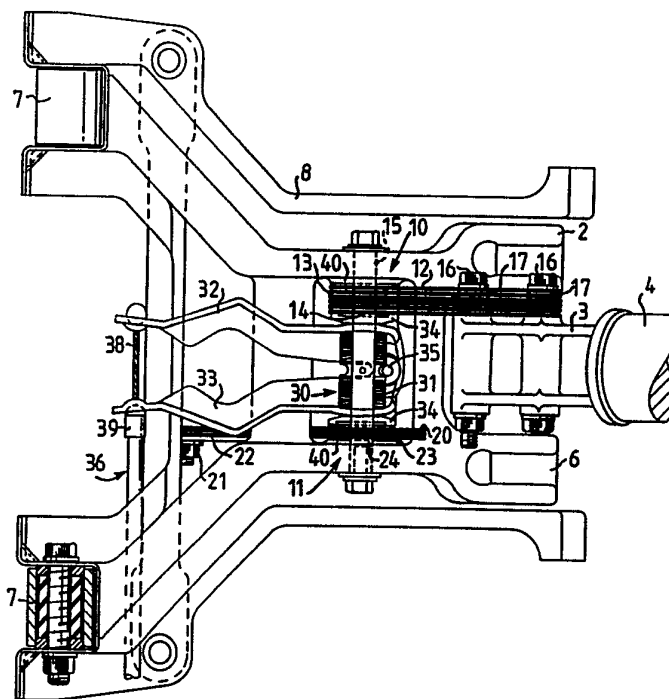




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(54) Title: ADJUSTABLE STEERING WHEEL



(57) Abstract

Adjustable steering wheel, preferably for trucks. The steering column (4) is on an upper supporting arm (3), which is pivoted in a lower supporting arm (2), which in turn is pivotally mounted to a windshield beam, for example, in the cab. The locking device in the form of a first and a second friction plate package (10, 11) with an intermediate conical spring washer package (30) locks the supporting arms relative to each other and relative to the cab. By means of a pair of levers (32, 33), a control cable (36) and a foot pedal, the spring package can be compressed to remove the locking effect of the plate packages.

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Adjustable steering wheel

The present invention relates to a steering wheel arrangement for motor vehicles, comprising a steering wheel, a steering shaft joined to the steering wheel, a bearing device in which the steering shaft is rotatably mounted, means for moveably suspending the bearing device in the vehicle and locking means, by means of which the bearing device is lockable in various positions relative to the suspension means, wherein the bearing device is joined to the suspension means for pivot movement about a first shaft, and that the lock means comprise, firstly, a first package of thin friction plates alternately joined to the bearing device and the suspension means, secondly, spring clamping means arranged to press together, with constant spring force, the thin plates in the plate package to lock the bearing device and, thirdly, manually actuated means to remove the clamping effect of the clamping means and release the bearing device for resetting relative to the suspension means.

Known arrangements of this type make it possible to adjust the vertical position of the steering wheel to adapt it to the driving position of the driver, either through a telescoping arrangement or through an arrangement with articulating means with a horizontal pivot shaft. In the latter case, the vertical adjustment also involves changing the steering wheel angle relative to the driver. Such devices also facilitate entering and exiting from the vehicle, as do arrangements which permit lateral swinging of the steering wheel.

Common to most of the various known adjustment arrangements is that they have a locking means actuated by a manual knob or lever of friction type, the locking effect of which is dependent on how hard the driver turns the

knob or pulls the lever. Since it is difficult to see to it that the lever or knob is always tightened with the same force, the locking force will in practice vary and deviations from ideal tightening, which produces a locking force which is suitably balanced for both normal loads and crash loads, are difficult to avoid.

One purpose of the present invention is to provide an adjustable steering wheel arrangement, in which the locking force is constant, so that one has full control of the locking characteristics and can achieve a suitable balance for normal loads and crash loads, which is always automatically maintained.

