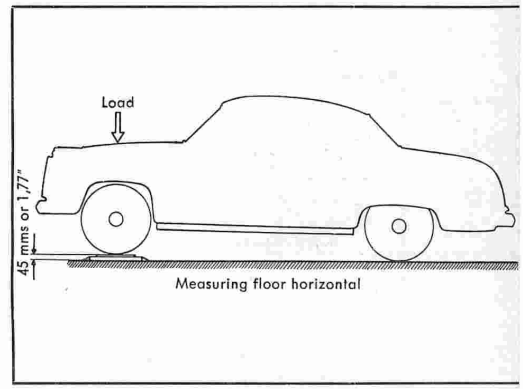
R. WHEEL MEASUREMENT

One of the most important tasks within the scope of supervision of vehicles is the control of wheel setting. This is especially important, for alterations of the adjustment of the independently suspended frontwheels can be caused by accidents etc. with the consequence that tyre wear and roadholding qualities of the vehicle will suffer. These controls of wheel setting, which could formerly be accomplished with sufficient security with castor, camber and toe-in measuring devices well known among experts, require to-day precision instruments, which do nut measure static units but start from the motion of the wheels to be measured.

The decisive adjustments and denotations for the wheel setting are assumptioned as known and thus only shortly illustrated.

1. Test floor: Must be horizontal, measuring chamfer 45 mm or 1.7716" according to figure.

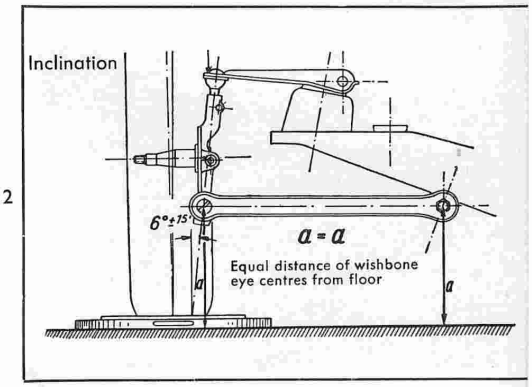
Figure 1



1

2. Toe-in 0 mm: Deviation of parallel alignment of a wheel pair.
3. King pin inclination $6^{o} \pm 15'$: Inclination of king pin top towards the inside whereby in connection with

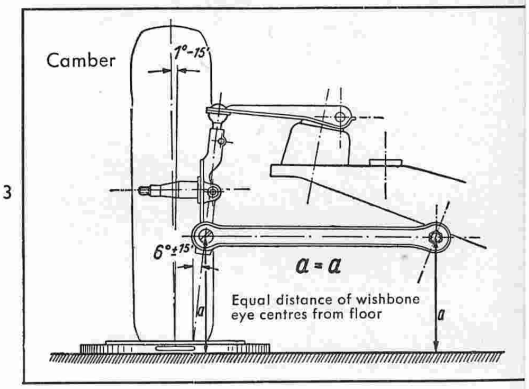
Figure 2



2

4. Camber 0 - 1^{o}: Inclination of the wheel on top towards the outside so that a wheel rotation radius, which is provided for in design, develops on the floor.

Figure 3



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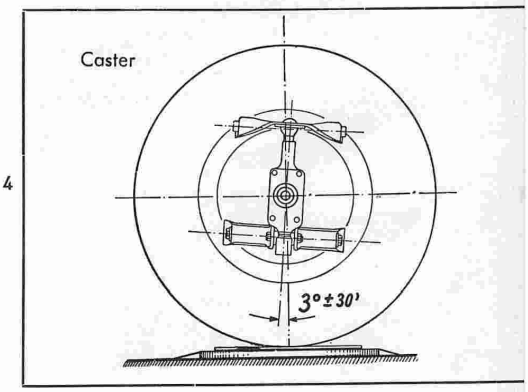
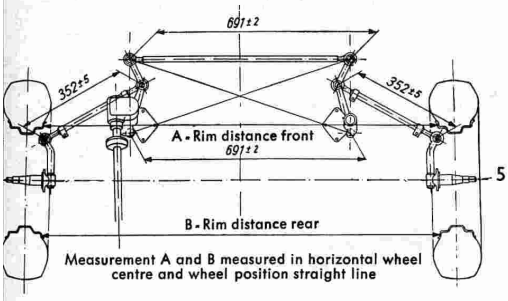
5. Castor $3^{o} \pm 30'$: Inclination of top king pin rearwards so that the guide point of the wheel touches the floor in front of the contact point of the wheel.

