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Adjustment device for steering columns of vehicles

Abstract

An adjustment device for vehicle steering columns has a steering shaft to which a steering element can be attached, and a drive unit for adjusting a length of the steering shaft. The steering shaft has at least two tubes, which engage into each other in a telescoping manner, can be moved relative to each other, and can in each case be driven by a drive unit. The two drive units are arranged next to each other in the region below the adjustment device. If the two tubes are inserted into each other, the adjustment device only has a short length, which is measured in the displacement direction of the tubes. Conversely, if the tubes are extended in a telescoping manner, a very large length adjustment range can be achieved despite the short length in the starting position.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

(1) This application is a national stage application, filed under 35 U.S.C. § 371, of International Patent Application PCT/EP2022/068977, filed on Jul. 7, 2022, which claims the benefit of German Patent Application DE 10 2021 003 660.3, filed on Jul. 9, 2021.

BACKGROUND

(2) Adjustment devices for steering columns of vehicles are used to adapt the steering element of a vehicle, such as a steering wheel, to the sitting position of the driver. The steering shaft of the adjustment device can be set at least in its length. There is less and less installation space available for the installation of such adjustment devices, in particular if such adjustment devices are to be installed in electric vehicles. However, this should not impair the functions of the adjustment device.

SUMMARY

(3) The disclosure provides an adjustment device for a steering column of a vehicles that requires little installation space without impairing its function. This is achieved in accordance with the invention by the features as claimed.

(4) The adjustment device is characterized by the fact that its two tubes engage into each other in a telescoping manner and can be displaced relative to each other. If the two tubes are inserted into each other, the adjustment device only has a short length, measured in the displacement direction of the tubes. Conversely, if they are extended in a telescoping manner, a very large length adjustment range can be achieved despite the short length in the starting position. The two tubes can in each case be displaced by a drive unit such that the tubes can be displaced continuously against each other as required. The drive units are located in the region below the adjustment device and are arranged next to each other, as a result of which a very compact design of the adjustment device is achieved.

(5) The two adjustment units advantageously in each case have a threaded spindle that can be driven in rotation. In each case, a drive nut, which is drive-connected to the respective tube, is seated on the threaded spindled. Rotating the threaded spindle displaces the drive nut, as a result of which the tube coupled to it accordingly is adjusted.

(6) In an advantageous embodiment, the threaded spindles of the two drive units for the two tubes are parallel to each other.

(7) The adjustment device is advantageously provided with a sheath tube, into which the two tubes can be displaced. The sheath tube protects the two tubes, such that it is ensured that the tubes can be displaced reliably over a long period of use.

(8) So that the two tubes can be reliably adjusted during the displacement process, the outer tube is advantageously provided on its inner side with at least one axial guide for the inner tube. The axial guide ensures that the two tubes can be displaced smoothly against each other.

(9) A steering spindle, which can be rotatably supported by a bearing arrangement in the inner tube, extends through the inner tube. The steering spindle and the inner tube are firmly connected to each other in the displacement direction via the bearing arrangement, such that the steering spindle is also moved when the inner tube is displaced. The steering spindle is a component of the steering rod and at its end carries the steering element.

(10) The steering spindle protrudes axially from the inner tube within the outer tube in an advantageous manner. A stop device is seated on such protruding part of the inner tube, which has at least one guide element that engages in the axial guide of the outer tube. In this manner, the steering spindle together with the inner tube can be displaced smoothly in relation to the outer tube.

(11) In an advantageous design, the stop device is provided with a grooved sleeve seated on the

