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(56) Documents Cited:
 JP 080295246 A JP 2008265647 A
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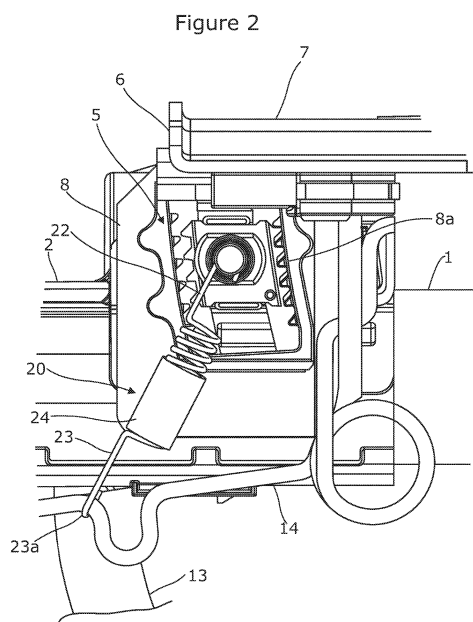
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(54) Title of the Invention: **Steering column assembly**
 Abstract Title: **Tiltable steering column with clamp having sleeved spring**

(57) A steering column comprises a shroud 1, 2, a support bracket 7 and a clamp 5 releasably securing shroud 1 to support bracket 7. A spring assembly 20 connects clamp 5 to another part of the steering column, for example a support spring 14 supporting part of the weight of shroud 1, 2 when unclamped, and comprises a spring having a wound helical coil (21, Figure 5), an upper end portion 22 and a lower end portion 23, and an open-ended sleeve 24 around the spring coil, which may be a plastic tube forming an interference fit with the coil. Spring assembly 20 also includes a support portion 25 between the coil and lower end portion 23, for example a part of the spring projecting radially outwardly from the coil to form a dog-leg with lower end portion 23, preventing unwanted downward creep of sleeve 24 onto lower end portion 23.



