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(54) **SENSOR CONSTRUCTION.**

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EP 0 370 003 B1

Description

The present invention relates to a sensor construction particularly for the sealing and electrical insulation of ceramic or other fragile membranes in pressurized conditions where high temperatures prevail.

While using high pressures and high temperatures, the problem is the leading through of the sensors into these spaces so that they are not damaged under the influence of the fluctuation of pressure and temperature. For example in the measurements of pH and oxygen, the common practice is to use relatively fragile sensors, which may be easily broken under pressure when brought into a pressurized space.

The object of the present invention is to eliminate the above mentioned drawbacks. A particular object of the present invention is to introduce a sensor construction which also enables the use of fragile materials in sensors under high pressures.

As regards the characteristic novel features of the invention, the claims section is referred to.

The invention is based on the principal idea that the fragile sensor is placed in a pressurized space in an essentially freely movable position, to float in the insulating material so that an equally high pressure is effective on all sides of the fragile construction.

The sensor construction of the invention comprises a housing which forms the pressure balancing chamber and is essentially open towards the pressurized space; a hollow tubular sensor, open at the end nearest to the said chamber, partly located in this chamber and partly protruding out of it, the measuring chamber of the sensor being located at the outermost, closed end of the said sensor; and a conductor, which is lead into the chamber via a leadthrough arrangement known as such, and is connected to the sensor and insulated from the housing. Moreover, the space of the chamber surrounding the sensor is mainly filled with the insulating material, which is separated from the pressurized space by means of the advantageously annular piston provided around the sensor.

The sensor is advantageously a hollow rod-like ceramic or other fragile membrane open at one end and closed at the other, and a conductor is lead into its outermost closed end, i.e. to the measuring chamber, via the open end. In between the measuring chamber and the open end of the sensor, there is a sealing chamber separated by means of screw units, which sealing chamber is filled with the insulating material while the screw units are freely movable under the influence of the pressure in the lengthwise direction of the sensor.

At the innermost end of the chamber, the part of the conductor which is located in between the screw unit and the leadthrough of the conductor, is bent to form a loose curve so that the sensor can be moved with respect to the housing without obstruction by the conductor. Advantageously the part of the chamber surrounding the sensor is provided with one or several guides, for instance sliding seal rings, which are arranged to be supported both by the sensor and the inner surface of the pressure balancing chamber so that they essentially prevent any transversal movements of the sensor, but allow the sensor to move freely in the lengthwise direction.

In the vicinity of the open end of the chamber, the piston sealing the space in between the chamber and the sensor can be a separate elastic ring, which is freely movable with respect to the walls of both the sensor and the chamber. It can also be an essential part of the sensor, for example made of the same ceramic material as the sensor, In which case the outer edge of this flange, resting against the chamber, is provided with sealing which prevents the insulating material from entering the other side of the piston. An essential feature for the insulating material, the piston and the guides is that they are all non-conducting so that the sensor is galvanically insulated from the housing.

The advantage of the invention, compared with the prior art, is that it enables the use of fragile sensors in high pressures and high temperatures, which has not been possible with the current methods.

In the following the invention is explained in detail with reference to the appended drawing, where a sensor construction according to the invention is illustrated.

The preferred embodiment of the sensor construction of the invention, illustrated in the drawing, includes a straight, tubular pressure balancing chamber 1 formed by the housing 2, which chamber is open at one end and closed at the other. At the closed end of the chamber, there is located the leadthrough 5 of the insulated conductor 6, which leadthrough leads the conductor into the pressure balancing chamber in a pressure-proof manner and insulated within the housing 2. Partly inside the chamber and partly protruding therefrom, there is arranged a tubular sensor 4 made of some fragile material, which sensor is open at its inner end and closed at its outer end. The closed end of the sensor comprises the measuring chamber 9, and the rest of the inside of the sensor is filled with insulating material 10 placed in between two screw units 11 and 14. The insulated conductor, lead via the leadthrough into the pressure balancing chamber, is arranged to proceed through the first screw unit 11, the insulating material 10 and the second screw unit 14 into the measuring chamber. The part 12 of the conductor which remains in between

the first screw unit and the leadthrough, is allowed to form a loose curve, thus enabling the sensor to move freely with respect to the housing 2.

