GEAR LOCK

FIELD OF THE INVENTION

The present invention relates, in general, to anti-theft devices for vehicles and, more particularly, to devices for locking the gears of a vehicle.

BACKGROUND OF THE INVENTION

The theft of vehicles, and particularly of private cars, is a phenomenon that has generated many different types of vehicle antitheft systems. Among these systems are various types of devices that lock a portion of the vehicle so as to make it undrivable. Among such devices are those mounted internally of the vehicle and arranged to lock the gear lever in a predetermined position so as to prevent an unauthorized person from being able to move the gear lever and thus drive the vehicle.

A disadvantage of internally mounted gear locking devices is that they may be unsightly and a vehicle owner may, therefore, be reluctant to install such a device.

Two representative gear locking devices of the art are United States Patents 4,671,085 to Yamaguchi et al. and 4,884,654 to Durigon. Yamaguchi et al. describes a vehicle gear shift lever locking apparatus including a key operated lock mounted on a steering column of a vehicle and for controlling the ignition system thereof, and a safety coupling means coupled between a steering column mounted lock and a remotely mounted shift lever. The coupling means is adapted to prevent movement of the shift lever with the lock in an off position and to allow movement of the lever with the lock in an on position. The apparatus includes a latch mechanism mounted on the steering column and responsive to movement of the lock.

Durigon describes a transmission control locking device adapted to disable the drive train of a motor vehicle. The device includes remotely controllable locking means adapted releasably to lock an actuator member constituted by a transmission gear selector level in a predetermined position when the lever is moved to that position, the predetermined position of the lever with the position of a gear selection that disables the vehicle drive train by the disengagement of the transmission therefrom.

The present applicant discloses in Israel Patent Application 091763, filed September 24, 1989, apparatus for locking a gear assembly of a vehicle which overcomes disadvantages of the above art. The apparatus for locking the gear assembly includes apparatus, mounted beneath the vehicle, for lockably engaging a predetermined portion of the

gear assembly. The predetermined portion is preferably a hand operated first, automatic gear selector lever extending partially into the interior of the vehicle. There is also provided a second, automatic gear actuator lever associated directly with the vehicle gearbox and located beneath the vehicle, the first lever being operative to rotate the second lever via an intermediate member hingedly connected to both the first and second levers, thereby to permit selection of a gear from the interior of the vehicle, the apparatus for lockably engaging being operative to lockably engage a predetermined portion of the first lever in a first predetermined position so as to cause the second lever to become locked in a second predetermined position corresponding to the first predetermined position. Apparatus is provided for selectably operating the apparatus for lockably engaging so as to lockably engage the predetermined portion of the gear assembly. Preferably the apparatus for selectably operating includes remotely actuable apparatus.

Alternatively, the predetermined portion is the selector lever for a manual gearbox and has a first portion extending into the interior of the vehicle and a second portion located beneath the vehicle, the apparatus for lockably engaging also including a scissors-like assembly attached to the second end portion of the elongate member and being closable about the second portion of the gear selector lever so as to lock it in a substantially immovable position.

SUMMARY OF THE INVENTION

The present invention seeks to provide novel gear locking apparatus for a vehicle which further improves the apparatus disclosed in Applicant's Israel Patent Application 091763, and which provides novel and improved features over the known art.

There is thus provided in accordance with a preferred embodiment of the invention, apparatus for locking a gear assembly of a vehicle, the apparatus for locking including apparatus for lockably engaging a predetermined portion of the gear assembly, and apparatus for selectably operating the apparatus for lockably engaging so as to lockably engage the predetermined portion of the gear assembly, characterized by the apparatus for lockably engaging including a shaft receiving portion formed with an aperture which engages a shaft of the gear assembly, wherein the shaft receiving portion is provided with a ratchet wheel lockingly engageable by a pawl, the pawl being actuable by the apparatus for selectably operating, such that when the pawl is in a predetermined orientation with the ratchet wheel, the shaft cannot be rotated to operate the gear assembly.

