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(54) Vehicle door locking system

(57) Central locking system for vehicle doors includes an electric actuator (13) whose motor (21) drives a snail cam (23) for shifting a lock operating lever (25) between locked and unlocked positions. The lever is held at the respective position with the cam at the extremes of its travel but is free to be operated manually e.g. by a sill button of the associated door, when the cam is at mid travel. A spring is arranged to urge the cam in one direction only from the unlocked extreme to mid travel but does not affect the cam at the locked extreme enabling the door to be dead-locked using the actuator i.e. so that it remains locked until the actuator is operated to shift the cam away from that extreme.

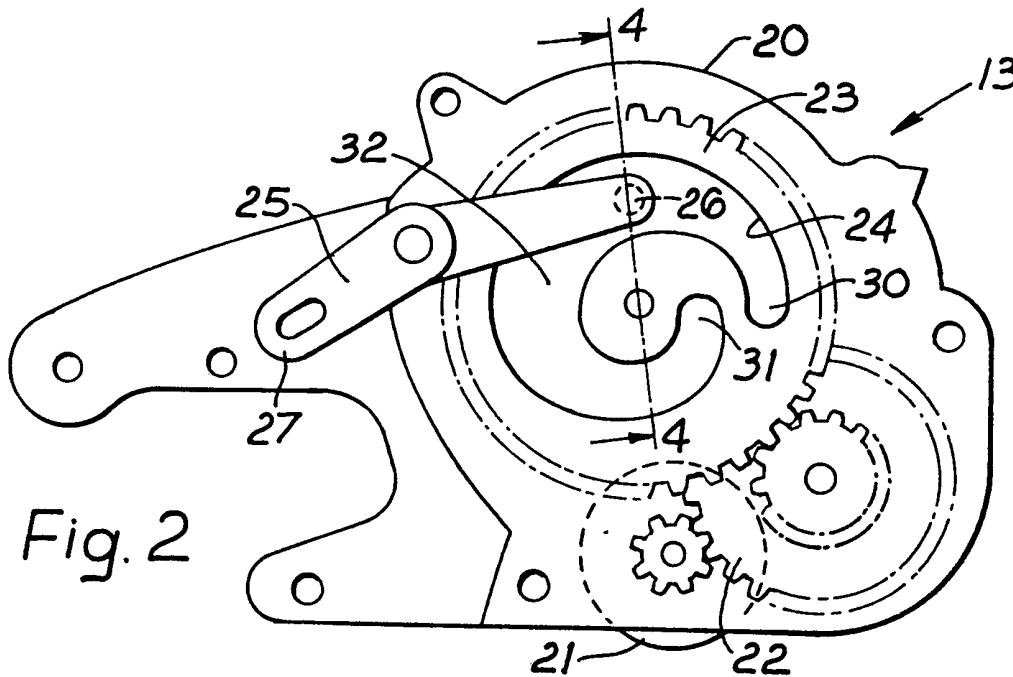


Fig. 2

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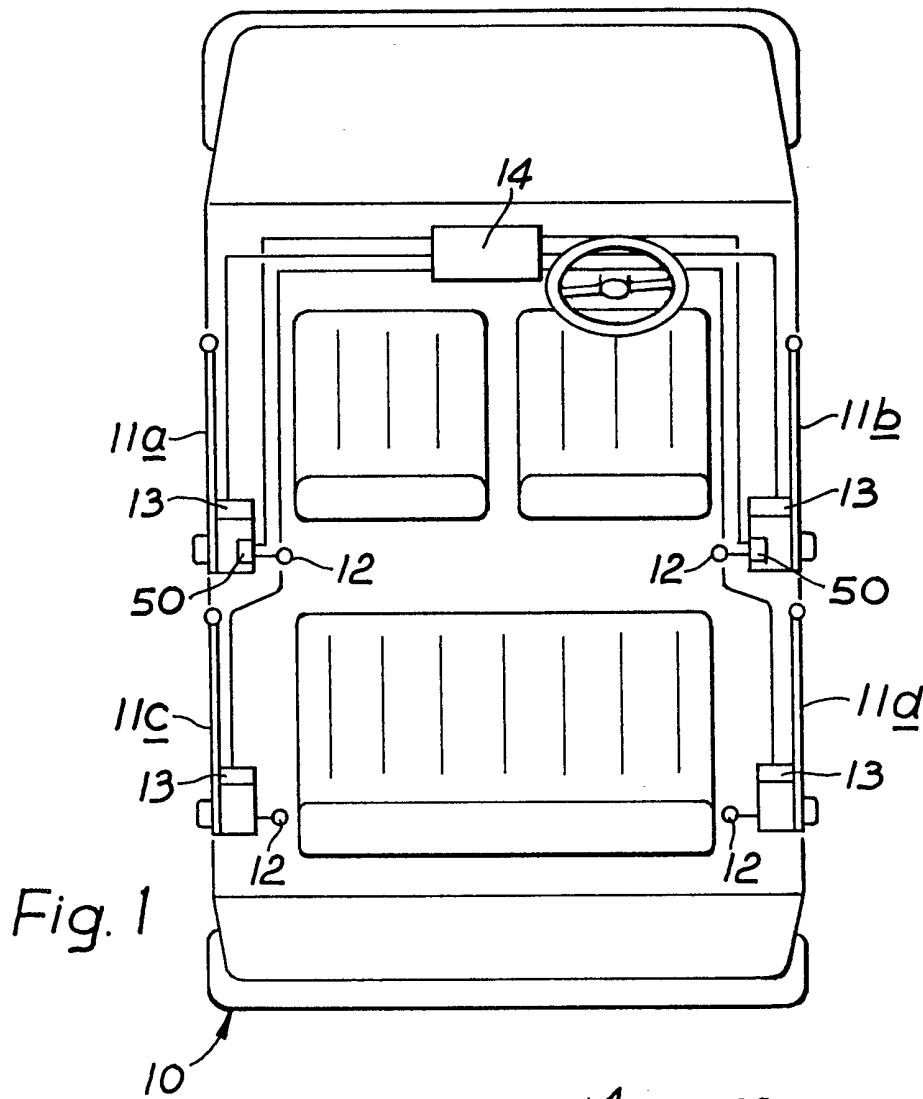


