(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 904 136 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
06.03.2019 Bulletin 2019/10

(21) Application number: **13766355.5**

(22) Date of filing: **25.09.2013**

(51) Int Cl.:
D03D 47/30 *(2006.01)* ***D03D 51/34*** *(2006.01)*

(86) International application number:
PCT/EP2013/069994

(87) International publication number:
WO 2014/053377 (10.04.2014 Gazette 2014/15)

(54) **DEVICE AND METHOD FOR MONITORING A WEFT THREAD**

VORRICHTUNG UND VERFAHREN ZUR ÜBERWACHUNG EINES SCHUSSFADENS

DISPOSITIF ET PROCÉDÉ POUR CONTRÔLER UN FIL DE TRAME

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **01.10.2012 BE 201200655**

(43) Date of publication of application:
12.08.2015 Bulletin 2015/33

(73) Proprietor: **Picanol**
8900 Ieper (BE)

(72) Inventors:
- **GHESQUIERE, Marnix**
  B-8930 Lauwe (BE)
- **LECLUYSE, Bart**
  B-8930 Lauwe (BE)
- **DEGRAEVE, Bram**
  B-8900 Ieper (BE)

(74) Representative: **Patentanwälte**
Ruff, Wilhelm, Beier, Dauster & Partner mbB
Kronenstraße 30
70174 Stuttgart (DE)

(56) References cited:
WO-A1-2011/000561 **FR-A1- 2 494 731**

EP 2 904 136 B1

Description

[0001] The invention relates to a weaving machine with a device for monitoring a weft thread comprising a broken-weft thread detector for providing a signal when an inserted weft thread exceeds its length by a predetermined amount and an air guide channel located upstream of the broken weft thread detector, wherein the broken-weft thread detector is mounted on a sley of a weaving machine. The invention further relates to a method for monitoring a weft thread in a weaving machine.

[0002] A weft thread detector arranged at the arrival side of a weaving machine for monitoring an arrival of an inserted weft thread is known and is called hereafter first weft thread detector or arrival detector for weft thread.

[0003] A weft thread detector for providing a signal when an inserted weft thread exceeds its length by a predetermined amount is called hereafter broken-weft thread detector. The broken-weft thread detector is also called second weft thread detector. The expression "second weft thread detector" is not to be construed as an indication of the number of weft thread detectors. In one embodiment, the second weft thread detector is used as only weft thread detector, i.e. without a first weft thread detector. The terms "first weft thread detector" and "second weft thread detector" rather denote an order in which the weft thread detectors are arranged in the insertion direction.

[0004] A device for monitoring a weft thread in a weaving machine comprising a first weft thread detector and a second weft thread detector are known in the prior art.

[0005] For example, GB 2 119 819 A discloses a device comprising a first weft thread detector, a suction device for weft thread and a second weft thread detector fixed in succession on a support of a sley of a weaving machine. The suction device is provided for catching and stretching inserted weft threads at the arrival side. A jet of air leaving the suction device without being deflected does not reach the detection zone of the second weft thread detector. The device comprises a deflection finger. The finger is located between the outlet of the suction device and the second weft thread detector and fixed to the frame of the weaving machine perpendicular to the insertion path. During beat-up, the finger is brought in the range of the jet of air and the jet of air is deflected towards the detection zone of the second weft thread detector. A weft thread present in the jet of air when the finger is located in the range of the jet of air, will be deflected towards the second weft thread detector and will be detected by the second weft thread detector.

[0006] US 4,432,399 discloses a device for monitoring a weft thread in a weaving machine, comprising a first weft thread detector for providing a stop signal when the inserted weft thread does not reach its normal length and a second weft thread detector spaced from the first weft thread detector for providing a signal when the inserted weft thread exceeds its normal length by a predetermined amount. Between the two weft thread detectors, an air guide channel is arranged for bridging the space between the two weft thread detectors, which air guide channel lies in the extension of the insertion path. The two weft thread detectors and the air guide channel are arranged in order to move with the reed.

[0007] WO 2011/000561 A1 discloses a weaving machine with a device for monitoring a weft thread comprising a broken-weft thread detector for providing a signal when an inserted weft thread exceeds its length by a predetermined amount.

[0008] It is the object of the invention to provide a weaving machine with a device for monitoring a weft thread and a method for monitoring a weft thread allowing a reliable detection of inserted weft threads that exceed their length by a predetermined amount, i.e. inserted weft threads extending too far outside the shed.

[0009] This object is solved by a weaving machine and a method with the features of claims 1 and 15.

[0010] According to a first aspect of the invention, a weaving machine with a device for monitoring a weft thread is provided, the device comprising a broken-weft thread detector for providing a signal when an inserted weft thread exceeds its length by a predetermined amount and an air guide channel located upstream of the broken-weft thread detector, wherein the broken-weft thread detector is mounted on a sley of a weaving machine and the air guide channel is arranged stationary on the weaving machine.

[0011] In other words, the air guide channel is arranged in a fixed position with respect to the frame of the weaving machine, whereas the broken-weft thread detector is mounted on the sley and moves with the reed during beat-up.

[0012] In preferred embodiments, an arrival detector for weft thread is provided upstream of the air guide channel, i. e. a weft thread detector for detecting the arrival of a weft thread is provided. The arrival detector is also referred to as first weft thread detector.

[0013] The arrival detector (first weft thread detector) and the broken-weft thread detector (second weft thread detector) are both mounted on the sley in the extension of the reed, wherein the first weft thread detector is arranged upstream of the air guide channel and the second weft thread detector is arranged downstream of the air guide channel.

[0014] Weft thread detectors generally have a limited detection zone. A weft thread is only detected when the weft thread reaches the detection zone. The first weft thread detector is arranged close to the end of the reed, wherein relay nozzles provided for an insertion of a weft thread blow the weft thread in the detection zone of the first weft thread detector.

[0015] A broken-weft thread detector for detecting weft threads that extend too far outside a shed is also called second weft thread detector. Such a second weft thread detector is arranged downstream of the first weft thread detector in the insertion direction. By providing an air guide channel, the air flow is directed to an area allowing the broken-weft thread

detector to detect a weft thread transported by the air flow. In accordance with the invention, the air guide channel is arranged stationary. Therefore, the weft thread end leaving the air guide channel is presented at a presenting area allowing a more reliable detection. The presenting area is determined by the shape and/or position of the air guide channel. The shape and/or position may be chosen to minimize the influence of the movement of the weft thread through the air guide channel and/or to minimize forces acting on the weft thread moving through the air guide channel at least in a zone of the air guide channel. Hence, an insertion of a weft thread upstream of the air guide channel is not or only slightly influenced by the transport of the weft thread through the air guide channel. In addition, a movement of the broken-weft thread detector with respect to the presented weft thread does not or only slightly influence the insertion of weft threads upstream of the air guide channel.

[0016] According to an embodiment, the air guide channel is configured to present a weft thread in a presenting area traversed by a detection zone of the broken-weft thread detector during beat-up. To this end, in one embodiment an air flow leaving the outlet opening of the air guide channel is channelled to the presenting area, which is chosen so that the detection zone of the broken-weft thread detector traverses the air flow leaving the outlet opening during beat-up. An end of for example a broken weft thread transported by the air flow will be presented in the presenting area. The broken-weft thread detector is mounted on the sley and moves during beat-up, wherein the detection zone traverses the presenting area. In result, an effective detection zone of the broken-weft thread detector is traversed. Therefore, a more reliable detection is ensured. In other words, during insertion the air guide channel does not necessarily guide the air flow towards the detection zone of the broken-weft thread detector, but rather to a presenting area in front of the detection zone during insertion, wherein during beat-up the detection zone is moved towards and across this presenting area and in this way traverses the presenting area. In the context of the application, a "presenting area in front of the detection zone" is defined an area that is located opposite the side of the broken-weft thread detector that in use is directed to the fabric and where a leading end-part of a weft thread extending outside the air guide channel can be located.

[0017] In one embodiment, a weft thread stretching device is provided in the extension of an insertion path of the weft thread upstream of the air guide channel, which weft thread stretching device is configured for catching end-parts of inserted weft threads, wherein preferably the air guide channel bridges at least 50%, more preferably at least 70%, in particular at least 80% of the distance between the weft thread stretching device and the broken-weft thread detector. In one embodiment the weft thread stretching device comprises a suction nozzle, more in particular a ring-jet suction nozzle. In the context of the application, a ring-jet suction nozzle is defined as a suction device, wherein a suction effect is obtained by blowing compressed air into the suction device. Compressed air used for catching inserted weft threads is used to transport a weft thread through the air guide channel. The air guide channel is in preferred embodiments provided in the extension of the cross-section of the suction nozzle at an outlet side of the suction nozzle.

[0018] In one embodiment, the air guide channel fits well with the outlet opening of the weft thread stretching device, more particularly with the outlet opening of the suction nozzle of the weft thread stretching device. In this case, efficient use of the air flow through the suction nozzle is made to transport the weft thread towards the presenting area, in particular to a presenting area in front of the detection zone of the broken-weft thread detector.

[0019] In preferred embodiments, the air guide channel comprises a tube, in particular a straight tube. The tube provides a closed air guide channel, wherein an air flow through the tube is not or only slightly disturbed by external influences. In addition, when providing a straight tube, forces acting on the weft thread while the weft thread is moving through the tube are minimised and the movement of the weft thread through the tube does not or only slightly influences an insertion of the weft threads upstream of the tube. The air guide channel also allows guiding a weft thread through the air guide channel.

[0020] According to an embodiment, the tube has an inlet opening having a circular cross-section. In particular when providing a ring-jet suction nozzle a tube having a circular cross-section allows a smooth transition of the air flow from the suction nozzle to the air guide channel.

[0021] The air guide channel is shaped to channel the air flow towards the presenting area. For this purpose, in one embodiment, the air guide channel comprises a nozzle-shaped end-part arranged at an outlet side of the air guide channel. In order to limit the presenting area of the air flow leaving the air guide channel, in preferred embodiments, the nozzle-shaped end-part has a flattened outlet opening, in particular an outlet opening with an oval cross-section. In the context of the application, the height of the outlet opening is defined as the dimension in the direction perpendicular to the insertion path of a weft thread and perpendicular to the beat-up direction.

[0022] In one embodiment, the nozzle-shaped end-part and the tube are manufactured as separate parts and fixed to each other. The nozzle-shaped end-part in one embodiment is detachably fixed to the tube, allowing for a replacement of the end-part. In other embodiments, the nozzle-shaped end-part is permanently fixed to the tube, in particular glued or welded to the tube. In still another embodiment, the nozzle-shaped end-part and the tube are formed in one piece.

[0023] The shape of the air guide channel is preferably optimized for minimizing a contact of internal walls with the weft thread. However, a weft thread may still make contact with the internal wall of the air guide channel, in particular at an end-part of the air guide channel. Therefore, in one embodiment at least in the vicinity of the internal wall of the air guide channel a wear-resistant coating and/or a wear-resistant insert is provided in a weft thread contact area of the

air guide channel, more in particular in an area of the air guide channel directed to the fabric.