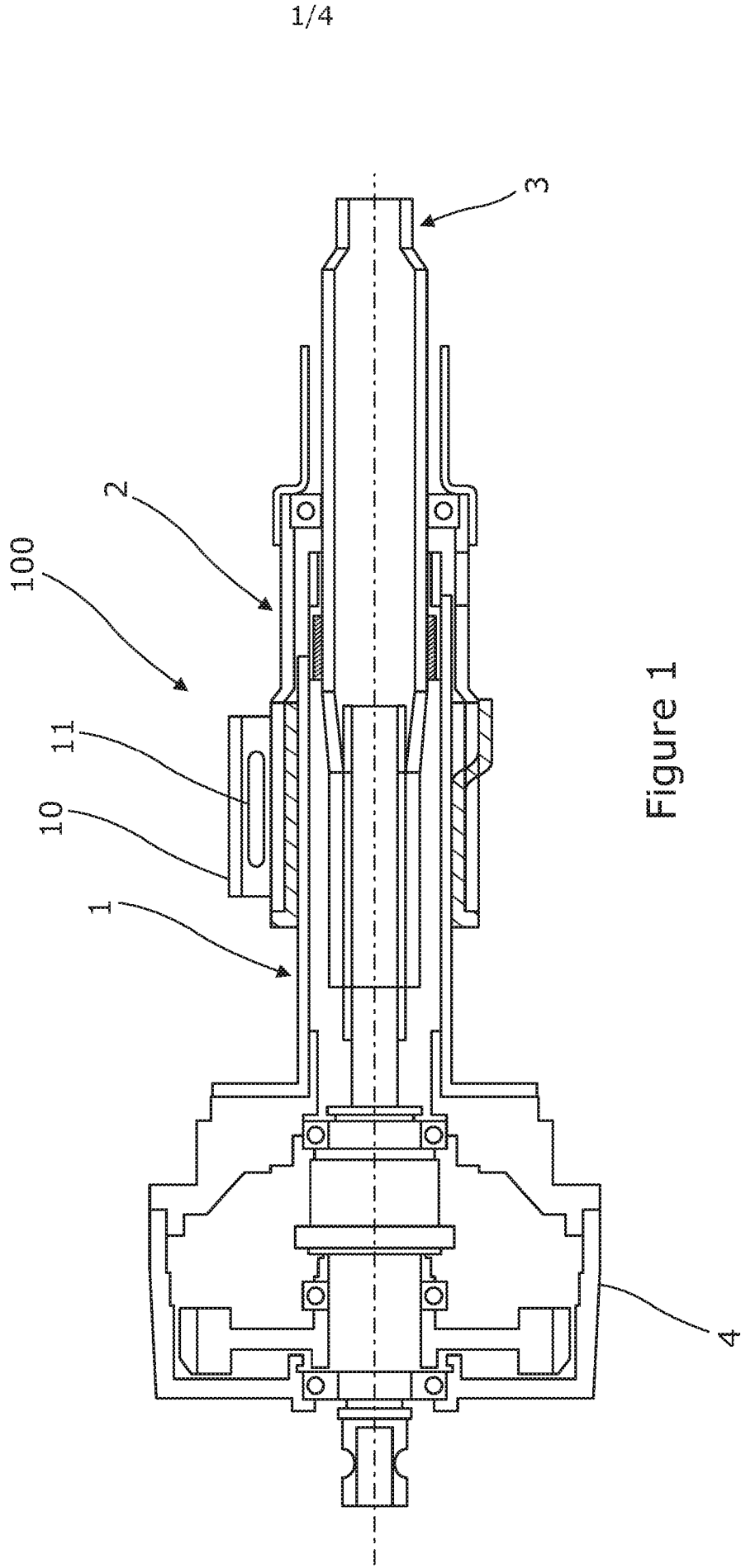


Figure 1

20 06 14

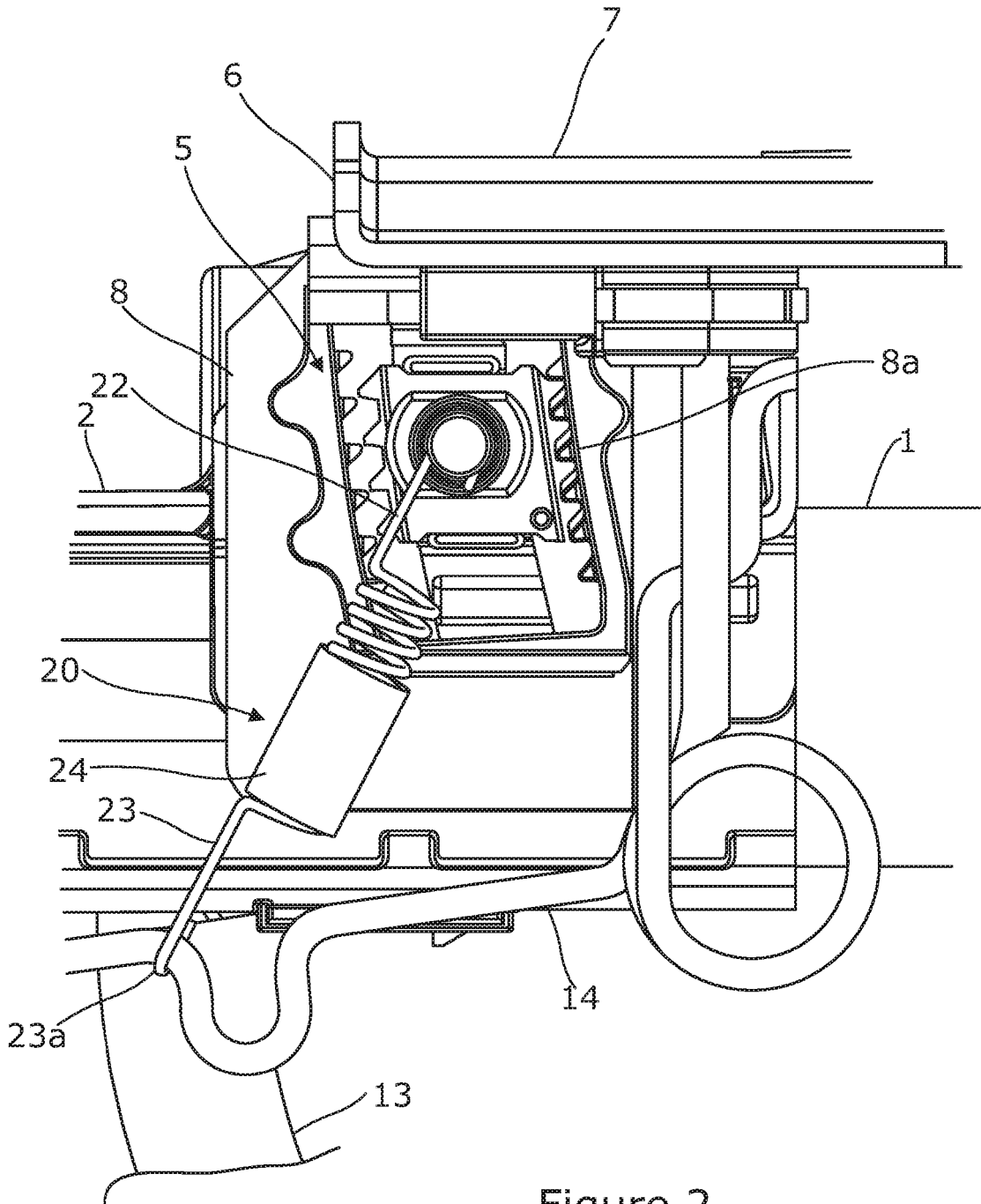


Figure 2

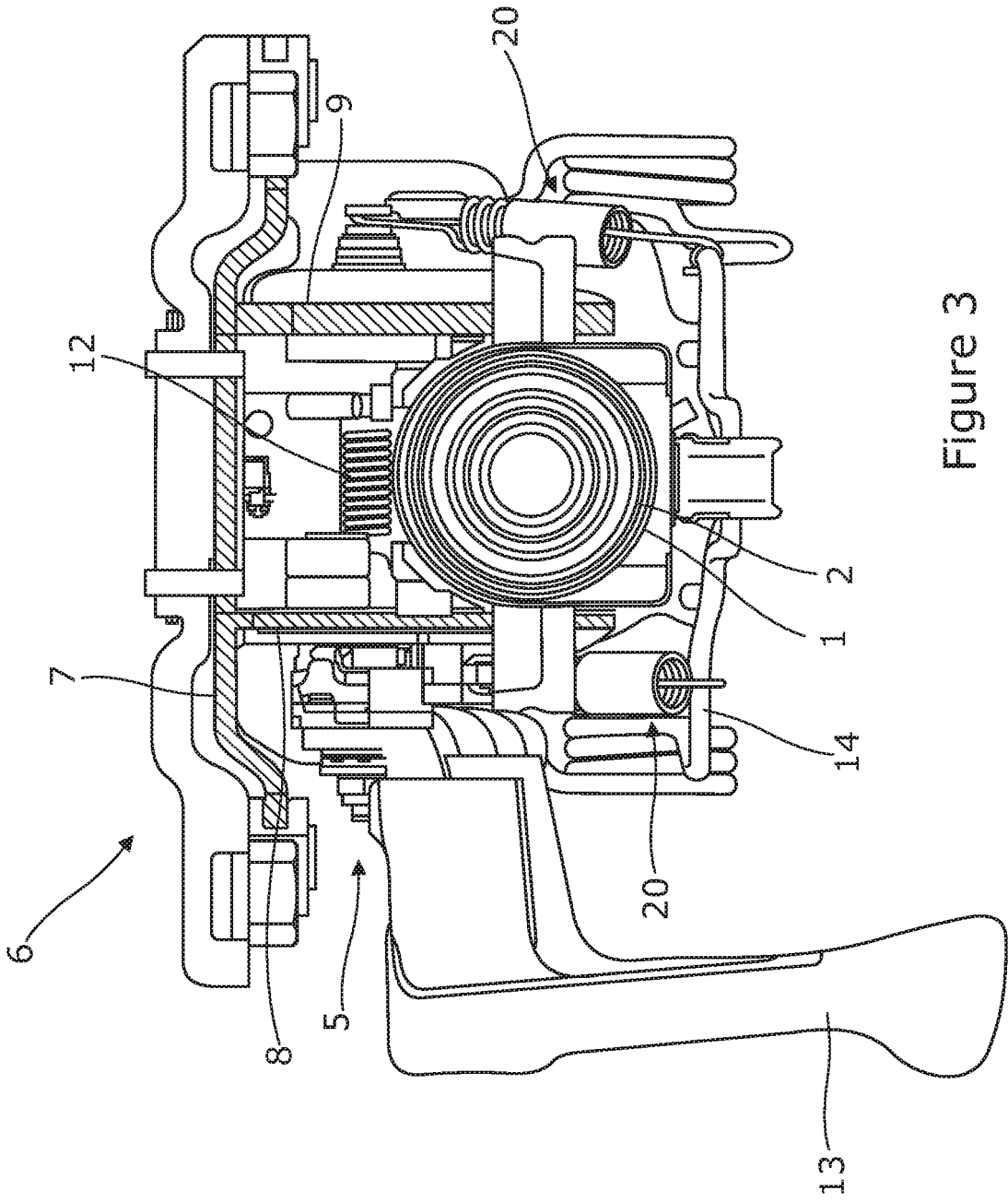


Figure 3

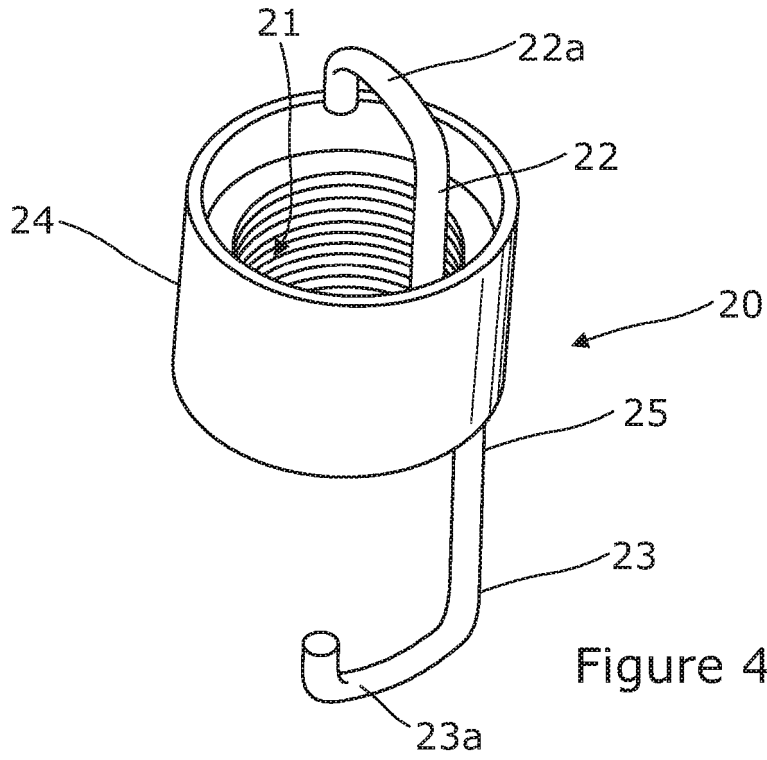


Figure 4

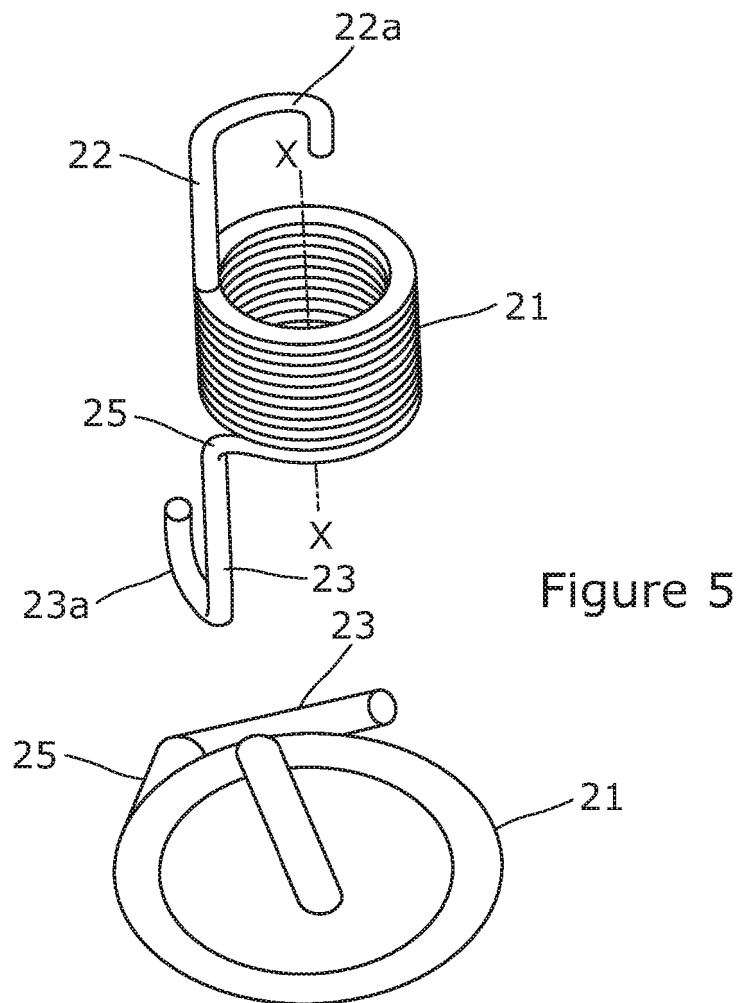


Figure 5

STEERING COLUMN ASSEMBLY

This invention relates to steering column assemblies.

5 It is known to provide a steering column assembly in which the steering shaft is adjustable for steering wheel height known as rake and for steering wheel distance known as reach. Such assemblies are known as double adjust steering columns. Single adjust columns are also known which adjust for reach or rake only, and non-adjustable steering column assemblies which are not adjustable for either reach or
10 rake.

A steering column shroud is provided that supports the steering shaft that in turn supports the steering wheel. To permit adjustment the shroud is secured to the vehicle at first point by a pivot and at a second point nearer the steering wheel by a