Figure 4



4

The demand, to employ to-day precision instruments with the highest degree of accuracy for the axle measurement has induced us to deal with two devices in this chapter, which guarantee for an exact and correct measurement of the wheels. The assumption for a measurement is the existence of an uniform tyre wear as well as uniform tyre pressure.
Besides, before controlling the wheel setting, it must not be neglected to check wheel suspension bolts and bushes as well as wheel bearing and to overhaul accordingly if found necessary. It is practically useless, to carry out a camber measurement, when the camber measure is altered by a worn out bearing so far that the arrangements provided for this cannot be corrected. Thus the demand to check and correct the complete wheel suspension.

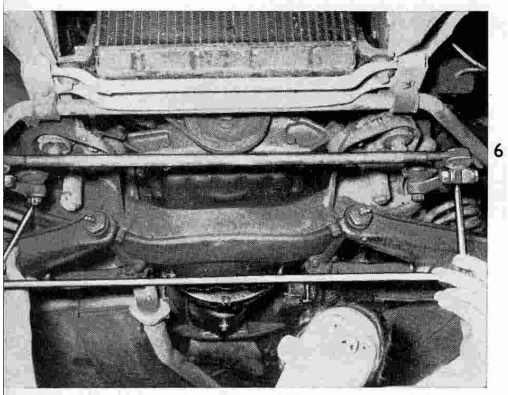


5

A further assumption for the undertaking of the measurement is that a plane measurement floor is available for the now described measurement bridge NC 27 (Manufacturer: Herwart Koch, Egestorf/Hannover, Germany). The same applies to the further below described optical measurement device "Exakta" (Manufacturer: F. C. Müller, Heilbronn a. N.)

An exact straight-line setting is essential for measurement of frontwheels. This can very easily be ascertained when measuring the rectangle formed by the two steering arms. The distance between the left steering arm fulcrum and the right cross tube eye should be the same as the distance between right steering arm fulcrum and left cross tube eye, at which divergences up to 2 mm or .0787" are admissible. Consequently the measurement in question is a diagonal measurement of the rectangle setting, formed by the two steering arms, at which the long side of the rectangle must have the fixed measure of 691 ± 2 mm or 27 13/64" ± .080".

Figure 5 and 6



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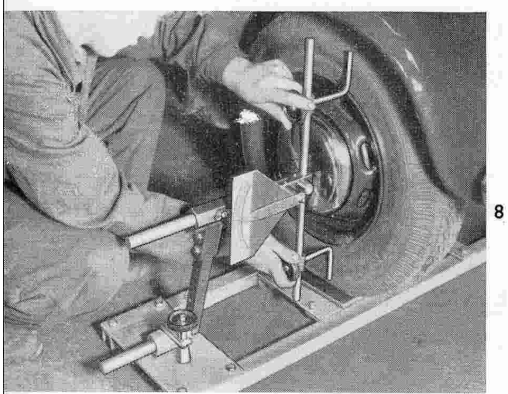
Divergences of the diagonal measurement must be equalized by resetting the drop arm before further measurement can be carried out. (See also L 2 Figure 5 and 6)

Measurements with the measuring bridge are carried out as follows: The measuring bridge is placed in front of the car so that both wheels are driven up on the moveable disks. Thereby both frontwheels are elevated by 45 mm or 1.77" from the horizontal floor.

Figure 7



8

Both lower links (wishbones) must be adjusted horizontally by the correct load (See also Figure 3). Both wheels are pressed together rearwards by a tension chain to appr. 12 kg or 26 lbs. to avoid eventual play in the steering. Actual driving conditions are copied by this measure, as wheels also are pressed outwards when running.

Measurement of camber

Now the camber can be checked with the fixed measuring device, positioned on both sides of the measuring bridge.

Figure 8 (See also Figure 3)

Toe-in measurement

The toe-in comes to 0 mm or 0 inch, with wheels in straight line setting and correct load of 160 kg or 353 lbs on front seats. Bring measuring aggregate to wheels on both sides. Adjustment "0" must then be readable on both aggregates. If this should not be the case, both measuring arms must be adjusted to "0" position. Both movable slide rods are adjusted to this "0" position until wheels adapt themselves to "0" position.

