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(54) **Freezer with a reduced frost formation**

Gefrierschrank mit verminderter Frostbildung

Congélateur doté d'une formation réduite de givre

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(73) Proprietor: **WHIRLPOOL CORPORATION**  
**Benton Harbor, MI 49022 (US)**

(72) Inventors:  
 • **Aronica, Alessandro**  
**21025, Comerio (IT)**

• **Nardi, Luca**  
**21025, Comerio (IT)**

(74) Representative: **Guerci, Alessandro**  
**Whirlpool EMEA S.p.A.**  
**Patent Department**  
**Viale G. Borghi 27**  
**21025 Comerio (VA) (IT)**

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## Description

**[0001]** The present invention relates to a freezer comprising a cabinet defining an inner cavity which can be closed by a door and in which said cavity communicates with the ambient by means of a conduit.

**[0002]** With the term "freezer" we mean every refrigeration appliance in which the temperature for storing food is kept in a range close to  $-18^{\circ}\text{C}$  (i.e. chest freezers, upright freezers, or portions of so called "combi" refrigerators having a freezer compartment). In this kind of domestic appliances it is well known the problem of frost formation on the inside walls, particularly in the region adjacent the opening which is closed by the door. This frost derives from the humidity contained in the ambient air which is sucked into the cavity past the sealing which is normally arranged around the edge of the door.

**[0003]** A solution is known from EP-A-494587 in which an external flexible container communicates with the cavity. Such solution, which in theory should prevent or reduce the formation of frost on the inner liner of the freezer, has shown quite low performances in terms of frost reduction.

**[0004]** Another commercial solution presents a pipe which allows communication with external ambient and which is provided with a filter inside the pipe for absorbing humidity and therefore postponing the defrosting operation. This solution has the drawback of a rapid clogging of the pipe by frost on the filter when ambient humidity is high, therefore making this arrangement useless. **A similar solution is disclosed by US 2011/000235 A1, where a desiccant device is placed on the inner door of the freezer.**

**[0005]** There is also a known solution in which a known chemical compound is used in bags or containers in the freezer for adsorbing humidity inside the cavity. Even if such solution is promising, it requires a regular replacement of the depleted compound, which is time consuming and expensive.

**[0006]** It is an object of the present invention to provide a freezer of the above kind which does not present the above drawbacks and which is efficient in reducing frost formation on the inner liner, therefore increasing the time between defrost operations.

**[0007]** This object is achieved thanks to the features listed in the appended claims.

**[0008]** One of the features of the present invention is the use of an internal and dedicated container which is in communication with the conduit between the external ambient and the cavity and which is quickly and easily removable after a certain amount of frost is accumulated therein. Moreover, for avoiding conduit blocking or clogging, a heating device is preferably associated with the conduit, preferably adjacent the end facing the cavity.

**[0009]** Further advantages and features according to the present invention will become clear from the following detailed description, with reference to the attached drawings in which:

- figure 1 is a perspective view of a chest freezer according to the present invention;
- figure 2 is a perspective view of the inner liner of the door of the freezer of figure 1 before the foaming operation and where the container for frost has been removed;
- figure 3 is an enlarged detail of figure 2;
- figure 4 is a perspective view of the conduit used in the door of figure 1;
- figure 5 is a perspective view of the foamed door of figure 1;
- figure 6 is an enlarged detail, partially sectioned, of figure 5;
- figures 7a and 7b show perspective views of a base portion of the container for frost shown in figure 1;
- figure 8 is a perspective view of a cover portion of the container for frost shown in figure 1;
- figure 8a is an enlarged detail of figure 8;
- figure 9 is an exploded view of the container shown in figure 1;
- figure 10 is a perspective view, partially sectioned, of a container for frost according to a second embodiment;
- figure 11 is an exploded view of the container shown in figure 10;
- figure 12 is a schematic cross section which shows a detail of the frost container in its configuration installed in the cavity of the chest freezer; and
- figure 13 is a cross section similar to figure 12 and showing a further embodiment of the invention.

**[0010]** With reference to the drawings, a chest freezer 10 according to the invention presents a cabinet 10a having a door or lid 10b hinged thereto. On the inner liner 12 of the door 10b it is removably mounted, for instance by means of a bayonet fastening system, a round-shaped frost collecting container 14 having a plurality of side apertures 14a.

