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(11)

EP 0 722 178 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

17.07.1996 Bulletin 1996/29(51) Int Cl.⁶: **H01H 37/00**(21) Application number: **96100060.1**(22) Date of filing: **04.01.1996**(84) Designated Contracting States:
DE DK ES FR GB IT SE• **Piovesana, Marco**
IT-31015 Conegliano, Treviso (IT)(30) Priority: **11.01.1995 IT PN950002 U**(74) Representative: **Giugni, Valter et al**
PROPRIA
Protezione Proprietà Industriale S.r.L.
Via Mazzini 13
I-33170 Pordenone (IT)(71) Applicant: **ELECTROLUX ZANUSSI**
ELETTRODOMESTICI S.p.A.
I-33170 Pordenone (IT)

(72) Inventors:

• **Paroni, Luigi**
IT-33033 Codroipo, Udine (IT)(54) **Refrigeration apparatus with explosion-proof thermostat**

(57) Refrigeration apparatus comprising at least a thermostat accessible by the atmosphere of the food storage compartment and provided with an adjustment stem protruding from the body of the same thermostat, which is enclosed in a hermetically sealed casing and is also provided with an actuation rod coming out with one of its ends from the body of the thermostat, said rod being coaxial with said adjustment stem, capable of being displaced longitudinally and independently with re-

spect to said stem, hermetically sealing means, preferably elastic, being provided between said stem and said rod.

In a preferred manner, said elastic sealing means are applied between the surface of the portion of said rod protruding from said stem and the surface of the outer head of said stem. In an advantageous manner, said elastic hermetically sealing means are in their resting position when said rod is in its pull-out position.

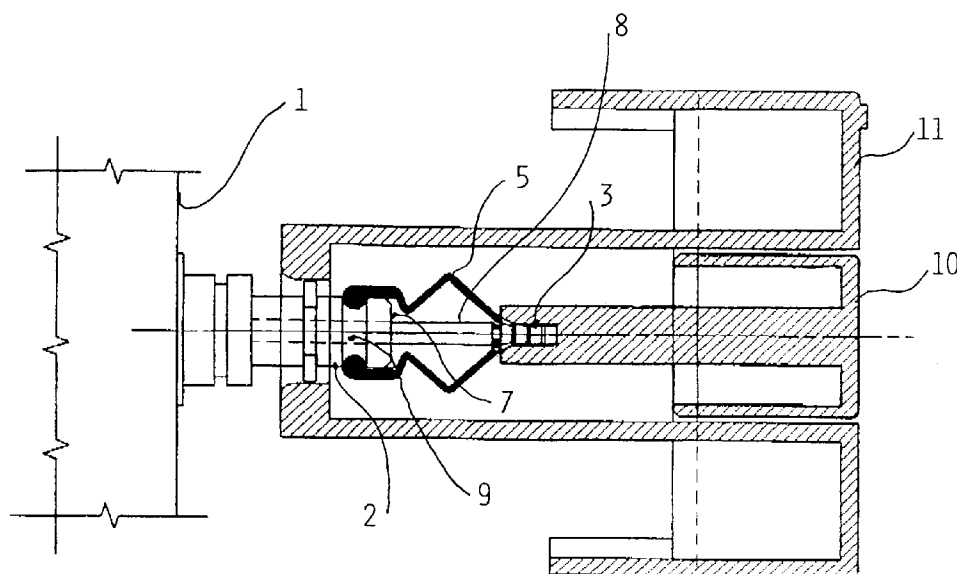


FIG. 1

Description

The present invention refers to an improved type of refrigeration apparatus provided with at least a food storage compartment and a corresponding temperature control thermostat which is accessible by the atmosphere of said food storage compartment and is appropriately isolated so as to prevent possible inflammable gas leaked into said food storage compartment from penetrating the same thermostat.

The present invention is an improvement of the invention described in the Italian patent application no. PNA000032 filed on 20th May 1994 by the same applicant, to which reference is also made, for the sake of brevity, as far as the illustration of an explosion-proof thermostat and the related explanation of both environmental and safety reasons that gave rise to such a demand for explosion-proof thermostats are concerned.

For reasons of greater simplicity, the following description will refer to a refrigeration apparatus provided with a single food storage compartment. It will however be appreciated that the invention similarly applies to refrigeration equipment provided with a greater number of food storage compartment and related temperature control thermostats.

Hermetically sealed thermostats are known, for instance from the disclosure in the afore cited patent application, which are adapted to operate in refrigeration equipment, particularly household-type refrigerators, making use of inflammable gases as their working fluids.

