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(54) **Protective element, system and method for protection the valve region of a pressurised gas container**

(57) The protective element (1) for a pressurised gas container (12) according to the present invention is comprising a jacket tube (2) limited in direction of an adjustment axis (3) by an upper opening (4) and a lower opening (5), wherein at least 80 % of the lateral surface area (6) of the jacket tube (2) is unperforated.

The protective element (1) according to the present invention allows the protection of pressurised gas containers which are filled e. g. with inflammable and/or toxic gases during filling of or extraction from the pressurised gas container (12). The operator and the surrounding can be protected from explosions and from the generation of toxic gas mixtures. In both cases an emergency flag can be set and an evacuation of the surrounding and/or the extraction of the harmful gas mixtures can be started.

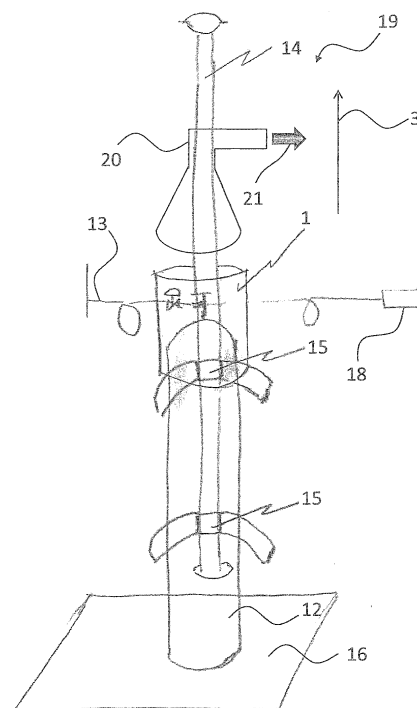


Fig. 4

Description

[0001] Subject matter of the present invention is a protective element, a system and a method for protecting the surrounding and in particular an operator of a pressurised gas container in particular from the consequences of leakages of inflammable and/or toxic gases.

[0002] Pressurised gas containers like e. g. gas bottles are used to store gases under high pressures of up to 300 bar. The gas is provided within the gas container and is extracted from it via a valve which is a part of the fitting of the gas container. A pipe is usually connected to the respective valve allowing the establishment of a gas flow from within the pressurised gas container to the pipe connected on the outside.

[0003] From prior art e. g. protective cowlings are known, e. g. from US 6,311,722 B1. These devices are adapted to protect the valve region of the pressurised gas container from mechanical load like e. g. when the pressurised gas container is tumbling or falling. The respective cowlings have usually great openings allowing the actuation and control of the valves of the pressurised gas container. These protective cowlings are thus not suitable for protecting the environment of the pressurised gas container or the user from harmful explosion or the leakage of toxic gases.

[0004] Therefore, it is an object of the present invention to provide a protective equipment for pressurised gas containers that improves the protection from inflammable and/or toxic gases compared to devices known from prior art. At the same time, a respective system and method for protecting the valve region of a pressurised gas container shall be proposed.

[0005] This object is accomplished by the subject matter of the independent claims. Dependent claims are directed to advantageous improvements of the present invention.

[0006] The protective element for a pressurised gas container according to the present invention comprises a jacket tube limited in direction of an adjustment axis by an upper opening and a lower opening, wherein at least 80 % of the lateral surface area of the jacket tube is unperforated.

[0007] The term "tube" is understood in this regard as a hollow structure which has an upper opening and a lower opening whereas the upper opening is adapted to allow the actuating of a valve system within the protective element whereas the lower opening is large enough to be provided around at least the valve region of the pressurised gas container or the pressurised gas container in particular in its shoulder region. The tube has preferably a circular cross section, nevertheless, other cross sections like elliptical or rectangular cross sections are possible.

[0008] The term "valve region" is to be understood such that it covers the valve of the pressurised gas container as well as filling adapters connected to the respective valve of the pressurised gas container. The protec-

tive element according to the present invention is adapted to surround the valve region contactless which means there is no thread or the like to connect the protective element directly to the pressurised gas container. The term "unperforated" is understood such that the lateral surface area of the jacket tube has no holes with a smallest diameter of 1 mm and larger. This means a part of the lateral surface area of the jacket tube can be perforated and can thus comprise openings, holes, slots or the like. The jacket tube can be in general of a cylindrical form but can e. g. be at least in part conically or can have a rectangular section as well. The jacket tube is preferably made of a non-inflammable material. Preferably, the jacket tube is shaped from a metal like e. g. steel and/or a plastic like e. g. a poly carbonate polymer. It is preferred that the jacket tube is at least in part made of a transparent material, in particular for electromagnetic radiation having a wavelength from 380 to 780 nm (nanometers). This allows the user to control the valve region optically and to react e. g. if a fire brakes out. Preferably, at least 90% of the lateral surface area of the jacket tube is unperforated.

[0009] The most frequent source of gas leak to the atmosphere from a pressurised gas container which is connected via its valve to either an equipment using the gas or an equipment for filling the cylinder with gas is usually during connection and disconnection of the cylinder valve to the equipment. This may happen for example when opening the cylinder valve at the start of feeding an equipment with gas from the cylinder or when starting to fill a cylinder with gas or when disassembling the connecting pipe from the cylinder valve outlet at the end of the cylinder use. If gas leaks from flammable compressed gases stored in pressurised gas containers there may be either a flame coming out of the connection with the risk of fire being communicated to the surrounding or a burn of a person nearby or if there is no immediate ignition an explosive atmosphere around the cylinder with the risk of explosion. If gas leaks from cylinders containing toxic gases there will be a toxic atmosphere around these cylinders with a risk of intoxication for a person nearby.

