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(19)

(54) LOCKING DEVICE.

(71) We, L & F WILLENHALL LIMITED, a British Company, of Church Street, Willenhall, West Midlands, do hereby declare

the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:–

The present invention relates to modifications of or improvements in the Locking Device described in Complete Specification No. 1 517 021. The aforesaid complete specification describes a lock of the kind (hereinafter called the kind specified) used for limiting or preventing movement of a rotatable shaft of a vehicle steering column or movement of some other movable member of a vehicle, the device comprising a body, a bolt which is movable relative to the body between locking and releasing positions, in the former of which positions a nose of the bolt can, when the device is fitted to the vehicle, engage the movable member of the vehicle to restrict movement of same and in the latter of which positions the nose is withdrawn from the movable member of the vehicle, and a key-receiving member which, when the correct key is present therein, can be rotated relative to the body from a locking position to a releasing position to move the bolt between its locking and releasing positions.

The Locking Device described in the aforesaid complete specification has a control member which is movable from a first position to a second position by rotation of the key when present in the key receiving member and is movable from the second position to the first position only when the key is withdrawn, and the device further has retaining means for retaining the bolt in its releasing position, the retaining means being effective to so retain the bolt only when the control member is in its second position.

According to a first aspect of the present invention, the retaining means for the bolt includes a first retaining element which is carried on the bolt for movement therewith between the locking and releasing positions and a second retaining element movable with the control member between the first and second position thereof, the first retaining element being movable relative to the bolt in directions towards and away from the second retaining element and the retaining elements co-operating with one another, when the bolt is in the releasing position and the control member is in its second position, to obstruct movement of the bolt and first retaining element out of the releasing position of the bolt.

The invention will now be described, by way of example, with reference to the accompanying drawings wherein:–

Figure 1 shows a cross-section of a locking device in accordance with the invention;

Figure 2 shows a similar cross-section of a further locking device in accordance with the invention;

Figure 3 shows a partial cross-section on the line III–III of Figure 2;

Figure 4 is a partial cross-section on the line IV–IV of Figure 2;

Figure 5 is a cross-section on the line V–V of Figure 2; and

Figure 6 is a cross-section on the line VI–VI of Figure 2.

The device shown in Figure 1 of the accompanying drawings is intended for use in a motor road vehicle to lock a rotatable shaft of the steering column (not shown) of the vehicle against rotation. The device comprises a body 10, which, in use, is secured to a fixed part of the vehicle, for example to a casing of the steering column. In the body 10 there is mounted a bolt 11 for sliding movement along a rectilinear path between a locking position, shown in Figure 1, in which a nose 12 of the bolt can engage in a notch formed in a collar (not shown) secured to the rotatable steering column shaft and a releasing position, in which the nose 12 is withdrawn from engagement with the collar.

The device further comprises a key-receiving member 13 which, when the correct key is present in the key-receiving member is rotatable relative to the body 10 about an axis 14. The key-receiving member includes a spindle 15 which extends through an opening in the bolt into a cam 16 so that the cam can be rotated about an axis 14. The cam is arranged to move the bolt 11 from its locking position

to its releasing position upon rotation of the key-receiving member 13. The cam is also adapted to drive an electrical switch (not shown) which is intended to be mounted in a cavity 51 of the body 11 for controlling electrical circuits of the vehicle. The bolt is urged towards its locking position by a spring 17 disposed within the body 10.

The spindle 15 engages with the cam 16, which in turn engages with an axially presented face of the body 10, in a manner such as to prevent movement of the key-receiving member 13 along the axis 14 in a direction towards the cam, hereinafter called the inward axial direction. A shoulder 18 on the key-receiving member faces away from the spindle 15 and engages with a part of the body 10 surrounding an opening 19 in such a manner as to prevent movement of the key-receiving member along the axis 14 in the outward direction. Axial displacement of the key-receiving member relative to the body is thereby prevented. An end face 20 of the key-receiving member is accessible through the opening 19 but this opening is closed by the key-receiving member itself.

The device further comprises a control member 21. The control member is in the form of a bar having at one end thereof a flange 22. The bar is slidably received in a channel 23 formed in the body 10 at one side of the key-receiving member. The open mouth of the channel is presented towards the axis 14 so that the bar is immediately adjacent to the key-receiving member 13 and presents a part of the surface of a bore in which the key-receiving member is disposed. The remainder of the surface of the bore is presented by the body 10. The length of the channel and the length of the control member both extend in a direction parallel to the axis.

