April 2022

AIWAC AUDI INTELLIGENT WHEEL ARCH COVER

Axel Unger
Bertrandt Ingenieurbüro GmbH

"AIWAC" AUDI INTELLIGENT WHEEL ARCH COVER - METHOD FOR A TRIM POSITION CONTROLLED WHEEL ARCH COVER VIA AN ADJUSTING DEVICE ON THE FENDER/SIDE PANEL OF A MOTOR VEHICLE WITH HEIGHT-ADJUSTABLE CHASSIS

Initial situation:
Electric vehicles can still be optimised in terms of range and there are many different solutions for this. The decisive factor in a motor vehicle is also the air resistance resulting from a shock effect on a wheel contact body of a mudguard/wheel housing to cover a tyre.

Depending on the wheel size and chassis (normal/sport chassis/air suspension chassis), the distance between a vehicle wheel with rim and tyre to a body edge of a wheel contact body varies. The legally prescribed mudguard of a wheel approach body with the angular dimensions 30 degrees in front of the wheel axle and 50 degrees behind the wheel axle result in an unfavourably long segment of an abutting edge of the mudguard and overlap at the wheel arch edge in the case of a height-adjustable chassis with lowered trim position. Cf. Fig. 1 and Fig. 2

Solution:
"AIWAC" Audi intelligent wheel arch cover / Method for a trim position controlled wheel arch cover via an adjusting device on the mudguard/side section of a motor vehicle with height-adjustable chassis.

The radian measure, i.e. segment length, of a wheel arch cover results from legally prescribed angular dimensions which refer to a wheel centre and from a trim position height of a motor vehicle. See Fig. 1 / Fig. 4.

The invention focuses on a mileage increase/range optimisation by an automated air friction optimisation at the mudguard of a motor vehicle with variable trim position. The aim is to automatically couple a shock edge length variably with a trim position control and thus to always ensure the smallest possible segment length of a wheel contact body, which is legally prescribed by the KBA with 30 or 50 angular degrees to the centre of the axle.

For this purpose ...

- in a first processing step, the trim position of a motor vehicle is queried by a height-adjustable running gear.
- in a subsequent second processing step, the segment arc of the wheel contact body is variably adjusted in the x-direction in the circumferential direction of the wheel in such a way that the specifications of the KBA are fulfilled to the aerodynamically most favourable minimum of the mudguard/tyre cover. Cf. Fig. 4

The indicated method also takes into account the variable tracking of a wheel contact body in the circumferential direction of the wheel in order to ensure a prescribed maximum which is vehicle class-dependent, e.g. class M1 (colloquially automobiles and motor homes) with respect to a cover.

The idea of the invention has the aim ...

- to increase an efficiency of a vehicle / C02 reduction
- to increase a range, in particular for an E-/H2-/Hybrid drive system
- to determine a design of a fender/tyre cover optimally to a trim position
- To reduce a variety of parts of statically fixed wheel contact bodies for different chassis in motor vehicles.

Advantages:
The advantages of the invention disclosure are shown in a reduction of disadvantageous impact loss and air friction influences of a wheel starting body. This effect has a particularly positive effect on a range of a motor vehicle with an alternative output, e.g. with an e-drive.

- Increase of an efficiency of a motor vehicle/increased CO2 neutrality
- Increased range, especially for an E-/H2-/Hybrid drive system
- Variable design element on a mudguard/tyre cover that always matches a trim position in terms of design, irrespective of trim position
- Cost saving by reducing the number of parts of statically fixed wheel contact bodies for different chassis in a motor vehicle.

Technical implementation
The task is solved with ...

- a motor vehicle (in particular an electric vehicle) which has a height-adjustable chassis

- a mudguard
- a mudguard/wheel cover, i.e. a so-called wheel contact body
- an interface to an AIWAC control unit with
- a length-adjustable/variable wheel contact body

The height-adjustable running gear can, for example, be an air suspension running gear.

