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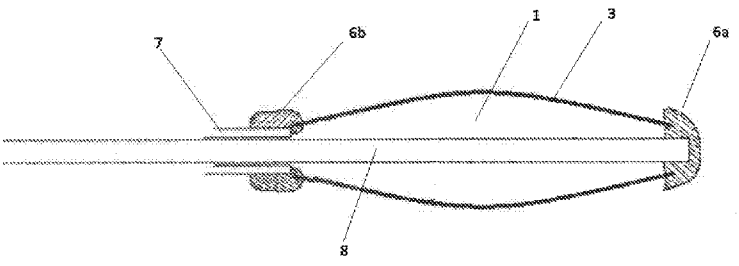
(54) **Title:** EQUIPMENT FOR THE COLLECTION OF LUNG TISSUE IN THE ENDOSCOPIC EXAMINATION OF THE LUNGS

Fig. 1



(57) **Abstract:** The lung parenchyma sampling device is formed at the distal end by a biopsy trap (1) and at the proximal end by a control device (2) of the biopsy trap (1) which are interconnected by a catheter (8) comprising a rod (5). The biopsy trap (1) consists of at least three flexible flat blades (3) located around the central part, formed by the catheter (8) provided with the rod (5) and connected to a rotating extension (9) of the catheter (8) located on the control device (2). The blades (3) are firmly connected to the central part at the distal end of the biopsy trap (1) by a soft fixation element (6a), and the proximal end of the biopsy trap (1) is formed by a proximal-moving anchor (7) of blades (3) provided with a soft fixing element (6b).

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Description

Title of Invention: Equipment for the collection of lung tissue in the endoscopic examination of the lungs

Technical Field

[0001] The present invention relates to a device for collecting lung tissue while minimizing the risk of bleeding or rupture of the lung during sampling of a lung parenchyma.

Background Art

[0002] Endoscopic lung examinations are now part of common medical practice. The reasons for the examination are various, endoscopic examination of the lungs is performed for both diagnostic and therapeutic reasons.

[0003] For diagnostic purposes, it is necessary to take samples from the airways.

[0004] Several techniques for sampling the airways and their surroundings are currently known. These include endobronchial aspiration, perbronchial puncture, brush biopsy, bronchalveolar lavage, endobronchial excision, transbronchial lung biopsy, and transbronchial cryobiopsy.

[0005] Two of these methods are used for lung parenchyma sampling, namely transbronchial biopsy, where sampling from the peripheral part of the bronchial tree is performed using biopsy forceps (samples of the lung parenchyma are also obtained during the examination), as well as transbronchial lung cryobiopsy, which is a method for obtaining larger samples of the lung parenchyma using a special freezing probe (cryoprobe).

[0006] In both of the above cases, it is a procedure in which a biopsy device is inserted into the periphery of the lungs to remove adjacent tissue. This can be done without control or with the help of ski-optical control. Both of the above techniques have common undesirable side effects, especially pneumothorax, which occurs when a biopsy device gets too close to the lung border and causes a rupture in the gutter. This risk is 1-5% for transbronchial biopsies and up to 50% for transbronchial pulmonary cryobiopsies. The second serious side effect is bleeding, which is usually not severe with a transbronchial biopsy, but can be severe with a transbronchial pulmonary cryobiopsy due to the size of the sample taken. Bleeding occurs in up to 40% of patients undergoing lung parenchyma biopsy.

[0007] It is therefore desirable to find a solution that would eliminate the risks associated with pulmonary parenchymal sampling.

[0008] From the state of the art, solutions are known which consist of pliers which are closed in the boot state so as to form a rounded tip. Examples are US2018353162, CN108969026, US2018280004, WO2018152626, WO 2014/186319 or

US2018177496. The disadvantage of these solutions is that the forceps must be opened and brought closer to the sampling point before the actual sampling. Because the individual arms of these forceps are formed to form spikes at their distal end, there is still a high risk of tissue injury and pneumothorax or bleeding.

[0009] The object of the invention is to provide a device for sampling the lung parenchyma which would substantially reduce the risks described.