[0024] In one embodiment, the air guide channel is at least partly made, in particular at least in the vicinity of the internal wall, of a material having a low frictional resistance to air and weft threads, in particular a synthetic material, for example a polyvinyl chloride reinforced with fillers.

[0025] In still another embodiment, the arrival detector for detecting the arrival of a weft thread and the broken-weft thread detector for providing a signal when an inserted weft thread exceeds its length by a predetermined amount are configured for optically monitoring the weft thread. In preferred embodiments, both weft thread detectors work on the same operating principle. In particular, optical weft thread detectors as described in EP 0 943 024 B1 are used, the content of which is herewith incorporated by reference.

[0026] In one embodiment, a detection zone of a arrival detector and/or broken-weft thread detector extends between an upper part and a lower part of the weft thread detector. In the context of the application, the upper part and the lower part of the weft thread detector are defined as parts of the weft thread detector arranged above and below an insertion path as seen in a direction approximately perpendicular to a fabric, i.e. in the direction of the height of the air guide channel.

[0027] According to a second aspect, a method is provided for monitoring a weft thread in a weaving machine with a device comprising a broken-weft thread detector for providing a signal when an inserted weft thread exceeds its length by a predetermined amount which is mounted on a sley of a weaving machine and an air guide channel, which air guide channel is located upstream of the broken-weft thread detector, wherein the air guide channel is arranged stationary on the weaving machine and channels an air flow to a presenting area, and a detection zone of the broken-weft thread detector is moved through the presenting area during beat-up.

[0028] Further features and advantages of the invention will emerge from the following description of the embodiments illustrated in the drawings, wherein

figure 1:	is a schematic top view of a part of a weaving machine with a device according to an embodiment of the invention;
figure 2:	is a perspective view of a part of the weaving machine shown in figure 1 in a position during insertion of a weft thread;
figure 3:	is a front view of an embodiment of a nozzle-shaped end part;
figure 4:	is a cross-section along a line A-A in figure 3;
figure 5:	is a front view of a weft thread detector and the nozzle shaped end-part during insertion;
figure 6:	is a front view of a weft thread detector and the nozzle shaped end-part of figure 5 during beat-up;
figure 7:	is a front view of a weft thread detector and the nozzle shaped end-part of figure 6 during further beat-up;
figure 8:	is a perspective view of a part of the weaving machine shown in figure 2 in a position during beat-up of a weft thread;
figures 9	and 10; figures 11 and 12, figures 13 and 14;
figures 15 and 16; and figures 17 and 18	are respectively variant embodiments of figures 3 and 4;
figure 19:	is a top view of an air guide channel provided with the nozzle-shaped end-part of figures 17 and 18;
figure 20	is a perspective view of figure 19.

[0029] Figure 1 is a schematic top view of a part of a weaving machine, more particularly of an air-jet weaving machine, with a device 1 for monitoring a weft thread comprising a broken-weft thread detector, hereinafter referred to as second weft thread detector 10, according to a first embodiment of the invention during insertion of a weft thread 2. Fig. 2 shows a perspective view of a part of a weaving machine similar to Fig. 1.

[0030] The weft thread 2 is inserted in a shed formed by selectively raising and lowering warp threads 3. During

insertion, the weft thread 2 is supported by relay nozzles 4 and guided in an insertion channel 509 (see Fig. 2) through a reed 5. The insertion channel 509 mainly determines the insertion path of the weft thread. In the embodiment shown, a first weft thread detector 6, also called arrival detector for weft thread, is arranged on the sley 500 (see Fig. 2) at the end of the insertion channel 509 next to the reed 5 in order to detect the arrival of the weft thread 2.

[0031] The leading end-part 2f of the inserted weft thread 2 is caught and stretched with a predetermined tension by a weft thread stretching device 7, such as a suction nozzle. As schematically shown, the weft thread stretching device 7 is arranged stationary on the weaving machine in an extension of an insertion path of the weft thread 2, for example by means of a support beam 700.

[0032] The reed 5 is attached to the sley 500 and is moved in beat-up direction B towards a beat-up line 800 of a fabric 8 for a beat-up movement, in short beat-up. The weft thread 2, of which the leading end-part 2f is caught and stretched by the weft thread stretching device 7, as schematically shown in Fig. 1, is moved with the reed 5 towards the beat-up line 800 and is beaten-up into the fabric 8.

[0033] In accordance with the embodiment shown in Fig. 1, a weft thread holding device 9 is arranged stationary on the weaving machine in an area of a beat-up line 800 for holding the leading end-parts of a number of beaten-up weft threads 2d. As mentioned above, the weft thread stretching device 7 is also arranged stationary on the weaving machine, at a distance from the beat-up line 800 in the extension of an insertion path of the weft thread 2. In one embodiment, a movable guiding device 91 is provided for guiding the caught leading end-part 2f of the weft thread 2 towards the weft thread holding device 9. The guiding device 91 is fixed on the sley 500. A cutting device 92 is provided between a fabric edge 801 of the fabric 8 and the weft thread holding device 9 for cutting the ends of the weft threads after they are bound by the warp threads 3. The cutting device 92 is arranged close to the fabric edge 801 for minimizing the length of the ends of the bound weft threads protruding from the fabric 8. The cut-off ends are removed via a duct (not-shown) provided to the weft thread holding device 9. Further also an optional suction device 12 for removing faulty inserted weft threads is shown schematically.

[0034] In the embodiment shown, the weft thread stretching device 7 is a ring-jet suction nozzle. The weft thread stretching device 7 is connected to a compressed-air tank (not shown) in order to obtain a suction effect.

[0035] The device 1 for monitoring a weft thread according to the invention comprises a second weft thread detector 10 for providing a signal when an inserted weft thread exceeds its length by a predetermined amount. The second weft thread detector 10 is mounted on the sley 500 of the weaving machine and moves together with the sley 500. In the embodiment shown, the second weft thread detector 10 is mounted on the sley 500 in line with the first weft thread detector 6.

[0036] Further, an air guide channel 11 is provided, which is located upstream of the second weft thread detector 10 seen in the insertion direction of the weft thread. The air guide channel 11 is arranged fixed in a position with respect to the frame of the weaving machine.

[0037] As schematically shown, the air guide channel 11 is arranged at the outlet side of the weft thread stretching device 7, in an extension of an insertion path of the weft thread 2 by means of a support beam 700. In the embodiment, the air guide channel 11 fits well with an outlet opening of the weft thread stretching device 7 configured as suction nozzle. The air guide channel 11 bridges mainly the distance between the weft thread stretching device 7 and the second weft thread detector 10, more in particular bridges at least 80% of the distance between the weft thread stretching device 7 and weft thread detector 10.

[0038] In an embodiment shown, the air guide channel 11 comprises a straight tube 110 having an inlet opening having a circular cross-section and a nozzle-shaped end-part 112 arranged at the outlet side of the air guide channel 11. In the embodiment shown, the nozzle-shaped end-part 112 is mounted on the straight tube 110. The air guide channel 11 is manufactured at least at the vicinity of the internal wall of a material having a low frictional resistance to air and a low frictional resistance to weft threads, for example a synthetic material.

[0039] Fig. 3 shows a front view and Fig. 4 a cross-section along a line A-A in Fig. 3 of an embodiment of a nozzle-shaped end-part 112. Other exemplary embodiments of nozzle-shaped end-parts 112 are shown in Figures 9 to 18 and will be described with reference to these figures below.

[0040] As shown in Figs. 3 and 4, the nozzle-shaped end-part 112 has a flattened outlet opening 112a. In the embodiment shown the outlet opening 112a has an oval cross-section. At the inlet opening 112b the nozzle-shaped end-part 112 has a circular cross-section that fits well with the cross-section of the tube shown in Fig. 2. A channel 112c is provided between the inlet opening 112b having a circular cross-section and the flattened outlet opening 112a. In the context of the application, the length of the nozzle-shaped end-part 112 is defined as the dimension in the direction of an insertion path of a weft thread. The width of the nozzle-shaped end-part 112 is defined as the dimension in the beat-up direction B, i.e. in the direction of a movement path of the weft thread during beat-up. The height of the nozzle-shaped end-part 112 is defined as the dimension in the direction perpendicular to the insertion path and perpendicular to the beat-up direction B. As shown in the cross-section of Fig. 3, in this embodiment, a width of the channel 112c is approximately constant over the length of the nozzle-shaped end-part 112. A height of the channel 112c through the nozzle-shaped end-part 112 decreases for channelling the air flow through the nozzle-shaped end-part 112 to a presenting area. As

seen in Fig. 3, the flattened outlet opening 112a is slightly curved upwards with respect to a center line in order to adapt the course of the flattened outlet opening 112a to the beat-up direction B.

[0041] For fixing the nozzle-shaped end-part 112 an annular space 112d for receiving the tube 110 (see Fig. 2) is provided at the inlet side of the nozzle-shaped end-part 112. Further, an insert 112e, for example a rod, near the outlet opening 112a, is provided. The insert 112e is made wear-resistant, for example, comprises a wear-resistant coating and/or is made of a wear-resistant material. The insert 112e can co-operate during beat-up with an end-part 2f (see Fig. 1) of a weft thread 2 extending between the nozzle-shaped end-part 112 and the second weft thread detector 10. Herewith the wear-resistant insert 112e is provided in a weft thread contact area of the air guide channel 11, more in particular in an area of the air guide channel 11 directed to the fabric 8.

[0042] During beat-up, the second weft thread detector 10 and the first weft thread detector 6 which are both mounted on the sley 500, are moved in the beat-up direction B as shown in Fig. 1.

[0043] Figs. 5 to 7 show a front view of a second weft thread detector 10 and the nozzle-shaped end-part 112 during the beat-up direction B at successive instants in time. The second weft thread detector 10 is configured for optically monitoring weft threads. The second weft thread detector 10 is, in a known way, fixed by fixation means 15 to the sley 500 (see Fig. 1). In the embodiment shown, the second weft thread detector 10 is provided with a guiding opening 10a arranged in the extension of the insertion channel 509 of the reed 5 (see Fig. 2). The shape of the guiding opening 10a of the second weft thread detector 10 is similar to the shape of the dents of the reed 5. The guiding opening 10a is limited by an upper leg 10b and a lower leg 10c, wherein light rays are directed transversely through the guiding opening 10a between the upper leg 10b and the lower leg 10c. In other words, a detection zone of the second weft thread detector 10 extends between an upper part and a lower part of the weft thread detector 10 perpendicular to an insertion path. The first weft thread detector 6 is, for example, configured similar to the second weft thread detector 10. Examples of weft thread detectors suitable to be used as the second weft thread detector 10 and/or the first weft detector 6 are described in EP 0 943 024 B1.