Fig. 1

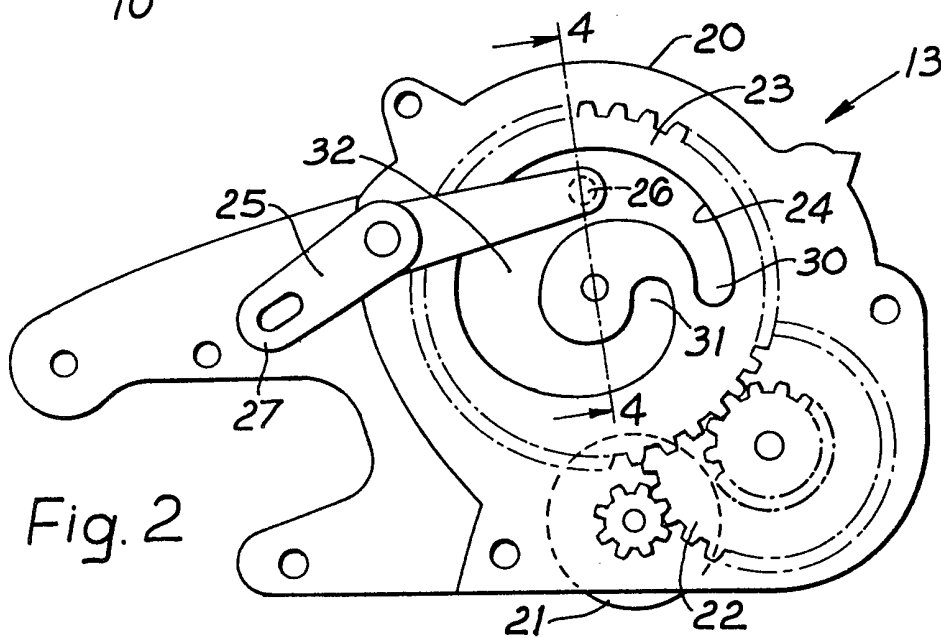


Fig. 2

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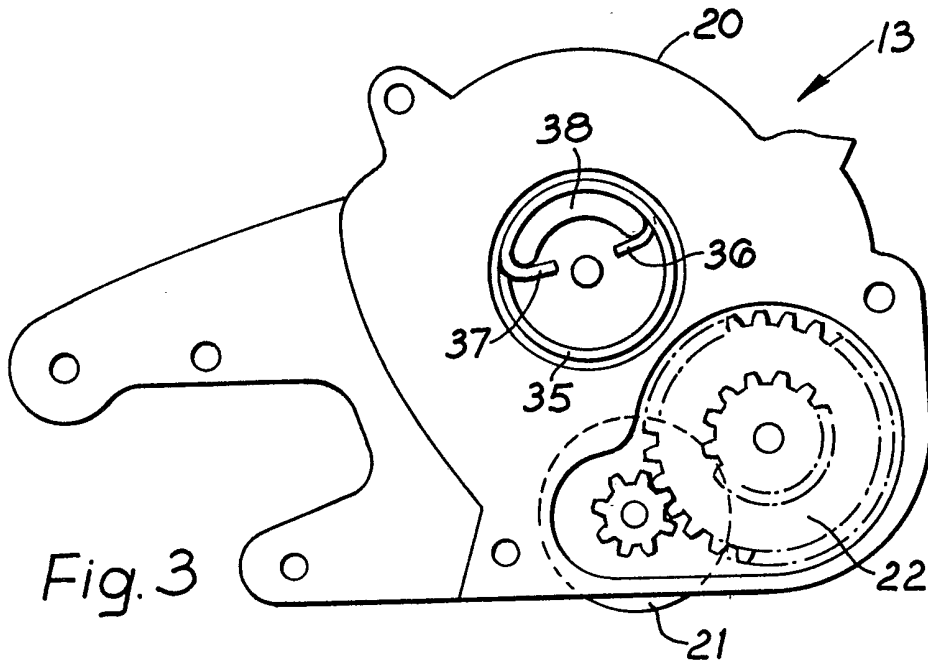


Fig. 3

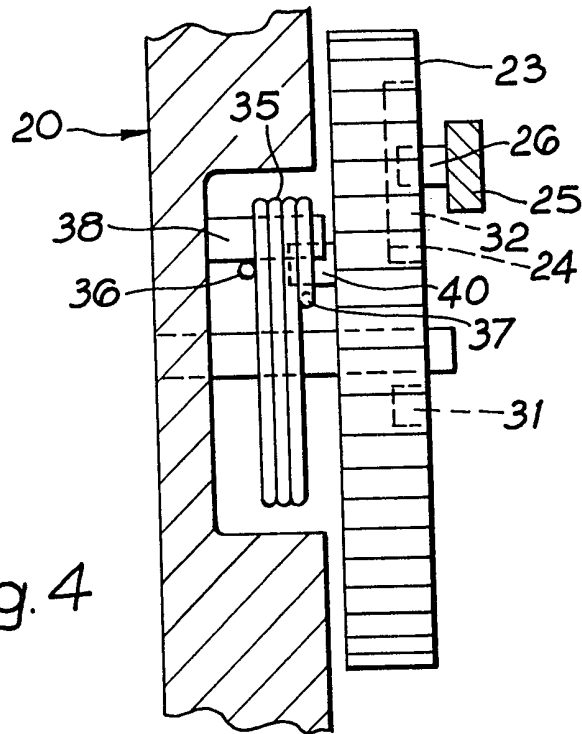


Fig. 4

SPECIFICATION

Vehicle door locking system

5 This invention relates to locking systems for
vehicle doors of the kind in which a central
control unit is connected to the individual
locks for electrical actuation of the latter
whereby locking or unlocking of all the doors
10 can be effected from a single control station
actuated from within or outside the vehicle,
e.g. by the use of a key and/or some kind of
remote control such as a radio or infra-red
emitter and systems of this kind are herein-
15 after referred to as "central locking systems".

