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(54) **VEHICLE STORAGE BOX LOCKING DEVICE**

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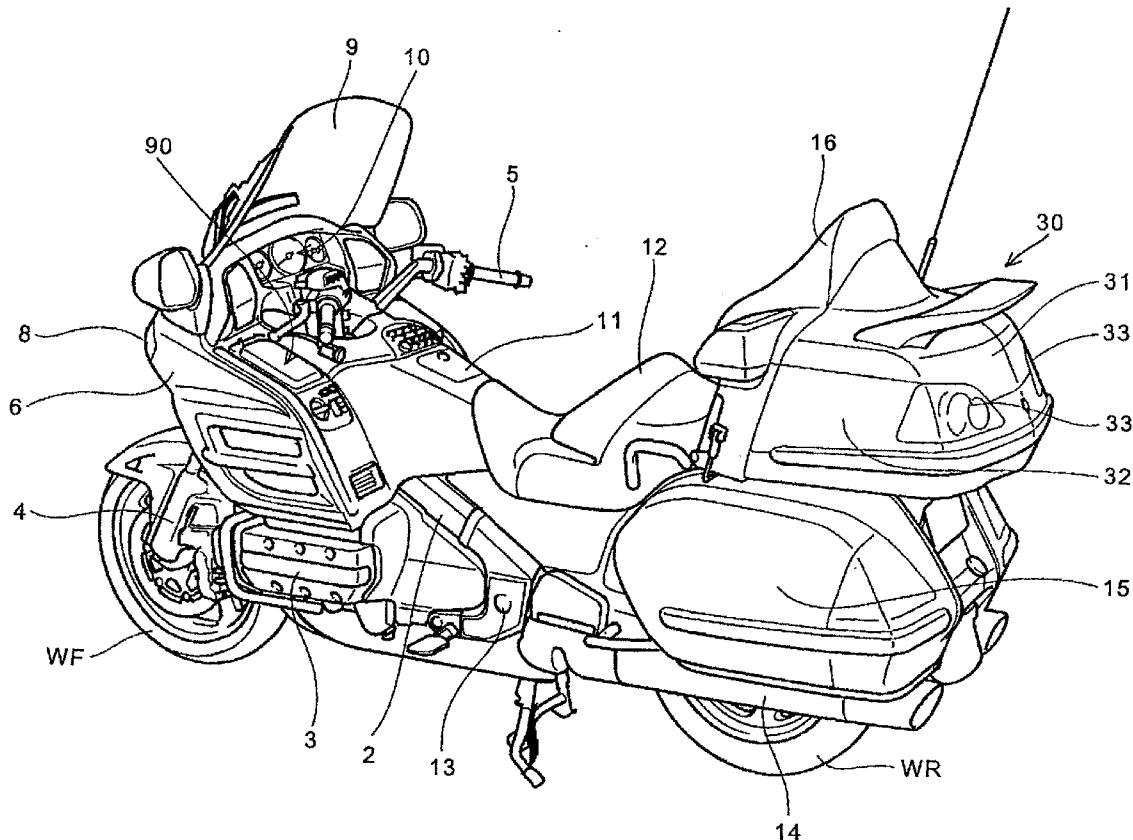
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(57) **ABSTRACT**

A locking device for a storage box in a vehicle includes a lock configured to place the storage box in a closed state or an open state, and an actuator configured to drive the lock. The locking device further includes a button configured to place the storage box in the open state. The locking device is configured to perform an authentication of a portable key when the button is operated and the storage box is closed. When the portable key is authenticated when the button is operated, the lock is configured to place the storage box in the open state. When the portable key is not authenticated when the button is operated, the storage box is configured to be held in the closed state without the lock being driven. When the portable key is authenticated when the storage box is closed, the lock is configured to be driven to place the storage box in the closed state. When the portable key is not authenticated when the storage box is closed, the storage box is configured to be held in the open state without the lock being driven.