[0044] The air guide channel 11, more in particular the nozzle-shaped end-part 112, is configured to present the weft thread in a presenting area. As shown in Figs. 5 to 7, the presenting area is chosen such that it is traversed by the detection zone of the second weft thread detector 10 during beat-up. As described above, the presenting area at which a weft thread is presented to the second weft thread detector 10 is determined by the position and/or the shape of the air guide channel 11. In the context of the application, the presenting area is determined by the area of the leading end-part 2f extending beyond the nozzle-shaped end-part 112. In the embodiment of Fig. 5, for example, the leading end-part 2f determining the presenting area is located approximately beyond the centre of the nozzle-shaped end-part 112. The presenting area is traversed in this embodiment by the detection zone of the second weft thread detector 10 in positions located near the positions shown in Figs. 6 and 7, such as the position of Fig. 8.

[0045] Figs. 9 to 18 show exemplary embodiments of nozzle-shaped end-parts 112. The nozzle-shaped end-parts 112 shown in Figs. 3 to 4 and 9 to 18 are similar in shape and common reference numbers will be used for similar or common elements. In all embodiments, the nozzle-shaped end-part 112 has a flattened outlet opening 112a with an oval cross-section and an inlet opening 112b with a circular cross-section that fits well on the cross-section of the tube 110 shown in Fig. 2. A channel 112c is provided between the inlet opening 112b and the flattened outlet opening 112a. The presenting area at which weft threads are presented to the second weft thread detector 10 is determined by the shape of the outlet opening 112a, its width, its height and its position with respect to the insertion path.

[0046] As mentioned above, the presenting area is chosen such that the presenting area is traversed by the detection zone of the second weft thread detector 10 during beat-up. Therefore, the height of the flattened outlet opening 112a is chosen in order that the presenting area is located between the upper leg 10b and the lower leg 10c of the second weft thread detector 10 during beat-up (see Figs. 5 to 7). However, within these boundary conditions, it is possible to vary the height. The width of the flattened outlet opening 112a and/or its offset with respect to a longitudinal axis of the weft thread stretching device 7 (see Fig. 2) in the beat-up direction B can also be varied in order to ensure that the presenting area is traversed by the detection zone of the second weft thread detector 10.

[0047] As the comparison of Figs. 3 and 4 and Figs. 9 and 10 shows, the embodiment of Fig. 9 differs from the embodiment of Fig. 3 in that a height of the flattened outlet opening 112a is decreased for decreasing the presenting area. However, a width of the channel 112c to the nozzle-shaped end-part 112 is kept constant.

[0048] In the context of the application, the area of the channel 112c arranged closer to the beat-up line 800 (see Fig. 1) is referred to as front area, whereas the opposing area of the channel 112c is referred to as rear area. In the embodiment of Figs. 11 and 12, a sidewall of the channel 112c through the nozzle-shaped end-part 112 is provided with a convex bulge in the front area. By providing a convex bulge in the front area, an air flow flowing in the front area is deflected towards the rear area.

[0049] Figs. 13 and 14 show an embodiment of the nozzle-shaped end-part 112 similar to that of Figs. 11 and 12. In the embodiment shown in Figs. 13 and 14, a sidewall of the channel 112c through the nozzle-shaped end-part 112 is also provided with a convex bulge in the front area of the nozzle-shaped end-part 112, wherein a height of the flattening outlet opening 112a is decreased compared to the embodiment of Figs. 11 and 12.

[0050] Figs. 15 and 16 show a further embodiment of a nozzle-shaped end-part 112, wherein a channel 112c through the nozzle-shaped end-part 112 is curved towards a beat-up line 800 (see Fig. 1) in order to provide a presenting area which is closer to the beat-up line 800. In the embodiment shown, a curvature of the sidewalls of the channel 112c is not uniform. Rather, an area of the channel 112c closer to the beat-up line 800 is provided with a more pronounced concave curvature for guiding an air flow towards to the rear area of the channel 112c.

[0051] Figs. 17 and 18 show an embodiment of a nozzle-shaped end-part 112 similar to that shown in Fig. 15 and 16. In the embodiment shown in Figs. 17 and 18, a curvature towards the beat-up line 800 is considerably more pronounced for bringing the presenting area closer to the beat-up line 800 (see Fig. 1).

[0052] Figs. 19 and 20 show an air guide channel 11 with a tube 110, for example a straight tube, which is provided with a number of openings 115 for escaping compressed air out of the tube 110. In order to easy the fixing, the tube 110 is also provided with recesses 116 in the vicinity of the inlet opening where the tube 110 is intended to be fixed to the weft thread stretching device 7. The openings in the tube 110 can be arranged according to a variant not shown in other positions along the tube 110, for example similar as with a tube known from EP 0 273 473.

[0053] The device and the method according to the invention are not limited to the embodiments described and illustrated in the drawings by way of example. The device and the method can also be configured within the claims according to variant embodiments, shapes and dimensions. Combinations of the illustrated embodiments that come under the claims are also possible.

Claims

1. Weaving machine with a device for monitoring a weft thread comprising a broken-weft thread detector (10) for providing a signal when an inserted weft thread exceeds its length by a predetermined amount and an air guide channel (11) located upstream of the broken-weft thread detector (10), wherein the broken-weft thread detector (10) is mounted on a sley (500) of the weaving machine,
characterized in that
the air guide channel (11) is arranged stationary on the weaving machine.

2. Weaving machine according to claim 1, **characterized in that** the air guide channel (11) is configured to present a weft thread (2) in a presenting area traversed by a detection zone of the broken-weft thread detector (10) during beat-up.

3. Weaving machine according to claim 1 or 2, **characterized in that** a weft thread stretching device (7) is provided in the extension of an insertion path of the weft thread (2) upstream of the air guide channel (11), which weft thread stretching device (7) is configured for catching end-parts (2f) of the inserted weft threads (2).

4. Weaving machine according to claim 3, **characterized in that** the air guide channel (11) bridges at least 80% of the distance between the weft thread stretching device (7) and the broken-weft thread detector (10).

5. Weaving machine according to claim 4, **characterized in that** the air guide channel (11) fits well on the outlet opening (112a) of the weft thread stretching device (7).

6. Weaving machine according to any one of claims 1 to 5, **characterized in that** the air guide channel (11) comprises a tube (110), in particular a straight tube (110), wherein the tube (110) preferably comprises an opening with a circular cross-section at the inlet side.

7. Weaving machine according to any one of claims 1 to 6, **characterized in that** the air guide channel (11) comprises a nozzle-shaped end-part (112) arranged at an outlet side of the air guide channel (11).

8. Weaving machine according to claim 7, **characterized in that** the nozzle-shaped end-part (112) has a flattened outlet opening (112a), in particular an outlet opening (112a) with an oval cross-section.

9. Weaving machine according to claim 7 or 8, **characterized in that** the nozzle-shaped end-part (112) and the tube (110) are formed in one piece.

10. Weaving machine according to any one of claims 1 to 9, **characterized in that** a wear-resistant insert (112e) is provided in a weft thread contact area of the air guide channel (11), more in particular in an area of the air guide channel (11) directed to the fabric (8).

11. Weaving machine according to any one of claims 1 to 10, **characterized in that** the air guide channel (11) is at least in the vicinity of the internal wall made of a material having a low frictional resistance to air and weft threads, in particular a synthetic material.

12. Weaving machine according to any one of claims 1 to 11, **characterized in that** an arrival detector (6) for detecting the arrival of a weft thread is provided, wherein the arrival detector (6) is mounted on the sley (500) of the weaving machine upstream of the air guide channel (11).

13. Weaving machine according to claim 12, **characterized in that** the arrival detector (6) for detecting the arrival of a weft thread and the broken-weft thread detector (10) for providing a signal when an inserted weft thread exceeds its length by a predetermined amount, are configured for optically monitoring a weft thread.

14. Weaving machine according to claim 13, **characterized in that** a detection zone of a weft thread detector (6, 10) extends between an upper part and a lower part of the weft thread detector (6, 10).

15. Method for monitoring a weft thread in a weaving machine with a device according to any one of claims 1 to 14 comprising a broken-weft thread detector (10) for providing a signal when an inserted weft thread exceeds its length by a predetermined amount which is mounted on a sley (500) of the weaving machine and an air guide channel (11) located upstream of the broken-weft thread detector (10),
characterized in that
the air guide channel (11) which is arranged stationary on the weaving machine channelling an air flow to a presenting area, and that a detection zone of the broken-weft thread detector (10) is moved through the presenting area during beat-up.

Patentansprüche

1. Webmaschine mit einer Vorrichtung zur Überwachung eines Schussfadens umfassend einen Schussfadenbruchwächter (10) zum Vorsehen eines Signals, wenn ein eingetragener Schussfaden seine Länge um einen vorbestimmten Betrag überschreitet, und einen Luftführungskanal (11), der sich stromaufwärts des Schussfadenbruchwächters (10) befindet, wobei der Schussfadenbruchwächter (10) an einer Weblade (500) der Webmaschine montiert ist, **dadurch gekennzeichnet, dass** der Luftführungskanal (11) stationär an der Webmaschine angeordnet ist.

2. Webmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** der Luftführungskanal (11) dazu ausgebildet ist, einen Schussfaden (2) in einem Präsentationsbereich zu präsentieren, der beim Anschlag von einer Erfassungszone des Schussfadenbruchwächters (10) durchquert wird.

3. Webmaschine nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** eine Schussfaden-Streckvorrichtung (7) in Verlängerung einer Eintragsbahn des Schussfadens (2) stromaufwärts des Luftführungskanals (11) vorgesehen ist, welche Schussfaden-Streckvorrichtung (7) zum Fangen von Endteilen (2f) der eingetragenen Schussfäden (2) ausgebildet ist.

4. Webmaschine nach Anspruch 3, **dadurch gekennzeichnet, dass** der Luftführungskanal (11) mindestens 80% des Abstandes zwischen der Schussfaden-Streckvorrichtung (7) und dem Schussfadenbruchwächter (10) überbrückt.

5. Webmaschine nach Anspruch 4, **dadurch gekennzeichnet, dass** der Luftführungskanal (11) gut auf die Austrittsöffnung (112a) der Schussfaden-Streckvorrichtung (7) passt.

6. Webmaschine nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** der Luftführungskanal (11) ein Rohr (110), insbesondere ein gerades Rohr (110) umfasst, wobei das Rohr (110) vorzugsweise eine Öffnung mit einem kreisförmigen Querschnitt an der Einlassseite umfasst.

7. Webmaschine nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** der Luftführungskanal (11) einen düsenförmigen Endteil (112) umfasst, der an einer Auslassseite des Luftführungskanals (11) angeordnet ist.

8. Webmaschine nach Anspruch 7, **dadurch gekennzeichnet, dass** der düsenförmige Endteil (112) eine abgeflachte Austrittsöffnung (112a), insbesondere eine Austrittsöffnung (112a) mit einem ovalen Querschnitt, aufweist.

