(19) DANMARK

(10) DK/EP 1967828 T3

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: *G 01 F 1/74 (2006.01)* *G 01 F 1/66 (2006.01)*

(45) Oversættelsen bekendtgjort den: **2018-03-19**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2017-12-27**

(86) Europæisk ansøgning nr.: **08002345.0**

(86) Europæisk indleveringsdag: **2008-02-08**

(87) Den europæiske ansøgnings publiceringsdag: **2008-09-10**

(30) Prioritet: **2007-03-09 DE 102007011546**

(84) Designerede stater: **AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR**

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(54) Benævnelse: **Fluidmåler**

(56) Fremdragne publikationer:
EP-A- 1 096 236
WO-A-00/23773
GB-A- 2 429 061
US-A1- 2002 124 661

Description

The present invention relates to a fluid counter having a measuring tube housing, a measured section located in the measuring tube housing, an ultrasonic transducer arrangement composed of at least one ultrasonic transducer for generating an ultrasonic signal and/or for converting an ultrasonic signal, which passes through the measured section, into an electrical signal, and a deflection device for deflecting the ultrasonic signal in the longitudinal direction of the measuring tube, according to the preamble of Claim 1.

An ultrasonic counter according to the preamble of Claim 1 is known from WO 00/23773. In this case, a plurality of ultrasonic transducers is affixed on the outer side of a pipeline, the surface normal of which is arranged perpendicular with respect to the longitudinal axis of the pipeline. The ultrasonic transducers can be arranged in this case on the pipeline in a 1-5 o'clock position or 7-11 o'clock position in relation to the position of a clock hand. In further designs, in which the ultrasonic signal emitted by a first ultrasonic transducer is to be received by a second ultrasonic transducer, the ultrasonic transducers are positioned on the outer side of the pipeline such that the surface normal thereof is inclined with respect to the longitudinal axis of the measuring tube. The ultrasonic transducers are connected via cables to an independent electronics housing, which also has a display screen.

A heat meter is known from the brochure of the measuring system "ultrakon®" ultrasonic heat meter EWZ 810 from IWK Regler und Kompensatoren GmbH, which comprises a terminal housing and an electronics housing fastened directly on the terminal housing. In addition, a separate calculator unit having display is provided. The calculator unit can be arranged positioned directly on the heat meter at a right angle to the electronics housing, on the one hand. The calculator unit can also be mounted remotely from the heat meter on the wall or also can be located remotely from the heat meter in a control panel, on the other

hand. Via an optional fitting, the calculator unit can be positioned, instead of in a horizontal or vertical location, in an angled location directly on the heat meter. During the mounting of the volume transmitter, it is always to be ensured that the electronics housing is always located laterally on the measuring tube housing. Another arrangement results in incorrect measurements.

Similar arrangements are also known from the operating instructions for "static heat meter 2WR4" order number NZ 839e-000 of Siemens AG and the brochure ULTRAFLOW II E20 499 from Kamstrup A/S.

US 2002/0124661 A1 discloses a device for measuring flows, in which the ultrasonic transducers can also be arranged laterally inclined with respect to the cross section of the measuring tube, but the surface normal thereof is also arranged extending obliquely with respect to the longitudinal axis of the measuring tube.

EP 1 096 236 A2 describes an ultrasonic flow rate meter for fluids, in which the surface normal of the respective ultrasonic transducer is arranged parallel to the longitudinal axis of the measuring tube and the ultrasonic signal leaving the respective ultrasonic transducer is reflected on a curve arranged in the measuring tube obliquely with respect to the opposite wall of the measuring tube and is also reflected further obliquely therefrom, until it reaches the second ultrasonic transducer.

DE 103 27 076 B3 describes a fluid counter, which comprises a multipart measuring tube arrangement. A measuring tube, which consists of brass, is located inside a measuring tube housing. The ultrasonic transducers are positioned on the upper side of the measuring tube housing in a corresponding recess. The electronics circuit board and the display element are typically located on the upper side of the transducer, each in a parallel arrangement with respect to the ultrasonic transducer surface. As the standardized installation plane, in a horizontal

pipeline, for example, for the medium water, a display having horizontally aligned, i.e., horizontally aligned display plane or a display plane rotated by 90° (vertical) is provided, and in a vertical pipeline, a display having vertical display plane is provided. The horizontal installation plane with horizontal display plane is the installation location occurring most frequently in practice. Therefore, the ultrasonic transducer is seated at the highest point through which fluid flows because of the most important, above-described arrangements. The disadvantage results therefrom that gas bubbles located in the fluid accumulate on the surface of the transducer and in this way cause disturbances in the measurement. Pivoting of the entire fluid counter to avoid the occupation of the transducer surfaces with gas bubbles is not possible, since fluid counters have to be mounted in precisely established installation locations and moreover the readability of the display unit would no longer be ensured upon a pivot. The installation situations are therefore merely subjected to very narrow limits.

An ultrasonic flow rate meter having a U-shaped measuring tube housing is known from GB 2 429 061 A. The measuring tube housing is enclosed by a further housing, which comprises a main housing part, a base part, and a cover. The base part and the main housing part form a receptacle for the measuring tube housing. Electronics parts are located inside the main housing part.

The object of the present invention is to provide a fluid counter of the type in question, in which, on the one hand, measurement inaccuracies because of gas bubbles in the region of the surface of the transducer are avoided and, on the other hand, narrow specifications in the installation of fluid counters can be maintained.

The present object is achieved in the fluid counter of the type in question by the features of the characterizing part of Claim 1. According to the invention, a further housing is provided for receiving electronics parts, wherein the measuring tube housing is accommodated in a holding device, which can be mounted on the

housing. Because of the conceptual separation of these two housings and the angle-offset connectability thereof via the holding device, the two housings may be positioned at a desired angle with respect to one another in a simple manner. According to the present invention, the ultrasonic transducer or transducers is/are no longer located at the uppermost position of the space through which medium flows, but rather lower. In this way, the gas bubbles present in the fluid are collected at a point in the interior of the counter at which they have no effect influencing the accuracy of the measurement. At the same time, however, the good readability of the fluid counter remains due to the display unit, which is still located at the highest point. The invention ensures that the fluid counter is well readable and the determinations of a standard installation are fulfilled, but at the same time disturbances as a result of air bubbles on the upper side of the measuring tube housing can be effectively precluded.