15 releasable clamp mechanism. When clamped the shroud, and hence shaft and wheel, are fixed in position. When released, the shroud and shaft may be pivoted upwards to provide rake adjustment. The shroud and shaft may also or alternatively be adjusted for length, typically by telescopic action, which provides for the reach adjustment. Once adjustment is complete the clamp mechanism is moved to the
20 locked, or clamped, position.

The weight of the steering wheel and shaft can be quite considerable. If the clamp mechanism is released and some additional support of the shroud/shaft/wheel is not present it could fall into a drivers lap with considerable force. The considerable
25 weight of the assembly may inconvenience the driver when raising the wheel to the required position and securing the clamp mechanism. As the driver typically needs one hand free to operate the clamp this adjustment may prove burdensome.

To solve this problem it is common to provide a spring loaded support mechanism
30 which acts between the vehicle and the shroud. The spring mechanism takes some of the weight of the shroud and shaft and wheel when the clamp assembly is

released for adjustment. This damps the fall of the assembly and assists the driver when they try to make rake adjustments by taking some of the weight.

5 An object of the present invention is to improve the prior art steering assemblies of the kind known in the prior art which include one or more springs to help support the steering column during adjustment.

10 According to a first aspect the invention provides a steering column assembly comprising a shroud, a support bracket and a clamp mechanism which releasably secures the shroud to the support bracket, and further including at least one spring assembly which connects the clamp mechanism to a different part of the steering column assembly to help support/orient the shroud when the clamp mechanism is in an unclamped condition, the spring assembly comprising a spring comprising a wound helical coil part, an upper end portion and a lower end portion, and a sleeve having open ends and which fits around the wound helical part of the spring assembly,
15 characterised in that the spring assembly further includes a support portion that is located between the wound part and the lower end portion, the support portion in use preventing unwanted movement of the sleeve downwards onto the lower end portion of the spring.
20

The applicants have appreciated in some conditions the damper of the prior art may drop down from the coil onto the lower portion of the spring, reducing partially or totally the damping effect it is intended to provide. This may happen over time as
25 the plastic material ages and relaxes and as the spring stretches. Even where the sleeve is a tight interference fit, it may surprisingly creep down from the coiled part of the spring as the spring vibrates when the vehicle is driven along rough roads or is adjusted.

30 By including a support portion to the spring between the coiled portion and the end portion the sleeve is prevented from sliding down.

In one arrangement the support portion may comprise a length of the spring which projects outwards in a direction generally radially away from the axis of the coil to join an upper part of the lower end portion.

- 5 One end of the support portion may be connected to a lower end of the coil and the other end to an uppermost end of the lower end portion.

The support portion and lower end portion may form a dog-leg shaped part of the spring. This allows the support portion to be provided without adding any
10 additional parts to the spring assembly.