9. Webmaschine nach Anspruch 7 oder 8, **dadurch gekennzeichnet, dass** der düsenförmige Endteil (112) und das Rohr (110) einstückig ausgebildet sind.

10. Webmaschine nach einem der Ansprüche 1 bis 9, **dadurch gekennzeichnet, dass** ein verschleissfester Einsatz (112e) in einem Schussfaden-Kontaktbereich des Luftführungskanals (11), insbesondere in einem auf das Gewebe (8) gerichteten Bereich des Luftführungskanals (11), vorgesehen ist.

11. Webmaschine nach einem der Ansprüche 1 bis 10, **dadurch gekennzeichnet, dass** der Luftführungskanal (11) mindestens in der Nähe der Innenwand aus einem Material mit einem geringen Reibungswiderstand gegen Luft und Schussfäden, insbesondere einem synthetischen Material, gefertigt ist.

12. Webmaschine nach einem der Ansprüche 1 bis 11, **dadurch gekennzeichnet, dass** ein Ankunftwächter (6) zum Erfassen der Ankunft eines Schussfadens vorgesehen ist, wobei der Ankunftwächter (6) an der Weblade (500) der Webmaschine stromaufwärts des Luftführungskanals (11) montiert ist.

13. Webmaschine nach Anspruch 12, **dadurch gekennzeichnet, dass** der Ankunftwächter (6) zum Erfassen der Ankunft eines Schussfadens und der Schussfadenbruchwächter (10) zum Vorsehen eines Signals, wenn ein eingetragener Schussfaden seine Länge um einen vorbestimmten Betrag überschreitet, zur optischen Überwachung eines Schussfadens ausgebildet sind.

14. Webmaschine nach Anspruch 13, **dadurch gekennzeichnet, dass** eine Erfassungszone eines Schussfadenwächters (6, 10) sich zwischen einem oberen Teil und einem unteren Teil des Schussfadenwächters (6, 10) erstreckt.

15. Verfahren zum Überwachen eines Schussfadens in einer Webmaschine mit einer Vorrichtung nach einem der Ansprüche 1 bis 14 umfassend einen Schussfadenbruchwächter (10) zum Vorsehen eines Signals, wenn ein eingetragener Schussfaden seine Länge um einen vorbestimmten Betrag überschreitet, der an einer Weblade (500) der Webmaschine montiert ist, und einen Luftführungskanal (11), der sich stromaufwärts des Schussfadenbruchwächters (10) befindet, **dadurch gekennzeichnet, dass** der Luftführungskanal (11), der stationär an der Webmaschine angeordnet ist, einen Luftstrom zu einem Präsentationsbereich kanalisiert, und dass eine Erfassungszone des Schussfadenbruchwächters (10) beim Anschlag durch den Präsentationsbereich bewegt wird.

Revendications

1. Machine à tisser avec un dispositif pour contrôler un fil de trame comprenant un détecteur d'un fil de trame cassé (10) pour prévoir un signal lorsqu'un fil de trame inséré dépasse sa longueur d'une quantité prédéterminée et un canal de guidage d'air (11) situé en amont du détecteur d'un fil de trame cassé (10), dans lequel le détecteur d'un fil de trame cassé (10) est monté sur un battant (500) de la machine à tisser, **caractérisée en ce que** le canal de guidage d'air (11) est disposé stationnaire sur la machine à tisser.

2. Machine à tisser selon la revendication 1, **caractérisée en ce que** le canal de guidage d'air (11) est configuré pour présenter un fil de trame (2) dans une région de présentation traversée par une zone de détection du détecteur d'un fil de trame cassé (10) pendant la frappe.

3. Machine à tisser selon la revendication 1 ou 2, **caractérisée en ce qu'**un dispositif d'étirage de fil de trame (7) est prévu dans le prolongement d'un trajet d'insertion du fil de trame (2) en amont du canal de guidage d'air (11), lequel dispositif d'étirage de fil de trame (7) est configuré pour saisir des parties d'extrémité (2f) des fils de trame (2) insérés.

4. Machine à tisser selon la revendication 3, **caractérisée en ce que** le canal de guidage d'air (11) couvre au moins 80% de la distance entre le dispositif d'étirage de fil de trame (7) et le détecteur d'un fil de trame cassé (10).

5. Machine à tisser selon la revendication 4, **caractérisée en ce que** le canal de guidage d'air (11) s'adapte bien à l'ouverture de sortie (112a) du dispositif d'étirage de fil de trame (7).

6. Machine à tisser selon l'une quelconque des revendications 1 à 5, **caractérisée en ce que** le canal de guidage d'air (11) comprend un tube (110), en particulier un tube droit (110), dans lequel le tube (110) comprend de préférence une ouverture avec une section transversale circulaire au niveau du côté d'entrée.

7. Machine à tisser selon l'une quelconque des revendications 1 à 6, **caractérisée en ce que** le canal de guidage d'air (11) comprend une partie d'extrémité en forme de buse (112) disposée au niveau d'un côté sortie du canal de guidage d'air (11).

8. Machine à tisser selon la revendication 7, **caractérisée en ce que** la partie d'extrémité en forme de buse (112) présente une ouverture de sortie aplatie (112a), en particulier une ouverture de sortie (112a) avec un section transversale ovale.

9. Machine à tisser selon la revendication 7 ou 8, **caractérisée en ce que** la partie d'extrémité en forme de buse (112) et le tube (110) sont formés d'une seule pièce.

10. Machine à tisser selon l'une quelconque des revendications 1 à 9, **caractérisée en ce qu'**un insert (112e) résistant à l'usure est prévu dans une région de contact du fil de trame du canal de guidage d'air (11), plus particulièrement une région du canal de guidage d'air (11) dirigée vers le tissu (8).

11. Machine à tisser selon l'une quelconque des revendications 1 à 10, **caractérisée en ce que** le canal de guidage d'air (11) est au moins au niveau de la paroi interne en une matière ayant une faible résistance à la friction à l'air et aux fils de trame, en particulier en une matière synthétique.

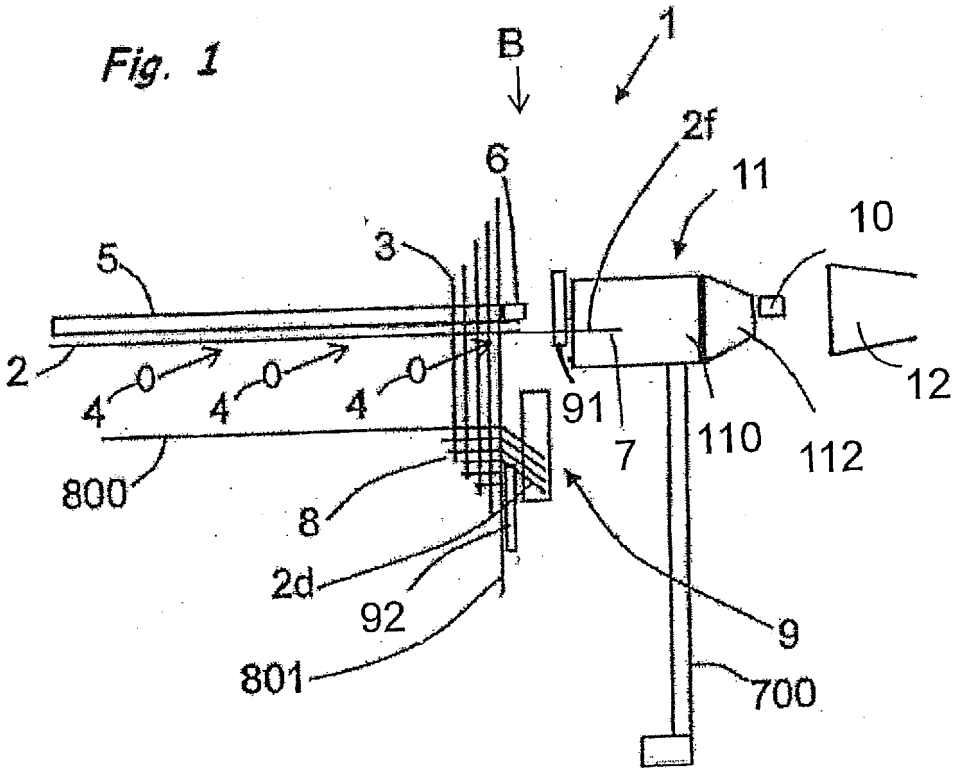
12. Machine à tisser selon l'une quelconque des revendications 1 à 11, **caractérisée en ce qu'**un détecteur d'arrivée (6) pour détecter l'arrivée d'un fil de trame est prévu, dans lequel le détecteur d'arrivée (6) est monté sur le battant (500) de la machine à tisser en amont du canal de guidage d'air (11).

13. Machine à tisser selon la revendication 12, **caractérisée en ce que** le détecteur d'arrivée (6) pour détecter l'arrivée d'un fil de trame et le détecteur d'un fil de trame cassé (10) pour prévoir un signal lorsqu'un fil de trame inséré dépasse sa longueur d'une quantité prédéterminée sont configurés pour contrôler optiquement un fil de trame.

14. Machine à tisser selon la revendication 13, **caractérisée en ce qu'**une zone de détection d'un détecteur de fil de trame (6, 10) s'étend entre une partie supérieure et une partie inférieure du détecteur de fil de trame (6, 10).

15. Procédé pour contrôler un fil de trame dans une machine à tisser avec un dispositif selon l'une quelconque des revendications 1 à 14 comprenant un détecteur d'un fil de trame cassé (10) pour prévoir un signal lorsqu'un fil de trame inséré dépasse sa longueur d'une quantité prédéterminée qui est monté sur un battant (500) de la machine à tisser et un canal de guidage d'air (11) situé en amont du détecteur d'un fil de trame cassé (10), **caractérisé en ce que** le canal de guidage d'air (11) qui est disposé stationnaire sur la machine à tisser canalisant un flux d'air vers une région de présentation, et **en ce qu'**une zone de détection du détecteur d'un fil de trame cassé (10) est déplacée à travers la région de présentation pendant la frappe.