This is achieved according to the invention in a steering wheel arrangement of the type described by way of introduction by virtue of the fact that the suspension means comprise a first supporting arm, which is mounted in the vehicle for pivotal movement about a second shaft and in which supporting arm the bearing device is mounted for pivotal movement about said first shaft, and that friction plates alternatingly joined to the supporting arm and to a fixed portion of the vehicle form a second plate package, which, by clamping means, can be compressed to lock the supporting arm relative to the vehicle.

By using thin friction plates it is possible to adapt the material and the size of the frictional surface to the requirements in order to achieve the desired lock in force, using a spring device, the spring force of which can be overcome without power assistance. For example, a simple foot pedal or wire arrangement in combination with a lever device can be sufficient to suspend the locking force.

In a further development of the invention for the purpose of achieving a particularly ergonomically advantageous adjustment range and a simple and secure installation in

combination with a simple and secure locking mechanism,
the suspension device comprises a first supporting arm
pivotally mounted in the vehicle and that thin friction
plates alternately joined to the supporting arm and to a
5 fixed portion of the vehicle form a second plate package
which, by clamping means, can be compressed to lock the
supporting arm relative to the vehicle with the aid of
spring clamping means coordinated with the first plate
package in connection with the bearing device being locked
10 relative to the supporting arm.

The invention will be described in more detail below with
reference to examples shown in the accompanying drawings,
where
15 Figure 1 shows a side view of one embodiment of the steer-
ing wheel arrangement according to the invention;
Figure 2 is a view from above of the arrangement in
Figure 1; and
Figures 3 and 4 are perspective views of the arrangement
20 in Figures 1 and 2 with certain parts removed.

The steering wheel arrangement according to the invention
has two main components which determine the movement geo-
metry when resetting the steering wheel 1, namely a lower
25 supporting arm 2 and an upper supporting arm 3 (see espe-
cially Figure 3). The supporting arm 3 is integrated with
a steering column 4 containing bearings for a steering
shaft (not shown) joined to the steering wheel 1. In
Figure 3, the numeral 5 designates a universal joint
30 securely joined to the steering shaft. The upper support-
ing arm 3 is pivoted in the lower supporting arm 2 in a
bearing 6, which has a horizontal pivot axis "a" which
passes through or in the immediate vicinity of the knuckle
cross centre of the universal joint 5. The lower support-
35 ing arm 2 is pivotally journalled via bearings 7 in a
bracket 8 solidly joined to the vehicle for pivot movement
about a horizontal pivot axis "b". The bracket 8 can be
mounted directly in a pedal plate or a supporting portion
of the vehicle cab, e.g. a windshield beam.

The arrangement shown makes possible the pattern of movement shown with the arrows in Figure 3. The supporting arms 2 and 3 can be swung in the same or different directions from an intermediate "normal position". When being swung in the same direction, e.g. counterclockwise, the steering wheel is moved upwards and forwards and thereby leaves a larger free space for getting in and out of the vehicle. When swinging in different directions, it is possible to readjust the steering wheel, i.e. a parallel displacement of the steering wheel without changing the angle, a movement essentially corresponding to that obtained with a telescoping arrangement.

The arrangement according to the invention has a first package 10 of thin plates for locking the supporting arms 2 and 3 relative to each other and a second package 11 of thin plates for locking the lower supporting arm relative to the bracket 8. The plate package 10 consists of a set of oblong friction plates 12 which are solidly joined to the upper supporting arm 3 and a set of intermediate circular friction washers 13 which have a central hole 14, through which there extends a shaft 15 securely screwed to the lower supporting arm 2. There is a small play between the hole 14 and the shaft 15 so that the washer 13 are easily displaceable axially on the shaft 15. The thin friction plates 12 are securely screwed to the upper supporting arm with the aid of two screws 16 and intermediate spacer washers 17 and are provided with a circle-arcuate curved oblong opening 18, the centre of curvature of which coincides with the pivot axis "a". The width of the opening 18 is adapted to the diameter of the shaft 15, which extends through all of the plates 12, 13.

