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Inventor(s) Jacotey; Jérémy et al.

Regulator assembly for an aircrew breathing mask

Abstract

A regulator assembly for an aircrew breathing mask includes a support and a mode selection knob mounted with the ability to pivot on the support. The selection knob is able to pivot between at least a first position, a second position and a third position. The mask further includes regulator designed to supply a breathing cavity at least in three modes of operation according to the position of the mode selection knob. At least one locking/unlocking device locks and unlocks the rotation of the mode selection knob towards the third position. The locking/unlocking device comprising has an operating member that pivots between a position in which the rotation of the mode selection knob is locked, and a position in which the rotation of the mode selection knob is unlocked.

Inventors: **Jacotey; Jérémy (Moissy-Cramayel, FR), Lamourette; Didier (Moissy-Cramayel, FR), Moreira; Serge (Moissy-Cramayel, FR)**

Applicant: **SAFRAN AEROTECHNICS** (Plaisir, FR)

Family ID: **1000008765022**

Assignee: **SAFRAN AEROTECHNICS (Plaisir, FR)**

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Primary Examiner: Ditmer; Kathryn E

Attorney, Agent or Firm: CHRISTENSEN O'CONNOR JOHNSON KINDNESS PLLC

Background/Summary

(1) The present disclosure relates to a control unit for an aircraft crew member's breathing mask.
(2) In a known manner, such a control unit for an aircraft crew member's breathing mask comprises: a holder, a mode-selection knob pivotally mounted on the holder about an axis of rotation between at least a first position EMER, a second position 100% and a third position N, a controller intended to be supplied from a source of breathing gas and adapted to supply a breathing cavity in at least three of the following modes of operation: when the mode-selector switch is in the first EMER position, the controller supplies the breathing cavity as long as the pressure in the breathing cavity is not higher than a first relative pressure to the ambient pressure, when the mode-selector switch is in the second position 100%, the controller supplies the breathing cavity as long as the pressure in the breathing cavity is not higher than a second pressure relative to the ambient pressure, the first pressure being higher than the second pressure, when the mode-selector switch is in the third position N, the controller supplies the breathing cavity with breathing gas diluted with air.
(3) The first position “EMER” corresponds to the “EMERGENCY” mode. It is selected in the event of smoke or fire in the cockpit. The second position “100%” corresponds to the “100%” mode. It offers protection against hypoxia. The third position “N” corresponds to the “NORMAL” mode. It can be used to limit oxygen consumption in preventive wear or on a descent profile landing. The selection button is by default in the second 100% position. The second 100% position is located in the middle between the first and third positions.
(4) The mode-selection button is not visible to the user when the mask is worn. Currently, the selection button is asymmetrical to allow the user to distinguish between the direction of rotation leading to “EMERGENCY” and “NORMAL” mode by touch. The selection button also has side markings to allow verification of the selected mode by a third party. Thus, current breathing masks have means of providing information on the selected mode of operation to the user, by means of the asymmetry of the button, and to third parties, by means of the side markings.
(5) Despite this asymmetry, without significant knowledge and frequent use of the respirator, it is difficult to know the direction of rotation between the “EMERGENCY” and “NORMAL” modes. In particular, in the event of a sudden emergency, the user may accidentally rotate the selection knob to “NORMAL” mode and lose protection against toxic fumes and gases. The user can select the wrong mode of operation if the information is misunderstood or if the user reacts in haste.
(6) The present disclosure is intended to provide a control unit that prevents accidental selection of “NORMAL” mode instead of “EMERGENCY” mode. The present disclosure is intended to

increase the level of safety of oxygen mask control units by preventing misuse of the mode-selection button.
(7) The invention improves the situation.
(8) The invention relates to a control unit for a respiratory mask comprising at least one locking/unlocking system adapted to lock and unlock the rotation of the mode-selection knob towards the third position, the locking/unlocking system comprising a operating member adapted to be pivoted between a position of locking the rotation of the mode-selection knob, and a position of unlocking the rotation of the mode-selection knob.
(9) Advantageously, the present disclosure mechanically prevents the selection of a wrong operating mode.
(10) The features set out in the following paragraphs can optionally be implemented. They can be implemented independently of each other or in combination with each other: the second position is positioned between the first position and the third position, and wherein said locking/unlocking system comprises an aperture formed in said holder; said aperture comprising a radial stop delimiting a first aperture portion and a second aperture portion, and wherein the operating member comprises a lug adapted to slide in the first aperture portion and to abut against said radial stop when the operating member is positioned in the locking position, said lug being adapted to slide in at least the second aperture portion, when the operating member is in the unlocking position. said aperture is in the form of at least one circular arc centred on the axis of rotation. the first aperture portion and the second aperture portion have the shape of an arc of a circle and wherein the arc of the circle of the second aperture portion has a radius different from the radius of the arc of the circle of the first aperture portion; the first aperture portion having a radial end wall forming a radial stop locking the passage of the lug in the second aperture portion when the operating member is in the locking position. the first aperture portion extends over a first angular sector and wherein the second aperture portion extends over the first angular sector and a further angular sector. the lug has a radial face extending perpendicular to the bottom of the mode-selector knob, said face bearing flat against the radial stop when the operating member is in the locking position. the operating member comprises a lever mounted to pivot relative to the mode-selection knob about a first pivot axis, the first pivot axis being parallel to the axis of rotation. said lug and said radial stop are disposed on one side of a plane, and wherein the operating member comprises an operating area disposed on the other side of said plane, said operating area being an area on which the user acts to unlock the rotation of the mode-selection knob; said plane being perpendicular to the bottom and passing through said first pivot axis and an end stop. the locking/unlocking system comprises a resilient element adapted to hold the operating member in the locking position, the resilient element being adapted to act between the operating member and a support wall of the mode-selection button. the resilient element comprises at least one compression spring adapted to be compressed by pressing on a part of the operating member to unlock the rotation of the mode-selection knob towards the third position. the support wall of the mode-selector button and/or the operating member comprises a guide suitable for guiding the resilient element during its compression; said guide comprising one of a circular housing and a guide pin. the peripheral rim of the mode-selector button has a through-opening, and wherein the operating member extends through said through-opening. the peripheral rim of the mode-selection button comprises a slot perpendicular to the axis of rotation which is extended by a cut-out parallel to the axis of rotation and opening out to the outside of the mode-selection button, and wherein a part of the peripheral rim delimited by the said slot and the said cut-out forms the operating member, the operating member being capable of pivoting by deformation of an axial part of the peripheral rim. the operating member has a through-recess, part of the through-recess is in the form of a flare, another part of the through-recess having a re-entrant wedge open to the flare, and wherein the support wall is perpendicular to the bottom and extends into the through-recess, said support wall being provided with a radial notch, the resilient element comprising at least one leaf spring wedgedly attached in said radial notch and in