Fig. 1



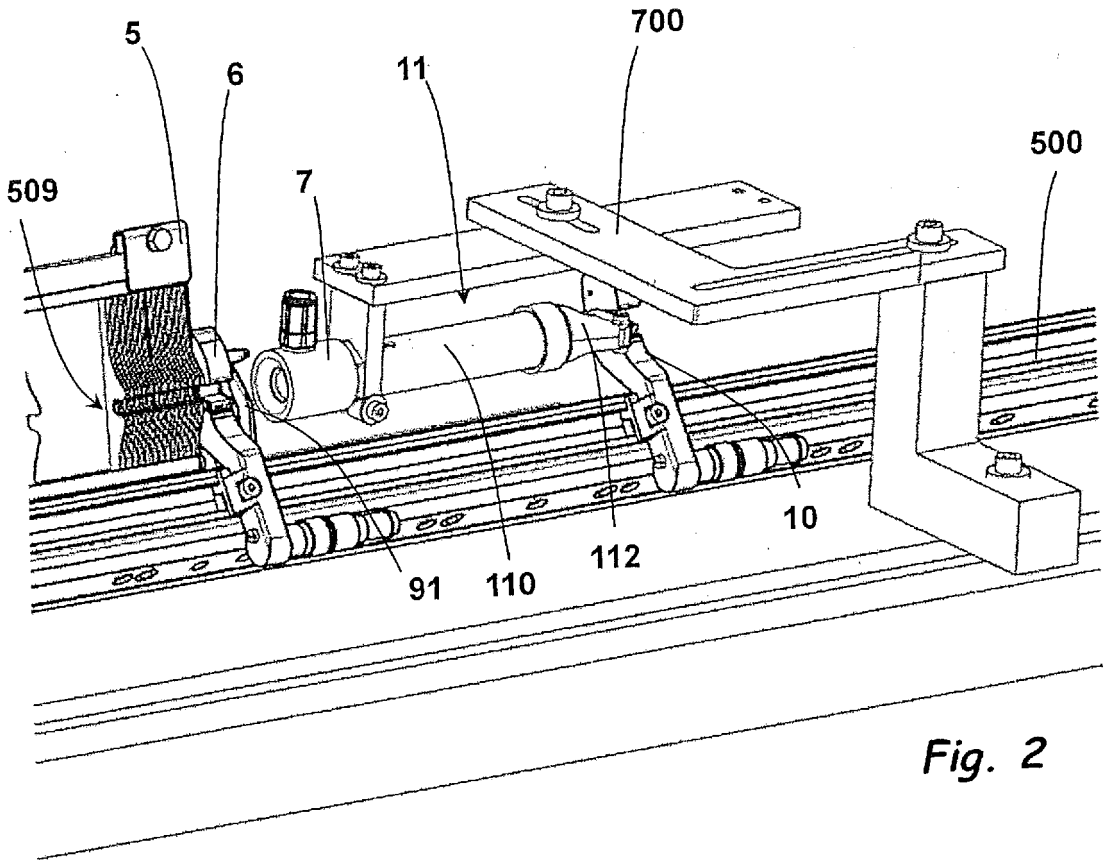
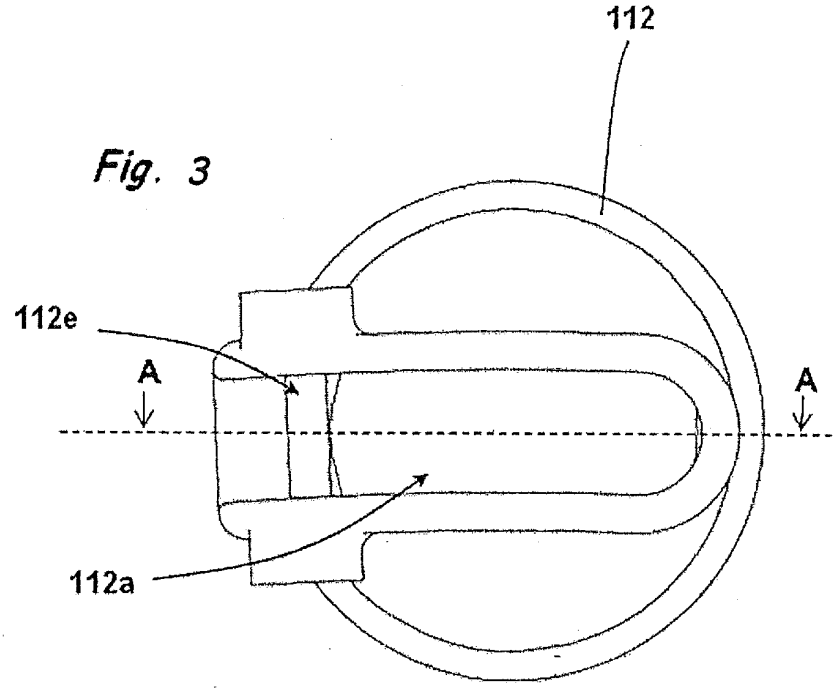