Figure 9

9

Toe-in difference-angle measurement

Ascertain toe-in differences at this measurement, i. e. measuring the angle alteration, which results on wheel setting to the centre of motion of the vehicle when cornering. This measurement is the most important measurement, for a wrong toe-in difference angle is in most cases decisive for cornering noises and increased wear. The measurement is made as follows: Put R. H. frontwheel in left curve at 20^{o}, read at left on measuring arm. Put L. H. frontwheel in right curve at 20^{o}, read at right measuring arm. Both measuring methods must be uniform. The inner wheel should have a larger angle in the curve. The angle difference comes to 2^{o} 20' - 3^{o} 10'. It is essential that the angle difference is uniform on both wheel angles, i. e. R. H. and L. H. wheel angle.

Figure 10

10

If the measurement shows that the toe-in difference angles are different, the axle must be checked for accident results, as the difference of toe-in difference angles suggests a deformation of links (wishbones) and/ or steering arms.

Castor measurement

Castor measurement is effectuated by a camber measurement with altered wheel angle. The wheel to be measured is first put inwards at 20^{o}, then the camber is measured. The measuring position must be marked by a chalk line.

Figure 11

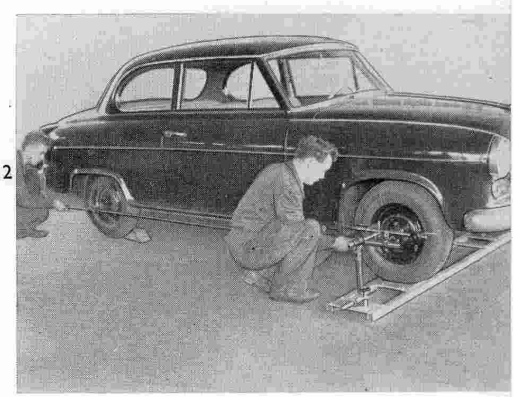
11

The same wheel is put to the opposite side at 20^{o} and a camber measurement is carried out at the same position. The difference between the two measurements shows the castor. Castor is fixed by the factory and comes to $3^{0} \pm 30'$.

Rear axle measurement

The rear wheels can also be measured by means of the NC-27-Bridge regarding the wheelbase as well as the toe-in and camber.

Figure 12



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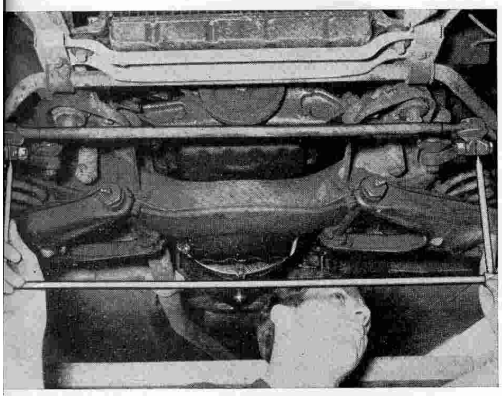

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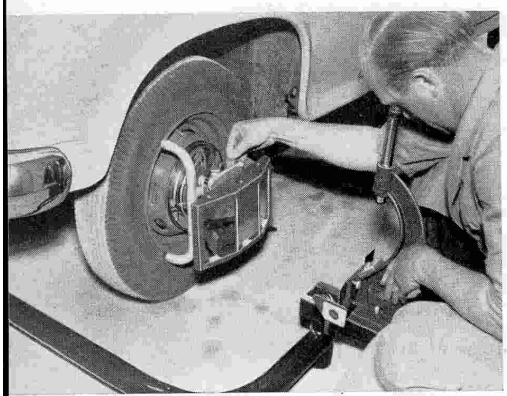
The offset of front and rear axle (lateral axle offset) is not measurable with the NC-Bridge. This measurement can be made by diagonal measurement by means of the perpendicular method, i. e. plumbing of fixed wheel positions on the floor.

Measurement with the "Exakta" measuring apparatus

The optical "Exakta" axle measurement apparatus is at present time the most exact measuring apparatus available in Germany. The application of this instrument enables a really exact wheel measurement and location of faults. The measurements can be recorded on a measuring card of which a copy can be handed over to the customer as customers service propaganda. The description of application of this apparatus, as well as the aforementioned description of the NC Measuring Bridge, applies only to main points which can be described within the scope of these explanations. In addition, purchasers are supplied with full operating instructions and in case of the "Exakta" apparatus a special works training is available.

At first, here also is the position of wheels controlled by measurement of the steering rectangle. (See also L 2 Figure 5 and 6)

Figure 13



15

The measurement of a vehicle with an "Exakta" apparatus is carried out as follows:

1. Lift car, check wheel bearings, check joint play etc., check steering for straight line setting, eliminate eventual wear, as otherwise even the most exact measurement results in fault possibilities.
2. Let vehicle down on floor and attach mirror holder.
3. Insert wheel mirror and adjust by turning on centre axis.
4. Apply "Exakta" apparatus, adjust distance and mirror.