A disadvantage of many known types of
vehicle lock including those actuated by or
forming part of a central locking system is
that there is no dead-locking facility, i.e. there
20 is nothing positively retaining the lock mecha-
nism at the secure position and it can be
freed quite readily for example by operating
manual actuating means on the inside of the
door such as the internal door handle or sill
25 release button. This may be done by forcing a
window and operating the button or the like
using wire or some similar tool to unlock the
door and gain unauthorised access to the
vehicle interior.

30 Central locking systems with a dead-locking
feature have been proposed but these have
hitherto involved special forms of lock mecha-
nism and lock actuators which are complex
and costly to provide and which have there-
35 fore hitherto only been available on more ex-
pensive types of vehicle.

The object of the present invention is to
provide a simple and economical central lock-
ing system having a low cost and effective
40 dead-locking facility which is easy to operate,
reliable in use, and makes use of a known
type and size of actuator so that it can readily
be provided as a modification of existing cen-
tral locking systems without any substantial
45 redesign or increase in tooling costs.

According to a first aspect of the invention
there is provided a power actuated unit for a
central locking system including a lock actu-
ating formation shiftable between locked and
50 unlocked positions; a motor driven rotary cam
having a snail formation co-acting with said
actuating formation for selective movement
thereof in response to operation of a central
control unit of the system in use, said snail
55 formation being shaped to prevent displace-
ment of the actuating formation from the
locked position at a first angular position of
the cam whereby the lock is held in a dead-
locked condition but to permit unrestricted
60 movement of the lock actuating formation be-
tween the locked and unlocked positions at a
second angular position of the cam remote
from the first position, and to positively dis-
place the actuating formation to the unlocked
65 position at a third angular position of the cam

70 remote from the second position and on the
opposite side thereof to the first position; and
resilient means urging the cam in one direction
of rotation only away from the third position
towards the second angular position whereby
once driven to the first angular position the
cam will remain at that position to retain the
actuating formation in the dead-locked condi-
75 tion until movement to the second or third
angular position is effected by a further oper-
ation of the central control unit.

The invention further resides in a central
locking system including one or more power
actuated units as defined by the last preceding
80 paragraph and a central control unit.

Preferably said last mentioned central lock-
ing system includes a subsidiary or overriding
control circuit whereby the motor or motors
of the actuating unit or units or a preselected
85 proportion thereof can be operated at reduced
power in response to a signal to the central
control unit derived from actuation of manual
internal release means, e.g. a sill button or
handle on the interior of one or more of the
90 vehicle doors, said power being sufficient to
displace the cams of the actuating units to the
second position while not overcoming the
force of the resilient means resisting move-
ment beyond that position whereby the asso-
95 ciated door or doors can then be selectively
unlocked by the use of said internal means,
e.g. for emergency escape from the vehicle.

An example of the invention is now de-
scribed in greater detail with reference to the
100 accompanying drawings wherein:

Figure 1 is a diagram of a vehicle fitted with
a central locking system,

Figure 2 is an end view of an actuating unit
of the system with an end plate removed;

105 *Figure 3* is a like view to Fig. 2 but with a
cam removed; and

Figure 4 is a sectional view on line 4-4 of
Fig. 2.

110 Referring to Fig. 1 a vehicle body shown
diagrammatically at 10 has, in this example,
four doors, two front doors 11a, 11b and
two rear doors 11c and 11d, each having a
respective lock mechanism of known kind in-
cluding manually operable internal release
115 means which, in this example, consists of a
respective sill button 12 of known kind.
Power actuating units 13 to be described in
further detail below are mounted in association
with each locking mechanism on each door
and are electrically connected to a central con-
120 trol unit 14 of the locking system. Further
locking mechanisms, e.g. of a tail-gate or boot
lid and/or bonnet may also be provided with
power actuated units interconnected with the
central control unit 14 but these have not
125 been shown for clarity.

