

## Candidate's answer

### A Respiratory Device

#### Field

The present invention relates to a respiratory device for dislodging secretions from a patient's lungs.

#### Background

A conventional respiratory device for dislodging lung secretions is shown in D2. The device comprises a mouthpiece through which a patient can inhale and exhale, a conduit 202, a rotatable disc 203 and two air pressure sensors 213a, 213b. A first portion of the conduit is connected to the mouthpiece 201. The air pressure sensor 213a is located in this part of the conduit. A second portion of the conduit 202 is open to the exterior of the device via an opening. The air pressure sensor 213b is located in this portion of the conduit. The disc is mounted in the conduit between the first portion and the second portion.

The disc has a slot 221 through which air can flow. When the slot is not aligned with the mouthpiece 201 and the opening 214, the disc 203 is in a blocking position in which it prevents air flowing through the conduit. When the slot is aligned with the mouthpiece 201 and the opening 214, air can flow through the conduit via the slot.

The air pressure sensor 213a is exposed to the air pressure in the mouthpiece 201 and the air pressure sensor 213b is exposed to the ambient air pressure. A control unit measures the difference in readings at the two sensors 213a, 213b.

In use, the disc is first oriented in the blocking position. The patient exhales into the mouthpiece. Since the disc is in the blocking position, the air pressure in the mouthpiece increases. When the difference between the two air pressure sensor readings reaches 0.1 bar, the control unit turns on an electric motor that causes the disc to rotate.

As the disc rotates, the slot comes into alignment with the mouthpiece and the opening 214, allowing air to flow from the mouthpiece and out of the opening. The air pressure in the mouthpiece rapidly decreases and an air pressure pulse is generated. The air pressure pulse can propagate into the patient's lungs to dislodge lung secretions.

The device of D2 is a complex device requiring multiple components. In particular, the requirement to provide multiple air pressure sensors, a control unit and a motor, and to power these electronically means the device is complex to manufacture and carries additional costs.

It is therefore desirable to provide a respiratory device that can generate air pressure pulses without the need for such additional, electronic components.

### Summary

According to the present invention, there is provided a respiratory device as set out in claim 1.

Advantageously, the blocking element is configured such that it will be forced from the blocking position to an open position when the force acting on it caused by the difference in pressure between the air pressure in the mouthpiece and the ambient air pressure reaches a threshold. In this way, the blocking element can be moved from its blocking position to the open position without the need to monitor the air pressure in the mouthpiece. The present invention therefore provides a device of greater simplicity, without the need for the additional electronic components shown in D2.

Additional advantageous features are set out in the dependent claims.

### Claims

1. A respiratory device for dislodging secretions from patient's lungs comprising:
  - a mouthpiece (1) through which the patient can inhale or exhale;
  - a conduit (2, 32, 42) connecting the mouthpiece (1) to the exterior of the device;
  - a blocking element (3, 43, 63) for blocking the conduit, the blocking element being movable between a blocking position in which it prevents air from flowing between the mouthpiece (1) and the exterior of the device via the conduit (2, 32, 42), and an open position in which it allows air to flow between the mouthpiece (1) and the exterior of the device via the conduit (2, 32, 42);
  - the blocking element being exposed to the air pressure in the mouthpiece (1) and to the ambient air pressure, such that a resultant air pressure force acts on the blocking element (3, 43, 63);
  - the device being arranged such that when the blocking element (3, 43, 63) is in the blocking position, a retaining force for retaining the blocking element in the blocking position acts on the blocking element;
  - characterised in that the device is configured such that when the blocking element (3, 43, 63) is in the blocking position and the air pressure in the mouthpiece (1) reaches a threshold, the resultant air pressure force acting on the blocking element (3, 43, 63) overcomes the retaining force and forces the blocking element to the open position, such that air is able to flow between the mouthpiece and the exterior of

- the device, thereby causing the air pressure in the mouthpiece to change and generating an air pressure pulse that can propagate into the patient's lungs to dislodge lung secretions.
2. A respiratory device according to claim 1, wherein the device is configured such that the blocking element is forced from the blocking position when the air pressure in the mouthpiece reaches a threshold that is greater than the ambient air pressure, and is also forced from the blocking position when the air pressure in the mouthpiece reaches an air pressure threshold that is less than the ambient air pressure.
  3. A respiratory device according to claim 1 or 2, wherein the blocking element is biased to return from the open position to the blocking position under the force of gravity.
  4. A respiratory device according to any one of claims 1 to 3 wherein the device comprises a magnet and the retaining force is at least in part provided by the magnet.
  5. A respiratory device according to any one of the previous claims wherein the retaining force is provided at least in part by friction between the blocking element and the conduit.
  6. A respiratory device according to claim 5, wherein at least one of the inner surface of the conduit and the blocking element are coated with a layer of material for increasing friction between them.
  7. A respiratory device according to claim 6 wherein the material is rubber.
  8. A respiratory device according to any one of the previous claims, comprising means for returning the blocking element to the blocking position from the open position.
  9. A respiratory device according to claim 8 wherein said means comprise an elastic member connected to the blocking element and the conduit.
  10. A respiratory device according to claim 8 or 9, wherein said means comprise a resilient pad, the blocking element being configured to impact off the pad to return to the blocking position.
  11. A respiratory device according to any one of claims 8 to 10 wherein said means comprise a wall that extends at least partway across the conduit.
  12. A respiratory device according to claim 11 wherein the wall has an orifice to allow air to pass there-through.

13. A respiratory device according to any preceding claim wherein the blocking element is a flap pivotably mounted in the conduit.
14. A respiratory device according to any one of claims 1 to 12 wherein the blocking element is a ball.
15. A respiratory device according to claim 14, wherein the conduit comprises a funnel shaped portion, wherein the smallest diameter of the funnel-shaped portion is less than the diameter of the ball.

**EXAMINATION COMMITTEE I**

Candidate No.

Paper A (Electricity/Mechanics) 2013 - Marking Sheet

Category	Maximum possible	Marks awarded	
		Marker	Marker
Independent claim	50	50	50
Dependent claims	35	29	31
Description	15	15	15
<b>Total</b>	100	94	96

Examination Committee I agrees on 95 marks and recommends the following grade to the Examination Board:

PASS  
(50-100)

COMPENSABLE FAIL  
(45-49)

FAIL  
(0-44)

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Chairman of Examination Committee I