DOOR LOCK WITH AUTOMATIC AND EMERGENCY CONTROL SYSTEM

Inventors: Henri Savarieau, Montgeron; Georges Bourrie, Neuilly-sur-Seine, both of France

Assignee: R. Alkan Cie, Paris, France

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Prior Art

United States Patent

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Primary Examiner—Albert G. Craig, Jr.
Attorney—William C. Linton et al.

ABSTRACT

The door locking device according to this invention is characterized in that it comprises a guiding sleeve disposed within the locker or like box and having slidably mounted therein a piston responsive to an electromagnet or a fluid pressure so as to actuate with its lateral surface at least one lateral locking member movable in said locker and adapted to co-act with a retaining member rigid with the door so as to lock or release this door according as said piston is in its front or back position in said sleeve.

16 Claims, 8 Drawing Figures
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BACKGROUND OF THE INVENTION

The present invention relates to door locking systems and has specific reference to a door locking device adapted to be actuated either automatically, for example electrically or through pressure-fluid means, or mechanically by manual means notably in case of emergency.

This invention is applicable more particularly to the locking of a normally closed box or small locker the opening of which may become necessary under certain specific conditions. Thus, for instance, the present invention is applicable to the closing of lockers enclosing oxygen masks on passenger airliners flying at high altitude. For obvious reasons, in this specific application the primary requirement of the door opening device is a high degree of reliability and it is the essential object of the present invention to provide for each locker of this type a device capable of opening same with the maximum reliability while having very reduced overall dimensions.

SUMMARY OF THE INVENTION

The door locking device according to this invention is characterized in that it comprises a guiding sleeve disposed within the locker or like box and having slidably mounted therein a piston responsive to an electromagnet or a fluid pressure so as to actuate with its lateral surface at least one lateral locking member movable about said piston and adapted to coact with a retaining member rigid with the door so as to lock or release this door according as said piston is in its front or back position in said sleeve.

To open the door, the piston is advantageously actuated in a direction opposite to said door to permit the manual opening thereof by exerting a pressure against the piston through a small aperture formed in the door or through the gap or slit formed or left between the door and its frame, for instance by using a special rod kept by the personnel (airhostess, steward, etc.), either for an emergency opening, in case of failure of the automatic control system, or for service maintenance requirements.

According to a preferred form of embodiment of this invention, said piston engages a recess formed in the internal surface of the door and the lateral locking member is pushed radially outwards by the lateral surface of the piston so as to engage an internal cavity of said recess and thus provide the requisite locking action, the door being released by causing the reverse movement of said locking member during the controlled backward stroke of the piston.

According to another form of embodiment of the invention the internal surface of the door carries an olive-shaped stud extending coaxially with the locking piston and adapted to engage a retaining mechanism comprising a pawl fulcrumed about a pivot pin parallel to the door and normally urged in its closing direction by the adjacent piston end, in the piston position nearest to said olive-shaped stud, the backward movement of said piston causing said pawl to release the stud and thus permit the door opening movement.

Said olive-shaped stud may be formed with an axial through hole for receiving a rod extending through said door and stud assembly, and adapted to push the piston in case of emergency by a manual opening manoeuvre.

According to a complementary feature characterizing this invention the ingress of the last-named axial through hole may be closed by a shutter-forming element for normally preventing the insertion of foreign bodies into said hole.

In either forms of embodiment broadly described hereinabove, instead of contemplating for the emergency manual actuation of the lock the pushing of said piston by means of an axial rod extending through a small aperture formed in the door, the piston movement may be obtained by using a bent rod introduced through the slit normally formed between the door and its frame on the side opposite to the door hinge. With this arrangement any risk of untimely door opening manoeuvre, by any unauthorized person tempted by the introduction of a small rod through the small hole formed in the door and aligned with the piston, is practically precluded.