Fig. 2

Fig. 3



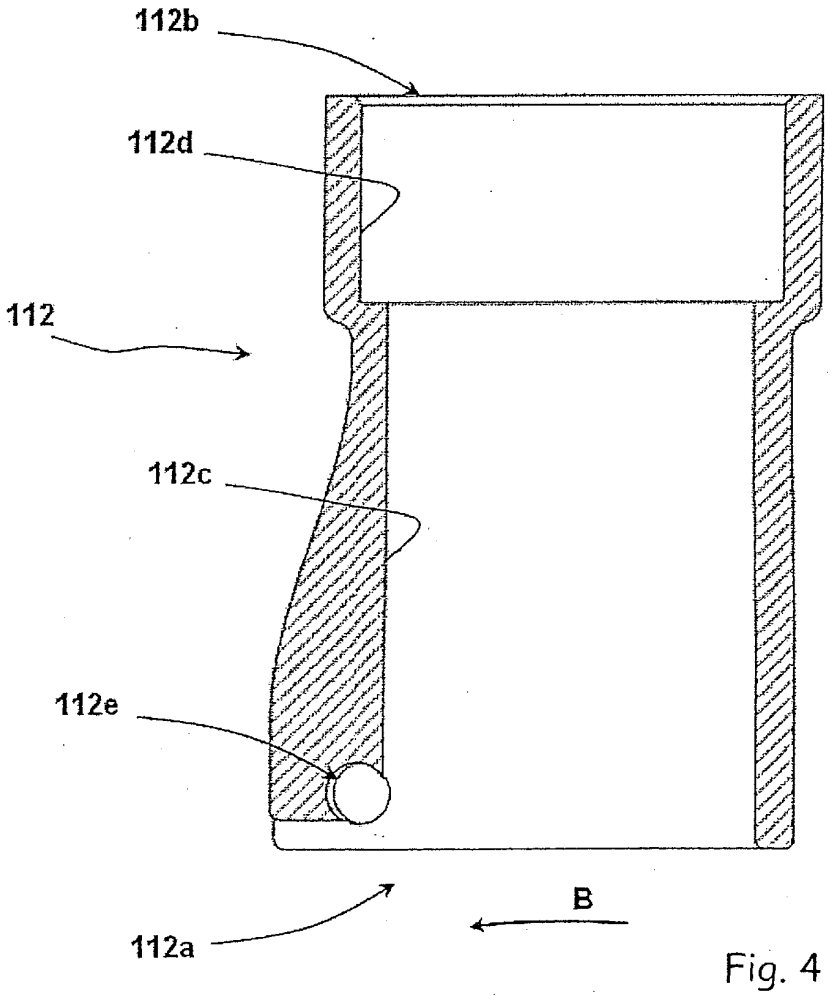


Fig. 4

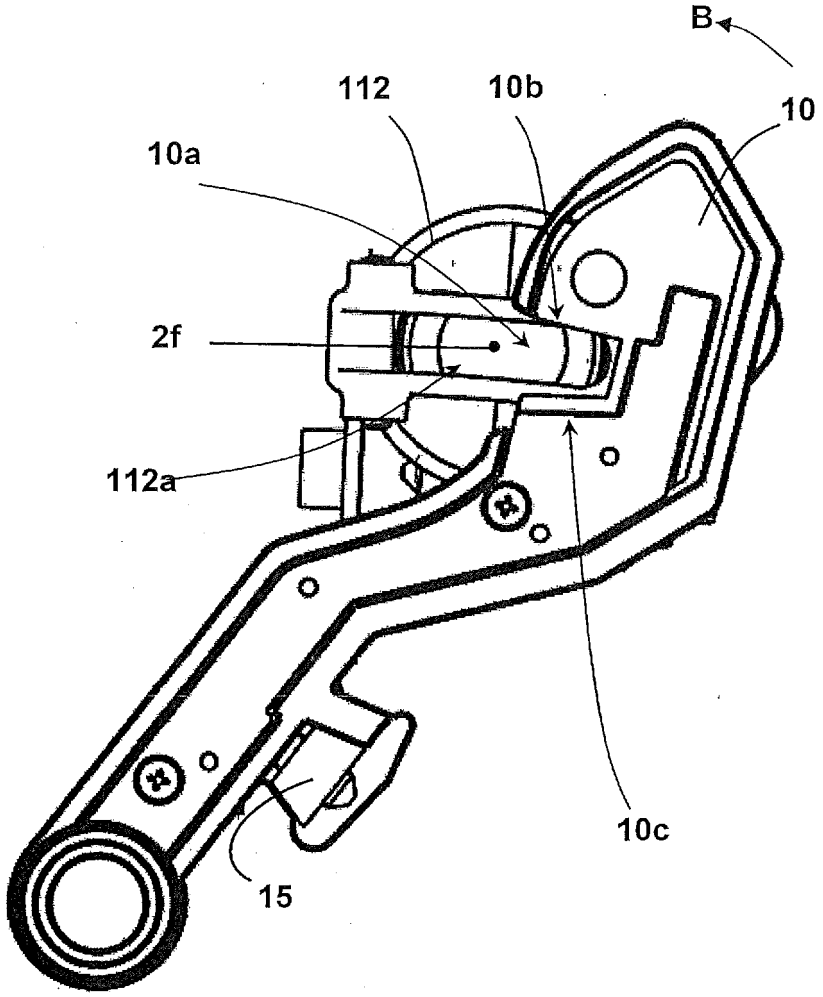


Fig. 5

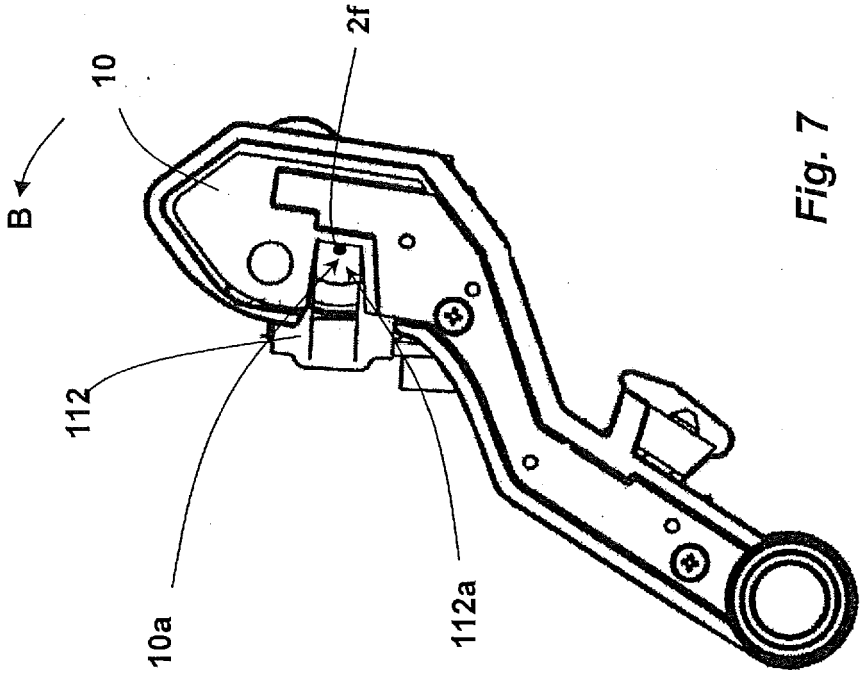


Fig. 7

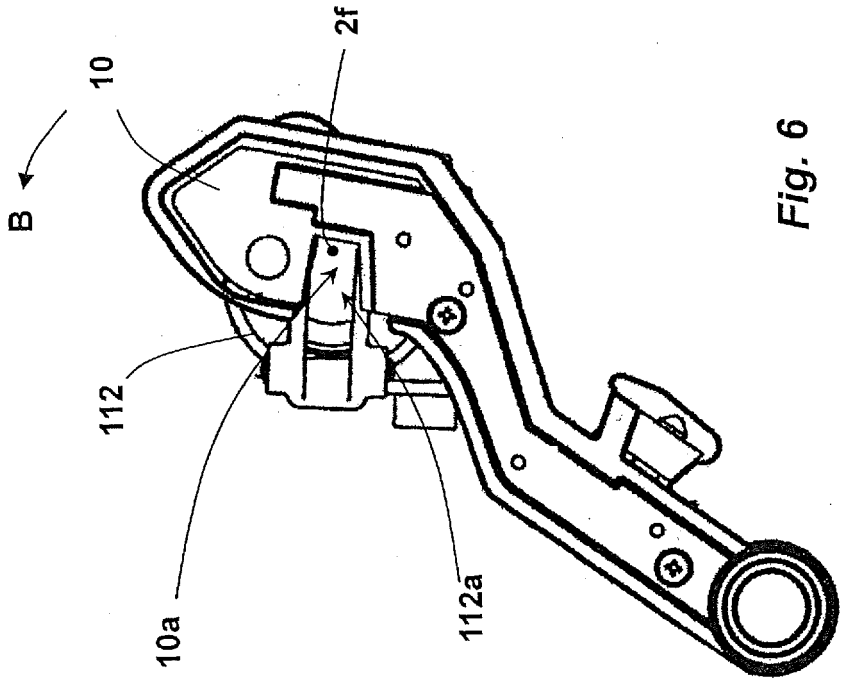


Fig. 6

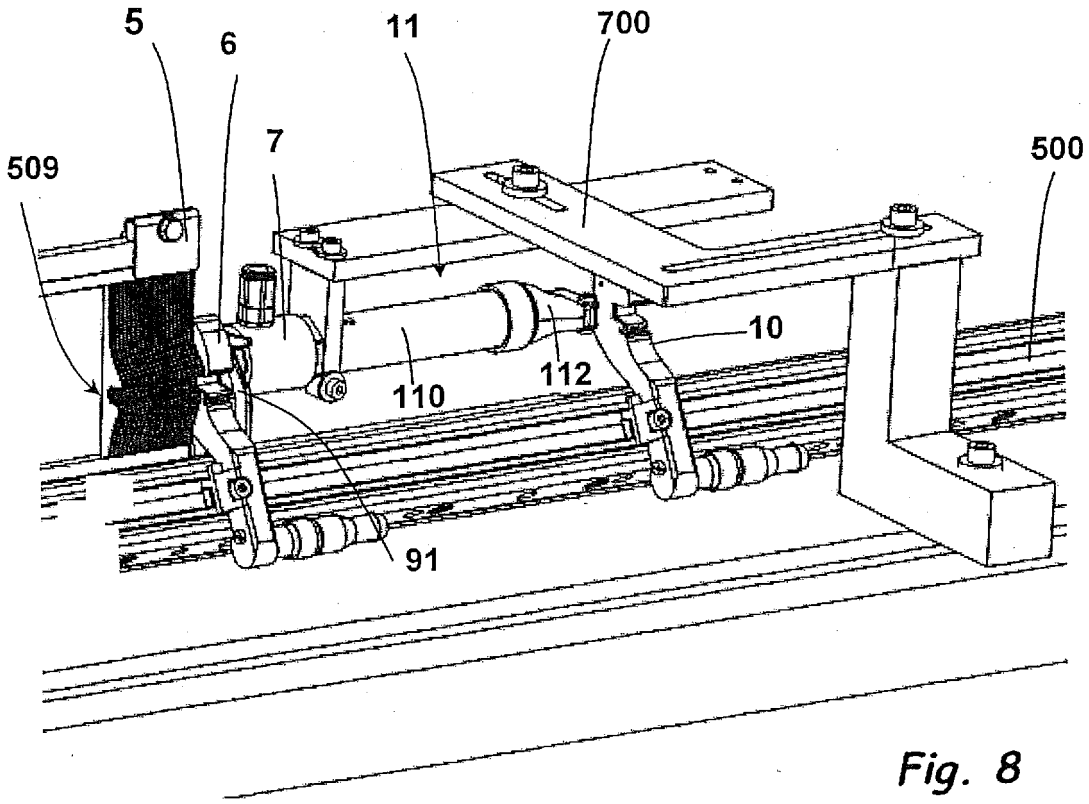
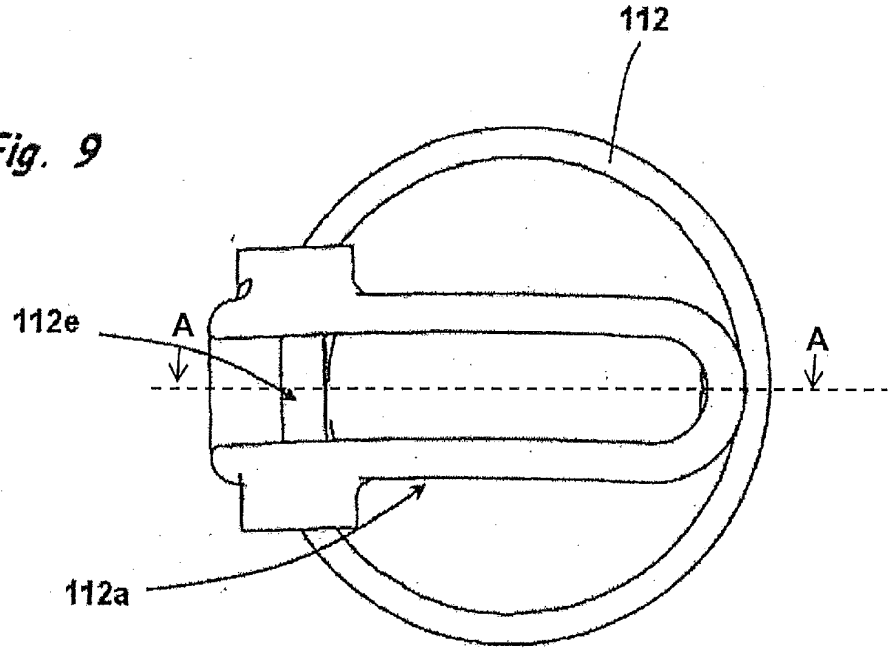


Fig. 8

Fig. 9



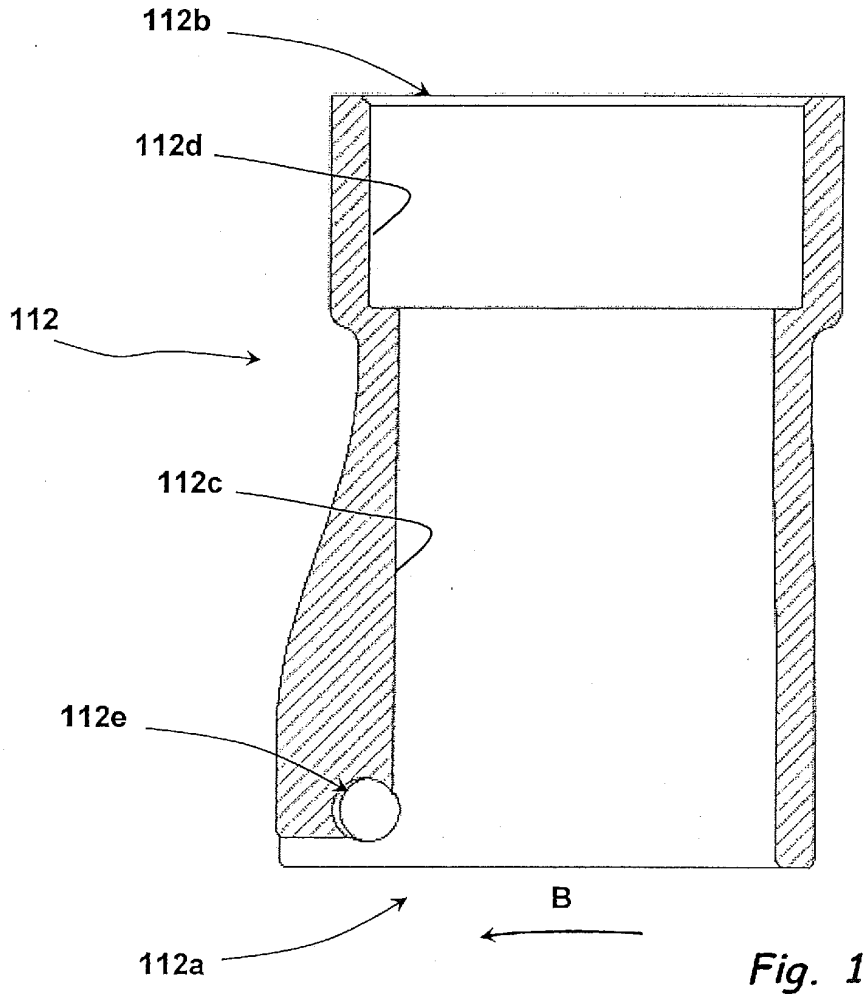
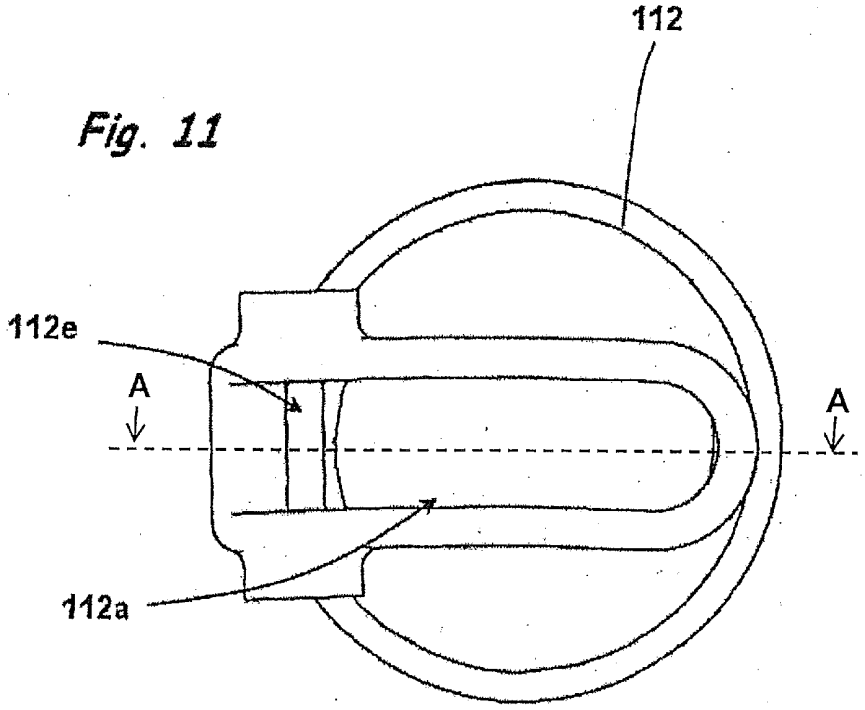