the re-entrant wedge. the operating member comprises a through-recess, a part of the through-recess having a cylindrical shape, and wherein the support wall comprises at one of its ends a pivot arranged in the cylindrical part of the recess, said pivot forming the first pivot axis.

Description

BRIEF DESCRIPTION OF THE FIGURES

(1) FIG. **1** is a perspective view of a breathing mask with a control unit according to the present invention;

(2) FIG. **2** is a view of one side of the control unit according to the invention, said side being marked with arrow II in FIG. **1**,

(3) FIG. **3** is a perspective view of the mode-selection button according to a first embodiment of the control unit according to the invention;

(4) FIG. **4** is a view of a rear face of a cover of the control unit according to the first embodiment of the present invention, when the mode-selection knob is in a locking position;

(5) FIG. **5** is a view of a rear face of a cover of the control unit according to the first embodiment of the present invention, when the mode-selection knob is in an unlocked position;

(6) FIG. **6** is a front view of a first variant of the mode-selection button according to the first embodiment of the invention;

(7) FIG. **7** is a view of a rear side of the first variant of the mode-selection button shown in FIG. **6**;

(8) FIG. **8** is a front view of a second variant of the mode-selection button according to the first embodiment of the invention;

(9) FIG. **9** is a view of a rear side of the second variant of the mode-selector switch shown in FIG. **6**;

(10) FIG. **10** is a side perspective view of a cover and a mode-selection knob of the control unit according to a second embodiment of the invention;

(11) FIG. **11** is a perspective view of a cover and a mode-selection knob of the control unit according to the second embodiment of the invention wherein the mode-selection knob is cut along a plane parallel to the bottom;

(12) FIG. **12** is a view of a face of the cover of the control unit according to the second embodiment of the invention;

(13) FIG. **13** is a front view of a first variant of the control unit according to the second embodiment of the invention;

(14) FIG. **14** is a view of a rear side of the first variant of the control unit according to the second embodiment of the invention;

(15) FIG. **15** is a front view of a second variant of the control unit according to the second embodiment of the invention;

(16) FIG. **16** is a view of a rear side of the second variant of the control unit according to the second embodiment of the invention;

(17) FIG. **17** is a bottom view of the mode-selection knob of a control unit according to a third embodiment of the invention;

(18) FIG. **18** is a perspective view of a control unit according to a fourth embodiment of the invention;

(19) FIG. **19** is a view of a face of the cover of the control unit according to the fourth embodiment of the invention;

(20) FIG. **20** is a perspective view of a control unit according to a fifth embodiment of the invention; and

(21) FIG. **21** is a view of a face of the cover of the control unit according to the fifth embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

(22) The drawings and the description below contain, for the most part, elements of a definite nature. They may therefore not only serve to further the understanding of the present disclosure, but also contribute to its definition, where appropriate.

(23) FIG. **1** illustrates a breathing mask **100** arranged in a pressurised cabin **8** of a commercial aircraft intended to carry crew members and usually also passengers.

(24) A device, preferably of the so-called isobaric type, pressurises the cabin to not less than a pressurisation pressure, generally corresponding to an altitude of between 1500 metres and 2400 metres. As the aircraft rises, the pressure in the cabin is substantially equal to the pressure outside the cabin and decreases, until it reaches the said pressurisation pressure. Under normal conditions, the cabin pressure is then held constant until the pressure outside the cabin becomes lower than the pressurisation pressure. The purpose of the breathing mask is to provide the user with sufficient oxygen and protection from harmful substances in the event of incidents, such as loss of pressure, the presence of toxic gases or the like, preventing the occupants of the cabin from breathing normally.

(25) The breathing mask **100** comprises a face-cover **2** and a control unit **1** according to a first embodiment of the invention.

(26) The oronasal face-cover **2** is intended to be applied substantially tightly to a user's face around the nose and mouth. The oronasal face-cover **2** has a breathing cavity **4** wherein the user breathes.

