRAKE DRUM

1 — Zed—area, max. 76
2 — After installation the codes on side of the brake linings should face to opposite direction
3 — Dimension data 53.895
4 — Dimension data 154.8
5 — Check dimension 310
6 — Dimension data 46.94

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For riveting use ONLY the rivets corresponding to **Fig. 2**

TECHNICAL REQUIREMENTS:

1 — Material: C10 MSZ 31
2 — Copper plated
3 — Tolerance of the untolerated dimensions is **± 0.254**
4 — Tolerance of the untolerated angles is **± 1°**

For riveting use the device equipped with tool developed according to **Fig. 3.**

1 — Rivet set, upper
2 — Rivet set, lower
3 — Globe R 2.4 mm

Perform riveting in sequence shown in **Fig. 4.**

1 — Center of the brake shoe
2 — Brake spanner end of the brake shoe

The brake lining should seat so, the feeler gage of **0.15 mm** could not be inserted between the lining and the brake shoe along the full length except the Zed-area **(see Fig. 1.).**

Check the surface of both linings for parallel to the dimension **"A"** so, to adjust the dimension **"A"** by a **ø 38.09 mm** pin into position shown (see Fig. 1.).

During checking the **20** off rivets should endure the **5340 N** test load, applied to bottom of the **ø 3.784 mm** bore, without loosening.

On each lining **2** off rivet flanges may crack in Vee-shape, provided the test load was endured.

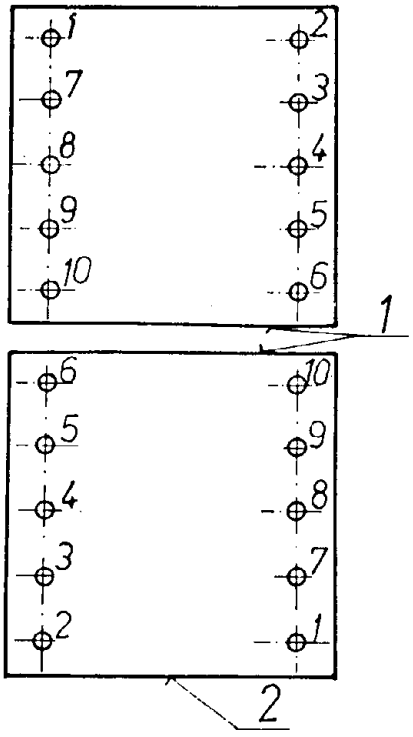

Fig. 4.: RIVETING SEQUENCE

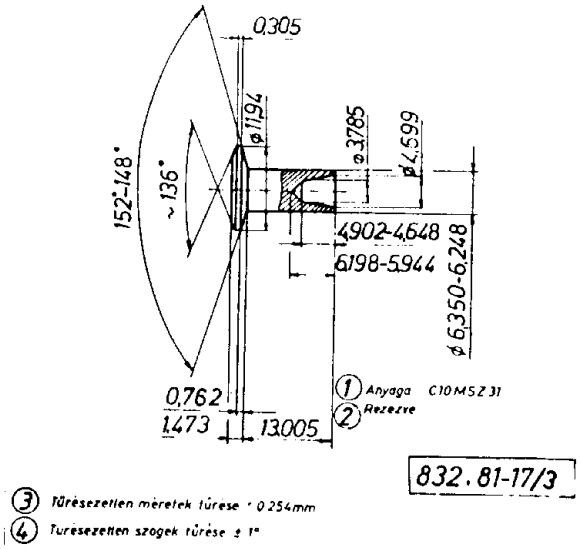

Fig. 2.: DIMENSIONS OF THE RIVETS

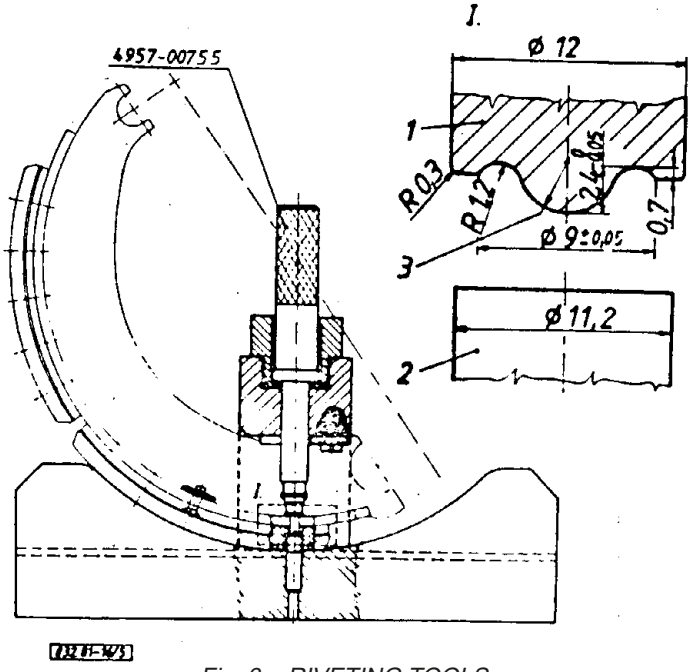

Fig. 3.: RIVETING TOOLS

CHECKING THE BRAKE DRUM

Check the inside surface of the brake drum.

If depth of the hair-cracks experienced on the brake drum surface does not exceed **1 mm** the brake drum can be repaired by true-up.

The maximum brake drum diameter after true-up **ø 423 mm.** Out of this diameter the brake drum should be replaced.

When trueing up the brake drum the brake shoes should be trued up taking the brake drum diameter into account.

E.g.: If diameter of the trued up brake drum is **422 mm,** true up the brake shoe to **R210.6 - R210.3 mm** as shown in **Fig. 1.**

SECTION 264

REMOVING AND REINSTALLING THE BRAKE SUPPORT AND THE CHAMBER BRACKET, ASSEMBLING THE SPRING SUPPORTING PIN

REMOVING THE BRAKE SUPPORT

If the brake support **(17)** or the shoe anchor pin **(18)** is damaged, replace the brake support.

Remove the brake cover plates. After backing out the hex. flanged bolts (**31** in **Section 210/1**) remove the brake support and the spindle from the steering knuckle.

REINSTALLING THE BRAKE SUPPORT

Install the proper brake support (RH-LH) to the spindle flange, using the hex. flanged bolts applied with thread adhesive and tightened to **205 - 225 Nm** torque.

ASSEMBLING THE SPRING SUPPORTING PINS

Install the spring supporting pins **(15)** with thread adhesive.

REMOVING AND REINSTALLING THE CHAMBER BRACKET

After removing the hex. flanged bolts **(5)** pull the chamber bracket **(4)** out of the brake support.

Position the relevant chamber bracket (RH-LH) into bore in the brake support and secure by hex. bolts with lock washers. Tighten the hex. bolts to **110 - 122 Nm** torque.

Install the brake cover plates by means of hex. bolts and lock washers. Tighten the hex. bolts to **10 - 12 Nm** torque.

SECTION 265

REMOVING AND REINSTALLING THE BRAKE LEVER AND THE BRAKE SPANNER

REMOVING THE BRAKE SPANNER

After removing the wheel hub and the brake shoes remove the snap ring **(1)** beside the brake lever **(3).**

Pull off the brake lever and remove the brake spanner from chamber holder.

REINSTALLING THE BRAKE SPANNER AND THE BRAKE LEVER

Apply grease to bearing bushings **(9)** of the brake spanner. Position the distance washer **(10)** to the brake spanner and push the relevant brake spanner (RH-LH) into the chamber holder.

Pull the spacer **(7)** and the shim pack **(6)** necessary for adjusting **0.1 - 0.5 mm** axial clearance over the brake spanner. Install the brake lever (RH - LH) so, the centerline of the brake lever bushing bore shall be in distance from the median plane of the chamber bracket as specified in **Fig. 260/1.**

Beside the brake lever install the shim **(2)** and secure by snap ring **(1).**

Check axial play of the brake spanner to be **0.1 - 0.5 mm.** If required adjust by shims **(6).**

Fill up the brake spanner bearings with specified grease.

WARNING!

After installing the RH, LH brake spanner make sure to check for installed properly. Actuating the brake lever the brake shoes should open.

SECTION 266

REPAIRING THE BRAKE SPANNER BEARING SUPPORT

REMOVING THE BEARING BUSHINGS AND THE SEALING RINGS

By means of the tool shown pull the bearing bushings **(9)** out of the chamber bracket **(4).** See **Fig. 1.**

The bushings will push out the sealing rings (8) ahead.

