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(54) Title: GEAR CHANGE CONTROL DEVICE FOR VEHICLE

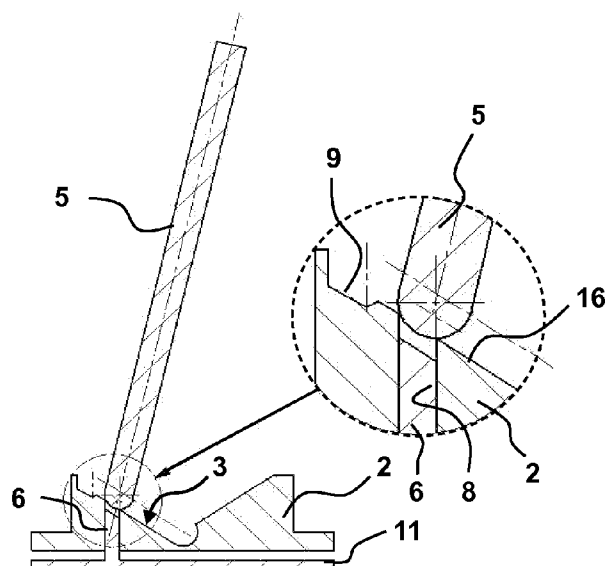


Fig 7a

(57) Abstract: The invention relates to a gear change control device(1) for a vehicle, comprising a spring-loaded gearshift(5) which runs in guide grooves (3) which are provided in a bottom plate (2) and define the gear change pattern and gear change resistance of the gearshift(5) when the driver moves the gear lever between different gear positions (9). The invention is achieved by at least one pin (6) being arranged to be movable in a recess or channel(8) in the bottom plate (2), by the pin (6) being arranged to be movable between different positions, from at least an inactive state to an active state, by the pin (6) being lockable/blockable in the active state and/or the inactive state, and by the pin (6) in one state being adapted to allowing engagement of a certain gear position(9) or preventing disengagement from a certain gear position(9).

GEARCHANGE CONTROL DEVICE FOR VEHICLE**TECHNICAL FIELD**

5

The present invention relates generally to gear change control devices intended for vehicles. The invention relates particularly to a gear change control device with a manual gear lever which has no mechanical connection to the vehicle's gearbox and which therefore controls the transmission by means of electrical signals. The invention relates also to a gear change control device whereby the gear lever gives the driver mechanical feedback so that the gear change control device behaves like a manual gear change control device.

15

STATE OF THE ART

Conventional manual gear change control devices involve the driver changing gear in the vehicle's transmission by means of a gear lever connected mechanically to one or more link rods which are connected to the gearbox and the transmission of the vehicle. However, it is becoming increasingly common for such mechanical gear change systems to be replaced by electric gear change systems whereby electrical signals control which gear is engaged. If the gear change movements are not transmitted directly via mechanical link rods but by electrical signals, the mechanical feedback to the driver is lost in that there is no mechanical sensation that a gear has actually been engaged. It thus becomes more difficult for the driver to know for example when to release the clutch in the vehicle. Most commonly these gear change control devices are therefore used in conjunction with automatic or semiautomatic gear change systems which have no clutch pedal.

35

An effect and disadvantage of such electric gear change systems is that they make it more difficult for the driver, without looking at the gear lever, to know which gear is being engaged. If it is desired to achieve a manual gear change system controlled via electrical signals with no physical mechanical contact between gearbox and gear lever in cases where it is desired that the gear lever should behave as in a manual gearbox, it is therefore necessary to provide mechanical feedback in the gear change control device. The primary purpose of such feedback is to provide the driver with tactile sensation as if the gear lever was actually in mechanical contact with the gearbox. The driver needs to "feel" that a gear has been engaged, so that he/she can know when it is possible to release the clutch pedal. A further problem pertains to the gearshift being moved in an incorrect direction and/or an incorrect gear position being engaged.

Certain gear change control device configurations use two relatively large and powerful actuators such as electromagnets, solenoids or the like in order inter alia to provide this feedback. Such a gear change control device will be expensive and also occupy a large amount of space, making it heavy, bulky and difficult to accommodate adjacent to, for example, a driving seat. Adopting pneumatic actuators also entails installing air pipes to the gear change control device from the gearbox. A solenoid valve is sometimes used to control the air supply to the actuator in the control device. Such solutions tend to make the gear change control device bulky, and a pneumatic solution also results in slower response in the gear change system. Pneumatic systems also usually cause disturbing noise which adversely affects driver comfort in the vehicle.

Attempts have previously been made to provide the driver with mechanical feedback in electric gear change systems.

Patent specification **US20080072698** refers for example to a
5 gear change control device for an automatic gearbox which provides the driver with mechanical feedback and is also intended to prevent engagement of incorrect gear positions. This is achieved by means of hollows or guide grooves in a plate which prevent the driver from moving the gear change
10 control device in an incorrect direction. However, this configuration will be relatively bulky and therefore difficult to accommodate in a vehicle with a high packing density.

Patent specification **US5852953** refers to another solution for
15 achieving a gear change control device which provides the driver with feedback during gear change operations. This gear change device is likewise primarily intended for a vehicle provided with an automatic gearbox and comprises a gear change lever which has its lower portion configured to follow a
20 groove. The configuration reads the current position of the gearshift contactlessly, to minimise the number of components, and controls the vehicle's transmission by means of electrical signals, with no mechanical connection between gearbox and gear change device.

25 Known gear change systems which are based on the gearbox being controlled by electrical signals but nevertheless provide the driver with mechanical feedback are thus not configured in a way which is simple, involves effective use of space and is
30 cost-effective to combine an electric gear change mechanism with the possibility of preventing engagement of certain gear positions or of making it impossible to engage certain gear positions unless predetermined conditions are fulfilled.