The flange 22 extends transversely of the axis 14 and is formed with a circular opening through which the spindle 15 extends. Thus, the flange is disposed in overlapping relation with the end face of the key-receiving member 13 which is opposite to the face 20. The co-operating faces of the flange 22 and key-receiving member 13 are formed with respective cam surfaces, indicated in Figure 1 at 24, which cause the control member 21 to be displaced in the axially inward direction relative to the key-receiving member and to the body when the key receiving member is rotated in a clockwise direction.

The control member 21 is constrained against rotation about the axis 14 and is guided for movement in a direction parallel to the axis by the surfaces of the channel 23. The control member may be further guided by co-operation between the spindle 15 and the flange 22. The control member is urged in the axially outward direction relative to the body 10 by a spring 27 which is also received in the channel 23 and is disposed radially outwardly of the control member 21. It will be noted that the spring 27 is off-set from the axis 14. The spring acts between an abutment 25 on the control member and an abutment 26 on the body. The abutment 26 may be in the form of a pin which is inserted through the body from one side thereof to the opposite side during assembly of the lock. Such pin may have the additional function of holding parts of the body in assembled relation with one another.

The device further comprises a first retaining element 30 which is mounted in a socket formed in the bolt 11 for movement relative to the bolt and relative to the body 10 in a direction parallel to the axis 14 between the active position shown in Figure 1 and an in-active position in which the retaining element is fully withdrawn into the socket of the bolt. The first retaining element is urged to its active position by a spring 31 contained in the socket of the bolt.

For holding the control member 21 in its second, axially innermost, position, there is provided positioning means comprising a pin 34 which is mounted in a socket formed in the control member. The key-receiving member is formed with a groove 36 which extends a part of the way around the periphery of the key-receiving member and is aligned with the pin 34 when the control member is in its second position. The pin is urged by a spring 35 out of the socket to engage in the groove 36 and so prevent return of the control member to its first position until the key-receiving member is rotated to its initial (locking) position. Such rotation drives the pin 34 up a ramp out of the groove 36 and so forces the pin back into its socket in the control member.

When the key is inserted into the key-receiving member 13 with the bolt 11 in its locking position and the key is then rotated in the clockwise direction, the cam 16 withdraws the bolt to its releasing position. Before the bolt reaches its releasing position, the cam surfaces 24 drive the control member 21 from its first position towards its second position, thereby compressing the spring 31 and forcing the retaining element 30 into its socket.

When the control member reaches its second position, the pin 34 engages in the groove 36. Once the bolt reaches its releasing position, the retaining element 30 is moved in the axially outward direction to its active position, where it overlaps with a retaining element 28 on the control member. This second retaining element 28 then obstructs movement of the bolt to its locking position until such time as the control member is moved once more to its first position.

For preventing return of the control member 21 to its first position when the key-receiving member 13 is in its locking position until the key has been withdrawn, there is provided a key detecting element 42. This key detecting element is mounted in a slot formed in the key-

receiving member, this slot extending from the keyway to the periphery of the key-receiving member. The key detecting element is thereby guided for movement radially with respect to the axis 14 but is prevented from moving along the axis. The key detecting element and control member 21 are formed with respective faces 43 and 44 which are inclined at an acute angle to the direction of movement of the key-detecting element and to the direction of movement of the control member. When the key-receiving member is in its locking position and the control member is in its second position, the faces 43 and 44 are in mutual contact and this engagement prevents axial movement of the control member whilst the key 54 remains within the key-receiving member. When the key is withdrawn, the key detecting element is able to move towards the axis 14 into the keyway, thereby clearing the face 44 and permitting the control member to move to its first position.

The control member 21 is formed with a recess 45 which, when the control member 21 is in its first position, is aligned with the key-detecting element 42 so that the latter can move out of the keyway of the key-receiving member into the recess 45. When the device is installed in the vehicle, the keyway is above the recess 45 so that the key-detecting element 42 is biased by gravity out of the keyway.

The face 44 is formed on a portion of the control member 21 which subtends a small angle only, typically 30°, at the axis 14. Accordingly, rotation of the key-receiving member 13 and key-detecting element 42 through an angle of 30° from the locking position carries the key-detecting element out of the recess 45 so that the key-detecting element no longer obstructs movement of the control member 21 in the axially inward direction.

It will be noted that the axially movable parts, namely the control member 21 and retaining element 30, are both completely enclosed by the body 10 and are inaccessible from the outside of the device. These parts are therefore protected against penetration of foreign matter between them and stationary surfaces with which they are in sliding contact.