[0010] The protective element according to the present invention forms in use a protective barrier between the valve region of the pressurised gas container and the operator and the surroundings. Preferably, protective elements with jacket tubes having a diameter of at least 8 inch or 10 inch are preferred. By a protective element according to the present invention the effect of explosion shockwaves on the surroundings and e. g. the operator of the pressurised gas container can be reduced. Flames within the protective element are confined by the protective element according to the present invention. Toxic gases can easily be extracted from the protective element, if a respective suction means is provided. This reduces the risk of the formation of toxic atmospheres around a leaked pressurised gas container.

[0011] The protective element according to the present

invention allows the handling of hazardous, e. g. inflammable or toxic gases without the use of a closed gas cabinet. This reduces the hardware costs significantly and improves the security of the operator of the gas containers significantly as in particular when using at least in part transparent protective elements an optical control of the conditions within the protective element can be done before starting to actuate the valve of the pressurised gas container.

[0012] According to an improvement of the protective element the element is made from a material having at least one of the following properties:

- a) an Izod impact strength at a temperature of 4°C of more than 600 J/m (Joule per meter) ;
- b) a Charpy impact strength at a temperature of 23°C of more than 20 kJ/m² (kilo Joule per square meter) in a notched Charpy test with notch A; and
- c) a ball indentation hardness of more than 100 MPa (mega pascal) when testing for 30s.

[0013] The Charpy impact strength in an un-notched Charpy test is tested by a bar impact bending test. A sample is hit by a pendulum axe e. g. with a speed of 5 m/s. The result of such Charpy impact test is the energy needed to fracture a material and is a measure for the toughness of the material and the yield strength. It is understood that in an un-notched Charpy test the sample of material of the protective element is not notched. In a notched Charpy test the sample of the material is notched on the opposite side of the impact side hit by the pendulum axe. A notch A has a notch radius of 0.25 mm. The notch depth is 2 mm, the notch flank angle is 45°. The ball indentation hardness is the quotient of a load applied via a ball and the surface area of the impression that is present underneath a ball after 30s at a given load. The Izod impact strength is preferably performed according to the American standard ASTM D256 or European standard ISO 180. During an Izod impact strength test a pendulum swings and strikes a notched, cantilevered plastic sample.

[0014] The materials having at least one of the properties a) to c) as defined above are advantageously suitable for manufacturing the protective element. In particular, materials known as bullet-proof or the like e. g. bullet-proof polycarbonate polymers can be used advantageously for manufacturing the protective element according to the present invention.

[0015] According to a further improvement of the present invention the protective element is manufactured from at least one of the following materials:

- a) a polycarbonate polymer (PC);
- b) a acrylonitrile-butadiene-styrene copolymer (ABS);
- c) a styrene acrylonitrile copolymer (ASA);
- d) a Polybutylene Terephthalate (PBT);
- e) a metal;

- f) Copper;
- g) Aluminium; and
- h) a steel.

[0016] In particular, mixtures of at least two of the plastics mentioned in a) to d) are preferred to manufacture the protective element. Most preferred is a protective element being manufactured at least in part from a polycarbonate polymer.

[0017] Polycarbonate polymers comprise a transparent plastic allowing the operator to monitor the valve region of the pressurised gas container optically without being in danger if a flame brakes out within the protective element. In a further improvement the protective element has a kind of skeleton made from a metal, in particular a steel, which is filled in a window like manner by transparent plastics like e. g. a polycarbonate polymer which can be combined with at least one other plastic. It is further preferred, if the protective element is manufactured from a metal, like e. g. a pure metal or an alloy. According to a further preferred embodiment the protective element is manufactured at least in part from a copper or aluminium alloy.

[0018] According to a further improvement of the protective element the lateral surface area of the protective element comprises at least one opening allowing the introduction of a supply pipe.

[0019] It is preferred to provide the jacket tube with at least one opening, preferably a slot starting from a boundary of the lower opening to allow an easy introduction of the piping connected to the valve of the pressurised gas container. To allow the connection of at least two pipes to the valve region it is possible to provide at least two slots, preferably at opposite sides of the jacket tube.

[0020] According to a further improvement of the present invention the protective element further comprises guiding means allowing the fixing of the protective element.

[0021] In particular if the pressurised gas container is used to manufacture a gas mixture within by a gravimetric method in which at least one component of the gas mixture are metered to the pressurised gas container by way of weighing on a scale it is advantageous if the protective element is not in contact with the pressurised gas container. This allows the protection of the valve region without spoiling the measurement results of the weighing process on the scale during cylinder filling. Furthermore, the guiding means allows to keep the protective element in place in case of flash fire of oxidant gas leak or an explosion of flammable gas leak.

[0022] According to a further aspect of the present invention a system for protecting the valve region of a pressurised gas container is proposed comprising a protective element according to the present invention and suction means for withdrawing a gas, wherein supporting means for supporting the protective element contactless around a valve region of a pressurised gas container are provided, wherein the suction means is provided above

the protective element such that gas can be extracted from the protective element.

[0023] In particular, the system according to the present invention is used for extracting gas from a leak at cylinder valve level from the protective element. The suction means can e. g. comprise a gas extraction duct, preferably a flexible extraction duct being able to be moved up and down in direction of the adjustment axis. Preferably, the suction means is having an open diameter being as least as large as the open diameter of the upper opening of the protective element. Preferably, the open diameter of the suction means above the upper opening of the protective element is at least 10 % larger than the open diameter of the upper opening. Preferably, the suction means is made of a non-inflammable material. It is connected preferably to a blower in order to create air ventilation coming through e. g. openings in the lateral surface area of the jacket tube and/or through the gap between the protective element and the pressurised gas container. Preferably, the blower has an explosion proof electrical motor in order to permit inflammable gas extraction.

[0024] According to an improvement of the system according to the present invention the suction means is supported movably in direction of the adjustment axis.