The damper sleeve may comprise a plastic sleeve. Mostly preferably it may comprise tube, an inner wall of the tube optionally being an interference fit onto the coiled part of the tension spring. This helps prevent the sleeve sliding along the
15 coiled part during normal use of the steering assembly, as the vehicle is driven.

The spring may comprise a single continuous length of wire which is bent into shape during manufacture to define the end portions, support portion and coil
20 portion.

Where the spring is formed from a single length of wire, each end portion may comprise an elongate straight portion of the spring which extends generally in parallel with an axis of the spring. Each end portion may have a length of at least 10mm or 20mm, and the helical portion of the spring may have a length of at least
25 20mm or 40mm and may comprise at least five, or at least ten, full turns.

The sleeve may surround at least half of the coiled portion, or at least 75 percent, or the entire coiled portion at least when the spring is not placed in tension.

30 The steering column assembly may include two spring assemblies, each of which has the features described hereinbefore. The spring assemblies may be substantially identical, with one spring arranged on each side of the shroud.

The support bracket may have a generally inverted U-shape, with a base portion and two generally vertical arms, a part of the shroud being located in the space between the arms, each arm including a slot through which a clamp pin of the clamp assembly is passed, the clamp pin also passing through a portion of the shroud.

The shroud may include a rail on an upper part of the shroud which includes the opening through which the clamp pin passes.

10 An upper end of the spring may be secured to an end part of the clamp pin. This may be a part of the clamp assembly located outside of the arms. Where two tension springs are provided their upper end portions may be connected to respective ends of the clamp pin.

15 The steering assembly may include a support spring mechanism that supports at least part of the weight of the shroud when the clamp assembly is unclamped, the lower end of the spring assembly being connected to the support spring to help support the shroud. The support spring mechanism will therefore be the different part of the steering column assembly within the meaning of the first aspect of the invention.

The clamp mechanism may include a clamp pin, and the upper end portion may be secured to the clamp pin.

25 The sprung support mechanism may be formed from a bent metal wire or rod and include a lower support portion that passes under the shroud land which is connected to the vehicle by two sprung arms, one on each side of the shroud, the spring assembly being secured at the lower end portion at a point along one of the sprung arms.

30

The spring assembly may be in tension when in use, both when the clamp assembly is clamped and when unclamped.

The steering assembly may be adjustable for reach and also for rake, or just for reach or just for rake. To achieve this the slots in the support bracket and the slots in the shroud through which the clamp pin passes may be elongated to permit the clamp pin to move along the slots when the clamp assembly is unclamped. When clamped the clamp assembly prevents the clamp pin moving along the slot.

The shroud may comprise an inner shroud part and an outer shroud part, the two parts being able to move telescopically relative to each other during adjustment of the steering column assembly for reach.

Each end portion may be terminated with a hook which enables the spring to be secured to a respective part of the steering assembly.

There will now be described by way of example only one embodiment of the present invention with reference to and as illustrated in the accompanying drawings of which:

Figure 1 is a view of an electric power assisted steering assembly in accordance with the invention;

Figure 2 is a side view of a portion of the assembly of Figure 1 showing the location of one of the two spring assemblies;

Figure 3 is an end view of the assembly of Figure 2 showing the location of two spring assemblies;

Figure 4 is view of the complete spring assembly prior to connection to the steering assembly; and

Figure 5 is an exploded view that shows the spring and the plastic sleeve of the spring assembly of Figure 5.

A steering column assembly 100 is shown in Figures 1 and 2 of the accompanying drawings. The assembly comprises a shroud 1,2 which is fixed to the vehicle (not shown), a steering shaft 3 supported in bearings journaled to the shroud, a steering wheel (not shown) connected to one end of the shaft 3, and an electric power assisted steering gearbox 4 connected to the end of the steering shaft 3 furthest from the steering wheel. The gearbox 4 connects the shaft 3 to a motor which provides assistance when the driver tries to turn the wheel by applying a torque of the same sense as that applied by the driver. The gearbox also connects the shaft through further mechanical links such as a steering rack to the road wheels.

10

The shroud 1,2 is fixed to the vehicle at one point by a pivot (not shown) close to the gearbox and at another point closer to the steering wheel through an adjustable clamp mechanism 5 seen in Figure 2 (and removed for clarity from Figure 1). When released the clamp mechanism 5 enables the shroud 1,2 to tilt up and down about the pivot to provide rake adjustment of the steering wheel.

