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• **Gapinski, Tomasz**
41-819 Zabrze (PL)

(74) Representative: **Korga, Leokadia**
Kancelaria Rzecznika Patentowego
ul. Bereniki 6/7
44-117 Gliwice (PL)

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(71) Applicant: **VIMEX Sp. z o.o.**
44-100 Gliwice (PL)

(72) Inventors:
• **Lenartowicz, Krzysztof**
44-217 Rybnik (PL)

Remarks:

A request for correction of the title has been filed pursuant to Rule 139 EPC. A decision on the request will be taken during the proceedings before the Examining Division (Guidelines for Examination in the EPO, A-V, 3.).

(54) **Peristaltic pump**

(57) The subject of the invention is a peristaltic pump particularly for medical use. A peristaltic pump comprising a peristaltic pump wheel, a drainage tube connection seat, a drainage tube measuring tap, a separator, a set of sensors and a control unit according to the invention is characteristic in that the drainage tube measuring tap [13] is connected to the set of sensors [6] by means of a

separator [5] and the said measuring system has a Y-type tube [11] connected to two sensors [6] and the plug of the drainage tube measuring tap [10] is connected to the measuring tube [11] by means of a non-contact connection control unit [7] of the plug [10] placed in the drainage tube connection seat [3].

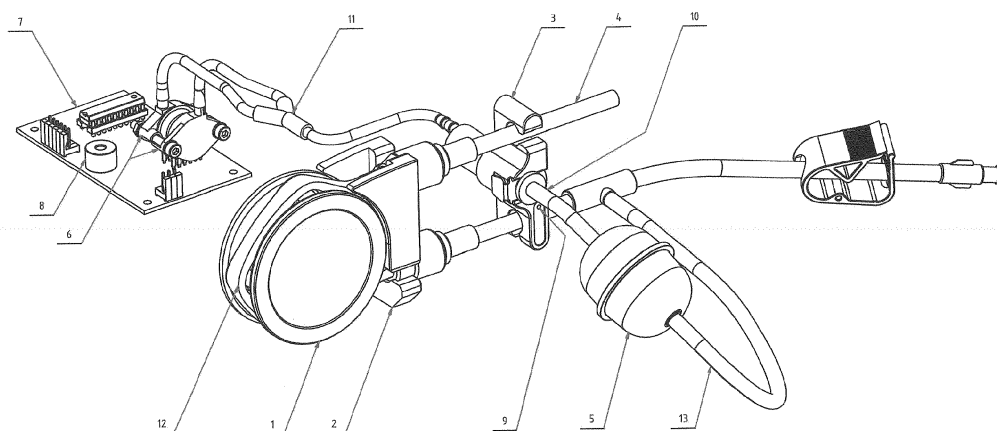


Fig. 1

Description

[0001] The subject of the invention is a peristaltic pump particularly for medical use.

[0002] Patent description PL 212438 discloses a peristaltic pump comprising a flexible tube encircled by actuators equipped with permanent magnets. The flexible tube with the actuators is encircled by coils placed in series where each coil is powered independently by an electrically powered control unit. The pump is used e.g. in laboratories or production lines for transporting masses of varied density and viscosity requiring insulation from the environment due to their toxicity, microbiological sterility or in order to be insulated from the negative influence of external factors.

[0003] Solutions known from prior art have not employed non-contact detection of the connection correctness between the drainage tube and the measuring system of the pump including optical-acoustic signaling of its status and connecting to a redundant measuring system.

[0004] The invention relates to the use of a peristaltic pump including the part of the drainage tube responsible for pressure transfer in the construction of the measuring system of a medical peristaltic pump.

[0005] A peristaltic pump comprising a peristaltic pump wheel, a drainage tube connection seat, a drainage tube measuring tap, a separator, a set of sensors and a control unit according to the invention is characteristic in that the drainage tube measuring tap is connected to the set of sensors by means of a separator and the said measuring system has a Y-type connected to two sensors and the plug of the drainage tube measuring tap is connected to the measuring tube by means of a non-contact connection control unit of the plug placed in the drainage tube connection seat.

[0006] Favourably, the connection control unit of the plug emits an acoustic or optical signal once the drainage tube is connected to the measuring system.

[0007] Favourably, the pressure measuring system is placed in the housing of the pump.