SUMMARY OF THE INVENTION

An object of the invention is to solve the problem indicated
5 above and propose for electric control of a vehicle's gearbox
a gear change control device which is simple, cost-effective,
compact, easily accommodated and of light weight and which can
prevent/block engagement or disengagement of individual gear
10 positions when certain predetermined conditions for the
relevant gear position are not fulfilled.

A further object of the invention is to provide the driver
with mechanical feedback on the current position of the
gearshift.

15 A further object of the invention is that engagement or
disengagement of individual gear positions should be
preventable/blockable if the driver has not disengaged the
clutch, if the engine speed is not correct etc.

20 A further object of the invention is that it should be
possible for blocking and/or locking of certain gear positions
to be by means of movable obstructions.

25 A further object of the invention is that it should be
possible for all of the movable obstructions to be operated at
the same time.

These and further objects and advantages are achieved
30 according to the invention by a gear change device configured
in accordance with the features indicated in the
characterising part of claim 1.

The invention relates to a gear change system or gear change control device for a vehicle, comprising inter alia a bottom plate provided with recesses in the form of tracks or guide grooves. The gear change control device further comprises a
5 spring-loaded gear lever, or gearshift, which has its lower portion running in the bottom plate's guide grooves. The guide grooves define the pattern according to which the gear lever or the gearshift is movable, and they also provide resistance which the driver feels in the gear lever when the
10 gearshift is moved between different gear positions.

To make it possible to block certain gear positions or to lock the gearshift in a certain adopted gear position, the invention involves the provision of one or more vertical
15 channels which lead into the bottom plate's various guide grooves at or near to the various possible gear positions, in which channels obstructions in the form of pins or pegs can be moved up or down. A plurality of pins may also be provided in, integrated with, a pin plate situated under the bottom
20 plate of the gear change control device in such a way that the pin plate can move relative to the bottom plate, preferably in vertical directions, i.e. up towards or down away from the bottom plate. The pins are movable and can be moved up and down in the channels of the bottom plate. The pin plate is
25 kept in an unlocked inactive state, e.g. by springs, and in a locked/blocked state by means of a locking device or locking mechanism arranged to move and firmly lock the pin plate in a locked state by abutment against the underside of the bottom plate so that the gearshift which runs in the guide grooves is
30 blocked from being moved into or out of a gear position.

The locking mechanism thus locks the pin plate to the bottom plate, e.g. by means of an eccentric spindle or the like situated under the pin plate, while the springs only press the

pin plate against the bottom plate, on its underside. The locking mechanism may be operated, e.g. be turned/rotated, via a small actuator which is controlled electrically by the control unit of the gearbox. The gearshift is thus blocked
5 from being moved in the bottom plate's guide grooves into or out of a gear position when the pin plate and the pins are locked in their active upper position.

The primary advantages of the gear change control device
10 according to the invention are that it is of simple, robust, compact and cost-effective construction with few movable parts. The gear change control device will thus be inexpensive, occupy little space, be of low weight and be easy to accommodate in the vehicle. Despite this, the gear change
15 control device according to the invention can generate the two most important haptic functions for a manual gear lever, i.e. blocking or presenting resistance to movement of the gear lever if the system does not fulfil correct requirements for allowing engagement or disengagement of a gear position.

20 In the locked state of the pin plate, all the forces will be absorbed by the locking mechanism and not by the actuator. The configuration with obstructive pins is usable for all gear positions and only one actuator is needed to block all of
25 them.

Further features and advantages of the invention are indicated by the more detailed description of it set out below and the attached drawings and other claims.

30

BRIEF LIST OF DRAWINGS

The invention is described in more detail below in the form of preferred embodiment examples with reference to the attached drawings.

5 **Figure 1** depicts in a view obliquely from above an electric gear change control device according to the invention, with one wall of the surrounding housing omitted.

Figure 2 depicts in more detail the gear change control device
10 according to Figure 1 with no surrounding walls, with an actuator associated with the bottom plate.

Figure 3 depicts the gear change control device according to Figure 2 but in a view from the other side in which a locking
15 means is visible.

Figure 4 depicts an enlargement of, inter alia, the locking means in the form of a spindle with locking protrusions
according to Figure 3.

20 **Figure 5** depicts part of the gear change control device as seen from one end, showing one of the springs which continuously press the pin plate against the bottom plate.

25 **Figure 6** depicts in a view from above the bottom plate of the gear change control device.

Figure 7 depicts a section through part of the gear change control device.

30 **Figure 8** depicts in a view obliquely from above the pin plate only.

Figure 9 depicts the pin plate as seen from one end.

Figure 10 depicts the pin plate as seen from the side.

Figures 11a-c depict alternative embodiments of the spindle of
5 the locking mechanism.

DESCRIPTION OF PREFERRED EMBODIMENTS

10 **Figure 1** depicts the invention, which relates to a gear change system or gear change control device 1, for electrical control of the transmission in a vehicle, comprising inter alia a bottom plate 2 provided with recesses in the form of tracks or guide grooves 3 and disposed in a housing 4. The gear change
15 control device 1 comprises also a spring-loaded gear lever or gearshift 5 which runs in the bottom plate's guide grooves 3, and pins 6 which are adapted to being movable, raisable and lowerable, in recesses or channels 8 which are provided in the bottom plate 2 and which lead out into the guide grooves 3 at
20 or near to the various possible gear positions 9 of the gear change control device 1.