Summary of Invention

[0010] This task is solved by a lung parenchyma sampling device having a biopsy trap at the distal end and a biopsy trap control device at the proximal end. The biopsy trap is formed of at least three flexible flat blades located around a central portion formed by a catheter and provided with a rod for actuating the biopsy trap. The blades are firmly connected to the catheter at the distal end of the biopsy trap by means of a soft fixation element, the length of which is 1-5 mm, and serves as protection against pneumothorax. The proximal end of the biopsy trap is formed by a proximal-distally movable anchor of the blade provided with a soft fixation element. The biopsy trap and the biopsy trap control device are connected by a catheter comprising a rod for controlling the proximo-distal movement of the blade and a rotating catheter extension for controlling the rotation of the biopsy trap.

[0011] In a preferred embodiment, the blades are made of austenitic or martensitic stainless steel of surgical grade or of a compound of nickel and titanium of surgical grade.

[0012] In a preferred embodiment, the fixing elements are made of a photopolymerically cured medical resin.

Brief Description of Drawings

Fig.1

[0013] [Fig.1] illustrates a view of the biopsy trap in the open state,

Fig.2

[0014] [Fig.2] illustrates a closed biopsy trap located in the working channel of the bronchoscope,

Fig.3

[0015] [Fig.3] illustrates the whole device with a closed biotic trap,

Fig.4

[0016] [Fig.4] illustrates the whole device with an open biotic trap,

Examples

[0017] Example 1

[0018] The lung parenchyma sampling device has a biopsy trap 1 at the distal end and a biopsy trap 1 control device 2 at the proximal end. The biopsy trap 1 is formed of four flexible flat blades 3 placed around a central part formed by a catheter 8 provided with

a rod 5 for actuating the biopsy trap 1. The blades 3 are firmly connected to the catheter 8 at the distal end of the biopsy trap 1 by means of a soft fixation element 6a, the length of which is 1-5 mm and serves as protection against pneumothorax. The proximal end of the biopsy trap 1 is formed by a proximo-distally movable anchor 7 of the blade 3 provided with a soft fixation element 6b. The biopsy trap 1 and the control device 2 of the biopsy trap 1 are connected by a catheter 8 comprising a rod 5 for controlling the proximo-distal movement of the blade 3 and a rotating attachment 9 of the catheter 8 for controlling the rotation of the biopsy trap 1. The blades 3 are made of austenitic steel in surgical quality. The fixing elements 6a, 6b are made of a resin usable in healthcare cured by photopolymerization. The lung parenchyma sampling device is inserted into the working channel of the bronchoscope 10, through which the biopsy trap 1 is introduced at the sampling site. By the action of the proximo-distal pressure by means of the rod 5, the blade 3 is compressed to a predefined diameter, whereby the biopsy trap 1 is opened by creating gaps between the individual blades 3. By the action of the rotational force caused by the rotation of the rotary attachment 9, the open biopsy trap 1 is rotated, whereby a sample of the lung parenchyma is taken. By releasing the proximal-distal pressure, the biopsy trap 1 closes, while the lung parenchyma sample remains inside the biopsy trap due to its porosity.

[0019] Example 2

[0020] The lung parenchyma sampling device has a biopsy trap 1 at the distal end and a biopsy trap 1 control device 2 at the proximal end. The biopsy trap 1 is formed of six flexible flat blades 3 placed around a central part formed by a catheter 8 provided with a rod 5 for actuating the biopsy trap 1. The blades 3 are firmly connected to the catheter 8 at the distal end of the biopsy trap 1 by means of a soft fixation element 6a, the length of which is 1-5 mm and serves as protection against pneumothorax. The proximal end of the biopsy trap 1 is formed by a proximo-distally movable anchor 7 of the blade 3 provided with a soft fixation element 6b. The biopsy trap 1 and the control device 2 of the biopsy trap 1 are connected by a catheter 8 comprising a rod 5 for controlling the proximo-distal movement of the blade 3 and a rotating attachment 9 of the catheter 8 for controlling the rotation of the biopsy trap 1. The blades 3 are made of a compound of nickel and titanium in surgical quality. The fixing elements 6a, 6b are made of a resin usable in healthcare cured by photopolymerization. The lung parenchyma sampling device is inserted into the working channel of the bronchoscope 10, through which the biopsy trap 1 is introduced at the sampling site. By the action of the proximo-distal pressure by means of the rod 5, the blade 3 is compressed to a predefined diameter, whereby the biopsy trap 1 is opened by creating gaps between the individual blades 3. By the action of the rotational force caused by the rotation of the rotary attachment 9, the open biopsy trap 1 is rotated, whereby a sample of the lung

parenchyma is taken. By releasing the proximal-distal pressure, the biopsy trap 1 closes, while the lung parenchyma sample remains inside the biopsy trap due to its porosity.