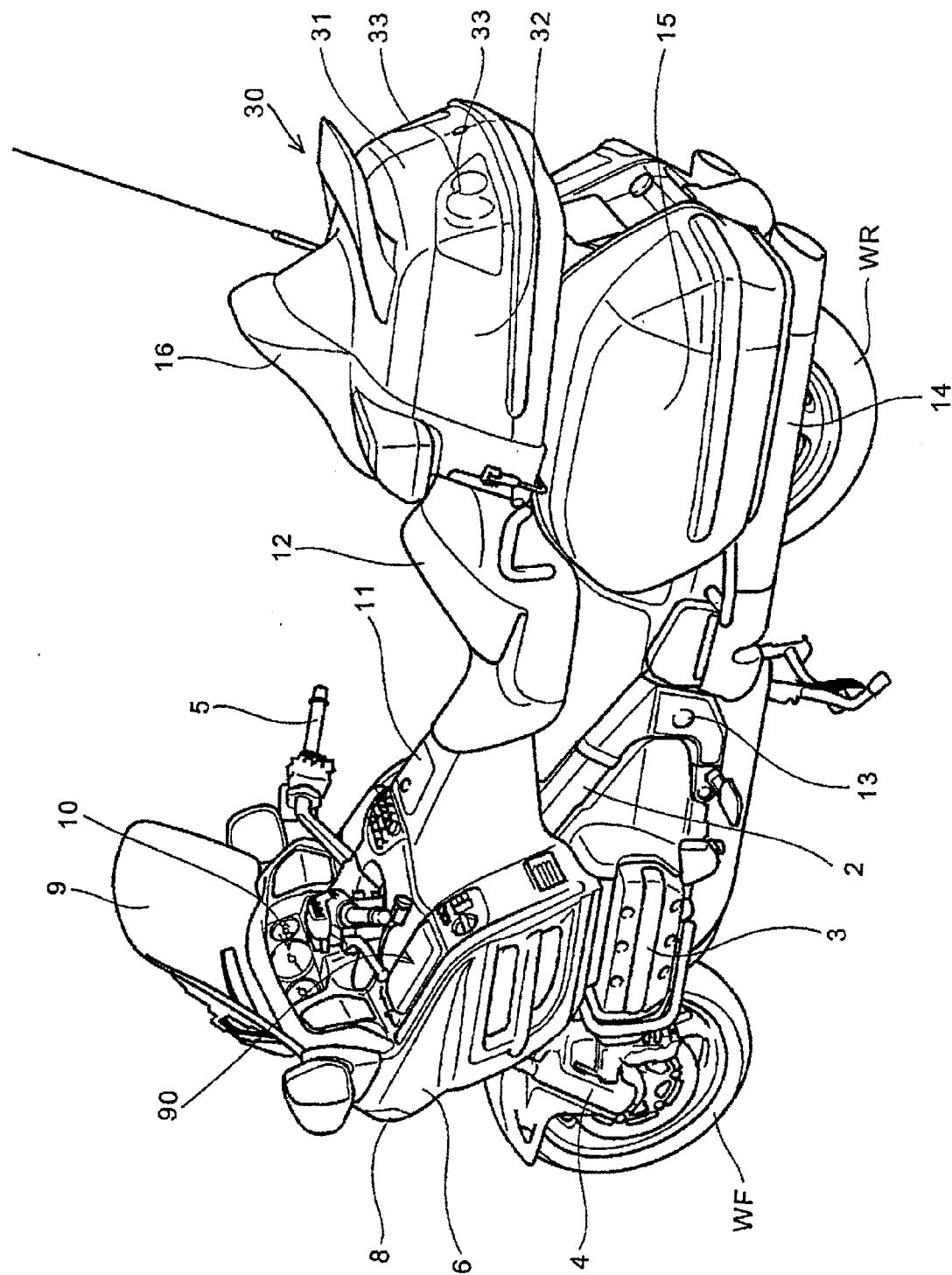


FIG. 1

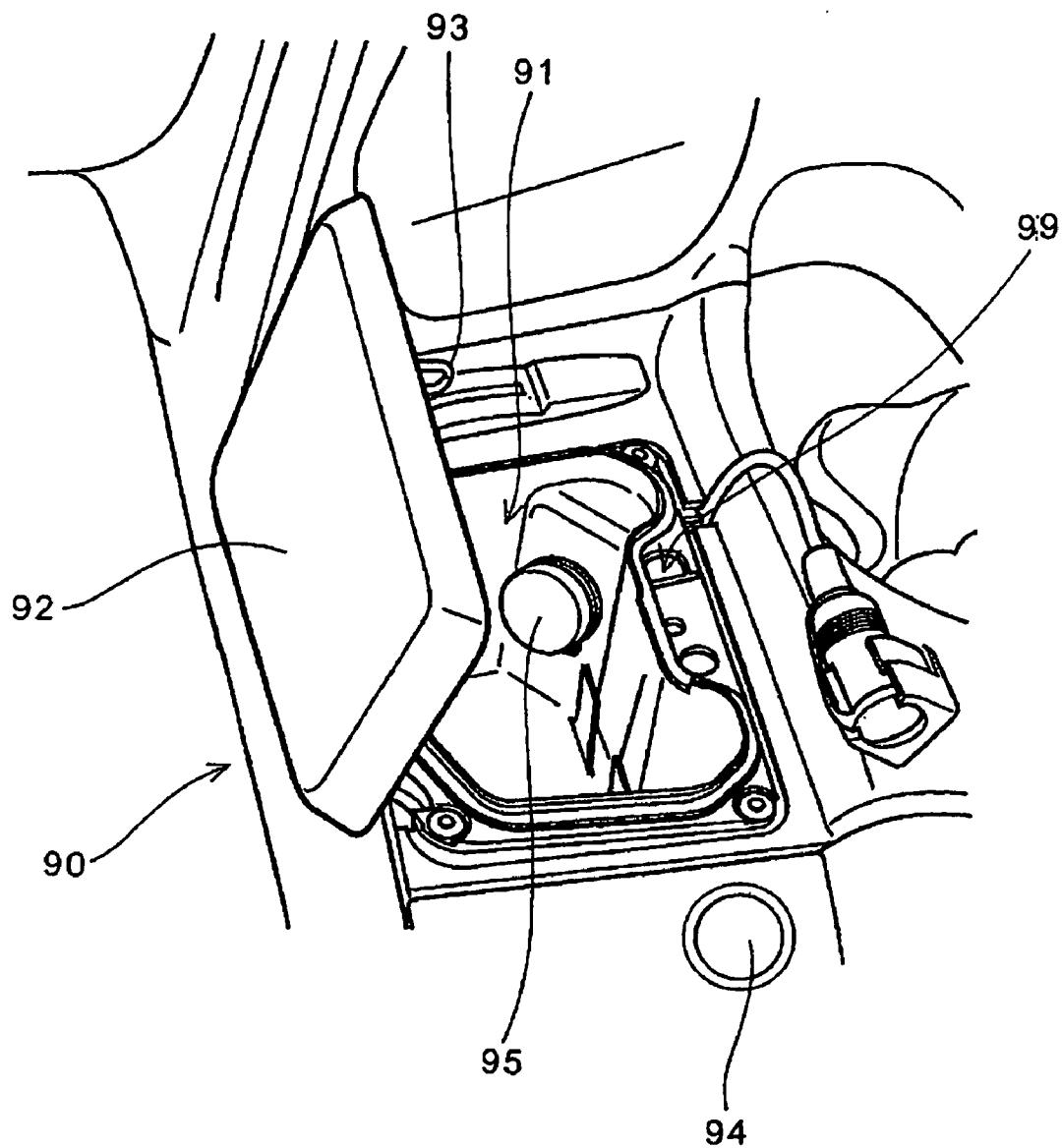


FIGURE 2

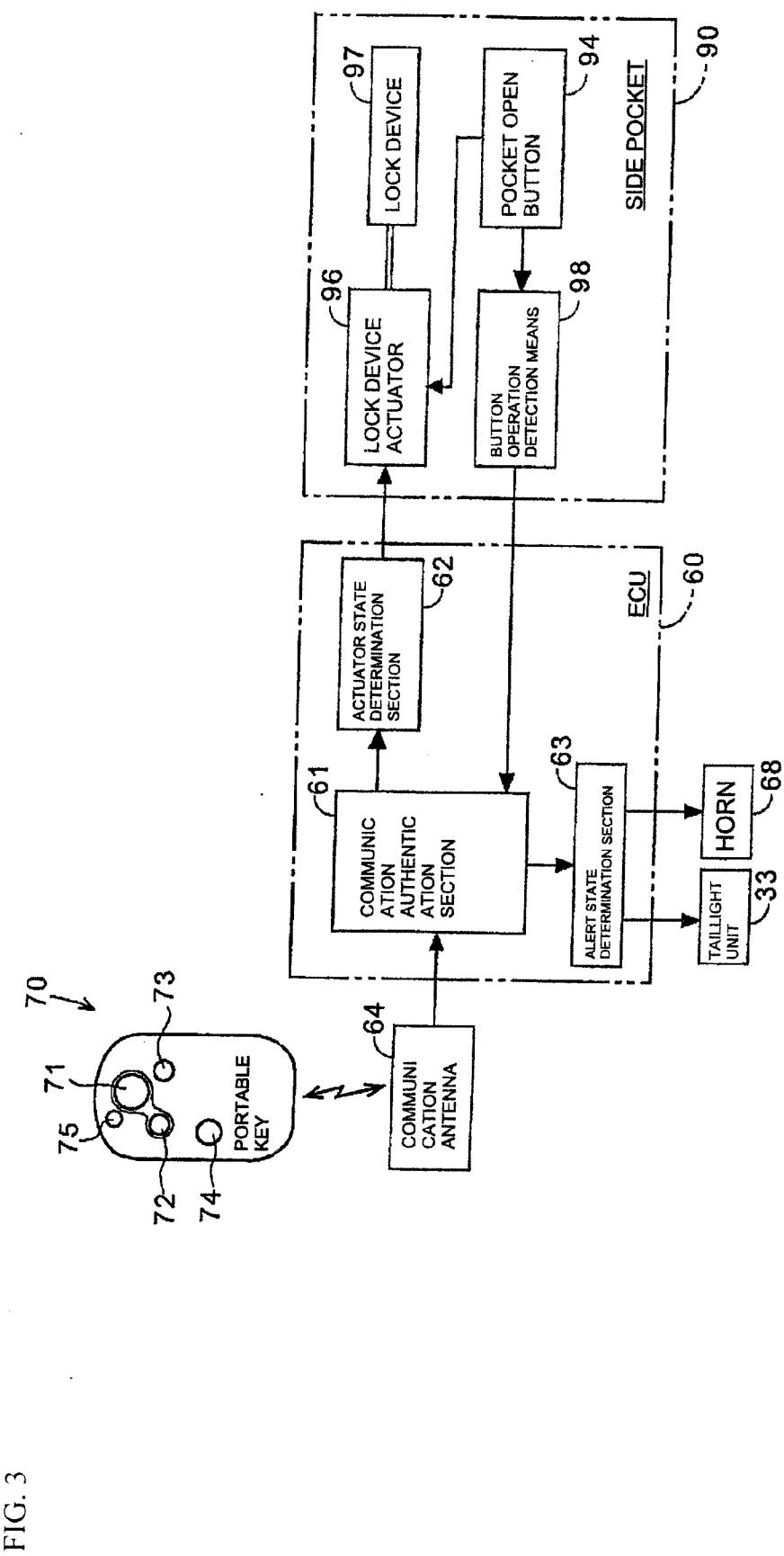
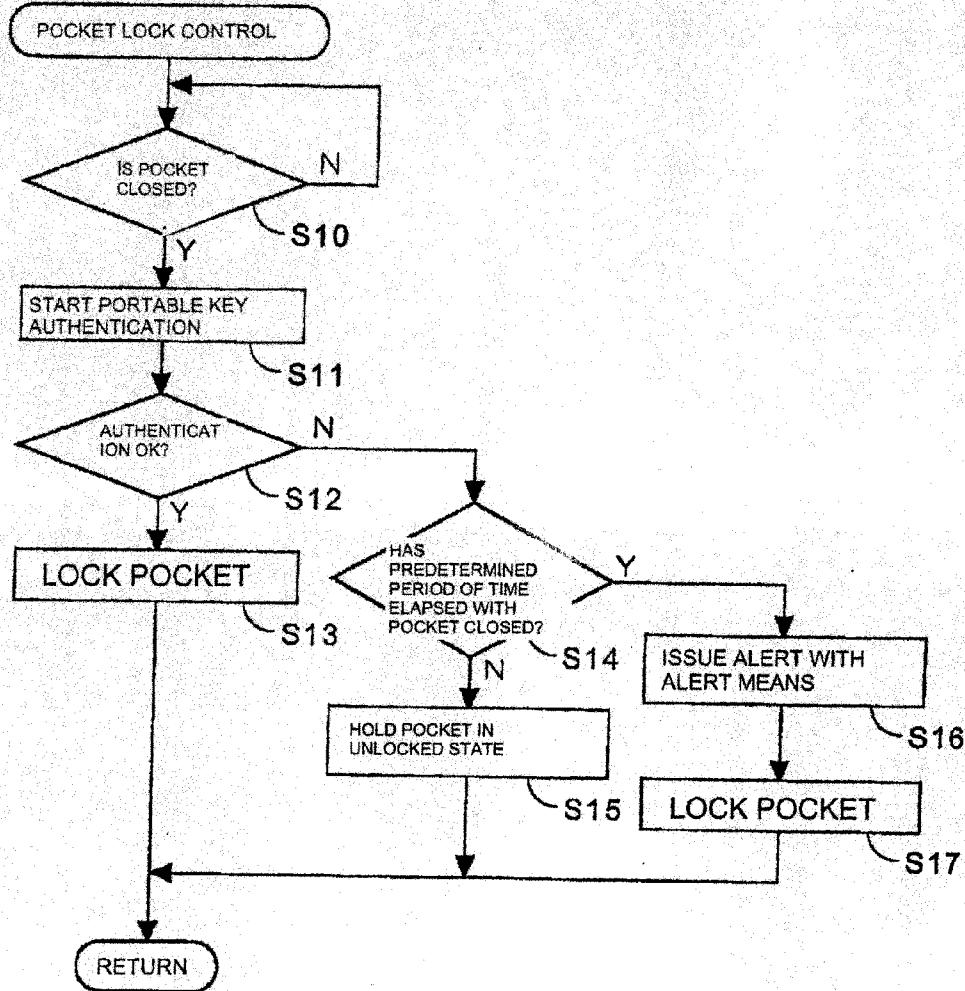