The lateral angle offset of the surface normal N of the ultrasonic transducer with respect to the perpendicular to the display plane A is in an angle range between 30°-60°, preferably 40°-50°, particularly preferably 42°-48°. The angle can be 45°, for example.

Alternatively, in the installation position the ultrasonic signal impinges on the deflection device from the underside.

The advantage of the lateral angle offset of 30°-60° is also that if the display unit is rotated by 90° out of the installation plane to read the counter laterally, the transducers are also not at the highest point and therefore the air bubbles can also only collect laterally with respect to the transducer. This would not be ensured at an angle of 90°.

The above-mentioned angle specifications of the surface normal N of the ultrasonic transducer relate to the perpendicular to the display plane A of the display element or at least a holding device for an external display element.

The holding device is advantageously designed such that the measuring tube housing can be clamped tight in the holding device. This type of mechanical fixing enables complex work (for example, the introduction of threaded boreholes) on the measuring tube housing, which consists of metal in particular, to be omitted. Only minor mechanical machining of the measuring tube housing (for example, the introduction of receptacle pockets for temperature sensors and/or passage boreholes for ultrasonic signals) are still necessary. The multiplicity of parts can be reduced in this way and the costs of production can be significantly reduced.

Because the holding device has a first holding part and a second holding part which form a recess for receiving the measuring tube housing, a structurally particularly simple solution for fixing is provided. The holding device of the above-mentioned type engages around the measuring tube housing like a hose clamp.

The above-described type of fastening has the additional advantage that at least one functional part can be held in position by the holding device engaging around it. The functional part is, for example, a transducer, which is located in a pocket or recess, for example, on the holding part, and/or a temperature sensor. Recesses, which are simple to implement by machining, merely have to be provided for these functional parts. The fixing is performed by the engaging around of the holding device. This engaging around of the holding device prevents the elements to be held (transducers/T sensor) from being pressed out of the position thereof by the internal pressure of the medium.

An anti-twist prevention means can advantageously be provided between the measuring tube housing and the holding device, for example, in the form of a projection on the holding device, which engages in a corresponding recess on the measuring tube housing, or vice versa. Upon application of a torque to the measuring tube housing, for example, when screwing it into a

fluid line, a displacement of the angle of the measuring tube housing with respect to the holding device and thus an incorrect position and/or damage of the interior can be avoided in this way.

The option advantageously exists of connecting the second holding part to the housing detachably, for example, via snap connections or the like. The second holding part can then be produced independently.

Because the respective mounting position is provided in a region on the second holding part which protrudes laterally from the housing for the electronics parts, the mounting position(s) is/are accessible particularly easily for fastening the first holding part. In particular, a type of veranda-shaped projection of the second holding part can be provided on the housing for the electronics parts.

At least one guide duct for a cable connection of the respective transducer and/or of a temperature sensor is advantageously provided in the housing. The guide duct ensures a predetermined alignment and positioning of the relevant connecting cable and therefore easy mounting ability and reduction of mounting errors during the assembly.

The first holding part can advantageously be embodied as a shell, which encloses the measuring tube housing on the underside, preferably over its length. Alternatively, however, multiple, for example, two holding parts can engage around the measuring tube housing at a distance (for example, on the front side and rear side) for the fixing thereof on the second holding part like a hose clamp.

If the ultrasonic transducer is also clamped during the clamping of the two housings to one another in the contact region, pressure forces occurring on the ultrasonic transducer can be absorbed in a simple manner by the housing.

The position moreover enables additional functional parts, for example, a temperature sensor, to be fixed in a permanent position and securely on the measuring tube housing without complex machining measures, by fixing the functional part in position in the mounting location by way of the housing for the electronics components or by the enclosing part.

Advantageous embodiments of the present invention will be explained in greater detail hereafter on the basis of the figures of the drawing. Repeating features are only indicated once for the sake of comprehensibility. In the figures:

Figure 1 shows a very simplified, schematic longitudinal sectional illustration of the measuring tube housing of a first embodiment of the fluid counter according to the invention;

Figure 2 shows a sectional illustration along line I-I of Figure 1;

Figure 3 shows a very simplified, schematic illustration in partial section of the first embodiment of the fluid counter according to the invention with mounted electronics housing;

Figure 4 shows an illustration in partial section of a fluid counter which is not part of the invention (without measuring tube housing);

Figure 5 shows an illustration of a housing, which is not part of the invention, for the electronics components having second holding part located thereon of the holding device in a top view (Figure 5A), in a perspective view (Figure 5B), and with mounted measuring tube housing (Figure 5C);

Figure 6 shows a view of a fluid counter, which is also not part of the invention, having comparative arrangement of measuring tube housings of different nominal widths in a side view (Figure 6A) and a view of the end face (Figure 6B);

Figure 7 shows a very simplified, schematic illustration of a fluid counter, which is also not part of the invention, in a lateral view, and

Figure 8 shows a very simplified, schematic illustration of a fluid counter, which is also not part of the invention, in a lateral view.

Figure 1 shows a very simplified, schematic sectional illustration of a part of a first embodiment of a fluid counter 1 according to the present invention. The fluid counter comprises a measuring tube housing 2, in which an elongated measuring tube 3 is positioned to ensure a measured section. A deflection device 11, for example, in the form of a mirror, is located inside the measuring tube, using which an ultrasonic signal emitted by an ultrasonic transducer 4 is reflected in the longitudinal direction with respect to the measuring tube 3 and vice versa.

A further housing (not shown for the sake of comprehensibility in Figure 1), which houses, for example, a display element, for example, an LCD display or the like, is seated on the measuring tube housing 2. The plane of the display element is identified with A.

The location of the installation plane is identified with E in Figure 2. As also shown in Figure 2, according to the invention, the respective ultrasonic transducer 4 is not arranged at the uppermost point in the interior of the measuring tube housing 2, but rather in contrast is located at a position which lies offset inclined at an angle α with respect to the perpendicular to the installation plane E. The inclination of the surface normal N of the ultrasonic transducer 4 to the perpendicular of the plane E is identified by the angle α. Gas bubbles in the fluid typically accumulate at the uppermost point in the interior of the measuring tube housing and therefore do not impair the ultrasonic propagation.