Figure 14 and 15

16

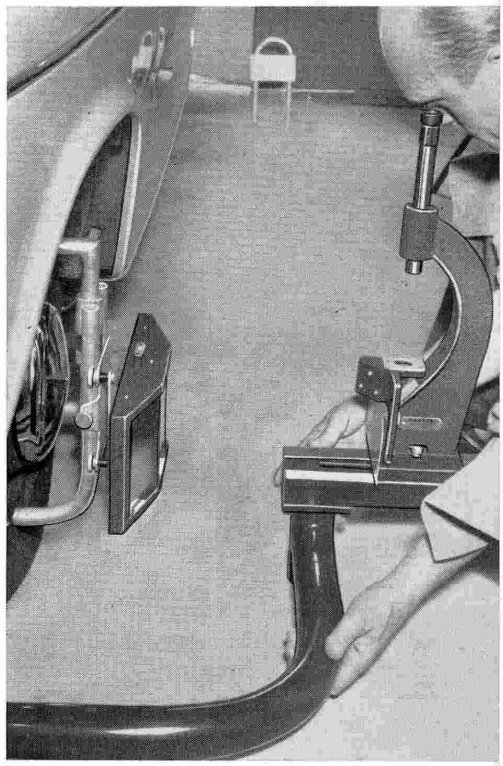
5. Put swivel plate underneath.
6. Spring vehicle several times to set wheel setting and suspension.
7. Adjust mirror distance to apparatus again with distance rod.

Figure 16

8. For rear wheel measurement adjust graduation bracket for distance and apply to rear wheel.
9. Tilt prisms over on measuring heads and adjust apparatus by moving to straight line setting. Measures must be uniform on both sides.

Figure 17/18

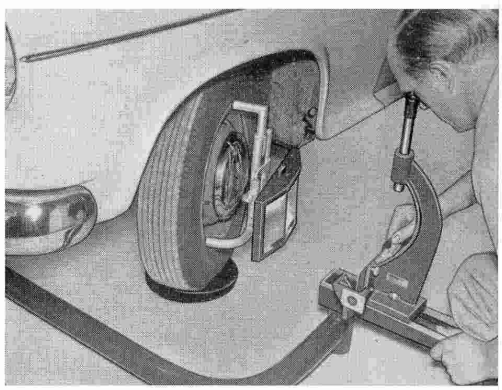
17/18



10. Swing prisms back again.
11. Left wheel on straight line setting, adjust toe-in setting to zero, read toe-in difference R. H. wheel.
12. Ascertain toe-in and camber values by reading and enter on measuring card.
13. Turn wheels to left and right hand, adjust mirror with distance rod to angle at which the wheel can be turned, read new values and enter on measuring card.

Figure 19

19

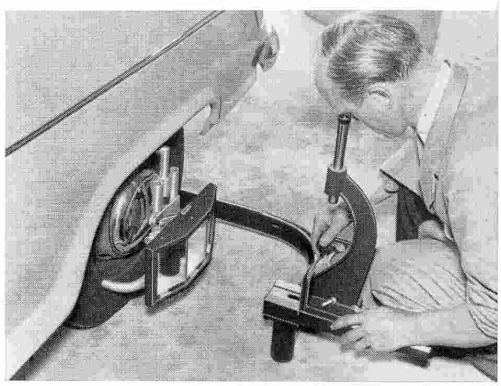


Caution: All measuring values as toe-in, toe-in difference angle, camber and castor are the result of these measurements and can be entered on the measurement card.

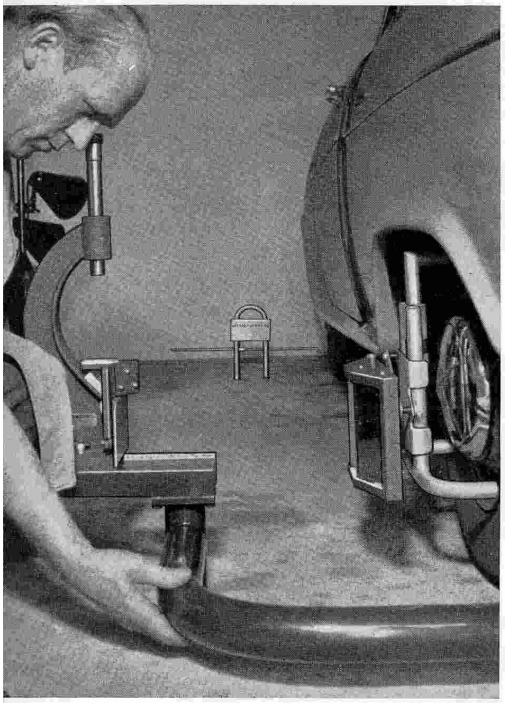
By reversal of the measuring apparatus the rear wheels can be measured in the same way, first of all the adjustment of rear wheels to front wheels. (Axle parallelism resp. run in track)