Industrial Applicability

[0021] The invention is repeatedly industrially applicable in the field of medicine, in particular diagnostics.

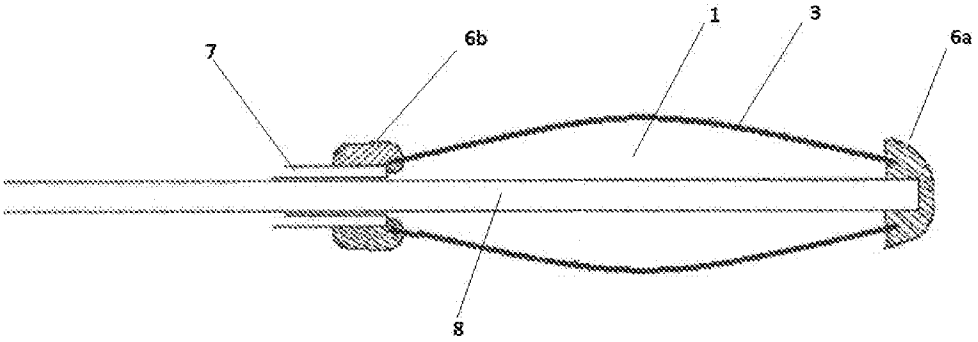
Claims

[Claim 1] A lung parenchyma sampling device formed at the distal end by a biopsy trap 1 and at the proximal end by a control device 2 of a biopsy trap 1 interconnected by a catheter 8 comprising a rod 5, **characterized in that** the biopsy trap 1 is formed by at least three flexible flat blades 3 located around a central part formed by a catheter 8 provided with a rod 5 and connected to a rotating extension 9 of the catheter 8 located on the control device 2, the blades 3 being firmly connected to the central part 4 at the distal end of the biopsy trap 1 by a soft fixation element 6a and the proximal end of the biopsy trap 1 being formed a proximo-distally movable anchor 7 of the blade 3 provided with a soft fixing element 6b.

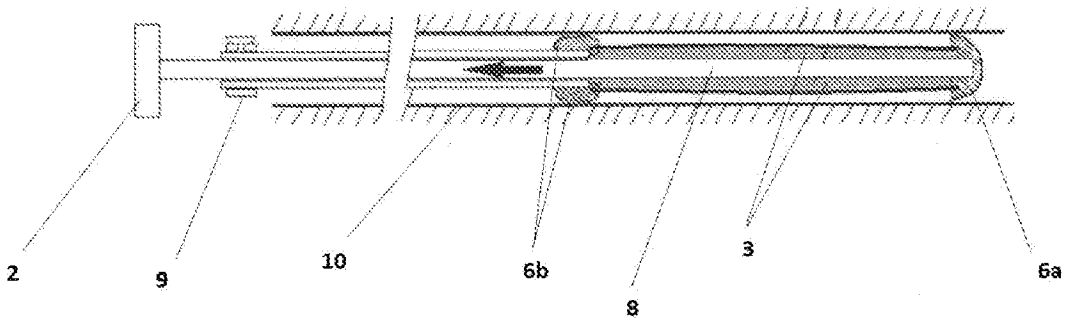
[Claim 2] The according to claim 1, characterized in that the blades 3 are made of austenitic or martensitic stainless steel in surgical grade or of a compound of nickel and titanium in surgical grade.

[Claim 3] The according to claim 1 or 2, characterized in that the fixing elements 6a, 6b are made of a resin usable in healthcare cured by photopoly-merization.