Fig. 10

Fig. 11



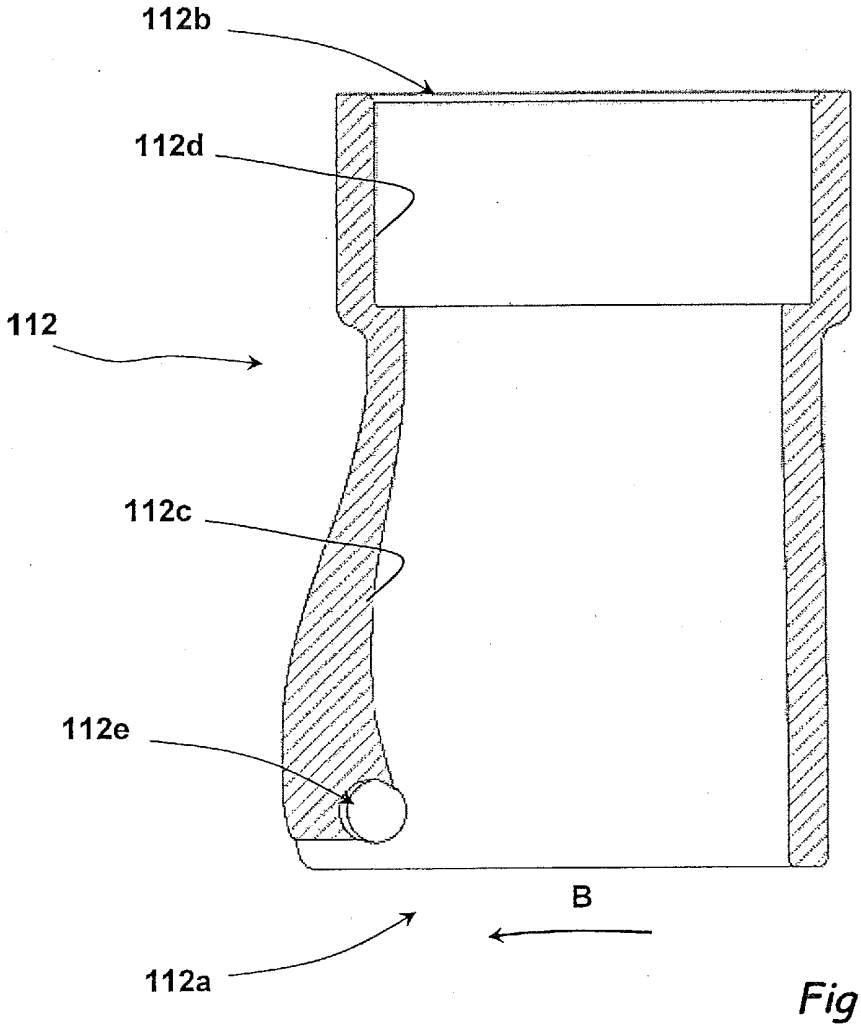
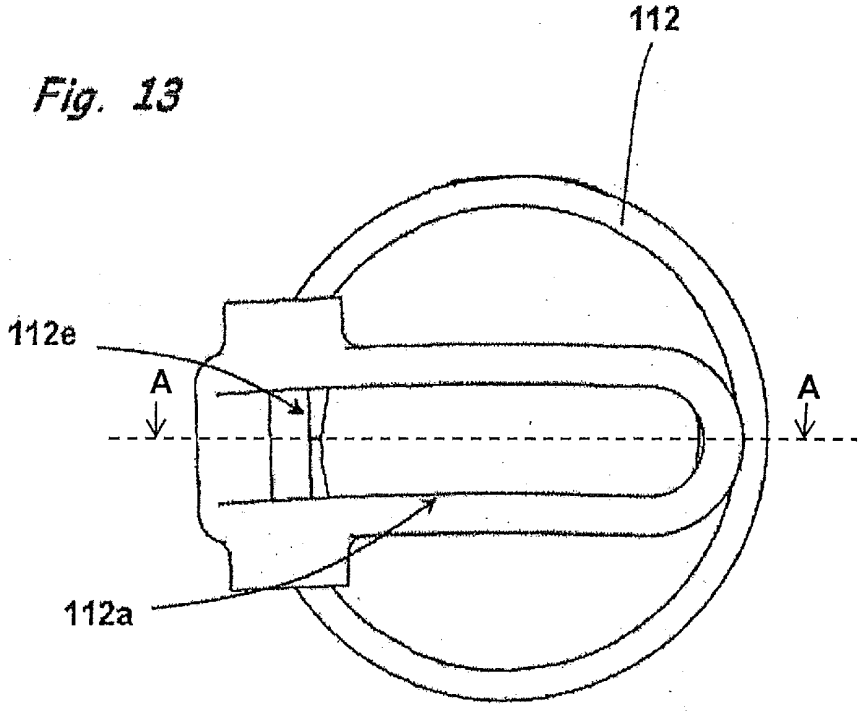


Fig. 12

Fig. 13



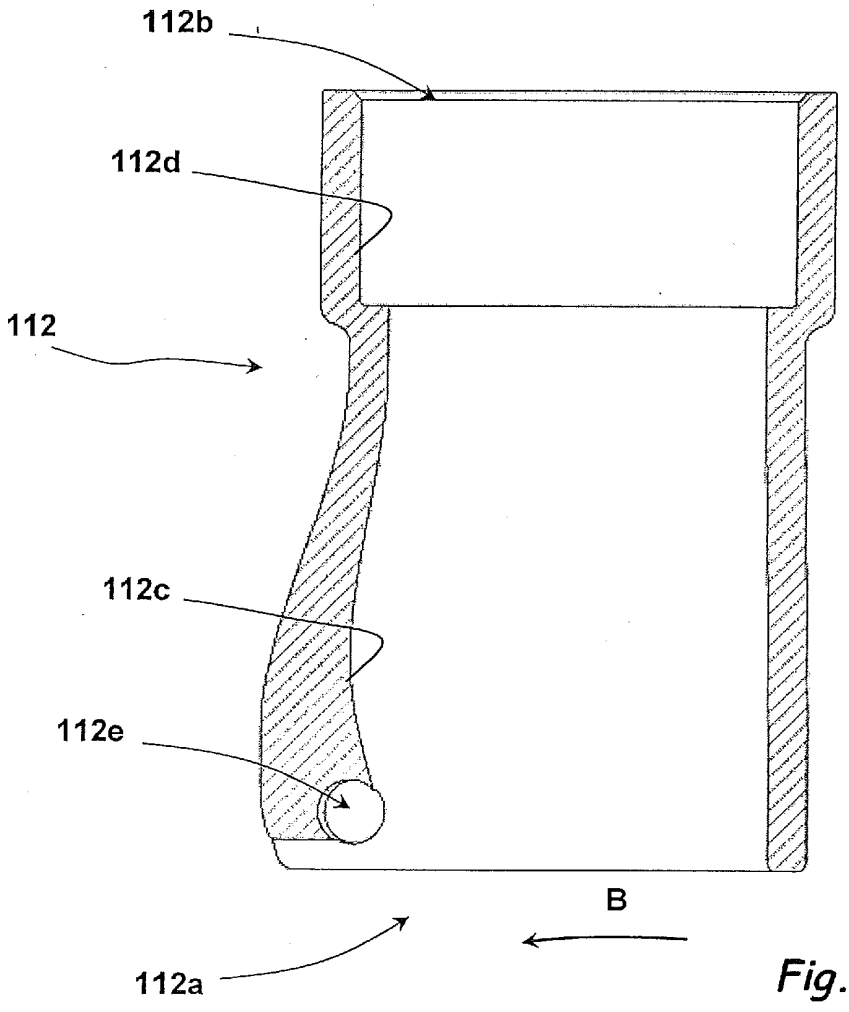
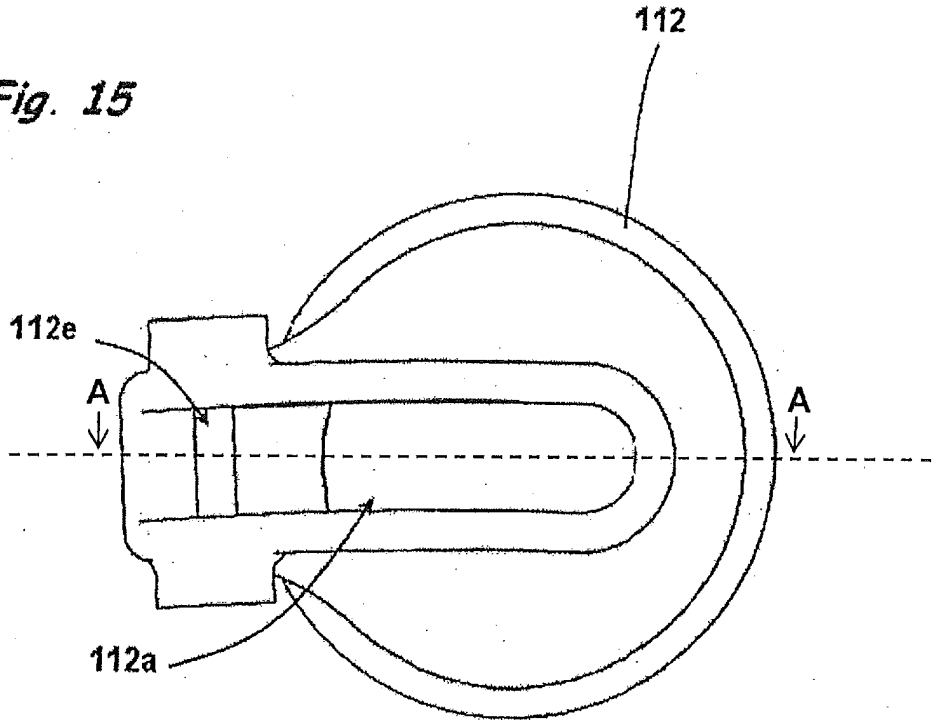