In accordance with a preferred embodiment of the invention, when the pawl is in locked engagement with the ratchet wheel, the shaft cannot be rotated to operate the gear assembly. Alternatively, when the pawl is disengaged from the ratchet wheel, the shaft cannot be rotated to operate the gear assembly.

Additionally in accordance with a preferred embodiment of the invention, the shaft receiving portion includes an extension of a link member that links a gear selector lever with the shaft of the gear assembly. Alternatively or additionally, the apparatus for lockably engaging includes a portion fixed to a structure of the vehicle.

Further in accordance with a preferred embodiment of the invention, the shaft receiving portion is not mechanically linked to a gear selector lever of the vehicle.

In accordance with a preferred embodiment of the invention, the apparatus for selectably operating includes remotely actuable apparatus.

Additionally in accordance with a preferred embodiment of the invention, the gear assembly is an automatic gear assembly and the predetermined portion is arranged to be lockably engaged in the "park" position.

Alternatively, the gear assembly is a manual gear assembly and the predetermined portion is arranged to be lockably engaged in any position whereat a gear is engaged. A biasing device may be provided for urging the pawl against the ratchet wheel.

There is also provided in accordance with a preferred embodiment of the present invention, a vehicle having a gear assembly and including apparatus for locking the gear assembly, the apparatus for locking including apparatus, mounted beneath the vehicle, for lockably engaging the predetermined portion of the gear assembly, and apparatus for selectably operating the apparatus for lockably engaging so as to lockably engage the predetermined portion of the gear assembly, characterized by the apparatus for lockably engaging including a shaft receiving portion formed with an aperture which engages a shaft of the gear assembly, wherein the shaft receiving portion is provided with a ratchet wheel lockingly engageable by a pawl, the pawl being actuable by the apparatus for selectably operating, such that when the pawl is in a predetermined orientation with the ratchet wheel, the shaft cannot be rotated to operate the gear assembly.

There is also provided in accordance with a preferred embodiment of the present invention, apparatus for locking a gear assembly of a vehicle, the apparatus for locking including apparatus for lockably engaging a predetermined portion of the gear assembly, and

apparatus for selectably operating the apparatus for lockably engaging so as to lockably engage the predetermined portion of the gear assembly, characterized by the apparatus for lockably engaging including a cup having a bore formed therein for receiving therethrough a gear shift lever, an arresting member having an aperture formed therein configured to snugly fit over a periphery of the cup, and a lever attached to the arresting member, wherein the lever is selectively movable to bring the arresting member into a snug fit over the cup thereby substantially preventing operational movement of the gear shift lever.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more fully understood and appreciated from the following detailed description, taken in conjunction with the drawings, in which:

Fig. 1A is a schematic side view of a back-wheel driven vehicle with a gearbox and employing gear locking apparatus constructed and operative in accordance with an embodiment of the invention;

Fig. 1B is a bottom view of the vehicle of Fig. 1A;

Fig. 1C is a view similar to that of Fig. 1B, but wherein the vehicle is a front-wheel driven vehicle;

Fig. 2 is a simplified illustration of gear locking apparatus, constructed and operative in accordance with a preferred embodiment of the present invention;

Figs. 3 and 4 are simplified illustrations of operation of the gear locking apparatus of Fig. 2 in accordance with the present invention;

Fig. 5 is a simplified illustration of gear locking apparatus, constructed and operative in accordance with another preferred embodiment of the present invention;

Figs. 6 and 7 are simplified illustrations of operation of the gear locking apparatus of Fig. 5 in accordance with the present invention;

Figs. 8 and 9 are simplified sectional and pictorial illustrations, respectively, of gear locking apparatus, constructed and operative in accordance with yet another preferred embodiment of the present invention, Fig. 8 being taken along lines VIII-VIII in Fig. 9; and