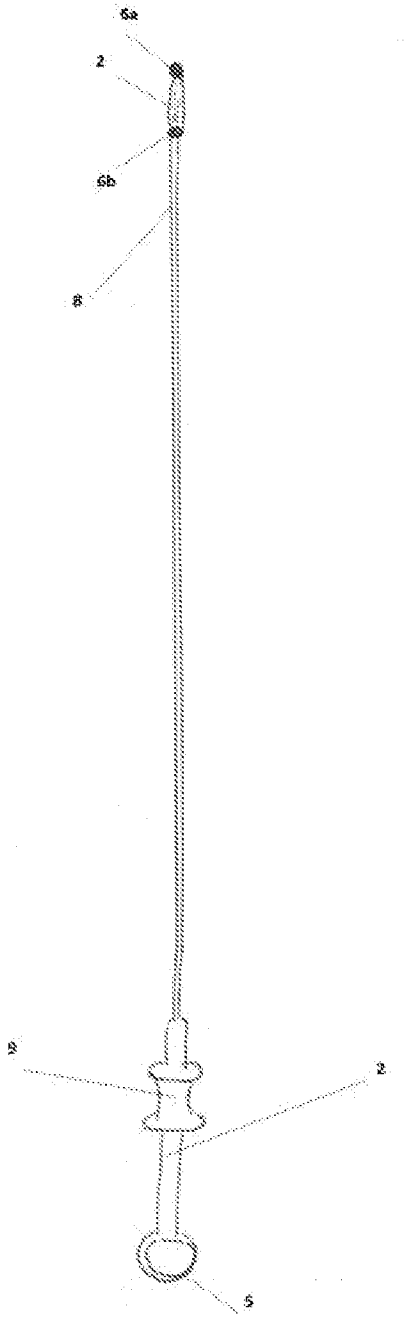
[Fig. 1]



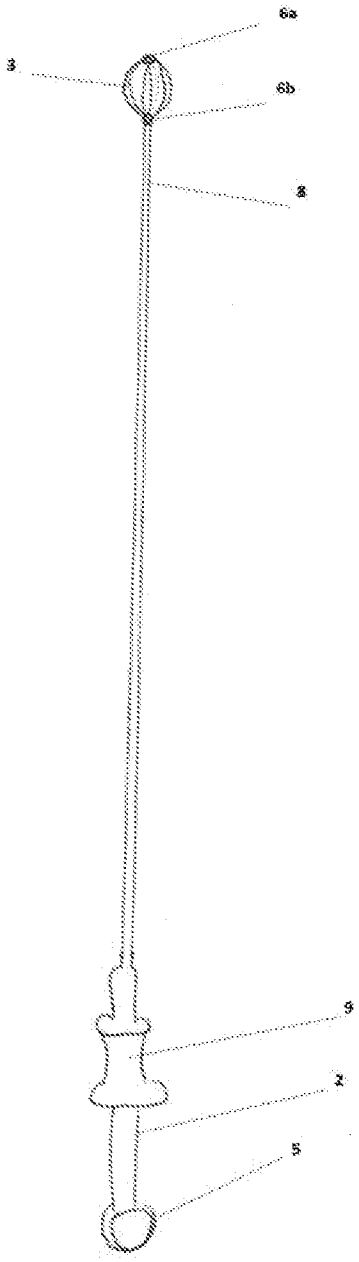
[Fig. 2]



[Fig. 3]



[Fig. 4]



INTERNATIONAL SEARCH REPORT

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PCT/CZ2020/050031

A.. CLASSIFICATION OF SUBJECT MATTER

A 61 B 10/04

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

CZ IPO database

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPOQUE (EPODOC, PATENW, X-Full), STN (CAplus, DWPI, BIOSIS, EMBASE, MEDLINE, full text databases)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 9904704 A1 (MCGUCKIN, JAMES) 4.2.1999, fig. 1 and 2, pages 12 and 13	1-3
Y	US 6152932 A (SAFE CONDUCT AB) 28.11.2000, fig 1 and 4, columns 3 and 4	1-3
A	US 8668654 B1 (GERRANS, LAWRENCE J.; GUNDAY, ERHAN H.; SANOVAS INC.) 11.03.2014, figures	1-3

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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