

DIVING MASK WITH INTEGRATED SNORKEL

Background of the invention

5 The present invention concerns the field of diving masks and in particular the masks used for « snorkelling ».

Snorkelling allows observation of marine life whilst swimming on the surface of the water. A snorkeler must therefore be able to hold the head under water whilst breathing.

10 In general, snorkelers are equipped with a mask for viewing and a snorkel for breathing. A snorkel is a tube whose lower end is equipped with a mouthpiece which fits into the user's mouth, and an upper end which allows both the entry of fresh air and the escaping of exhaled air.

15 It is known that such equipment has numerous disadvantages. First, since breathing via the mouth is not natural, some persons have difficulty breathing orally through a snorkel. Another disadvantage is that it is not possible to talk underwater when wearing a snorkel.

20 A further disadvantage, related to the use of the mask, is that the inner wall of the faceplate generally tends to fog up which is detrimental to good visibility and compels the user to clean the mask regularly. The onset of fogging is due to the fact that the user's nose opens into the viewing chamber located between the faceplate and the user's eyes.

The use of this mask-snorkel device is therefore not very comfortable.

25 To overcome this drawback, document FR 2 720 050 proposes a diving mask with which it is possible to breathe through the nose and through the mouth.

For this purpose the diving mask comprises:

a frame having an upper part;

a faceplate secured to the frame;

30 a flexible skirt secured to the frame, the skirt comprising a partition delimiting an upper chamber for viewing and a lower chamber for breathing, the partition being arranged such that it bears upon the top of the user's nose so that the user's mouth and nose are positioned in the lower chamber, whilst the user's eyes are positioned in the upper
35 chamber, the partition comprising at least one passageway arranged to

allow circulation of inhaled air directed from the upper chamber towards the lower chamber during an inhalation phase by the user;

a snorkel having an inlet channel for inhaled air and at least a first escape channel for exhaled air, the said snorkel being in the continuation of the upper part of the frame, the inlet channel for inhaled air leading into the upper chamber, whilst the first escape channel for exhaled air communicates with the lower chamber.

According to this document, the exhaled air circulates in the skirt formed of a flexible hollow seal adhering between the mask and the face.

Said mask has a drawback however. If the user over-tightens the mask attaching system, the hollow flexible seal is squeezed against the face which will cause obstruction of the duct through which exhaled air flows. On the other hand, if the user does not sufficiently tighten the attaching system there will no longer be a perfect seal between the face and skirt failing which there is a risk that water might enter inside the lower or upper chambers, this being undesirable.

Subject and summary of the invention

It is one objective of the invention to propose a diving mask which in particular overcomes the aforementioned disadvantages.

The invention attains this objective through the fact that:

the frame is rigid, and

side the frame there is arranged at least one first inner duct for exhaled air, the said first inner duct having an upper end leading into the escape channel for exhaled air, and a lower end in fluid communication with the lower chamber.

Since the frame is rigid it will be understood that the first inner duct cannot be squeezed, unlike the hollow seal in the prior art. In addition, since the coupling sleeve projects from the first side edge of the flexible skirt there is no risk that it will be squashed if the attaching system is drawn very tight.

The frame therefore has a dual function, namely to support the faceplate and to form air circulation means.

The connection between the frame and the flexible skirt is preferably obtained via a flexible junction between the flexible skirt and the lower end of the first inner duct.

Preferably, the frame comprises an upper portion and a lower portion assembled onto the upper portion, and the first inner duct is arranged in the upper portion. Further preferably, the first inner duct opens into the lower end of the upper portion.

5 Advantageously, the flexible skirt further comprises at least one first coupling sleeve projecting from a first side edge of the flexible skirt and extending towards the upper part of the mask, the first coupling sleeve having a lower end leading into the lower chamber and an upper end, opposite the lower end, in fluid connection with the lower end of the first
10 inner duct.

Preferably the flexible skirt is made in silicone whilst the frame is made of rigid plastic such as polypropylene or polycarbonate.

Advantageously the frame comprises a least one first lateral connector engaged in the second end of the first coupling sleeve.

15 Preferably this first lateral connector extends towards the lower part of the mask. This first lateral connector is preferably curved towards the inside of the mask.