FIG. 4



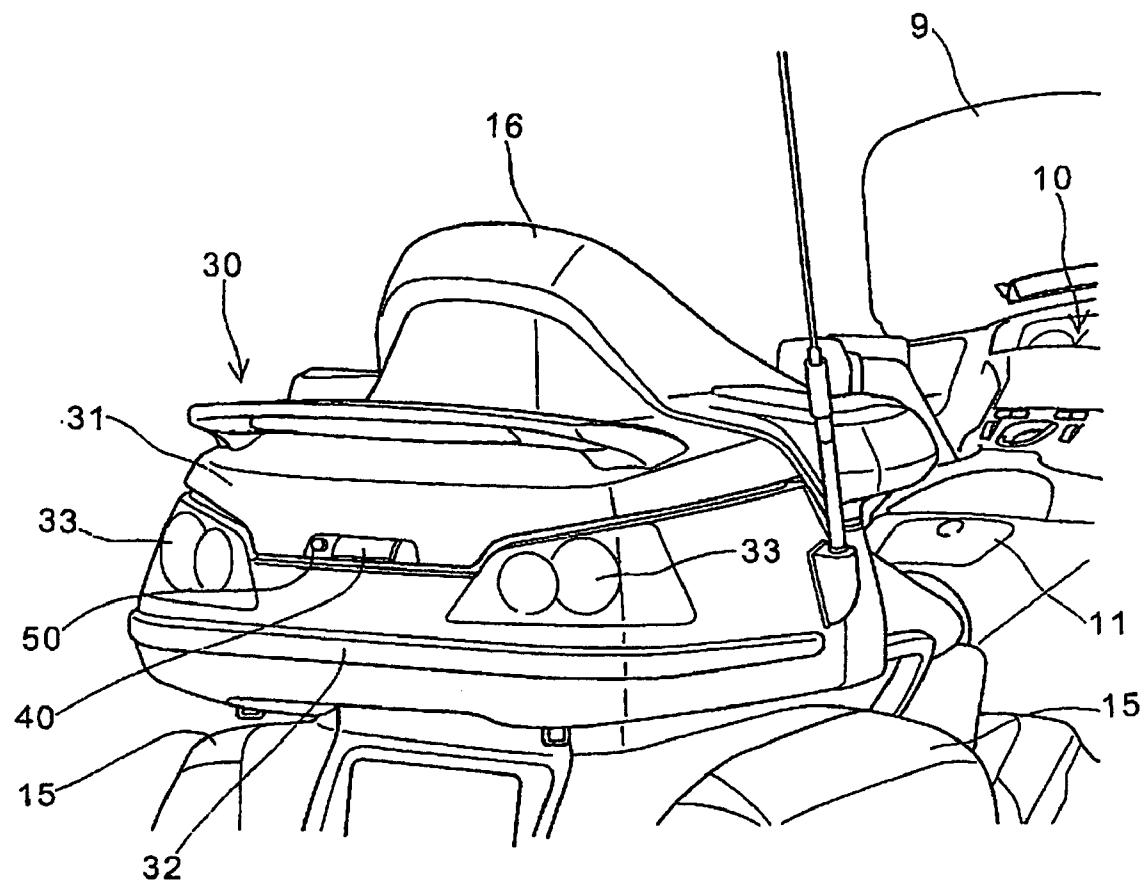


FIGURE 5

FIGURE 6

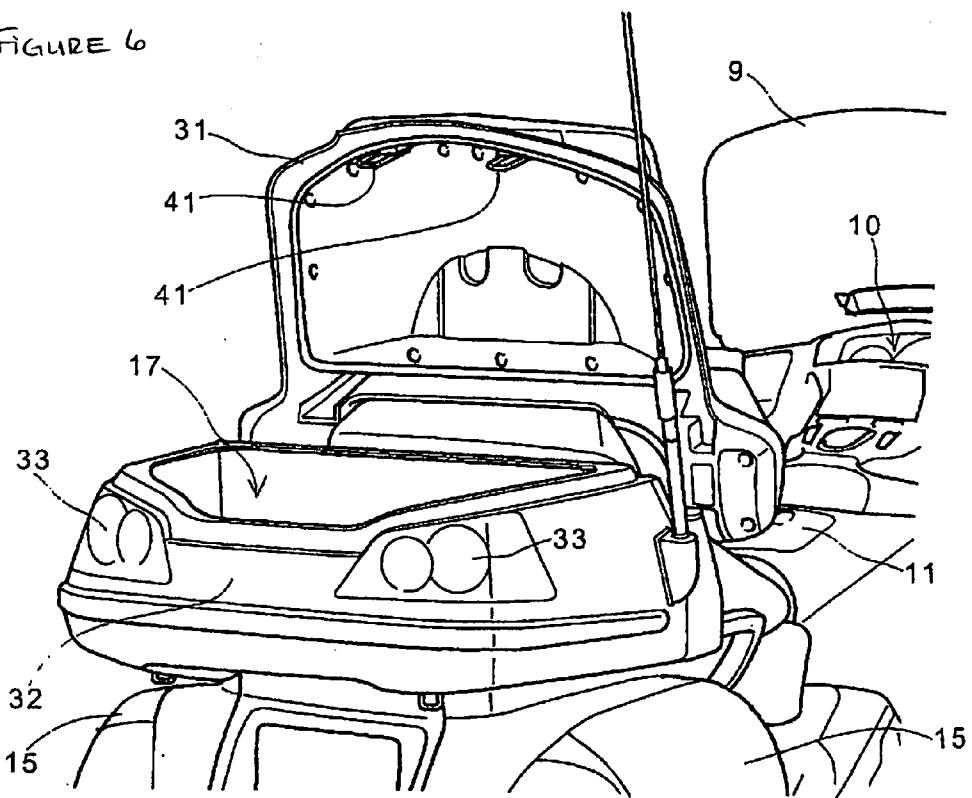
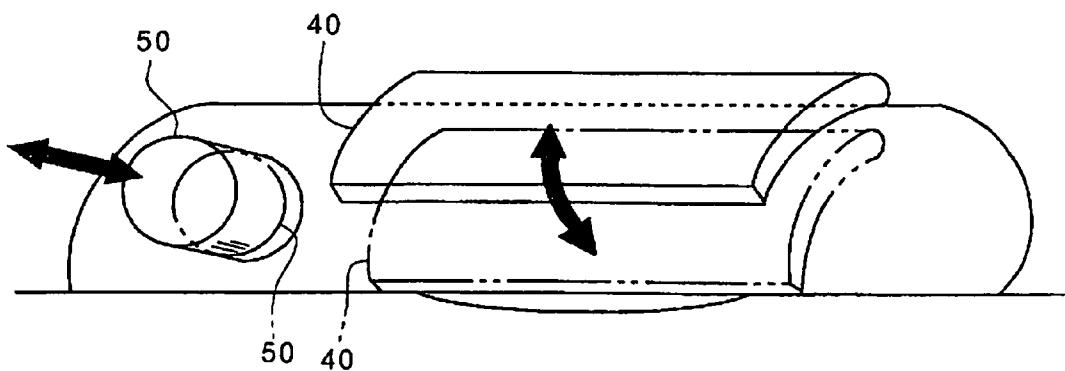