130 Referring to Figs. 2-4 one of the actuating
units 13 will now be described in greater de-
tail. A body 20 of the unit to be operatively
mounted in a convenient fixed location on or

in the respective door 11 mounts an actuating motor 21 and encloses a gear train 22 which drivingly connects the motor to a rotary cam 23, conveniently a plastics moulding, one face of which is formed to provide a snail formation in the form of a spiral profile hollow.

A lock actuating formation in the form of a bell crank 25 pivoted on body 20 has an end formation in the form of a pin 26 which co-acts with snail formation 24, the opposite end 27 of crank 25 projecting from body 20 and being operatively connected to the door lock mechanism (not shown), cam 23 serving to shift lever 25 angularly between locked and unlocked positions for corresponding mechanical operation of the locking mechanism.

The profiling of snail formation 24 is such that it extends through substantially 360° in this example from a radially outer end 30 which is narrow enough to confine the pin 26 of lever 25 against angular movement so retaining it positively at the locked position, and a radially inner end 31 of like width which will constrain pin 26 for positive location of lever 25 at the locked position.

Formation 24 increases in radial width away from ends 30, 31 to a maximum width portion indicated generally at 32 which, when in co-acting relationship with pin 26 permit unobstructed angular movement of lever 25 between the unlocked and locked positions.

A cylindrically coiled torsion spring 35 having radially inwardly directed first and second hooked ends 36, 37 locates in a hollow of body 20 co-axially with cam 23 and behind the cam as viewed from the snail formation side. Both hooked ends locate against the opposite ends of a crescent-shaped boss 38 within said hollow, first end 36 being spaced axially further away from the rear face of cam 23 and second end 37 in the assembled condition.

The rear face of cam 23 is provided with an axially projecting abutment 40 which, as the cam rotates in one direction, engages the nearer second end 37 of spring 35 though it is not long enough to engage the first end 36 when rotating in the opposite direction.

Spring 35 is so disposed that when cam 23 is rotated to a first angular position at which the radially outer end 30 of snail formation 24 engages pin 26 the spring is not engaged, thus when motor 21 drives cam 23 to this position it will remain there and not be displaced (the ratio of gear train 22 is sufficient to resist any accidental displacement due to vibration etc) until motor 21 is operated in the reverse direction to shift the cam away from that position. Thus, in this position, the associated locking mechanism is dead-locked i.e. it cannot be displaced or released by mechanical actuation of the associated sill button 13, door handle or the like.

When cam 23 is shifted to a second angular position at which maximum width portion

32 of formation 24 is in co-acting relationship with pin 26, lever 25 can move freely and the locking mechanism can be actuated using sill button 13 or the exterior door handle, i.e. the door can be fastened or unfastened manually in the usual way.

When motor 21 is operated to drive cam 23 to a third angular position at which the radially inner end 31 of formation 24 co-acts with pin 26 lever 25 is positively displaced to the unlocked position to free the door mechanism, i.e. all the doors can be locked or unlocked from the central control unit by operation of the motors 21 of the respective actuating unit 13 simultaneously. In moving cam 23 from the second to the third position boss 38 engages the second end 37 of spring 35 so that it is tensioned. Once the operating pulse of current to motor 21 has been terminated, i.e. unlocking has been effected, spring 35 urges cam 23 back to the second or mid-position referred to above.

With the arrangement as so far described it will be appreciated that it would be possible to lock all the vehicle doors from the central control unit 14 while the vehicle is occupied (which may be desirable in some circumstances from the point of view of security of the occupants) but, as all the doors will then be dead-locked, this would have the disadvantage that the occupants could not readily release themselves from the vehicle, e.g. a passenger could not undo his door in an emergency without calling on the driver to operate the central control unit. To avoid this an overriding provision is made.