Further preferably, the second end of the first coupling sleeve has a bottom cross-section smaller than the cross-section of the first lateral connector. One advantage is to improve the seal between the second end
20 of the first coupling sleeve and the first lateral connector.

Preferably the second end of the first coupling sleeve lies flush with one side of the frame which makes it possible to obtain a frame having a smooth side. By means of this arrangement, the coupling sleeve has no
25 catch point and there is therefore no risk that it might be inadvertently uncoupled from the first lateral connector.

According to one preferred embodiment, the first lateral connector comprises at least one rib on its outer surface, the said rib cooperating with the inner surface of the second end of the first coupling sleeve. The
30 second end of the first coupling sleeve becomes deformed in contact with the rib. This allows an improvement in the seal between the first coupling sleeve and the first lateral connector, whilst improving the anchoring of the first coupling sleeve onto the first lateral connector.

Advantageously, the frame comprises an upper portion and a lower
35 portion, the first inner duct is arranged in the upper portion of the frame, the first inner conduit extends between the top of the frame and a lower

end of the upper portion of the frame, and the first lateral connector projects from the lower end of the upper portion.

According to one preferred embodiment, the lower portion of the frame has an upper end assembled onto the lower end of the upper portion. In this embodiment, the frame is formed of at least two parts, namely the upper portion forming an upper rim surrounding the upper periphery of the flexible skirt, and the lower portion formed of one or more elements forming a lower rim surrounding the lower periphery of the flexible skirt.

Said arrangement is advantageous since it allows a mask to be manufactured using a minimum number of parts.

The upper portion, forming an upper rim, is preferably moulded in a single part.

According to one variant, the lower portion and the upper portion form one and the same part.

According to one preferred assembly, the flexible skirt is attached to the upper and lower portions of the frame.

Advantageously the skirt comprises a peripheral sealing lip arranged to bear against the user's face, and the first coupling sleeve flanks the said peripheral sealing lip.

Therefore the first coupling sleeve extends outside the flexible skirt moving up towards the upper part of the mask. This makes it possible to prevent squeezing of the first coupling sleeve and hence avoids obstruction thereof, whilst promoting the flow of exhaled air towards the upper portion of the frame thereby aiding the evacuation of spent air.

Advantageously, the partition forms one and the same part with the flexible skirt. The flexible skirt is therefore in a single piece, on the understanding that the first coupling sleeve forms one and the same part with the flexible skirt.

Advantageously, the flexible skirt comprises a top coupling sleeve cooperating with a top connector of the frame into which there opens the inlet channel of the snorkel for inhaled air, the said top coupling sleeve leading into the upper chamber.

Preferably, the top coupling sleeve forms one and the same part with the flexible skirt. Further preferably, the top coupling sleeve is arranged between the peripheral lip and the upper portion of the frame.

Preferably the top connector projects from an upper portion of the frame, whilst the second coupling sleeve projects from an upper edge of the flexible skirt, the top connector engaging inside the top coupling sleeve.

5 The cross-section of the top coupling sleeve is slightly smaller than the cross-section of the top connector to ensure a seal between the two elements. Further preferably, the top connector comprises at least one rib projecting from its outer surface, the said rib cooperating with an inner wall of the coupling sleeve to further improve the seal between the two
10 elements connected to one another.

According to one preferred embodiment of the invention the snorkel also comprises a second outlet channel for exhaled air, and the frame also comprises a second inner duct for exhaled air which has an upper end leading into the second channel for exhaled air and a lower end in fluid
15 communication with the lower chamber.

The mask of the invention therefore has two independent circuits for exhaled air. Said arrangement has several advantages. First it facilitates breathing notably by allowing spent air to be expelled more quickly, which is particularly necessary when muscular effort is required
20 e.g. for faster swimming. Secondly, the snorkeler is able to continue breathing even if one of the exhaled air circuits e.g. the first inner duct should become clogged.

Advantageously, the flexible skirt comprises a second coupling sleeve projecting from a second side edge of the skirt, opposite the first
25 side edge, the said second coupling sleeve having a lower end leading into the lower chamber and an upper end, opposite the lower end, in fluid communication with the lower end of the second inner duct.