Such sealed-construction thermostats are fully capable of preventing inflammable gases, which may possibly leak into the food storage compartment, from penetrating the interior of the thermostat itself, in the case in which only electric wires, and no further actuation or control member, are connected thereto.

However, such refrigeration appliances are known to be usually and necessarily provided with devices, and related actuation members, for implementing some automatic function for defrosting the food storage compartment and, quite often, such defrost-cycle actuation member consists of a push-button attached to the outer end portion of a rod that is coaxial with the adjusting stem of the thermostat, but free to be displaced coaxially with respect thereto, said rod protruding from the body of the same thermostat, since it is pushed by a spring that keeps it in a pulled-out position.

By pushing said push-button, said rod is pushed into the body of the thermostat, but, although the portion of the thermostat casing surrounding the attachment of the stem being engaged therewith has a sealed, air-tight construction, in view of ensuring an adequate freedom of axial displacement of said rod with respect to said stem, a certain clearance is nevertheless provided between said elements to enable the described movement of the rod to occur without generating any sensible friction.

However, such a clearance unfortunately creates at

the same time a passage-way through which gas can penetrate from outside into the casing of the thermostat, thereby making the sealed construction of the body of the thermostat, and the portion thereof surrounding the attachment of the stem thereto, practically void of any effectiveness, and this seriously jeopardizes the security of the thermostat against risks of accidental explosion.

As a matter of fact, such a thermostat presents a further dangerous circumstance represented by the fact that it contains electric switches, so that, if it is accessible by the atmosphere prevailing inside the food storage compartment, wherein said atmosphere may possibly be imbued with inflammable gas, the risk of a such inflammable mixture being ignited by the thermostat's switching contacts arises again.

It would therefore be desirable, and it is in fact a purpose of the present invention, to provide a household-type refrigeration apparatus provided with at least a food storage compartment and a corresponding temperature control thermostat provided with an adjusting stem and an actuating rod, which is coaxial with said stem, and effectively protected against any risk of becoming a source of ignition of any inflammable gas mixture that may be contained in the food storage compartment, regardless of the position of such a rod.

This and further aims are reached according to the present invention in a thermostat which is provided with appropriate sealing protection means, some embodiments of which will be described below by way of non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 is a vertical-section view of a thermostat according to the present invention, with the defrost push-button in its resting position;
- Figure 2 is a lateral-section view of the thermostat illustrated in Figure 1, however with the defrost push-button depressed for carrying out the defrosting operation;
- Figure 3 is an enlarged view of a detail of the illustration of Figure 2;
- Figure 4 is a view of a variant of the detail shown in Figure 3.

The present invention consists substantially in providing a type of thermostat 1 which is provided, further to an adjustment stem 2, also with an actuating rod 3 that can be actuated from outside and is adapted to act inside said thermostat. In the description given below, the example will be made of an adjustment stem having said rod housed inside it. This in fact corresponds to a preferred embodiment of the present invention, but it will be appreciated that the latter similarly covers thermostats with their adjustment stem housed inside the ac-

uation rod.

With reference to Figures 1 and 2, it can be noticed that said rod is shown to be coaxially arranged in said adjustment stem and is capable of moving independently from and longitudinally with respect to said adjustment stem thanks to an appropriate bore provided centrally in said stem, said rod being inserted in said bore.

In order to enable the rod to freely move with respect to said stem and vice-versa, said central bore in the stem shall of course be made with a diameter which is greater than the diameter of said rod, and this practically creates a radial clearance through which outside gas may actually flow into the body of the thermostat.

A first solution to such a problem consists in inserting one or more preferably elastic, adequately sized sealing gaskets of an appropriate material between the rod and the stem. Such a solution lends itself to a number of variants in the selection of the shape, position and material of said sealing means. However, such a solution would anyway give rise to other drawbacks deriving from both wear-down and braking effect of said sealing means, to the extent that the application of said sealing means would quite soon prove ineffective and unreliable.

In order to avoid such problems, an advantageous solution consists in applying sealing means 5 having a sleeve-like shape, and being preferably provided with bellows-like pleats to improve their extensibility and compressibility, on the outside of the possible passage or clearance between rod and stem, and precisely between a circumference on the surface of the portion of said rod protruding from said stem and substantially a circumference 9 on the surface of the outer head portion 7 of the stem, as illustrated in Figures 1 and 2.