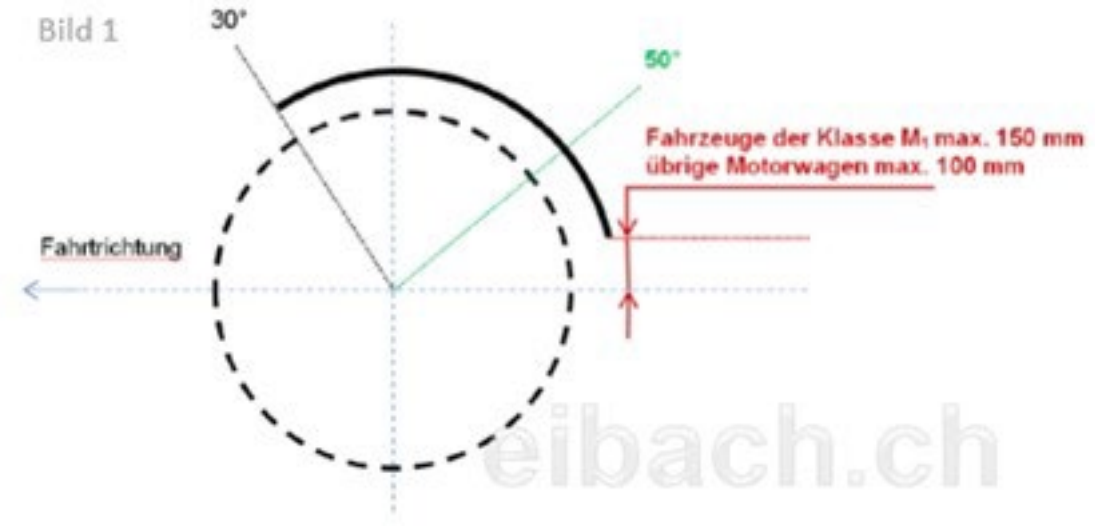

Fig. 1 Wheel start body / mudguard with cover on a wheel arch:

If the vehicle body, i.e. a trim level of a motor vehicle body, is lowered, then the arc/segment dimension of a legally prescribed wheel cover on a mudguard - in the range 30 degrees in front of/50 degrees after the wheel axle - can be reduced while at the same time ensuring the legal requirements by the KBA with regard to a road safety.

In simplified terms, the invention disclosure "AIWAC" describes the automated tracking of a cover of a wheel as a function of the ground clearance dimension of a body/body/passenger compartment.