The device according to this invention may be designed with a view to resort to modern industrial processes for making lightweight parts thereof, such as moulded plastic pieces.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to afford a clearer understanding of this invention and of the manner in which the same may be carried out, a few typical forms of embodiments thereof will now be described by way of example with reference to the accompanying drawings, in which the specific case of door locks for small lockers enclosing oxygen masks on board aircrafts is illustrated. However, it is obvious that the invention should not be construed as being strictly limited by this specific application, since many other applications may be contemplated within the scope of the invention. In the drawings:

FIG. 1 is an axial section showing a first form of embodiment of the locking device of this invention;
FIG. 2 is a similar section showing one portion of the device modified according to another form of embodiment of the invention;
FIG. 3 is a fragmentary cross-sectional view of the locker, showing the engagement of a curved rod for unlocking the door;
FIG. 4 is a similar section showing the device brought to its release or unlocking position by pushing said curved rod;
FIG. 5 is an axial section showing another form of embodiment of the device incorporating an olive-shaped retaining member;
FIG. 6 is an end view of the support of the device shown in FIG. 5;
FIG. 7 is a front view of the door illustrated in FIGS. 5 and 6, showing the shutter or tamper-proof seal of the passage formed through said olive-shaped member, and FIG. 8 shows a modified form of embodiment contemplated for an emergency actuation of the device by means of a rod introduced into the slit between the door and its frame.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1, the reference numeral 1 designates a fixed part of the locker which comprises a tapped hole 2 permitting the mounting and adjustment
of the fixed support 3 through a screw 4 revolving on the trunnion 5 of the fixed support.

This fixed support 3 constitutes the external body of a control electromagnet and encloses a coil 6 having its supply conductors 7 disposed in a lateral notch 8 of the fixed support 3 and inserted in an electrical control circuit comprising for example a current source and an electric switch adapted to close automatically under the control of an aneroid capsule or bellows detecting a predetermined reduction in the pressure of the interior atmosphere of the aircraft, in case the locker is used for enclosing an oxygen mask. However, if the locker encloses other safety or emergency equipments, the electric circuit may be controlled in any other suitable manner consistent with the specific equipment to be released for use.

At its lower end the fixed support 3 carries a guiding sleeve 9 slidably engaged by a piston 10 constituting the core of the electromagnet which is constantly urged outwards by a relatively weak spring 11 interposed between a shoulder 12 of said support 3 and another shoulder 13 formed on the piston head. The piston end or head comprises an extension 14 of reduced diameter beyond a larger portion consisting of a hardened portion 15 adapted to engage a circular set of locking balls 16 received in lateral apertures 17 formed in said sleeve 9 so as to project outwards when the ring 15 is coplanar with said balls (i.e., external or inoperative position of the piston, as shown in FIG. 1).

The outer end of sleeve 9, in the closed locker position, engages a recess 18 formed on the inner surface of the door 19 and the open end 20 of this recess is narrowed so that the balls can clear this end 20 only when they recede towards the piston axis as permitted when the piston 10 is attracted by and moved towards the electromagnet coil 6. A small aperture 21 is formed through the door 19, coaxially to said recess 18, so that the authorized personnel can introduce into this aperture 21 a rod permitting the manual actuation of the device by pushing back against the force of said weak spring 11 for unlocking the device and opening the door.

The normal or automatic operation of the device takes place under the control of the pressure within the passenger compartment of the aircraft, as already explained in the foregoing; in fact, a predetermined pressure drop causes through means known per se the energization of the electromagnet coil 6, whereby the core 10 is attracted in spite of the moderate force of weak spring 11. As a result, the narrower end portion 14 of piston 10 registers with the balls in lieu of ring 15, the balls 16 being thus allowed to recede towards the piston axis and thus permit the opening of door 19.

In the example described hereinabove with reference to FIG. 1, the balls 16 constitute the locking members of the device of this invention. However, it will readily occur to those conversant with the art that this arrangement should not be construed as limiting the invention since other locking members may be contemplated in lieu of said balls, for example in the form of elements having a different configuration and mode of action, as exemplified in FIG. 2 showing in axial section the external portion of the electromechanical control means of this modified form of embodiment.

In the example shown in FIG. 2 the piston 10 constituting the electromagnet core is similar to the piston of FIG. 1 and the corresponding parts are designated by the same reference numerals in either case. The sleeve 9 is also formed with lateral cavities 17 but the locking members, also disposed circularly as in the preceding example, consist in this construction of bent lugs 22 connected to the rear end of sleeve 9 by spring blades 23. Thus, when the piston 10 is moved away from the door 19 the lugs 22 are allowed to move inwards and thus permit the opening of door 19.