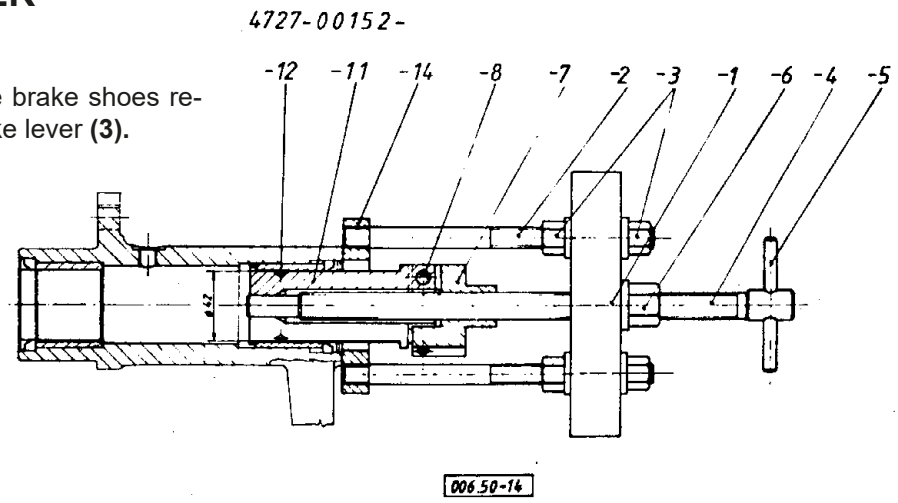

Fig. 1.: PULLING OUT THE BEARING BUSHINGS

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REINSTALLING THE BEARING BUSHINGS

By means of the tools shown drive in the new bearing bushings until the tool bottoms out **(Fig. 2.).**

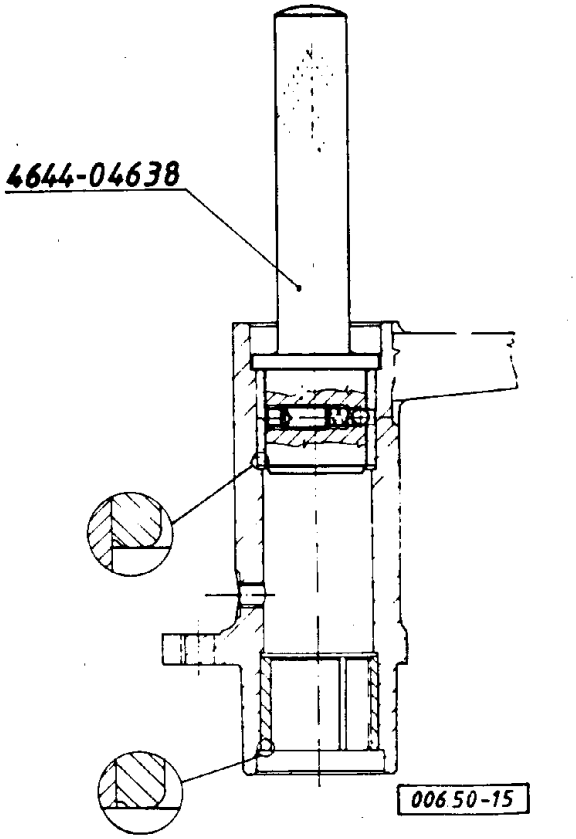

Fig. 2.: DRIVING IN THE BEARING BUSHINGS

REINSTALLING THE SEALING RINGS

When driving in the sealing rings make sure to check if the sealing lips of the rings both near the brake spanner head and on the brake lever side face toward the axle housing center and the brake lever. **(Fig. 3.).**

By this means leak-tightness at the brake spanner head is assured.

During lubrication with grease the sealing ring near the brake lever should pass the surplus lubricant toward the brake lever.

By means of the tools shown drive in the sealing rings before the bushings (see **Fig. 3.**).

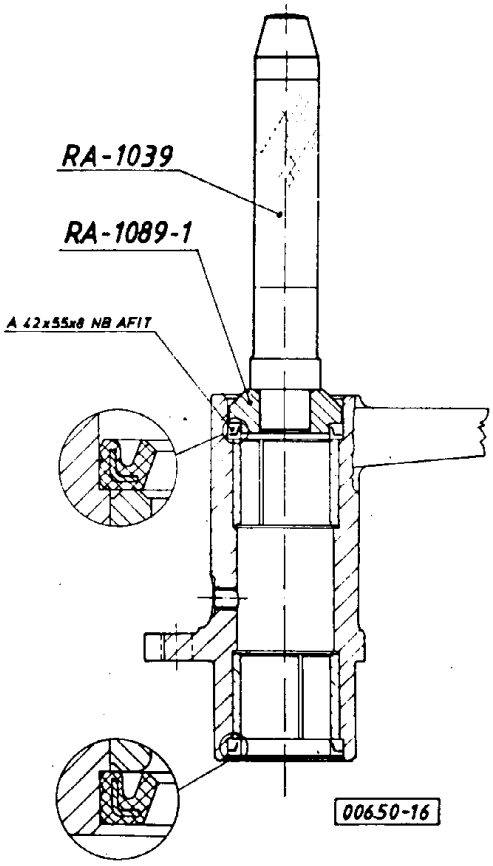

Fig. 3.: DRIVING IN THE SEALING RING

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MANUAL SLACK ADJUSTER AND ITS ASSEMBLING

DISASSEMBLING THE MANUAL SLACK ADJUSTER

Remove the snap ring **(6)** and the shims **(5).** Back out the grub screw **(12),** then remove the spring **(11)** and the steel ball **(10).** Fixing the worm gear (at the brake spanner stem) unscrew the worm **(3)** from the brake lever. The worm will push out the backing disk **(4)** ahead.

On both sides remove the snap rings **(9)** before the worm gear and remove the worm gear **(8)** as well.

Drive the bushing **(1)** out of the brake lever also, if required, and drive in the new bushing to flush with side surface of the brake lever.

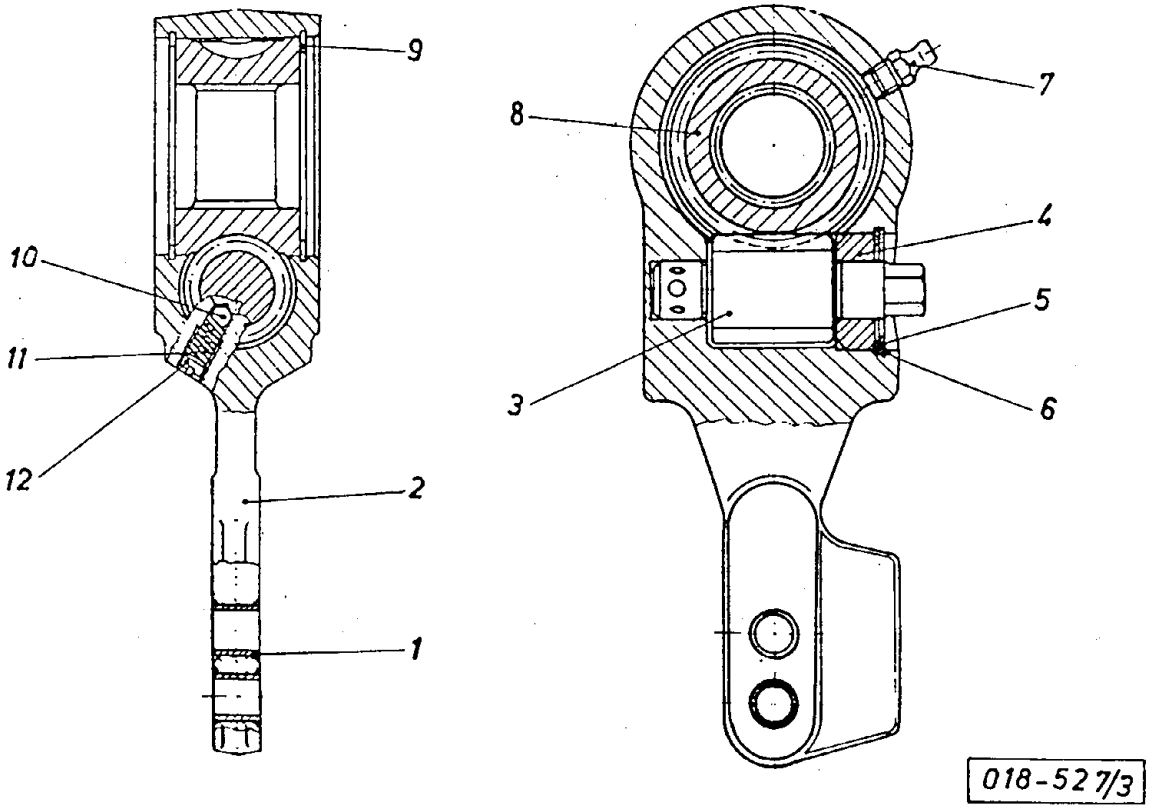

Fig. 1.: MANUAL SLACK ADJUSTER

1 — Bushing
2 — Brake lever
3 — Worm
4 — Backing disk
5 — Shim
6 — Snap ring
7 — Ball lube fitting
8 — Worm gear
9 — Snap ring
10 — Steel ball
11 — Spring
12 — Grub screw

REASSEMBLING THE MANUAL SLACK ADJUSTER

In case of damage to the teeth replace the worm-worm gear pair. Position the worm **(3)** and the worm gear **(8)** into the brake lever. Secure the worm gear by snap rings **(9)** on both sides.