[0025] According to a further improvement of the system according to the present invention at least one sensor for measuring at least one of the following properties are provided:

- a) the temperature within the protective element;
- b) the temperature in the suction means;
- c) the concentration of at least one substance in gas within the protective element;
- d) the concentration of at least one substance in the gas within the suction means; and
- e) a pressure sensor.

[0026] The at least one sensor is preferably provided within the protective element and/or the suction means. In general it is preferred that within the system according to the present invention temperature sensors and/or gas concentration sensors and/or pressure sensors are provided. In particular, the pressure within a pipe connected to the valve of the pressurised gas container can be monitored. A sudden pressure drop which is larger than a predeterminable pressure drop limit can hint an emergency situation, e. g. a major gas leak, which can be dealt with by setting a so called emergency flag. This can mean that either an operator is informed e. g. by optical and/or acoustical signals and/or by taking automatic measures like e. g. increasing the air flow through the suction means. Due to measuring properties like at least one gas concentration and/or the temperature in the protective element and the suction means it is possible to determine a leak rate about leaking gas from the protective element that allows an assumption regarding the hazard for people in the surroundings of the system for example in case

of a leaking toxic gas. It is preferred to measure the concentration of at least one component which is part of the gas or the gas mixture in the pressurised gas container. The detection of a concentration of such a gas outside the gas container, e. g. in the protective element and/or the suction means clearly indicates a leak, the measurement of which can be used to trigger countermeasures by e. g. setting an emergency flag by which the operator is informed.

[0027] According to a further aspect of the present invention a method for protecting the valve region of a pressurised gas container is proposed, wherein a protective element comprising a jacket tube limited in direction of an adjustment axis by an upper opening and a lower opening having a lateral surface area at least 80 % of which is unperforated is provided around the valve region, wherein the valve region is actuatable through the upper opening.

[0028] The method according to the present invention allows the protection of the environment and in particular of people around the pressurised gas container while being connected to other equipment. It is preferred that the protective element is a protective element according to the present invention. It is further preferred that the protective element is made at least in part from a transparent material. This allows the user to monitor and operate the valves of the pressurised gas container while being able to quickly realise a hazard e. g. that a flame has been ignited.

[0029] According to an improvement of the present invention gas is extracted from within the protective element. This can e. g. be done by using a suction means according to the system of the present invention. If an inflammable and/or toxic gas mixture is created within the protective element the extraction of the gas from the protective element lowers the risk for the environment and for people around the pressurised gas container like an operator of the gas container.

[0030] In this context it is preferred that gas is extracted continuously at a rate of 20 to 50 m³/h (cubic meters per hour).

[0031] A flow rate of 20 to 50 m³/h, preferably 30 to 40 m³/h has been found to be advantageous to dilute in the air stream a flammable gas leak of up to 0.1 litre per second, representing a concentration of 1% below the lowest flammability limits of flammable gases in air.

[0032] According to a further improvement of the present invention at least one of the following properties is measured at least discontinuously:

- a) the temperature within the protective element;
- b) the temperature of the gas extracted from the protective element;
- c) the concentration of at least one substance in the gas within the protective element;
- d) the concentration of at least one substance in the gas extracted from the protective element; and
- e) the pressure of a gas in a tube connected to the

valve of the pressurised gas container.

[0033] The monitoring of the temperature of the gas within and/or being extracted from the protective element allows to detect the outbreak of fire or an explosion if a temperature rise which is larger than a predeterminable limit is detected. The concentration of substances in the gas within and/or extracted from the protective element allows to monitor the gas composition of this gas. In particular it is preferred to monitor the concentration of at least one toxic and/or inflammable substances. The term "at least discontinuously" is understood in such a manner that the respective property is measured at constant and/or variable time intervals, at specific times, at random times and/or continuously.

[0034] According to a further improvement of the method according to the present invention an emergency flag is set if at least one of the following provision is met:

- a) the temperature within and/or of the gas extracted from the protective element is above a predeterminable upper temperature limit;
- b) the temperature within and/or of the gas extracted from the protective element is below a predeterminable lower temperature limit;
- c) the concentration of at least one toxic and/or inflammable substance within and/or in the gas extracted from the protective element is above a predeterminable concentration limit;
- d) the concentration of at least one toxic and/or inflammable substance within and/or in the gas extracted from the protective element is below a predeterminable concentration limit;
- e) the pressure in at least one pipe connected to the valve of the pressurised gas container is below a predeterminable pressure limit; and
- f) a pressure drop in at least one pipe connected to the valve of the pressurised gas container is above a predeterminable drop limit.

[0035] The term "pressure drop" is understood in this context as the change of pressure over time. If the valve of the pressurised gas container is connected via at least one pipe to at least one equipment using the gas the pressure provided by the pressurised gas container is more or less constant and will - if the pressure within the pressurised gas container decreases - slowly decrease without any leakage. Nevertheless, in case of a leak of the gas the pressure will drop significantly. This means a relatively high pressure drop which can be detected and can be used for to trigger an emergency flag. This is in particular preferred when extracting gas from the pressurised gas container.

[0036] According to a further improvement of the method according to the present invention gas is extracted from within the protective element at a rate of at least 600 m³/h if an emergency flag is set.

[0037] This volume flow rate which is significantly high-

er than usual flow rated continuously applied to the protective element allow a significant delusion of the gas mixture which is generated by the leak of gas. Thus, it can be avoided that an explosive gas mixture or a toxic gas mixture is generated. In general, it is preferred to increase the flow rate by a factor of at least 6 or even at least 8, if an emergency flag is set, compared to a situation where no emergency flag is set.

[0038] According to a further improvement of the present invention the protective element is supported above the pressurised gas container so that a gap between the protective element and the pressurised gas container, in particular of at most 10 mm is provided.