Advantageously, the snorkel has an upper part provided with an air-permeable cage, the snorkel further comprising a float that is mobile
30 in said cage, the said float having an upper end provided with a shut-off device, the said float being arranged so that when the snorkel is submerged in the water the float is caused to move so that the shut-off device closes the entry to the snorkel.

Preferably, the float is a hollow element containing a volume of air,
35 whilst the shut-off device is formed of a flexible diaphragm. Further

preferably, the float comprises a body in which the flexible diaphragm is press-fitted thus imparting very good robustness to the float.

The air-permeable cage is preferably formed by an upper portion of the snorkel in which slits are provided.

5 Preferably the cage, in its lower part, comprises holes to evacuate water which might enter therein.

The cage is arranged on a sidewall of the upper part of the snorkel body in which there extend the inlet and outlet channels.

Advantageously the snorkel also comprises a plate having:

10 a main orifice communicating with the snorkel intake;

an inlet orifice communicating with the inlet of the inlet channel for inhaled air;

at least one first outlet orifice communicating with the outlet of the first escape channel;

15 a first check valve arranged to close the inlet orifice during an exhalation phase;

a second check valve arranged to close the first outlet orifice during an inhalation phase;

20 the snorkel further comprising a fluid communication chamber; the main orifice, the inlet orifice and the first outlet orifice leading therein.

It will be understood that the shut-off device is configured to close the main orifice when the snorkel is submerged in water. For this purpose the submerged float, undergoing Archimedes' thrust, is caused to move until the shut-off device, preferably a flexible diaphragm, closes the main orifice. In this case, the snorkel intake is closed. There is therefore no risk that the user will inhale water. However the user can exhale since the flow of exhaled air can counteract Archimedes' thrust acting on the float.

When the snorkel is out of the water, and during an inhalation phase, fresh air enters into the fluid communication chamber via the main orifice when the float, in bottom position due to the use of gravity, does not block the snorkel intake. The second check valve is closed whilst the first valve allows fresh air to pass from the fluid communication chamber through the inlet orifice, the fresh air then successively flowing in the inlet channel for inhaled air, in the upper chamber via the top connector and the top coupling sleeve, then into the lower chamber where it is inhaled

by the user. It is specified that the check valve of the partition allows inhaled air to pass through the partition.

When the snorkel is out of the water, and during an exhalation phase, the air exhaled by the user in the lower chamber successively flows
 5 in the first coupling sleeve (and in the second coupling sleeve if any), then in the first inner duct (and in the second inner duct if any), then in the first escape channel for exhaled air (and in the second escape channel for exhaled air if any). The exhaled air then flows into the fluid communication chamber via the first outlet orifice after which it leaves the
 10 fluid communication chamber via the main orifice. The spent air then escapes to outside the snorkel.

Preferably, the snorkel comprises a body having an upper end, the inlet channel for inhaled air and the first escape channel for exhaled air extending within the body, and the fluid communication chamber is
 15 arranged in a cap sealingly attached to the upper end of the body.

According to one advantageous aspect of the invention, the snorkel is removable or can be tilted. This is useful when the mask is not being used.

Advantageously, the mask of the invention also comprises an elastic retaining strap which extends between an upper portion of the frame and a lower portion of the frame.
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Preferably, the elastic strap comprises at least one link point with one or other of the lower or upper portions of the frame, the said link point being formed by the cooperation between one bulged end of the elastic strap and a slot formed in the lower or upper portion of the frame.
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One advantage is to facilitate the mounting operation of the elastic strap and the holding in place thereof in relation to the frame.

Preferably, the slot is formed by a loop attached to the frame.

Further preferably, the elastic strap comprises two upper link points with the upper portion of the frame, and two lower link points with the lower portion of the frame.
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The elastic strap is therefore X-shaped making it possible to cover ten rear part of the user's head, thereby providing stable maintaining of the mask on the user's head.

35 In addition, the upper portion of the frame advantageously has a triple function; namely supporting the faceplate, forming means for the

flow of exhaled and inhaled air, and allowing attachment of the elastic strap.