All or selected ones of the sill buttons 12 (e.g. those of the front doors 11a, 11b) may be provided with overriding switches indicated diagrammatically on Fig. 1 at 50 connected into a subsidiary operating circuit including control unit 14. Operation of sill button 12 will actuate the associated switch 50 causing the central control unit to pass a current at a reduced voltage to the motors 21 of the actuating units 13 to drive them in a direction for moving the associated cams 23 from the first to the second positions, so freeing the associated levers 25 for free movement between the locked and unlocked positions, thus the associated door or doors can be released, e.g. by the passengers using the sill buttons 12 in the normal way. The reduced current applied to each motor 21 is sufficient to displace cam 23 between the first and second positions (during which travel spring 35 is not engaged) but is not sufficient to overcome the force of said spring and drive the cam 23 to the third position at which the doors are positively unlocked. Thus only those doors which are mechanically unlocked e.g. by use of the sill buttons 12 are released.

It is to be understood that for some applications the operation of cam 23 may be reversed, i.e. the radially inner end 31 of the

snail formation 24 may be utilised to retain the lever 25 at the locked position and the outer end 30 may be utilised to shift it positively to the unlocked position, in this case the disposition and action of spring 35 would be reversed to give the overriding feature referred to above and the polarity of the current applied to motor 21 would also be reversed for drive in the opposite direction.

CLAIMS

1. A power actuated unit for a central locking system including a lock actuating formation shiftable between locked and unlocked positions; a motor driven rotary cam having a snail formation co-acting with said actuating formation for selective movement thereof in response to operation of a central control unit of the system in use, said snail formation being shaped to prevent displacement of the actuating formation from the locked position at a first angular position of the cam whereby the lock is held in a dead-locked condition but to permit unrestricted movement of the lock actuating formation between the locked and unlocked positions at a second angular position of the cam remote from the first position, and to positively displace the actuating formation to the unlocked position at a third angular position of the cam remote from the second position and on the opposite side thereof to the first position; and resilient means urging the cam in one direction of rotation only away from the third position towards the second angular position whereby once driven to the first angular position the cam will remain at that position to retain the actuating formation in the dead-locked condition until movement to the second or third angular position is effected by a further operation of the central control unit.

2. A unit as in Claim 1 wherein the snail formation is a hollow of spiral profile in a face of the rotary cam.

3. A unit as in Claim 2 wherein said hollow has an angular extent about the cam axis of substantially 360°.

4. A unit as in Claim 2 or 3 wherein the lock actuating formation is a lever one arm of which carries a pin in coacting relationship with said hollow.

5. A unit as in Claim 4 wherein the radially outer and radially inner ends of said hollow are dimensioned to constrain the pin of said lever arm against angular movement, a median portion of said hollow being wide enough to permit angular movement of said arm between locked and unlocked positions.

6. A unit as in any preceding claim wherein the resilient means is a coiled torsion spring both ends of which engage an anchorage formation of the body with the spring in an undeformed condition, an axially extending abutment of the cam being engageable with one said spring end only whereby the spring

is tensioned as the cam is moved from the second to the third position but is not so engaged when the cam is moved between the second and the first positions.

7. A power actuated unit for a central locking system substantially as hereinbefore described with reference to and as shown in Figs. 2, 3 and 4 of the accompanying drawings.

8. A central locking system for a vehicle including one or more power actuated units as in any preceding claim and a central control unit.

9. A system as in Claim 8 including a subsidiary or overriding control circuit whereby the motor or motors of the actuating unit or units or a preselected proportion thereof can be operated at reduced power in response to a signal to the central control unit derived from actuation of a manual internal release means, said reduced power being sufficient to displace the cams of the associated actuating units to the second position but not being sufficient to overcome the force of the resilient means to move them beyond that position, so allowing the locks of the associated door or doors to be selectively freed for manual unlocking by the use of their internal release means.

10. A system as in Claim 9 wherein the internal release means is a sill button or interior door handle of one or more of the vehicle passenger doors.

11. A system as in Claim 9 or 10 wherein the signal for causing said reduced power operation is derived from actuation of the internal handles or sill buttons of the front passenger doors of the vehicle only.

12. A central locking system substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

13. A vehicle including an actuating unit as in any one of Claims 1 to 7 and/or a central locking system as in any one of Claims 8 to

11.