[0039] This gap allows that fresh air is sucked into the protective element when gas is extracted from the same. In case of a toxic or inflammable gas leaking from the pressurised gas container via the valve unit or the piping this can reduce the risk of the creation of an explosive or toxic gas mixture significantly. A relatively small gap between the pressurised gas container and the protective element allows on the other hand an effective protection of the surroundings and/or users around the pressurised gas container. Air flow from outside the protective element to the inside of the protective element is furthermore possible through openings, which allow e. g. the connection of a supply pipe to the valve of the pressurised gas container.

[0040] Detail and advantages of the protective element according to the present invention can be transferred and are applicable to the system according to the present invention and the method according to the present invention and vice versa, respectively. In the following the invention is disclosed in more detail with reference to the accompanying drawings by the way of example only, in which the following is shown schematically:

Fig. 1: a perspective view of an embodiment of a protective element according to the present invention;

Fig. 2: a sectional view of the embodiment of the protective element according to the present invention;

Fig. 3: an example of the protective element according to the present invention in use;

Fig. 4: a system according to the present invention;

Fig. 5: a detailed schematically view of the system according to the present invention;

Fig. 6: a cross section of a pressurised gas container surrounded by an embodiment of the protective element according to the present invention; and

Fig. 6: a perspective view of a second embodiment of

a protective element according to the present invention.

[0041] Fig. 1 depicts schematically a protective element 1 for a pressurised gas container. This protective element 1 is adapted to be positioned such that the valve region of a pressurised gas container is surrounded by the protective element 1. The protective element 1 comprises a jacket tube 2. In the direction of an adjustment axis 3 the jacket tube 2 is limited by an upper opening 4 and a lower opening 5. The jacket tube 2 comprises a lateral surface area 6 which is a theoretical surface being delimited by an upper boundary 7 of the upper opening 4 and a lower boundary 8 of the lower opening 5. Upper 7 and lower boundary 8 are not connected to each other. At least 80 % of the lateral surface area 6 of the jacket tube 2 is unperforated. In the present embodiment shown in fig. 2 the jacket tube 2 comprises two openings 9. These opening 9 allow the introduction of supply pipes to be connected to the valve of pressurised gas container within the protective element 1. The term "unperforated" is to be understood in such a manner that at least 80 % of the lateral surface area 6 of the jacket tube 2 do not comprise holes of a maximum dimension of at least 1 mm. The protective element 1 further comprises guiding means 10 for supporting the protective element 1.

[0042] Fig. 2 displays a sectional view of the protective element 1. The guiding means 10 is shaped such that it allows a motion of the protective element 1 in direction of the adjustment axis 3. In the figure it is shaped such that it corresponds to a notched slide bar which supports the protective element 1 movably in direction of the adjustment axis 3.

[0043] Fig. 3 depicts a perspective view of the protective element 1 according to the present invention in use for protecting the valve region 11 of a pressurised gas container 12, like e. g. a gas bottle. The valve region 11 in particular comprises the fitting of the gas bottle, an extraction valve and if necessary a pressure reducing device. The protection element 1 is preferably shaped from a material being at least in regions translucent for light with a wavelength of 380 to 780 nm or it is transparent for light of such wavelengths. The protective element 1 is in particular advantageous for protecting the valve region 11 of a pressurised gas container 12 being filled with inflammable and/or toxic gases or gas mixtures. Due to leaks in the fitting or mistakes of the operator when coupling the supply pipe 13 to the valve region 11 of the fitting, explosive gas mixtures can be generated in particular outside the valve region 11 of the pressurised gas container 12. As the protection element 1 is provided as a jacket tube 2 it is advantageous compared to usual valve cages or cowlings as these are not suitable for absorbing the power of an explosion. Due to the protective element 1 according to the present invention the power of an explosion is at least in part adsorbed and the operator which might be nearby or other equipment in the surrounding is protected from the major blow of the ex-

plosion.

[0044] The protection element 1 is guided moveably on the guide rail 14 allowing movement of the protective element 1 in direction of the adjustment axis 3. Therefore, the user can adjust the protective element 1 around the valve region 11 of the pressurised gas container 12. Further clamps 15 allow to fix the pressurised gas container 12 to refrain it from significant movements relative to the protective element 1. It is preferred that at least some of the clamps 15 are movable in direction of the adjustment axis 3 on the guide rail 14. This allows to adjust the whole apparatus to be used with pressurised gas containers 12 of different sizes.

[0045] The pressurised gas container 12 can be provided on a scale 16 as the protective element 1 is not touching the pressurised gas container 12 but is provided such that a gap 17 (see fig. 6) between the protective element 1 and the pressurised gas container 12 is maintained. The protective element 1 does therefore not influence the measurement of the scale 16. Thus, gravimetric measurements for e. g. preparing high precision mixtures within the pressurised gas container 12 are not influenced by the weight of the protective element 1. The protective element 1 is preferably made of a material comprising polycarbonate polymers. These are lightweight, transparent and have a high impact strength.

[0046] The supply line 13 can be provided with a pressure sensor 18 to monitor the pressure within the supply line 13. If the pressure in the supply line 13 suddenly drops below a predeterminable pressure limit an emergency flag can be set which can be used to trigger emergency actions. These will be described example wise below.

[0047] Fig. 4 depicts schematically an embodiment of a system 19 for protecting the valve region of a pressurised gas container 12. The system 19 is depicted in use. The system 19 comprises a protective element 1 as described above and furthermore suction means 20 for withdrawing a gas. Via the suction means 20 a gas stream 21 can be extracted inter alia from within the protective element 1. The gas stream 21 can be provided a. g. to a respective adsorbent allowing to adsorb the gas stream 21 in case of a contamination with hazardous components.