15

As can also be seen in Figure 1 the shroud comprises a first member 1 and a second member 2, and end of the first member 1 being received partially within an end of the second member 2 and free to telescope relative to the second member 2 when the clamp mechanism 5 is released. Both members 1,2 are generally cylindrical metal tubes. As can be seen in Figure 1 the inner diameter of the second member 2 is greater than the outer diameter of the first member 1 and so it can slide over the end of the first member 1. The steering shaft 3 is also provided in two parts which can telescope to follow changes in length of the shroud. This movement provides reach adjustment of the steering wheel.

25

The clamp mechanism 5 comprises a fixed bracket 6 which has an inverted U – shape in cross section (when viewed along the length of the shroud). The base 7 of the U shaped bracket 7 is rigidly fixed to the vehicle body above the shroud 1,2 and has two arms 8,9 that depend down either side of the shroud. The base and arms are shown using cross hatching in Figure 3. A clamp rail 10, visible in Figure 1, which is also of U-shape in cross section, comprises an aluminium casting that is secured

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to the top of the shroud, perhaps by welding, along a length of the shroud which is surrounded by the arms of the fixed bracket 7. The clamp rail 10 is a snug fit within the arms of the bracket 7 so that the side walls of the clamp rail touch the inside of the arms of the bracket 7 and prevent excessive side to side movement of the shroud relative to the bracket 7. As shown the rail 10 is fixed to the top of the second member of the shroud which has the larger diameter.

Each arm 8,9 of the bracket 7 is provided with a vertically extending elongate slot. One slot 9a in arm 9 can be seen in Figure 2. Each side wall of the clamp rail 10 is provided with a substantially horizontal slot 11 as shown in Figure 1. A clamp bolt 12 passes through the slots in the arms 8,9 and side rails and is provided with a fixed head on one end and an adjustable head on the other operated by a hand lever 13. The driver can rotate the hand lever 13 to move the adjustable head towards the fixed head. This clamps the arms of the bracket to the side walls of the clamp rail and locks the shroud in place. The driver can also move the lever 13 to expand the distance between the fixed head and adjustable head which unclamps the bracket arms and clamp rail. In this condition the clamp bolt can slide up and down the vertical rails to give rake adjustment and along the horizontal slots to give reach adjustment.

It will be appreciated that the weight of the shroud 1,2, the steering shaft 3, the wheel and the moving part of the clamp mechanism 5 is considerable. A sprung support mechanism 14 is therefore provided which is formed from a bent metal wire or rod. It has a lower support portion that passes under the shroud 1,2 and which is connected to the vehicle by two sprung arms, one on each side of the shroud. One of the arms can be seen in Figure 2. Each arm comprises a torsion coil spring with multiple turns forming a right angled connection between the lower support portion and the fixed bracket. If the clamp mechanism 5 is released with the steering wheel at its highest rake position, the sprung support mechanism 14 damps the fall of the shroud.

The steering column assembly also includes two spring assemblies 20 which assist in orienting the shroud in an unlocked condition. The spring assemblies are shown in use in Figures 2 and 3, and prior to installation in Figures 4 and 5.

5 Each spring assembly 20 comprises a single length of spring steel wire, which is bent and turned into a central helical coil portion 21 with a leg at each end forming an upper and lower end portion 22,23. Each leg is terminated with a hook 22a, 23a, and an upper leg is hooked onto the clamp assembly and a lower hook is hooked onto the support spring mechanism 14. One spring assembly is provided on the left
10 side of the bracket, as viewed looking down the shroud from the wheel, and the other on the right as a mirror image.

Under certain conditions the applicant has observed that the support spring, if unchecked, would have a tendency to vibrate as the vehicle is driven, and this
15 vibration may be transferred into the shroud causing the assembly to generate acoustic noise. To stop the helical coil spring from resonating as the vehicle is driven, and to stop the unwanted noise being generated, a plastic sleeve 24 is fitted around the helical coil 21. The sleeve 24 is a transition fit onto the coiled part 21 of the spring. The sleeve acoustically damps the spring and protects metal on metal
20 contact between the spring and other metal parts of the steering assembly or vehicle. It may also be colour coded to assist with assembly.