FIGURE 7



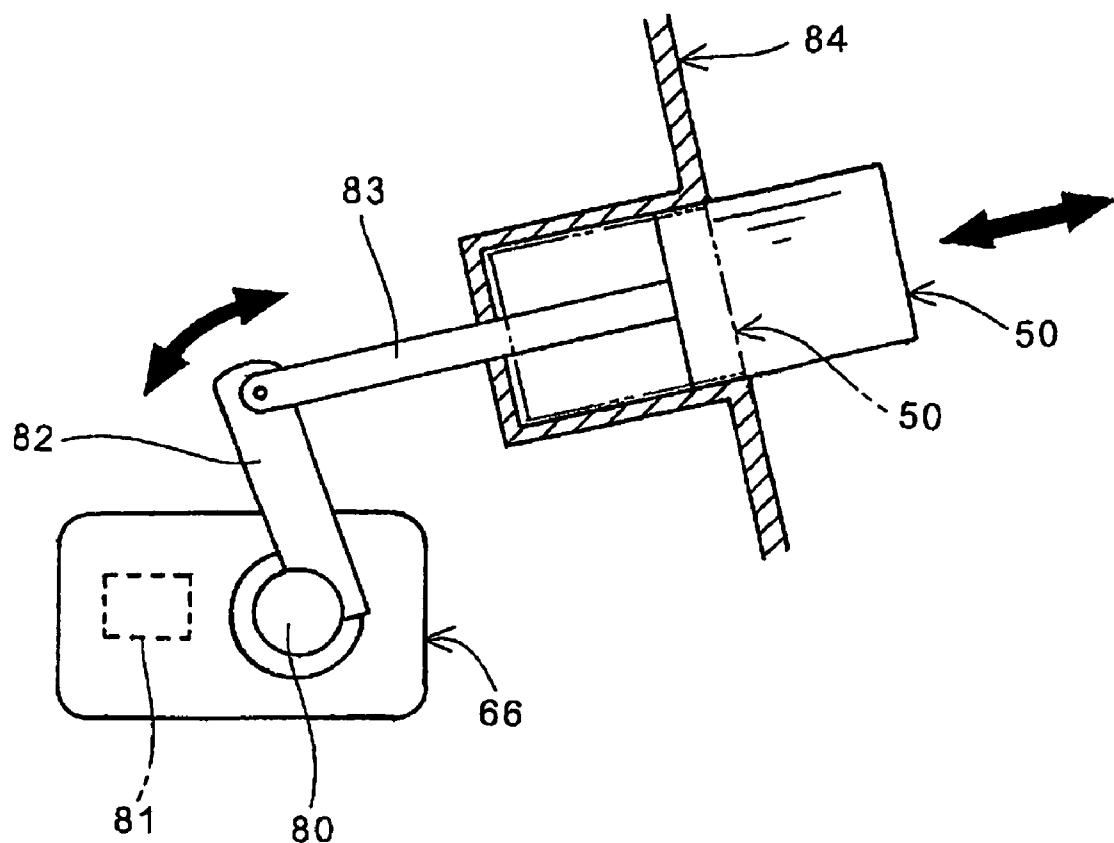


FIGURE 8

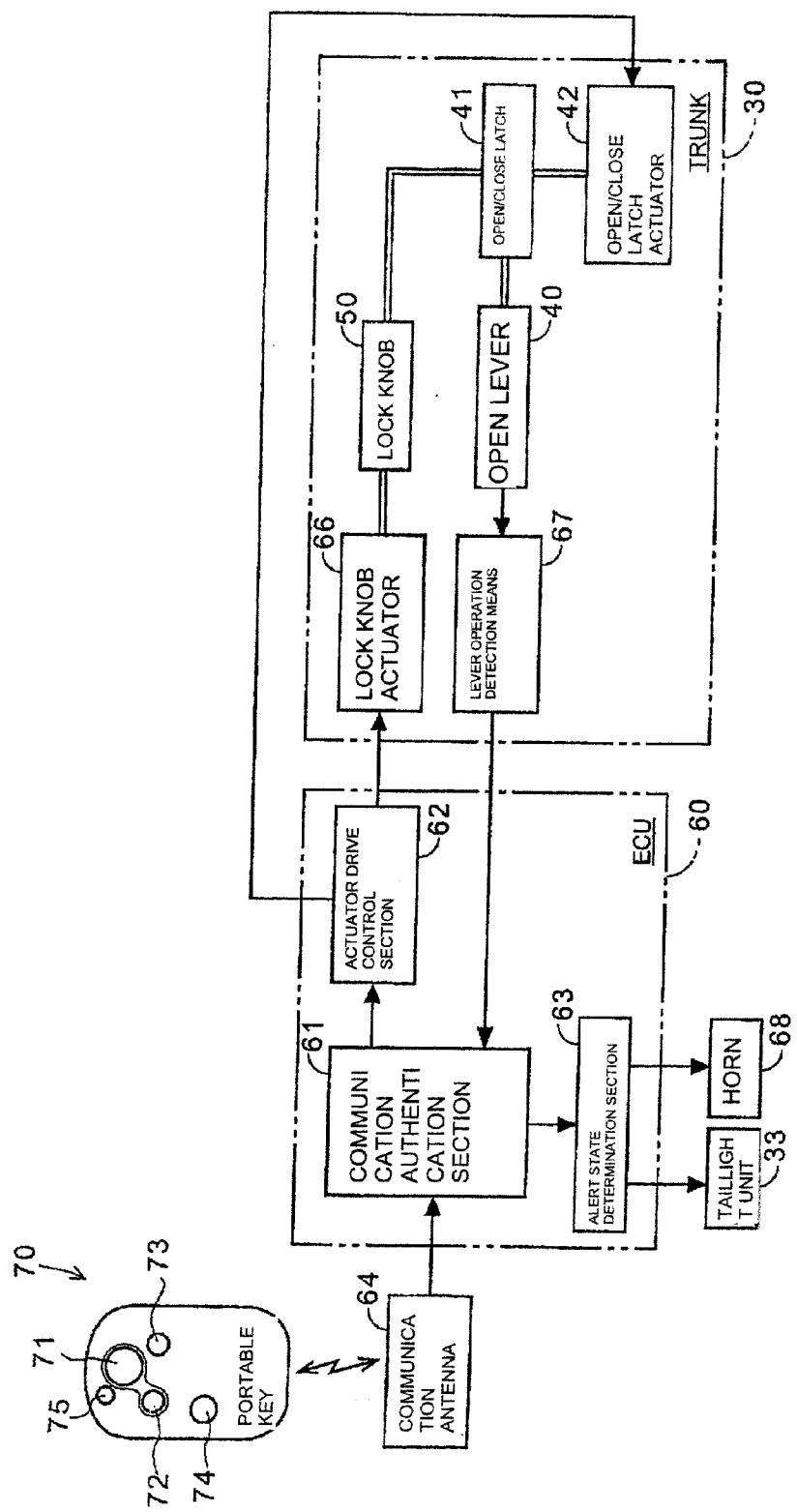
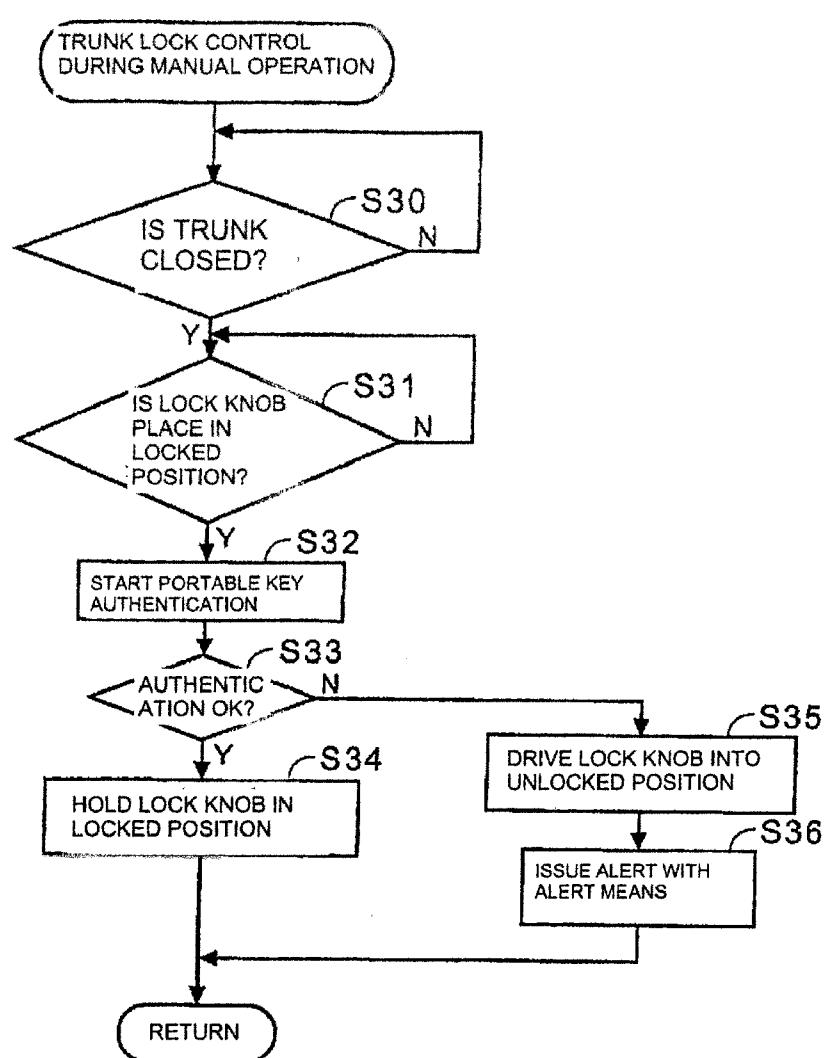


