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ELECTRONIC VEHICLE ANTI-THEFT SYSTEM

FIELD OF THE INVENTION

The present invention relates to vehicle theft prevention apparatus generally.

BACKGROUND OF THE INVENTION

Since the development of the automobile, motor vehicle theft has been an increasingly serious phenomenon. Various types of theft prevention systems have been proposed and commercialized, including audio alarms, vehicle electrical system interlocks and mechanical locks, preventing unauthorized operation of vehicle controls, such as the steering wheel, gear shift and brakes.

A gear shift lock manufactured and sold worldwide under U.S. Patent 4,693,099 and under the registered trademark MUL-T-LOCK by the applicant/assignee of the present invention has enjoyed significant commercial success. U.S. Patent Applications 07,787,902, 07,932,661, 07,787,902 and 08/175,111 of the applicant/assignee, the disclosures of which are incorporated by reference herein, describe further improvements of this gear shift lock, including, inter alia operation of an ancillary anti-theft system, such as an alarm, by locking of the gear shift lock.

It is self-evident that locks only provide security when they are used. Often, drivers leaving their car in a hurry do not take the time to lock the gear shift lock, defeating the entire purpose of the anti-theft system.

SUMMARY OF THE INVENTION

The present invention seeks to provide an improved vehicle anti theft system.

There is thus provided in accordance with a preferred embodiment of the present invention a vehicle anti-theft system including a gear shift lock at least partially operated by a key and an auxiliary vehicle anti-theft subsystem actuated at least partially by locking of the gear shift lock and also at least partially operated by said key.

In accordance with a preferred embodiment of the present invention, both the gear shift lock and the auxiliary vehicle anti-theft subsystem are actuatable without the use of a key and both require use of the key for deactuation.

Preferably, the gear shift lock comprises at least two microswitches, one detecting locking of a shackle in a lock body and the other detecting insertion of a key into a keyway.

In accordance with a preferred embodiment of the present invention the vehicle anti-theft system also comprises logic circuitry which automatically actuates the auxiliary vehicle anti-theft subsystem in response to sensing that the vehicle is unoccupied.

The logic circuitry may be incorporated in the vehicle computer or be ancillary thereto.

Preferably the logic circuitry distinguishes between a sensed vehicle unoccupied condition when the shackle is locked in the lock body and when it is not. For example, automatic actuation may occur more quickly when the shackle is locked in the lock body and less quickly when the shackle is not locked in the lock body.

Sensing of a vehicle unoccupied condition may be achieved by the use of one or more of the following sensors: a weight sensor in the drivers' seat, a vibration sensor, a volume sensor and an acoustic sensor.

BRIEF DESCRIPTION OF THE DRAWINGS

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

Fig. 1 is partially pictorial, partially block diagram illustration of a vehicle anti-theft system constructed and operative in accordance with a preferred embodiment of the present invention;

Fig. 2 is a pictorial illustration of a gear shift lock incorporating a key operated system control, forming part of the system of Fig. 1;

Fig. 3 is an exploded view illustration of the gear shift lock of Fig. 2;

Figs. 4A and 4B are respective exploded and assembled view illustrations of microswitch assemblies useful in the apparatus of Figs. 1 - 3;

Fig. 5 is a sectional illustration taken along the lines V - V in Fig. 2;

Fig. 6 is a sectional illustration taken along the lines VI - VI in Fig. 2;

Figs. 7A and 7B are sectional illustrations corresponding to Fig. 6, showing the gear shift lock in locked and unlocked orientations; and

Fig. 8 is a simplified flow chart illustration of the operation of logic circuitry forming part of the apparatus of Figs. 1 - 7B.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Reference is now made to Fig. 1 which illustrates a vehicle anti-theft system constructed and operative in accordance with a preferred embodiment of the present invention. The vehicle anti-theft system comprises a key-operated gear shift lock 10, which is operative to lock the gear shift of a vehicle 12 in a position preventing normal operation of the vehicle. Alternatively, the gear shift lock may be instead a hand-brake lock, a steering wheel lock, a clutch lock or any combination of the foregoing, which is operative, when locked, to disable an essential operator control and thus prevent operation of the vehicle.

An auxiliary anti-theft subsystem, indicated generally by reference numeral 13, may include one or more subsystems preferably interconnected to a vehicle computer 14. These subsystems may include an audio alarm 16, a vehicle electrical system interlock 18, a visual alarm (not shown), a remote alarm (not shown) to a central monitoring system or any combination of the foregoing. The auxiliary anti-theft system is preferably operated by a user at least partially by the same key 20 used to unlock the gear shift lock 10.

In accordance with a preferred embodiment of the present invention, the gear shift lock is locked, and the auxiliary vehicle anti-theft subsystem is actuated by physical locking of the gear shift lock, which need not necessarily involve use of the key 20. Alternatively, the auxiliary vehicle anti-theft subsystem may be actuated automatically in response to the absence of persons within the vehicle for a predetermined amount of time or in response to any other suitable criteria.

Automatic activation of the auxiliary vehicle anti-theft system may be initiated by the presence or

absence of an electrical signal from the vehicle ignition lock 22 or by a driver weight sensor 24 located in the driver's seat, or a volume, vibration or audio sensor 26, located on the interior of the vehicle.

It is a particular feature of the present invention that deactivation of both the gear shift lock and the auxiliary vehicle anti-theft subsystem requires use of the key 20.