steering spindle. It has a helically extending groove into which the guide element engages with at least one engagement element. The engagement element is advantageously formed by rolling balls.
(12) The groove of the groove sleeve advantageously extends over an angular range of more than 360°. Due to a relative rotation between the left spindle and the outer tube, the steering spindle together with the inner tube in relation to the outer tube is axially adjusted.
(13) In an advantageous embodiment, the outer tube is drive-connected to the inner tube via at least one crash element. The crash element is advantageously formed by a sheet metal strip, which can be manufactured easily and inexpensively and mounted on the adjustment device.
(14) One end of the crash element is connected to a connecting element, which is connected to the drive nut of the adjustment unit for the outer tube.
(15) The connecting point of the connecting element to the drive nut is advantageously effected via at least one shearing element. In the event of a crash, the connection between the outer tube and the inner tube is broken by shearing off the shearing element.
(16) It is particularly advantageous if the steering shaft can be adjusted not only in length, but also in height. This ensures optimum adaptation of the steering element to the sitting position of the driver.
(17) To adjust the height of the steering shaft, an adjustment unit is provided which is mounted on a bearing support about an axis that is transverse to the longitudinal adjustment direction of the steering spindle. Depending on the pivot direction, the steering shaft can be pivoted upwards or downwards.
(18) Advantageously, a lever is pivotably mounted on the bearing support, which on its part is pivotably connected to the sheath tube. Depending on the pivoting position of the lever relative to the bearing support, the steering shaft is pivoted upwards or downwards.
(19) In an advantageous embodiment, the adjustment unit for adjusting the height of the steering shaft engages on the lever. This pivots the lever in the desired direction using the adjustment unit, in order to move the steering shaft upwards or downwards.
(20) This adjustment unit advantageously has a threaded spindle that can be driven in rotation, with which a drive nut that is coupled to the lever can be adjusted. Thus, via the drive nut, the lever is pivoted in the desired direction.
(21) The invention is explained in more detail with reference to an exemplary embodiment shown in the drawing.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** is a perspective view of a steering column adjustment device in a stowed position.
(2) FIG. **2** is a perspective view of the steering column adjustment device in accordance with FIG. **1** with the steering spindle extended to its maximum.
(3) FIG. **3** is a top view of the steering column adjustment device in accordance with FIG. **1**.
(4) FIG. **4** is a top view of the steering column adjustment device with the steering spindle extended partially.
(5) FIG. **5** is a top view of the steering column adjustment device in accordance with FIG. **2**.
(6) FIG. **6** is a side view of the steering column adjustment device in accordance with FIG. **1**.
(7) FIG. **7** is a side view of the steering column adjustment device in accordance with FIG. **2**.
(8) FIG. **8** is a representation corresponding to FIG. **7** of the steering column adjustment device in a first pivot position.
(9) FIG. **8***a* shows, in enlarged representation, a section of FIG. **8**.
(10) FIG. **9** shows the steering column adjustment device in accordance with FIG. **7** in a second pivoted position.

(11) FIG. **10** and FIG. **11** are sectional views showing the steering column adjustment device with the steering spindle extended to different lengths.
(12) FIG. **12** shows a section along line XII-XII in FIG. **6**.
(13) FIG. **13** and FIG. **14** shows enlarged representations of sections from FIGS. **10** and **11**.
(14) FIGS. **15** to **17** show, in each case in perspective representation and partially in sectional view, different positions of a ball nut of a stop device of the steering column adjustment device.
(15) FIG. **18** is a perspective view of a safety unit of the steering column adjustment device.
(16) FIG. **18***a* shows the safety unit in accordance with FIG. **18** in the triggered position.
(17) FIG. **19** is a top view of the safety unit in accordance with FIG. **18**.
(18) FIG. **19***a* is a top view of the safety unit in accordance with FIG. **19**.
(19) FIG. **20** is a side view of the safety unit in accordance with FIG. **18**.