Figs. 10 and 11 are simplified sectional illustrations and Fig. 12 is a simplified pictorial illustration of gear locking apparatus, constructed and operative in accordance with still another preferred embodiment of the present invention, Figs. 10 and 11 being taken along lines X-X in Fig. 12, wherein Fig. 10 illustrates the gear locking apparatus in an unlocked orientation and Fig. 11 illustrates the gear locking apparatus in a locked orientation.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to Figs. 1A and 1B, there is shown a back-wheel driven vehicle, referenced generally 10, with a gear assembly, referenced generally 11, having a gearbox 12 adjacent an engine 14 operatively associated with the rear axle 16 of the vehicle via a drive shaft 18 thereof. Fig. 1C is a bottom view of a front-wheel driven vehicle, referenced generally 20, also with a gearbox 12 adjacent an engine 14 operatively associated with the front axle 22 of the vehicle. The present invention is applicable both for automatic and manual transmission vehicles. Both vehicles 10 (Figs. 1A and 1B) and 20 (Fig. 1C) employ gear locking apparatus constructed and operative in accordance with the present invention, and which is described in detail hereinbelow.

The gear locking apparatus of the invention comprises control apparatus 24, which, via an elongate member 26, is operative, to cause locked engagement of a lockable portion of the gear assembly 11 of the vehicle. In the shown embodiment, the lockable portion of the gear assembly is a gear selector lever 28. It will be appreciated that the precise location of the control apparatus is not limited to the typical locations shown in Figs. 1A to 1C.

Reference is now made to Fig. 2 which illustrates gear locking apparatus 102, constructed and operative in accordance with a preferred embodiment of the present invention. Gear selector lever 28 is illustrated for a manual transmission, although, as stated previously, the invention is equally applicable for an automatic transmission. Gear selector lever 28 is mechanically engaged with a shaft 104 of gearbox 12 by a link member 106. Gear locking apparatus 102 preferably includes a stationary member 108 which also engages shaft 104 via a shaft receiving portion 110 formed with an aperture 112. Stationary member 108 is preferably fixed to some structure of the vehicle, such as a bulkhead or wall 113 in the vicinity of gearbox 12, or alternatively, to some portion of gearbox 12 itself. Shaft 104 and aperture 112 are preferably correspondingly shaped with one or more flats to effect the mechanical engagement. For example, as illustrated, shaft 104 and aperture 112 may be correspondingly hexagonally shaped. Shaft receiving portion 110 is preferably formed with a ratchet wheel 114 engageable by a pawl 116. Pawl 116 is actuable by control apparatus 24 via elongate member 26.

Reference is now made to Figs. 3 and 4 which illustrate operation of gear locking apparatus 102 in accordance with the present invention. Control apparatus 24 may include a motor 32, preferably a gear motor, such as gear motor No. 0130-821-069, manufactured by Robert Bosch GmbH of Stuttgart, Germany. Alternatively, control apparatus

24 may include any other type of hydraulic, pneumatic, electrical or electronic actuator which may be used to move elongate member 26, and the terms "motor" and "actuator" are used interchangeably throughout the specification and claims.

Elongate member 26 may be a relatively flexible, metal, cable-like member, which engages control apparatus 24 by any known means, such as pinned or threaded engagement. Elongate member 26 is typically enclosed within a sheath 27, along most of its length, so as to prevent cutting of the elongate member by a person wishing to break into the vehicle.

In Fig. 3, control apparatus 24 may be used to move elongate member 26 generally in the direction of an arrow 120, thereby lockably engaging pawl 116 with ratchet wheel 114 and preventing rotation of ratchet wheel 114 and shaft 104. Thus, gear selector lever 28 and link member 106 are prevented from operating gearbox 12. Once pawl 116 has been moved to engage ratchet wheel 114 and the resistance of elongate member 26 to being moved any further in the direction of arrow 120 increases, a load detector 50 preferably deactivates motor 32 of control apparatus 24 upon detecting a predetermined load thereon. A suitable load detector is, for example, a PATROL HPS-40, marketed in Israel by AV-GAD Systems Ltd., Tel Aviv, Israel.

