EUROPEAN PATENT SPECIFICATION

A PROCEDURE FOR MEASURING THE WHEEL ANGLE ON STEERABLE VEHICLES
VERFAHREN ZUR MESSUNG DES RADWINKELS EINES STEUERBAREN FAHRZEUGS
PROCÉDE PERMETTANT DE MESURER L'ANGLE DE ROUE SUR DES VEHICULES DIRIGÉS

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References cited:
US-A- 5 014 227

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Description

[0001] The present invention relates to a procedure for measuring large wheel angles, preferably front wheels, on steerable vehicles. The main requirement for achieving good running characteristics and slight tyre wear is for the driving wheels of the vehicle to assume specific angle positions with narrow tolerances. On a straight course, therefore, a certain toe-in occurs, which means that both wheels are directed slightly inwards in relation to the direction of travel. The wheels shall also have a certain camber in relation to a level road surface. When cornering both wheel axles are turned about individual kingpins which shall have a certain gradient in relation to the normal direction of a level road surface, both in the caster and in the banking (KPI) direction of the vehicle. Demands are also placed on the curve angle difference, i.e. the relationship of the drive angles of the two wheels to each other when cornering.

[0002] A large number of different measuring systems for the wheel angle have been developed to measure these angles. In most of them measuring devices are applied with the aid of holders on the wheels whose angles are to be measured. The measuring devices include measuring transducers for camber, toe-in and direction. The camber is normally measured as deviation from the vertical line and upon measuring it is assumed that the vehicle is parked on a level, horizontal surface. The rear axle is used when measuring toe-in and direction in the case of smaller vehicles such as private cars, whereas a reference line perpendicular to the chassis of the vehicle is preferred in the case of large vehicles. The measuring methods used are generally based on lines stretched between the wheels or on optical principles in which mirrors are applied on the rear wheels, or plates with markings are suspended at the front and rear ends of the vehicle chassis.

[0003] These devices are used to directly measure toe-in and camber. The kingpin banking is determined indirectly by measuring the influence of the kingpin gradients on camber at a few different course angles, preferably straight course, 20 degrees left-turning course and 20 degrees right-turning course. The banking of the kingpins is determined in the same way or by measuring how much a locked wheel is turned in direction of rotation when a left-turning or right-turning course is steered. The kingpin gradients are calculated from the camber or wheel turning values obtained, using known trigonometric formulae, either with the aid of ready reckoners or nowadays computer programs.

[0004] A limitation in most existing wheel measuring systems is the difficulty of measuring large course angles. This is of interest when measuring the curve angle difference and the maximum wheel deflection possible for a vehicle. The main problem is that the maximum wheel deflection in many vehicles is so large that the wheel hub with the measuring device applied disappears into the wheel housing, which makes both optical measurement and stretching a straight measuring string impossible. Furthermore, if the rear axle is used as a reference during measurement, the wheel blocks the view of the wheel forming the outer curve. One way of overcoming this problem is to place the ordinary measuring device on an extension shaft so that it is outside the wheel housing. However, this entails a number of extra manipulations and also assumes that the design of the wheel housing allows sufficient space for such an extension. The method otherwise most often used hitherto to avoid this problem has been to use special, separate measuring devices for these large angles. Such a measuring device may consist of swivelling, graduated measuring plates placed under the wheels, or of a scale placed on the ground close to the wheel, a measuring beam from the measuring device on the wheel being directed obliquely down towards this scale. Characteristic of the measuring devices are that they require irritatingly many manipulations to be applied and calibrated on site or that, due to their complexity, they entail unreasonable extra expense. Consequently measuring large course angles is in practice often omitted - even in cases when it is called for.

[0005] The object of the present invention is to provide an easily manageable method, suitable for automation, of determining the maximum wheel deflection and other large course angles of vehicles. The procedure according to the invention involves measuring the toe-in and camber on a straight course in the conventional manner, and also measuring the usual angles when the wheels are driven and from this calculating the gradient of the kingpin in longitudinal direction (caster) and in transverse direction (banking, KPI). Thereafter the course angle to be measured is set, e.g. maximum wheel deflection. Characteristic of the procedure according to the invention is that, instead of attempting to measure the course angle directly, the wheel camber, or alternatively the turning of the wheel upon locking of the brakes, is measured. The course angle sought is then calculated with the help of the angle thus measured as well as the other wheel and kingpin angles measured and calculated. This is possible since, just as the kingpin angles can be calculated on the basis of a few combinations of course and wheel camber angles, so also can an individual unknown course angle be measured on the basis of its equivalent angle of camber or turning and the kingpin angles. In practice this can easily be done using a ready reckoner or with the aid of a computer program. Since the straight course and kingpin angles are routinely determined when measuring a vehicle, the procedure in practice means that only one camber or turning measurement need be performed, and this can generally be performed using existing measuring equipment.

[0006] As regards calculation of the course angle, the variant of starting directly from the measured values from which the kingpin angles are calculated instead of utilizing the kingpin angles, falls within the scope of the invention.
Claims

1. A procedure for measuring large course angles of steering wheels on vehicles on which the straight course angles, the toe-in and camber are measured, as well as necessary angles to enable determination of caster and banking (KPI) of the kingpin of the wheel, characterized in that the turning of the wheel upon locking of the brakes, or alternatively the camber, is also measured at the course angle to be determined, and that the course angle sought is calculated utilizing both the turning or camber angle and also the known straight course and kingpin angles or the angle from which these have been calculated.

Patentansprüche


Revendications

1. Procédure pour mesurer des angles de route larges de roues directrices sur des véhicules sur lesquelles les angles de route droits, le pincement et l'ouverture sont mesurés ainsi que les angles nécessaires pour permettre la détermination de l'inclinaison latérale et de l'inclinaison transversale (KPI) du pivot de la roue, caractérisée en ce que le braquage de la roue sur un blocage des freins, ou alternativement l'ouverture, est également mesuré à l'angle de route à être déterminé et en ce que l'angle de route visé est calculé en utilisant à la fois l'angle de braquage ou d'ouverture et également les angles de route droits et d'inclinaison du pivot connus ou l'angle à partir duquel ceux-ci ont été calculés.