Figure 3 shows the measuring tube housing 2 together with a holding device 6 and the housing 8 for receiving the electronics components. A display element, for example, in the form of an LCD display, which is indicated by the reference sign 7, is located on the upper side of the housing 8. The display element 7 lies in the plane A (display plane).

The measuring tube housing 2 is fixed via the holding device 6 on the housing 8. The holding device 6 comprises a first holding part 10, which forms a recess 15, and which engages around the measuring tube housing 2. Furthermore, a second holding part 13, which has a plate-like shape in the embodiment according to Figure 3, is provided. The measuring tube housing 2 is clamped between the first holding part 10 and the second holding part 13, for example, by screwing the two holding parts 10, 13 together via screws (not shown), i.e., clamping them to one another.

Alternatively, the connection of the first and second holding parts 10, 13 can also take place via a one-sided suspension by means of hooking geometries, which are adapted to one another and attached on one side, of first and second holding parts 10, 13 and opposing screw connections.

The ultrasonic transducer 4 is located in this case, for example, in a recess 19 on the second holding part 13, which aligns with a borehole in the measuring tube housing 2. In the clamped state, the ultrasonic transducer 4 is held inside the recess because of the structure. Mechanical impairments are advantageously absorbed by the second holding part 13.

Furthermore, a temperature sensor 18 is seated in a pocket 25 on the first holding part 10. This temperature sensor 18 is also held in the pocket because of the structure. To enable the first holding part 10 to be pushed on when the temperature sensor is previously mounted, the pocket 25 extends parallel to the plane of the drawing up to the open end of the first holding part. The pocket 25 is adapted to the size of the temperature sensor 18

inserted into the first holding part. The remaining cavity (not shown in Figure 3) is closed again later by a filler part (also not shown in Figure 3), for example, made of plastic or rubber.

A projection 21, which engages in a corresponding recess 20 on the first holding part 10, is formed in the measuring tube housing 2, for example, on the side opposite to the ultrasonic transducer 4. In this way, an anti-twist prevention means is ensured, for example, when the fluid counter is screwed together with the power supply connection.

The second holding part 13 can be connected as an independent part to the housing 8, for example, via a snap connection, clamp connection, or the like. The plane E in Figure 3 identifies the alignment of the plane in the installation location of the fluid counter 1, which is parallel with the display plane A.

Figure 4 illustrates an embodiment of a fluid counter, which is not according to the invention, with the housing 8 for the electronics components omitted. The measuring tube housing 2 has a flange 22 having individual flange boreholes 23 for the location-predetermined mounting on the line network in this case. The flange 22 is generally provided at both ends of the measuring tube housing 2.

The embodiment according to Figure 4 also has a housing 8 for the electronics components, which is not shown in Figure 4 for the sake of comprehensibility, however. In contrast to the embodiment according to Figure 3, the first housing part 10 of the holding device 6 is an integral component of the measuring tube housing 2. The measuring tube housing can be produced, for example, from plastic, in one production step.

The recess 20 illustrated in Figure 3 and the projection 21 engaging therein are not absolutely necessary in the embodiment according to Figure 4.

Figure 5A shows the housing 8 for the electronics components and

also the second holding part 13 of the holding device 6 for the measuring tube housing 2. The housing recess 12 is provided to receive a display element, for example, an LCD display screen or the like. Furthermore, a printed circuit board having components of the control electronics, the electronics for measured value processing, and data relay is located in the region of the housing recess 12.

A power source (not shown) is advantageously also located in the region of the housing recess 12.

A guide duct 14 for the cable connection of a temperature sensor is formed into the housing recess 12. The housing 8 is detachably connected via multiple snap connections 16 to the second holding part 13 and is dimensioned for this purpose such that the second holding part 13 forms a circumferential projection 17, which receives the individual mounting positions, for example, passage boreholes.

Both the second holding part 13 and also the housing 8 are preferably conceived as plastic molded parts.

A cover (not shown in Figures 5A and 5B) is provided to cover the housing 8, which is connectable via catch connections (also not shown) to the housing 8. According to Figure 5C, in the mounted state, the first holding part 10, which has the shape of a trough in this case, closes over nearly the entire length of the measuring tube housing 2 and fixes it in its location.

As can be seen from Figures 6A and 6B, a standardized arrangement, consisting of housing 8 and second holding part 13, can be used for measuring tube housing 2 having various nominal diameters (for example, nominal diameter DN 15 - DN 100).

The differently arranged mounting positions 9 illustrated, for example, in Figures 5A and 5B, enable measuring tube housings of different sizes to be fastened by selecting the mounting positions. The second holding part 13 like an adapter in this

case.

Figure 7 shows a further embodiment of the fluid counter in a very simplified illustration. A one-piece holding device 6, which has the shape of a circumferential bow or ring, is provided for fixing the measuring tube housing 2 on the housing 8. The holding device 6 is pushed in the longitudinal direction, i.e., axially with respect to the longitudinal direction of the measuring tube 3, with position measuring tube housing 2 and fixed with the housing 8. For example, a catch connection (not shown) between overlap part and an attachment 28 on the housing 8 can be provided for the fixing.

By means of the holding device 6, the measuring tube housing 2 can be clamped in a fixed location between overlap part and housing 8. The attachment 28 can be formed integrally with the housing or can be connectable to the housing 8, for example, via a snap connection. In addition, a screw 29 can be provided for the location fixing of the holding device 6, for tolerance compensation, and for clamping tight the measuring tube housing.

A rubber layer (not shown) is provided between the measuring tube housing 2 and the attachment 28, which also compensates for tolerances and is used for sealing the ultrasonic transducer (also not shown). Instead of the rubber layer, other elastic elements, for example, a compression spring or the like, can also be used for tolerance compensation.