The diagram shows the gear change control device 1 with one of its wall portions 10 omitted. A spring-loaded lower portion
25 (not described in more detail) of the gear lever or gearshift 5 of the gear change control device runs in the tracks or guide grooves 3 provided in the bottom plate 2 situated in the lower portion of housing 4. The guide grooves 3 define a pattern according to which the gearshift 5 can be moved, and
30 also provide resistance which the driver feels when the gear lever/ gearshift 5 is moved between different gear positions 9.

Figure 2 depicts in more detail a gear change control device 1 according to the invention as in Figure 1 but with no surrounding wall portions. A pin plate 11 movable in height directions is provided under the bottom plate 2. The movements of the pin plate 11 are controlled by an actuator 12 situated at one end of the bottom plate 2. The actuator 12 may take the form of an electromagnet/solenoid, a stepping motor, an electric motor, a pneumatic unit or the like (not depicted).

Figure 3 depicts the gear change control device 1 as in Figure 2 but from a different direction, showing a locking means 13. The locking means 13 here takes the form of a spindle with protrusions 14 and can lock/block the pin plate 11 in an upper position when the spindle is turned so that part of it presses against the pin plate 11. The pin plate 11 is thus locked against the underside of the bottom plate 2 and is blocked in that position. When the pin plate 11 is not locked, i.e. when the locking means 13 is turned to a position in which the spindle's protrusions 14 are no longer directed towards the bottom plate 2, the pin plate 11 can move in a vertical direction and be pressed downwards by the gearshift 5 against the action of one or more springs 15.

Figure 4 depicts the locking means 13 in more detail, as seen from one end of the bottom plate 2. It illustrates more clearly that the locking means 13 is provided with semicircular protrusions 14. The protrusions 14 do not extend all the way round the locking means 13. The result is that the pin plate 11 is movable when the side of the locking means 13 which has no protrusions 14 is facing towards the pin plate 11.

Figure 5 depicts part of the gear change control device 1 in plan view directly from one end, showing one of the, for example, four springs 15 which continuously endeavour to press or push the pin plate 11 against the underside of the bottom plate 2. The locking means 13 is here turned so that its protrusions 14 lock/block the pin plate 11 in the position in which it is brought together with the bottom plate 2.

Figure 6 depicts in a view from above the bottom plate 2 of the gear change control device 1. It shows part of the gearshift 5 and also the guide grooves 3 of the bottom plate 2, the locking means 13, the upper end portions of the pins 6, and the actuator 12 for turning the locking means 13.

Figure 7 depicts from the side a section through the gear change control device 1. The channels 8 extend from the lower surface to the upper portion of the bottom plate 2 and preferably lead out in the bottom surface 16 of one or more of the various guide grooves 3 of the bottom plate 2, preferably in the vicinity of respective gear positions 9. The pins 6 protrude above the bottom surface 16 of the guide grooves 3 and are therefore able to lock/block the gearshift 5 in a certain gear position 9. To this end, the actuator 12 (not depicted) is adapted to pushing the pin plate 11 up towards the bottom plate 2 and locking/blocking it in that position.

Figure 8 depicts in a view obliquely from above the pin plate 11 only. The pin plate may with advantage be made of metal or some other tolerant material suitable for the purpose, e.g. a plastic such as POM. Five pins 6 protrude in this case substantially perpendicularly from the pin plate 11 and preferably point upwards, in such a way that in a fitted state they can run movably in channels 8 in the bottom plate 2 (not depicted).

Figure 9 depicts the pin plate 11 from one end, showing three out of the five different pins 6 of the pin plate 11. Each pin 6 is provided at the top end with a concave hollow 17 and with chamfered edges 18 to make it easier for the gearshift 5 to push the pins 6 down and move past.

Figure 10 is a side view of the pin plate 11 showing more clearly the chamfered upper edges 18 of the pins 6 in the direction in which the gearshift 5 can be moved. The upper end portions of the pins 6 may also be gently rounded (not depicted) to make it possible for the gearshift 5 to push down and pass the pins 6 in their unlocked state.

Figures 11a-c depict alternative embodiments of the spindle in the locking means 13. The various embodiments are depicted partly in oblique side view and partly from one end, in the form of a front surface. The locking means 13 may therefore be of elliptical shape in cross-section (Figure 11a) or be configured with an eccentric portion 18 (Figure 11b) or be provided with protrusions 14 of half-moon or semicircular shape (Figure 11c) or be provided with protrusions of some other shape and be accommodated in some other way (not depicted).

The above description is primary intended to facilitate comprehension of the invention. Accordingly, the invention is of course not confined merely to the embodiments indicated, since other variants of it are also possible and conceivable within the scope of the inventive concept and the protective scope of the claims set out below. Thus it is possible that one and the same pin plate may both block the gearshift in a certain gear position and allow the gearshift to reach a certain gear position or prevent the gearshift from reaching a

certain gear position. In such cases the pin plate may be put into more than two different height positions and the locking mechanism might lock the pin plate in any of various different height positions. The invention may also be supplemented by a
5 further actuator to provide vibrations in the gear lever with the object of increasing the tactile sensation in certain situations.

Claims

1. A gear change control device (1) for a vehicle, comprising a spring-loaded gearshift (5) which runs in guide grooves (3) which are provided in a bottom plate (2) and which define the gear change pattern and gear change resistance of the gearshift (5) when the driver moves the gear lever between different gear positions (9),

characterised

- in that at least one pin (6) is integrated with a pin plate (11) and is arranged to be movable in a channel (8) in the bottom plate (2),
- that the pin plate (11) can be kept in at least two different positions,
- that the pin plate (11) in a locked state is adapted to preventing disengagement from a certain gear position (9),
- that the pin plate (11) in an unlocked state allows disengagement from a certain gear position (9).