DETAILED DESCRIPTION

(20) The electric steering column adjustment device described below has a high degree of rigidity and a compact design. Therefore, it can be installed in installation spaces with limited volume. The adjustment device is suitable for semi-autonomous driving with a vehicle with which the steering is not transmitted mechanically to the steerable vehicle wheels by means of a steering element, such as a steering wheel, but is carried out electrically.
(21) The adjustment device has the steering element (not shown), which is fastened for co-rotation to a steering shaft **1**. The adjustment device is designed such that the steering element can be set both in the longitudinal direction of the steering shaft **1** and transversely to it in the vertical direction to adapt to the position of the driver.
(22) The steering shaft **1** has a steering spindle **2**, to the free end of which the steering element is fastened in a known manner. The steering spindle **2** can be displaced in its longitudinal direction in order to adjust the steering element to different longitudinal positions.
(23) In order to give the driver the feeling of direct steering of the wheels despite the electrical adjustment of the steerable vehicle wheels, the adjustment device can be provided with an actuator **3**, which generates a counter-torque when the steering shaft **1** is rotated by means of the steering element. This gives the driver the feeling that he is steering the wheels of the vehicle mechanically.
(24) The actuator **3** has a drive unit **3***a*, whose axis extends perpendicularly to the axis of the actuator **3** and that rotatably drives a toothed shaft **4** that projects into a sheath tube **5** (FIG. **10**). It is fastened to a housing **6** of the actuator **3**.
(25) The sheath tube **5** surrounds a guide tube **7** with clearance, which can be displaced relative to the sheath tube **5**. The guide tube **7** on its part surrounds an inner guide tube **8** with radial clearance, into which the steering spindle **2** projects. It is firmly connected to the inner guide tube **8**, such that the steering spindle **2** is moved together with the inner guide tube **8** when the length of the steering shaft **1** is adjusted.
(26) An angle sensor **9** is fastened to the free end of the inner guide tube **8** outside the outer guide tube **7**, through which the steering spindle **2** projects.
(27) The steering spindle **2** is supported in the inner guide tube **8** by a spindle bearing **10**, which is formed, for example, by two axially spaced bearings. They are provided near both ends inside the guide tube **8**.
(28) The sheath tube **5** and the two guide tubes **7**, **8** together with the steering shaft **2** form a telescopic steering shaft **1**. FIG. **10** shows the steering shaft **1** in its maximum extended length, while FIG. **11** shows the steering shaft **1** in the retracted position.
(29) In order to enable a safe telescoping movement, the sheath tube **5** is provided on diametrically opposite sides in each case with a guide strip **11** (FIG. **12**), which extends in the axial direction of the sheath tube and engages in a corresponding counter-guide **12** formed by a recess on diametrically opposite regions of the outer guide tube **7**. They are provided on the outer side of the outer guide tube **7** and extend axially.
(30) The inner guide tube **8** has diametrically opposed, axially extending guide strips **13** on its

outer side, which engage in corresponding axially extending recesses **14** on the inner side of the outer guide tube **7**.
(31) As can be seen in FIG. **12**, the guide strips **11**, **13** and the recesses **12**, **14** are diametrically opposite each other at the same height. In principle, the guide system **11**, **13** can be arranged at an angle offset in relation to the guide system **12**, **14**, for example by 90°.
(32) A length adjustment drive **15** is used to adjust the length of the inner guide tube **8**, which has a threaded spindle **16** parallel to the toothed shaft **4**, on which a drive nut **17** is seated (FIG. **1**). Depending on the direction of rotation of the threaded spindle **16**, the drive nut **17** is moved along the threaded spindle **16**.
(33) The drive nut **17** is firmly connected to the inner guide tube **8**, which is displaced in the respective direction relative to the outer guide tube **7** depending on the movement direction of the drive nut **17** on the threaded spindle **16**. The outer guide tube **7** is provided with an opening **18** extending in the axial direction (FIGS. **3**, **4** and **8***a*), through which the drive nut **17** with a corresponding connecting part **17′** projects. It is fastened to the outer side of the inner guide tube **8** with fastening elements **17***a* (FIG. **8***a*).
(34) The length adjustment drive **15** is firmly connected to the inner guide tube **8**, such that the length adjustment drive **15** is moved along with the inner guide tube **8** when the steering shaft **1** is adjusted in length.
(35) A further length adjustment drive **19** (FIG. **2**), which rotatably drives a threaded spindle **20** parallel to the threaded spindle **16**, is used to displace the outer guide tube **7** in relation to the sheath tube **5**. A drive nut **21** is seated on it and is axially fixed to the outer guide tube **7**. The outer guide tube **7** can be displaced axially in relation to the sheath tube **5** using the drive nut **21**.
(36) In the driving position of the mechanism, the guide tube **7** is not displaced by the length adjustment drive **19**. The guide tube **7** is held in the driving position by the self-locking mechanism of the transmission **20**, **21**, which is advantageous for a crash function yet to be described.
(37) The end of the threaded spindle **20** turned away from the length adjustment drive **19** is rotatably mounted in a radial extension **22** of the sheath tube **5** (FIGS. **1**, **2** and **6** to **11**).
(38) The drive nut **21** projects through an axial opening **23** in the sheath tube **5** (FIG. **10**) in a manner to be described with a connecting part **36**.
(39) In contrast to the length adjustment drive **15**, the length adjustment drive **19** is arranged in a fixed position, such that its position does not change in relation to the adjustment device when the length of the steering shaft **1** is adjusted.
(40) FIG. **11** shows the steering shaft **1** in its retracted position. The outer guide tube **7** is almost completely retracted into the sheath tube **5** by means of the length adjustment drive **19**. The drive nut **21** is located on the threaded spindle **20** in its left-hand starting position shown in FIG. **11**. The inner guide tube **8** is retracted into the outer guide tube **7** to such an extent that it only protrudes a short length from the outer guide tube **7**. The steering spindle **2** is connected to the inner guide tube **8** in such a manner that it protrudes beyond both ends of the inner guide tube **8**. In the retracted position of the inner guide tube **8**, the steering spindle **2** also projects axially beyond the outer guide tube **7** in the direction of the drive **3**.
(41) The steering spindle **2** can be displaced from such stowed position shown in FIG. **11** to the maximum extended position shown in FIG. **11** with the aid of the two length adjustment drives **15**, **19**. Starting from the stowed position in accordance with FIG. **11**, the outer guide tube **7** can first be displaced in relation to the sheath tube **5** by means of the length adjustment drive **19** via the drive nut **21**.
(42) At the same time, the adjustment drive **15** moves the inner guide tube **8** together with the steering spindle **2**. In this manner, both guide tubes **7**, **8** can be moved into an intermediate position, which is shown in FIG. **4**.
(43) The described adjustment achieves an intermediate position in which the inner guide tube **8** is displaced together with the steering spindle **2** and the outer guide tube **7** is moved in relation to the