The embodiment according to Figure 8 shows a housing 8 having an upper-side display element 7. The holding device 6 is embodied as a C-shaped bow, which is connected via a hinge 26 to the housing 8. The housing 8 and the holding device 6 together form a recess 15 for receiving the measuring tube housing 2. A cable 30 is led to the electronic components of the housing 8 from the ultrasonic transducer 4 in the bow of the holding device 6. The measuring tube housing 2 is laid in the bow, for example, after the sealing (embedding) of the housing 8. Subsequently, the bow is folded up and snapped at the snap connection 27 to the housing

8.

LIST OF REFERENCE NUMERALS

1	fluid counter
2	measuring tube housing
3	measuring tube
4	ultrasonic transducer
5	ultrasonic transducer
6	holding device
7	display element
8	housing
9	mounting position
10	first holding part
11	deflection device
12	housing recess
13	second holding part
14	guide duct (temperature sensor)
15	recess
16	snap connection
17	projection
18	temperature sensor
19	opening
20	recess
21	projection
22	flange
23	flange boreholes
24	guide duct (transducer cable)
25	pocket
26	hinge
27	snap connection
28	attachment
29	screw
30	cable

Patentkrav

1. Fluidmåler (1) med
et målerør (3),
et visningselement (7) med et visningsplan A,
et ultralydstransducerarrangement bestående af i det mindste en ultralydstransducer (henholdsvis 4 og 5) til generering af et ultralydssignal og/eller til konvertering af et ultralydssignal, der gennemløber en målestrækning, til et elektrisk signal,
en inde i målerøret (3) anbragt omstyringsindretning (11) til omstyring af ultralydssignalet
og et elektronikhus (8), som omfatter visningselementet (7), kendetegnet ved, at
der er indrettet et målerørshus (2), hvor ultralydstransduceren (4, 5) er positioneret i udtagninger på målerørshuset (2),
målestrækningen befinder sig i målerørshuset (2),
omstyringsindretningen (11) omstyrer ultralydssignalet i målerørets (3) længderetning,
målerørshuset (2) er anbragt i en holdeindretning (6), der er monteret på elektronikhuset (8),
og ultralydstransduceren (henholdsvis 4 og 5) er anbragt sådan, at ultralydstransducerens (henholdsvis 4 og 5) fladenormal N er anbragt hældende i en skrå vinkel α relateret til den vinkelrette på visningsplanet A, således at ultralydssignalet i monteret position ved horisontal rørledning med horisontalt orienteret visningsplan A for fluidmåleren (1) ikke rammer ovenfra på omstyringsindretningen (11).

2. Fluidmåler ifølge krav 1,
kendetegnet ved, at
ultralydstransducerens (henholdsvis 4 og 5) fladenormal N relateret til den vinkelrette på visningsplanet A ligger i et vinkelområde på 30° - 60°, fortrinsvis 40° - 50°, fortrinsvis 42° - 48°.

3. Fluidmåler ifølge krav 1,
kendetegnet ved, at
ultralydssignalet i monteret position rammer fra undersiden på

omstyringsindretningen (11).

4. Fluidmåler ifølge krav 1, kendetegnet ved, at målerørshuset (2) kan fastklemmes i holdeindretningen (6).

5. Fluidmåler ifølge krav 1 eller 4, kendetegnet ved, at holdeindretningen (6) har en første holdedel (10) samt en anden holdedel (13), hvilke holdedele danner en udtagning (15) til optagelse af målerørshuset (2).

6. Fluidmåler ifølge krav 5, kendetegnet ved, at i det mindste en funktionsdel, især en transducer (4 og/eller 5) og/eller en temperaturføler (18), holdes i position af holdeindretningen (6).

7. Fluidmåler ifølge i det mindste et af kravene 1 - 6, kendetegnet ved, at der er indrettet en drejesikring mellem målerørshus (2) og holdeindretning (6).

8. Fluidmåler ifølge i det mindste et af kravene 1 - 7, kendetegnet ved, at den første holdedel (10) er integreret i målerørshuset (2).

9. Fluidmåler ifølge i det mindste et af kravene 1 - 8, kendetegnet ved, at den anden holdedel (13) er indrettet som fælles del til optagelse af første holdedele (10) med forskellige nominelle gennemstrømningstværsnit.

10. Fluidmåler ifølge krav 9, kendetegnet ved, at der på den anden holdedel (13) er indrettet flere valgbare montagepositioner (9).

11. Fluidmåler ifølge i det mindste et af kravene 5 - 10, kendetegnet ved, at
den anden holdedel (13) er løsbart forbundet med elektronikhuset (8).

12. Fluidmåler ifølge i det mindste et af kravene 5 - 10, kendetegnet ved, at
montagepositionen (9) foreligger i et område på den første holdedel (10), hvilket område rager sideværts frem fra elektronikhuset (8).

13. Fluidmåler ifølge i det mindste et af kravene 5 - 12, kendetegnet ved, at
der i elektronikhuset (8) er indrettet i det mindste en føringskanal (14 og/eller 24) for kabelforbindelser.

14. Fluidmåler ifølge i det mindste et af de foregående krav 5 - 13,
kendetegnet ved, at
den første holdedel (10) er udformet som skal.

15. Fluidmåler ifølge i det mindste et af kravene 5 - 13, kendetegnet ved, at
der er indrettet flere første holdedele (10), som griber omkring målerørshuset (2) i afstand til hinanden.

