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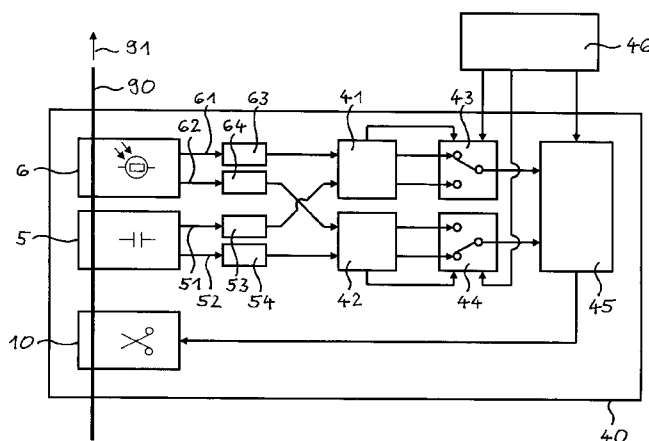


Fig. 4

(57) Abstract: The yarn clearer comprises a measurement head (40) with a capacitive measuring cell (5) and an optical measuring cell (6) for detecting characteristics of a yarn (90). An evaluation unit (45) compares the detected yarn characteristics with predetermined quality criteria. A cutter device (10) cuts the yarn (90) upon a cut command from the evaluation unit (45). The capacitive measuring cell (5) detects yarn-mass variations and the optical measuring cell (6) detects yarn-diameter variations. The evaluation unit (45) Outputs an unevenness cut command if the yarn-mass Variation detected by the capacitive measuring cell (5) and/or the yarn-diameter Variation detected by the optical measuring cell (6) do not comply with the predetermined quality criteria. Both the capacitive measuring cell (5) and the optical measuring cell (6) further detect foreign matter contents in the yarn (90). The evaluation unit (45) Outputs a foreign-matter cut command if the foreign-matter content detected by the capacitive measuring cell (5) and/or the foreign matter content detected by the optical measuring cell (6) do not comply with the predetermined quality criteria. The yarn clearer is versatily usable.

YARN CLEARER AND METHOD FOR CLEARING YARN

TECHNICAL FIELD

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The present invention lies in the field of textile quality control. It relates to a yarn clearer and to a method for clearing yarn, according to the preambles of the independent claims.

10 PRIOR ART

So-called yarn clearers are applied for ensuring the yarn quality on spinning machines or winding machines. Such a yarn clearer is known for example from EP-0'439'767 A2. It contains a yarn clearer measurement head with at least one sensor, which scans the moved
15 yarn and measures at least one parameter of the yarn. It is the object of yarn clearing to detect yarn faults such as thick places, thin places or foreign matter in the yarn, to assess them according to certain quality criteria, and to eliminate them as the case may be. The most common sensor principles are the following:

- 20 • The capacitive measurement principle; cf. US-6,346,819 B1. The yarn is guided through an air gap of a measuring condenser. The measuring condenser measures essentially the yarn mass inside it. The capacitive measurement principle has a high measurement accuracy and a sensitivity that is stable over many years. Its drawbacks are an undesired sensitivity to humidity changes and the non-usability with electrically conductive yarns.
- 25 • The optical measurement principle; cf. US-2006/164,646 A1. The yarn is illuminated, and light reflected and/or transmitted by the yarn is detected. The detected light is a measure for the yarn diameter and/or the optical characteristics of the yarn such as its reflectivity, color, etc. The optical measurement principle is less sensitive to diameter changes and less stable over a long time than the capacitive. Nevertheless, it may be
30 advantageous for those applications for which the capacitive measurement principle is unsuitable, e.g., in environments with strong air-humidity changes or for electrically conductive yarns. Foreign matter in the yarn, which has a reflectivity that strongly

differs from that of the yarn base material, can be detected by the optical measurement principle in a simple way.

5 It has been proposed to scan the yarn with different sensors and to combine the different sensor signals for evaluation. For instance CN-2'896'282 Y mentions the combination of a capacitive and a photoelectric sensor for detecting the density and diameter, respectively, of the same yarn. The two sensors are operated in a master-slave mode, and their signals are processed by applying a weighted synthesis of the two signals.

10 US-2003/107,729 A1 teaches to arrange two sensors one after the other along the yarn path. A first of the sensors measures the optical reflection from the yarn; a second of the sensors measures capacitively or optically the mass or the diameter, respectively, of the yarn. The output signals of the two sensors are evaluated according to certain evaluation criteria. Based on the evaluation, at least two kinds of foreign matters are distinguished
15 from each other.

SUMMARY OF THE INVENTION

20 It is an object of the present invention to provide a yarn clearer and a yarn-clearing method that are versatily usable.

The object is solved by the yarn clearer and the yarn-clearing method as defined in the independent claims. Advantageous embodiments of the invention are defined in the
25 dependent claims.

