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METHOD AND CONTROL FOR A HEICHT-ADJUSTABLE TRAILER HITCH ON A MOTOR VEHICLE

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METHOD AND CONTROL FOR A HEIGHT-ADJUSTABLE TRAILER HITCH ON A MOTOR VEHICLE

Current status / problem

You may be familiar with the condition of loading a bicycle carrier with an e-bike. According to the State of the art, bicycle carrier systems are mounted on a ball head of a trailer coupling, described below as AHK. The support rails of the bicycle carrier systems for accommodating the wheels are thus at the height level of the ball pin in the z-direction. The ball head of an AHK is located in the range of approx. 350-420mm height above the road surface at the permissible total weight of a motor vehicle. This design ensures a ramp angle at the rear of the vehicle via the ground clearance and thus a safe use of the motor vehicle with its attachments in road traffic

The disadvantage is that with increasing motor power of the e-bikes and the associated heavier e-motors and batteries/power storage, the mass/weight of the e-bikes increases significantly and the handling when mounting/dismounting the bikes, i.e. the manual lifting of the e-bikes on the bicycle carrier system, becomes more difficult.

In principle, luggage compartment accessibility is limited with bicycle carrier modules and tilt/tilting functions specially integrated in the carrier system have to be operated mechanically. The disadvantage of these systems is that, when the carrier system is loaded, it is not necessary to exert a great deal of weight by hand to support the load. This can result in a risk of accidents and damage to mounted loads, e.g. for e-bikes, or a risk of crushing for the user of the motor vehicle.

With regard to another application describing the coupling/uncoupling process of a loaded trailer or caravan, this leads to the fact that in certain situations of a handling, a drawbar load - for example an advantageous/recommended drawbar load of approx. 50-75 kg for vehicle/trailer stability in hitching/trailing operation - has to be applied with manual force in order to perform the coupling/uncoupling process.

With regard to the recommended drawbar load on a trailer coupling and thus on a ball head, the AHK operation/handling often also raises the question for a motor vehicle user "What drawbar load do I have on my ball head, and is the permissible drawbar load possibly exceeded, or too low"?

It becomes especially critical when there is no drawbar load on a ball head and a rear axle is unloaded by an unfavourably loaded transport or caravan trailer. This can reduce the rear axle's grip on the ground and reduce vehicle safety.

The aim is to provide an assistance with regard to the four examples listed, which provides a simplified handling procedure for a user of a motor vehicle and increases road safety.

New idea

In order to reduce/simplify the manual forces/handling for loading a bicycle carrier system with heavy bicycles, e.g. modern e-bikes, and to facilitate a coupling/uncoupling process of a transport trailer/caravan, the invention disclosure proposes a method that a ball head of a trailer coupling can be variably adjusted electromechanically in the z-direction. The adjustment is carried out with a spindle, a support nut/lifting nut analogous to a spindle drive, which carries out an axial adjustment of a lifting component in the z-direction with an electric motor

The electrical energy of the drive motor can be supplied, for example, via ..

- an on-board power supply connection of a trailer coupling, or
- directly via a powerful connection to an energy storage unit of an electric vehicle

The process can be controlled ..

- by activating a function key when the vehicle is stationary, or
- outside next to the motor vehicle with a mobile terminal coupled to the control.

In simplified and colloquial terms, the height adjustment of a ball head on a trailer coupling is comparable to the height adjustment of a support arm

An electrically driven spindle moves a spindle nut connected to the ball head of the trailer coupling, e.g. a support nut with trapezoidal thread, upwards or downwards in the z-direction.

Spindle drive means that an electrically driven spindle is installed in the module, which is advantageously installed in a boot or under a rear apron. On this spindle run 2 spindle/lifting nuts, i.e. a support nut and a safety nut. Both nuts have a fixed position in relation to the ball head of the trailer coupling, i.e. they do not rotate, and the rotation of the spindle moves these lifting nuts with the flange-mounted ball head upwards or downwards. The entire weight on the ball head, i.e. the drawbar load, rests on the upper lifting nut, which is called the support nut. The second lifting nut under the support nut is the safety nut. This only runs "loosely" without being loaded. It is only used if the support nut is defective and guarantees the safety of the height-adjustable ball head. For the arrangement and designation of the individual components, see Fig. 1 in the appendix.

Special design

In a special embodiment, the spindle nut or the ball head is equipped with a piezoelectric pressure transducer which takes into account a manufacturer-recommended support load specification of the spindle drive

Functional sequence

With the user's mobile end device, a ball head of a trailer coupling and the components mounted on the trailer coupling, e.g.

- a bicycle/load carrier system
- a drawbar of a load/transport trailer
- a tow bar of a caravan

can be adjusted variably in the z-direction and thus

- facilitate loading of a bicycle carrier/load carrier module
- selectively adjust a drawbar load on a ball head
- facilitate access to a luggage compartment by lowering the ball head
- adjust the angle of inclination of the loading area of a transport/caravan

Driving with a load on a ball head of a trailer coupling is monitored by the control unit. An optical/acoustic warning is activated if a drawbar load is exceeded or detected as "zero" / negative and a rear axle is thus overloaded / a ground adhesion is borderline.

An inclination angle adjustment of the loading area of a transport trailer in the direction of the rear drop side can, for example, simplify an unloading process when unloading a bulk material, e.g. gravel/sand

An angle of inclination adjustment of a living trailer can, for example, compensate for an inclined position on a sloping/rising roadway/parking surface in order to optimally adjust a lying level for a level resting/sleeping position.

The task is solved with

- a trailer coupling with a ball head
- an docking module for a trailer coupling on a body/vehicle chassis with ..
- an electric spindle drive with control
- a trailer socket/interface to an e-storage system/vehicle electrical system
- two spindle nuts which are firmly connected to a ball head
- a piezoelectric pressure transducer
- a mobile terminal

Advantages

- Provision of a loading assistance for an AHK
- Provision of simplified boot accessibility / lowering of the ball head
- Provision of an unloading assistance / tipping position loading area
- Provision of an added value / reclining / level / resting position for caravan operation
- Ensuring a prescribed drawbar load on a trailer hitch
- Increase of road safety
- Reduction of the risk of injury during the coupling process
- Reduction of the risk of injury in the boot area / tailgate area