[0008] The main advantage of the invention is the fact that the pump provides a reliable and secure connection, non-contact detection of correct drainage tube connection to the pump, optical-acoustic initialization, separation of the sterile agent being transferred to the operative field (NaCl 0,9%) from the non-sterile measuring system. The construction of the measuring system also provides redundancy of the pressure measurement in the operative field.

[0009] The invention is characteristic in that non-contact detection is used for verifying the correctness of the connection between the drainage tube to the measuring system of the pump including optical-acoustic signaling of its status and a redundant measuring system. The non-contact detection consists in operating the reeds of the magnetic reed-relay by a permanent magnet located in the piston moving in the cylinder. Such a system ensures

high durability and leakproofness of the system and eliminates the use of mechanical switches or optical systems. Using them would require additional sealing and would pose the risk of leakage during operation.

[0010] The measuring system of the device has been placed inside the device thus eliminating the risk of mechanical damage to the fragile pressure sensors.

[0011] One non-limiting embodiment of the invention is presented in the drawing, where:

Fig 1 presents the peristaltic pump system;

Fig. 2 presents the connection control unit of the plug.

Exemplary embodiment

[0012] The peristaltic wheel 1 rolls over the flexible part of the drainage tube 13 moving along doses of liquid enclosed between the rollers of the peristaltic wheel 1. Thus transferred liquid (usually NaCl 0,9%) is supplied to the enclosed operative field. As the amount of the supplied liquid increases so does the pressure in the closed patient - pump system. The measurement of the pressure value is conducted by a set of pressure sensors 6 installed on the control unit 7 situated inside the pump housing 14. The separator 5 which is part of the drainage tube measuring tap 13 constitutes a natural sterility barrier between the liquid in the patient-pump system and the air compressed in the measuring system. The barrier ensures sterility of the liquid being transferred to the operative field by separating it from the non-sterile connection seat of the drainage tube 3. As the pressure value measured by the set of sensors 6 changes, the control unit 7 adjusts the rotational speed of the peristaltic wheel 1 so as to obtain optimal values of the pumped liquid. The higher the pressure, the lower the rotational speed of the peristaltic wheel of the pump 1. The pressure is measured by a set of sensors [6] connected in parallel using a Y-type tube 11. This ensures redundancy necessary to obtain measurement certainty and a significant improvement of patient safety. In the event of one of the sensors in the set of sensors 6 breaking, or in case the reading of the pressure value measured by a sensor differs from the reading of the other sensor, the control unit 7 stops the peristaltic wheel of the pump 1 to protect the operative field from excessive or uncontrolled pumping.

[0013] The correctness of the connection of the drainage tube with the device is ensured by the system of plug 10 detection in the drainage tube connection seat 3. During installation the plug 10 pushes the piston 3.9 along the cylinder 3.13. At the end of the piston 3.9 there is a permanent magnet 3.8, which initiates the operation of the magnetic reed relay 3.14 in the last phase of moving the piston 3.9. This state is determined by releasing the blocking element 3.1 by deflecting the spring of the blocking element 3.3 and activating the lock 3.5, which driven by the force of the spring of the lock 3.4 causes the plug 10 to lock in the drainage tube connection seat 3. Thus

initiated magnetic reel relay 3.14 informs the control unit 7 that the plug 10 of the drainage tube measuring tap 12 has been connected correctly. The control unit 7 signals this fact by switching on the optical LED signaler 3.7 for the duration of the correct connection. Also, the possibility to start the peristaltic wheel of the pump 1 is only possible once the control unit has received information about the correct connection of the plug 10 of the drainage tube measuring tap from the magnetic reel relay 3.14.

[0014] In the event of an attempt being made to start the peristaltic wheel 1 while the plug 10 of the drainage tube tap 12 has not been connected correctly to the drainage tube connection seat 3, the control unit 7 sets off an optical and acoustic alarm while blocking the possibility of starting the peristaltic wheel 1 at the same time. Optical signaling of this status is realized by means of an optical LED signaler 9 installed in the drainage tube connection seat 3 under the SENSOR 3.2. The acoustic signal is sounded by an acoustic signaler 8 located on the control unit 7.

[0015] The above exemplary embodiment does not exhaust the possibilities of using the invention.

[0016] Leakproofness is the most important feature in the risk management process while constructing a medical device. Minimizing the number of possible occurrences which require additional sealing makes it possible to lower that risk significantly and to avoid medical incidents as a consequence.