In this manner, said sealing means keep being permanently and hermetically applied between the stem and the rod, thereby definitively excluding any possibility for such gas to penetrate between said elements. Furthermore, their elasticity, which certainly is very useful, although not strictly necessary, is instrumental in better ensuring said sealing effect even when the rod is set in any different position.

Such a bellows-like sleeve may however give rise to a problem deriving from the circumstance that the rod, in its resting position, is pulled out, since a device is usually provided inside the thermostat which, upon conclusion of the defrosting cycle, causes it to rise so as to regain its normal position.

It may therefore occur that, if said elastic sealing means are applied when the rod is in its inserted or pushed-in position, they act as springs tending, under normal conditions, to keep the rod in the same initial position, ie. pushed-in or inserted, by opposing the regular outward displacement of the rod, so that they ultimately endanger the correct operation of the defrost control.

For such a problem to be avoided, it is necessary for said elastic means providing air-tight sealing to be installed, and be arranged in their resting position, when

said rod is in its pulled-out position 8, so that they will work in the same direction as the afore cited device provided to reset the rod in its initial position, as this can also be noticed by comparing the illustrations in Figure 1 and Figure 2.

Figures 3 and 4 illustrate two possible variants of such elastic sealing means formed by differently shaped sleeves 5 and 6, the outer side of which is pierced open by a hole 13 that is then sealed at an appropriate position around the rod, while the inner side thereof has a substantially circular opening, the edge of which is preferably provided with a tickened section 14 adapted to engage a respective groove provided on the outside of the stem, so as to further improve, even by interference, the firm attachment of the sleeve on the stem.

In order to more completely reach the aim of the present invention, it would be further appropriate for said rod to be secured rigidly to a push-button 10, said stem be secured rigidly to a knob 11, and said push-button and said knob be capable of being actuated and displacing independently.

It should now be fully apparent that a thermostat has been provided in the afore described manner, which is fully safe as far as the risk of ignition of a gas-containing surrounding atmosphere is concerned, since it is completely isolated from said atmosphere even in the case in which it is provided with an actuating rod for the control of the defrost cycle, regardless of the position in which said rod may also be set.

Claims

1. Refrigeration apparatus comprising one or more thermostats (1), at least a compressor, a condenser and an evaporator associated to at least a food storage compartment and an inflammable working fluid, said at least one thermostat being accessible by the atmosphere of the food storage compartment and being provided with an adjustment stem (2) protruding with an outer head portion (7) thereof from the body of the same thermostat, which is enclosed in a hermetically sealed casing including the attachment portion of said adjustment stem, **characterized in that** said thermostat is also provided with an actuation rod (3) extending with one of its ends from the body of the thermostat, said rod being coaxial with said adjustment stem and being further capable of being displaced independently from and longitudinally with respect to said stem into at least a pushed-in position and a pulled-out position, hermetically sealing means (5, 6) being provided between said rod and said stem.
2. Refrigeration apparatus according to claim 1, **characterized in that** said rod is arranged inside said stem.

3. Refrigeration apparatus according to claim 1 or 2, **characterized in that** said sealing means (5, 6) are elastic.
4. Refrigeration apparatus according to claim 3, **characterized in that** said elastic hermetically sealing means are provided with two opposite openings, said openings being sealingly clamped between a circumference on the surface of the portion of said rod which protrudes from said stem and substantially a circumference (9) on the surface of said outer head portion (7) of said stem. 5 10
5. Refrigeration apparatus according to claim 3 or 4, **characterized in that** said elastic hermetically sealing means are in their resting position when said rod is in said pulled-out position (8). 15
6. Refrigeration apparatus according to any of the preceding claims from 3 to 5, **characterized in that** said rod is provided of internal actuating means adapted to cause said rod to rise into its pulled-out position when said internal actuating means are in their resting position. 20 25
7. Refrigeration apparatus according to any of the preceding claims, **characterized in that** said rod is secured rigidly to a push-button (10), said stem is secured rigidly to a knob (11), and said push-button and said knob are adapted to be actuated and displace independently. 30
8. Refrigeration apparatus according to any of the preceding claims from 3 to 7, **characterized in that** the inner side of said sealing means has an opening whose edge is provided with a thickened portion (14) adapted to engage a corresponding groove provided on the outside of the stem. 35 40