2. A gear change control device (1) according to claim 1,

characterised

- in that a plurality of pins (6) are integrated with the pin plate (11) and are arranged to be movable in a plurality of channels (8) in the bottom plate (2).

25

3. A gear change control device (1) according to claim 1 or 2,

characterised

- in that the pin plate (11) is arranged to be movable relative to the bottom plate (2).

30

4. A gear change control device (1) according to any one of the foregoing claims,

characterised

- in that the pin plate (11) is situated below the bottom plate (2).

5 5. A gear change control device (1) according to any one of the foregoing claims,

characterised

- that the pin plate (11) is arranged to be movable in vertical directions relative to the bottom plate (2).

10 6. A gear change control device (1) according to any one of the foregoing claims,

characterised

- in that the pin plate (11) in the unlocked state is adapted to being pressed against the bottom plate (2) by one or more
15 springs (15).

7. A gear change control device (1) according to any one of the foregoing claims,

characterised

20 - in that a locking means (13) is provided to lock the pin plate (11) against the bottom plate (2) in the locked state.

8. A gear change control device (1) according to claim 7,

characterised

25 - in that the locking means (13) takes the form of a spindle with elliptical cross-section.

9. A gear change control device (1) according to claim 7,

characterised

30 - in that the locking means (13) takes the form of a spindle with an eccentric portion (18).

10. A gear change control device (1) according to claim 7,

characterised

- in that the locking means (13) takes the form of a spindle provided with at least one semicircular protrusion (14).

11. A gear change control device (1) according to any one of
5 claims 7-10,

characterised

- in that an actuator (12) is provided to guide the locking means (13) between the locked state and the unlocked state.

10 12. A gear change control device (1) according to claim 11,
characterised

- in that the actuator (12) takes the form of an electromagnet/solenoid.

15 13. A gear change control device (1) according to claim 11
characterised

- in that the actuator (12) takes the form of a stepping motor.

20 14. A gear change control device (1) according to claim 11,
characterised

- in that the actuator (12) takes the form of an electric motor.

25 15. A gear change control device (1) according to any one of
claims 11-14,

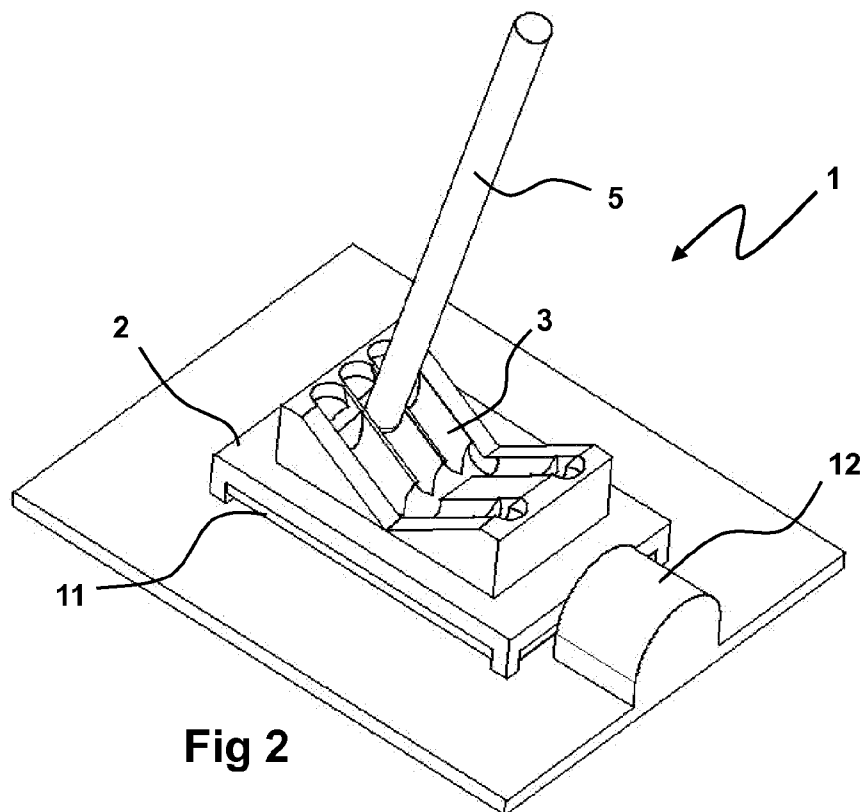
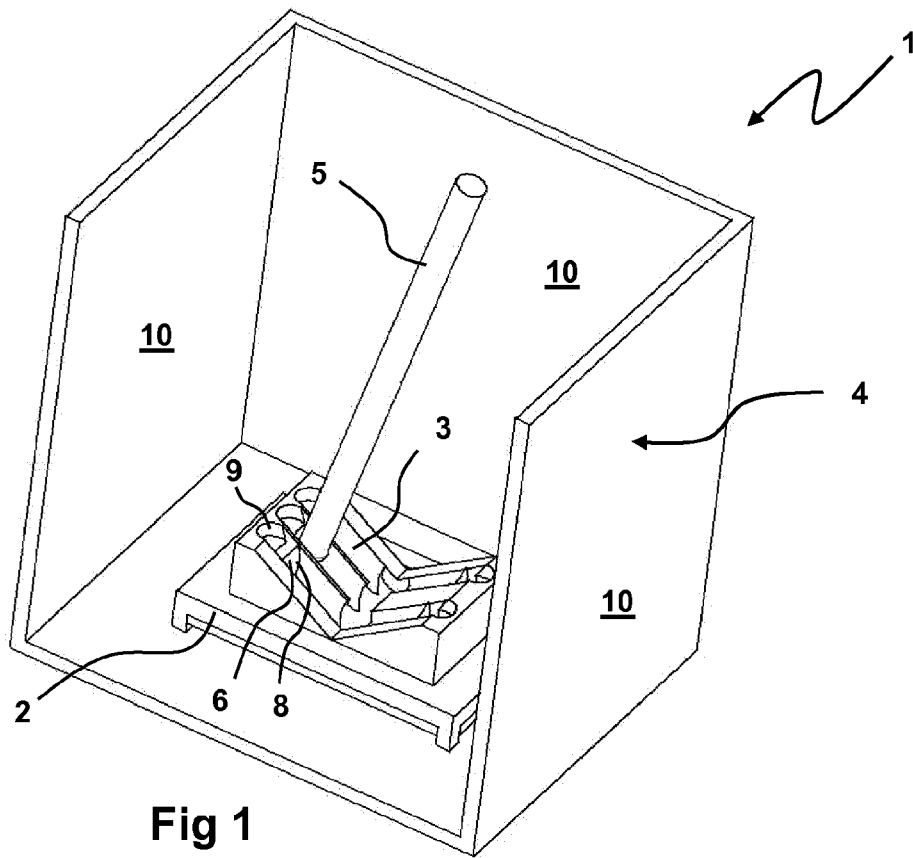
characterised