The worm and the worm gear should be rotatable without jamming and jerk.

Insert the steel ball **(10)** and the spring **(11)** into the seat and secure by grub screw **(12).**

Before the worm drive in the backing disk **(4)** to bottom out, position the required shim pack so, to be able to insert the snap ring without clearance. Finally install the snap ring.

Fill up the worm gear with specified grease.

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AUTOMATIC SLACK ADJUSTER MOM TYPE

The slack adjuster requires no maintenance, since it is automatically readjusted according to the brake lining wear.

In case of replacing the brake linings of after repairing the axle perform adjustment of the shoe clearance and the automatic slack adjuster as follows:

ITEMS:

1 — Adjusting plate
2 — Setscrew (hex. distance 13)
3 — Setscrew (hex. distance 10)
4 — Plastic protection cup
5 — Hex. adjusting ring (hex. distance 32)
6 — Stop pin
7 — Plastic thread protector

ADJUSTMENT DATA:

A = Distance between the chamber holder plane and the brake lever bore

B = - " -

C = Brake lever installation radius

D = - " -

For dimensions A - C and B - D refer to **"TECHNICAL DATA".**

A/ ADJUSTING POSITION OF THE BRAKE LEVER AND THE SHOE CLEARANCE:

— Remove setscrews **(2, 3).**

— Take care of the plastic thread protector **(7).**

— Remove the adjusting plate **(1)** and the plastic protection cap **(4).**

— By turning the hex. adjusting ring **(5)** to proper direction adjust the specified distance between the seating surface and the brake lever bore. (Start adjustment from a distance higher than specified.

If required, also adjust the push rod clevis.)

— After the above operation adjust the shoe clearance to **0.3 - 0.6 mm.**

B/ ADJUSTING AND FIXING THE ADJUSTING PLATE:

— Secure the stop fork "E" of the adjusting plate **(1)** in bottom position relative to stop pin **(6)** as shown in **Fig. 1.**

— Complete adjustment by reinstalling the plastic protection cap **(4)** and the adjusting plate **(1)** as well as installing and securing the setscrews **(2, 3)** and screwing on the plastic thread protector **(7).**

— During fixing plane of the adjusting plate should be perpendicular to the stop pin **(6).**

— Before installation apply graphitic grease to serration of the brake lever.

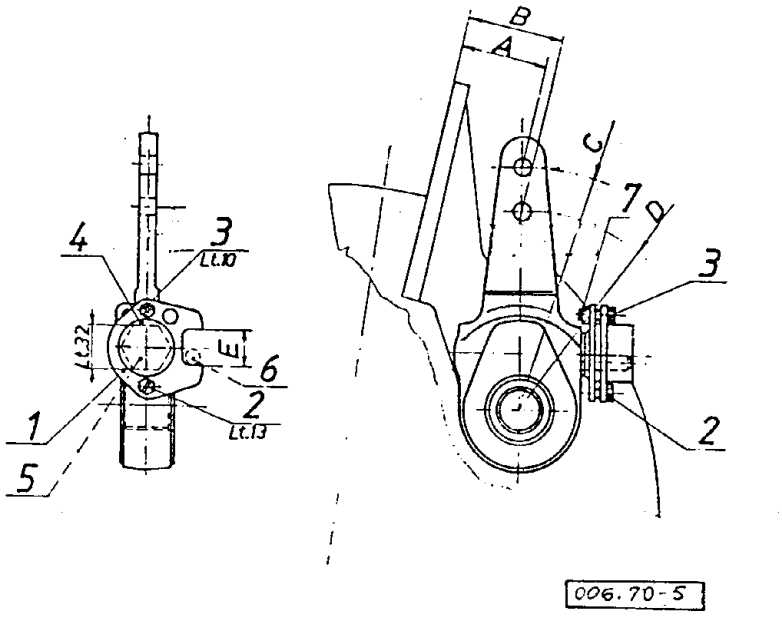

Fig. 1.: AUTOMATIC SLACK ADJUSTER

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SECTION 310

DIFFERENTIAL CARRIER ASSEMBLY

DIFFERENTIAL CARRIER ASSEMBLY SECTIONAL VIEW

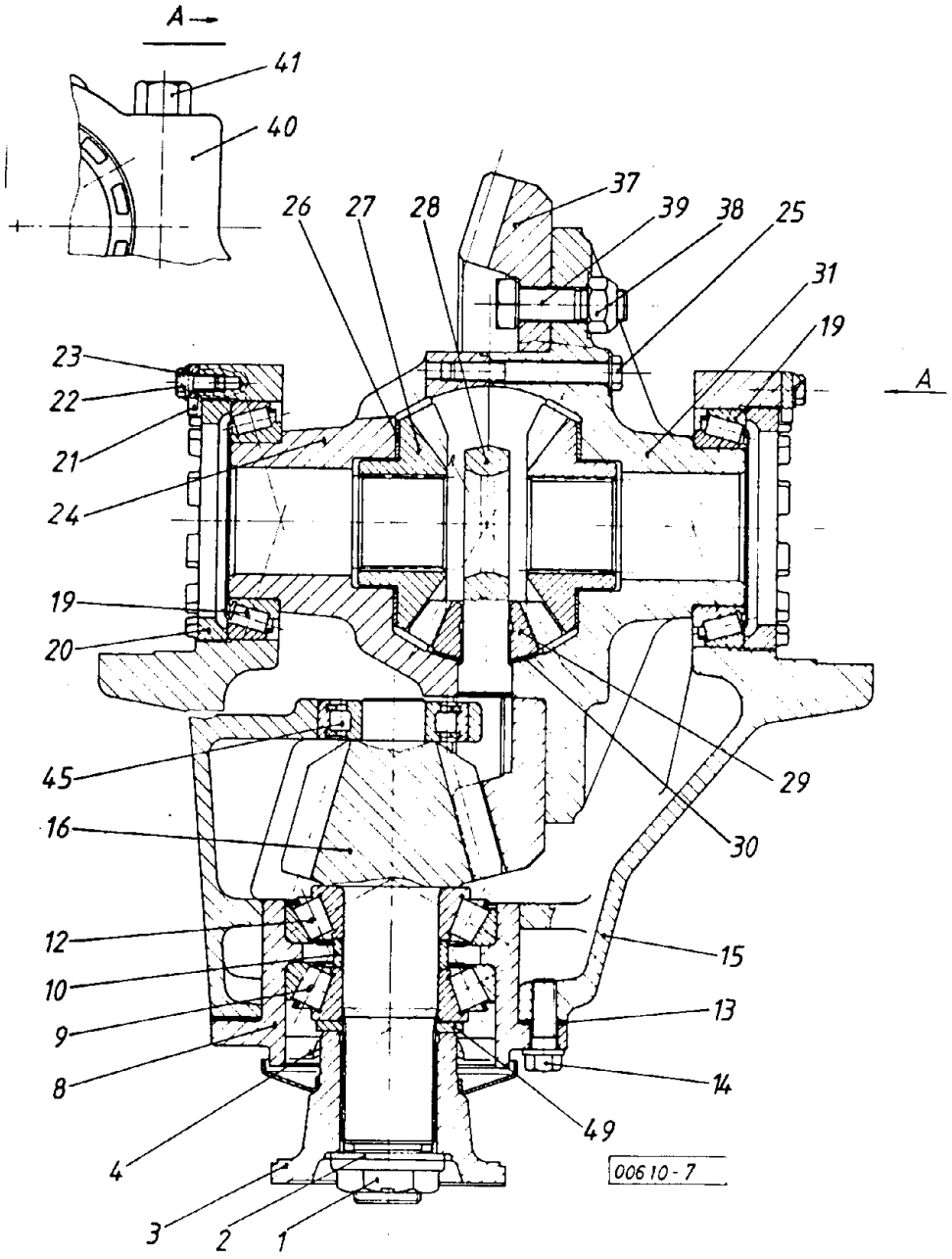

Fig. 1.: DIFFERENTIAL CARRIER ASSEMBLY SECTIONAL VIEW

SECTION 311

PARTS OF THE DIFFERENTIAL CARRIER ASSEMBLY

1 — Self—lock nut
2 — Washer
3 — Companion flange
4 — Sealing rings
—
8 — Bearing cage
9 — Taper roller bearing
10 — Distance ring
—
12 — Taper roller bearing
13 — Shims
14 — Hex. flanged bolt
15 — Differential carrier
16 — Drive pinion
—
19 — Taper roller bearing
20 — Bearing adjuster
21 — Tab lock plate
22 — Hex. bolt
23 — Lock plate
24 — Differential case half
25 — Clamp bolt
26 — Spacer
27 — Differential gear
28 — Spider
29 — Differential pinion
30 — Shim
31 — Differential case half (with flange)
—
37 — Drive gear
38 — Self—lock nut
39 — Hex. bolt
40 — Bearing shackle
41 — Hex. bolt
—
45 — Cylindric roller bearing
—
49 — Disk