The basic idea of the present invention is to provide a yarn clearer with a capacitive and an optical measuring cell, both measuring cells being adapted for detecting the yarn unevenness as well as foreign matter in the yarn. Each of the two different measuring cells
30 can be individually switched on and off, either by an operator or automatically.

Thus, the yarn clearer according to the invention comprises a measurement head with a capacitive measuring cell and an optical measuring cell for detecting characteristics of a

yarn. The two measuring cells are arranged adjacent to each other in the longitudinal direction along a path of the yarn. The yarn clearer further comprises an evaluation unit for comparing the detected yarn characteristics with predetermined quality criteria, and a cutter device for cutting the yarn upon a cut command from the evaluation unit. The

5 capacitive measuring cell is adapted for detecting yarn-mass variations and the optical measuring cell is adapted for detecting yarn-diameter variations. The evaluation unit is adapted for outputting an unevenness cut command if the yarn-mass variation detected by the capacitive measuring cell and/or the yarn-diameter variation detected by the optical measuring cell do not comply with the predetermined quality criteria. Both the capacitive

10 measuring cell and the optical measuring cell are adapted for detecting foreign matter contents in the yarn. The evaluation unit is adapted for outputting a foreign-matter cut command if the foreign-matter content detected by the capacitive measuring cell and/or the foreign matter content detected by the optical measuring cell do not comply with the predetermined quality criteria.

15

In a first alternative, the yarn clearer comprises an input unit that allows an operator to input whether the yarn-mass variation detected by the capacitive measuring cell or the yarn-diameter variation detected by the optical measuring cell or both variations shall trigger the unevenness cut command. The input unit may also allow an operator to input

20 whether the foreign-matter content detected by the capacitive measuring cell or the foreign matter content detected by the optical measuring cell or both foreign-matter contents shall trigger the foreign-matter cut command.

In a second alternative, the yarn clearer comprises a comparison unit for comparing the

25 yarn-mass variation detected by the capacitive measuring cell with the yarn-diameter variation detected by the optical measuring cell and for automatically determining, based on the comparison, whether the yarn-mass variation detected by the capacitive measuring cell or the yarn-diameter variation detected by the optical measuring cell or both variations shall trigger the unevenness cut command. A comparison unit may also be present for

30 comparing the foreign-matter content detected by the capacitive measuring cell with the foreign-matter content detected by the optical measuring cell and for automatically determining, based on the comparison, whether the foreign-matter content detected by the

capacitive measuring cell or the foreign-matter content detected by the optical measuring cell or both foreign-matter contents shall trigger the foreign-matter cut command.

5 The measurement head may further comprise signal-processing units for pre-processing signals from the measuring cells, the evaluation unit and the cutter device.

10 In a preferred embodiment the optical measuring cell comprises a light source, at least one light detector for detecting light transmitted by the yarn and at least one light detector for detecting light reflected by the yarn. The light source is preferably a light-emitting diode, and one single light detector for detecting light transmitted by the yarn and two light detectors for detecting light reflected by the yarn are present.

15 In the inventive method for clearing yarn characteristics of the yarn are detected by a measurement head with a capacitive measuring cell and an optical measuring cell, the two measuring cells being arranged adjacent to each other in the longitudinal direction along a path of the yarn. The detected yarn characteristics are compared with predetermined quality criteria. The yarn is cut if the detected yarn characteristics do not comply with the predetermined quality criteria. Yarn-mass variations are detected by the capacitive measuring cell and/or yarn-diameter variations are detected by the optical measuring cell.

20 The yarn is cut if the yarn-mass variation detected by the capacitive measuring cell and/or the yarn-diameter variation detected by the optical measuring cell do not comply with the predetermined quality criteria. Foreign matter contents in the yarn are detected by the capacitive measuring cell and/or the optical measuring cell. The yarn is cut if the foreign-matter content detected by the capacitive measuring cell and/or the foreign matter content

25 detected by the optical measuring cell do not comply with the predetermined quality criteria.

30 In the first alternative, an operator inputs whether the yarn-mass variation detected by the capacitive measuring cell or the yarn-diameter variation detected by the optical measuring cell or both variations shall trigger an unevenness cut. An operator may also input whether the foreign-matter content detected by the capacitive measuring cell or the foreign matter content detected by the optical measuring cell or both foreign-matter contents shall trigger a foreign-matter cut.

In the second alternative, the yarn-mass variation detected by the capacitive measuring cell is compared with the yarn-diameter variation detected by the optical measuring cell, and it is automatically determined, based on the comparison, whether the yarn-mass variation detected by the capacitive measuring cell or the yarn-diameter variation detected by the optical measuring cell or both variations shall trigger an unevenness cut. In an analogous way, the foreign-matter content detected by the capacitive measuring cell may be compared with the foreign-matter content detected by the optical measuring cell, and it is automatically determined, based on the comparison, whether the foreign-matter content detected by the capacitive measuring cell or the foreign-matter content detected by the optical measuring cell or both foreign-matter contents shall trigger a foreign-matter cut.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are described in the following with reference to the drawings, which are for the purpose of illustrating the preferred embodiments of the invention and not for the purpose of limiting the same.