(27) The control unit **1** according to the first embodiment comprises a holder **10**, a controller, a mode-selection knob **20** mounted with the ability to pivot on the holder **10** about an axis of rotation Z and a device for locking/unlocking **30** the rotation of the selection knob.

(28) In this application, the term “radial” and “axial” is defined with respect to the Z axis of rotation, except where another axis is explicitly mentioned.

(29) In the embodiment shown, the holder **10** comprises a housing **13** and a cover **14** adapted to close the housing. The housing **13** is provided with a breathing-gas supply orifice **6** for receiving the end of a hose to connect the controller to a source of breathing gas containing primarily oxygen.

(30) The controller is housed in the housing **13**. It operates in three modes. In the first operating mode, called “EMERGENCY” mode, the controller supplies the breathing cavity **4** only with breathing gas until a slight overpressure is reached in the breathing cavity **4** compared to the ambient cabin air pressure, generally this overpressure is between 3 mbar and 30 mbar. At the most common overpressure values, between 3 and 7 mbar, this overpressure value is hardly felt by the user. Above 10 to 12 mbar, the overpressure requires a substantial additional effort from the user to breathe which is quickly felt by the user.

(31) In the second mode of operation, referred to as “100% mode”, the controller supplies the breathing cavity **4** with breathing gas only until substantially ambient pressure is reached. In practice, it is generally useful to provide for the supply to the breathing cavity to be stopped before the breathing cavity reaches ambient pressure, so that there is a very slight negative pressure (a few tenths of mbar to a few mbar) in the breathing cavity **4**

(32) The third breathing mode, known as “NORMAL”, differs from the second breathing mode in that the breathing cavity **4** is supplied with breathing gas diluted with air, generally ambient air, the proportion of which is usually a function of the pressure in the cabin **8**.

(33) With reference to FIG. **2**, the mode-selector switch **20** has a first position marked “EMER” and controlling the controller to operate in the first mode. The mode-selector switch **20** has a second position marked “100%” and controlling the controller to operate in the second mode. The mode-selector switch **20** has a third position marked “N” and commands the controller to operate in the third mode. The middle position of the selection knob corresponds to the second position. In the illustrated embodiment, the third position “N” is located to the right of the centre position. Thus, the mode-selection knob **20** must be rotated counter-clockwise from the second position to the third position.

(34) In the illustrated embodiment, the axis of rotation Z of the selector button extends substantially vertically when the user holds his or her head vertically, so that the mode-selector button **20** extends below the holder **10**. Of course, the mode-selection button **20** could be placed differently, in particular on the front of the holder **10** and/or with an axis of rotation extending substantially horizontally. In a known manner, the three positions of the mode-selector button are discrete positions embodied by notches.
(35) The mode-selector switch **20** has a bottom **21**, a peripheral edge **22** surrounding the bottom and a rod **23** for attachment to the holder **10**. The bottom **21** comprises an opening surrounded by an axial ring **24**. The attachment rod **23** is arranged in the orifice. It forms the axis of rotation Z of the selection knob **20**.
(36) In the illustrated embodiment, EMER, 100% and N are marked on the bottom **21** and on the peripheral edge **22** of the selection button. A marker **11***a* is arranged in the centre of the width of the cover **14** and two side markers **11***b* are arranged on the edges of the housing **13** to show the mode-selection position **20**.
(37) The locking/unlocking system **30** is adapted to lock and unlock the rotation of the mode-selection knob from the second position 100% to the third position N. The locking/unlocking system **30** comprises an operating member **31** adapted to be moved between a locking position and an unlocking position, and a through aperture **32** formed in the holder **10** shown in FIGS. **4** and **5**.
(38) With reference to FIG. **3**, the mode-selection knob **20** accommodates the operating member **31**. For this purpose, the mode-selection knob **20** comprises a support block **25** and a guiding and stopping wall **26** of the operating member. The support block **25** is provided with a tubular cavity **27** extending in the direction of the rotation axis Z. The guide and stop wall **26** has a rounded face centred on the tubular cavity **27**. A side part of the peripheral edge **22** has a through-opening **29** of substantially rectangular shape.
(39) A portion of the peripheral edge **22** adjacent to the opening **29** and the guide and stop wall **26** forms a locking stop **28** against which the operating member **31** bears, when positioned in the locking position, as shown in FIG. **3**.
(40) According to the embodiment shown, the operating member **31** is formed by a lever mounted so as to pivot with respect to the selection knob **20** about a first pivot axis X. The first pivot axis X is parallel to the axis of rotation Z.
(41) The operating member **31** comprises a pivot **33** at one end, an end face **34** at the other end, two main faces **35** parallel to the bottom **31** and two side faces **36**, **37** parallel to each other and perpendicular to the bottom **31**.
(42) The pivot **33** is arranged in the tubular cavity **26** of the selector button support block. The end face **34** is positioned opposite the guide and stop wall **26**. When the operating member **31** is pivoted into the release position, the operating member is guided along its travel by the guide and stop wall **26**.
(43) One of the main faces **35** of the operating member arranged in line with the cover **14** is equipped with a lug **38** extending in the direction of the axis of rotation Z. In the illustrated embodiment, the lug **38** has the general shape of a quadrilateral with two slightly rounded opposing faces **39** having the axis of rotation Z as their centre, and a radial face **40** which is for example flat. A normal vector to this radial face **40** is directed in a direction from the second position 100% to the third position N.
(44) An inner side face **36** of the operating member is equipped with a circular housing **41** extending radially with respect to the axis of rotation Z. The other side face **37** has a support wall **42** and a first projecting portion **43**. The bearing wall **42** bears against the locking stop **28** when the operating member **31** is in the locking position. The first projecting portion **43** is capable of passing through the opening **29** of the peripheral edge, when the operating member **31** is in the locking position. This first protruding portion **43** comprises an operating area **44** which the user is adapted to press to rotate the operating member **31** from the locking position to the unlocking position.