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SECTION 312

REMOVING AND REINSTALLING THE DIFFERENTIAL CARRIER ASSEMBLY AND THE DIFFERENTIAL

REMOVING THE DIFFERENTIAL CARRIER

Drain the oil from the axle.

Remove the double joint as described in **Section 243.**

Unscrew the hex. flanged bolts attaching the differential carrier to the axle housing.

By means of two **M10** bolts driven into the threaded bores in the differential carrier flange remove the differential carrier from the axle housing.

REINSTALLING THE DIFFERENTIAL CARRIER

As described in the **"GENERAL SERVICE INSTRUCTIONS"** apply oil-proof surface sealant to seating flange of the axle housing and the differential carrier, to between the inner edge and the bolt bores. Aligning the bores position the differential carrier into the axle housing.

Secure the differential carrier with hex. flanged bolts applied with thread locker to the axle housing.

Tighten the bolts diagonally to **88 - 98 Nm** torque.

Install the double joint as described in **Section 243.**

SECTION 313

REMOVING AND REINSTALLING THE COMPANION FLANGE, REPLACING THE OIL SEAL

REMOVING THE COMPANION FLANGE

By means of the tools shown **(Fig. 1.)** remove the self-lock nut **(1).**

Pull the companion flange by means of the tools **4644-00642-19, 4644-00642-8, 4644-00642-10** and **M12** nuts **(Fig. 1. In Section 317).**

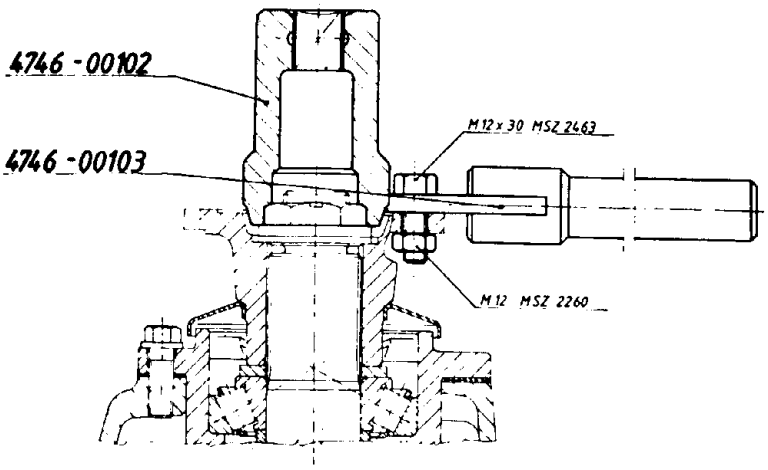

Fig. 1.: ASSEMBLING THE SELF-LOCK NUT

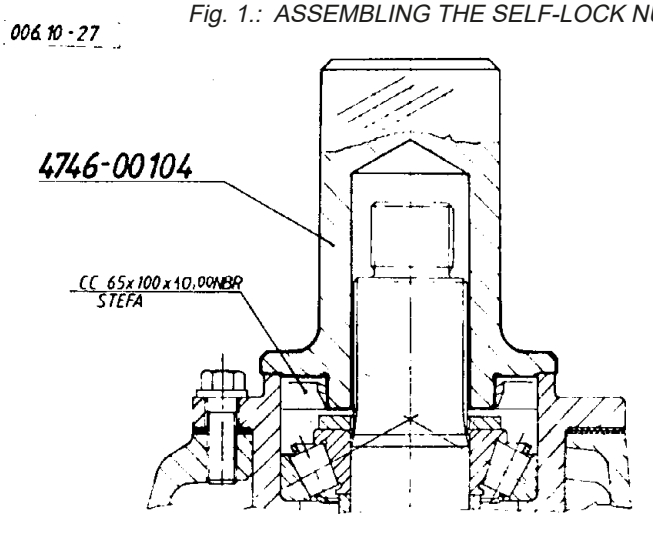

Fig. 2.: DRIVING IN THE OIL SEAL

REPLACING THE OIL SEAL

By means of pry remove the old oil seal **(4).**

Drive in the new oil seal by means of the tools shown **(Fig. 2.)** to bottom out.

Pack the space between the sealing lip and the dust protection edge of the oil seal with lithium-base grease.

REINSTALLING THE COMPANION FLANGE

Position the disk **(49)** over the cone of the inner taper roller bearing **(9).**

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Press on the companion flange **(3)** to the splines of the drive pinion **(16)** to bottom out. Use the tool shown **(Fig. 3.).**

Position the washer **(2),** and screw on the self-lock nut **(1).** By means of the tools shown in **Fig. 1.** tighten the nut to **677 - 814 Nm** torque.

SECTION 314

REMOVING AND REINSTALLING THE DIFFERENTIAL, ADJUSTING THE BACKLASH AND THE CONTACT PATTERN

REMOVING THE DIFFERENTIAL

Back out the hex. bolts **(22)** and remove the lock plates **(23)** and the tab lock plates **(21).**

Back out the hex. bolts **(41)** and remove the bearing shackles **(40).** Following this remove the differential from the differential carrier and remove the outer race of the taper roller bearings **(19)** and the bearing adjusters **(20).**

REINSTALLING THE DIFFERENTIAL

Reinstall the differential only after installing the bearing cage and adjusting the axis distance (see **Section 316**).

Fit the assembled differential together with cups of the taper roller bearings **(19)** into the differential carrier, then screw on the bearing adjusters hand-tight, position the bearing shackles to the original place, adjust on the bearing adjusters and secure. Tighten the hex. bolts **(41)** applied with thread locker to **326 - 380 Nm** torque.

ADJUSTING THE BACKLASH AND THE BEARING PRELOAD

Adjust the drive pinion to gear backlash to **0.2 - 0.3 mm** in case of ratio $\frac{37}{9}$ **= 4.111** to $\frac{41}{7}$ **= 5.857,**
while to **0.18 - 0.25 mm** in case of ratio
$\frac{43}{7}$ **= 6.143 to** $\frac{43}{6}$ **= 7.167** (KLINGELNBERG toothing).

Measure the backlash at the drive gear diagonally at 4 places, by means of dial indicator with stand and perpendicularly to the tooth surface, while the drive pinion is locked.

By means of the bearing adjusters adjust the backlash, then after adjusting zero bearing clearance, tighten both bearing adjuster further by **7.5º - 15º** so, to be able to secure by one of the tab lock plates **(21).**

After adjusting the backlash and the bearing preload check the contact pattern for proper as described below.