Each spring assembly 20 also includes a support portion 25 that is located between the lower end portion 23 and the coil 21, formed by introducing a dog-leg into the
25 wire so that a part of the wire, which forms the support portion, protrudes along a path with a radial component away from the axis (marked X-X in Figure 5) of the spring and projects beyond the outer cylindrical wall of the sleeve.

The dog-leg support portion 25 prevents the sleeve being able to slide down onto
30 the lower leg portion, keeping it in place around the helical coil.

CLAIMS

1. A steering column assembly comprising a shroud, a support bracket and a clamp mechanism which releasably secures the shroud to the support bracket, and
5 further including at least one spring assembly which connects the clamp mechanism to a different part of the steering column assembly, the spring assembly comprising a spring comprising a wound helical coil part, an upper end portion and a lower end portion, and a sleeve having open ends and which fits around the wound helical part of the spring assembly,
10 characterised in that the spring assembly further includes a support portion that is located between the wound part and the lower end portion, the support portion in use preventing unwanted movement of the sleeve downwards onto the lower end portion of the spring.
- 15 2. A steering column assembly according to claim 1 in which the support portion comprises a length of the spring which projects outwards along a path with a component that extends radially away from the axis of the wound helical part to join an upper part of the lower end portion.
- 20 3. A steering column assembly according to any preceding claim in which one end of the support portion is connected to a lower end of the coil and the other end to an uppermost end of the lower end portion.
4. A steering column assembly according to any preceding claim in which the
25 support portion and lower end portion form a dog-leg shaped part of the spring.
5. A steering column assembly according to any preceding claim in which the damper sleeve comprises a plastic tube, an inner wall of the tube being a transition or interference fit onto the coiled part of the tension spring.

6. A steering column assembly according to any preceding claim in which the spring comprises a single continuous length of wire which is bent into shape during manufacture to define the end portions, support portion and coil portion.

5 7. A steering column assembly according to claim 6 in which each end portion comprises an elongate straight portion of the spring which extends generally in parallel with an axis of the spring.

8. A steering column assembly according to any preceding claim which
10 includes two spring assemblies, each of which comprises connects the clamp assembly to a different part of the steering column assembly to help support and/or orient the shroud when the clamp assembly is in an unclamped condition.

9. A steering column assembly according to any preceding claim in which the
15 support bracket has a generally inverted U-shape, with a base portion and two generally vertical arms, a part of the shroud being located in the space between the arms, each arm including a slot through which a clamp pin of the clamp assembly is passed, the clamp pin also passing through a portion of the shroud, and in which an upper end of the spring is secured to an end part of the clamp pin.

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10. A steering column assembly according to any preceding claim in which the steering assembly includes a support spring mechanism that supports at least part of the weight of the shroud when the clamp assembly is unclamped, the lower end of the spring assembly being connected to the support spring mechanism to help
25 support the shroud.

11. A steering column assembly substantially as described herein with reference to and as illustrated in the accompanying drawings.

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Application No: GB1406491.9

Examiner: Simon Rose

Claims searched: 1-11

Date of search: 14 October 2014

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1, 5, 9-10	US 5915726 A (HIBINO et al) See particularly Figures 16-19, sleeved spring 226, supports 227, 230
X	1, 5, 9-10	JP 08295246 A (NIPPON SEIKO) See particularly Figures 1, 3-5, 9, 11 and 12, sleeved spring 26, supports 27, 30, and WPI abstract accession number 1996-436442
X	1, 5, 9-10	JP 2008265647 A (NSK) See particularly Figures 2-4, clamp 22, spring 23, damping member 24, bolt 20, and WPI abstract accession number 2008-M72668
A		US 4723461 A (YOSHIDA et al) See particularly Figures 3-5, spring 36e
A		US 4538478 A (SATO et al) See particularly Figures 2 and 10, spring 44
A		US 3504569 A (ZOLTOK) See particularly Figures 2 and 3, spring 35, cylinder 26

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X :

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Worldwide search of patent documents classified in the following areas of the IPC

B62D

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI, TXTE, TXTT



International Classification:

Subclass	Subgroup	Valid From
B62D	0001/184	01/01/2006
B62D	0001/185	01/01/2006
B62D	0001/189	01/01/2006