According to a preferred embodiment, motor 32 of locking apparatus 102 of the present invention is remotely actuable, and control apparatus 24 also includes a signal transmitter 52 and a signal receiver 54 which, when receiving a first predetermined signal from transmitter 52, activates motor 32 so as to move elongate member 26 in the direction of arrow 120 as previously described.

A typical signal transmitter suitable for use in the invention is the VM7001 remote control unit, manufactured by AV-GAD Systems Ltd., Tel Aviv, Israel. A typical signal receiver suitable for use in the invention is such as is employed in the AVD-2000 system, also manufactured by AV-GAD Systems Ltd.

Conversely, as illustrated in Fig. 4, control apparatus may be used to move elongate member 26 generally in the direction of an arrow 122, opposite to arrow 120, thereby disengaging pawl 116 with ratchet wheel 114 and permitting rotation of ratchet wheel 114 and shaft 104. For remote control operation, upon receiving a second predetermined signal, receiver 54 activates motor 32 so as to move elongate member in the direction of arrow 122.

In the orientation of Fig. 4, gear selector lever 28 and link member 106 may be used to operate gearbox 12.

In the present embodiments, wherein gearbox 12 is a conventional automatic gearbox, locking apparatus 102 is preferably arranged to lock gear selector lever 28 in the "PARK" position. For a manual gearbox, gear selector lever 28 not need be locked in a predetermined position, but, may be locked in any position whereat a gear is engaged.

Reference is now made to Fig. 5 which illustrates gear locking apparatus 130, constructed and operative in accordance with another preferred embodiment of the present invention. In this embodiment, gear selector lever 28 is mechanically engaged with shaft 104 of gearbox 12 by a link member 132 which includes a shaft receiving portion 134 formed with an aperture 136. The rest of the structure of gear locking apparatus 130 is substantially identical to gear locking apparatus 102, with like elements being designated by like numerals, except that in gear locking apparatus 130 there is no stationary member 108. In addition, in gear locking apparatus 130, elongate member 26 is preferably relatively short and motor 32 of control apparatus 24 is preferably located relatively close to pawl 116. Motor 32 may be attached to any suitable structure in the vicinity of link member 132 or any other portion of gear locking apparatus 130, or may be left unattached.

Reference is now made to Figs. 6 and 7 which illustrate operation of gear locking apparatus 130 in accordance with the present invention. The operation of gear locking apparatus 130 is essentially opposite that of gear locking apparatus 102. In Fig. 6, control apparatus 24 moves elongate member 26 generally in the direction of an arrow 140, thereby *disengaging* pawl 116 with ratchet wheel 114, and thus disengaging gear selector lever 28 and link member 132 from operating gearbox 12.

Conversely, as illustrated in Fig. 7, control apparatus may be used to move elongate member 26 generally in the direction of an arrow 142, opposite to arrow 140, thereby *engaging* pawl 116 with ratchet wheel 114 and permitting gear selector lever 28 and link member 132 to operate gearbox 12.

Reference is now made to Figs. 8 and 9 which illustrate gear locking apparatus 230, constructed and operative in accordance with another preferred embodiment of the present invention. Gear locking apparatus 230 is similar in principle to gear locking apparatus 130, with like elements being designated by like numerals. As with gear locking apparatus 130, link member 132 includes shaft receiving portion 134 formed with aperture 136 which engages

a shaft 104A (Fig. 9) of the gearbox, and ratchet wheel 114 is engageable by pawl 116 (Fig. 8). Shaft 104A is basically the same as shaft 104, except for its oval shape, but it is of course appreciated that the shape of the shaft is immaterial to the present invention.