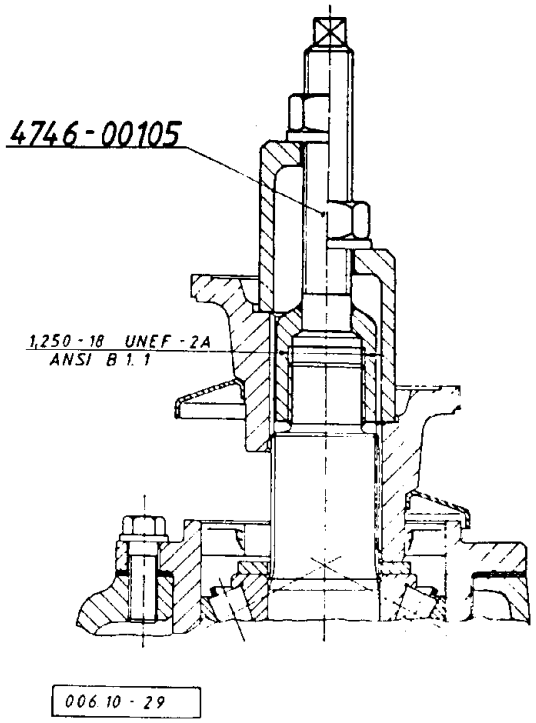

Fig. 3.: PRESSING ON THE COMPANION FLANGE

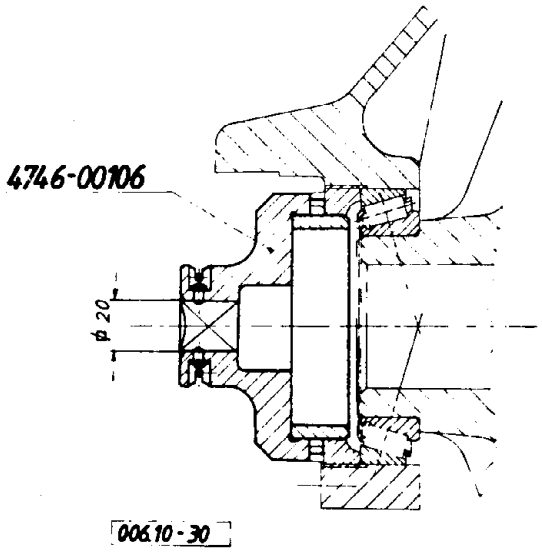

Fig. 1.: ASSEMBLING THE BEARING ADJUSTERS

ADJUSTING THE CONTACT PATTERN

Apply indicator paint to opposite teeth pairs of the drive gear at 4 places of **90º** pitch and one tooth of the drive pinion.

Rotate the drive pinion to both directions for approx. **15 sec,** while braking the drive gear by a piece of wood.

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PROPER CONTACT PATTERN

If a contact pattern shown in detail **1 of Fig. 2.** is obtained, the drive gear-pinion pair is installed properly.

Practically the perfect contact pattern shown in the figure cannot be obtained, but it is important that the pattern shall nowhere reach the edge of the tooth surface.

In case of KLINGELNBERG toothing the contact pattern should be symmetrically in the center of the drive gear tooth length.

THE CONTACT PATTERN RUNS OUT AT THE DEDENDUM:

If the contact pattern runs out at the dedendum, as shown in **Fig. 2/2.,** somewhat increase the "axis distance" by increasing the thickness of the shim pack **(13),** while reducing the increase backlash by displacing the driver gear to obtain the contact pattern shown in **Fig. 2/1.**

D = Large diameter
1 = Proper contact
2 = Too deep contact
3 = Too high contact

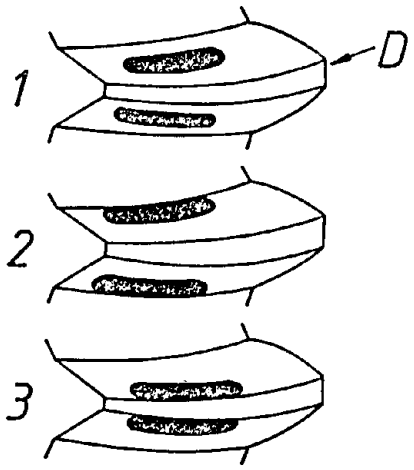

Fig. 2.: CONTACT PATTERN ON THE DRIVE GEAR

THE CONTACT PATTERN RUNS OUT AT THE ADDENDUM:

If the contact pattern runs out at the addendum, as shown in **Fig. 2/3.,** somewhat increase the "axis distance" by reducing the thickness of the shim pack **(13)** while increasing the reduced backlash by displacing the drive gear to obtain the contact pattern shown in **Fig. 2/1.**

After each contact pattern adjustment also measure the backlash and adjust the bearing preload.

In case of proper contact pattern, backlash and bearing clearance adjustment install the bearing cage as described in the **Section 316.** By means of the properly selected tab lock plate (one of the 4 different ones) secure the bearing adjusters **(20)** on both sides. Tighten the lock plate mounting hex. bolts to **15 - 20 Nm** and secure.

SECTION 315

DISASSEMBLING AND REASSEMBLING THE DIFFERENTIAL

Pull the cone of the taper roller bearings **(19)** from the removed differential **(see Fig. 1.).**

For disassembling the differential case remove the hex. bolts **(25)** clamping the case halves **(24 and 31)** together and separate the case halves.

Remove the spider **(28)** together with the differential pinions **(29)** and shims **(30)** as well as the differential gears **(27)** and the spacers **(26).**

Replace the drive gear ONLY together with the matched drive pinion.

The match-marks are stamped to one end of the drive pinion and to one tooth end on the outer taper surface of the drive gear.

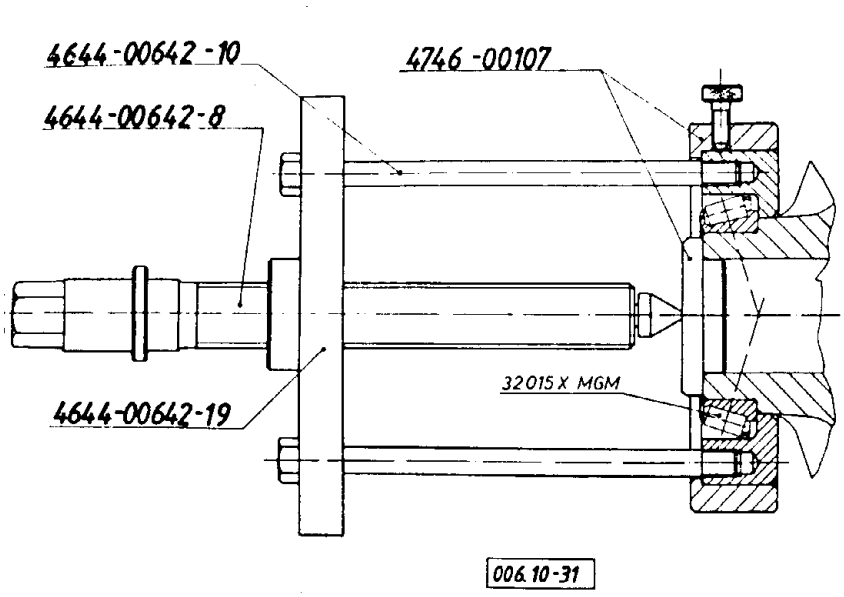

Fig. 1.: PULLING OFF THE CONE OF TAPER ROLLER BEARINGS

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The marks contain the identification number of the matched drive gear-pinion pair, as well as the value of deviation from the theoretical distance measured between the drive pinion face and the drive gear centerline, i.e. The “axis distance”, in true-to-sense. E.g.: **1225 + 0.032.**

REASSEMBLING THE DIFFERENTIAL

Pull the flanged differential case half **(31)** over the lower service mandrel **(Fig. 2.).** Insert the spacer **(26)** and the differential gear **(27)** as well as the spider **(28)** subassembled with pinion washers **(30)** and differential pinions **(29),** then the other differential gear and spacer.

Aligning the bores fit the differential case halves together according to the factory match-mark, then secure by clamp bolts **(25).** By means of the upper service mandrel lock the differential and tighten the clamp bolts to **49 - 59 Nm** torque.

Remove the upper service mandrel and rotate the differential on the lower mandrel.

The differential should roll evenly and smoothly without jamming and jerks.

Fit the drive gear to the subassembled differential and by means of four small-headed bolts of at least 90 mm length and nuts with washers pull the drive gear to the differential to bottom out **(Fig. 3.).**

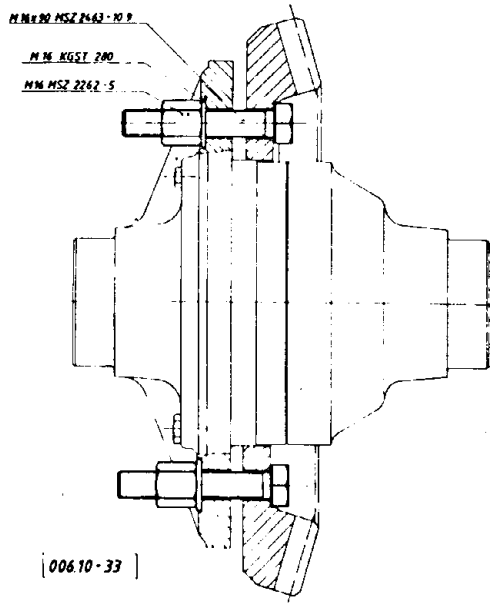

Fig. 3.: PULLING ON THE DRIVE GEAR

After this remove the small-headed bolts, install the original hex. bolts **(39)** and tighten the self-lock nuts **(38)** attaching the drive gear to the differential to **260 - 290 Nm** torque.