The key-receiving member 13 contains a plurality of tumblers 46 which are biased towards positions in which respective end portions project radially from the key-receiving member. The body is formed with recesses at diametrically opposite positions for receiving these end portions of the tumblers when the key is absent from the key-receiving member.

Engagement of the end portions of the tumblers in the recesses prevents rotation of the key-receiving member relative to the control member 21 and therefore relative to the body 10.

When the correct key is inserted into the key-receiving member, the tumblers are withdrawn from the recesses and the key-receiving member can be rotated. Rotation of 30° in the clockwise direction brings the key detecting element 42 out of the recess 45 so that the control member 21 is free to move axially to its second position.

A further rotation of 30° causes the control member 21 to move axially to its second position. At this stage, the bolt 11 is still in its locking position and therefore the retaining element 30 cannot remain in its active position. Accordingly, the retaining element is moved into its recess in the bolt and the spring 31 is compressed. When the control member reaches its second position, the pin 34 snaps into the groove 36. This axial movement of the control member stresses the spring 27.

Continued rotation of the key-receiving member beyond 60° causes the bolt 11 to be displaced into its releasing position and, immediately this position is reached, the retaining element 30 moves under the action of the spring 31 into its active position. The key-receiving member may be rotated further in the clockwise direction to operate an associated electrical switch.

When the vehicle is required to be immobilised, the key-receiving member is rotated in the anti-clockwise direction by means of the key into its locking position. Only when the key is withdrawn, is movement of the control member 21 to its first position, under the action of the spring 27, permitted. Such movement displaces the key detecting element 42 radially inwardly and releases the bolt for movement into its locking position. As shown, the key-detecting element 42 is situated near to the end face 20 of the key-receiving member so that the key must be almost completely withdrawn before the bolt is released for movement to its locking position.

Referring now to the locking device shown in Figures 2 to 6, certain parts thereof correspond to parts already described with reference to Figure 1. Such corresponding parts are indicated in Figures 2 to 6 by like reference numerals with the pre-fix 1 and the preceding description is deemed to apply, except for the differences hereinafter mentioned.

The main difference between the device of Figures 2 to 6 and the device of Figure 1 is that, in the former device, the second retaining element 128 is structurally separate from the control member 121. The retaining element 128 is carried on the spindle 115 and is slideable relative thereto along the axis 114. The control member 121 has a hook portion 160 which engages in a groove 161 formed in the second retaining element 128. The hook portion 160 constrains the second retaining element to move axially with the control member relative to the body 110.

As shown, the cam 116 is integral with the

second retaining element 128. The cam and second retaining element are keyed to the spindle 115 to rotate therewith. Accordingly, there is a sliding clearance between the second retaining element and the control member 121 and the surface of the second retaining element on which the first retaining element 130 bears, when the bolt 111 is in its releasing position and the control member 121 is in its axially inner position, is a cylindrical surface co-axial with the key-receiving member 113.

The control member 121 and second retaining element 128 are urged in the axially outward direction by the spring 127. For displacing the control member and second retaining element in the axially inward direction upon clockwise rotation of the key-receiving member 113, there is provided a cam face on the axially inner end of the key-receiving member and a co-operating cam face on the second retaining element.

WHAT WE CLAIM IS:—

1. A Locking Device of the kind specified having a control member which is movable from a first position to a second position by rotation of the key when present in the key-receiving member and is movable from the second position to the first position only when the key is withdrawn from the key-receiving member, a first retaining element which is carried on the bolt for movement therewith between the locking and releasing positions and a second retaining element movable with the control member between the first and second positions thereof, the first retaining element being movable relative to the bolt in directions towards and away from the second retaining element and the retaining elements co-operating with one another, when the bolt is in the releasing position and the control member is in its second position, to obstruct movement of the bolt and first retaining element out of the releasing position of the bolt.

2. A Locking Device according to Claim 1 wherein the first retaining element is urged towards the second retaining element by a spring or other resilient element.

3. A Locking Device according to Claim 1 or Claim 2 wherein the control member is slidable along a channel formed in the body and disposed to one side of the axis of rotation of the key-receiving member.

4. A Locking Device according to any preceding claim wherein there is associated with the control member a first spring for urging the control member from its second position to its first position and said first spring is offset from the axis of rotation of the key-receiving member.

5. A Locking Device according to Claim 4 wherein there is associated with the control member a further spring and a positioning element which co-operates with the control member and with the key-receiving member to hold the control member in its second position during pre-determined stages of operation of the locking device, the second spring urging the positioning element into an active position and the first and second springs being so arranged as to tend to rock the control member in opposite directions.