Gear locking apparatus 230 differs from gear locking apparatus 130 in that elongate member 26 includes a coupler 232 which preferably comprises a pair of swivel joints 234 and 236 pivotally joined at a pivot 238, as seen best in Fig. 8. Swivel joint 236 preferably includes a linking rod 240 which protrudes through an aperture 242 formed in joint 236 and which has a head 244 which can abut against an inner surface of swivel joint 236.

The pawl 116 of gear locking apparatus 230 is preferably shaped generally as a dowel 246 with an end 248 and a central bore 250 which fixedly receives therein linking rod 240 as seen best in Fig. 8. Ratchet wheel 114 has one or more (preferably one) recesses 252. Gear locking apparatus 230 is configured such that when the gear selector lever 28 (not shown in Figs. 8 and 9) is in the "PARK" position, recess 252 of ratchet wheel 114 is aligned with end 248 of dowel 246. Alternatively, for a manual transmission, one or more recesses 252 may be provided which are aligned with end 248 at one or more predetermined positions of gear selector lever 28, such as reverse or first gear. As seen in Fig. 8, when recess 252 is aligned with end 248, a biasing device 254, such as a spring, urges end 248 generally in the direction of an arrow 256 into locking engagement with recess 252, thereby engaging pawl 116 with ratchet wheel 114 and permitting gear selector lever 28 and link member 132 to operate gearbox 12 (not shown in Figs. 8 and 9). When end 248 is engaged with recess 252, elongate member 26 rotates together with shaft 104A.

Conversely, control apparatus 24 (not shown in Figs. 8 and 9) can be used to move elongate member 26 generally in a direction opposite to that of arrow 256, thereby disengaging pawl 116 from ratchet wheel 114, and thus disengaging gear selector lever 28 and link member 132 from operating gearbox 12. (Control apparatus 24 may be attached to elongate member 26 by any suitable means, such as a cable attached to swivel joint 234.) In this non-operable configuration, end 248 is moved against biasing device 254 and head 244 of linking rod 240 freely slides towards pivot 238 inside swivel joint 236. When end 248 is disengaged with recess 252, elongate member 26 rotates freely about shaft 104A.

It is noted that if recess 252 is not aligned with end 248, for example, if gear selector lever 28 is not in the "PARK" position, end 248 cannot engage ratchet wheel 114 even if an attempt is made to use control apparatus 24 to engage end 248 with ratchet wheel 114.

Moreover, any unauthorized tampering with elongate member 26 or with the connection between elongate member 26 and control apparatus 24, such as cutting a portion thereof, will simply result in end 248 not being able to engage recess 252 and thus prevent operating gearbox 12.

Reference is now made to Figs. 10, 11 and 12 which illustrate gear locking apparatus 260, constructed and operative in accordance with still another preferred embodiment of the present invention. Gear locking apparatus 260 preferably includes a housing 262, typically cylindrical in shape, in which is mounted a cup 264 with a central bore 266 formed therein for receiving therethrough a gear shift lever 268. Only a portion of gear shift lever 268 is shown in Figs. 10-12, it being understood that gear shift lever 268 extends through cup 264 and is connected directly or indirectly to a gearbox (not shown).

Preferably pivotally attached to housing 262 about a pivot 269 is a lever 270 actuated by a cable (or handle) 272 attached to an end 274 of lever 270. Pivotally attached to an end 276 (seen in Fig. 10) of lever 270, opposite to end 274, is an arresting member 278 which is preferably biased against an inner surface of housing 262 by a biasing device 280, such as a spring. Arresting member 278 preferably has an aperture 282 formed therein configured to snugly fit over the periphery of cup 264.

Fig. 10 illustrates gear locking apparatus 260 in an unlocked orientation, i.e., gear shift lever 268 is free to move and operate a gearbox (not shown). As seen in Fig. 11, cable 272 may be used to rotate lever 270 about pivot 269 to force arresting member snugly over cup 264, thereby preventing any motion of gear shift lever 268 and thus locking gear shift lever 268.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described hereinabove. Rather the scope of the present invention includes both combinations and subcombinations of the features described hereinabove as well as modifications and variations thereof which would occur to a person of skill in the art upon reading the foregoing description and which are not in the prior art.