State of the art / geometrically fixed wheel cover / cf. Fig. 5

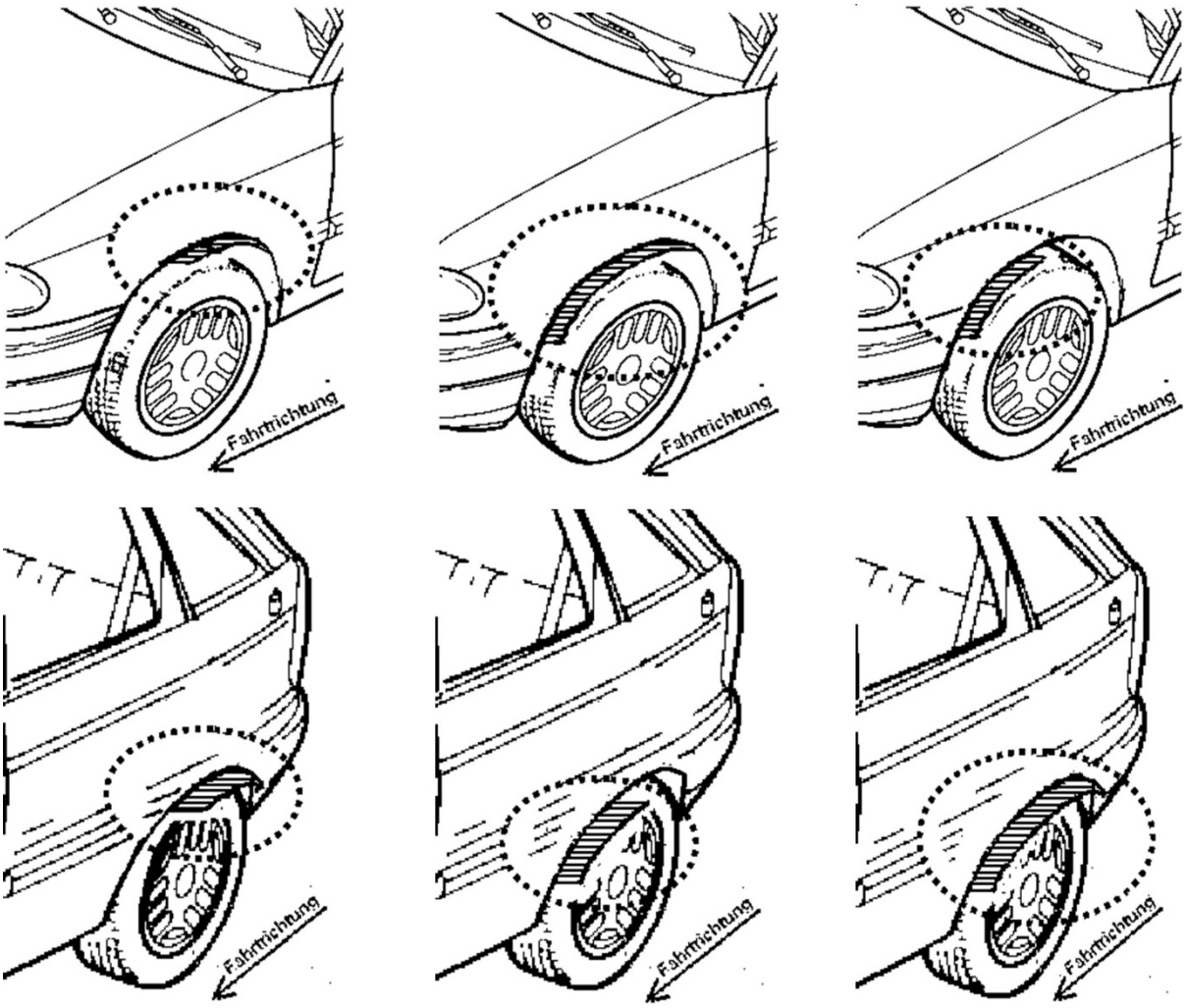

Fig. 2 shows the wheel tread prescribed by the KBA on the front axle (30 grd. front - left picture - 50 grd. rear - right picture - and shown complete on the front axle in the centre picture and the wheel tread prescribed by the KBA on the rear axle (30 grd. front - left picture - 50 grd. rear - right picture - and shown complete on the rear axle in the centre picture).

The differentiation to the SDT represents a variable wheel cover in the indicated procedure, which fulfils the legal requirements in a trim position-controlled manner and thus exerts the smallest possible air resistance on the motor vehicle with a lowered body/passenger cell structure.

In simplified terms, when the vehicle is lowered, the wheel start body can shorten in the longitudinal extension in the x-direction (+/-) along the wheel arch edge of the motor vehicle - red line in Fig. 3., cf. also Fig. 4