FIG. 9

FIG. 10



VEHICLE STORAGE BOX LOCKING DEVICE

BACKGROUND

[0001] 1. Field

[0002] The present invention relates to a locking device for a storage box in a vehicle and, more particularly, to a vehicle storage box locking device that changes from a locked state to an unlocked state, or vice versa, by performing authentication with a portable key uniquely set for the vehicle.

[0003] 2. Description of Related Art

[0004] Currently, a vehicle locking device is configured to, for example, start an engine of a vehicle or open a trunk or other storage box of the vehicle, when an ID uniquely set for the vehicle is authenticated through radio communication performed between a portable key possessed by a user and a control unit included in the vehicle. The locking device requires a measure that can prevent an “inadvertent locking” of the portable key inside the storage box, so that the portable key is no longer accessible.

[0005] Patent Document 1, Japanese Patent Laid-Open No. 2006-77408, describes a trunk locking system for a four-wheel vehicle, whereby a dedicated transmitter that detects a portable key existing inside a trunk is disposed inside the trunk. When the dedicated transmitter detects that the portable key has been locked in the trunk, an unlocking switch disposed on the outside of the trunk is enabled, so that the user can open the trunk even if the portable key is not in the user's possession.

[0006] Unfortunately, however, the technique described in Patent Document 1 has the following problem. The technique requires the use of the dedicated transmitter that detects the portable key existing inside the trunk, increasing the number of parts, and further complicating the arrangement of parts required for the trunk locking system. It is also difficult to apply the technique to a vehicle, such as a motorcycle, that has little extra space.

[0007] Therefore, it is desirable to provide a vehicle storage box locking device that can prevent a portable key from being locked in the vehicle by performing authentication of the portable key before a locking operation of the storage box.

SUMMARY

[0008] In one embodiment, the invention includes a locking device for a storage box in a vehicle. The locking device includes a lock configured to place the storage box in a closed state or an open state, and an actuator configured to drive the lock. The locking device further includes a button configured to place the storage box in the open state. The locking device is configured to perform an authentication of a portable key when the button is operated and the storage box is closed. When the portable key is authenticated when the button is operated, the lock is configured to place the storage box in the open state. When the portable key is not authenticated when the button is operated, the storage box is configured to be held in the closed state without the lock being driven. When the portable key is authenticated when the storage box is closed, the lock is configured to be driven to place the storage box in the closed state. When the portable key is not authenticated when the storage box is closed, the storage box is configured to be held in the open state without the lock being driven.

[0009] In another embodiment, the invention includes a locking device for a storage box in a vehicle. The locking device includes an open/close latch configured to change the

storage box between a closed state and an open state. The locking device further includes an open lever configured to drive the open/close latch in an open direction, and a lock knob. The lock knob is disposed outward of a vehicle body and is configured to be manually changed from an unlocked position to a locked position, and placed in the unlocked position from the locked position only by an actuator. The lock knob is also configured to be selectively placed in the locked position, whereby the storage box is configured to be brought into a locked state by prohibiting the open/close latch from being driven in the open direction. The lock knob is also configured to be selectively placed in the unlocked position, whereby the storage box is configured to be brought into an unlocked state by enabling the open/close latch to be driven in the open direction. The locking device further includes the actuator configured to selectively place the lock knob in one of the locked position and the unlocked position. The locking device is configured to authenticate a portable key, when the open lever is operated when the storage box is in the locked state. When the portable key is authenticated when the open lever is operated, the lock knob is configured to be driven into the unlocked position. When the portable key is not authenticated, the lock knob is configured to be held in the locked position. The locking device is also configured to authenticate the portable key, when the lock knob is changed from the unlocked position to the locked position. When the portable key is authenticated when the lock knob is operated, the lock knob is configured to be held in the locked position. When the portable key is not authenticated, the actuator is configured to place the lock knob in the unlocked position.

[0010] In another embodiment, the invention includes a locking device for a storage box in a vehicle. The locking device includes securing means for placing the storage box in a closed state or an open state. The locking device further includes actuating means for driving the lock device, and releasing means for placing the storage box in the open state. The locking device is configured to perform an authentication of a portable key when the releasing means is operated and the storage box is closed. When the portable key is authenticated when the releasing means is operated, the securing means is for placing the storage box in the open state. When the portable key is not authenticated when the releasing means is operated, the storage box is configured to be held in the closed state without the securing means being driven. When the portable key is authenticated when the storage box is closed, the securing means is for placing the storage box in the closed state. When the portable key is not authenticated when the storage box is closed, the storage box is configured to be held in the open state without the securing means being driven.

[0011] In another embodiment, the invention includes a locking device for a storage box in a vehicle. The locking device includes latching means for changing the storage box between a closed state and an open state. The locking device further includes levering means for driving the latching means in an open direction, and securing means disposed outward of a vehicle body. The securing means is for manually changing the locking device from an unlocked position to a locked position. The securing means is also for selectively placing the locking device in the locked position, whereby the storage box is configured to be brought into a locked state by prohibiting the open/close latch from being driven in the open direction. The securing means is also for placing the locking device in the unlocked position, whereby the storage box is configured to be brought into an unlocked state by enabling

the open/close latch to be driven in the open direction. The locking device further includes actuating means for selectively placing the securing means in one of the locked position and the unlocked position. The locking device is configured to authenticate a portable key, when the levering means is operated when the storage box is in the locked state. When the portable key is authenticated when the levering means is operated, the actuating means is for driving the securing means into the unlocked position. When the portable key is not authenticated, the actuating means is for driving the securing means into the locked position. The locking device is configured to authenticate the portable key, when the securing means is changed from the unlocked position to the locked position. When the portable key is authenticated when the securing means is operated, the actuating means is for driving the securing means to be held in the locked position. When the portable key is not authenticated, the actuating means is for placing the securing means in the unlocked position.

[0012] In another embodiment, the invention includes a method for changing a locking device of a storage box from a locked state to an unlocked state by performing authentication of a portable key uniquely set for a vehicle. The method includes determining whether the storage box is in a closed state or an open state, and performing the authentication of the portable key, using a locking device, when a button is operated and the storage box is closed. The method further includes placing the storage box in the open state, when the portable key is authenticated when the button is operated, and holding the storage box in the closed state without the locking device being driven, when the portable key is not authenticated when the button is operated. Further, the method includes placing the storage box in the closed state, when the portable key is authenticated when the storage box is closed, and holding the storage box in the open state without the locking device being driven, when the portable key is not authenticated when the storage box is closed.

[0013] In another embodiment, the invention includes a method for changing a storage box in a vehicle between a locked state and an unlocked state by performing authentication of a portable key uniquely set for the vehicle. The method includes determining whether the storage box is in a closed state or an open state. The method further includes performing the authentication of the portable key, using a locking device, when an open lever is operated when the storage box is in the locked state. The performing includes driving the lock knob of the locking device to place the storage box in the unlocked state, when the portable key is authenticated when the open lever is operated. The performing further includes holding the lock knob of the locking device to place the storage box in the locked state, when the portable key is not authenticated. The method further includes performing an authentication of the portable key, using the locking device, when the lock knob of the locking device is changed from the unlocked position to the locked position. The performing includes holding the lock knob of the locking device to place the storage box in the locked state, when the portable key is authenticated when the lock knob is operated. Further, the performing includes actuating the locked knob to place the storage box in the unlocked state, when the portable key is not authenticated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 is a perspective view of a motorcycle including a storage box locking device according to an embodiment of the invention.