Claims

1. A peristaltic pump comprising a peristaltic pump wheel, a drainage tube connection seat, a drainage tube measuring tap, a separator, a set of sensors and a control unit **characteristic in that** the drainage tube measuring tap [13] is connected to the set of sensors [6] by means of a separator [5] and the said measuring system has a Y-type tube [11] connected to two sensors [6] and the plug of the drainage tube measuring tap [10] is connected to the measuring tube [11] by means of a non-contact connection control unit [7] of the plug [10] placed in the drainage tube connection seat [3].
2. A peristaltic pump according to claim 1 **characteristic in that** the connection control unit [7] of the plug emits an acoustic or optical signal once the drainage tube [4] is connected to the measuring system in control unit [7].
3. A peristaltic pump according to claims 1 and 2 **characteristic in that** the pressure measuring system is placed in the housing [14] of the pump.

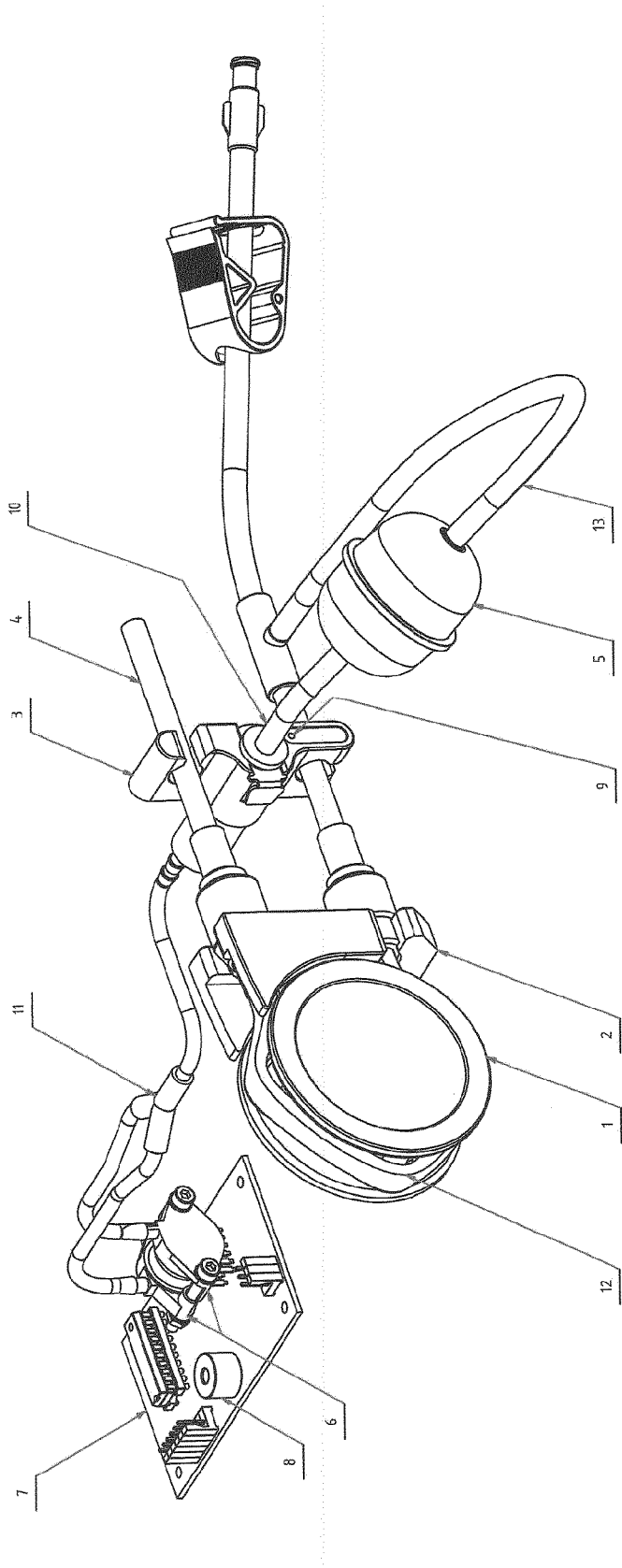


Fig. 1

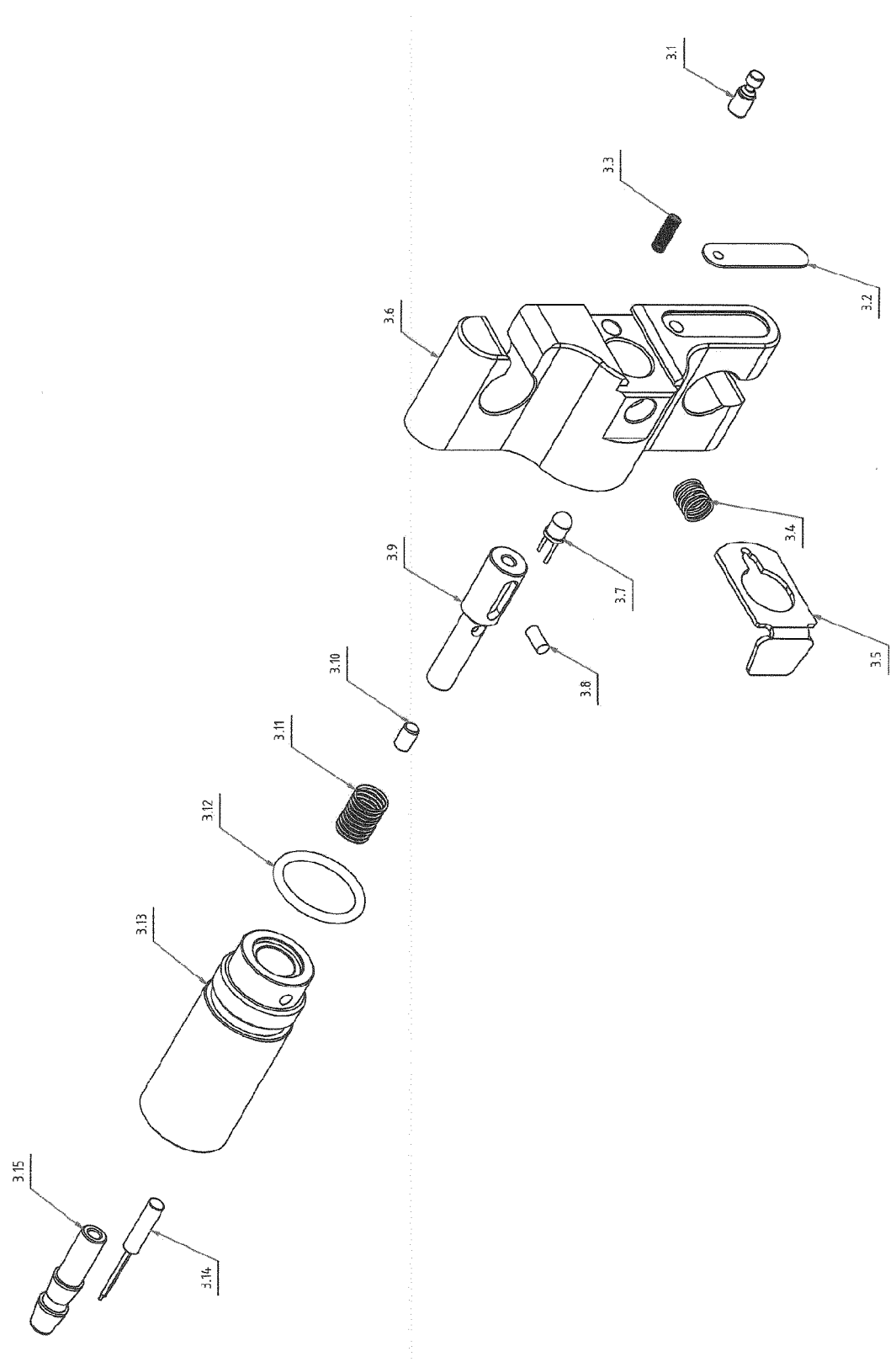


Fig. 2



EUROPEAN SEARCH REPORT

Application Number
EP 14 19 8914

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A	EP 0 128 388 A2 (BECK WALTER [CH]; WERNER MARGRIT [DE]) 19 December 1984 (1984-12-19) * page 9, paragraph 2 - page 11, paragraph 3; figure 1 *	1-3	
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 29 March 2016	Examiner Ziegler, Hans-Jürgen
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 14 19 8914

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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