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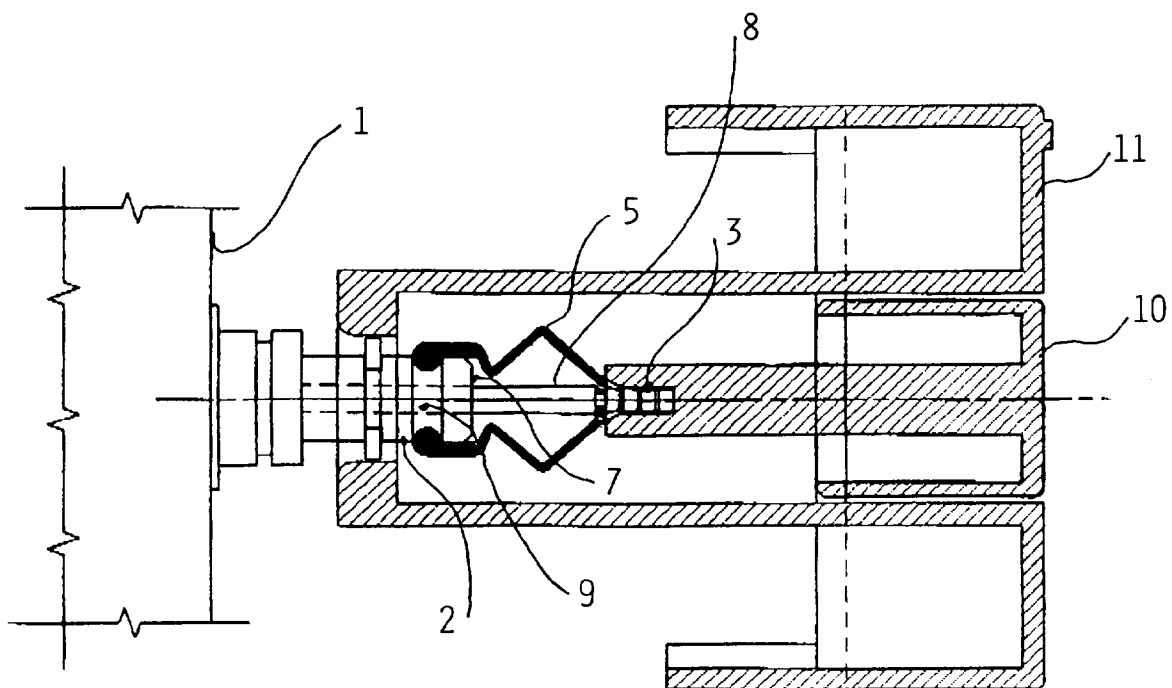