sheath tube **5**.

(44) Starting from such intermediate position, the inner guide tube **8** can be displaced in relation to the outer guide tube **7** to the end position shown in FIGS. **5** and **7** to **10**. This is achieved by moving the drive nut **17** along the threaded spindle **16** with the length adjustment drive **15**, as a result of which the inner guide tube **8** with the steering spindle **2** is moved out of the outer guide tube **7** into the end position.

(45) In the region outside the inner guide tube **8**, the outer guide tube **7** is connected to the steering spindle **2** via a stop device **24**. The stop device **24** has a grooved sleeve **25**, which is fastened to the end of the steering spindle **2** that protrudes inwards beyond the inner guide tube **8** (FIGS. **13** and **14**). The grooved sleeve **25** is provided with a coiled groove **26**. The groove sleeve **25** is surrounded by a ball nut **27** (FIG. **14**), from which a guide element **28** protrudes radially, which engages in an axially extending guide **29** in the inner wall **30** of the outer guide tube **7** (FIGS. **13** to **17**).

(46) Rolling balls **31**, which engage in the groove **26**, are located in the ball nut **27**. The guide element **28** ensures that the ball nut **27** is not rotated about its axis when the steering spindle **2** is rotated. As a result of the engagement of the rolling balls **31** in the groove **26**, the ball nut **27** is displaced axially.

(47) At its end turned towards the actuator **3**, the groove sleeve **25** is provided with a stop ring **32**, which is seated so that it cannot rotate on the groove sleeve **25** and against which the guide element **28** of the ball nut **27** comes to bear in an end position (FIG. **16**).

(48) As can be seen in FIG. **16**, the helical groove **26** ends with a spacing from the end **33** of the ball nut **27** opposite the stop ring **32**. At such end **33**, the groove sleeve **25** is provided with a radially protruding stop **34**, which can limit the movement path of the ball nut **27** along the groove sleeve **25**.

(49) The helical groove **26** extends over a total angular range of 540°, i.e. the groove sleeve **25** can perform a two-and-a-half rotation in relation to the ball nut **27**.

(50) In the position shown in FIG. **16**, the ball nut **27** bears with its guide element **28** against the stop ring **32**. In such position of the ball nut **27**, the inner guide tube **8** together with the steering spindle **2** is pushed furthest out of the outer guide tube **7**.

(51) FIGS. **16** and **17** show the two end positions of the guide element **28** of the ball nut **27**. In the one end position (FIG. **16**), the guide element **28** bears against the stop ring **32**. The other end position (FIG. **17**) is reached if the ball nut **27** comes to bear against the stop **34**.

(52) The stop device **24** protects the adjustment device from overload torques after ±X° rotations of the steering wheel. The possible rotation angular range can be adapted in an advantageous manner.

(53) Since the stop device **24** is provided at the end of the steering spindle **2** turned towards the actuator **3**, it is protected within the adjustment device in any extended position of the steering shaft **1**.

(54) FIG. **10** shows the maximum length adjustment L.sub.Vmax. The maximum adjustment length L.sub.Vmax is a measure of the maximum stowage space of the adjustment device. Ü.sub.A indicates the overlap of the toothed shaft **4** with the stop device **24** and Ü.sub.Fa indicates the overlap of the outer guide tube **7** with the sheath tube **5**.