(45) In the illustrated embodiment, the mode-selection knob **20** further has a second projecting portion **45** diametrically opposite the first projecting portion **43** with respect to the axis of rotation Z. This asymmetry makes it easier to recognise the position of the selection button **20** relative to the holder **10** by touch.
(46) With reference to FIGS. **4** and **5**, the lug **38** of the operating member is arranged in the aperture **32**. The lug **38** is adapted to slide in the aperture **32**, when the user turns the mode-selector knob **20**. The aperture **32** formed in the cover **14** has a first aperture portion **46** and a second aperture portion **47** communicating with the first aperture portion. The first and second light portions **46**, **47** are each substantially in the shape of a circular arc centred on the axis of rotation Z. The radius of the arc of the first aperture portion **46** is greater than the radius of the arc of the second aperture portion.
(47) In the illustrated embodiment, the first aperture portion **46** extends over a first angular sector. The second portion of aperture **47** extends over the same first angular sector as well as an additional angular sector. The first angular sector corresponds to the travel of the mode selector switch **20** between the first EMER position and the second 100% position. The additional angular sector corresponds to the travel of the mode-selection knob between the second 100% position and the third N position.
(48) The end of the first aperture portion **46** adjacent to the additional angular sector of the second aperture portion **47** comprises a radial wall. This radial wall forms a radial end stop **48** preventing the passage of the lug **38** into the second aperture portion **47**, when the operating member **31** is in the locking position. A vector normal to this radial end stop **48** is directed towards the first EMER position.
(49) When the operating member **31** is in the unlocking position, the lug **38** can slide from the second aperture portion **47** to the first aperture portion **46**. In this way, the user can quickly turn the mode-selection knob **20** from the third position N to the first position EMER without putting the operating member **31** in the locking position or waiting for it to return to the locking position under the action of a resilient element **50**.
(50) With reference to FIG. **3**, the locking/unlocking system **30** further comprises a resilient element **50** suitable for holding the operating member **31** in the locking position. In the embodiment shown in FIGS. **3** to **5**, the resilient element **50** is constituted by a compression spring adapted to be compressed by bearing on the operating area **44** of the operating member. It is suitable for acting between the operating member **31** and a support wall **51** formed on the axial ring **24** of the selection button. Preferably, the support wall **51** is a flat surface. The support wall **51** extends perpendicular to the bottom **21** and in line with the through-opening **29**. Preferably, the support wall **51** comprises a guide pin **52**.
(51) The resilient element **50** is, on the one hand, fitted around the guide pin **52** and, on the other hand, arranged in the circular housing **41** of the operating member. The guide pin **52** and the circular housing **41** guide the resilient element **50** during its compression.
(52) Preferably, the cover **14** comprises two reliefs **53** (visible in FIGS. **6**, **8** and **10**) adapted to come into end stop against two protrusions **54** (visible in FIG. **3**) of the mode-selection knob to prevent the rotation of the selection knob beyond the first position EMER or beyond the third position N.
(53) In the illustrated embodiment, the lug **38** and the radial end stop **48** of the aperture **32** are arranged on one side of a plane A perpendicular to the bottom **31** and passing through the first pivot axis X. The actuating zone **44** of the operating member **31** is arranged on the other side of the plane A. Alternatively, the actuating zone **44** of the operating member **31** is arranged on the same side of the plane A.
(54) Alternatively, the second aperture portion **47** may communicate with only part of the first aperture portion **46**.
(55) According to a less advantageous variant, the radius of the arc of a circle of the second