The second package 11 of thin plates is, in a corresponding manner, made up of a set of oblong plates 20 screwed with screws 21 securely at one end to the bracket 8 with intermediate spacer washers 22 and a set of intermediate

circular friction washers 23 with a central hole 24, through which the shaft 15 extends. The shaft 15 extends also through an arcuate oblong opening 25, the centre of curvature of which coincides with the pivot axis "b".

5

Between the packages of thin plates 10, 11, there is a spring device 30 in the form of a plurality of spring washers 31 slipped onto the shaft 15 and thus forming a spring package. Between the outer spring washer and the
10 respective plate package 10 or 11 there is a lever 32 or 33, respectively, and a pressure washer 34, through which the shaft 15 extends.

The levers 32 and 33 are pivotally joined to each other by
15 means of a pivot pin 35. A control cable 36 from an actuating pedal 37 has its wire 38 joined to the opposite end of one of the levers 32 and its casing 39 abutting against the opposite end of the other lever 33. When the pedal 37 is depressed, the levers 32 and 33 are moved
20 towards each other and thus compress the spring package 30.

In the unloaded state, i.e. when the pedal is not depressed, the spring package 30 presses against the two
25 pressure washers 34 which simultaneously compress the plate packages 10, 11 between themselves and the abutments 40 on the lower supporting arm 2. The steering wheel is thus fixed in its set position. When the pedal 37 is depressed, thus moving the levers towards each other via the cable 36, the clamping force is suspended on the plate
30 packages 10, 11, and the supporting arms 2, 3 can be swung in the suitable direction to set the steering wheel in the desired position. As soon as the pedal is released, the supporting arms will be locked as the plate packages are again compressed.

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In a modified embodiment (not shown here) there is used, instead of the "pliers" shown here, a single lever which is spring loaded and actuates a pair of pressure pistons

corresponding to the pressure washers 34, in such a way that the pressure pistons compress the plate packages by the action of the lever and the spring means acting thereon. By using one spring loaded lever, it is possible to multiply the spring force up to 20 times, making it possible to use a relatively weak spring ($F=L70W$), and this in turn results in low pedal forces. If one also allows the lever to pivot about a pin on the shaft 15 and if one loads one of the pressure pistons by means of a spring washer, the locking function can be divided in two steps. When the pedal is depressed half-way, the pressure piston which is not loaded by a spring washer is released first. As the pedal is depressed to the bottom, the other pressure piston is also released, so that both angular and vertical adjustment can be made.

By using other spring means, e.g. a gas spring (not shown), between the points 50 and 51 (Figure 1) on the upper supporting arm 3 and the bracket 8, respectively, it is possible to achieve an automatic swinging of the steering wheel to a forward/raised position to facilitate getting in and out of the vehicle. Such an arrangement is particularly suited to truck cabs.

As an alternative to the pedal and wire arrangement 36, 37 for suspending the clamping force on the plate packages 10, 11, pneumatic or hydraulic means can be used which can be electrically controlled. They can be actuated by a switch on the instrument panel, the steering column or on the steering wheel.

In the embodiment shown and described here, the locking functions of the two plate packages are suspended simultaneously. It is, however, conceivable to have a control arrangement which gives priority to one of the functions, so that a certain depression of the foot pedal releases the lock between the supporting arms and only an additional depression of the pedal suspends the lock between the lower supporting arm and the cab.