(55) The adjustment device is provided with a safety unit **35** (FIGS. **18** to **20**), which serves as a crash device. The safety unit **35** has a U-shaped bracket **36** that surrounds the drive nut **17**.

(56) The one leg **37** of the bracket **36** projects into a recess **38** extending in the longitudinal direction of the outer guide tube **7**, which is provided in the underside **39** in the region of a side wall of the inner guide tube **7**. One end of an upright sheet metal strip **40**, which is arranged in the recess **38**, is fastened to the free end of the bracket leg **37**. Following the bracket leg **37**, the sheet metal strip **40** bears against a side wall **41** of the recess **38**.

(57) With a spacing from the bracket **36**, the sheet metal strip **40** is bent by 180° and fastened with its other free end to the opposite side wall **42** of the recess **38**. The two ends of the sheet metal strip

40 are spaced apart in the displacement direction of the guide tube **7**. The end of the sheet metal strip **40** located on the side wall **42** is fastened to the side wall **42** of the recess **38** by means of a fastening element **43**, which is a rivet in the exemplary embodiment. The head of the fastening element **43** is recessed in a recess **44** on the outer side **45** of the side wall **42**.
(58) The other end of the sheet metal strip **40** is fastened by three fastening elements **46** near the free end of the leg **37** of the bracket **36**.
(59) The bracket **36** is connected to the drive nut **17** by at least one shearing element **47**. The shearing element **47** is advantageously a shear pin, which extends through the drive nut **17** in the region outside the threaded spindle **16** and protrudes with both ends over the legs **37** of the bracket **36** (FIG. **19**).
(60) The region between the semi-circularly bent section of the sheet metal strip **40** and the correspondingly bent end region **48** of the recess **38** forms a deformation space **49** (FIG. **19**). The arrow **50** in FIG. **19** indicates the direction of the crash. In the event of a crash, the bracket **36** and the sheet metal strip **40** firmly connected to it remain stationary, such that a relative displacement occurs between the bracket **36** and the outer guide tube **7**. The result of this is a deformation of the sheet metal strip **40** (FIGS. **18***a* and **19***a*).
(61) As can be seen from FIGS. **10**, **11** and **18** to **20**, the bracket **36** is provided with an L-shaped retaining element **51**, which bears against the end face of the outer guide tube **7** turned towards the actuator **3**. In the event of a crash, the retaining element **51** separates the drive nut **21** from the bracket **36** by shearing off the shearing element **47**.
(62) The steering column adjustment device is not only adjustable in the longitudinal direction, but also in the vertical direction. This is achieved by a pivot movement of the steering shaft **1** in the vertical direction.
(63) The steering shaft **1** with the various drives is pivotably mounted on a bearing support **52** about an axle **53** (FIG. **1**). The pivot axis **53** is perpendicular to the threaded spindles **16**, **20** of the length adjustment drives **15**, **19**. The entire adjustment device is fastened in the vehicle with the bearing support **52**. A U-shaped lever **54** is pivotably mounted on the bearing support **52** about an axis **55**, which is parallel to the pivot axis **53**. The sheath tube **5** is pivotably connected to the lever **54**. The corresponding pivot axis **56** is parallel to the pivot axis **55**.
(64) The bearing support **52** has a cover plate **57** that covers the steering shaft **1** over most of its length. At one end of the cover plate **57**, two tongues **58** parallel to each other protrude from the two longitudinal sides, of which only one tongue can be seen in the drawings. The two tongues **58** are located on both sides of the steering shaft **1**, which is hinged to the tongues **58** near their free ends (pivot axis **53**).
(65) At the other end, further tongues **59** protrude from the longitudinal sides of the cover plate **57**, which, like the tongues **58**, extend from the cover plate **57** in the direction of the length adjustment drives **15**, **19**. Near the free ends of the tongues **59**, the lever **54** is hinged in a manner pivoting about the axis **55**.
(66) The lever **54** has a connecting bar **60** (FIG. **1**), which connects two legs **61**, **62** parallel to each other. The two legs **61**, **62** of the lever **54** are pivotably connected to the tongues **59** of the bearing support **52** via the pivot axis **55**.
(67) The two legs **61**, **62** in each case have an elongated opening **63** (FIG. **6**), through which the pivot axis **56** projects with clearance. It is formed by pins that protrude from the sheath tube **5** and extend through the openings **63**.
(68) A drive nut **64** is hinged to the free end of one leg **61**. It is connected in an articulated manner to the leg **61** of the lever **54** about an axis parallel to the pivot axes **55**, **56**.
(69) The drive nut **64** is seated on a threaded spindle **65**, which is rotatably driven by a drive **66**. It can be pivoted about an axis **67** (FIG. **6**) parallel to the pivot axes **53**, **55**, **56**. The drive **66** is connected to the actuator **3** via such pivot axis **67**.
(70) The pivot axis **55**, with which the bearing support **52** and the lever **54** are connected to each