In the example illustrated in FIGS. 3 and 4 the device comprising a locking piston carried by the fixed portion of the locker and internally thereof may be substantially similar to the above-described device, for example with reference to FIG. 1. The recess 18 engaged by the sleeve 9 and piston 10 is mounted on the door 19 along its opening edge opposite the hinged edge, a slit being normally left or formed between this opening edge and the fixed frame 24 of the door. In this recess 18 and adjacent the frame 24 a lateral opening 25 extends towards the door beyond the end 14 of piston 10 in the forward position thereof is formed to permit the insertion, through the slit formed between the door and its frame and also through this opening 25, of a curved rod 26 adapted to project with its end between the piston end 14 and the door 19, as illustrated in FIG. 3.

In the example illustrated in FIGS. 3 and 4 the door is formed with an internal ledge 27 also formed with a suitable opening 28 permitting the passage of said curved rod 26.

When the curved rod 26 has thus been introduced it is clear that by pushing same inwards of the locker the piston 10 is caused to recede against the relatively reduced force of its return spring, thus releasing the locking members (not shown in FIGS. 3 and 4) and permitting the opening of door 19 as explained in the foregoing with reference to FIGS. 1 and 2. FIG. 4 shows the backward position of piston 10 which permits of opening the door 19.

This invention is also concerned with the special tool consisting of a curved rod adapted to be introduced between the locking piston and the door through the slit left or formed between the door and its frame on the side opposite to the door hinge.

In the exemplary form of embodiment illustrated in FIG. 5 the reference numeral 101 designates the locker to be closed and 102 is the door hinged at 103 and adapted to open instantaneously either by gravity or through the action of an opening spring (not shown). Mounted to the inner surface of this door is an olive-shaped stud 104 having its axis perpendicular to the door main surface; this stud 104 is formed with a base flange retained in a socket 105 secured to the door. Between the door and the stud flange a resilient washer 106 is disposed to permit a slight oscillation of the olive-shaped stud 104 and therefore an improved locking engagement between this stud and a retaining pawl to be described presently. The olive-shaped stud 104 has an axial hole 107 formed therein, this hole registering with the hole of washer 106 and also with a corresponding hole 108 formed through the door 102.

The fixed element of the structure to which the door 102 is hingedly mounted carries the locking device proper. This device comprises in this example an electromagnet and a plunger core. The electromagnet consists of a winding 109 housed in a case 110 covering a base plate 111 in a support-forming protection case comprising advantageously a pair of shells 112, 113 as-
sembled by means of bolts 114. The plunger core 115 is coaxial with the olive-shaped stud 104 and carries a retaining circlip or spring ring 116 limiting the stroke of the plunger core by abutting against a shoulder of said case 112, 113; this plunger core 115 is normally urged to its lower position, as seen in the drawing, by a coil compression spring 117 inserted between the base plate 111 and circlip 116, but it is adapted to rise while compressing the spring 117 when a suitable voltage is fed to the terminals of winding 109 through energizing conductors (not shown). In the lower position the lower end of plunger core 115 prevents the oscillation of a latch pawl 118 fulcrummed about a horizontal pivot pin 119 and adapted to wedge with one end or arm one side of the olive-shaped stud 104, the other side of stud 104 engaging the inner wall of case 112, 113, whereby the olive-shaped stud 104 is retained in the position to close the door 102. A spring 120 constantly urges the pawl 118 to its door-closing position.

When the electromagnet 109 is energized the plunger core 115 rises, thus releasing the pawl 118 and permitting the rocking thereof about the pivot pin 119 by the action of door 102, so that the stud 104 can drop and permit the opening of door 102.

To permit the proper adaptation of the relative positions of stud 104 and of the electromagnetic device, there are provided, in addition to the possibility of tilting the olive-shaped stud 104 mentioned in the foregoing, means for securing the electromagnetic device which include buttonholes 121 permitting the proper adjustment of the operative position thereof. Moreover, the door 102 is closed with the interposition of a plastic gasket 122 giving a certain flexibility to the position of these elements.