[0015] FIG. 2 is an enlarged view of a side pocket of the storage box locking device according to another embodiment of the invention.

[0016] FIG. 3 is a block diagram of an arrangement of a locking device and parts associated therewith of the side pocket according to another embodiment of the invention.

[0017] FIG. 4 is a flowchart diagram of control operations performed when the side pocket is to be closed according to another embodiment of the invention.

[0018] FIG. 5 is a partly enlarged view of a trunk in a closed state according to another embodiment of the invention.

[0019] FIG. 6 is a partly enlarged view of a trunk in an open state according to another embodiment of the invention.

[0020] FIG. 7 is an enlarged perspective view of an open lever and a lock knob according to another embodiment of the invention.

[0021] FIG. 8 is an illustration of the lock knob and a lock knob actuator that drives the lock knob, illustrating how the lock knob actuator actuates the lock knob according to another embodiment of the invention.

[0022] FIG. 9 is a block diagram of an arrangement of a locking device of the trunk and parts associated therewith according to another embodiment of the invention.

[0023] FIG. 10 is a flowchart of control operations performed when the trunk is locked through manual operation according to another embodiment of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0024] Embodiments to which the invention is applied will be described below with reference to the accompanying drawings.

[0025] FIG. 1 is a perspective view of a motorcycle 1 including a storage box locking device according to an embodiment of the invention. The motorcycle 1 is viewed from a left rearward direction. In this embodiment of the invention, the motorcycle 1 includes a steering stem (not shown) that is rotatably journaled forward of a vehicle body frame 2. A steering handlebar 5 and a pair of left and right front forks 4 are fixed on upper and lower portions, respectively, of the steering stem. A front wheel WF is rotatably journaled on lower ends of the front forks 4. A drive source, for example, engine 3, is suspended below the vehicle body frame 2. A side cowl 6 covers an area above the engine 3. A left-right two-lamp headlight 8 is disposed forward of the side cowl 6. A meter unit 10 is disposed at a central portion of the vehicle body forward of the steering handlebar 5. A windscreen 9 is attached above the meter unit 10. A storage box, for example, side pocket 90, is disposed above the side cowl 6 on the left side of the vehicle, in a vehicle width direction.

[0026] An openable lid 11 of a filler port is disposed at the center of the vehicle, in the vehicle width direction, rearward of the steering handlebar 5. A seat 12 is disposed rearward of the openable lid 11. A swing arm (not shown) that rotatably journals a rear wheel WR is vertically and swingably journaled on a pivot 13 at a rear end portion of the vehicle body frame 2. A pair of left and right mufflers 14 is mounted on outboard sides of the vehicle, in the vehicle width direction, of the swing arm. A pair of left and right saddle bags 15 is mounted on upper portions of the mufflers 14. A storage box, for example, a trunk 30, is mounted above the saddle bags 15 at the center of the vehicle, in the vehicle width direction. The trunk 30 includes an openable trunk lid 31 disposed in an opening of a case 32. A pair of left and right taillight units 33

is disposed at a rear end portion of the case 32. A backrest 16 of a rear seat is disposed at a forward upper portion of the case 32.

[0027] FIG. 2 is an enlarged view of the side pocket 90 of the storage box locking device according to another embodiment of the invention. In this embodiment of the invention, the side pocket 90 includes a storage portion 91 and a pocket lid 92 that is mounted over an opening of the storage portion 91 using a hinge (not shown). The pocket lid 92 is in an open direction at all times by a positioning means (not shown). The side pocket 90 is configured to maintain a closed state, whereby a lock device (not shown) disposed inside an engagement hole 99 grips a hook 93 provided in a standing condition on a backside of the pocket lid 92. An open button 94 is configured to drive the lock device to release the hook 93, specifically, for opening the pocket lid 92 in a rearward direction from the side pocket 90.

[0028] The operation of this embodiment of the side pocket 90 is as follows. When the open button 94 is operated under a predetermined condition, the pocket lid 92 automatically opens to an open position as shown in FIG. 2. When the pocket lid 92 is closed under a predetermined condition, the lock device is activated to maintain the pocket lid 92 in a closed state. A power outlet 95 for accessories can be disposed inside the storage portion 91.

[0029] FIG. 3 is a block diagram of an arrangement of the lock device and parts associated therewith of the side pocket 90 according to another embodiment of the invention. Like parts are identified by the same reference numerals as those used in FIGS. 1 and 2. In this embodiment of the invention, the side pocket 90 includes a pocket open button 94 (hereinafter referred, at times, to as the "open button") for driving a lock device 97. The side pocket 90 also includes a lock device actuator 96 and button operation detector 98. Specifically, the lock device actuator 96 drives the lock device 97. The button operation detector 98 detects that the open button 94 has been operated. The lock device 97 can include a pin configured to be engaged with the hook 93 and one of a solenoid, a motor, or other part that is configured to protrude or retract the pin.

[0030] A portable key 70 carried by an occupant of the vehicle includes a power button 74 of the portable key 70, a light-emitting diode 75 for operation check, a lock button 71, an unlock button 72, and a pop-up (automatically open) button 73 as used for operation of the above-referenced trunk 30. The portable key 70 is set to offer a communicable range of a radius of, for example, less than two meters from the vehicle.

[0031] An electronic control unit (ECU) 60 includes a communication authentication section 61, an actuator state determination section 62, and an alert state determination section 63. The actuator state determination section 62 applies a driving signal to the lock device actuator 96. The communication authentication section 61 performs authentication as to whether the portable key 70 is a valid portable key of the motorcycle 1 based on a radio wave received via a communication antenna 64. Authentication can be terminated when the communication authentication section 61 determines that the portable key 70 is a valid portable key of the motorcycle 1. The alert state determination section 63 determines whether the occupant needs to be alerted, based on the result of authentication performed by the communication authentication section 61, about a condition of the lock device 97.

[0032] The communication authentication section 61 performs authentication of the portable key 70 through, for example, collation of an encryption code contained in the

received radio wave. The alert state determination section 63, when determining that an alert is necessary, can activate an alert unit that can include, for example, the taillight units 33 and a horn 68. Various other modified forms are possible for the alert unit, including a headlight, a flasher unit, a display of a navigation system, and a speaker of an audio system.

[0033] FIG. 4 is a flowchart diagram of control operations performed when the side pocket 90 (hereinafter referred, at times, to as the "pocket 90") is to be locked according to another embodiment of the invention. For example, in step S10, a determination can be made whether the pocket lid 92 of the pocket 90 is closed. An open or closed position of the pocket lid 92 is detected by, for example, a switch sensor that detects that the pocket lid 92 leaves a closed position. Step S11 can be reached when, in step S10, the switch sensor determines that the pocket lid 92 is in the closed position. In step S11, authentication of the portable key 70 is started. As described above, authentication can be terminated when the communication authentication section 61 determines that the portable key 70 is a valid portable key of the motorcycle 1. In step S12, a determination can be made whether the authentication has been terminated. Step S13 is reached when, in step S12, the determination is made that the authentication has been terminated. In step S13, the lock device actuator 96 is driven to place the pocket lid 92 in a locked state and the series of control operations can be terminated.

[0034] Step S14 is reached when, in step S12, a determination is made that the authentication has not been terminated. In step S14, a determination can be made whether a predetermined period of time, e.g., 15 seconds has elapsed with the side pocket 90 closed. If, in step S14, the determination has been made that the predetermined period of time has not elapsed, the pocket 90 is held in an open state without the lock device 97 being driven (step S15), and the series of control operations can be terminated. If, in step S14, the determination has been made that the predetermined period of time has elapsed, step S16 is reached, and an alert is issued using the alert unit. In step S17 of this embodiment of the invention, the pocket 90 is placed in the locked state and the series of control operations is terminated. It should be noted that the portable key 70 is not authenticated, if the portable key 70 exists in an area outside a communicable range relative to a vehicle body side, or radio communication is disabled due to a faulty portable key 70 or a rundown battery. Further, the portable key 70 is authenticated, if the portable key 70 exists in an area within the communicable range relative to the vehicle body side, i.e., when the portable key 70 exists inside the pocket 90.

[0035] When the pocket 90 in the locked state is to be opened, authentication of the portable key 70 is performed as the open button 94 is operated. If the authentication is terminated, the lock device actuator 96 is driven to open the pocket lid 92. If the authentication is not terminated, the lock device actuator 96 is not driven and the pocket lid 92 remains in the closed position.