aperture portion **47** is greater than the radius of the arc of a circle of the first aperture portion **46**. In this case, the user has to pull the first protruding portion **43** to unlock the rotation of the mode-selection knob **20** from the second position 100% to the third position N.
(56) Alternatively, the aperture **32** has the shape of an arc of a circle with the same diameter and a radial groove in its middle to form the radial stop **48**.
(57) At rest, the operating member **31** is in the locked position. The user can rotate the mode-selector switch **20** between the first EMER position and the second N position. When the user rotates the mode-selector switch **20** from the first EMER position to the second 100% position, the lug **38** slides into the first aperture portion **46**. However, the user cannot rotate the mode-selector knob **20** to the third position N because the lug **38** abuts the radial stop **48** as seen in FIG. **4**. In order to be able to rotate the mode-selector switch **20** to the third position N, the user must press the operating area **44**, the operating member **31** then rotates about the first pivot axis X. The resilient element **50** is compressed. The lug **38** slides from the first aperture portion **46** to the second aperture portion **47**. The user can then turn the mode-selector switch to the third position N. The lug **38** slides into the second aperture portion **47** as shown in FIG. **5**.
(58) Advantageously, the lug **31** is able to slide in the first aperture portion and in the second aperture portion when the operating member **31** is in the unlocking position. FIGS. **6** and **7** illustrate a first variant **100** of the first embodiment of the control unit. According to this embodiment, the control unit **100** comprises a mode-selector button **200**, a first locking/unlocking system **30** and a second locking/unlocking system **300** arranged in the mode-selector button **200**. The first locking/unlocking system **30** is identical to the previously described locking/unlocking system **30** and will not be described a second time. The second locking/unlocking system **300** has the same technical elements as the locking device **30** of the previously described control unit **1**, but these technical elements are arranged differently. The operating member **31** and the resilient element **50** are arranged symmetrically with respect to a radial plane P**1**. The lug **38** of the second locking/unlocking system **300** is rotated through an angle of approximately 150°. The aperture **32** of the cover **14** is rotated through an angle of 180° about the axis of rotation Z.
(59) The radial plane P**1** is perpendicular to the bottom **21** of the mode-selection knob. The radial plane P**1** passes through the axis of rotation Z.
(60) In the embodiment shown, the radial plane P**1** also passes through a point at the centre of the width of the cover **14**. This centre is indicated by the mark **11***a*.
(61) FIGS. **8** and **9** illustrate a second variant **101** of the first embodiment of the control unit. According to this second variant, the control unit **101** comprises a mode-selection button **201**, a first locking/unlocking system **30** and a second locking/unlocking system **301** arranged in the mode-selection button **201** diametrically opposite to the first locking device **30** with respect to the rotation axis Z. The first locking/unlocking system **30** is identical to the previously described locking/unlocking system **30** and will not be described a second time. The second locking/unlocking system **301** has the same technical elements as the locking device **30** of the control unit **1** described above, but these technical elements are rotated through an angle of 180° in relation to the axis of rotation Z.
(62) Thus, the operating member and the aperture of the first locking/unlocking system and the operating member and the aperture of the second locking/unlocking system are symmetrical to each other with respect to the axis of rotation Z.
(63) When using the first embodiment **100** and the second embodiment **101** of the control unit of the first embodiment of the invention, the user must press the two operating areas **44** of the two operating members **31** to unlock the clockwise rotation of the mode-selection buttons **200**, **201** from the second position 100% to the third position N.
(64) Alternatively, the mode-selector switch has between three and five operating members. Each operating member has an operating area **44** so that the mode-selection button has between three and five operating areas.

(65) The control unit **102** according to a second embodiment is shown in FIGS. **10** to **16**. This control unit **102** is identical to the control unit **1** according to the first embodiment of the invention except for the fact that the mode-selection knob **202** is made of a plastic material capable of being deformed, the fact that the locking/unlocking system **302** comprises an operating member **310** made by a part of the mode-selection knob and the fact that it does not comprise a resilient element **50**. The technical elements of the control unit **102** according to the second embodiment identical or similar to the technical elements of the control unit **1** according to the first embodiment bear the same references and will not be described a second time.
(66) The mode-selection knob **203** of the control unit **102** according to the second embodiment is made of a plastic material suitable for deformation, such as a polyamide.
(67) With reference to FIG. **10**, the mode-selection knob **202** of the control unit **102** according to the second embodiment is pivotally mounted on the cover **14** about the axis of rotation Z. The mode-selector switch **202** has a bottom **21**, a peripheral edge **22** surrounding the bottom and a rod **23** for attachment to the holder **14**. The mode-selector knob **202** further has a through-slot **55** formed on a lateral side of the peripheral edge **22**. This slot extends perpendicularly to the axis of rotation Z and is continued by a cut-out **56** which is parallel to the axis of rotation Z and opens out at the outer edge of the mode-selector button. The slot **55** and the cut-out **56** form a tab **57** capable of pivoting towards the inside of the button by deformation of a part **220** of the peripheral edge of the mode-selection button. This tab **57** forms a lever having a first pivot axis X. This tab **57** thus constitutes the operating member **310** of the locking/unlocking system of the control unit **102** according to the second embodiment. The operating member **310** is thus capable of pivoting with respect to its end fixed to the peripheral edge **22** of the mode-selection button **203**.
(68) Seen in cross-section in a plane parallel to the bottom **21**, as in FIG. **11**, the cut-out **56** advantageously has the shape of a step or a set-back. A locking stop **28** is thus formed on the side of the mode-selection button and a shoulder **59** is formed on the side of the operating member **310**. The shoulder **59** of the operating member forms a bearing face **42** adapted to abut against the locking stop **28** when the operating member **310** moves from the unlocked position to the locked position. In the illustrated embodiment, the tab **57** further comprises a first protruding portion **43** adjacent to the cut-out **56** and extending radially with respect to the rotation axis Z. This first protruding portion **43** has an operating area **44** which the user is able to press to unlock the rotation of the mode-selection button **202**. With reference to FIG. **12**, the main face **35** of the operating member **310** located opposite the cover **14** comprises a lug **380** arranged in the aperture **32**. In the illustrated embodiment, the lug **380** has the shape of a peg. The lug **380** is adapted to move in the first aperture portion **46** and to come into abutment against the radial stop **48**, when the operating member is in the locking position. The lug **380** is able to move in the first aperture portion **46** and in the second aperture portion **47**, when the user presses on the tab **57**—operating member **310** to put it in the unlocking position.
(69) FIGS. **13** and **14** illustrate a first variant **103** of the second embodiment of the control unit. According to this embodiment, the control unit **103** comprises a mode-selector button **203**, a first locking/unlocking system **302** and a second locking/unlocking system **302** arranged in the mode-selector button **203**. The first locking/unlocking system **302** is identical to the previously described locking/unlocking system **302** and will not be described a second time. The second locking/unlocking system **302** has the same technical elements as the locking device **302** of the previously described control unit **102**, but these technical elements are arranged differently. Thus, the operating member is arranged symmetrically with respect to the radial plane P**1**. The radial plane P**1** is perpendicular to the bottom **21** of the mode-selection knob. The radial plane P**1** passes through the axis of rotation Z. In the embodiment shown, the radial plane P**1** also passes through a point at the centre of the width of the cover **14**. This centre is indicated by the mark **11***a*. The aperture **32** of the second locking/unlocking system **302** is rotated by an angle of approximately 150° with respect to the axis of rotation Z.