- in that the actuator (12) is adapted to being controlled via the control unit of the gearbox.

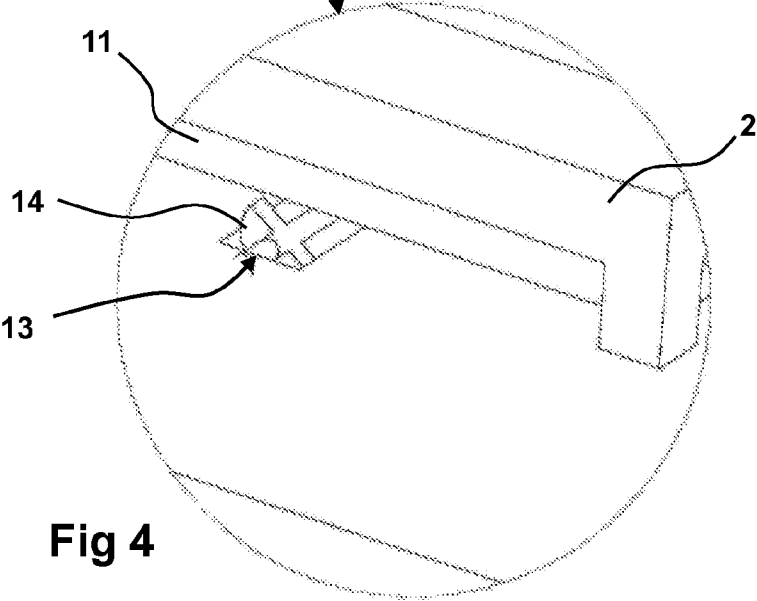
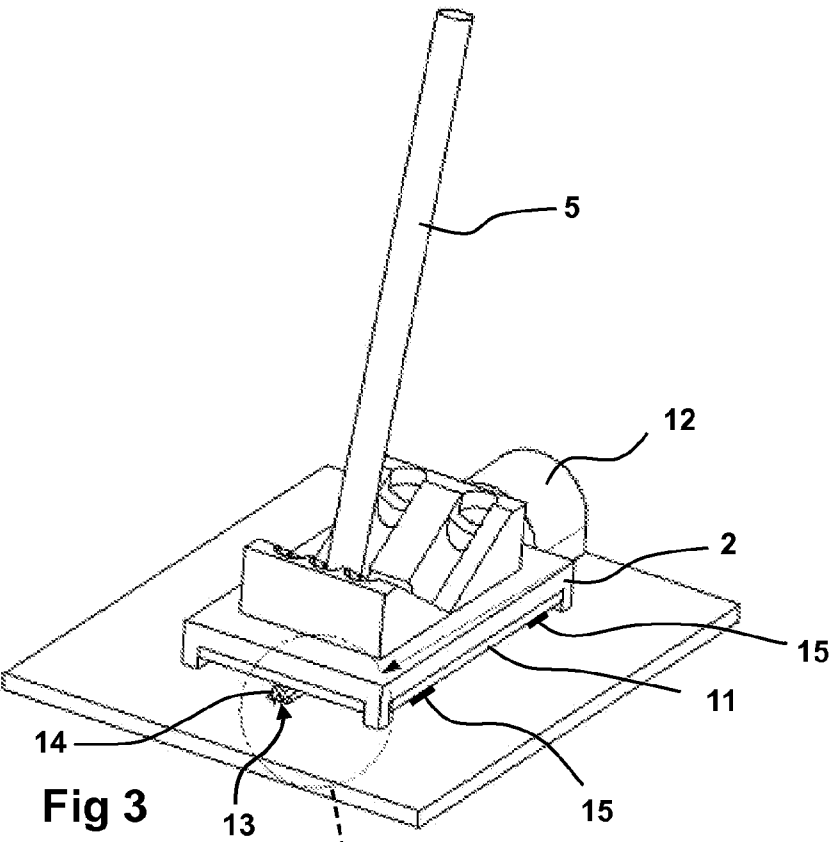
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16. A vehicle, particularly a truck, provided with a gear change control device according to any one of claims 1-15.