[0036] According to the locking and unlocking control of the side pocket 90 as described above, the side pocket 90 can be prevented from being opened or closed by any third person who does not carry the portable key 70. In addition, should the side pocket 90 be closed with the portable key 70 left therein, the authentication of the portable key 70 can be performed as the open button 94 is operated, so that the side pocket 90 can be opened, since it is confirmed during closing that radio communication is possible with the portable key 70. This prevents the portable key 70 from being locked in.

[0037] Additionally, if a predetermined period of time elapses with the pocket lid 92 closed, the side pocket 90 is locked even if the authentication with the portable key 70 is not terminated. Should the portable key 70 be faulty, therefore, the side pocket 90 can be closed at the will of the occupant.

[0038] FIGS. 5 and 6 are enlarged views of the trunk 30 as a storage box according to another embodiment of the invention. In particular, FIG. 5 illustrates a condition, whereby the trunk 30 is in a closed state. FIG. 6 illustrates a condition, whereby the trunk 30 is in an open state. Like parts are identified by the same reference numerals as those used in FIG. 1. In these embodiments of the invention, the trunk 30 includes a hinge (not shown) disposed at a front end portion of the case 32, with which to journal the trunk lid 31 to an open position. Referring also to FIG. 7 of an enlarged view, the trunk lid 31 includes an open lever 40 and a button-type lock knob 50, both disposed to extend outward from the vehicle body. The open lever 40 drives an open/close latch 41. The lock knob 50 pops up or down based on a locked state or an unlocked state of the trunk 30.

[0039] When the open lever 40 is operated with the trunk 30 in a closed and unlocked state, the open/close latch 41 is driven to be disengaged from a hook (not shown) on a side of the case 32, so that the trunk lid 31 is opened. When the trunk 30 is in the locked state, the open/close latch 41 is not driven even by operating the open lever 40, so that the trunk lid 31 is not to be opened. Alternatively, when the trunk lid 31 is to be closed, there is no need to use the open lever 40, instead simply pressing an upper portion of the trunk lid 31 downward can make the hook and the open/close latch 41 engage with each other to maintain the closed state.

[0040] The lock knob 50 can have, for example, a cylindrical shape and can be in an unlocked position (indicated by a solid line in FIG. 7), whereby the lock knob 50 protrudes from a mounting surface when the trunk 30 is in the unlocked state. When the trunk 30 is in the locked state, the lock knob 50 can be retracted into the mounting surface, whereby only a portion of the lock knob 50 is exposed (indicated by a dash-double-dot line in FIG. 7). This allows the occupant of the motorcycle 1 to determine whether the trunk 30 is in the locked or unlocked state by simply viewing the lock knob 50.

[0041] The lock knob 50 can also be configured in the locked position, whereby a round bottom operating face of the lock knob 50 is retracted to be flush with, or lower than, the mounting surface. This allows the lock knob 50, when in the unlocked position, to be depressed down into the locked position, preventing the occupant from inadvertently moving the lock knob 50 from the locked to the unlocked position.

[0042] The shapes and positions of the open lever 40 and the lock knob 50 are not limited to those described in the aforementioned embodiments of the invention and other shapes and positions are possible. For example, the open lever 40 and the lock knob 50 can be, for example, disposed on the side of the case 32, and the open/close latch 41 can also, for example, be disposed on the side of the case 32. The open lever 40 and the lock knob 50 can still be disposed on a lower surface or a side surface of the case 32, or can be disposed at separate places spaced apart from each other.

[0043] FIG. 8 is an illustration of the lock knob 50 and a lock knob actuator 66 that drives the lock knob 50, illustrating how the lock knob actuator 66 actuates the lock knob 50 according to another embodiment of the invention. In this embodiment of the invention, a rocking arm 82 is mounted on

a rocking shaft 80 of the lock knob actuator 66 that can include, for example, a solenoid or a motor. A driving rod 83 is connected to the rocking arm 82. The lock knob 50 is mounted on a leading end of the driving rod 83. According to the foregoing arrangements, driving the lock knob actuator 66 allows the lock knob 50 to be selectively placed in either the locked position or the unlocked position.

[0044] When the lock knob 50 is in the unlocked position, in which the lock knob 50 protrudes from a mounting surface 84, the lock knob 50 can be depressed from the outside. This can allow the lock knob 50 to be depressed into the mounting surface 84 into the locked position (indicated by a dash-double-dot line in FIG. 8), while rotating the rocking shaft 80 in a counterclockwise direction as shown in FIG. 8. Note that an output signal from a position sensor 81 that detects that the lock knob 50 is in either the locked position or the unlocked position is transmitted to the communication authentication section 61 of the ECU 60.

[0045] FIG. 9 is a block diagram of an arrangement of a locking device of the trunk 30 and parts associated therewith according to another embodiment of the invention. Like parts are identified by the same reference numerals as those used in the foregoing figures. Descriptions of the same arrangements as those illustrated in FIG. 3 will not be reiterated. As described earlier in another embodiment of the invention, the trunk 30 includes the open lever 40 for driving the open/close latch 41 and the lock knob 50 that prohibits driving of the open/close latch 41 in the locked state. The trunk 30 also includes the lock knob actuator 66, an open/close latch actuator 42, and a lever operation detector 67. Specifically, the lock knob actuator 66 drives the lock knob 50. The open/close latch actuator 42 drives the open/close latch 41. The lever operation detector 67 detects that the open lever 40 has been operated. The lever operation detector 67 can be structured to include, for example, an ON-OFF type switch sensor that detects that the lever has moved out of an initial position.

[0046] The trunk 30 is configured to be operable to be locked, unlocked, or automatically opened by the portable key 70 carried by the occupant. The ECU 60, according to this embodiment of the invention includes the actuator state determination section 62, the communication authentication section 61, and the alert state determination section 63. Specifically, the actuator state determination section 62 applies a driving signal to each of the lock knob actuator 66 and the open/close latch actuator 42. The communication authentication section 61 performs authentication as to whether the portable key 70 is a valid portable key of the motorcycle 1 based on a radio wave received via a communication antenna 64. The alert state determination section 63 determines whether the occupant needs to be alerted based on the result of authentication performed by the communication authentication section 61 and the condition of the lock knob 50.

[0047] FIG. 10 is a flowchart of control operations performed when the trunk 30 is locked through manual operation according to another embodiment of the invention. In this embodiment of the invention, in step S30, a determination can be made whether the trunk 30 is closed. Step S31 is reached when, in step S30, the determination is made that the trunk 30 is closed. The determination whether the trunk lid 31 is in the closed state or the open state can be detected by, for example, an ON-OFF type sensor that detects that the trunk lid 31 moves out of the closed position. In step S31, a determination can be made whether the lock knob 50 is placed in the locked position. Step S32 is reached when, in step S31, a determi-

nation has been made that the lock knob **50** is in a locked position, and authentication of the portable key **70** can be started. Note that the operation returns to steps S30 and S31, when steps S30 and S31 are determined in the negative, respectively.

[0048] In step S33, a determination can be made whether the authentication has been terminated. Step S34 is reached and the lock knob **50** is held in the locked position when, in step S33, a determination is made that the authentication has been terminated. This completes the series of control operations. Note that, if step S33 is determined in the negative, specifically, if it is determined that an operator who does not carry the portable key **70** with him or her presses the lock knob **50**, the operation proceeds to step S35. In step S35, the lock knob actuator **66** returns the lock knob **50** to the unlocked position and, in step S36, an alert is issued using the alert unit.

[0049] When the trunk **30** in the locked state is to be opened manually, authentication of the portable key **70** is performed as the open lever **40** is operated. If the authentication is terminated, the lock knob actuator **66** is driven to place the lock knob **50** in the unlocked position, so that the trunk lid **31** is opened. If the authentication is not terminated, the lock knob actuator **66** is not driven, so that the trunk **30** is held in the closed state.

[0050] According to the locking and unlocking control of the trunk **30** as described above, the trunk **30** can be prevented from being opened or closed by any third person who does not carry the portable key **70** with him or her. In addition, should the trunk **30** be closed with the portable key **70** left therein and should the lock knob **50** then be further depressed, the trunk **30** can still be opened by operating the open lever **40**. This prevents the portable key **70** from being locked in the trunk **30**.

[0051] As described above, in the storage box locking device according to embodiments of the invention, when the storage box, for example, the side pocket or the trunk, is closed, radio communication is carried out with the portable key and the storage box is to be placed in the locked state after an authentication of the portable key is terminated. Accordingly, the storage box can be opened again by operating the open lever, the open button or the like, even if the portable key is locked in the side pocket or the trunk. This prevents the portable key from being locked in the side pocket, the trunk, or other storage box.