- Figure 1 shows in perspective views a yarn clearer measurement head according to the invention with (a) a closed housing and a cutter device attached to it and (b) an open housing.
- Figure 2 shows a measuring unit of a yarn clearer according to the invention in a perspective view.
- Figure 3 schematically shows an optical measuring cell of the yarn clearer according to the invention.
- Figure 4 shows a block diagram of part of a yarn clearer according to the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

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The **Figures 1(a) and (b)** show a preferred embodiment of a measurement head of a yarn clearer according to the invention in different assembly states. The yarn clearer measurement head comprises a housing 1 with a detachable cover 2 along a cross section

of the housing 1. The cover 2 may be taken off the rest of the housing and give way to the interior of the housing. The housing has a measurement slot 3, through which a yarn (not shown) can run along its axis. The yarn is guided through the measurement slot 3 by guide elements 4 on the upstream and downstream entries of the slot 3. Two measuring cells 5 and 6 located next to the measurement slot 3 for collecting information data concerning yarn quality are supported by the housing 1. The measuring cells may be designed as a capacitive measuring cell 5 and an optical measuring cell 6 as known from the art.

A cutter device 10 can be attached to the housing 1 on the upstream side next to the measurement slot 3, such that the cutter device 10 can cut yarn running through the measurement slot 3. In the embodiment of Figure 3, the cutter device 10 comprises a body 13 holding a plunger coil 14. A blade holder 12 bears a moveable blade 11. The blade holder 12 is connected to a plunger 15, which is located inside the plunger coil 14. When an electric current runs through the plunger coil 14, the plunger 15 is electromagnetically accelerated, whereby the blade 11 hits an anvil 16. The yarn is thus cut by the blade 11. For assembling, the cutter device 10 is preferably freely inserted into mounting elements 17, which immovably secure it in the two directions perpendicular to the yarn axis. Then a cutter cover (not shown) is mounted onto the housing 1, e.g., by a lock-in connection and/or at least one screw. The cutter cover secures the cutter device 10 in the third direction. Thus, the cutter device 10 is preferably not directly mechanically attached to the housing 1.

Inside the housing 1 one single printed-circuit board 7 is provided with a plurality of electronic components 8. The entirety of the components 8 together build a processing and/or evaluation unit of the yarn clearer measurement head, which is designed for processing signals collected by the measuring cells 5 and 6 and for controlling the cutter device 10 at least. Electronic components 8 are for example resistors, transistors, capacitors, relays, integrated circuits and the like. All the electronic components 8 are preferably attached to both surfaces of the printed-circuit board 7. The printed-circuit board 7 extends throughout the cross section of the housing from the measurement slot 3 to the surrounding inner walls of the housing 1.

The measuring cells 5 and 6 are constantly electrically connected to the one single printed-circuit board 7. Furthermore the printed-circuit board 7 comprises a connector port 9 for connection of the cutter device 10. The connector port 9 is accessible through an opening in the cover 2, when the housing 1 is closed by the cover 2 or may extend through the opening. When the cutter device 10 is attached externally to the housing 1, it can be electrically connected to the one single printed-circuit board 7 via the connector port 9.

Figure 2 shows a combined yarn clearer measuring unit comprising a capacitive measuring cell 5 and an optical measuring cell 6. The capacitive measuring cell 5 has a capacitive cell body with a capacitive measurement slot, and the optical measuring cell 6 has an optical cell body with an optical measurement slot. The capacitive measuring cell 5 and the optical measuring cell 6 are arranged adjacent to each other in the longitudinal direction along which a yarn to be tested (not shown) is running in the measurement slots. The capacitive measuring cell 5 is arranged upstream of the optical measuring cell 6. The capacitive measurement slot and the optical measurement slot form together the measurement slot 3.

The optical cell body and the capacitive cell body each have a relatively complex structure as a result of their individual functions, but since these structures are not subject of the invention they are not further described. However, the optical cell body and the capacitive cell body are joined together in a combined measuring unit. The combined measuring unit is mounted on the printed-circuit board 7 (see Figure 1(b)) in a way to make sure that the capacitive measuring cell 5 remains aligned with the optical measuring cell 6. The printed-circuit board 7 is thereby arranged perpendicular to the longitudinal moving direction of the yarn to be tested.