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3/6

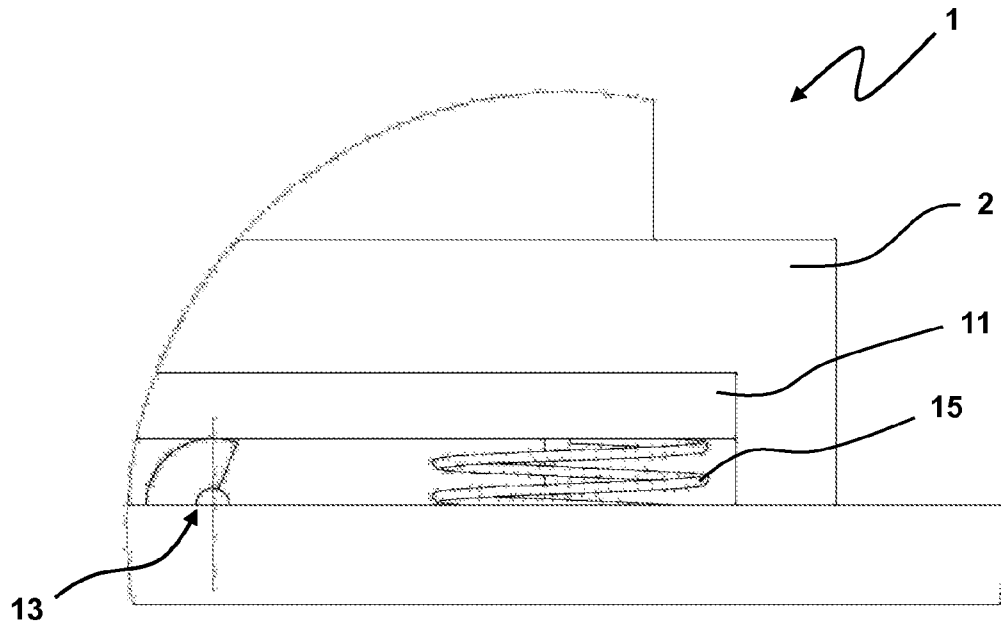


Fig 5

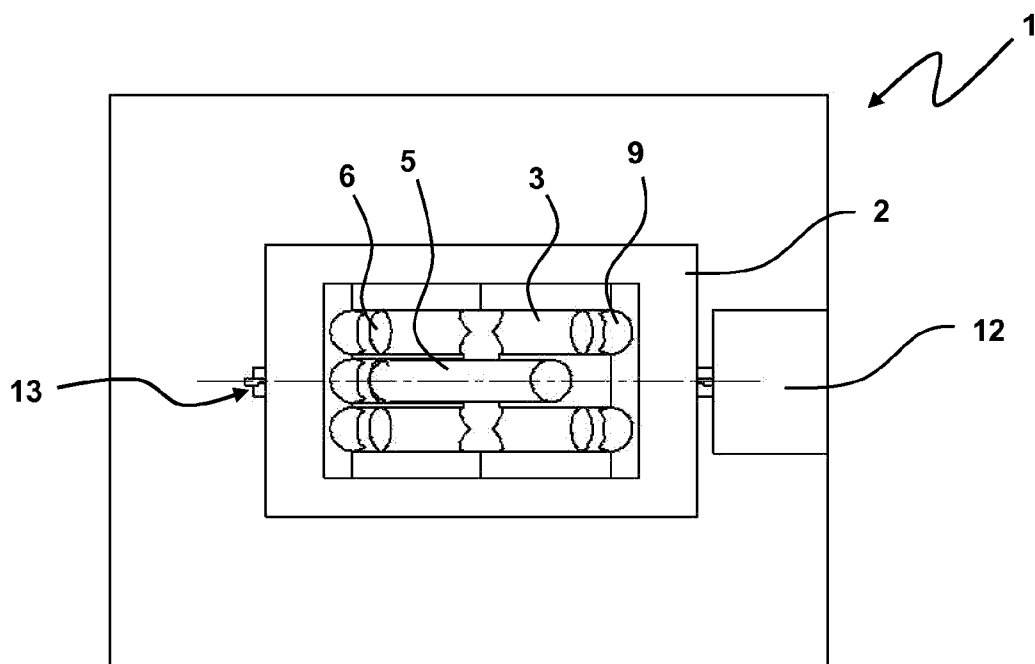


Fig 6

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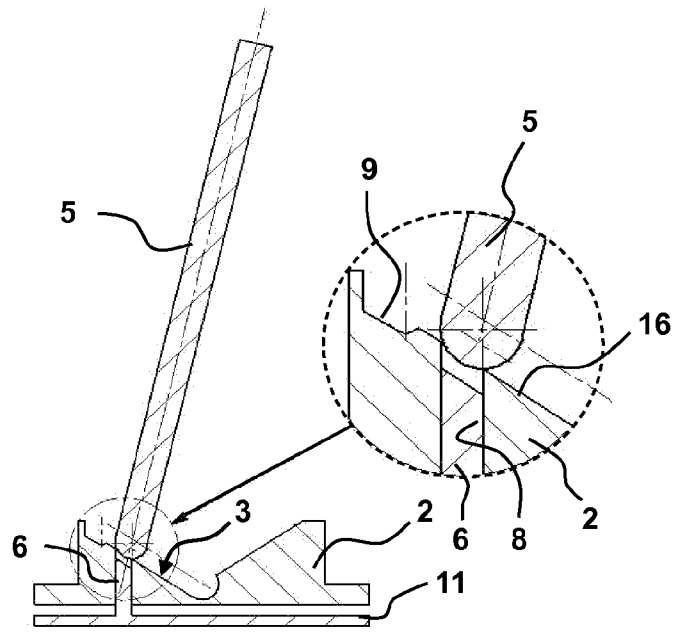