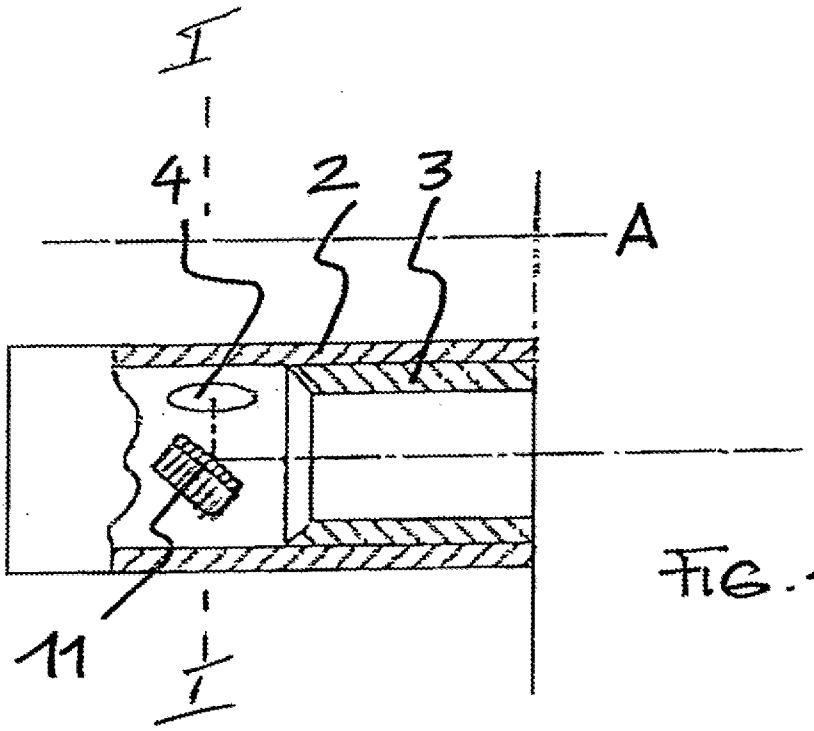

FIG. 1

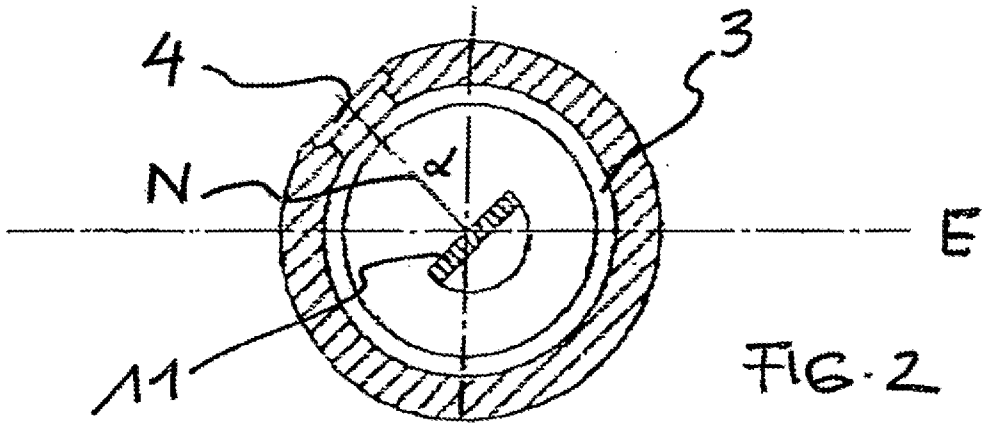

FIG. 2

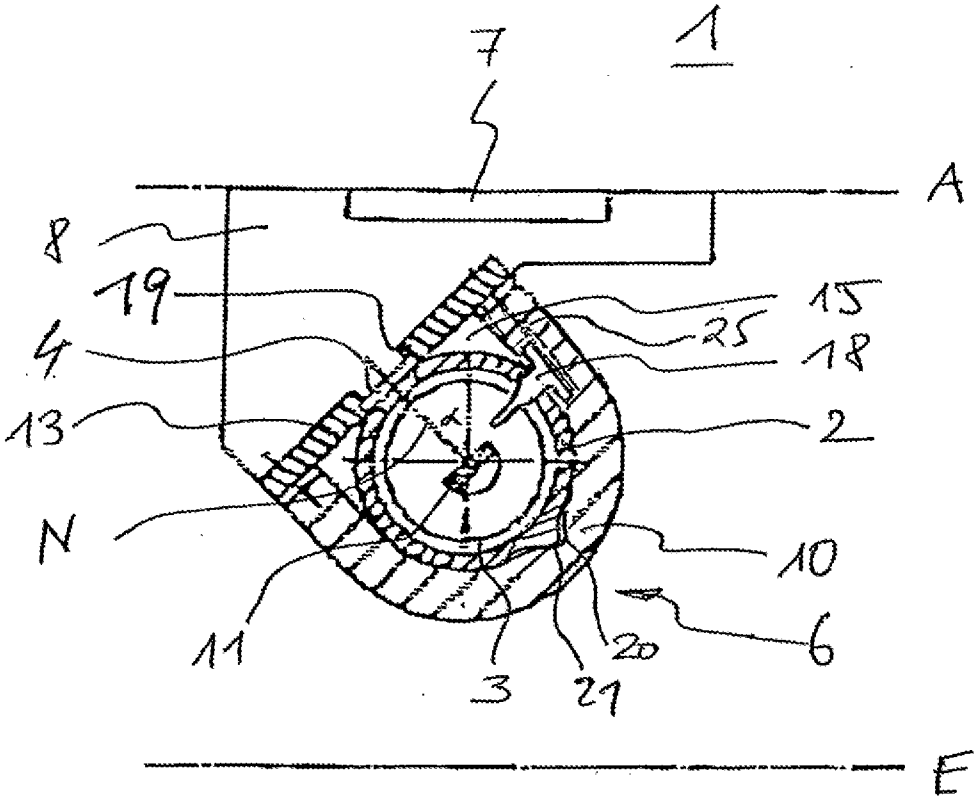