The sensor 4 is supported against the pressure balancing chamber 1, in the vicinity of the open end of the chamber, by means of an annular, elastic piston 8, so that the inner part of the said chamber, separated by the piston, is filled with some insulating compound or liquid 7, which is for instance tetrafluoroethylene or silicone. Moreover, further inside the chamber the sensor is supported against the chamber walls by the sliding seal rings, which essentially prevent the sensor from moving transversally in the chamber, but allow it to move freely in the lengthwise direction thereof.

The sensor construction of the invention is operated as follows. While pressure is effective outside the tip 15 of the sensor 4, the piston 8 is pushed inside and presses the insulation 7 located in the pressure balancing chamber 1. The pressure enters, via the chamber-side open end 3 of the sensor, to the inside of the sensor, so that the first screw unit 11 presses the sealing material 10, and this in turn presses the second screw unit 14, thus causing the pressure in the measuring chamber 9 to be equal to the pressure in the pressurized space on the other side of the fragile ceramic. The sensor 4 itself can move freely in the lengthwise direction, supported by the piston 8 and the guides 13, because the sensor is not attached to the housing in a rigid fashion, but only flexibly by intermediation of the conductor 6. Thus the fragile sensor material is evenly loaded on all sides, so that it is not subject to tensions and can resist high pressures. Moreover, the electric insulation required in measurement-technical applications is achieved by employing the disclosed construction.

In the above specification, the invention has been explained with reference to one preferred embodiment only. It does not, however, restrict the invention in any way, but the different modifications thereof can vary within the scope of the appended patent claims.

Claims

1. A sealing and insulating construction of a sensor, to be used in pressurized conditions, which construction comprises
   - a housing (2) which is essentially open towards the pressurized space and forms a pressure balancing chamber (1);
   - the tubular sensor (4) partly located within said chamber and partly protruding therefrom;
   - a conductor (6) connected to the sensor and electrically insulated from the housing of the construction, brought into the chamber by means of a leadthrough arrangement (5);
   - **characterized** in that the construction includes electric insulation (7) which for the most part fills the space of the chamber (1) surrounding the sensor (4), as well as a piston (8) placed around the sensor, which piston separates said insulation (7) from the pressurized space and is adapted to press said insulation (7) when pressure is effective outside said chamber (1), the said sensor being open at its chamber-side end and closed at its outer end outside said chamber (1) and electrically insulated from the housing so that, in use of the construction, an essentially equal pressure prevails both inside and outside the sensor.

2. The construction of claim 1, **characterized** in that the pressure balancing chamber (1) is a tubular space open at its one end.

3. The construction of claim 1 or 2, **characterized** in that the sensor (4) is a rod-like ceramic or other fragile membrane, the outer end whereof is provided with a measuring chamber (9) whereto the conductor (6) is connected.

4. The construction of claim 3, **characterized** in that the sensor (4) includes a sealing chamber (10) which is separated from the measuring chamber (9) and from the open end of the sensor by means of screw units (11, 14).

5. The construction of claim 3, **characterized** in that the part (12) of the conductor located in between the leadthrough (5) and the sensor (4) forms a loose curve in order to allow the sensor to move with respect to the housing (2).

6. The construction of any of the claims 1-5, **characterized** in that the insulation (7) is composed of some non-conducting insulating compound or liquid, for instance tetrafluoroethylene or silicone.

7. The construction of any of the claims 1-6, **characterized** in that the chamber (1) surrounding the sensor (4) comprises guides (13), for instance sliding seal rings, in order to support the sensor so that it is freely movable with respect to the chamber.

8. The construction of any of the claims 1-7, **characterized** in that the piston (8) is an at least partly elastic flange which under pressure is urged into a compact contact against the

chamber (1).