A preferred embodiment of the optical measuring cell 6 is illustrated in **Figure 3**. A light source 31, preferably a light-emitting diode (LED), illuminates a yarn 90. Light transmitted and reflected by the yarn 90 is detected. For this purpose, three light detectors 32-34 are arranged around the yarn 90. A first detector 32 is arranged essentially opposite to the light source 31 with respect to the yarn 90. It detects light 35 that is transmitted by the yarn 90, i.e., essentially light that directly travels from the light source 31 to the first detector 32 without interacting with the yarn 90. The output signal of the first detector 32 is a measure for the yarn diameter. It is processed by a first signal-processing unit 38, which outputs a

yarn-diameter signal. A second and a third light detector 33, 34 are arranged such that they detect light 36, 37 reflected by the yarn 90. Their output signals are influenced by the yarn diameter as well as by changes of the yarn reflectivity, i.e., by foreign matter in the yarn 90. The yarn-diameter influence can be compensated by a suitable combination with the diameter-dependent signal of the first detector 32, e.g., by an addition or a multiplication, such that the combined signal indicates only the foreign-matter content of the yarn 90. This is done in a second signal-processing unit 39, which outputs a foreign-matter-content signal.

10 The block diagram of **Figure 4** shows a preferred embodiment of part of a yarn clearer according to the invention. A yarn 90 is moved along its axis through a measurement slot 3 (see Figure 2; not shown in Figure 4) of a yarn clearer measurement head 40; the direction of movement is indicated in Figure 4 by an arrow 91. The yarn 90 passes in the measurement head 40 through a capacitive measuring cell 5 and an optical measuring cell 15 6, which are also shown in Figure 2. The capacitive measuring cell 5 outputs on a first output line 51 a yarn-mass signal and on a second output line 52 a foreign-matter signal. The capacitive detection of a yarn-mass signal is well known; the capacitive detection of foreign matter is described in US-6,346,819 B1 and need not be repeated here. The optical measuring cell 6 outputs on a first output line 61 a yarn-diameter signal and on a second 20 output line 62 a foreign-matter signal. Figure 3 shows an example of an optical measuring cell 6 for optically detecting such signals. The output signals of the capacitive measuring cell 5 and the optical measuring cell 6 are fed into corresponding signal-processing units 53, 54, 63, 64, which may pre-process the signals and convert them from the analog to the digital domain.

25

The measurement head 40 contains an evaluation unit 45 for comparing the detected yarn characteristics with predetermined quality criteria. First quality criteria relate to the yarn-mass variation detected by the capacitive measuring cell 5 and the yarn-diameter variation detected by the optical measuring cell 6. The evaluation unit 45 outputs an unevenness cut 30 command to the cutter device 10 (see also Figure 1) if the yarn-mass variation detected by the capacitive measuring cell 5 and/or the yarn-diameter variation detected by the optical measuring cell 6 do not comply with the first quality criteria. Second quality criteria relate to the foreign-matter content detected by the capacitive measuring cell 5 and the foreign-

matter content detected by the optical measuring cell 6. The evaluation unit 45 outputs a foreign-matter cut command to the cutter device 10 if the foreign-matter content detected by the capacitive measuring cell 5 and/or the foreign matter content detected by the optical measuring cell 6 do not comply with the second quality criteria. The cut commands are triggered either by an output signal from the capacitive measuring cell 5 or by an output signal from the optical measuring cell 6 or by output signals from both measuring cells 5, 6. This is schematically indicated in the diagram of Figure 4 by a first switch 43 and a second switch 44. The first switch 43 is for selecting either the unevenness signal from the capacitive measuring cell 5 or the unevenness signal from the optical measuring cell 6 to trigger the unevenness cut command. The second switch 44 is for selecting either the foreign-matter signal from the capacitive measuring cell 5 or the foreign-matter signal from the optical measuring cell 6 to trigger the foreign-matter cut command. The third mode of operation, in which the signals from both measuring cells 5, 6 trigger the cut commands, is not covered by the schematic illustration of Figure 4, but is also within the scope of the invention. A person skilled in the art is able to realize the latter embodiment, e.g., by combining both signals with a logic OR interconnection and triggering the cut command as soon as at least one of both signals does not comply with the quality criteria. It will be evident to the person skilled in the art that the switches 43, 44 shown in Figure 4 are only symbols. They need not be realized as physical switches between two electric lines, but may be realized in other ways well known to the person skilled in the art, such as digital logic circuits.

In a first alternative of the invention, the switches 43, 44 can be set manually by an operator via an input unit 46. The operator may, for instance, select the signal from the capacitive measuring cell 5 to trigger the unevenness cut command and the signals from both measuring cells 5, 6 to trigger the foreign-matter cut command if the yarn 90 is from cotton. When, however, a yarn 90 with electrically conductive fibers is processed, the operator activates the switches via the input unit 46 such that only the signals from the optical measuring cell 6 are used to trigger both the unevenness cut command and the foreign-matter cut command. In a second alternative, the switches 43, 44 are set automatically. For this purpose, comparison units 41, 42 may be provided which essentially compare the corresponding signals from the capacitive measuring cell 5 and the optical measuring cell 6. If a comparison unit 41, 42 detects an unexpected or peculiar

behaviour of one of the two signals, it actuates the switch 43, 44 such that the other signal triggers the cut command. The first and second alternative can be combined, e.g., such that the comparison units 41, 42 automatically set the switches 43, 44, but an operator still has the possibility of overriding the automatic setting by a manual input via the input unit 46.