(70) FIG. **12** illustrates a second variant **104** of the second embodiment of the control unit. According to this second embodiment, the control unit **104** comprises a mode-selector button **204**, a first locking/unlocking system **302** and a second locking/unlocking system **302** arranged in the mode-selector button **204** diametrically opposite the first lock device **302** with respect to the axis of rotation Z.
(71) The first locking/unlocking system **302** is identical to the previously described locking/unlocking system **302** and will not be described a second time. The second locking/unlocking system **302** has the same technical elements—and in particular an aperture **32** in the cover **14**, an operating member **302**—as the locking device **302** of the control unit **102** described above, but these technical elements are arranged symmetrically with respect to the axis of rotation Z.
(72) When using the first embodiment **103** and the second embodiment **104** of the second embodiment of the invention, the user must press the two operating areas **44** of the two operating members **310** to unlock the clockwise rotation of the mode-selection buttons **203**, **204** from the second position 100% to the third position N.
(73) Alternatively, the mode-selector switch has between three and five operating members. Each operating member has an operating area **44** so that the mode-selection button has between three and five operating areas.
(74) The control unit **105** according to a third embodiment is shown in FIG. **13**. This control unit **105** is identical to the control unit **102** according to the second embodiment of the invention except that the locking/unlocking system **303** further comprises a resilient element **50** suitable for acting between the operating member **311** and the support wall **51** formed on the axial ring **24**. In the illustrated embodiment, the support wall **51** as well as the inner side face **36** of the operating member are provided with a guide pin **52**. The resilient element **50** is arranged around the guide pin **52** of the operating member **311** and around the guide pin **52** of the support wall **51**.
(75) The other technical elements of the control unit **105** according to the third embodiment are identical or similar to the technical elements of the control unit **102** according to the second embodiment and will not be described a second time.
(76) The control unit **106** according to a fourth embodiment is shown in FIGS. **14** and **15**. This control unit **106** comprises a mode-selection button **206** and a locking/unlocking system **304**.
(77) The locking/unlocking system **304** comprises an operating member **312** pivotally mounted with respect to the mode-selection knob **206** about the first pivot axis X, a resilient element **66** adapted to hold the operating member **312** in the locking position, and an aperture **32** formed in the cover **14**.
(78) The mode-selector button **206** has a bottom not shown in FIGS. **14** and **15**, a peripheral edge **22** surrounding the bottom, an orifice surrounded by an axial ring **24**. An attachment rod for the mode-selection knob is arranged in the orifice. It forms the axis of rotation Z.
(79) A through-opening **29** is provided in a side face of the peripheral edge **22**. The edge of the opening **29** on the side of the free end of the operating member **312** has a set-back forming a locking stop **28**. The bottom **21** of the mode-selection button further comprises a pivot **63** extending towards the cover **14** and a support wall **64** integral with the pivot **63**. The pivot **63** forms the first pivot axis X. It is parallel to the rotation axis Z. The support wall **64** is perpendicular to the bottom **21** and extends inwards from the mode selector switch. The support wall **64** forms an angle with respect to a radial plane P**1** equal to half the pivot angle of the operating member **312** between the locking position and the unlocking position. The radial plane P**1** passes through the axis of rotation Z and the reference mark **11***a*. The end of the support wall **64** has a notch **65**.
(80) The operating member **312** forms a lever. It comprises a longitudinally extending through-recess **60**. This recess **60** has a circular cylindrical portion **61**, an intermediate flared portion **58** open to the cylindrical portion **61** and a substantially rectangular parallelepiped portion **62** open to the flared portion **58**. The operating member **312** is arranged in the mode-selection knob **206** such

that the cylindrical portion **61** of the recess accommodates the pivot **63**. Thus, the operating member **312** is capable of pivoting about a pivot **63**. The support wall **64** is arranged in the flared portion **58**. The support wall **64** extends against one wall of the flared portion **58** when the operating member **312** is in the locking position shown in FIG. **14**, and against an opposite wall of the flared portion **58**, when the operating member **312** is in the unlocking position. The resilient element **66** comprises a leaf spring arranged in the recess **60**. The resilient element **66** is wedged into the recess **65** and into a recessed corner **67** of the parallelepipedic portion **62**. The leaf spring **66** extends outwardly from the notch **65**. The re-entrant corner **67** is located on the opposite side of the notch **65**. It is adjacent to the first radial projection **43**.