Advantageously, the diving mask of the invention also comprises a purge valve arranged in the breathing chamber to evacuate liquid to outside the mask. By means of sharp exhalation, any water which may be contained in the lower chamber will be expelled to outside the mask via the purge valve.

Preferably, so that the mask is more comfortable to wear, the partition comprises a fold forming a lip intended to come into contact with the user's nose.

Advantageously, the passageway in the partition comprises a check valve arranged to allow circulation of inhaled air directed solely from the upper chamber towards the lower chamber during an inhalation phase by the user.

By means of the check valve, the flow of exhaled air does not rise back into the upper chamber, thereby improving the efficacy of the anti-fogging system of the mask.

Brief description of the drawings

The invention will be better understood on reading the following description of one embodiment of the invention given as a non-limiting example with reference to the appended drawings in which:

- Figure **1** is a perspective view of a diving mask of the invention;
- Figure **2** is an exploded view of the diving mask in Figure **1**;
- Figure **3** is a rear view of the flexible skirt of the mask in Figure **1**;
- Figure **4** is an overhead view of the flexible skirt in Figure **3**;
- Figure **5** is a front view of the flexible skirt assembled onto the frame;
- Figure **6** illustrates the snorkel of the mask in Figure **1**, as seen from its lower end;
- Figure **7** is an overhead view of the flexible skirt assembled onto the frame;
- Figure **8** is a detailed view of the connection of the top coupling sleeve of the flexible skirt with the top connector of the frame;

- Figure **9** is a rear view of the mask in Figure **1**, without the attaching strap;
- Figures **10A** and **10B** are detailed views of the connection of the first coupling sleeve of the flexible skirt with the first lateral connector of the frame;
- Figure **11** is an exploded view of the upper part of the snorkel of the mask in Figure **1**;
- Figure **12** illustrates the air inlet circuit into the snorkel;
- Figure **13** shows the situation in which the float shuts off the snorkel intake when it is submerged in water; and
- Figure **14** is a rear view of the mask in Figure **1**, with the attaching strap.

Detailed description of the invention

Figure **1** gives an example of embodiment of a diving mask **10** conforming to the present invention. The diving mask **10** comprises a frame **12** of general oblong shape having an upper part **12a** and a lower part **12b**.

In this example the frame **12** comprises an upper portion **14** forming an upper rim and a lower portion **16** forming a lower rim.

The upper **14** and lower **16** portions of the frame are secured to one another to form a rim surrounding the user's face.

The diving mask **10** also comprises a faceplate **18** which is secured to the frame **12**. In this example, the faceplate **18** is made in a hard, transparent plastic material.

As will be understood with the help of Figure **1**, the frame **12** surrounds the faceplate **18**. This mask also comprises a purge valve **17** to evacuate any water which may enter inside the mask.

In addition, the diving mask **10** comprises a snorkel **20** which has a lower part **20a** connected to the upper part **12a** of the frame. In this example, the snorkel **20** is removable. It can be unclipped from the frame **12**, making the mask more compact when not in use. The snorkel **20**, more clearly seen in Figure **2**, also has an upper part **20b** that is provided with an air-permeable cage **22**.

As will be described in more detail below the snorkel **20** also comprises a cap **24** which cooperates with the cage **22**.

With reference now to the exploded view, it can be seen that the lower portion **16** of the frame **12** comprises a first element **16'** and a second element **16''** which are attached to one another to form the lower portion.

5 It can also be seen that the snorkel **20** comprises an elongate body **26** whose lower end **26a** press fits into an extension **28** of the upper portion **14** of the frame **12** which projects from the upper end **12a** of the frame.

10 In addition, the snorkel **20** comprises a float **30** which is mobile inside the cage **22**, the float having an upper end **30a** provided with a shut-off device **32**. As is described in detail below, the float **30** is arranged so that the when the snorkel **20** is submerged in the water, the float is caused to move so that the shut-off device **32**, here a flexible diaphragm, closes the snorkel intake.

15 With reference to Figures **3**, **4** and **5**, it can be seen that the flexible skirt **40** is of general oblong shape substantially having the same dimensions as the frame **12** and faceplate **18**. The flexible skirt **40** is arranged between the faceplate **18** and the frame **14**.