FIG. 1

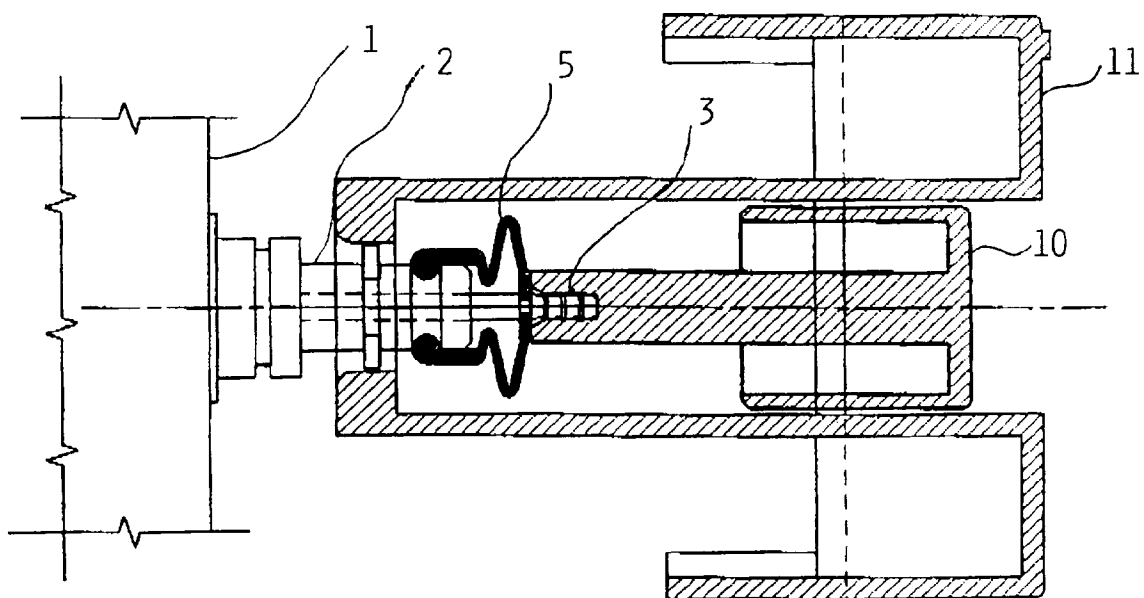
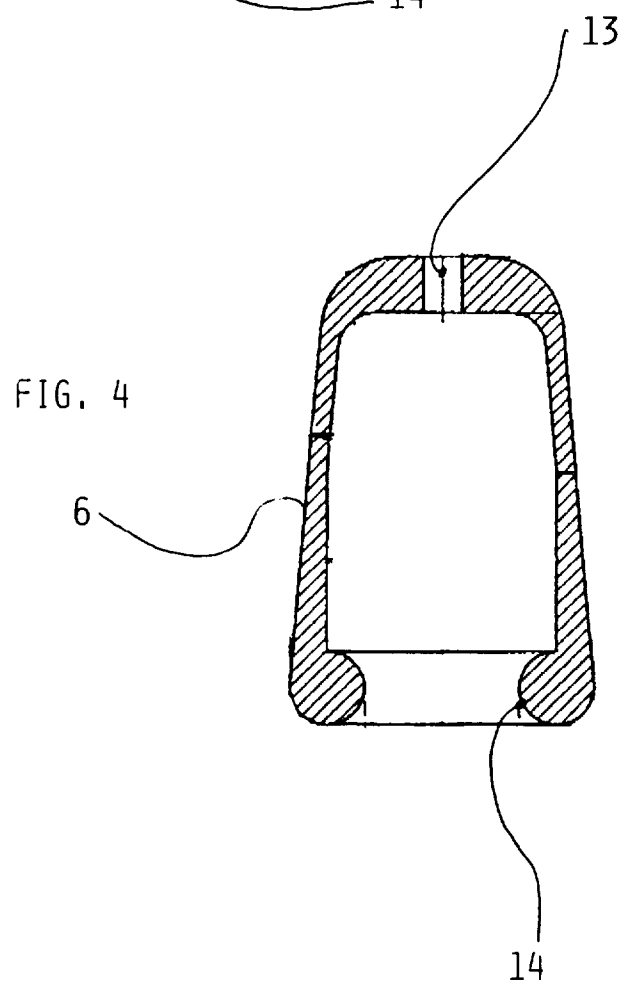
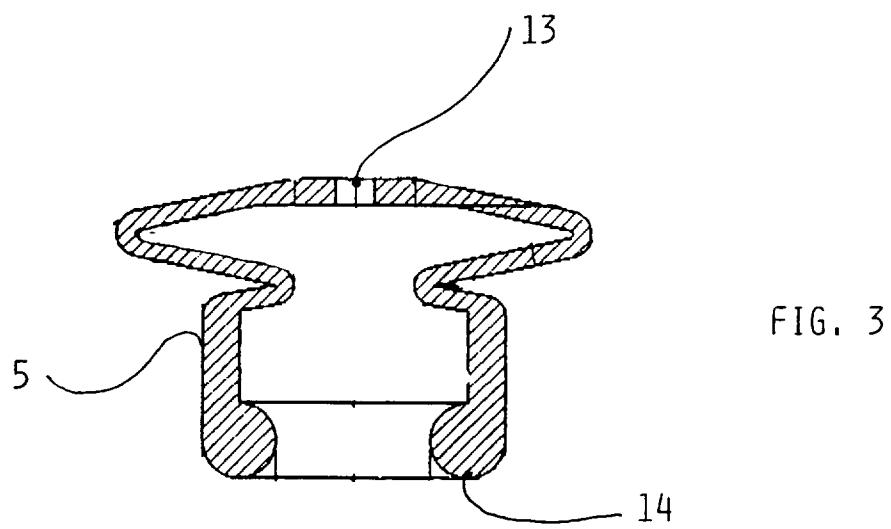


FIG. 2





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EUROPEAN SEARCH REPORT

Application Number
EP 96 10 0060

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	US-A-2 769 061 (GENERAL ELECTRIC) 30 October 1956 * claim 1; figures 1,5 *	1	H01H37/00
Y	EP-A-0 027 976 (EGO ELEKTRO BLANC & FISCHER) 6 May 1981 * page 13, last paragraph - page 14, paragraph 2; figure 10 *	1	
A	US-A-3 878 498 (ALLEN JAMES B ET AL) 15 April 1975 * abstract; figures 6,8 *	1	
D,P, A	EP-A-0 687 875 (ZANUSSI ELETTRODOMESTICI) 20 December 1995	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6) H01H
Place of search THE HAGUE		Date of completion of the search 19 April 1996	Examiner Janssens De Vroom, P
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