Fig 7a

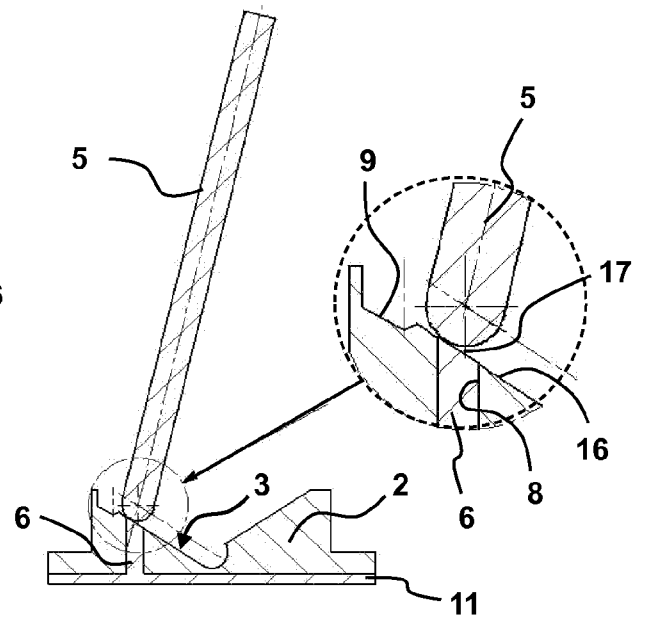


Fig 7b

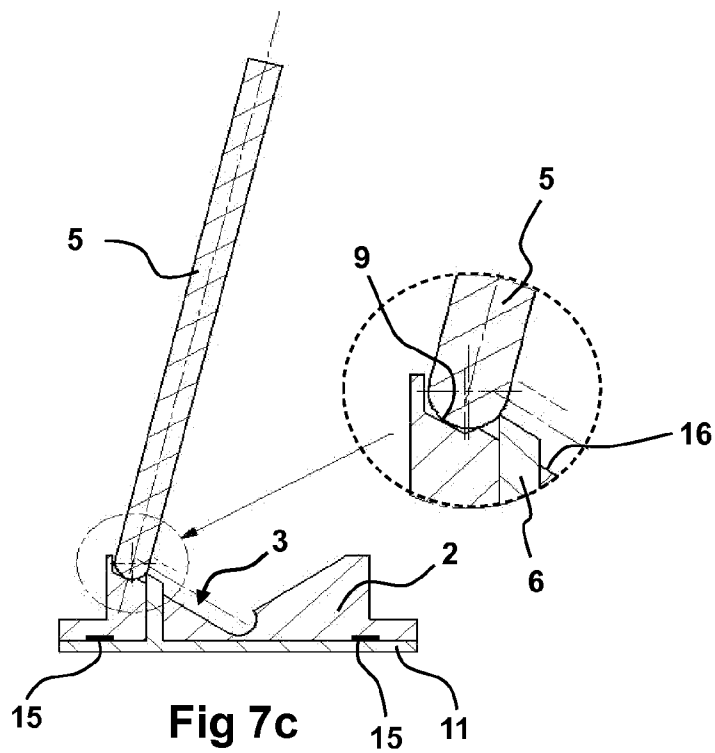


Fig 7c

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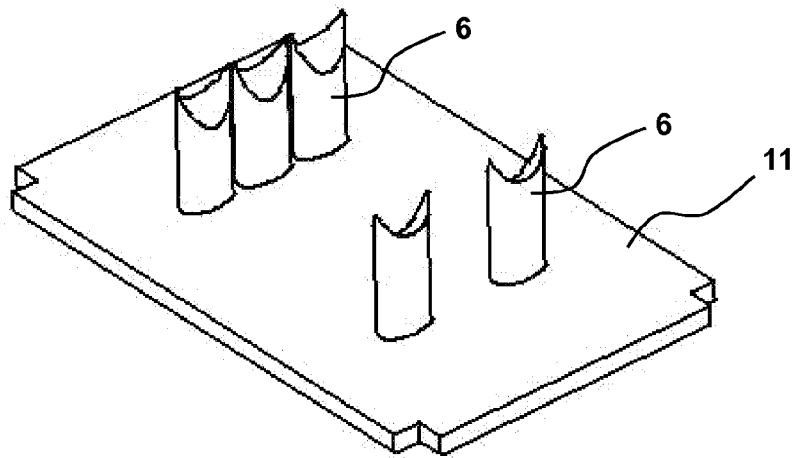