20 More specifically, the flexible skirt comprises a periphery **42** which has an upper part attached with the lower portion of the frame.

The flexible skirt **40** further comprises a peripheral sealing lip **44** arranged to bear against the user's face, so as to prevent water from entering between the user's face and the faceplate.

25 The flexible skirt **40** also comprises a partition **46** arranged to bear upon the top of the user's nose. This partition **46** therefore delimits an upper chamber **50** for viewing, from a lower chamber **52** for breathing. As will be understood with reference to Figure **5**, which illustrates the frame **12** assembled with the faceplate **18** and skirt **40**, the user's mouth and nose are positioned in the lower chamber **52**, whilst the user's eyes are positioned in the upper chamber **50**.

In other words, the upper chamber **50** is delimited by the faceplate, the user's eyes, the upper wall **46a** of the partition **46**, and that part of the flexible skirt extending above the partition **46**.

35 The lower chamber **52** is delimited by the faceplate **18**, the user's mouth and nose, the lower part **46b** of the partition **46**, and by that part of the flexible skirt extending below the partition **46**.

In this example, the partition comprises a pair of passageways provided with check valves **54** arranged to allow circulation of inhaled air directed solely from the upper chamber **50** towards the lower chamber **52** during an inhalation phase by the user. In this example, the flexible skirt is made in silicone and forms one and the same part with the partition **46**, the sealing lip **44** and the periphery **42**.

Figure **6** illustrates the snorkel **20** as seen from its lower portion **20a**.

It can be seen that the snorkel **20** comprises an inlet channel for inhaled air **60** which extends between the lower end **20a** of the snorkel and the upper end **20b** of the snorkel. This inlet channel for inhaled air therefore extends in a longitudinal direction of the body **26**. As will be explained in more detail below, the inlet channel for inhaled air leads into the upper chamber.

The snorkel **20** further comprises a first escape channel for exhaled air **62**, which also extends in the longitudinal direction of the body **26** between the lower part **20a** and the upper part **20b** of the snorkel **20**. This first escape channel for exhaled air **62** communicates with the lower chamber **52**.

In this example, the snorkel **20** comprises a second escape channel for exhaled air **64** similar to the first channel for exhaled air.

As seen in Figure **6**, the inlet channel for inhaled air **60** is separated from the first and second escape channels for exhaled air **62**, **64** via two longitudinal walls **66**, **68**.

As seen in Figure **7**, which illustrates an overhead view of the frame **12** assembled onto the flexible skirt **40**, the extension **28** also comprises a central channel **70** arranged to communicate with the inlet channel for inhaled air **60** when the snorkel is attached to the frame, and two exhalation channels **72**, **74** arranged to communicate with the first and second escape channels for exhaled air **62**, **64** respectively.

With reference now to Figure **8**, it can be seen that the frame **12** also comprises a top connector **80** projecting from the upper portion **14** of the frame **12**. The flexible skirt **40** has a top coupling sleeve **82** projecting from an upper part of the flexible skirt **40** leading into the upper chamber **50**. It can be seen that the top connector **80** engages inside the top coupling sleeve **82** to form a sealed connection between

these two elements. In Figure **8**, the arrow **F1** symbolises the flow of inhaled fresh air.

It will be understood that during an inhalation phase, fresh air enters the snorkel, flows along the inlet channel for inhaled air, then into
5 the upper chamber **50** passing through the top coupling sleeve **82**.

We will now turn our attention to the exhaled air circuit.

According to the invention, inside the frame **12**, and more specifically inside the upper part **14** of the said frame there is arranged a
10 first inner duct **90** for exhaled air and a second inner duct **92** for exhaled air. As seen in Figure **9**, these first and second inner ducts are arranged either side of a longitudinal plane **P** of the mask. This plane **P** here forms the plane of symmetry of the mask.

Insofar as the first and second inner ducts **90**, **92** are identical, a description is given solely of the first inner duct **90**. This duct has an
15 upper end **90a** which corresponds to the outlet of the channel **72** illustrated in Figure **7**. The first inner duct **90** also has a lower end **90b**.