**[0011]** As it clearly shown in figure 6, within the inner liner 12 of the foamed door 10b and an outer liner 16 thereof, an L-shaped conduit 18 is placed, with a first open end 18a on a side 16a of the outer liner 16 of the door 10b and a second open end 18b on the inner liner 12. The first open end 18a of the conduit 18 is provided with a replaceable filter 19 (figure 6), for instance in the form of a sponge or the like, in order to retain powder and air impurities. Such filter can have also antibacterial properties. The second end 18b of the conduit 18 has a conical shape so that its cross section area is increasing towards the cavity of the freezer. In figures 5 and 6 it is also shown a rubber gasket 20 fixed to the rim of the door 10b.

**[0012]** The shape of the second end 18b of the conduit 18 reduces the possibility of frost formation in the conduit itself which could lead to clogging thereof. In order to further reduce such frost formation, the conduit 18 can be provided with a heating resistance 22 (figure 4) on the outside surface of the conduit 18, and electrically con-

ned to the control unit of the appliance (not shown). Such electrical resistance 22 can be activated according to a certain duty cycle or it can be activated only if the humidity in the ambient air, detected by a specific sensor of the freezer, is higher than a predetermined threshold.

**[0013]** On an edge of the second end 18b of the conduit 18 there are provided shaped notches 17 which are used for removably mounting the frost collecting container 14. This latter comprises a base disc-shaped portion 21 (figures 7a and 7b) with a central conical zone 21a having a central aperture (matching the shape of the second end 18b of the conduit 18) and an annular zone 21b having protruding pin 23 adapted to cooperate, in a bayonet fastening system, with the shaped notches 17 of the conduit 18. The outer edge of the annular zone 21b is provided with shaped notches 25 adapted to cooperate with corresponding pins 27 on a rim 29a of the cup-shaped cover portion 29 of the frost collecting container 14.

**[0014]** In the embodiment shown in figures 10 and 11, where the same reference numerals used in the previous figures have been used for similar elements, the cover portion 29 is provided centrally with an aluminium disc 31 and with annular walls 33 adapted to create a sort of labyrinth effect for air flow so that humidity of air has high chances to frost on surfaces before passing through apertures 14a. Instead of the aluminium disc 33, a metal layer can be used as well. The aluminium disc 31 acts as a thermal mass in order to facilitate frost formation on the surface thereof, therefore assuring that the remaining zone of the container 14 is free from frost for a longer time. Around the annular walls 33, the container 14 is provided with a toroidal filter 35 with antibacterial and anti-odour properties. For the assembly of the cover portion 29 and the base portion 21 of the frost container 14 shown in figures 10 and 11, the cover portion 29 is provided with elastic tongues 38 with notches adapted to cooperate, in a snap engagement fastening system, with corresponding slots 40 on an annular wall of the base portion 21.

**[0015]** In figure 12 it is schematically shown how and where the frost F is accumulating in the container 14, i. e. on its bottom surface. The funnel shape of the second end 18b of the conduit 18, together with the position of the side apertures 14a avoid the formation of frost in other positions different from the bottom of the container 14. The container 14 can be easily removed by the user as a single piece composed by the base portion 21 and by the cover portion 29. It is then a choice of the user to remove manually the frost by separating the two above portions or to leave the frost container 14 in an environment where the frost can melt. This operation of removal of frost increases the time usually needed between defrost operations of the freezer. The air flowing from the side apertures 14a of the container is dry and does not contribute to frost formation on the inner liner of the freezer.

**[0016]** Figure 13 shows a further embodiment of the invention in which the conduit 24 is straight and presents

its first end 24a on the upper face of the liner 16 of the door 10b and a second end 24b which does not present a conical or funnel shape. In this case the heating resistance 22 is preferably positioned only on the portion of the conduit 24 adjacent its second end 24b. The removable container 14 presents internally a cylindrical central portion 26 which conveys the humid air toward the bottom of the container where the humidity can freeze.

**[0017]** Optimal result in terms of clogging avoidance have been obtained by the applicant by using an heating resistance having a power comprised between 15 and 5 W, preferably lower than 10 W, which has been activated in the range of 6 to 2 minutes per hour, preferably about 3 minutes per hour, therefore with a very limited increase in overall power consumption.

**[0018]** The timing between defrosting (which is a very annoying and time consuming operation for the user since all the frozen products have to be removed from the cavity) has been increased compared to traditional chest freezers.