[0048] Fig. 5 describes the suction means 20 and further components in further detail schematically. The suction means 20 is connected via a data line 22 to a control device 23. The control device 23 controls the flow rate of the gas extracted by the suction means 20. This gas flow rate can in particular be increased by a factor of 2 to 4, in particular of 3 to 4, regarding a standard extraction flow rate if an emergency flag is set. This emergency flag is for example set by the control device 23 itself or it is received from other sources. The emergency flag is preferably set if the concentration of oxygen within the protective element 1 and/or within the suction means 20 is below a predeterminable oxygen concentration limit, if the concentration of at least one toxic and/or inflammable

substance in particular within the protective element 1 or the suction means 20 is above a predeterminable concentration limit, if the temperature within the protective element 1 and/or within the suction means is below a predeterminable lower temperature limit and/or if the temperature within the protective element 1 and/or within the suction means 20 is above a predeterminable upper temperature limit.

[0049] For to decide whether the emergency flag is to be set the control device 23 is connected via data lines 22 with at least temperature sensor which is in this embodiment provided within the protective element 1 and the suction means 20 but can be additionally or alternatively disposed in another place. Furthermore, the control device 23 is connected via a data line 22 to one or more gas concentration sensors 25. In the embodiment displayed in fig. 5 the gas concentration sensor 25 is provided within the protective element 1 and the suction means 20 but can be disposed on another place alternatively or additionally.

[0050] Furthermore, the control device 23 is connected via a data line 22 with a pressure sensor 18 provided within in the supply pipe 13. Via this pressure sensor 18 it is possible to monitor the pressure within the supply pipe 13. If one or more of the parameters monitored by the respective sensors 18, 24 and/or 25 are outside the predeterminable limits given the emergency flag is set and the suction means 20 is set to an emergency gas extraction flow rate which is e. g. 400 m³/h or above, in order to dilute in the gas stream a very large flammable gas leak of 1 litre per second down to a concentration of 1% below the lowest flammability limits of flammable gases in air. Additionally, alarm signals can be given e. g. acoustically and/or optically.

[0051] The suction means 23 is preferably driven by a blower 26. This blower is preferably explosion proof in order to permit a flammable gas extraction. It is preferably provided with an explosion proof electrical motor.

[0052] Fig. 6 discloses the gap 17 between a protective element 1 according to the present invention and a pressurised gas container 12. The gap 17 is preferably set such that it is at most 10 mm.

[0053] Fig. 7 displays a second embodiment of a protective element 1 according to the present invention. Compared with the first embodiment as displayed e. g. in Fig. 1 the second embodiment has only one opening 9 allowing the introduction of supply pipes to be connected to the valve of pressurised gas container within the protective element 1. As the first embodiment the second embodiment comprises guiding means (not visible in Fig. 7) for supporting the protective element 1 contactless from outside the protective element 1.

[0054] The protective element 1 according to the present invention allows the protection of pressurised gas containers which are filled e. g. with inflammable and/or toxic gases during filling of or extraction from the pressurised gas container 12. The operator and the surrounding can be protected from explosions and from the

generation of toxic gas mixtures. In both cases an emergency flag can be set and an evacuation of the surrounding and/or the extraction of the harmful gas mixtures can be started.

List of reference numerals

[0055]

10	1	protective element
	2	jacket tube
	3	adjustment axis
	4	upper opening
	5	lower opening
15	6	lateral surface area
	7	upper boundary
	8	lower boundary
	9	opening
	10	guiding means
20	11	valve region
	12	pressurised gas container
	13	supply pipe
	14	guide rail
	15	clamp
25	16	scale
	17	gap
	18	pressure sensor
	19	system for protecting the valve region of a pressurised gas container
30	20	suction means
	21	gas stream
	22	data line
	23	control device
	24	temperature sensor
35	25	gas concentration sensor
	26	blower

Claims

- Protective element (1) for a pressurized gas container (12), comprising a jacket tube (2) limited in direction of an adjustment axis (3) by an upper opening (4) and a lower opening (5), wherein at least 80 % of the lateral surface area (6) of the jacket tube (2) is unperforated.
- Protective element (1) according to claim 1, wherein the protective element (1) is made from a material having at least one of following properties:
 - an Izod impact strength at a temperature of 4 °C of more than 600 J/m (Joule per meter) ;
 - a Charpy impact strength at a temperature of 23°C of more than 20 kJ/m² (kilo Joule per square meter) in a notched Charpy test with notch A; and