In addition, according to the invention, the flexible skirt **40** also comprises a first coupling sleeve **100** projecting from a first side edge **41**
20 of the flexible skirt **40** and extending towards the upper part **12a** of the frame **12**. The first coupling sleeve, which forms one and the same part with the flexible skirt, has a lower end **100a** leading into the lower chamber **52** and an upper end **100b**, opposite the lower end, which is in fluid communication with the lower end of the first inner duct. It will be understood that the coupling sleeve forms a duct for exhaled air.

25 The flexible skirt also comprises a second coupling sleeve **200**, identical to the first coupling sleeve **100**, the second coupling sleeve **200** projecting from a second side edge **43** of the skirt **40**, opposite the first side edge. The second coupling sleeve has a lower end **200a** leading into the lower chamber **52** and an upper end **200b**, opposite the lower end,
30 which is in fluid communication with the lower end **92b** of the second inner duct **92**.

With reference to Figure **9**, it can be seen that the first inner duct **90** extends between the top of the frame and a lower end **14a** of the upper portion **14** of the frame.

35 With reference to Figures **9**, **10A** and **10B**, it is seen that the frame **12**, and more specifically the lower end of the upper portion **14** of

the frame **12**, comprises a first lateral connector **110** which is engaged in the second end **100b** of the first coupling sleeve. To improve strength and sealing, the first lateral connector **110** is provided with ribs **112** on its outer surface **110a**, the ribs **112** cooperating with the inner surface **101** of the second end of the first coupling sleeve. Again with reference to Figure **9**, it can be seen that the second end of the first coupling sleeve lies flush with a side **12c** of the frame **12**.

It will therefore be understood that exhaled air successively flows through the first coupling sleeve **100**, through the first inner duct **90** then through the first escape channel for exhaled air **62**. This outflow of air is illustrated by the arrow **F2**. The arrow **F3** illustrates the other circuit for outflowing air which flows via the second coupling sleeve **200** and the second inner duct **92**.

With the help of Figures **11** to **13**, it is the upper portion of the snorkel **20** that will now be more particularly described.

The snorkel **20** of the mask according to the invention and at its upper end comprises means for regulating air entering and leaving the snorkel. For this purpose, the snorkel **20** comprises a plate **300** which is sealingly arranged between the cap **24** and the upper end **26b** of the body **26** of the snorkel **20**.

This plate comprises a main orifice **302** communicating with the intake **E** of the snorkel. In this example, the intake **E** of the snorkel is formed by slits **23** arranged in the cage **22**.

The plate **300** also comprises an inlet orifice **304** communicating with the inlet **60a** of the inhaled air channel **60**.

The plate **300** further comprises a first outlet orifice **306** which communicates with the outlet **62a** of the first escape channel **62**.

The plate **300** further comprises a second outlet orifice **308** which communicates with the outlet **64a** of the second escape channel for exhaled air.

As will be understood with the help of Figure **11**, the cross-sections of the main orifice **302**, of the inlet orifice **304** and of the two outlet orifices **306**, **308** substantially correspond to the cross-sections of the inlet channel for inhaled air **60** and of the escape channels **62**, **64** for exhaled air.

The plate **300** also comprises a first check valve **310** arranged facing the first inlet orifice **304**, to shut off the said inlet orifice during an exhalation phase. The plate **300** also has a second check valve **312**, arranged facing the first outlet orifice to close the said outlet orifice during an inhalation phase. And in this example the plate **300** also has a third check valve **312** arranged to close the second outlet orifice during an inhalation phase.

The snorkel **20** further comprises a fluid communication chamber **350** into which the main orifice **302**, the inlet orifice **304**, the first outlet orifice **306** and the second outlet orifice **308** all lead. The fluid communication chamber **350** is arranged in the cap **24** which is sealingly attached to the upper end of the body **26**.

Figure **12** illustrates the configuration of the snorkel during an inhalation phase. It will be understood that inhaled fresh air, illustrated by the arrow **F1**, enters the cage **22** via the slits **23** then enters the fluid communication chamber **350** via the main orifice **302** and then into the inlet channel for inhaled air **60** passing through the inlet orifice **304**, the first check valve **310** being open to allow the passing of the air flow.