Reference is now made additionally to Figs. 2 - 7B, which illustrate a gear shift lock and key controller constructed and operative in accordance with a preferred embodiment of the present invention.

The gear shift lock comprises a lock body assembly 30 and a shackle 32. The shackle preferably comprises a generally U-shaped element 34 having a pair of legs 36 and 38, at least one and preferably both of which are formed with a notch 40. The lock body assembly 30 preferably comprises a cover member 50 (Fig. 1), typically formed of plastic, which at least partially encloses a lock housing 52.

Disposed within the lock housing is a lock assembly 54 and a lock and microswitch support 56. Lock and microswitch support 56 supports a pair of microswitch assemblies 58 and 60 in operative engagement with the lock assembly 54.

Lock assembly 54 comprises an enclosure 70 which defines a pair of bores 72 and 74 which accommodate legs 36 and 38 respectively, a lock cylinder 76 and first and second locking elements 78 and 80 which are spring loaded by a spring 82 and displaced by operation of lock cylinder 76 into and out of locking engagement with notches 40 on respective legs 36 and 38.

Lock cylinder 76 includes a cylinder housing 84 and a plug 86 rotatable within the housing 84 and defining a keyway 88 which accepts a key 20 (Fig. 1).

Microswitch assembly 58 includes a microswitch

90 which is operated by the presence or absence of leg 38 in bore 74 and is associated with a retractable button 92, biased by a spring 94. Microswitch assembly 60 includes a microswitch 96, which is operated by rotation of plug 86 within housing 84, which can only take place upon insertion of key 20 in keyway 88. The microswitch 96 is associated with a retractable button 98, which is engaged by the rotating plug 86, the plug being configured that rotation thereof changes the location of button 98 relative to microswitch 96.

Microswitch assembly 60 preferably also supports a printed circuit board 100 which may contain logic or other operating circuitry used for operating the auxiliary vehicle anti-theft device. The printed circuit board 100 communicates with the remainder of the auxiliary vehicle anti-theft subsystem 13 via a cable 102.

Logic circuitry, preferably located on printed circuit board 100, is preferably provided for identifying authentic, suitably coded electrical signals transmitted along cable 102 for ensuring their authenticity and for preventing unauthorized transmission of spurious signals for disabling all or part of the system.

For ease in manufacture and assembly of the gear shift lock, the microswitch assemblies 58 and 60 are preferably designed to be interlocking, as illustrated in Figs. 4A and 4B.

Reference is now made to Fig. 8, which is a flow chart illustration of the automatic operation of the vehicle anti-theft system in accordance with a preferred embodiment of the present invention.

Actuation of the system is preferably automatic, in response to the sensed unoccupied condition of the vehicle, as indicated, for example by sensors 24 and 26 (Fig. 1). If the shackle 32 is locked in the lock body, as sensed by microswitch 90, the system is actuated after a relatively short delay, such as 10 seconds. If the

shackle 32 is not locked in the lock body, as indicated by microswitch 90, the system is actuated after a relatively long delay, such as 5 minutes.

The difference in the delay to automatic actuation is to permit a user to leave the vehicle for a very short time without actuation of the system.

Upon automatic actuation of the system, the vehicle windows are automatically closed and the doors and windows are automatically locked. The vehicle is preferably immobilized by interlock apparatus 18. Various theft indication responsive sensors and warning indicators described above may also be actuated.

In accordance with a preferred embodiment of the invention, deactivation of the vehicle theft system requires at least insertion of the key 20 into keyway 88 and may require rotation of the plug 86 in the cylinder housing 76.

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 is defined only by the claims which follow:

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1. A vehicle anti-theft system comprising:

a gear shift lock at least partially operated by a key and an auxiliary vehicle anti-theft subsystem actuated at least partially by locking of the gear shift lock and also at least partially operated by said key.

2. A vehicle anti-theft system according to claim 1 and wherein both the gear shift lock and the auxiliary vehicle anti-theft subsystem are actuatable without the use of a key and both require use of the key for deactuation.

3. A vehicle anti-theft system according to either of claims 1 and 2 and wherein the gear shift lock comprises at least two microswitches, one detecting locking of a shackle in a lock body and the other detecting insertion of a key into a keyway.

4. A vehicle anti-theft system according to any of the preceding claims and also comprising logic circuitry which automatically actuates the auxiliary vehicle anti-theft subsystem in response to sensing that the vehicle is unoccupied.

5. A vehicle anti-theft system according to claim 4 and wherein said logic circuitry is incorporated in the vehicle computer or be ancillary thereto.

6. A vehicle anti-theft system according to either of claims 4 and 5 and wherein the logic circuitry distinguishes between a sensed vehicle unoccupied condition when the shackle is locked in the lock body and when it is not.



7. A vehicle anti-theft system according to any of the preceding claims and wherein automatic actuation occurs more quickly when the shackle is locked in the lock body and less quickly when the shackle is not locked in the lock body.

8. A vehicle anti-theft system according to any of the preceding claims and including apparatus for sensing of a vehicle unoccupied condition.

9. A vehicle anti-theft system according to claim 8 and wherein said apparatus for sensing of a vehicle unoccupied condition comprises at least one of the following sensors: a weight sensor in the drivers' seat, a vibration sensor, a volume sensor and an acoustic sensor.

* C L M S *