(81) The operating member **312** further comprises a first radial protruding portion **43** extending through the opening **29** of the peripheral edge **22** of the mode-selector button. An operating area **44** of the mode-selection button is disposed on the first radial protruding portion **43**. The operating member **312** further comprises a support face **42** located in the extension of the first radial protruding portion **43** towards the free end of the operating member. The bearing face **42** comes to bear against the locking stop **28**, when the operating member comes into or is in the locking position. The main face **35** of the operating member is provided with a lug **380** arranged in the aperture **32**. The aperture **32** is identical or similar to the aperture **32** of the locking/unlocking system **30** according to the second embodiment. The technical elements of the locking/unlocking system and in particular of the aperture **32** and the technical elements of the mode-selection button of the control unit **106** according to the fourth embodiment, which are identical or similar to the technical elements of the control unit according to the second embodiment, have the same references and will not be described a second time.

(82) The control unit **107** according to a fifth embodiment is shown in FIGS. **16** and **17**. This control unit **107** comprises a mode-selection button **207** and a locking/unlocking system **305**. The locking/unlocking system **305** comprises an operating member **313** pivotally mounted with respect to the mode-selection knob **207** about the first pivot axis X, a resilient element **68** adapted to hold the operating member **313** in the locking position, and an aperture **32** formed in the cover **14**.

(83) The mode-selector switch **207** has a bottom **21** with a hole, with a peripheral edge **22** surrounding the bottom **21**. A side face of the peripheral edge **22** is provided with a through-opening **29**. The edge of the opening **29** on the side of the free end of the operating member **313** has a set-back forming a locking stop **28**. The mode-selection button **207** further comprises a support block **25** provided with a tubular cavity **26** and a support wall **69** on which the resilient element **68** comes to rest. The support wall **69** is perpendicular to the bottom **21**. It extends from the peripheral edge **22** towards the opening of the mode-selection button. The free end of the support wall **69** comprises a part **70** of a second hinge member adapted to hinge to the resilient element **68**.

(84) The operating member **313** is a lever capable of pivoting about a first pivot axis X between a locking position and an unlocking position. The operating member **313** comprises a pivot **33** at one of its ends, an end face **34** at its other end, two main faces **35** parallel to the bottom **31** and two lateral faces **36**, **37** parallel to each other and perpendicular to the bottom **31**. The pivot **33** is arranged in the tubular cavity **26** of the support block so that the operating member **313** is able to pivot about the first pivot axis X. The end face **34** comprises a shoulder **59** forming a support face **42** capable of coming into abutment against the locking stop **28**. One of the main faces **35** located opposite the base **21** is provided with a lug **380** arranged in the aperture **32**. The inner lateral face **36** of the operating member comprises a part **71** of a first articulation element capable of articulating to the resilient element **68**. The outer side face **37** is provided with a first radial protruding portion **43** passing through the through aperture **29** and having an operating area **44** on which the user presses to rotate the operating member into the unlocking position.

(85) The resilient element **68** comprises a first hollow cylinder **72**, a second hollow cylinder **73** slidably mounted around the first hollow cylinder and a compression spring **74** contained partly

within the first hollow cylinder and partly within the second hollow cylinder. The first hollow cylinder and the second hollow cylinder have a bottom wall. The compression spring **74** is attached to the bottom wall of the first hollow cylinder and to the bottom wall of the second hollow cylinder. The first hollow cylinder **72** comprises a complementary portion **75** of the first hinge element. The second hollow cylinder **73** comprises a complementary portion **76** of the second hinge element. In the illustrated embodiment, the first hinge and the second hinge are formed by a circular housing **70**,**71** and a pivot **75**,**76** mounted in the circular housing.

(86) With reference to FIG. **17**, the aperture **32** is identical to the aperture **32** of the locking/unlocking system **30** according to the second embodiment. The technical elements of the locking/unlocking system, and in particular of the aperture **32**, and the technical elements of the mode-selection button of the control unit **107** according to the fifth embodiment, which are identical or similar to the technical elements of the control unit according to the second embodiment, have the same references and will not be described a second time.

(87) When the user does not press the operating member **313**, the resilient element **68** holds the operating member **313** such that the bearing face **42** is in abutment with the locking stop **28**. The user may move the mode-selector switch **207** between the first EMER position and the second 100% position. The user cannot dispose the mode-selector knob **207** in the third position N because the lug **380** is in abutment with the radial stop **48**.

(88) When the user presses the operating area **44** of the operating member **313**, the operating member **313** pivots about the first pivot axis X. The spring **74** is compressed. The resilient element **68** pivots relative to the mode-selector switch **207** by means of the first joint **70**, **75** and relative to the operating member **313** by means of the second hinge **71**, **76**. The lug **380** slides in the second aperture portion **47** allowing the mode-selection knob **307** to pivot from the second position 100% to the third position N.

(89) According to a first variant, not shown, of the third embodiment, the fourth embodiment and the fifth embodiment, the control unit **105**, **106**, **107** comprises a member for operating a first locking/unlocking system and a member for operating a second locking/unlocking system arranged, in the mode-selection button, symmetrically to the member for operating the first locking/unlocking system with respect to a radial plane P**1**. The radial plane P**1** is identical to the radial plane P**1** described above.

(90) According to a second variant, not shown, of the third, fourth and fifth embodiments, the control unit **105**, **106**, **107** comprises a first locking/unlocking system, and a second locking/unlocking system arranged in the mode-selection knob diametrically opposite the first locking device with respect to the axis of rotation Z.