Figure **13** illustrates the case in which the snorkel is submerged in the water. The float **30**, under the effect of Archimedes' thrust, rises inside the cage **22** until the shut-off device **32** closes the main orifice **302**, thereby closing the snorkel intake.

As illustrated in Figure **14**, according to another advantageous aspect of the invention, the diving mask **10** further comprises a retaining elastic strap **400** extending between the upper portion **14** of the frame and the lower portion **16**. The elastic strap **400** comprises two link points **402, 404** with the upper portion **14** and two link points **406, 408** with the lower portion **16**. It is therefore seen that the elastic strap is X-shaped.

The upper portion **14** of the frame **12** has two loops **410, 412** through which the ends are passed of the two upper parts of the strap portions **414, 416**. It can be seen that the ends of these two strap portions **414, 416** form bulges **418, 420** which are larger than the slots **422, 424** arranged in the loops, thereby ensuring the retaining of the elastic strap **400** on the frame.

CLAIMS

1. A diving mask (10) comprising:
 - a frame (14) having an upper part (12a);
 - 5 a faceplate (18) secured to the frame (12);
 - a flexible skirt (40) secured to the frame, the skirt comprising a partition (46) delimiting an upper chamber (50) for viewing and a lower chamber (52) for breathing, the partition being arranged to bear upon the top of the user's nose so that the user's mouth and nose are positioned in
 - 10 the lower chamber, whilst the user's eyes are positioned in the upper chamber, the partition (46) having at least one passageway arranged to allow circulation of inhaled air directed from the upper chamber (58) towards the lower chamber (52) during an inhalation phase by the user;
 - a snorkel (20) having an inlet channel for inhaled air (60) and at
 - 15 least one first escape channel for exhaled air (62), the said snorkel being a continuation of the upper part of the frame, the inlet channel for inhaled air leading into the upper chamber, whilst the first escape channel for exhaled air (62) communicates with the lower chamber (52);
 - the diving mask being characterized in that:
 - 20 the frame is rigid; and in that
 - side the frame (12) there is arranged at least one first inner duct (90) for exhaled air, the said first inner duct having an upper end opening into the escape channel for exhaled air, and a lower end in fluid communication with the lower chamber.
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2. The diving mask according to claim **1**, characterized in that the flexible skirt (40) also comprises at least one first coupling sleeve (100) projecting from a first side edge (41) of the flexible skirt (40) and extending towards the upper part of the frame, the first coupling sleeve
- 30 having a lower end (100a) leading into the lower chamber (52) and an upper end (100b), opposite the lower end, in fluid connection with the lower end of the first inner duct.
3. The diving mask according to claim **2**, characterized in that the
- 35 frame (12) comprises at least one first lateral connector (110) engaged in the second end (100b) of the first coupling sleeve (100).

4. The diving mask according to claim **3**, characterized in that the second end of the first coupling sleeve lies flush with a side (12c) of the frame (12).

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5. The diving mask according to claim **3** or **4**, characterized in that the first lateral connector (110) comprises at least one rib (112) on its outer surface (110a), the said rib cooperating with the inner surface (101) of the second end of the first coupling sleeve.

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6. The diving mask according to any one of claims **3 to 5**, characterized in that the frame comprises an upper portion (14) and a lower portion (16), in that the first inner duct (90) is arranged in the upper portion of the frame, in that the first inner duct extends between the top of the frame and a lower end (14a) of the upper portion (14) of the frame, and in that the first lateral connector projects from the lower end of the upper portion.

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7. The diving mask according to claim **6**, characterized in that the lower portion (16) of the frame has an upper end (16a) assembled onto the lower end (14a) of the upper portion (14).

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8. The diving mask according to claim **6**, characterized in that the lower portion and the upper portion form one and the same part.

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9. The diving mask according to any one of claims **6 to 8**, characterized in that the flexible skirt (40) is attached to the upper (14) and lower (16) portions of the frame.

30

10. The diving mask according to any one of claims **2 to 9**, characterized in that the flexible skirt has a peripheral sealing lip (44) arranged to bear against the user's face, and in that the first coupling sleeve flanks the said peripheral sealing lip.