6. A Locking Device according to Claim 3 wherein the control member is provided with a flange which extends transversely of the direction of movement of the control member along the channel past said axis to overlap, as viewed along the axis, with an end of the key-receiving member.

7. A Locking Device according to Claim 6 wherein the key-receiving member is constrained against axial movement relative to the body.

8. A Locking Device according to Claim 6 or Claim 7 wherein there is further provided positioning means for holding the control member in its second position during rotation of the key-receiving member from its releasing position to its locking position.

9. A Locking Device according to Claim 8 wherein the positioning means comprises a positioning element arranged to co-operate with both the control member and the key-receiving member.

10. A Locking Device according to Claim 9 wherein the positioning element is carried on one of the control member and key-receiving member and is received in a groove formed in the other member when the control member is in its second position.

11. A Locking Device according to Claim 10 wherein resilient biasing means is provided for urging the positioning element into said groove.

12. A Locking Device according to any preceding claim wherein the control member is inaccessible from the outside of the device when the device is in use.

13. A device according to Claim 6 or any of Claims 7 to 12 as appendant thereto wherein the flange on the control member has an opening through which there extends a rotatable spindle associated with the key-receiving member for rotation therewith.

14. A device according to any preceding claim wherein the control member defines a part of the peripheral boundary of a bore in which the key-receiving member is disposed.

15. A device according to Claim 4 wherein the body comprises a plurality of structurally separate parts which are held in assembled relation with one another by means including a pin and wherein the first spring associated with the control member acts between the control member and said pin.

16. A Locking Device substantially as herein described with reference to and as shown in Figure 1 of the accompanying drawings.

17. A Locking Device substantially as herein described with reference to and as shown in Figures 2 to 6 of the accompanying drawings.

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1580896 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