Figure 20

20



Here too the mirror is firstly attached in the same way as described under Figure 1-7 and adjusted. Adjust as well apparatus to mirror on distance.



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The measurement of rear wheels to front wheels is carried out in the same manner as the measurement of front wheels to rear wheels.

Figure 21 and 22

Measuring card and measuring card valuation

1. Valuation of front axle.

   a) The track is directly patent from the scale "Track straight on". The difference from the unpressed to the pressed measurement shows the play present in the joints. The difference must not exceed more than 10 angle minutes per joint: Regarding track of front wheels attention must be paid to the alterations of track when loading and springing as well as tensioning of wheels. The measuring result is vital for the track setting with wheels pressed together rearwards and load of vehicle, which nearly resembles actual driving conditions. Track should then be between + 5 minutes and - 20 minutes.

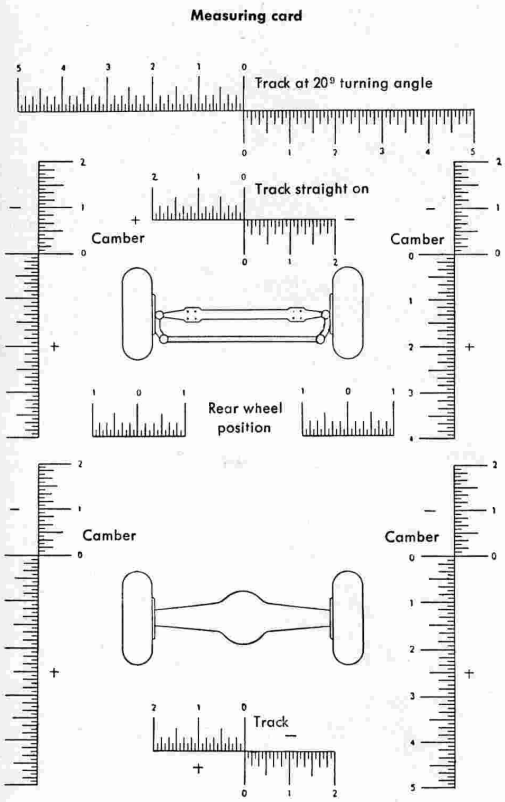
   b) The value, marked "gr", on the left and right vertical camber scales show directly the camber value. This value must coincide with the correct value. Generally a tolerance of appr. 1/2 - 1° is admissible. It will answer the purpose when the camber left and right hand is of uniform size, as the wheel with larger positive camber can pull to the side.

   c) Castor.
   Castor is calculated by the camber values, left and right angles at which wheels are turned.
   The camber value "gr" can be disregarded. Minutes must be added, which lie between the measured left ("L") and right ("R") angle turned camber values.
   Thereby 40 minutes come to 1° each (10 minutes = 1/4°). Camber and castor must not be mixed up. Camber on the left wheel can be recognized when the camber value of the left turning angle lies below the right turning angle. If, however, the camber value of the right turning angle should be below, castor is present.
   Camber of the right wheel can be recognized when the camber value of the right turning angle lies below the left turning angle. Values on left and right wheel should be uniform. A difference larger than half a degree should not be exceeded.

   d) Track at 20° turning angle.
   The actual value is calculated from the entered values in the upper horizontal scale "Track at 20° turning angle" and the track straight-on. If the turning angle measurement was made unpressed, the difference measurement of track straight-on, from zero to unpressed position, must be added. The calculation of the double actual value with plus toe-in runs to:
   Left turning angle + Right turning angle + 2 times toe-in.
   With minus toe-in it reads:
   Left turning angle + right turning angle - 2 times toe-in.

2. Rear axle:
   Rear wheel position fo vehicle axis is patent from the scales "Rear Wheel" position. If both measured values are zero, both wheels run parallel. The largest inclination of the rear axle must not exceed 20 minutes.

Measuring Card 22/24



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