CLAIMS

1. Steering wheel arrangement for motor vehicles comprising a steering wheel, a steering shaft joined to the steering wheel, a bearing device in which the steering shaft is rotatably mounted, means for moveably suspending the bearing device in the vehicle and locking means, by means of which the bearing device is lockable in various positions relative to the suspension means, wherein the bearing device (4) is joined to the suspension means (2, 3) for pivot movement about a first shaft (a), and that the lock means comprise, firstly, a first package (10) of thin friction plates (12, 13) alternately joined to the bearing device and the suspension means, secondly, spring clamping means (30) arranged to press together, with constant spring force, the thin plates in the plate package to lock the bearing device and, thirdly, manually actuated means (32, 33, 36, 37) to remove the clamping effect of the clamping means and release the bearing device for resetting relative to the suspension means, characterized in that the suspension means comprise a first supporting arm (2), which is mounted in the vehicle for pivotal movement about a second shaft (b) and in which supporting arm (2) the bearing device is mounted for pivotal movement about said first shaft (a), and that friction plates (20, 23) alternately joined to the supporting arm and to a fixed portion (8) of the vehicle form a second plate package (11), which, by clamping means, can be compressed to lock the supporting arm relative to the vehicle.
2. Steering wheel arrangement according to Claim 1, characterized in that the first and second plate packages (10, 11) are coordinated with a common clamping device (30).

3. Steering wheel arrangement according to Claim 2,
c h a r a c t e r i z e d in that the plate package (10,
11) has thin plates (13, 23) displaceable in the axial
direction on a common shaft (15), that spring means (30)
5 arranged on the shaft between the plate packages act in
opposite directions to clamp between themselves and co-
operating in abutments (40) the plates (12, 13, 20, 23) in
the respective packages, and that a manually actuated
device (32, 33) acts between opposite ends of the spring
10 means to counteract the spring force and remove the clamp-
ing force.

4. Steering wheel arrangement according to Claim 3,
c h a r a c t e r i z e d in that the shaft (15) carrying
15 the plates is solidly joined to a first supporting arm (2)
pivotable about a horizontal axis (b), that the bearing
device (4) is mounted on a second support arm (3), which
is pivotable about a horizontal axis (a) at one end of the
first supporting arm, and that the steering wheel shaft
20 has a universal joint (5), the pivot centre of which lies
on or in the vicinity of the horizontal pivot axis of the
second supporting arm.

5. Steering wheel arrangement according to Claim 3 or 4,
25 c h a r a c t e r i z e d in that the spring means (30)
are arranged between a pair of levers (32, 33) pivotally
joined to each other at one end, and that force actuated
means (36, 37) are provided, by means of which the
opposite ends of the levers can be moved towards each
30 other to compress the spring means.

6. Steering wheel arrangement according to one of
Claims 3-5, c h a r a c t e r i z e d in that the
spring means (30) are a package of spring washers.
35

7. Steering wheel arrangement according to one of
Claims 3-6, c h a r a c t e r i z e d in that each

package (10, 11) of plates has a first set of plates (13, 23) in the form of friction washers with circular holes (14, 24) adapted to the diameter of the shaft (15) carrying the plates, and a second set of plates (12, 20) in the form of oblong, plate elements with elongated circle-arcuate curved holes (18, 25), the width of which corresponds to the diameter of the shaft carrying the plates and the centre curvature of which lies on the associated pivot axis (a, b).

10

8. Steering wheel arrangement according to one of Claims 1-7, characterized in that spring means tensioned between anchor points (50, 51) on the bearing device and a fixed portion of the vehicle load the bearing device in one pivot direction in order to swing the bearing device (4) to one end position when the clamping effect of the clamping means (30) is removed.