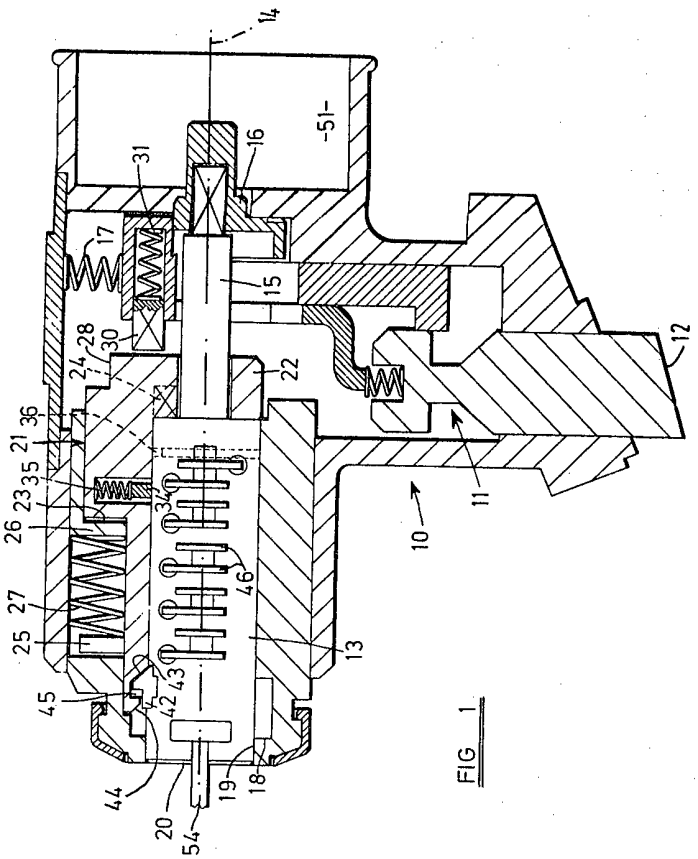

FIG 1

1580896 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 2

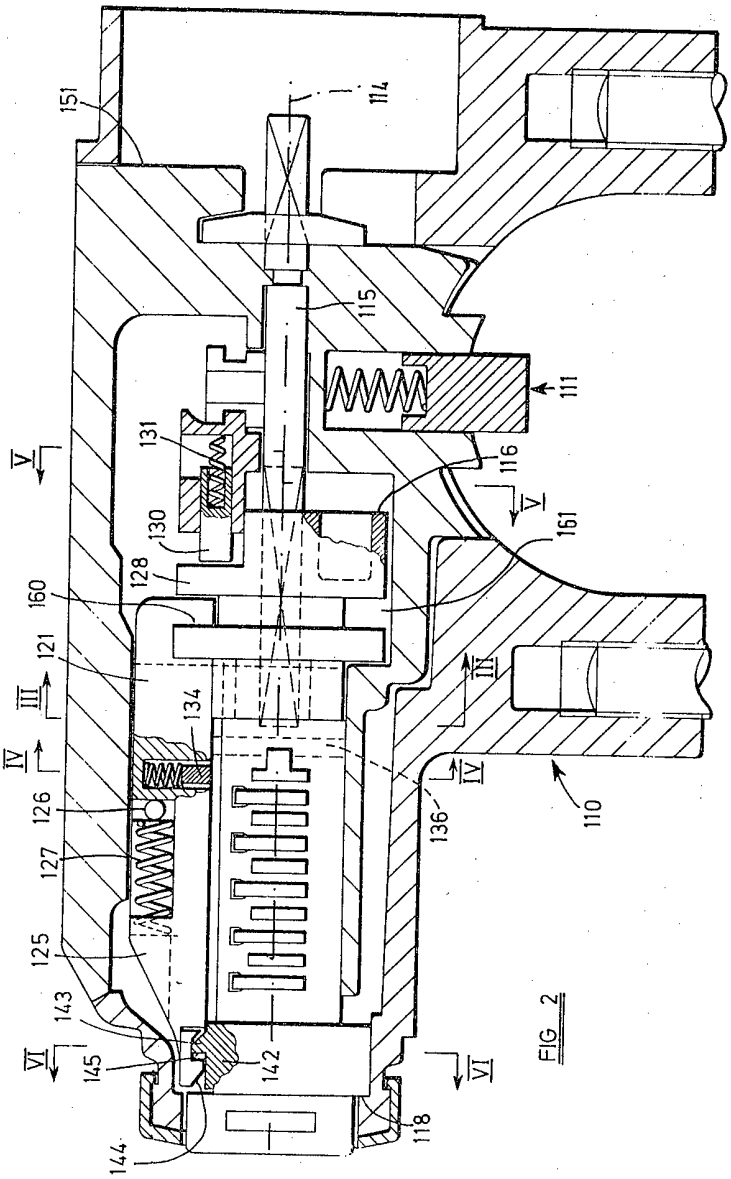

FIG. 2

1580896 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 3

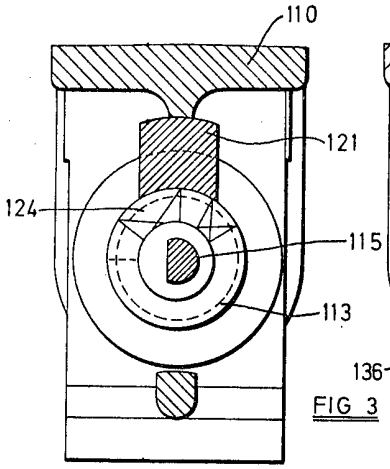

FIG 3

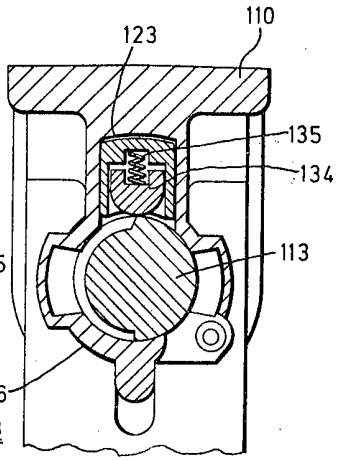

FIG 4

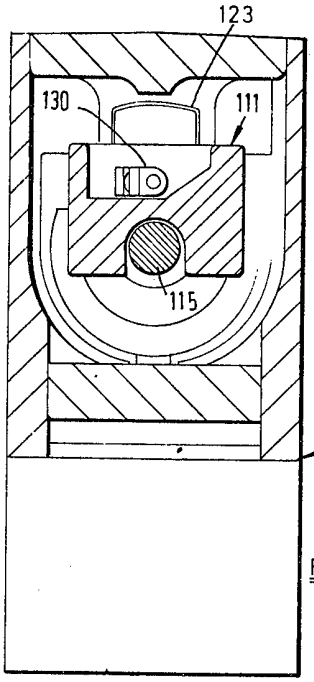

FIG 5

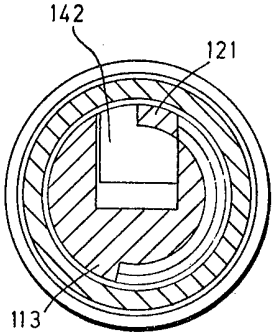

FIG 6