Drive on the taper roller bearing cone by means of the tool shown **(Fig. 4.).**

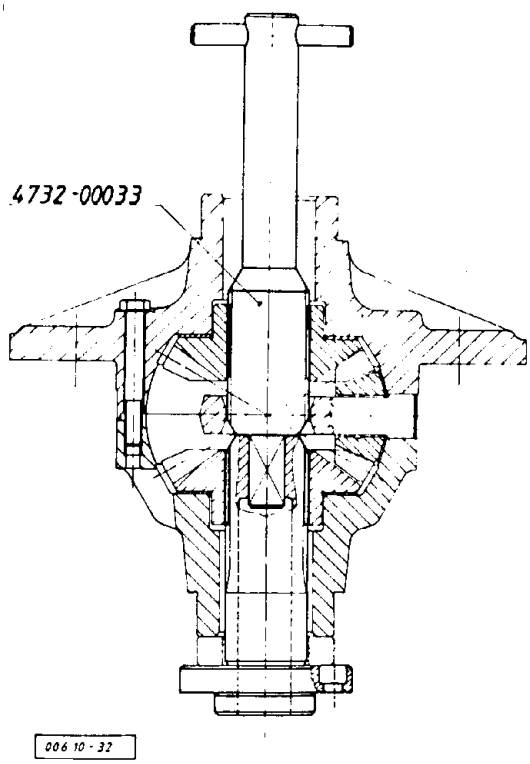

Fig. 2.: ASSEMBLING AND CHECKING THE DIFFERENTIAL

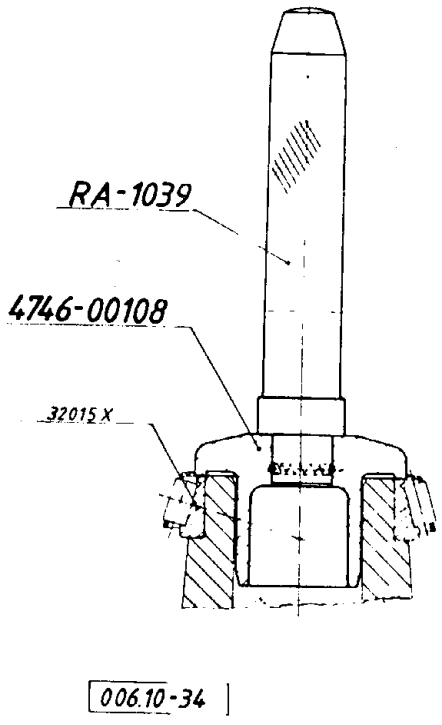

Fig. 4.: DRIVING ON THE TAPER ROLLER BEARING CONE

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REMOVING AND REINSTALLING THE BEARING CAGE, ADJUSTING THE AXIS DISTANCE

REMOVING THE BEARING CAGE

After removing the companion flange **(Section 313)** pull the bearing cage out of the differential by means of **M10** bolts of at least **50 mm** thread length driven into the two threaded bores the bearing cage flange, then remove the shims **(13).**

REINSTALLING THE BEARING CAGE

Finally install the bearing cage after adjusting the rolling torque - bearing preload - **(Section 317),** as well as the axis distance and the contact pattern **(Section 314).**

ADJUSTING THE AXIS DISTANCE

After assembling the bearing cage and adjusting the bearing preload **(Section 317),** for purpose of piloting drive **M12** piloting stud bolts into two opposite bores in the differential carrier. To these stack the shim pack necessary for adjusting the drive pinion "axis distance" and the contact pattern so, the two extreme ones shall be the thicker.

Push the bearing cage subassembled with drive pinion into the differential carrier and provisionally secure by **2** off hex. flanged bolts **(14)** at the opposite bores.

At the measuring pin of the accessory **"A"** of the measuring device shown in **Fig. 1.** adjust the theoretical **"AXIS DISTANCE" B = 84.55 mm minus 10 mm** (master gage thickness) = **74.55 mm** by zeroing the dial indicator.

By means of a thrust plate attached to the differential carrier flange secure the master gage to the drive pinion face.

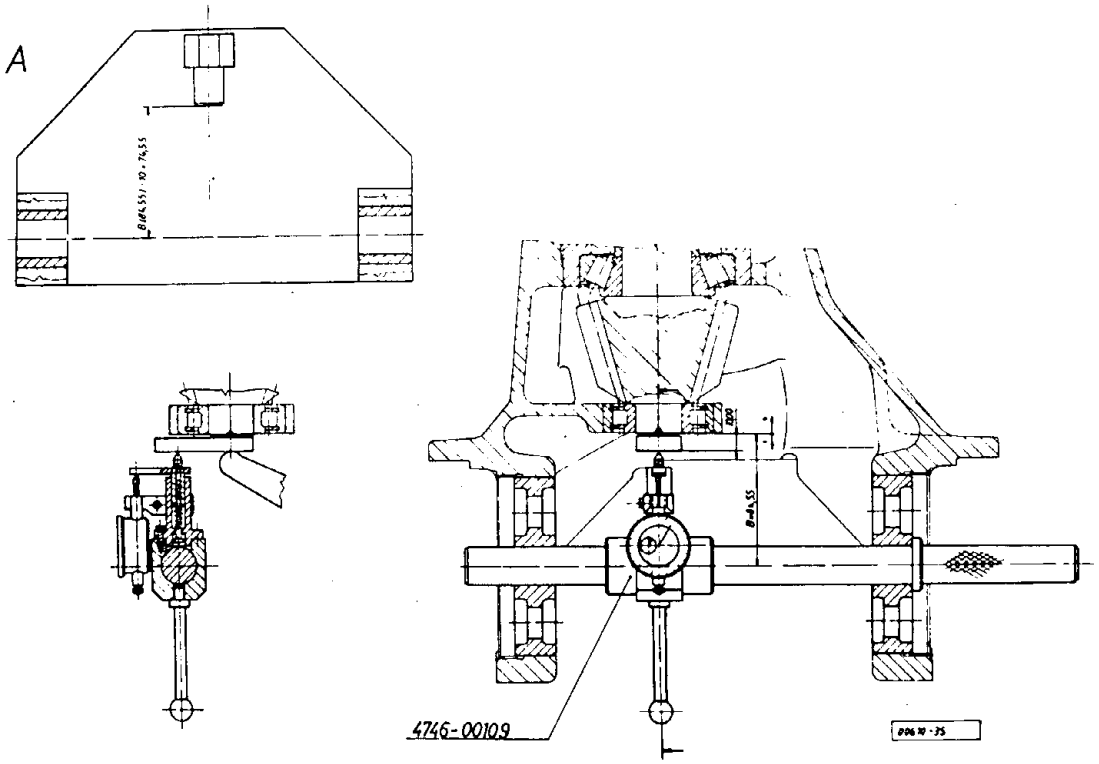

Fig. 1.: CALIBRATING THE AXIS DISTANCE

As shown in **Fig. 1.** insert the measuring device set the **74.55 mm** into the differential carrier and measure the deviation from the specified **"AXIS DISTANCE".** Check if this deviation is identical to that stamped into end of the drive pinion.

In case of identical deviations the adjustment is proper, otherwise adjust the specified value by selecting the proper thickness of the shim pack **(13).** Assure **± 0.025 mm** accuracy at the adjustment.

E.g.: If the axis distance deviation marked on the drive pinion is **+ 0.04,** the value **"B"** to the adjusted is **84.55 ± 0.04 = 84.95 ± 0.025 mm.**

INSTALLING THE BEARING CAGE

In case of proper contact pattern adjustment **(Section 314)** and operation, remove the bearing cage assembled with drive pinion and according to the **"GENERAL SERVICE INSTRUCTIONS"** apply oil-proof surface sealant to the inner flange, then reinstall the bearing cage and secure by of hex. flanged bolts **(14)** coated with thread locker. Diagonally tighten the bolts to **70 - 80 Nm** torque.

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SECTION 317

DISASSEMBLING AND REASSEMBLING THE BEARING CAGE

DISSEMBLING THE BEARING CAGE

By means of the device shown press the drive pinion **(16)** out of the bearing cage **(Fig. 1.).**

By means of the device shown **(Fig. 2.)** press out the cone of the inner taper roller bearing **(12)** remained on the drive pinion.

By means of the device shown **(Fig. 3.)** pull the cylindric roller bearing **(45)** off the drive pinion.

When replacement of the bearing cage **(8)** is required the new bearing cage is available subassembled with cups of the taper roller bearings **(9 and 12)** and furnished with bearing cones. When assembling use care of original pairing of the bearings.