11. The diving mask according to any one of the preceding claims, characterized in that the partition (46) forms one and the same part with the flexible skirt (40).

5 12. The diving mask according to any one of the preceding claims, characterized in that the flexible skirt (40) comprises a top coupling sleeve (82) cooperating with a top connector (80) of the frame and in which there opens the inlet channel for inhaled air (60) of the snorkel (20), the said top coupling sleeve leading into the upper chamber.

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 13. The diving mask according to claim **12**, characterized in that the top connector (80) projects from an upper portion (14) of the frame (12), whilst the second coupling sleeve projects from an upper edge of the flexible skirt, the top connector (80) engaging inside the top coupling sleeve (82).

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 14. The diving mask according to any one of the preceding claims, characterized in that the snorkel (20) further comprises a second escape channel for exhaled air (64), in that inside the frame there is also arranged a second inner duct (92) for exhaled air which has an upper end leading into the second channel for exhaled air, and a lower end in fluid communication with the lower chamber.

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 15. The diving mask according to claim **14**, characterized in that the flexible skirt further comprises a second coupling sleeve (200) projecting from a second side edge (43) of the skirt (40), opposite the first side edge, the said second coupling sleeve having a lower end (200a) leading into the lower chamber (52) and an upper end (200b), opposite the lower end, in fluid connection with the lower end (92b) of the second inner duct (92).

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 16. The diving mask according to any one of the preceding claims, characterized in that the snorkel (20) has an upper part (20b) provided with an air-permeable cage (22), the snorkel also comprising a float (30) mobile in said cage (22), the said float having an upper end (30a) provided with a shut-off device (32), the said float being arranged such

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that when the snorkel is submerged in the water the float is caused to move so that the shut-off device (31) closes the snorkel intake.

17. The diving mask according to claim **16**, characterized in that
5 the snorkel (20) further comprises a plate (300) comprising:

a main orifice (302) communicating with the intake (E) of the snorkel;

an inlet orifice (304) communicating with the inlet (60a) of the channel for inhaled air (60);

10 at least one first outlet orifice (306) communicating with the outlet (620) of the first escape channel for exhaled air (62);

a first check valve (310) arranged to close the inlet orifice during an exhalation phase;

15 a second check valve (310) arranged to close the first outlet orifice during an inhalation phase;

the snorkel further comprising a fluid communication chamber (350) into which the main orifice, the inlet orifice and the first outlet orifice all lead.

20 18. The diving mask according to claim **17**, characterized in that the snorkel (20) comprises a body (26) having a lower end (26a) and an upper end (26b), in that the inlet channel for inhaled air (60) and the first escape channel for exhaled air (62) extend inside the body between the lower end (26a) and the upper end (26b), and in that the fluid
25 communication chamber (350) is arranged in a cap (24) sealingly attached to the upper end of the body.

19. The diving mask according to any one of the preceding claims, characterized in that the snorkel (20) is removable or can be tilted.

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20. The diving mask according to any one of the preceding claims, characterized in that it further comprises an elastic retaining strap (400) which extends between an upper portion (14) of the frame and a lower portion (16) of the frame.

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21. The diving mask according to claim **20**, characterized in that the elastic strap (400) comprises at least one link point (402, 404, 406, 408) with one or other of the lower or upper portions of the frame, the said link point being formed by the cooperation between one bulged end
5 of the elastic strap with a slot formed in the lower or upper portion of the frame.

22. The diving mask according to claim **20** or **21**, characterized in that the elastic strap (400) comprises two upper link points (402, 404)
10 with the upper portion of the frame, and two lower link points with the lower portion of the frame.

23. The diving mask according to any one of the preceding claims, characterized in that it further comprises a purge valve (17) positioned in
15 the lower chamber (52) to evacuate liquid to outside the mask.

24. The diving mask according to any one of the preceding claims, characterized in that the partition (46) comprises a fold (47) forming a lip intended to come into contact with the user's nose.
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25. The diving mask according to any one of the preceding claims, characterized in that the passageway of the partition (46) comprises a check valve (54) arranged to allow circulation of inhaled air directed solely from the upper chamber (58) towards the lower chamber (52) during an
25 inhalation phase by the user.