Fig 8

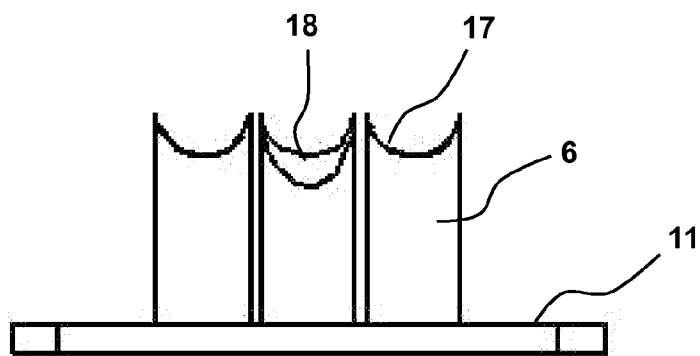


Fig 9

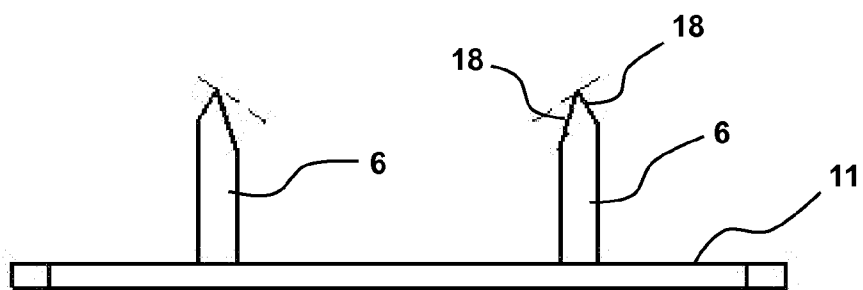


Fig 10

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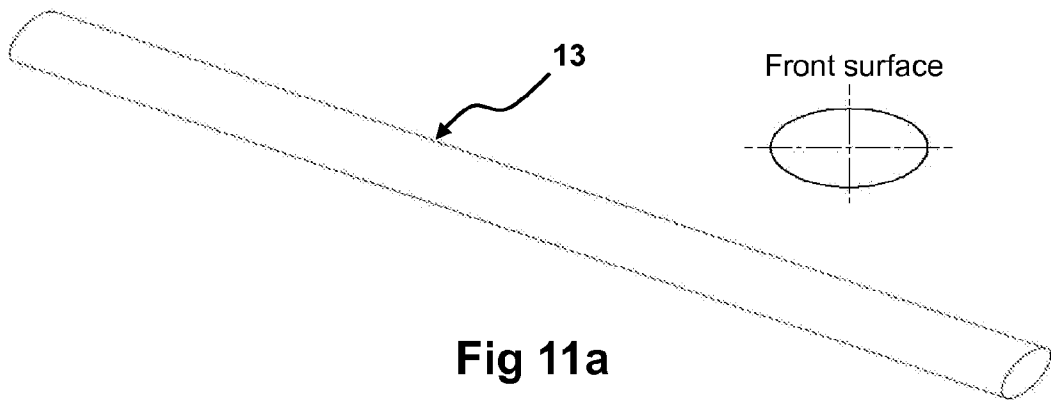


Fig 11a

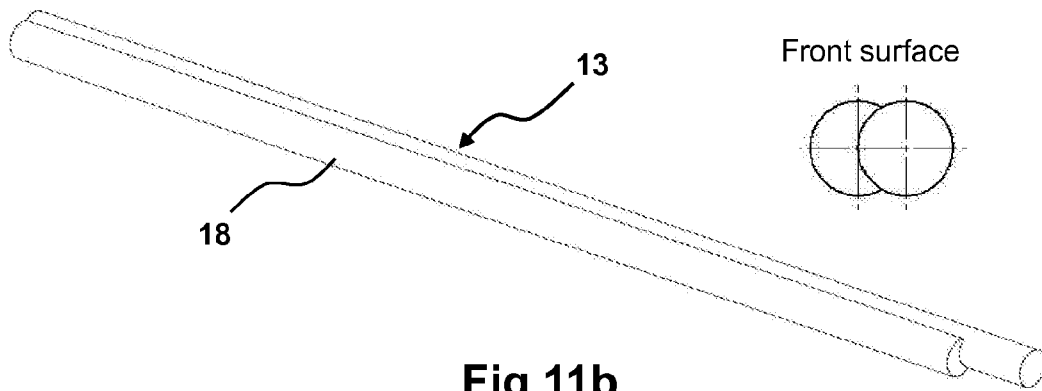


Fig 11b

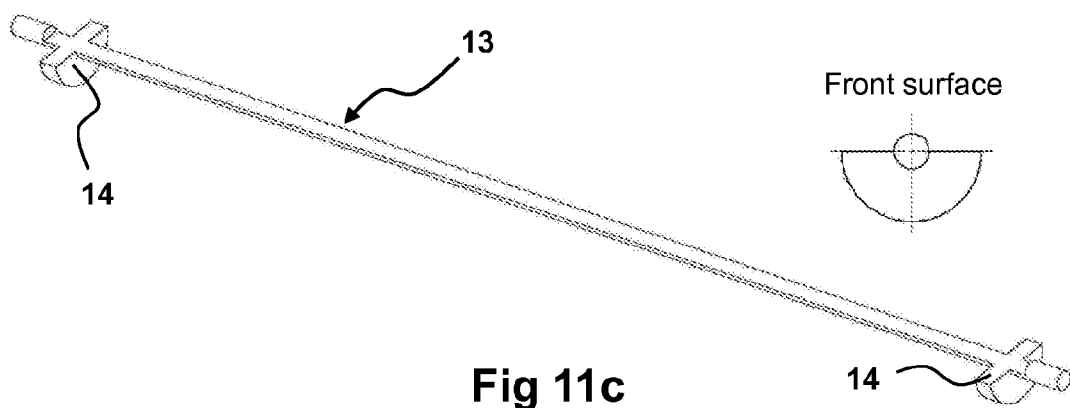


Fig 11c

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2011/050588

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B60K, F16H, G05G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2009156087 A1 (ECS ENGINEERED CONTROL SYSTEMS ET AL), 30 December 2009 (2009-12-30); abstract; figures --	1-16
A	WO 0233290 A (SCANIA CV ABP ET AL), 25 April 2002 (2002-04-25); abstract; figures --	1-16
A	US 20080072698 A1 (HIRANO MORIMICHI), 27 March 2008 (2008-03-27); abstract; figures --	1-16
A	US 5852953 A (ERSOY METIN), 29 December 1998 (1998-12-29); abstract; figures -- -----	1-16



Further documents are listed in the continuation of Box C.



See patent family annex.

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F16H 61/22 (2006.01)

G05G 5/02 (2006.01)

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