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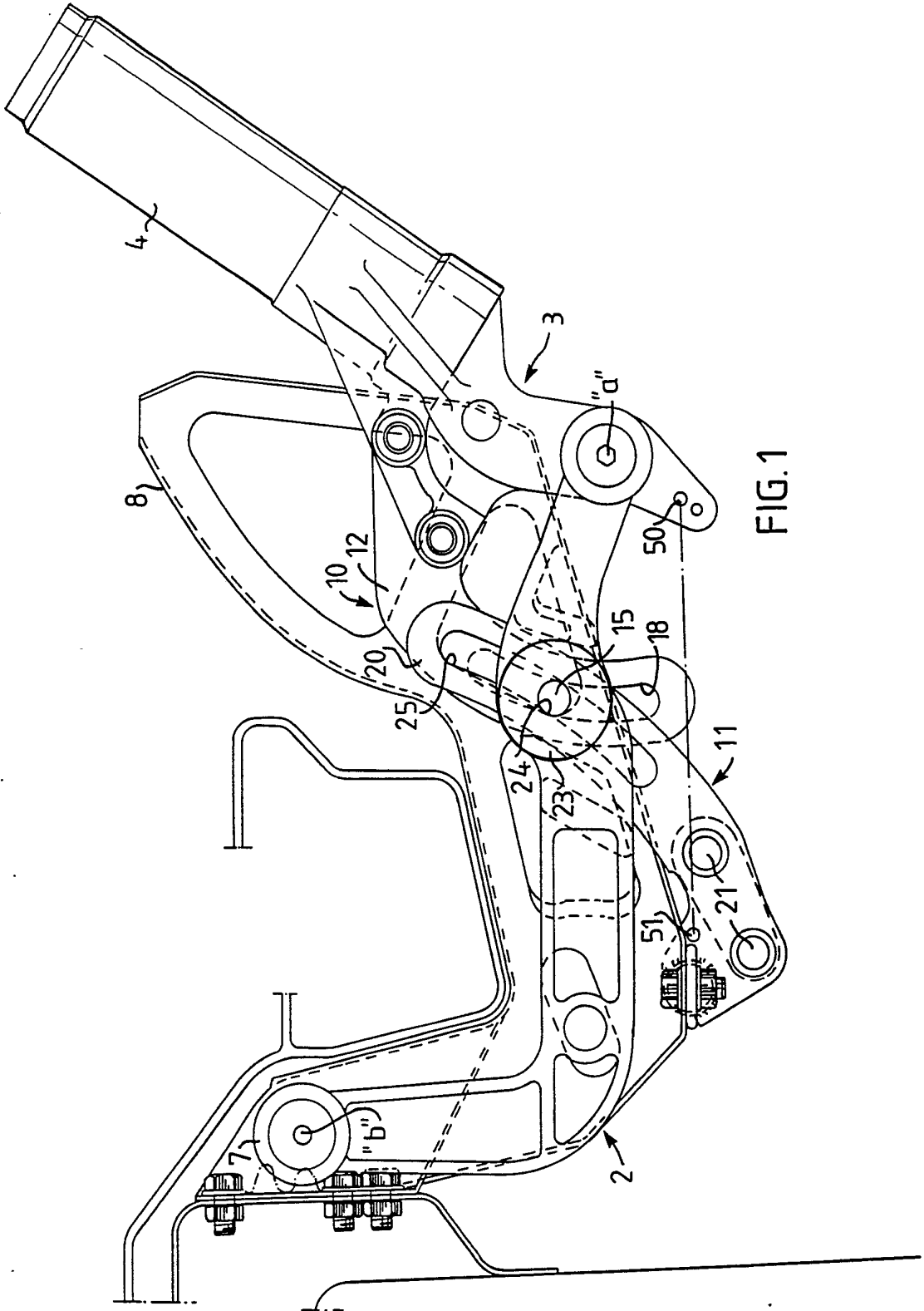