other in an articulated manner, is located between the two pivot axes **53** and **56**, as seen in side view in accordance with FIG. **6**.

(71) The lever **54**, whose two legs **61**, **62** are overlapped on the outside by the tongues **59** of the bearing support **52**, has two lever arms **68**, **69** (FIG. **6**), which extend from the pivot axis **56** at an obtuse angle. The drive nut **64** engages near the free end of the lever arm **68**.

(72) FIG. **7** shows the steering shaft **1** in its neutral position, in which the pivot axle **56** bears against the end of the elongated openings **63** turned towards the bearing support **52**. The lever **54** is loaded by the drive nut **64** in such a manner that it bears against the pivot axis **56** under force in the manner described.

(73) FIG. **8** shows the steering shaft in a downwardly pivoted position in relation to FIG. **7**. In order to reach such lower pivot position, the threaded spindle **65** is rotated with the drive **66**, such that the drive nut **64** is adjusted in the direction of the drive **66** up to the stop position shown in FIG. **8**. As a result, the lever **54** is pivoted clockwise about the pivot axis **55**. Thereby, the lever **54** also pivots about the pivot axis **55** in relation to the bearing support **52**. With its end turned away from the pivot axis **55**, the opening **63** bears under force against the lever **54**, which is loaded accordingly by the drive nut **64**. The steering shaft **1** itself can pivot about the pivot axis **53** into the position shown in FIG. **8**.

(74) FIG. **9** shows the steering shaft **1** in an upwardly pivoted position in relation to the neutral position (FIG. **7**). In order to achieve this, the threaded spindle **65** is rotated with the drive **66**, such that the drive nut **64** moves in the direction of the free end of the threaded spindle **64**. The lever **54** is pivoted counterclockwise about the axle **55** in relation to the bearing support **52**. At the same time, the steering shaft **1** is pivoted upwards about the pivot axis **53**. The pivot axis **56** bears under force on the end of the elongated opening **63** of the lever **54** turned away from the pivot axis **55**.

(75) The drive **66** with the threaded spindle **65** is pivoted about the axle **67** relative to the steering shaft **1** and the bearing support **52** during the corresponding pivoting movements.

(76) The arrangement can be such that the pivot angle of the steering shaft **1** is greater during the upward pivot movement than during the downward pivot movement. This can be achieved by designing the lever **54** accordingly, for example.

(77) The steering column adjustment device described is characterized by its compact design. Nevertheless, a large length and height adjustment range is ensured. The two guide tubes **7**, **8** can be adjusted in the described manner from the starting position (stowed position) shown in FIG. **1** very far into the maximum extended position, as shown as an example in FIG. **2**. The telescopic design of the steering rod makes it possible for the adjustment device to have only a short length in the retracted position, but a long length in the extended position. This makes it possible, for example to get into the vehicle, to displace the steering element so far that the driver can get in comfortably. The long extension length means that the steering element can also be set to the optimum position for tall riders.

(78) The compact design of the adjustment device is enhanced by the fact that the drives for at least the length adjustment of the steering rod **1** are arranged next to each other on the side opposite the bearing support **52**. As a result, the drives **15**, **19** take up very little installation space. The drive **66** for the height adjustment is also located in a space-saving manner directly next to the sheath tube **5** and, seen in top view (FIG. **3**), directly next to the bearing support **52**.