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The quality criteria are stored in the evaluation unit 45, e.g., as clearing limits in a two-dimensional event field, as is well-known from the prior art. They are preferably set automatically or by an operator's manual input. In the latter case, the input unit 46 described above or another input device can be used.

10

In a preferred embodiment of the invention, the measurement head 40 comprises the capacitive measuring cell 5, the optical measuring cell 6, the signal-processing units 53, 54, 63, 64, the comparison units 41, 42, the switches 43, 44, the evaluation unit 45 and the cutter device 10. The input unit 46 is preferably part of a separate, external central clearer unit, which is connected to the measurement head 40 by electric lines, e.g., a bus line. Data can also be transferred from the measurement head 40 to the central clearer unit and displayed there on an output unit (not shown). Preferably a plurality of measurement heads 40 are connected to one central clearer unit.

15

Of course the present invention is not limited to the embodiments discussed above. With the knowledge of the invention, the person skilled in the art would be able to derive further variants which also belong to the subject matter of the present invention.

20

LIST OF REFERENCE SIGNS

	1	Housing
	2	Cover
5	3	Measurement slot
	4	Guide elements
	5	Capacitive measuring cell
	6	Optical measuring cell
	7	Printed-circuit board
10	8	Electronic components
	9	Connector port
	10	Cutter device
	11	Blade
	12	Blade holder
15	13	Cutter device body
	14	Plunger coil
	15	Plunger
	16	Anvil
	17	Mounting elements
20	31	Light source
	32-34	Light detectors
	35	Transmitted light
	36, 37	Reflected light
	38, 39	Signal-processing units
25	40	Measurement head
	41, 42	Comparison units
	43, 44	Switches
	45	Evaluation unit
	46	Input unit
30	90	Yarn
	91	Direction of yarn movement

CLAIMS

1. A yarn clearer comprising
a measurement head (40) with a capacitive measuring cell (5) and an optical
5 measuring cell (6) for detecting characteristics of a yarn (90), the two measuring
cells (5, 6) being arranged adjacent to each other in the longitudinal direction (91)
along a path of the yarn (90),
an evaluation unit (45) for comparing the detected yarn characteristics with
predetermined quality criteria, and
10 a cutter device (10) for cutting the yarn (90) upon a cut command from the
evaluation unit (45),
characterized in that
the capacitive measuring cell (5) is adapted for detecting yarn-mass variations and
the optical measuring cell (6) is adapted for detecting yarn-diameter variations,
15 the evaluation unit (45) is adapted for outputting an unevenness cut command if the
yarn-mass variation detected by the capacitive measuring cell (5) and/or the yarn-
diameter variation detected by the optical measuring cell (6) do not comply with the
predetermined quality criteria,
both the capacitive measuring cell (5) and the optical measuring cell (6) are adapted
20 for detecting foreign matter contents in the yarn (90), and
the evaluation unit (45) is adapted for outputting a foreign-matter cut command if the
foreign-matter content detected by the capacitive measuring cell (5) and/or the
foreign matter content detected by the optical measuring cell (6) do not comply with
the predetermined quality criteria.
25
2. The yarn clearer according to claim 1, further comprising an input unit (46) that
allows an operator to input whether the yarn-mass variation detected by the
capacitive measuring cell (5) or the yarn-diameter variation detected by the optical
measuring cell (6) or both variations shall trigger the unevenness cut command.
30
3. The yarn clearer according to any of the preceding claims, further comprising an
input unit (46) that allows an operator to input whether the foreign-matter content
detected by the capacitive measuring cell (5) or the foreign matter content detected

by the optical measuring cell (6) or both foreign-matter contents shall trigger the foreign-matter cut command.

4. The yarn clearer according to claim 1, further comprising a comparison unit (41) for
5 comparing the yarn-mass variation detected by the capacitive measuring cell (5) with the yarn-diameter variation detected by the optical measuring cell (6) and for automatically determining, based on the comparison, whether the yarn-mass variation detected by the capacitive measuring cell (5) or the yarn-diameter variation detected by the optical measuring cell (6) or both variations shall trigger the
10 unevenness cut command.
5. The yarn clearer according claim 1 or 4, further comprising a comparison unit (42) for comparing the foreign-matter content detected by the capacitive measuring cell (5) with the foreign-matter content detected by the optical measuring cell (6) and for
15 automatically determining, based on the comparison, whether the foreign-matter content detected by the capacitive measuring cell (5) or the foreign-matter content detected by the optical measuring cell (6) or both foreign-matter contents shall trigger the foreign-matter cut command.
- 20 6. The yarn clearer according to any of the preceding claims, wherein the measurement head (40) further comprises signal-processing units (53, 54, 63, 64) for pre-processing signals from the measuring cells (5, 6), the evaluation unit (45) and the cutter device (10).
- 25 7. The yarn clearer according to any of the preceding claims, wherein the optical measuring cell (6) comprises a light source (10), at least one light detector (32) for detecting light transmitted by the yarn (90) and at least one light detector (33, 34) for detecting light reflected by the yarn (90).
- 30 8. The yarn clearer according to claim 7, wherein the light source (10) is a light-emitting diode, and one single light detector (32) for detecting light transmitted by the yarn (90) and two light detectors (33, 34) for detecting light reflected by the yarn (90) are present.