9. The construction of claim 8, **characterized** in that the flange is a stationary part of the sensor (4), so that an elastic sealing ring is provided on the outer circumference of the flange.

10. The, construction of claim 8, **characterized** in that the flange is a ring which under pressure is freely movable both with respect to the chamber and to the sensor, and that the pressure urges it into a compact contact against them.

Patentansprüche

1. Abdicht- und Isolierkonstruktion eines Sensors zur Verwendung unter Druckbedingungen, wobei die Konstruktion aufweist:
- ein Gehäuse (2), das in Richtung auf den Druckraum im wesentlichen offen ist und eine Druckausgleichskammer (1) bildet;
- wobei sich der rohrförmige Sensor (4) zu einem Teil innerhalb der Kammer befindet und zu einem Teil aus dieser herausragt;
- einen mit dem Sensor verbundenen und gegenüber dem Gehäuse der Konstruktion elektrisch isolierten Leiter (6), der mittels einer Durchführungsanordnung (5) in die Kammer eingebracht ist;
- dadurch gekennzeichnet, daß die Konstruktion eine elektrische Isolierung (7), die den Raum der den Sensor (4) umgebenden Kammer (1) zum größten Teil ausfüllt, sowie einen um den Sensor herum angeordneten Kolben (8) umfaßt, der die Isolierung (7) von dem Druckraum trennt und dazu ausgelegt ist, die Isolierung (7) mit Druck zu beaufschlagen, wenn außerhalb der Kammer (1) Druck wirkt, wobei der Sensor an seinem kammerseitigen Ende offen ist und an seinem außerhalb der Kammer (1) gelegenen, äußeren Ende (1) geschlossen ist und gegenüber dem Gehäuse elektrisch isoliert ist, so daß bei Verwendung der Konstruktion ein im wesentlichen gleicher Druck sowohl innerhalb als auch außerhalb des Sensors herrscht.

2. Konstruktion nach Anspruch 1,
dadurch gekennzeichnet, daß es sich bei der Druckausgleichskammer (1) um einen an seinem einen Ende offenen rohrförmigen Raum handelt.

3. Konstruktion nach Anspruch 1 oder 2,
dadurch gekennzeichnet, daß es sich bei dem Sensor (4) um eine stangenartige keramische oder andere zerbrechliche Membran handelt, deren äußeres Ende mit einer Meßkammer (9) versehen ist, mit der der Leiter (6) verbunden ist.

4. Konstruktion nach Anspruch 3,
dadurch gekennzeichnet, daß der Sensor (4) eine Dichtkammer (10) beinhaltet, die von der Meßkammer (9) und von dem offenen Ende des Sensors mittels Schraubeneinheiten (11, 14) getrennt ist.

5. Konstruktion nach Anspruch 3,
dadurch gekennzeichnet, daß der zwischen der Durchführung (5) und dem Sensor (4) liegende Teil (12) des Leiters eine lockere Kurve beschreibt, so daß dem Sensor in bezug auf das Gehäuse (2) eine Bewegung ermöglicht ist.

6. Konstruktion nach einem der Ansprüche 1 bis 5,
dadurch gekennzeichnet, daß die Isolierung aus einer nicht-leitenden Isoliermasse oder Isolierflüssigkeit, wie zum Beispiel Tetrafluorethylen oder Silikon, gebildet ist.

7. Konstruktion nach einem der Ansprüche 1 bis 6,
dadurch gekennzeichnet, daß die den Sensor (4) umgebende Kammer (1) Führungen (13), wie zum Beispiel Gleitdichtringe, beinhaltet, um den Sensor derart zu lagern, daß er in bezug auf die Kammer frei beweglich ist.

8. Konstruktion nach einem der Ansprüche 1 bis 7,
dadurch gekennzeichnet, daß es sich bei dem Kolben (8) um einen wenigstens teilweise elastischen Flansch handelt, der bei Druckbeaufschlagung in kompakten Kontakt gegen die Kammer (1) gedrückt wird.