CLAIMS

What is claimed is:

1. Apparatus for locking a gear assembly of a vehicle, said apparatus for locking comprising:

apparatus for lockably engaging a predetermined portion of the gear assembly; and

apparatus for selectably operating said apparatus for lockably engaging so as to lockably engage the predetermined portion of the gear assembly,

characterized by

said apparatus for lockably engaging comprising a shaft receiving portion formed with an aperture which engages a shaft of the gear assembly, wherein said shaft receiving portion is provided with a ratchet wheel lockingly engageable by a pawl, said pawl being actuable by said apparatus for selectably operating, such that when said pawl is in a predetermined orientation with said ratchet wheel, said shaft cannot be rotated to operate the gear assembly.

2. Apparatus according to claim 1 wherein when said pawl is in locked engagement with said ratchet wheel, said shaft cannot be rotated to operate the gear assembly.

3. Apparatus according to claim 1 wherein when said pawl is disengaged from said ratchet wheel, said shaft cannot be rotated to operate the gear assembly.

4. Apparatus according to claim 1 or claim 3 wherein said shaft receiving portion comprises an extension of a link member that links a gear selector lever with said shaft of the gear assembly.

5. Apparatus according to claim 1 or claim 2 wherein said apparatus for lockably engaging comprises a portion fixed to a structure of the vehicle.

6. Apparatus according to claim 1 or claim 2 wherein said shaft receiving portion is not mechanically linked to a gear selector lever of the vehicle.

7. Apparatus according to claim 1 and wherein said apparatus for selectably operating comprises remotely actuable apparatus.

8. Apparatus according to claim 1 and wherein the gear assembly is an automatic gear assembly and the predetermined portion is arranged to be lockably engaged in the "park" position.

9. Apparatus according to claim 1 and wherein the gear assembly is a manual gear assembly and the predetermined portion is arranged to be lockably engaged in any position whereat a gear is engaged.

10. Apparatus according to claim 1 and comprising a biasing device for urging said pawl against said ratchet wheel.

11. A vehicle having a gear assembly and including apparatus for locking said gear assembly, said apparatus for locking comprising:

apparatus, mounted beneath said vehicle, for lockably engaging said predetermined portion of said gear assembly; and

apparatus for selectably operating said apparatus for lockably engaging so as to lockably engage the predetermined portion of the gear assembly,

characterized by

said apparatus for lockably engaging comprising a shaft receiving portion formed with an aperture which engages a shaft of the gear assembly, wherein said shaft receiving portion is provided with a ratchet wheel lockingly engageable by a pawl, said pawl being actuable by said apparatus for selectably operating, such that when said pawl is in a predetermined orientation with said ratchet wheel, said shaft cannot be rotated to operate the gear assembly.

12. A vehicle according to claim 11 wherein when said pawl is in locked engagement with said ratchet wheel, said shaft cannot be rotated to operate the gear assembly.

13. A vehicle according to claim 11 wherein when said pawl is disengaged from said ratchet wheel, said shaft cannot be rotated to operate the gear assembly.

14. A vehicle according to claim 11 and wherein said apparatus for selectably operating comprises remotely actuable apparatus.

15. Apparatus for locking a gear assembly of a vehicle, said apparatus for locking comprising:

apparatus for lockably engaging a predetermined portion of the gear assembly; and

apparatus for selectably operating said apparatus for lockably engaging so as to lockably engage the predetermined portion of the gear assembly,

characterized by

said apparatus for lockably engaging comprising:

a cup having a bore formed therein for receiving therethrough a gear shift lever;

an arresting member having an aperture formed therein configured to snugly fit over a periphery of said cup; and

a lever attached to said arresting member, wherein said lever is selectively movable to bring said arresting member into a snug fit over said cup thereby substantially preventing operational movement of said gear shift lever.

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