9. A method for clearing yarn (90), wherein characteristics of the yarn (90) are detected by a measurement head (40) with a capacitive measuring cell (5) and an optical measuring cell (6), the two measuring cells (5, 6) being arranged adjacent to each other in the longitudinal direction (91) along a path of the yarn (90),
5 the detected yarn characteristics are compared with predetermined quality criteria, and
the yarn (90) is cut if the detected yarn characteristics do not comply with the predetermined quality criteria,
10 **characterized in that**
yarn-mass variations are detected by the capacitive measuring cell (5) and/or yarn-diameter variations are detected by the optical measuring cell (6),
the yarn is cut if the yarn-mass variation detected by the capacitive measuring cell (5) and/or the yarn-diameter variation detected by the optical measuring cell (6) do
15 not comply with the predetermined quality criteria,
foreign matter contents in the yarn (90) are detected by the capacitive measuring cell (5) and/or the optical measuring cell (6), and
the yarn (90) is cut if the foreign-matter content detected by the capacitive measuring cell (5) and/or the foreign matter content detected by the optical measuring cell (6)
20 do not comply with the predetermined quality criteria.
10. The method according to claim 9, wherein an operator inputs whether the yarn-mass variation detected by the capacitive measuring cell (5) or the yarn-diameter variation detected by the optical measuring cell (6) or both variations shall trigger an
25 unevenness cut.
11. The method according to claim 9 or 10, wherein an operator inputs whether the foreign-matter content detected by the capacitive measuring cell (5) or the foreign matter content detected by the optical measuring cell (6) or both foreign-matter
30 contents shall trigger a foreign-matter cut.
12. The method according to claim 9, wherein the yarn-mass variation detected by the capacitive measuring cell (5) is compared with the yarn-diameter variation detected

by the optical measuring cell (6), and wherein it is automatically determined, based on the comparison, whether the yarn-mass variation detected by the capacitive measuring cell (5) or the yarn-diameter variation detected by the optical measuring cell (6) or both variations shall trigger an unevenness cut.

5

13. The method according to claim 9 or 12, wherein the foreign-matter content detected by the capacitive measuring cell (5) is compared with the foreign-matter content detected by the optical measuring cell (6), and wherein it is automatically determined, based on the comparison, whether the foreign-matter content detected by the capacitive measuring cell (5) or the foreign-matter content detected by the optical measuring cell (6) or both foreign-matter contents shall trigger a foreign-matter cut.