9. Konstruktion nach Anspruch 8,
dadurch gekennzeichnet, daß der Flansch ein ortsfester Teil des Sensors (4) ist, so daß ein elastischer Dichtring an dem Außenumfang des Flansches vorgesehen ist.

10. Konstruktion nach Anspruch 8,
dadurch gekennzeichnet, daß es sich bei dem Flansch um einen Ring handelt, der bei Druckbeaufschlagung sowohl in bezug auf die Kammer als auch in bezug auf den Sensor frei beweglich ist, und daß der Druck den Flansch in kompakten Kontakt gegen diese drückt.

Revendications

1. Montage fermé hermétiquement et isolé pour détecteur, destiné à être utilisé dans des conditions pressurisées, comprenant :
   - un boîtier (2) qui est essentiellement ouvert vers l'espace pressurisé et constitue une chambre d'équilibre de pression (1) ;
   - le détecteur tubulaire (4) partiellement disposé à l'intérieur de ladite chambre et formant partiellement saillie hors de celle-ci ;
   - un conducteur (6) connecté au détecteur et électriquement isolé du boîtier du montage, amené à l'intérieur de la chambre au moyen d'un dispositif d'accès (5) ;

   caractérisé en ce qu'il inclut une isolation électrique (7) dont la plus grande partie remplit l'espace de la chambre (1) entourant le détecteur (4), et un piston (8) placé autour du détecteur, lequel piston sépare ladite isolation (7) de l'espace pressurisé et est adapté pour comprimer ladite isolation (7) quand une pression est présente à l'extérieur de ladite chambre (1), ledit détecteur étant ouvert à son extrémité côté chambre et fermé à son extrémité externe en dehors de ladite chambre (1), et isolé électriquement du boîtier tel que, pendant l'utilisation du montage, des pressions essentiellement égales existent à l'intérieur et à l'extérieur du détecteur.

2. Montage selon la revendication 1, caractérisé en ce que la chambre d'équilibre de pression (1) est un espace tubulaire ouvert à l'une de ses extrémités.

3. Montage selon la revendication 1 ou 2, caractérisé en ce que le détecteur (4) est une membrane en céramique ou autre matériau fragile en forme de baguette, dont l'extrémité extérieure abritant une chambre de mesure (9) à laquelle le conducteur (6) est connecté.

4. Montage selon la revendication 3, caractérisé en ce que le détecteur (4) comprend une chambre fermée hermétiquement (10) qui est séparée de la chambre de mesure (9) et de l'extrémité ouverte du détecteur à l'aide d'éléments à vis (11, 14).

5. Montage selon la revendication 3, caractérisé en ce que la partie (12) du conducteur, située entre le dispositif d'accès (5) et le détecteur (4), forme une courbe lâche dans le but de permettre au détecteur d'être mobile par rapport au boîtier (2).