- c) a ball indentation hardness of more than 100 MPa (mega pascal) when testing for 30 s (seconds).
3. Protective element (1) according to one of the preceding claims being manufactured from at least one of the following materials:
- a) a polycarbonate polymer (PC);
 - b) a acrylonitrile-butadiene-styrene copolymer (ABS);
 - c) a styrene acrylonitrile copolymer (ASA);
 - d) a Polybutylene Terephthalate (PBT);
 - e) a metal;
 - f) Copper;
 - g) Aluminium; and
 - h) a steel.
4. Protective element (1) according to one of the preceding claims, wherein the lateral surface area (6) comprises at least one opening allowing the introduction of a supply pipe (13).
5. Protective element (1) according to one of the preceding claims, further comprising guiding means (10) allowing the fixing of the protective element (1).
6. System (19) for protecting the valve region (11) of a pressurized gas container (12), comprising a protective element (1) according to one of the preceding claims and suction means (20) for withdrawing a gas, wherein supporting means (10, 14) for supporting the protective element (1) contactless around a valve region (11) of a pressurized gas container (12) are provided, wherein the suction means (20) is provided above the protective element (1) such that gas can be extracted from the protective element (1).
7. System (19) according to claim 6, wherein the suction means (19) is supported movably in direction of the adjustment axis (3).
8. System (19) according to one of claims 6 to 7, wherein at least one sensors (18, 24, 25) for measuring at least one of the following properties are provided:
- a) the temperature within the protective element (1);
 - b) the temperature in the suction means (20);
 - c) the concentration of at least one substance in gas within the protective element (1);
 - d) the concentration of at least one substance in the gas within the suction means (20); and
 - e) a pressure sensor (18).
9. Method for protecting the valve region (11) of a pressurized gas container (12), wherein a protective element (1) comprising a jacket tube (2) limited in direction of an adjustment axis (3) by an upper opening (4) and a lower opening (5), having a lateral surface area (6) at least 80 % of which being unperforated is provided around the valve region (11), wherein the valve region (11) is actuatable through the upper opening (4).
10. Method according to claim 9, wherein gas is extracted from within the protective element (1).
11. Method according to claim 10, wherein gas is extracted continuously at a rate of 20 to 50 cubic meters per hour (m³/h).
12. Method according to one of claims 9 to 11, wherein at least one of the following properties is measured at least discontinuously:
- a) the temperature within the protective element (1);
 - b) the temperature of the gas extracted from the protective element (1);
 - c) the concentration of at least one substance in the gas within the protective element (1);
 - d) the concentration of at least one substance in the gas extracted from the protective element (1); and
 - e) the pressure of a gas in a tube connected to the valve of the pressurised gas container (12).
13. Method according to one of claims 9 to 12, wherein an emergency flag is set if at least one of the following provisions is met:
- a) the temperature within and/or of the gas extracted from the protective element (1) is above a predeterminable upper temperature limit;
 - b) the temperature within and/or of the gas extracted from the protective element (1) is below a predeterminable lower temperature limit;
 - c) the concentration of at least one toxic and/or inflammable substance within and/or in the gas extracted from the protective element (1) is above a predeterminable concentration limit;
 - d) the concentration of at least one toxic and/or inflammable substance within and/or in the gas extracted from the protective element (1) is below a predeterminable concentration limit;
 - e) the pressure in at least one pipe connected to the valve of the pressurised gas container (12) is below a predeterminable pressure limit; and
 - f) a pressure drop in at least one pipe connected to the valve of the pressurised gas container (12) is above a predeterminable drop limit.
14. Method according to one of claims 9 to 13, wherein gas is extracted at a rate of at least 400 cubic meters per hour if an emergency flag is set.

15. Method according to one of claims 9 to 14, wherein the protective element (1) is supported above the pressurized gas container (12) so that a gap (17) between the protective element (1) and the pressurized gas container (12) in particular of at most 10 mm (millimeters) is provided. 5

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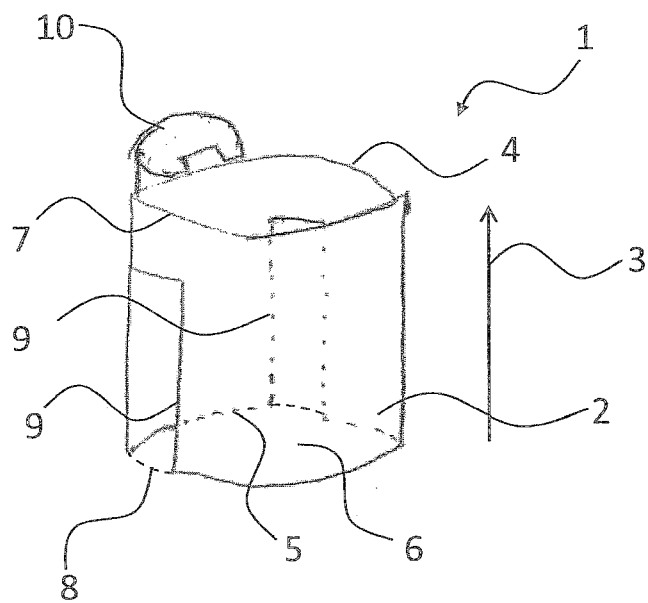