In case a failure in the current supply prevented the automatic opening of the device, this opening can nevertheless be obtained by introducing a thin metal rod through the door hole 108 and axial passage 107 of the olive-shaped stud 104, the thrust produced with this rod causing the plunger core 115 to move upwards and thus permits the rocking of pawl 118 and the opening of the door 102. This thrust exerted on the plunger core 115 also permits, before the door closing, the oscillation of pawl 118 to re-introduce the stud 104 into the locking device.

Considering again the specific case of the application of this invention to the closing of lockers containing an oxygen mask on board airliners, the current necessary for opening the lockers may be fed automatically, if desired, in case of undesired or accidental pressure drop in the passenger compartment, by using a suitable or known manometric device therefor. In this respect, it will be noted that the emergency opening device is of particular or unusual design to avoid any untimely action of the device by a passenger. In the case contemplated the door must be opened by an air hostess or steward conversant with the mode of operation of the device. For the same reasons, the door cannot be re-closed unless the same tool is resorted to, so that the qualified personnel can check the proper disposition of the contents of a locker before closing same.

To reduce the weight and cost of the device, all the component elements thereof, except of course the winding 109, the magnetic circuitry and the springs, may be moulded from suitable plastic material.

Although the axial passage 107 and the door hole 108 registering therewith are of relatively small diame-

ter and scarcely visible, it may be advantageous to provide a pivoting shutter 123 disposed against the inner surface of door 102. This shutter 123 is pivoted to a small pin 124 and extends through a slot formed in the lateral ledge of the door so as to project externally with a bent lug 125 movable in the gap 126 formed or left between the door 102 and its frame 127. This shutter 123 may consist for example of a lug formed beneath the olive-shaped stud 104 with a wider portion 128 in which a hole 129 is formed. In the normal position (lower or dash-line position in FIG. 7) of bent lug 125, the hole 129 is shifted in relation to the door hole 108 which is thus occluded by the wider portion 128, thus preventing the untimely introduction of a foreign body into the device. To free the door hole 108 the bent lug 125 of shutter 123 is moved to its other end position (dash and dot lines in FIG. 7) by means of the same thin metal rod provided for pushing the plunger core, the rod being introduced through the aforesaid gap 126; this operation causes the hole 129 to be aligned with the door hole 108 and stud passage 107, so that the rod can be introduced home through the stud 104 to push back the plunger core 115 and free the pawl 118.

The use of a single pawl such as 119 may be replaced by the use of two or three similar paws disposed around the olive-shaped stud 104. The locking piston 115 may if desired be actuated by means other than an electromagnetic device; thus, notably in the specific application concerning oxygen mask lockers on board airliners, this piston could be actuated directly by a manometric capsule or bellows responsive to any abnormal reduction in the atmospheric pressure in the passenger compartment.

Finally, the locking device is applicable to various equipments, whenever the opening of a door is to be controlled automatically, or remote-controlled, by using electric current or fluid pressure.

Instead of contemplating a manual emergency actuation of the device by using an axial rod engageable through a door orifice, which may lead to use the shutter device 123 described hereinafter, it is possible, according to a preferred form of embodiment of this invention, to push back the locking piston 115 by introducing a slightly curved rod engaging the slit normally formed or provided between the door and its frame, on the side opposite to the door hinge, and this alternate form of embodiment illustrated in FIG. 8 will now be described.

In this figure the reference numeral 102 designates similarly the door, 105 being the socket retaining the base flange of the olive-shaped stud 104, and 113 the case portion enclosing the locking mechanism which may be similar to the one shown in section in FIG. 5. This case is disposed behind the opening edge of the door which is opposite to the hinge shown in FIG. 8, and carries laterally towards the door frame an L-sectioned member 132 adapted to slide slightly in the direction of the axis of locking piston 115, this member 132 being guided by a screw 133 extending through an elongated aperture formed in this member and engaging a tapped hole formed in the case of the locking mechanism. The member 132 comprises a bent lug 134 registering with the piston end, adapted to be pushed by means of a slightly curved rod 135 inserted through the slit formed or left between the door 102 and frame 131. It is clear that when the member 132 is pushed by means of rod 135 the former pushes in turn the piston...
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115 to release the door. In the example illustrated the door 102 comprises an inner lip or ledge 136 in which an aperture 137 is formed for receiving said rod 135.