Fig. 14

Fig. 15



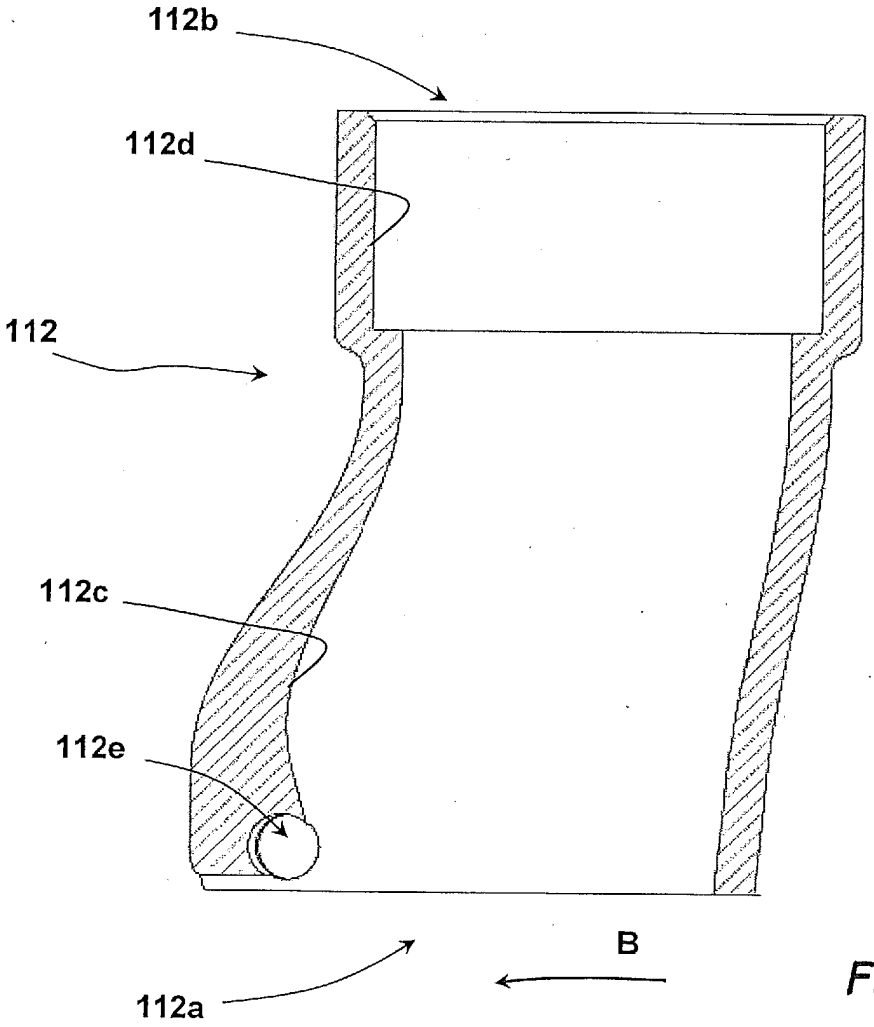
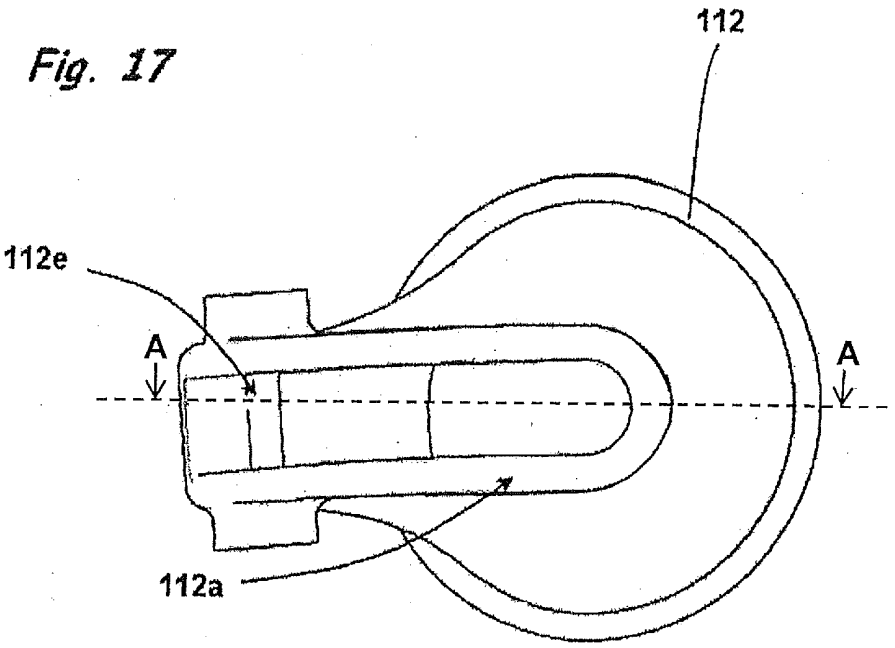


Fig. 16

Fig. 17



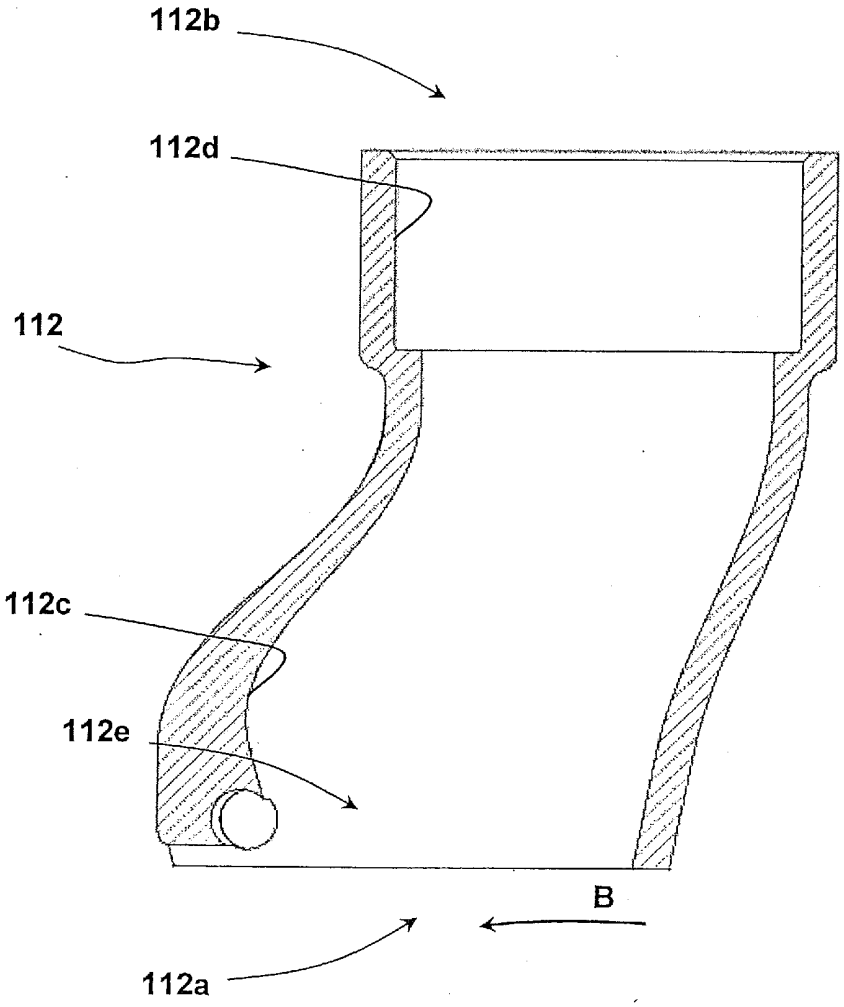


Fig. 18

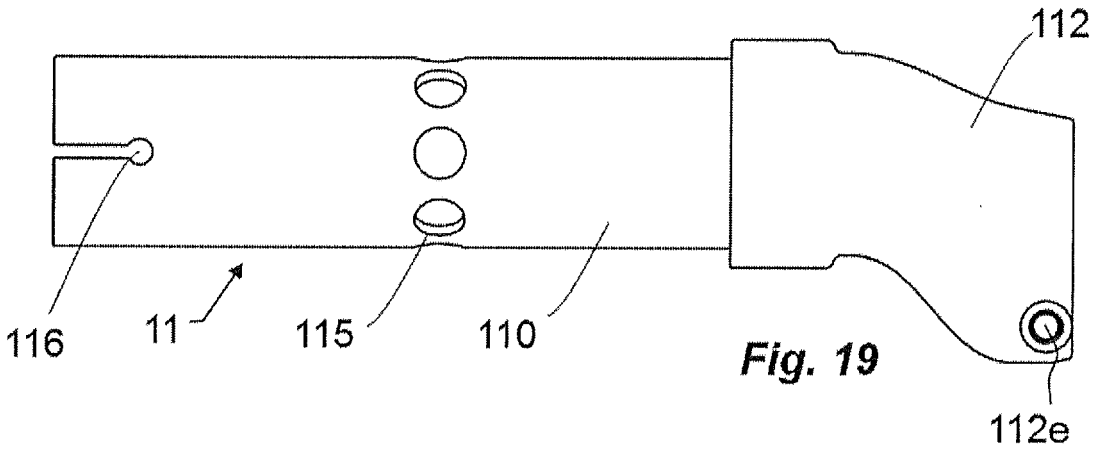


Fig. 19

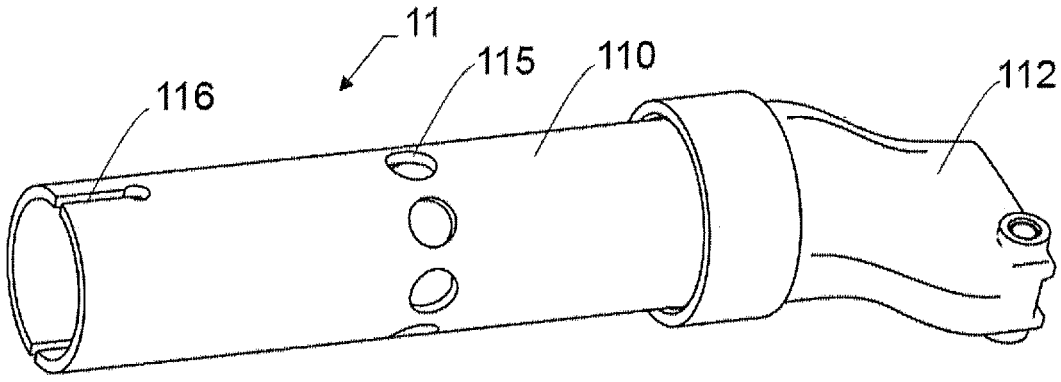


Fig. 20

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- GB 2119819 A **[0005]**
- US 4432399 A **[0006]**
- WO 2011000561 A1 **[0007]**
- EP 0943024 B1 **[0025] [0043]**
- EP 0273473 A **[0052]**