FIG.3

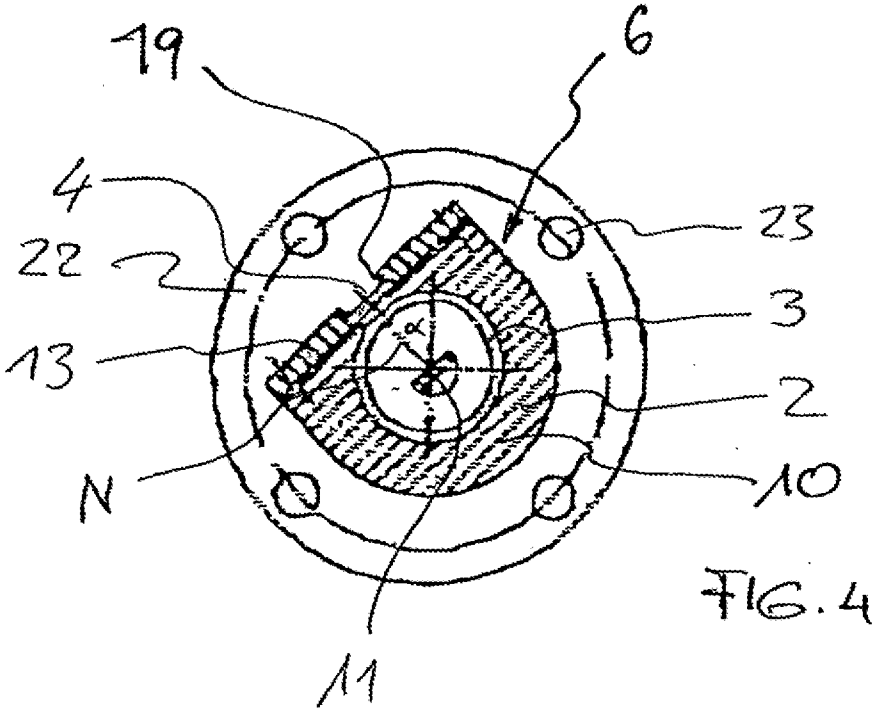

FIG.4

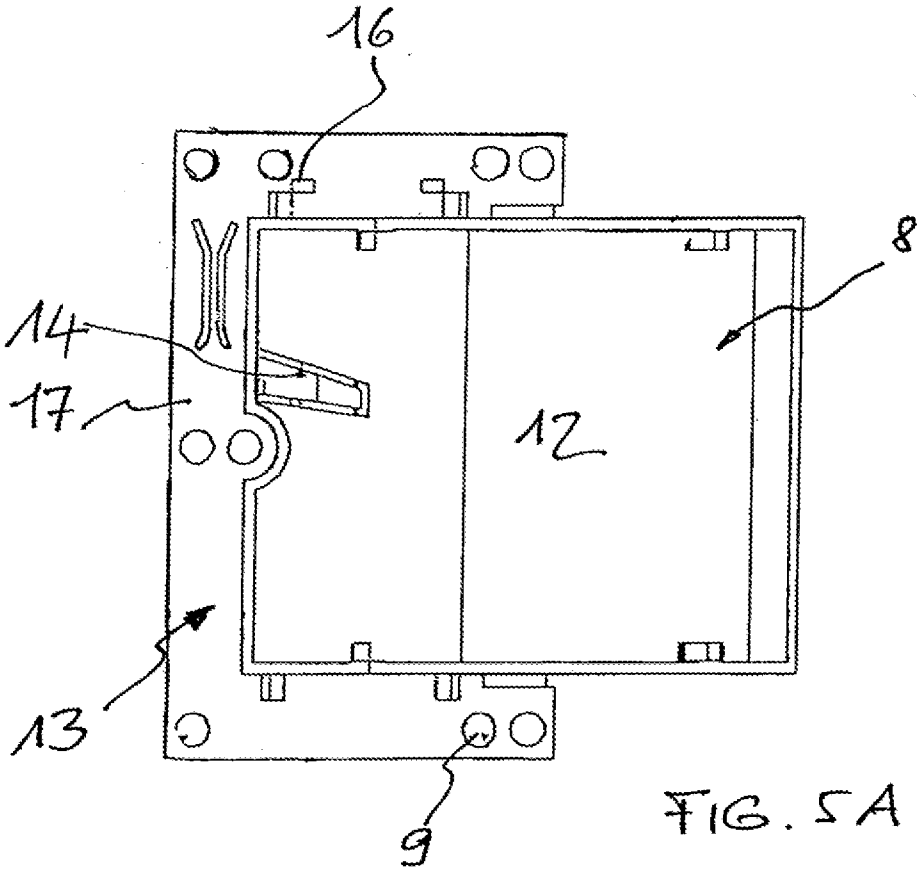

FIG. 5A

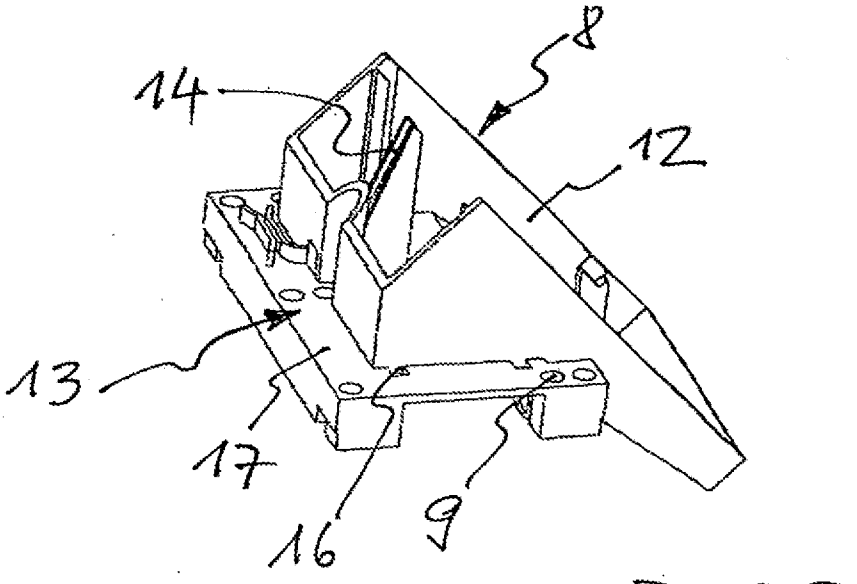