Although the present invention has been described with particular reference to a few typical forms of embodiment, it will readily occur to those skilled in the art that various modifications may be brought thereto without departing from the basic principles of the invention as set forth in the appended claims.

What we claim as new is:

1. Device for locking the door of a locker comprising a guiding sleeve, rigid with the inner part of said locker, piston slidably positioned in said sleeve, remote control means for actuating said piston, hollow retaining means rigid with the inner face of the locker door and adapted, in the closed position of the door, to axially surround the end of said sleeve, at least one lateral locking member disposed within said sleeve and adapted to co-operate with the lateral surface of said piston in order either to engage said retaining means thus securing the locking of the door, or to disengage said retaining means and allow the opening of the door, according as said piston is in a front or back position respectively, the locker door presenting in axial alignment with the piston axis an aperture allowing to impart to the piston, from the external face of the door in locked position, a manual pushing against the resistance of a relatively weak spring to permit an emergency release of the device.

2. Device as claimed in claim 1, wherein the remote control means actuating said piston is an electromagnet.

3. Device as claimed in claim 1, wherein the remote control means actuating said piston is a fluid pressure.

4. Device according to claim 1, characterized in that locking members are provided which consist of balls forming a ring in openings formed in said guiding sleeve.

5. Device according to claim 1, characterized in that said locking members are housed in lateral notches formed in said guiding sleeve on which said members are supported through spring blades.

6. An application of the device described in claim 3, in the specific case of the automatic control of the doors of individual lockers provided on board airliners and containing oxygen masks, in that said piston is moved backwards for releasing the locking system by energizing an electromagnet coil automatically through an aneroid capsule or bellows adapted to detect a predetermined reduction in the air pressure within the aircraft.

7. Device according to claim 1 with auxiliary or emergency manual control means for opening the door, characterized in that said retaining means rigid with the door consists of a recess adapted to receive said locking piston and formed on the side adjacent to the opening edge of the door which is opposite to the hinged side, a lateral aperture extending towards said door beyond the piston end in the front position thereof to permit the introduction, between said piston and said door, of the end of a special curved rod inserted in the slit formed between the door and its frame and through the lateral aperture of said recess solid with the door, so that the piston can be pushed axially inwards to open the door.

8. Locking device for a container door, of the automatic control type, acting by axial movement of a spring-loaded piston and provided with a manual emergency control means, characterized in that it comprises an olive-shaped stud coaxial with said piston and mounted on the inner surface of said door, a pawl, pivot pin connected to the container and positioned parallel to the plane of said door and said pawl being pivotally supported by said pin and normally held in the stud retaining position by holding the piston in its position nearest to said stud.

9. Device according to claim 8, characterized in that said piston constitutes the plunger core of an electromagnet adapted to release the door when the electromagnet winding is energized with a suitable electrical control voltage.

10. Device according to claim 8, characterized in that members connected to the container are enclosed in a protection case acting as a support and consisting of a pair of moulded plastic half-shells.

11. Device according to claim 10, characterized in that the support of said locking mechanism is mounted to the fixed portion of the structure equipped with the door adapted to be locked, by means of button-holes permitting the proper adjustment of the position of said support.

12. Device according to claim 8, characterized in that it further comprises a spring urging said pawl to its stud retaining position.

13. Device according to claim 8, characterized in that said olive-shaped stud is provided with an integral base flange adapted to be retained in a socket secured to the inner surface of the door and to oscillate slightly by causing the distortion of a resilient washer interposed between said base flange and said door.

14. Device according to claim 8, characterized in that said olive-shaped stud has formed therethrough an axial passage registering with a hole formed through the door, whereby said piston can be pushed back to its release position by introducing a metal rod through said door hole and stud passage, in case of failure of the automatic door opening control system.

15. Device according to claim 14, characterized in that it comprises between said olive-shaped stud and said door a shutter-like member adapted, in one position, to close the hole formed through the door for the passage of the emergency control rod.

16. Device according to claim 8, characterized in that said fixed structure carries in the vicinity of the door frame and opposite to the door hinge a sliding member formed with a head registering with the end of the locking piston for controlling the backward movement of said piston and adapted to be pushed back in turn by means of a rod formed with a slightly bent end portion which is inserted for the manual opening maneuver through the slit formed between the door and frame.

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