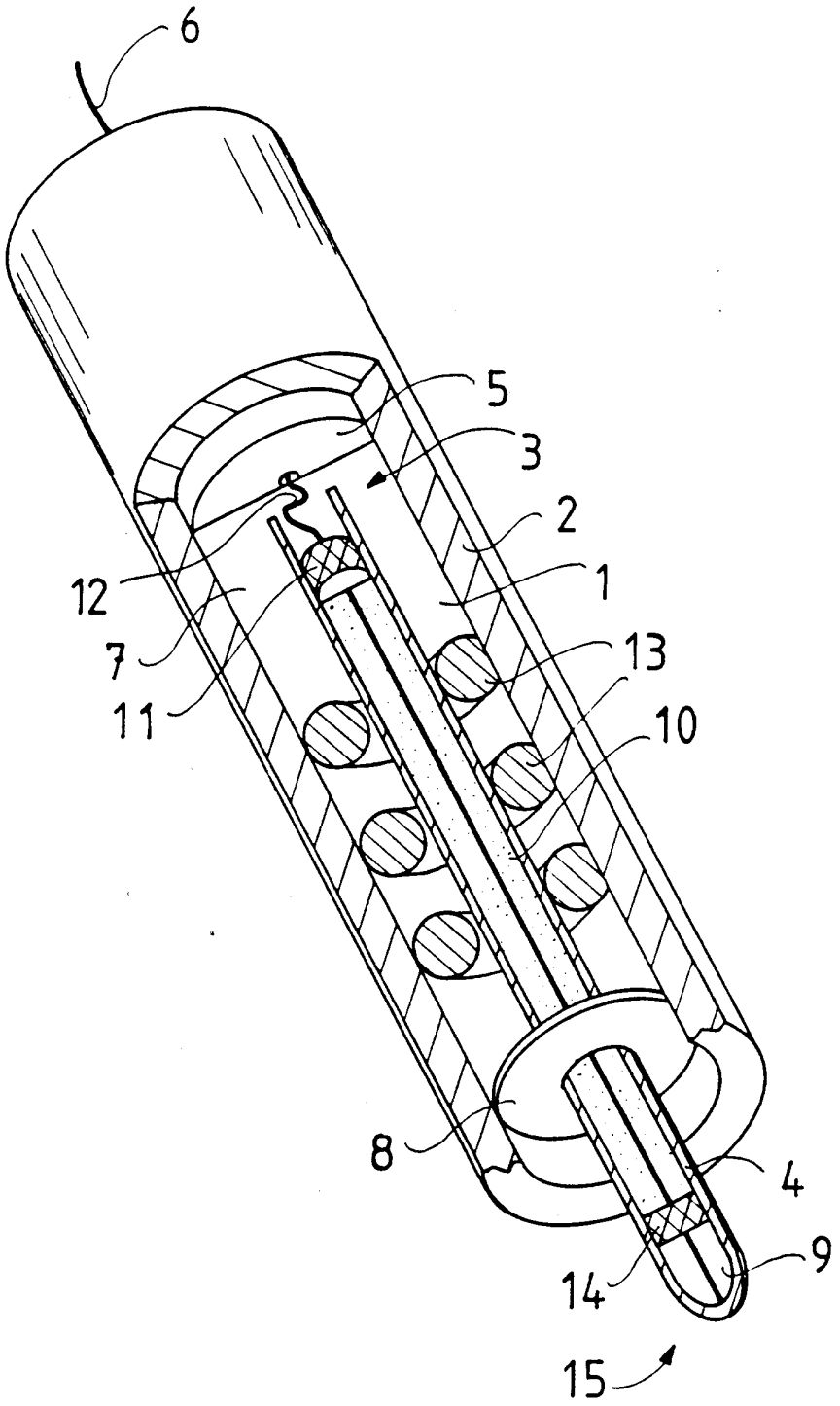
6. Montage selon l'une quelconque des revendications 1 à 5, caractérisé en ce que l'isolation (7) est composée par un solide ou liquide isolant, non-conducteur, par exemple du tétrafluoroéthylène ou du silicone.

7. Montage selon l'une quelconque des revendications 1 à 6, caractérisé en ce que la chambre (1) entourant le détecteur (4) comprend des guides (13), par exemple des anneaux d'étanchéité glissants, dans le but de porter le détecteur de telle sorte qu'il soit librement mobile par rapport à la chambre.

8. Montage selon l'une quelconque des revendications 1 à 7, caractérisé en ce que le piston (8) est une bride au moins partiellement élastique qui, soumise à pression, est pressée contre la chambre (1) par contact compressif.

9. Montage selon la revendication 8, caractérisé en ce que la bride est une partie fixe du détecteur (4), de telle sorte qu'une bague d'étanchéité élastique est montée sur la circonférence externe du boudin.

10. Montage selon la revendication 8, caractérisé en ce que la bride est une bague qui, soumise à la pression, est librement mobile relativement à la chambre et au détecteur, et que la pression les presse contre eux par contact compressif.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