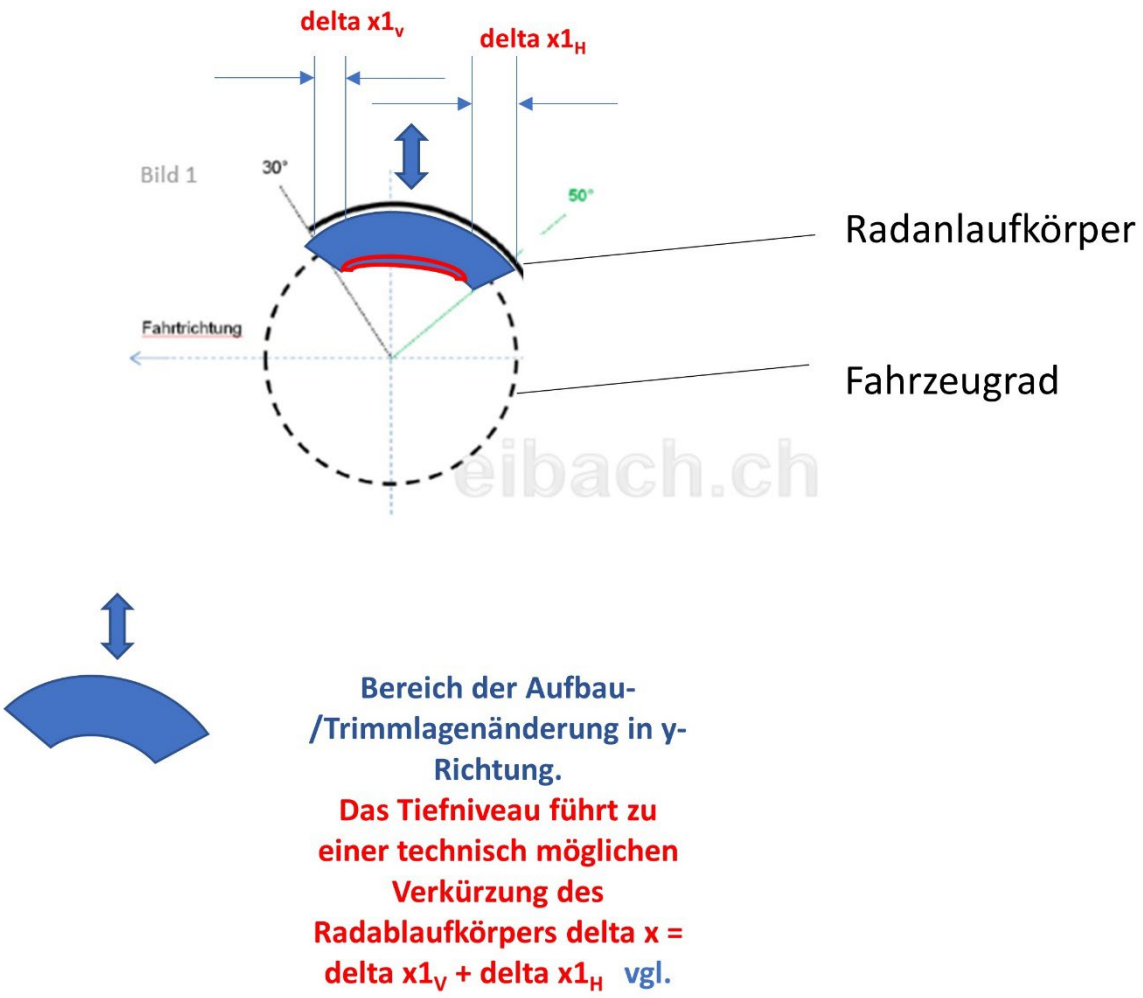

Fig. 3 Variable wheel starting body

Appendix
§ 22 in conjunction with § 20 Road Traffic Licensing Regulations (StVZO)

KBA requirements for the registration of a motor vehicle
The wheel cover on axle 1 must be produced by extending the front apron and the mudguard or by fitting permanently attached body parts in the area 30 degrees in front of the wheel centre and 50 degrees behind the wheel centre. The entire width of the wheel/tyre combination must be covered in the above-mentioned area, taking into account the maximum possible operating dimension of the tyre (1.04 times the nominal width of the tyre).
24D) The wheel cover on axle 2 must be produced by extending the rear apron and the mudguard or by fitting permanently attached body parts in the area 30 degrees in front of the wheel centre and 50 degrees behind the wheel centre. The entire width of the wheel/tyre combination must be covered in the above-mentioned area, taking into account the maximum possible operating dimension of the tyre (1.04 times the nominal width of the tyre).
24J) The wheel cover on axle 1 must be produced by extending the front apron and the mudguard or by fitting permanently attached body parts in the area 30 degrees in front of the wheel centre and 50 degrees behind the wheel centre. Depending on the set-up condition of the vehicle (e.g. vehicle lowering, wheel cover widening, etc.) it may be possible that the wheel cover is sufficient. The entire width of the wheel/tyre combination must be covered in the above-mentioned area, taking into account the maximum possible operating dimension of the tyre (1.04 times the nominal width of the tyre).
24M) The wheel cover on axle 2 must be produced by extending the rear apron and the mudguard or by attaching permanently fixed body parts in the area 30 degrees in front of the wheel centre and 50 degrees behind the wheel centre. Depending on the set-up condition of the vehicle (e.g. vehicle lowering, wheel cover widening, etc.) it may be possible that the wheel cover is sufficient. The entire width of the wheel/tyre combination must be covered in the above-mentioned area, taking into account the maximum possible operating dimension of the tyre (1.04 times the nominal width of the tyre).

51A) The tyre inflation pressure prescribed by the vehicle manufacturer (see operating instructions or tyre inflation pressure notice on the vehicle) or tyre manufacturer must be observed.
According to the manufacturer, the use of run-flat tyres is only permitted with a tyre pressure monitoring system.