Fig. 1

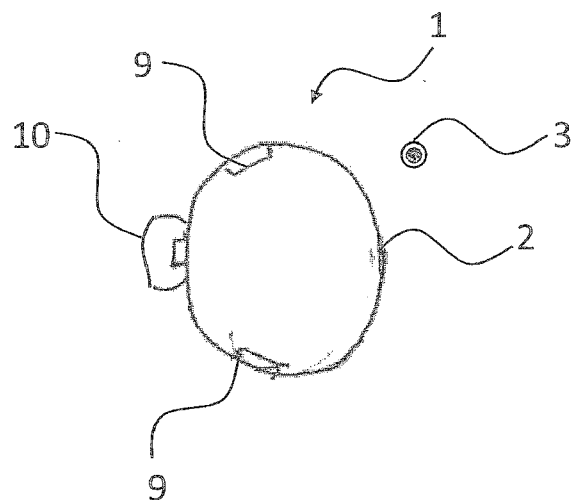


Fig. 2

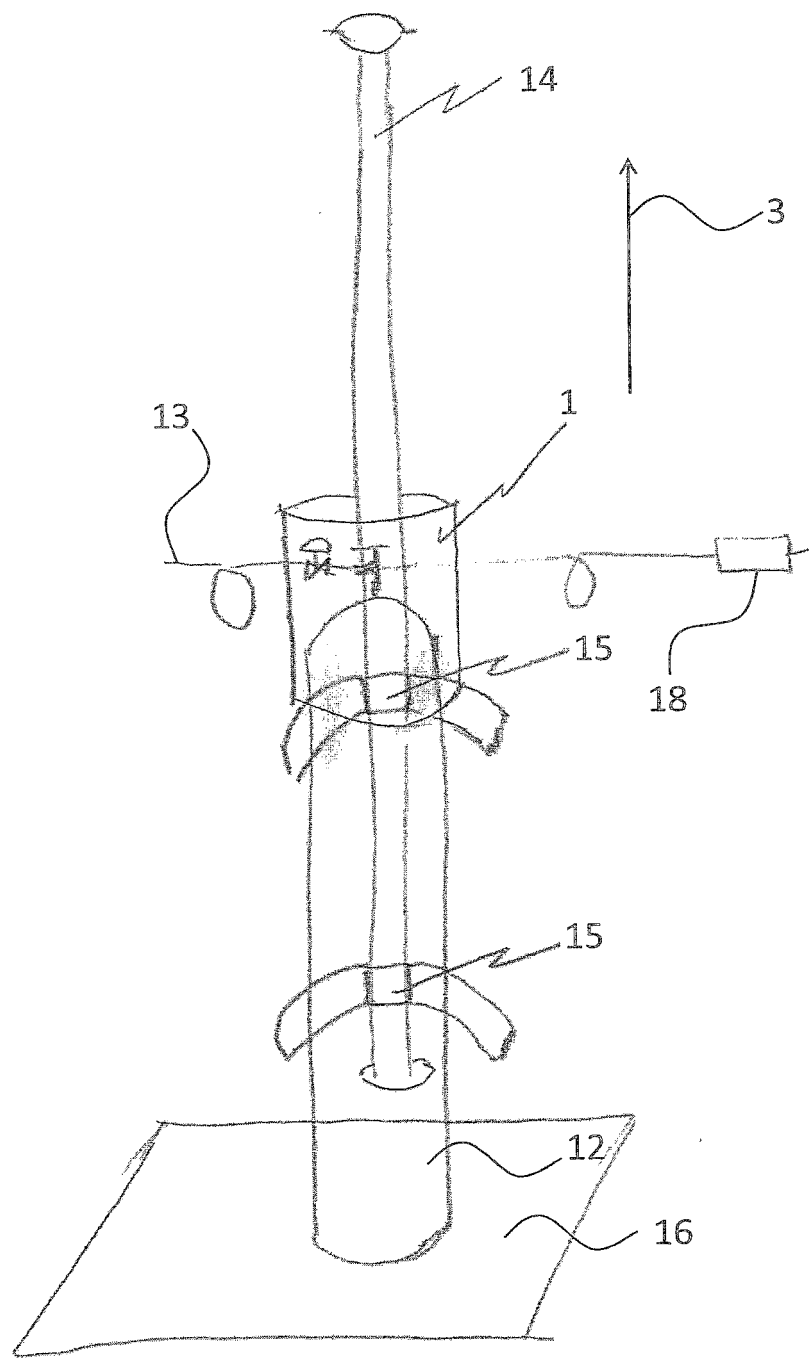


Fig. 3

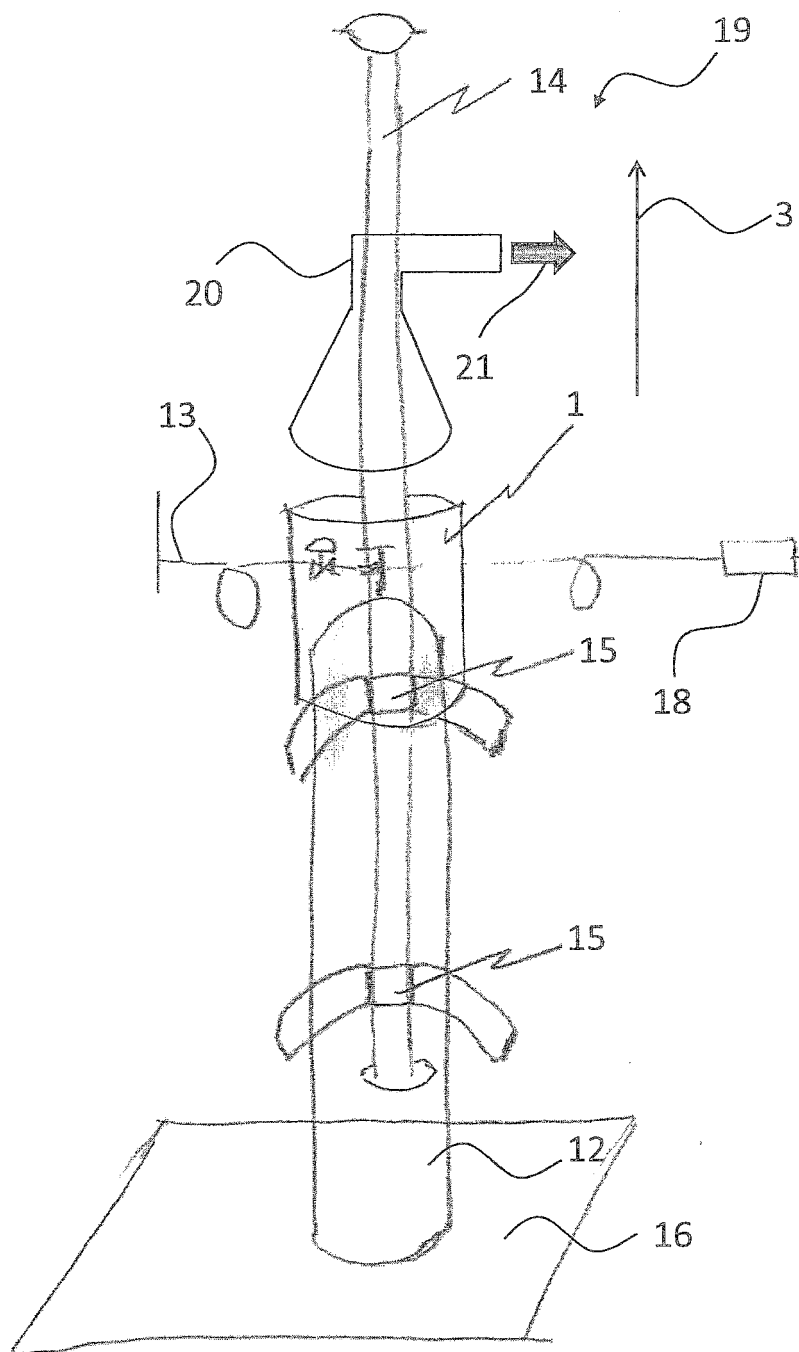


Fig. 4

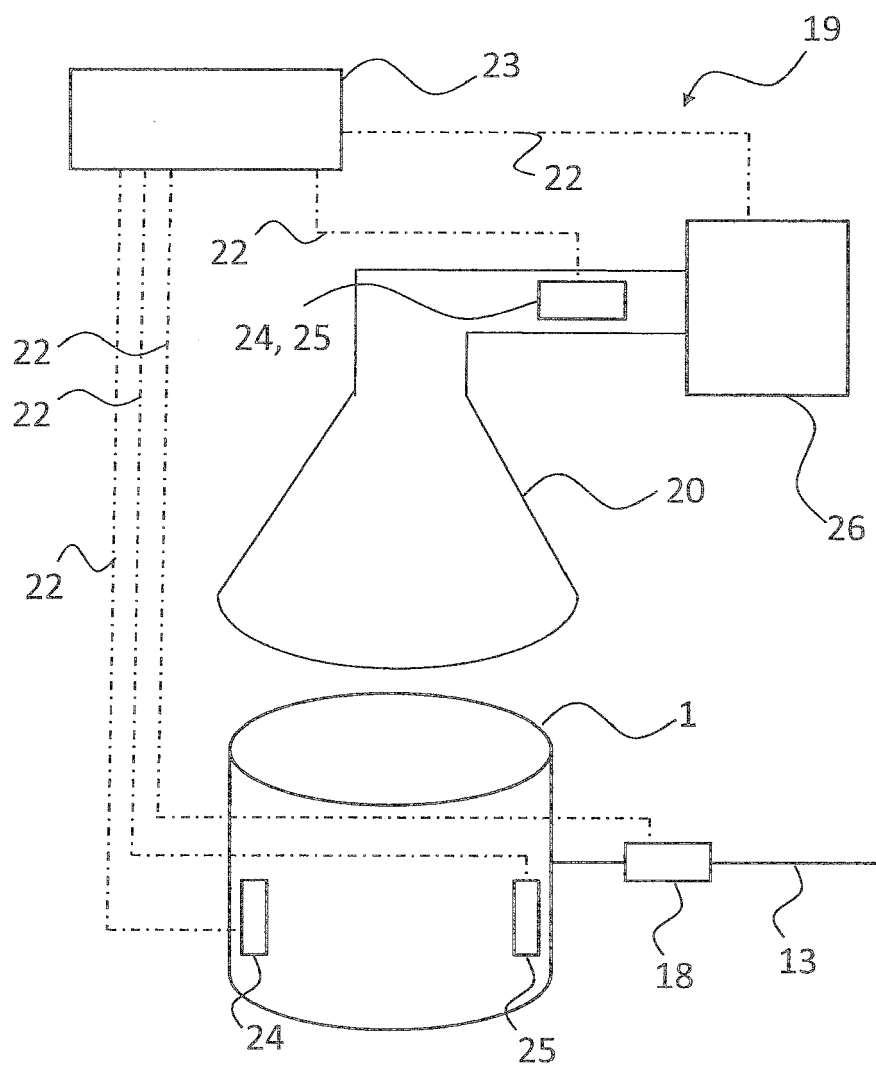


Fig. 5

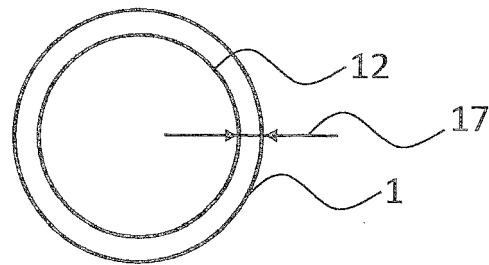


Fig. 6

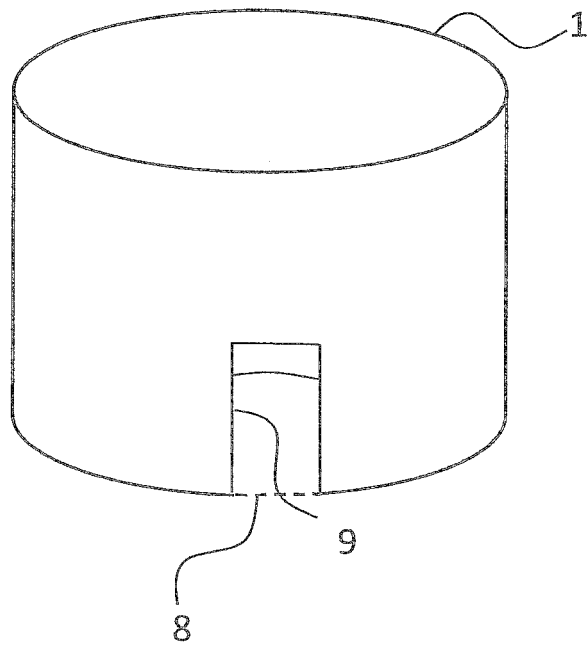


Fig. 7



EUROPEAN SEARCH REPORT

Application Number
EP 09 15 3810

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Place of search Munich		Date of completion of the search 19 June 2009	Examiner Ott, Thomas
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The members are as contained in the European Patent Office EDP file on
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19-06-2009

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