Claims

1. An adjustment device for a steering column of a vehicle, comprising: a steering shaft (**1**) to which a steering element can be attached; and two drive units (**15**, **19**) for adjusting a length of the steering shaft (**1**), wherein the steering shaft (**1**) comprises two tubes (**7**, **8**), including an outer tube (**7**) and an inner tube (**8**), that engage into each other in a telescoping manner and can be displaced relative to each other, wherein each of the two tubes (**7**, **8**) is driven by a respective one of the drive

units (**15**, **19**), wherein the two drive units (**15**, **19**) are arranged next to each other in a region below the steering shaft (**1**), wherein the two drive units (**15**, **19**) each comprise a threaded spindle (**16**, **20**) that can be driven in rotation, and wherein a respective drive nut (**21**) that is drive-connected to a respective one of the two tubes (**7**, **8**) is seated on each of the threaded spindles (**16**, **20**).
2. The adjustment device according to claim 1, wherein the threaded spindles (**16**, **20**) are parallel to each other.
3. The adjustment device according to claim 1, wherein the two tubes (**7**, **8**) can be displaced in a sheath tube (**5**).
4. The adjustment device according to claim 1, wherein the outer tube (**7**) is drive-connected to the inner tube (**8**) via a crash element (**40**).
5. The adjustment device according to claim 4, wherein one end of the crash element (**40**) is connected to a connecting element (**36**) connected to a drive nut (**21**) of the drive unit (**19**) for the outer tube (**7**).
6. The adjustment device according to claim 5, wherein the connecting element (**36**) is connected to the drive nut (**21**) via at least one shearing element (**47**).
7. An adjustment device for a steering column of a vehicle, comprising: a steering shaft (**1**) to which a steering element can be attached; and two drive units (**15**, **19**) for adjusting a length of the steering shaft (**1**), wherein the steering shaft (**1**) comprises two tubes (**7**, **8**), including an outer tube (**7**) and an inner tube (**8**), that engage into each other in a telescoping manner and can be displaced relative to each other, wherein each of the two tubes (**7**, **8**) is driven by a respective one of the drive units (**15**, **19**), wherein the two drive units (**15**, **19**) are arranged next to each other in a region below the steering shaft (**1**), wherein the two tubes (**7**, **8**) can be displaced in a sheath tube (**5**), and wherein the outer tube (**7**) has, on an inner side (**30**) thereof, at least one axial guide (**29**) for the inner tube (**8**).
8. The adjustment device according to claim 7, wherein a steering spindle (**2**) is rotatably supported in the inner tube (**8**) by a bearing arrangement (**10**).
9. The adjustment device according to claim 8, wherein the steering shaft (**1**) can be adjusted in a vertical direction.
10. The adjustment device according to claim 9, wherein an adjusting unit (**66**) for height adjustment is pivotably mounted on a bearing support (**52**) about an axis (**67**) that is transverse to a longitudinal adjustment direction of the steering spindle (**2**).
11. The adjustment device according to claim 10, wherein a lever (**54**) is pivotably mounted on the bearing support (**52**) and is pivotably connected to the sheath tube (**5**).
12. The adjustment device according to claim 11, wherein the adjusting unit (**66**) engages on the lever (**54**).
13. The adjustment device according to claim 11, wherein the adjusting unit (**66**) has a threaded spindle (**65**) that can be driven in rotation and on which a drive nut (**64**) that is coupled to the lever (**54**) is seated.
14. The adjustment device according to claim 8, wherein a stop device (**24**) is seated on an end of the steering spindle (**2**) that protrudes axially beyond the inner tube (**8**) and has at least one guide element (**28**) that engages in the axial guide (**29**) of the outer tube (**7**).
15. The adjustment device according to claim 14, wherein the stop device (**24**) has a groove sleeve (**25**) that is seated on the steering spindle (**2**) and has a helically extending groove (**26**), in which the guide element (**28**) engages with at least one engagement element (**31**).
16. The adjustment device according to claim 15, wherein the at least one engagement element (**31**) is a plurality of rolling balls.
17. The adjustment device according to claim 15, wherein the helically extending groove (**26**) extends over an angular range of more than 360°.
18. An adjustment device for a steering column of a vehicle, comprising: a steering shaft (**1**) to

which a steering element can be attached; and two drive units (**15**, **19**) for adjusting a length of the steering shaft (**1**), wherein the steering shaft (**1**) comprises two tubes (**7**, **8**), including an outer tube (**7**) and an inner tube (**8**), that engage into each other in a telescoping manner and can be displaced relative to each other, wherein each of the two tubes (**7**, **8**) is driven by a respective one of the drive units (**15**, **19**), wherein the two drive units (**15**, **19**) are arranged next to each other in a region below the steering shaft (**1**), wherein the outer tube (**7**) is drive-connected to the inner tube (**8**) via a crash element (**40**), and wherein the crash element (**40**) is a sheet metal strip.