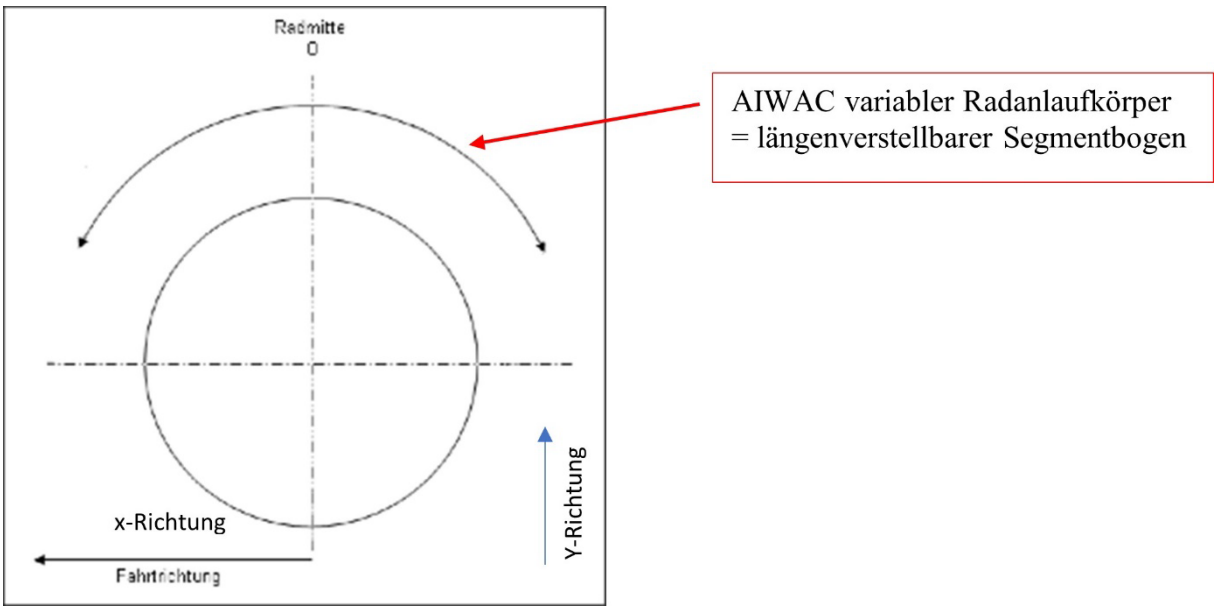

Fig. 4 Driving direction describes the x-direction / the ground clearance describes the y-direction

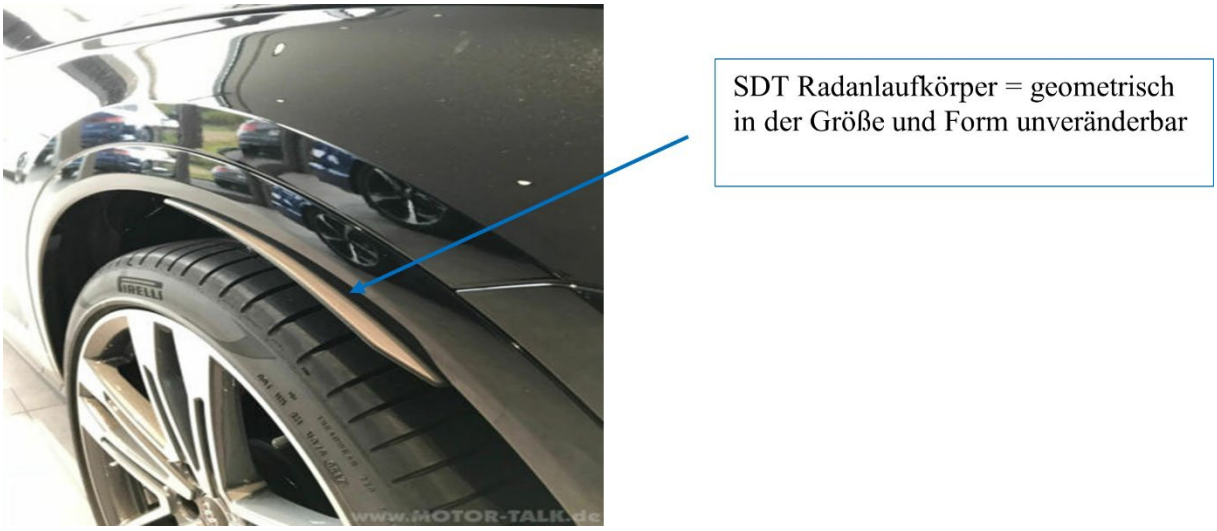

Fig. 5 Wheel contact body (static fixed/non-variable) SDT on an Audi Q5