FIG. 5B

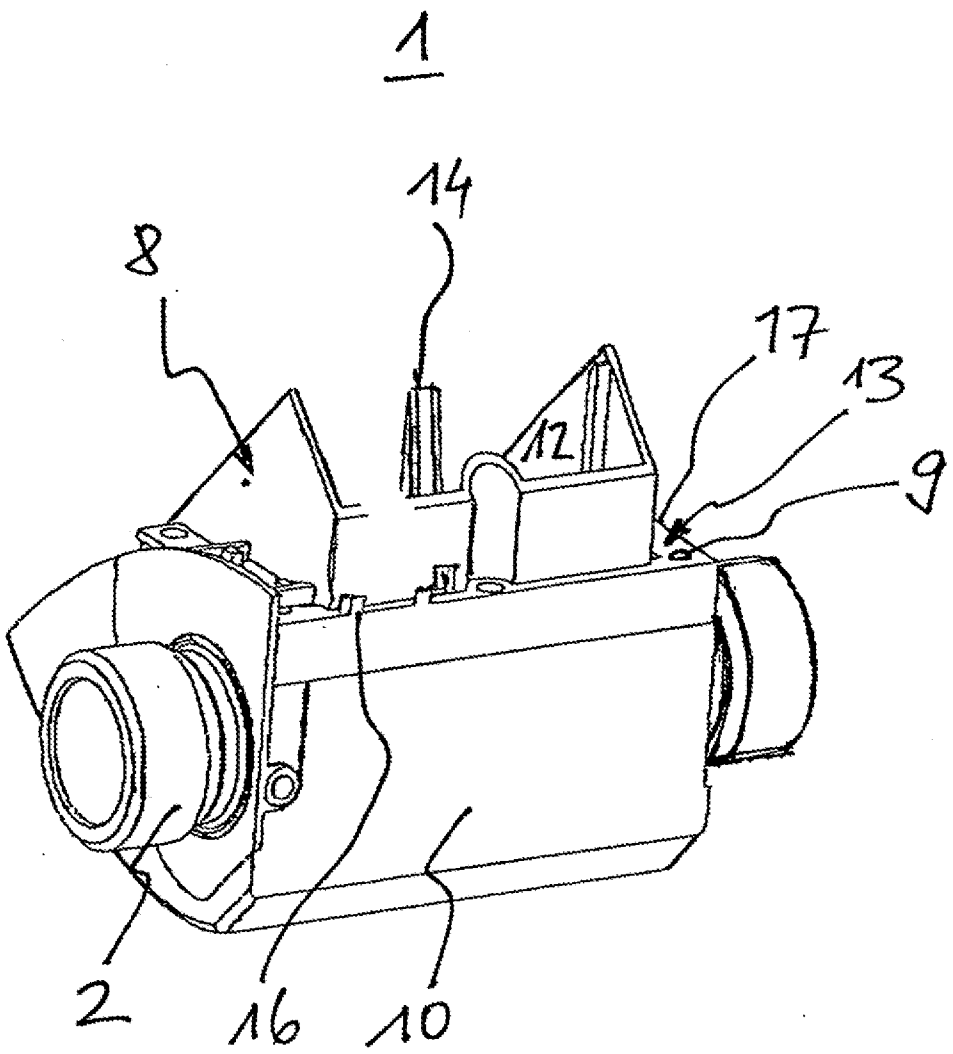

FIG. 5C

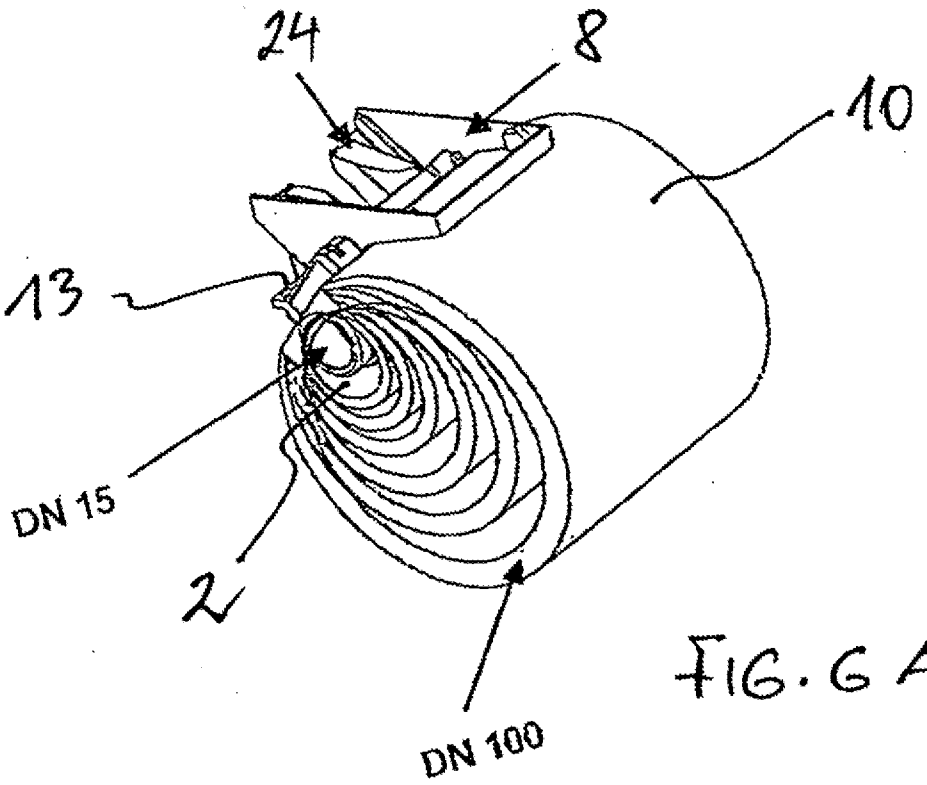

FIG. 6A