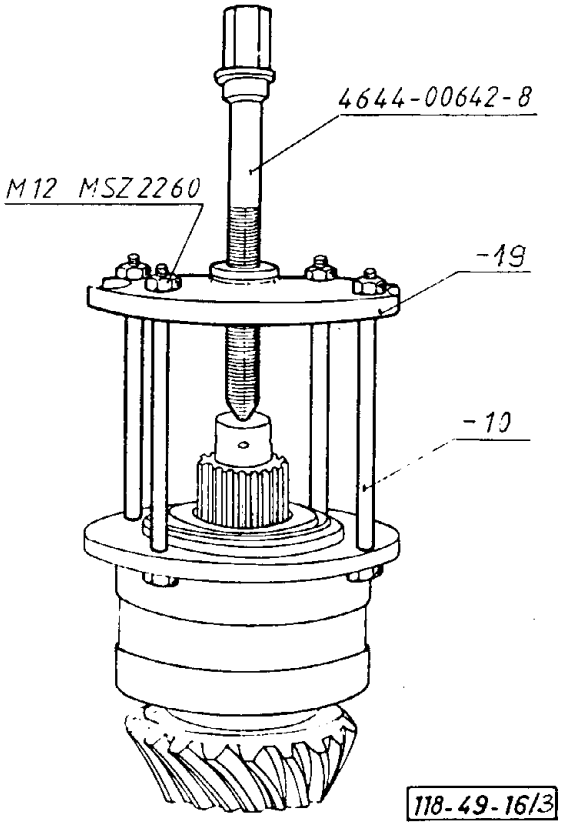

Fig. 1.: PRESSING OUT THE DRIVE PINION

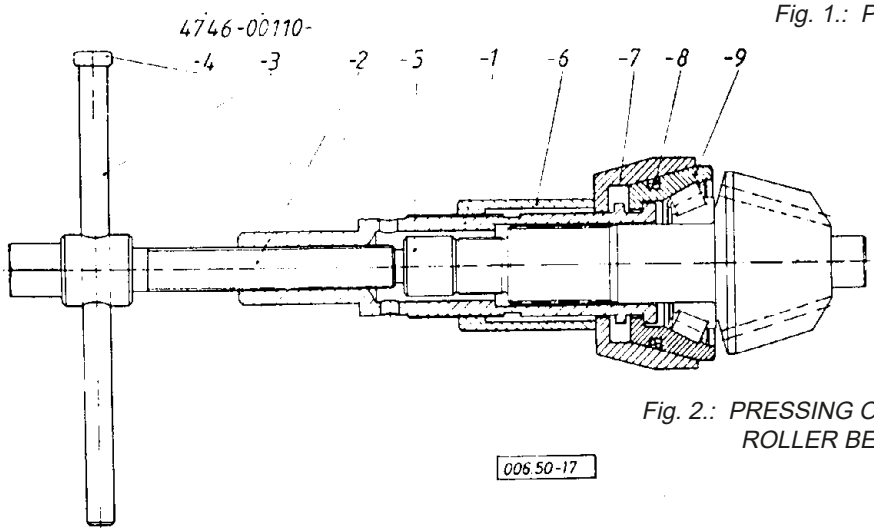

Fig. 2.: PRESSING OFF THE INNER TAPER ROLLER BEARING CONE

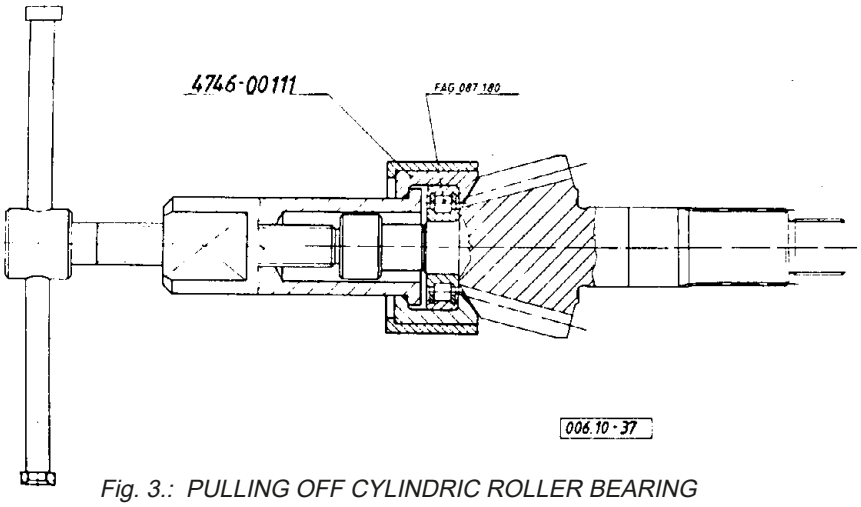

Fig. 3.: PULLING OFF CYLINDRIC ROLLER BEARING

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If replacement of only the taper roller bearings is required, install the taper roller bearing cones as shown in **Fig. 4., 5., 6.**

The cone and the cup of the taper roller bearings should be replaced together according to the factory pairing.

By means of the tools shown **(Fig. 4.)** drive the cup of the taper roller bearing **(9)** out of the bearing cage.

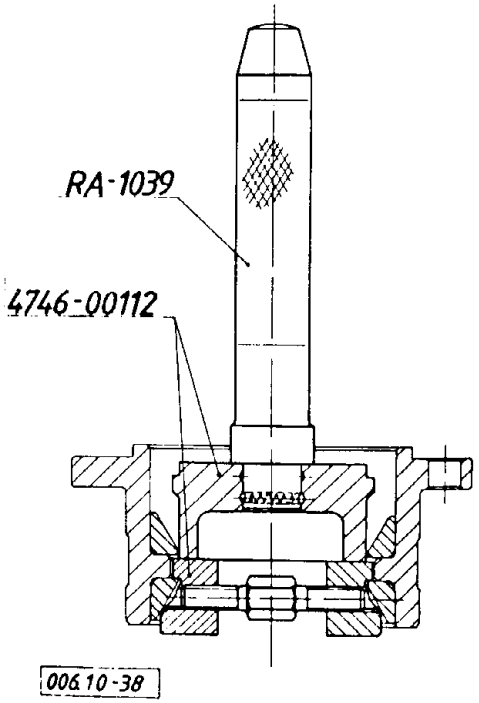

Fig. 4.: DRIVING OUT THE TAPER ROLLER BEARING CUP

Turn the bearing cage over and drive out the cup of the outer taper roller bearing **(12)** as shown **(see Fig. 5.).**

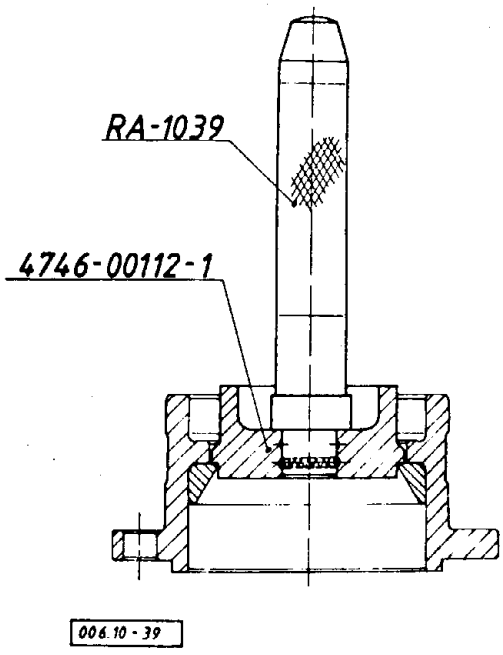

Fig. 5.: DRIVING OUT THE TAPER ROLLER BEARING CUP

REASSEMBLING THE BEARING CAGE

When reassembling the bearing cage select the thickness of the distance ring **(10)** to be installed to between the taper roller bearing cups so, after tightening the nut to the specified torque, the rolling torque of the bearing cage — without installing the sealing ring — shall be between the specified limits.

Drive the cup of the taper roller bearing **(9)** to both sides by means of the tools shown, to bottom out **(Fig. 6.).**

Before assembling by means of caliper determine the expected thickness of the distance ring.