FIG. 1

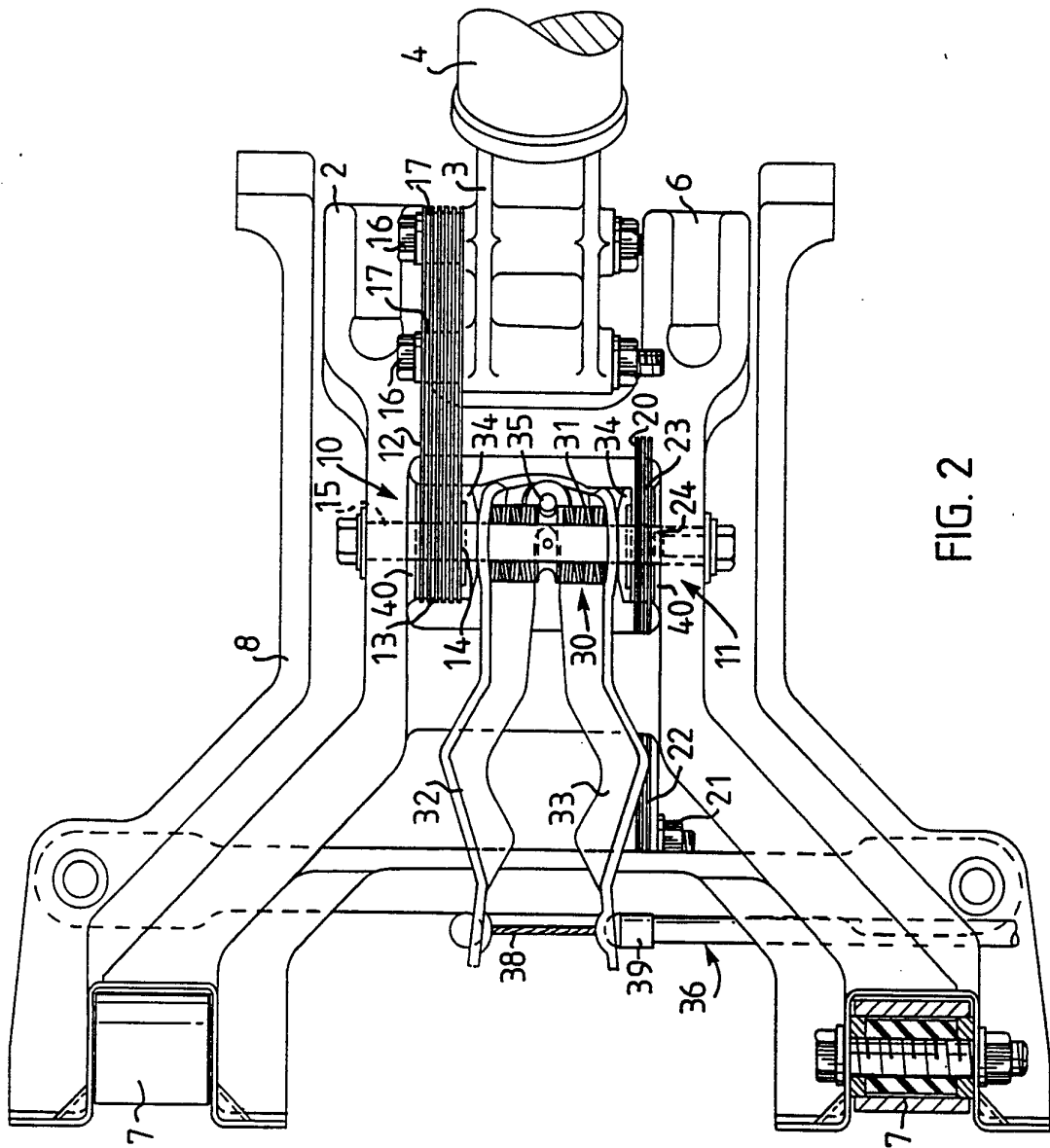


FIG. 2

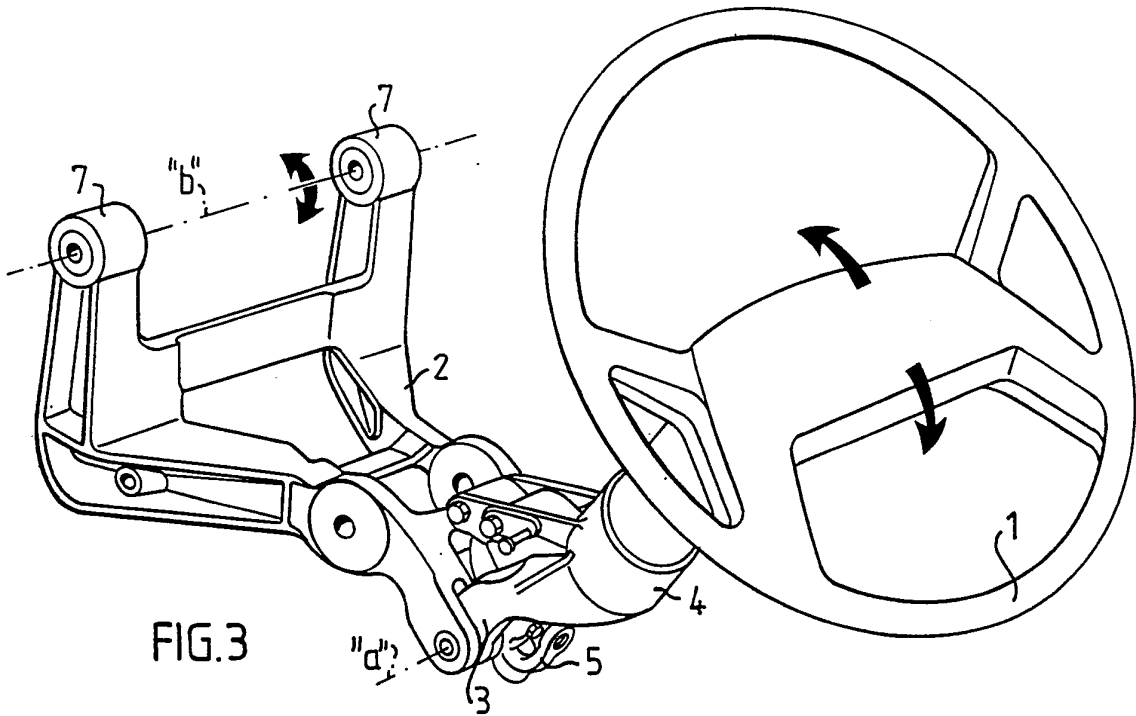


FIG. 3

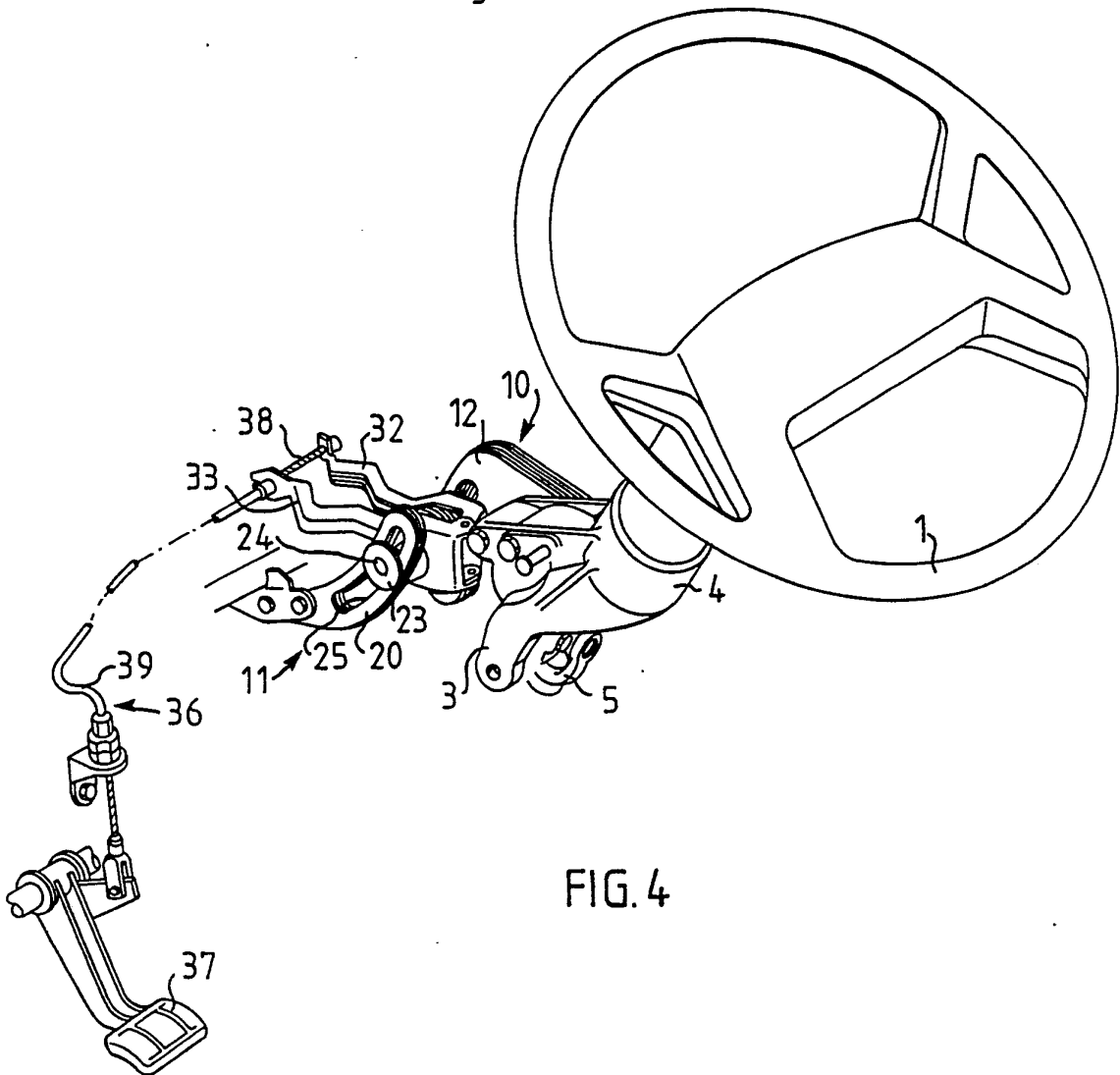
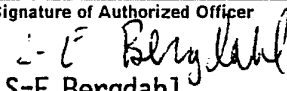


FIG. 4

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 90/00706

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶				
According to International Patent Classification (IPC) or to both National Classification and IPC				
IPC5: B 62 D 1/18				
II. FIELDS SEARCHED				
Minimum Documentation Searched ⁷				
Classification System	Classification Symbols			
IPC5	B 62 D			
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched ⁸				
SE,DK,FI,NO classes as above				
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹				
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³		
A	Patent Abstracts of Japan, Vol 9, No 286, M429, abstract of JP 60-128076, publ 1985-07-08 (KANTOU JIDOUSHIYA KOGYO K.K.)j --	1-8		
A	GB, A, 2092967 (FORD MOTOR COMPANY) 25 August 1982, see the whole document --	1-8		
A	DE, A1, 3510311 (KLÖCKNER -HUMBOLDT-DEUTZ AG) 25 September 1986, see the whole document -- -----	1-8		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>* Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="width: 50%; vertical-align: top;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </td> </tr> </table>			<p>* Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>
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IV. CERTIFICATION				
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report			
24th January 1991	1991 -01- 29			
International Searching Authority	Signature of Authorized Officer			
SWEDISH PATENT OFFICE	 S-E Bergdahl			

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 90/00706**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on **90-12-28**
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 2092967	82-08-25	EP-A-B- 0058495	82-08-25
		US-A- 4507982	85-04-02

DE-A1- 3510311	86-09-25	DE-A- 3660535	88-09-22
		EP-A-B- 0199106	86-10-29
		US-A- 4656888	87-04-14