[0052] The structures of the side pocket and the trunk, structures and positions of the open button of the side pocket, and the lock knob and the open lever of the trunk, and structures and configurations of actuators, sensors, and other parts, are not limited to those described in the embodiments of the invention previously discussed; rather, various modifications are possible. For example, the storage box locking device according to an embodiment of the invention can be applicable, for example, to a side pocket having a lock knob or a trunk having no lock knobs. Further, the storage box locking device according to an embodiment of the invention can be applied, for example, to a three-wheeled vehicle or a four-wheeled vehicle, in addition to the motorcycle previously discussed.

DESCRIPTION OF REFERENCE NUMERALS

- [0053] 1: Motorcycle (vehicle)
- [0054] 30: Trunk (storage box)
- [0055] 31: Trunk lid
- [0056] 32: Case

- [0057] 33: Taillight unit (alert unit)
- [0058] 40: Open lever
- [0059] 41: Open/close latch
- [0060] 42: Open/close latch actuator
- [0061] 50: Lock knob
- [0062] 60: ECU
- [0063] 61: Communication authentication section
- [0064] 62: Actuator state determination section
- [0065] 63: Alert state determination section
- [0066] 64: Communication antenna
- [0067] 66: Lock knob actuator
- [0068] 67: Lever operation detector
- [0069] 68: Horn (alert unit)
- [0070] 70: Portable key
- [0071] 90: Side pocket (storage box)
- [0072] 91: Storage portion
- [0073] 92: Pocket lid
- [0074] 93: Hook
- [0075] 94: Open button
- [0076] 96: Lock device actuator
- [0077] 97: Lock device
- [0078] 98: Button operation detector

We claim:

1. A locking device for a storage box in a vehicle, comprising:

a lock configured to place the storage box in a closed state or an open state;

an actuator configured to drive the lock; and

a button configured to place the storage box in the open state,

wherein the locking device is configured to perform an authentication of a portable key when the button is operated and the storage box is closed,

wherein, when the portable key is authenticated when the button is operated, the lock is configured to place the storage box in the open state, and wherein, when the portable key is not authenticated when the button is operated, the storage box is configured to be held in the closed state without the lock being driven, and

wherein, when the portable key is authenticated when the storage box is closed, the lock is configured to be driven to place the storage box in the closed state, and wherein, when the portable key is not authenticated when the storage box is closed, the storage box is configured to be held in the open state without the lock being driven.

2. The locking device according to claim 1, wherein the lock is further configured to maintain the storage box in the closed state, when the storage box is held in the closed state for a predetermined period of time and when the portable key is not authenticated.

3. The locking device of claim 1, further comprising: an authenticator configured to perform the authentication of the portable key,

wherein the authenticator is configured to terminate the authentication when the authenticator determines that the portable key is a valid portable key for the vehicle, and

wherein the authenticator is configured to continue the authentication when the authenticator determines that the portable key is not the valid portable key for the vehicle.

4. The locking device of claim 1, wherein the locking device is configured to be implemented on the storage box of a motorcycle.

5. A locking device for a storage box in a vehicle, comprising:

an open/close latch configured to change the storage box between a closed state and an open state;
 an open lever configured to drive the open/close latch in an open direction;
 a lock knob configured to be disposed outward of a vehicle body, manually changed from an unlocked position to a locked position, placed in the unlocked position from the locked position only by an actuator, and selectively placed in one of the locked position, wherein the storage box is configured to be brought into a locked state by prohibiting the open/close latch from being driven in the open direction, and
 the unlocked position, wherein the storage box is configured to be brought into an unlocked state by enabling the open/close latch to be driven in the open direction,
 the locking device further comprising the actuator configured to selectively place the lock knob in one of the locked position and the unlocked position, wherein the locking device is configured to authenticate a portable key, when the open lever is operated when the storage box is in the locked state, wherein when the portable key is authenticated when the open lever is operated, the lock knob is configured to be driven into the unlocked position, and wherein when the portable key is not authenticated, the lock knob is configured to be held in the locked position, and wherein the locking device is configured to authenticate the portable key, when the lock knob is changed from the unlocked position to the locked position, wherein, when the portable key is authenticated when the lock knob is operated, the lock knob is configured to be held in the locked position, and wherein when the portable key is not authenticated, the actuator is configured to place the lock knob in the unlocked position.

6. The locking device of claim 5, further comprising: an authenticator configured to perform the authentication of the portable key, wherein the authenticator is configured to terminate the authentication when the authenticator determines that the portable key is a valid portable key for the vehicle, and

wherein the authenticator is configured to continue the authentication when the authenticator determines that the portable key is not the valid portable key for the vehicle.

7. The locking device of claim 5, wherein the locking device is configured to be implemented on the storage box of a motorcycle.

8. A locking device for a storage box in a vehicle, comprising:
 securing means for placing the storage box in a closed state or an open state;
 actuating means for driving the lock device; and
 releasing means for placing the storage box in the open state,
 wherein the locking device is configured to perform an authentication of a portable key when the releasing means is operated and the storage box is closed,

wherein, when the portable key is authenticated when the releasing means is operated, the securing means is for placing the storage box in the open state, and wherein, when the portable key is not authenticated when the releasing means is operated, the storage box is configured to be held in the closed state without the securing means being driven,

wherein, when the portable key is authenticated when the storage box is closed, the securing means is for placing the storage box in the closed state, and wherein, when the portable key is not authenticated when the storage box is closed, the storage box is configured to be held in the open state without the securing means being driven.

9. A locking device for a storage box in a vehicle, comprising:

latching means for changing the storage box between a closed state and an open state;
 levering means for driving the latching means in an open direction;
 securing means disposed outward of a vehicle body for manually changing the locking device from an unlocked position to a locked position, and selectively placing the locking device in one of the locked position, wherein the storage box is configured to be brought into a locked state by prohibiting the open/close latch from being driven in the open direction, and
 the unlocked position, wherein the storage box is configured to be brought into an unlocked state by enabling the open/close latch to be driven in the open direction,

the locking device further comprising actuating means for selectively placing the securing means in one of the locked position and the unlocked position, wherein the locking device is configured to authenticate a portable key, when the levering means is operated when the storage box is in the locked state, wherein when the portable key is authenticated when the levering means is operated, the actuating means is for driving the securing means into the unlocked position, and wherein when the portable key is not authenticated, the actuating means is for driving the securing means into the locked position, and

wherein the locking device is configured to authenticate the portable key, when the securing means is changed from the unlocked position to the locked position, wherein, when the portable key is authenticated when the securing means is operated, the actuating means is for driving the securing means to be held in the locked position, and wherein when the portable key is not authenticated, the actuating means is for placing the securing means in the unlocked position.

10. A method for changing a locking device of a storage box from a locked state to an unlocked state by performing authentication of a portable key uniquely set for a vehicle, the method comprising:

determining whether the storage box is in a closed state or an open state;
 performing the authentication of the portable key, using a locking device, when a button is operated and the storage box is closed;
 placing the storage box in the open state, when the portable key is authenticated when the button is operated;

holding the storage box in the closed state without the locking device being driven, when the portable key is not authenticated when the button is operated;

placing the storage box in the closed state, when the portable key is authenticated when the storage box is closed; and

holding the storage box in the open state without the locking device being driven, when the portable key is not authenticated when the storage box is closed.

11. The method of claim **10**, further comprising:

maintaining the storage box in the closed state, when the storage box is held in the closed state for a predetermined period of time and when the portable key is not authenticated.

12. The method of claim **10**, further comprising:

terminating the authentication of the portable key when a determination has been made that the portable key is a valid portable key for the vehicle.

13. A method for changing a storage box in a vehicle between a locked state and an unlocked state by performing authentication of a portable key uniquely set for the vehicle, the method comprising:

determining whether the storage box is in a closed state or an open state;

performing the authentication of the portable key, using a locking device, when an open lever is operated when the storage box is in the locked state, the performing comprising

driving the lock knob of the locking device to place the storage box in the unlocked state, when the portable key is authenticated when the open lever is operated, and

holding the lock knob of the locking device to place the storage box in the locked state, when the portable key is not authenticated; and

performing an authentication of the portable key, using the locking device, when the lock knob of the locking device is changed from the unlocked position to the locked position, the performing comprising

holding the lock knob of the locking device to place the storage box in the locked state, when the portable key is authenticated when the lock knob is operated, and actuating the locked knob to place the storage box in the unlocked state, when the portable key is not authenticated.

14. The method of claim **13**, further comprising:

terminating the authentication of the portable key when a determination has been made that the portable key is a valid portable key for the vehicle.

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