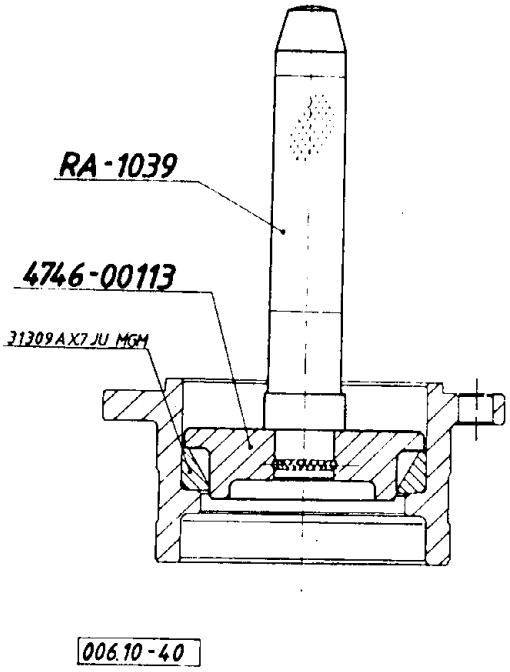

Fig. 6.: DRIVING IN THE TAPER ROLLER BEARING CUP

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Before pressing to the drive pinion, subassemble the bearing cage on a loose-fit master shaft as per **Fig. 7.** to be able to determine the installation thickness of the distance rings after tightening the flanged nut to the specified torque.

Install the parts to the master shaft and tighten the flanged nut of the device and tighten to **450 - 500 Nm** torque.

Measure the rolling torque by means of a cord attached to mantle of the bearing cage and by a fish-scale.

In case of installing new bearings, by speed **50 rpm** the fish-scale should read **16.2 - 43.8 N,** which corresponds to the specified **0.98 - 2.65 Nm** rolling torque. In case of installing used bearings adjust the rolling torque to **0.5 - 1.3 Nm** (the half of that of the new bearings).

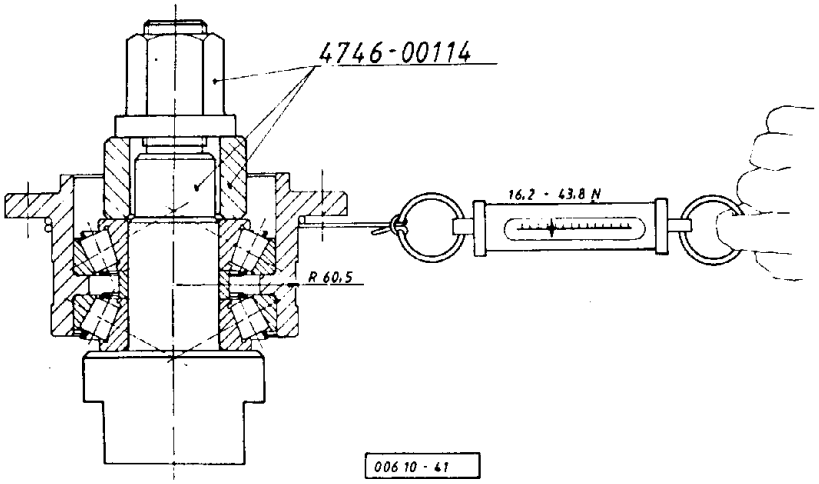

Fig. 7.: ADJUSTING THE BEARING PRELOAD

In case of deviation, perform correction by changing the distance ring **(10).** In case of higher rolling torque use thicker distance ring, while at lower torque use thinner one.

In case of proper adjustment relocate the parts from the master shaft to the drive pinion. (Do not install the oil seal yet.)

Make sure to install ONLY the parts used for adjustment to the drive pinion.

Press on the cylindric roller bearing **(45)** by means of the press head shown **(Fig. 8.).**

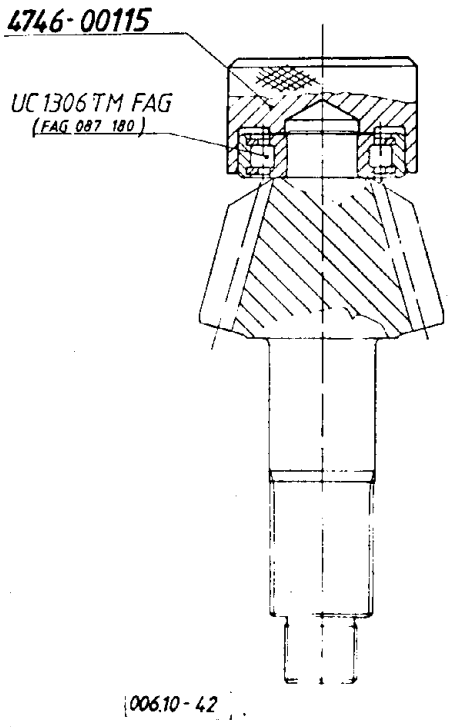

Fig. 8.: PRESSING ON THE CYLINDRIC ROLLER BEARING

By means of the shown securing press head secure the cylindric roller bearing by indenting the journal end of the drive pinion **(Fig. 9.).**

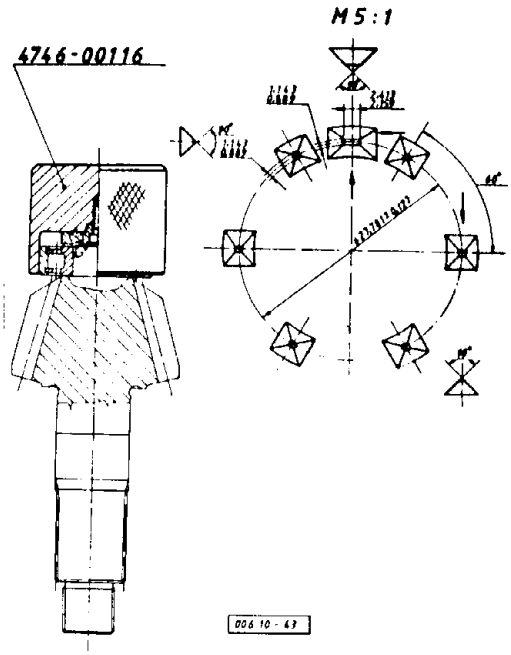

Fig. 9.: SECURING THE CYLINDRIC ROLLER BEARING

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By means of the tools shown press on the cone of the inner taper roller bearing **(12)** to bottom out **(Fig. 10.).**

Position the earlier selected distance ring **(10),** then press on the bearing cage subassembled with bearing cups and the cone of the outer taper roller bearing by means of the press sleeve to bottom out, taking care of proper connection of the bearings.

Position the disk **(49)** and press the companion flange **(3)** onto the drive pinion. Screw on the flanged nut of the adjusting device and tighten to **450 - 500 Nm** torque. Do not install the sealing ring yet.

Check the rolling torque and in case of deviation repeat the adjustment procedure until the proper value is obtained.

After adjusting the proper rolling torque remove the companion flange. Install the sealing ring and the companion flange as described in **Section 313.**

Tighten the self-lock nut **(1)** to the specified **450 - 500 Nm** torque.

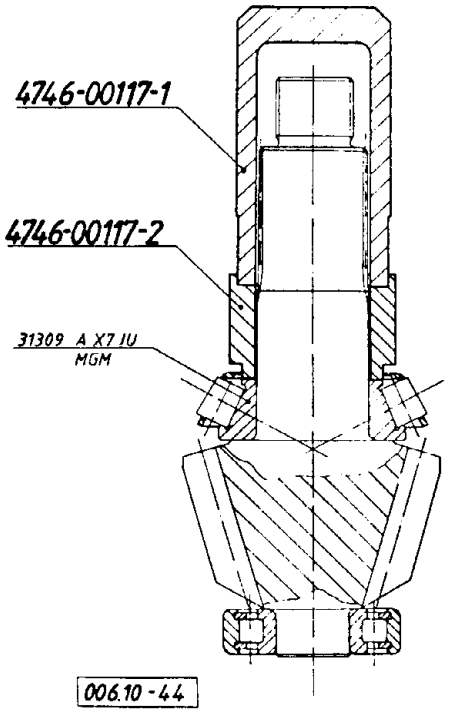

Fig. 10.: PRESSING ON THE CONE OF THE INNER TAPER ROLLER BEARING

SECTION 395

OIL FILL-UP, RUN, CHECK

Thru the oil filler holes on the end-cover of the wheel hubs and on the axle housing fill up the finish assembled axle with oil of grade specified in the Operators Manual.

Fill ONLY completely clean oil to the axle.

After oil fill-up install the screw plug to be leak-tight. Following this run the axle to both directions at varying speed.

DURING RUN CHECK THE FOLLOWING:

The axle for leaks: No leaks are permitted.

The axle for operation: No excessive sound of friction or unusual noise is permitted at the rotary mechanism in the differential and the wheel hubs. The meshing gears should roll on one another smoothly without unusual noise.

The axle for warming: At the end of running the maximum temperature of the wheel hub may be approx. **60° C,** while at the input section approx. **80° C.**

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