Claims

1. A control unit for an aircraft crew member's breathing mask, said unit comprising: a support, a mode-selection knob mounted on the support and configured to pivot with respect to an axis of rotation, the axis of rotation being arranged perpendicular to said support, the mode-selection knob having a bottom extending perpendicular to the axis of rotation and a peripheral rim, the selection knob being pivotal between at least a first position, a second position and a third position, a controller configured to be supplied from a source of breathing gas and to supply a breathing cavity with the breathing gas in at least the following three modes of operation: when the mode-selection knob is in the first position, the controller supplies the breathing cavity as long as the pressure in the breathing cavity is not higher than a first pressure relative to the ambient pressure, when the mode-selection knob is in the second position, the controller supplies the breathing cavity as long as the pressure in the breathing cavity is not higher than a second pressure relative to the ambient pressure, the first pressure being higher than the second pressure, and when the mode-selection knob is in the third position, the controller supplies the breathing cavity with breathing gas diluted

with air, wherein the control unit further comprises at least one locking/unlocking system configured to lock and to unlock the rotation of the mode-selection knob towards the third position, the locking/unlocking system comprising an operating member configured to be pivoted between a position locking the rotation of the mode-selection knob such that rotation of the mode-selection knob between the first and second positions is allowed, but rotation to the third position is blocked, and a position unlocking the rotation of the mode-selection knob such that the rotation to the third position is allowed.

2. The control unit according to claim 1, wherein the second position is positioned between the first position and the third position, and wherein said locking/unlocking system comprises an aperture formed in said holder holder, said aperture comprising a radial stop delimiting a first aperture portion and a second aperture portion, and wherein the operating member comprises a lug configured to slide in the first aperture portion and to abut against said radial stop when the operating member is positioned in the locking position, the said lug being configured to slide in at least the second aperture portion when the operating member is in the unlocking position.

3. The control unit according to claim 2, wherein said aperture has the shape of at least one arc of a circle centered on the axis of rotation.

4. The control unit according to claim 2, wherein the first aperture portion and the second aperture portion have the shape of an arc of a circle and wherein the arc of the circle of the second aperture portion has a radius different from the radius of the arc of the circle of the first aperture portion; the first aperture portion having a radial end wall forming said radial stop for blocking the passage of the lug into the second aperture portion when the operating member is in the locking position.

5. The control unit according to claim 1, wherein the operating member comprises a lever mounted so as to pivot with respect to the mode-selection knob about a first pivoting axis, the first pivoting axis being parallel to the axis of rotation.

6. The control unit according to claim 2, wherein the operating member comprises a lever mounted so as to pivot with respect to the mode-selection knob about a first pivoting axis, the first pivoting axis being parallel to the axis of rotation, and wherein said lug and said radial stop are disposed on one side of a plane, and wherein the operating member has an operating area disposed on the other side of said plane, said operating area being an area on which the user acts to unlock the rotation of the mode-selection knob; said plane being perpendicular to the bottom and passing through said first pivot axis and an end stop.

7. The control unit according to claim 1, wherein the locking/unlocking system comprises a resilient element configured to hold the operating member in the locking position, the resilient element being configured to act between the operating member and a support wall of the mode-selection knob.

8. The control unit according to claim 7, wherein the resilient element comprises at least one compression spring configured to be compressed by pressing on a part of the operating member in order to unlock the rotation of the mode-selection knob towards the third position.

9. The control unit according to claim 1, wherein the peripheral rim of the mode-selection knob comprises a slot perpendicular to the axis of rotation which is extended by a cut-out parallel to the axis of rotation and opening outside the mode-selection knob, and wherein a part of the peripheral rim delimited by the said slot and the said cut-out forms the operating member, the operating member being able to pivot by deformation of an axial part of the peripheral rim.

10. The control unit according to claim 7, wherein the operating member has a through-recess, a part of the through-recess is in the form of a flare, another portion of the through-recess having a re-entrant corner open to the flare, and wherein the support wall is perpendicular to the bottom and extends into the through-recess, said support wall being provided with a radial notch, the resilient element comprising at least one leaf spring wedgedly secured in said radial notch and in the re-entrant corner.

11. The control unit according to claim 5, wherein the operating member comprises a through-

recess, a part of the through-recess having a cylindrical shape, and wherein a support wall of the mode-selection knob comprises at one end thereof a pivot arranged in the cylindrical portion of the recess, said pivot forming the first pivot axis.

12. The control unit according to claim 5, wherein the locking/unlocking system comprises a resilient element adapted to hold the operating member in the locking position, the resilient element being adapted to act between the operating member and a support wall of the mode-selection knob, a first hinge element being arranged between said resilient element and the mode-selection knob and a second hinge element being arranged between said resilient element and the operating member.

13. The control unit according to claim 12, wherein the resilient element comprises a compression spring, a first hollow cylinder with a bottom wall and a second hollow cylinder with a bottom wall; and wherein the second hollow cylinder is slidable about the first hollow cylinder, the compression spring being housed partly in the first hollow cylinder and partly in the second hollow cylinder, the compression spring being attached to said bottom wall of the first hollow cylinder and to the bottom wall of the second hollow cylinder.

14. The control unit according to claim 1, wherein said locking/unlocking system is a first locking/unlocking system and wherein said control unit comprises a second locking/unlocking system arranged diametrically opposite to the first lock device with respect to the axis of rotation.

15. The control unit according to claim 1, wherein said locking/unlocking system is a first locking/unlocking system, and wherein said control unit comprises a second locking/unlocking system, an operating member of the second locking device being arranged symmetrically opposite the operating member of the first locking device with respect to a radial plane perpendicular to the bottom, said radial plane passing through the axis of rotation.