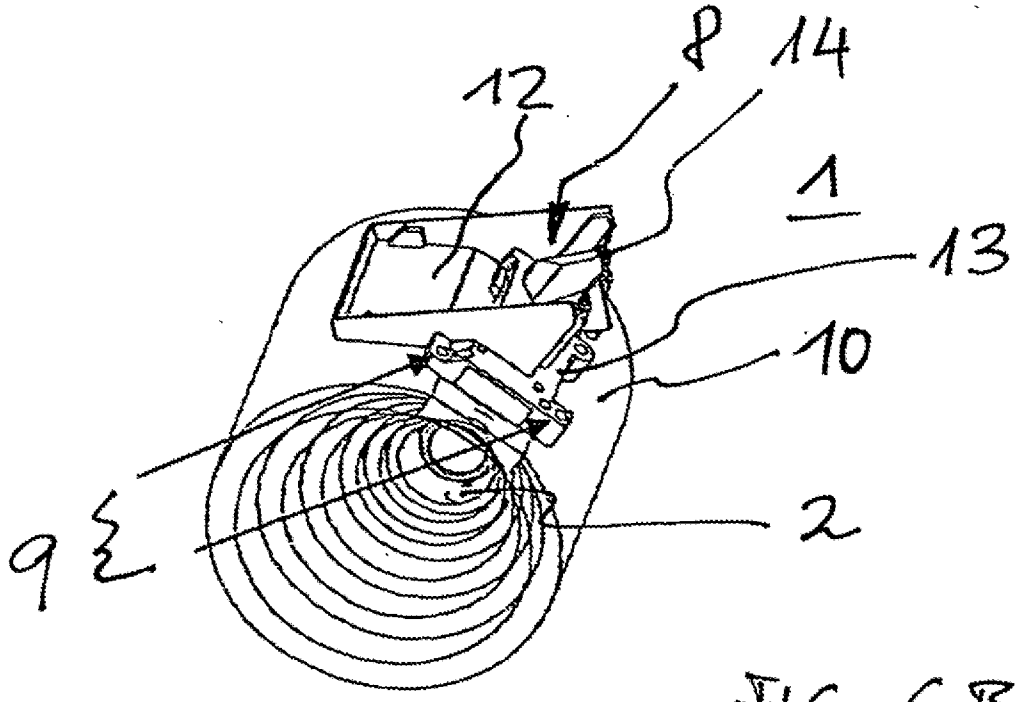

FIG. 6B

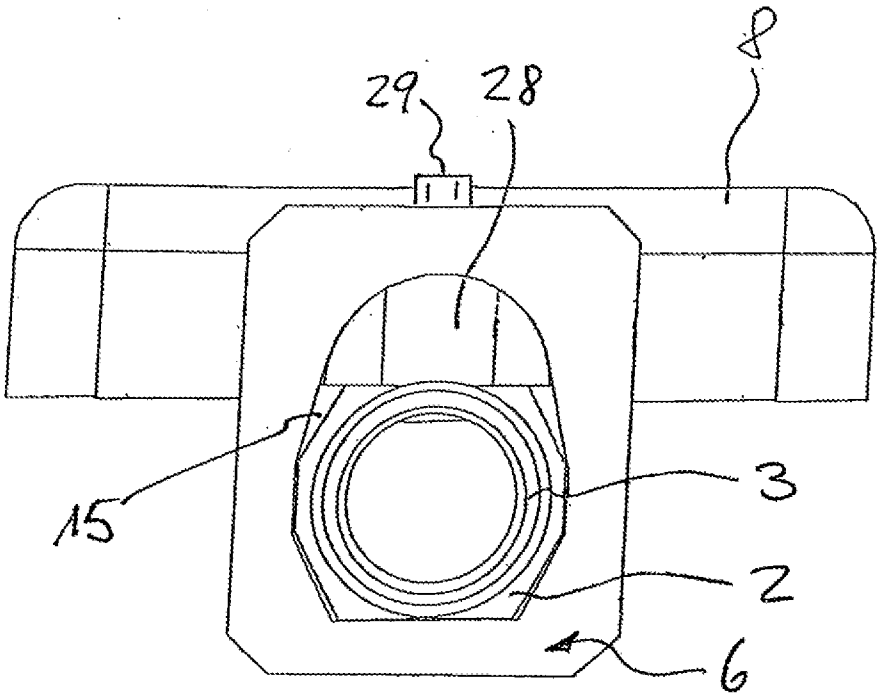

FIG. 7

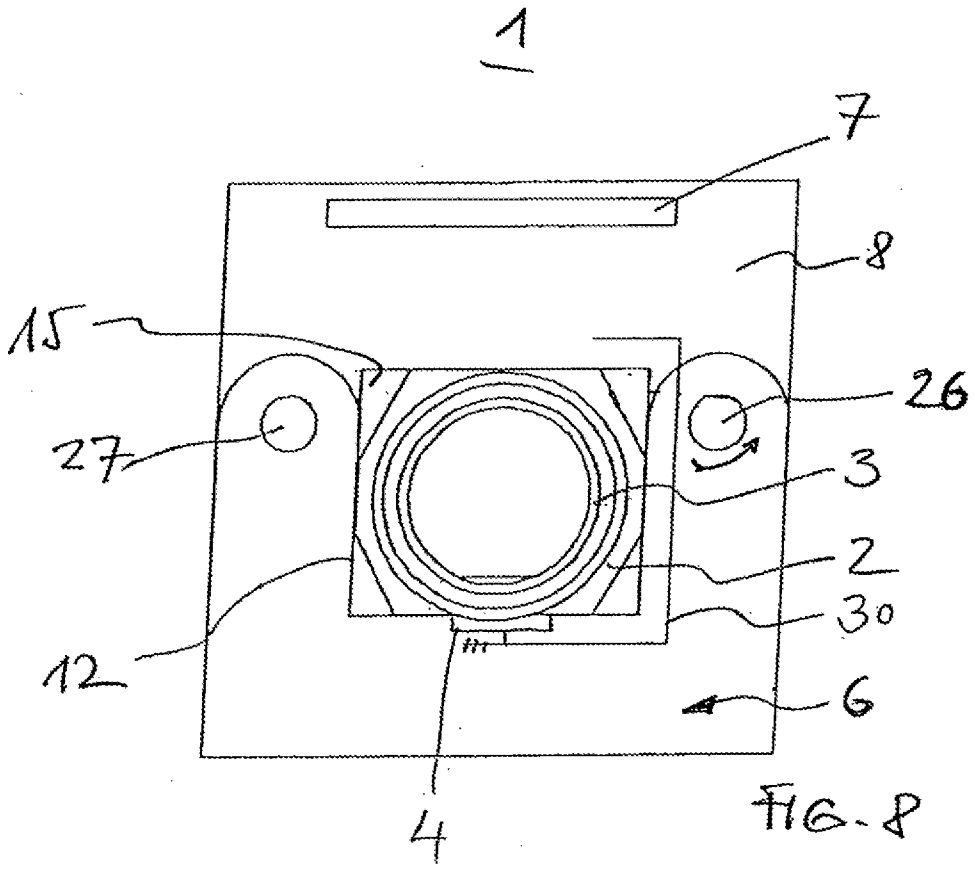

FIG. 8