10

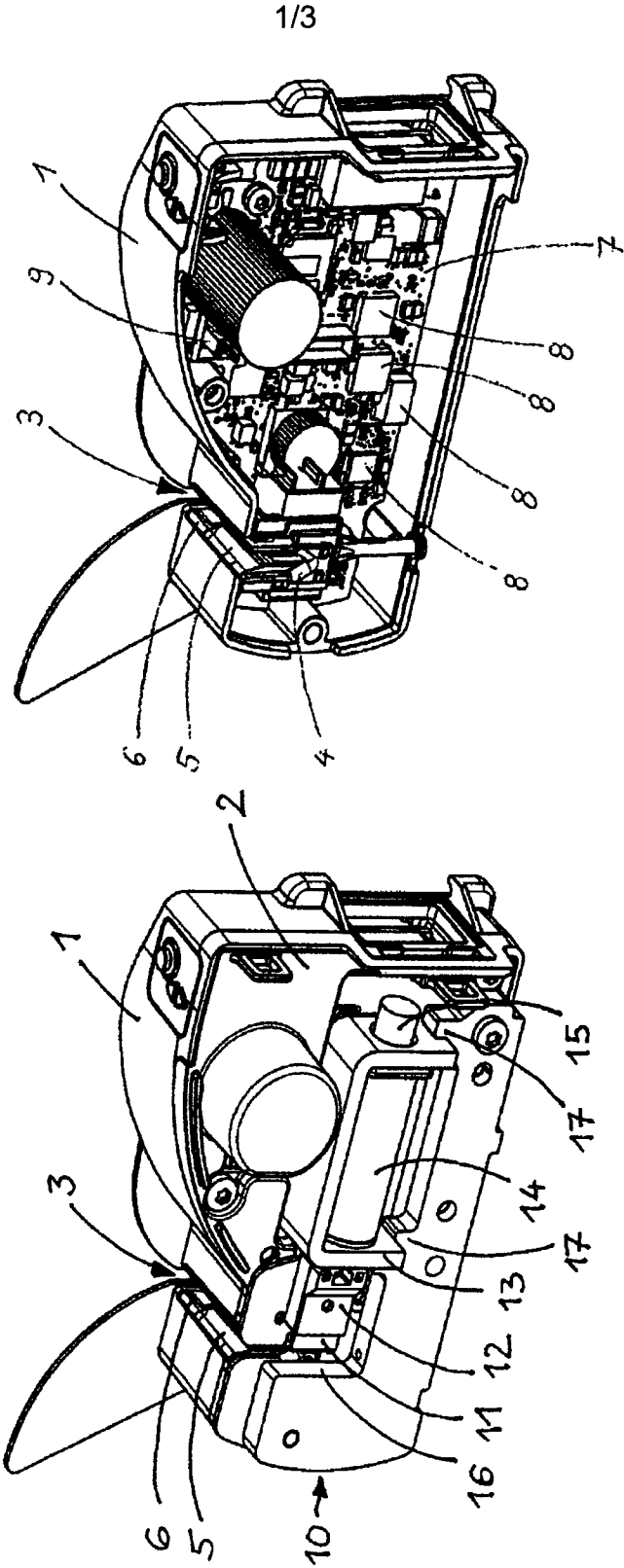


Fig. 1(b)

Fig. 1(a)

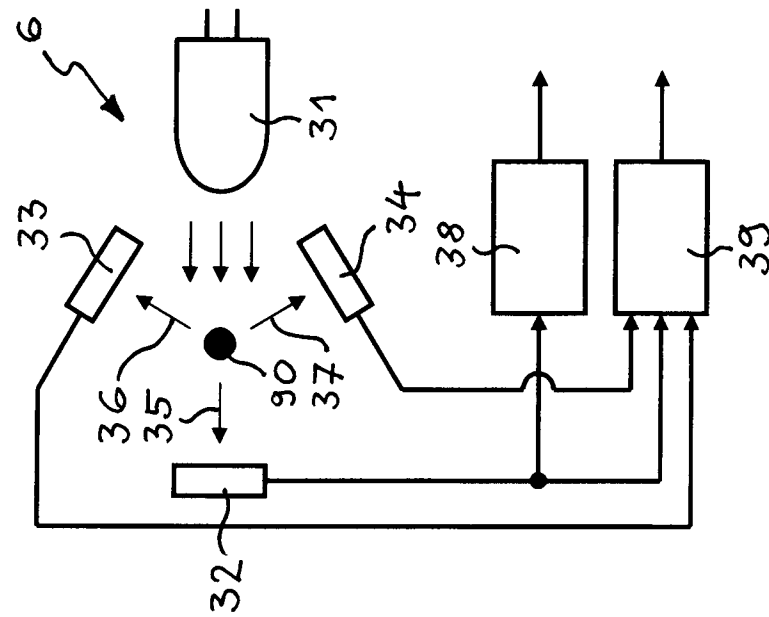


Fig. 3

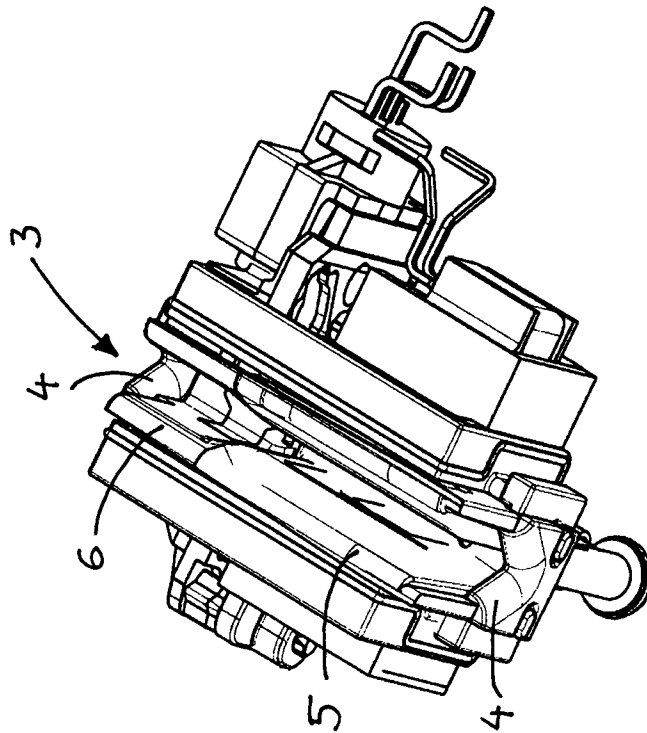


Fig. 2

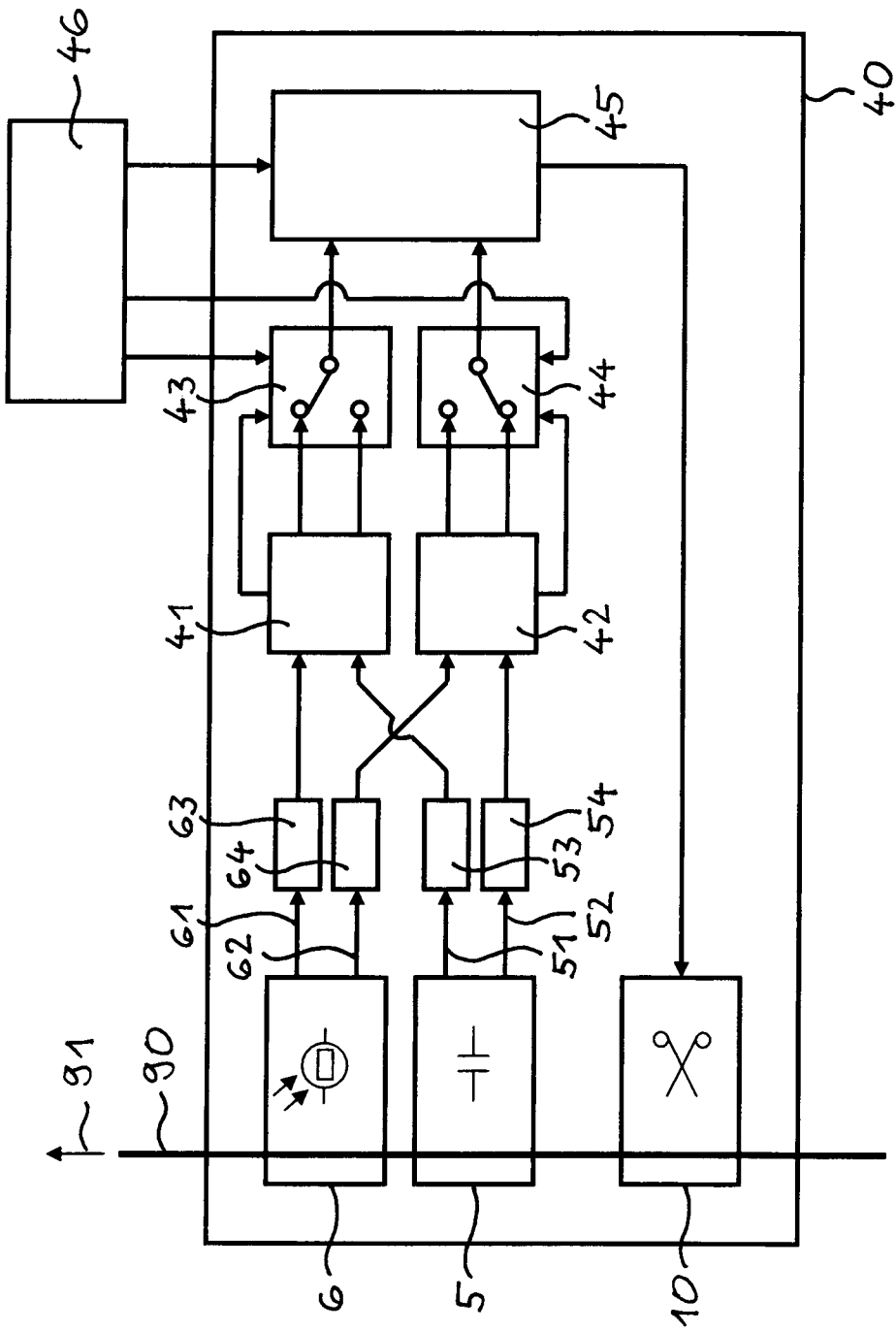


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/CH2011/000240

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01N33/36 B65H63/06
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65H G01N

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2009/076782 A1 (USTER TECHNOLOGIES AG [CH]; SCHMID PETER [CH]; PIRANI PETER [CH]) 25 June 2009 (2009-06-25) page 7, line 21 - page 8, line 25 figure 1	1-13
X	WO 2007/056883 A2 (USTER TECHNOLOGIES AG [CH]; MEIXNER CHRISTINE [CH]; PETERS GABRIELA [C]) 24 May 2007 (2007-05-24) page 9, line 13 - line 27 page 21, line 22 - line 33	1-13
X	EP 0 884 409 A1 (LUWA AG ZELLWEGER [CH]) 16 December 1998 (1998-12-16) column 1, line 47 - column 4, line 35 figure 1	1-13
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/CH2011/000240

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X	EP 1 621 872 A2 (PREMIER EVOLVICS PVT LTD [IN]) 1 February 2006 (2006-02-01) paragraph [0038] paragraph [0107] figure 1a -----	1-13

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Information on patent family members

International application No

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