### Claims

1. Freezer (10) comprising a cabinet (10a) defining an inner cavity closable by a door (10b), and in which said cavity communicates with the ambient by means of a conduit (18, 24), **characterized in that** such conduit (18, 24) is provided with a frost collecting container (14) removably mounted at one end (18b, 24b) of said conduit (18, 24) in the cavity and having at least one opening (14a) for allowing air flow, **characterized in that** said container (14) is a frost collecting container when placed inside the freezer (10) and is apt to allow frost be removed from the container, either manually or by melting, when the container is removed from the freezer (10), **in that** said conduit (18, 24) is provided in the door (10b), **in that** the door, in its close configuration, is horizontal, said frost collecting container (14) being mounted on the inner liner (12) of the door (10b), and **in that** the frost collecting container (14) presents a plurality of openings (14a) on its side wall.
2. Freezer according to claim 1, wherein such conduit (18, 24) is provided with a heating device (22).
3. Freezer according to claim 1, wherein the frost collecting container (14) has a round shape and the openings (14a) are provided in its circular wall.
4. Freezer according to any of the preceding claims, wherein the conduit (18) presents the end (18b) facing the cavity with a funnel shape having an increasing cross section area towards the cavity.
5. Freezer according to claim 4, wherein the heating

device (22) is a heating resistance provided on the outside surface of the conduit (18, 24).

6. Freezer according to claim 5, wherein the heating resistance has a power comprised between 5 and 15 W.
7. Freezer according to claim 6, wherein the heating resistance is activated for a period comprised between 2 and 6 minutes per hour.
8. Freezer according to any of the preceding claims, wherein the conduit (18, 24) is provided with a replaceable filter (19).
9. Freezer according to any of the preceding claims, wherein the frost collecting container (14) presents a base portion (21) and a cover portion (29) removably assembled together.
10. Freezer according to claim 9, wherein the base portion (21) of the frost collecting container (14) has a shape matching one end (18b) of the conduit (18).
11. Freezer according to any of the preceding claims, wherein the frost collecting container (14) is provided with an internal layer or a disc (31) of metal.
12. Freezer according to any of the preceding claims, wherein the frost collecting container (14) is provided with an internal filter (35) and/or an internal wall (33) creating a labyrinth passage for air flow.

#### Patentansprüche

1. Gefriertruhe (10), die ein Gehäuse (10a) umfasst, das einen inneren Hohlraum definiert, der durch eine Tür (10b) schließbar ist, und in dem der Hohlraum mit der Umgebung mittels einer Leitung (18, 24) kommuniziert, **dadurch gekennzeichnet, dass**, die Leitung (18, 24) mit einem Frostsammelbehälter (14) bereitgestellt ist, der entfernbar an einem Ende (18b, 24b) der Leitung (18, 24) in dem Hohlraum montiert ist, und mindestens eine Öffnung (14a) zum Erlauben einer Luftströmung hat, **dadurch gekennzeichnet, dass** der Behälter (14) ein Frostsammelbehälter ist, wenn er im Inneren der Gefriertruhe (10) platziert ist, und geeignet ist, um zu erlauben, Frost aus dem Behälter zu entfernen, entweder manuell oder durch Schmelzen, wenn der Behälter aus der Gefriertruhe (10) entfernt ist, wobei die Leitung (18, 24) in der Tür (10b) bereitgestellt ist, wobei die Tür in ihrer geschlossenen Konfiguration horizontal ist, wobei der Frostsammelbehälter (14) auf der inneren Auskleidung (12) der Tür (10b) montiert ist, und wobei der Frostsammelbehälter (14) mehrere Öffnungen (14a) auf seiner Seitenwand aufweist.

2. Gefriertruhe nach Anspruch 1, wobei die Leitung (18, 24) mit einer Heizvorrichtung (22) bereitgestellt ist.

3. Gefriertruhe nach Anspruch 1, wobei der Frostsammelbehälter (14) eine runde Form hat und die Öffnungen (14a) in seiner kreisförmigen Wand bereitgestellt sind.

4. Gefriertruhe nach einem der vorhergehenden Ansprüche, wobei die Leitung (18) das Ende (18b), das zu dem Hohlraum weist, mit einer Trichterform aufweist, die einen zunehmenden Querschnittsbereich hin zu dem Hohlraum hat.

5. Gefriertruhe nach Anspruch 4, wobei die Heizvorrichtung (22) ein Heizwiderstand ist, der auf der äußeren Fläche der Leitung (18, 24) bereitgestellt ist.

6. Gefriertruhe nach Anspruch 2 oder 5, wobei der Heizwiderstand eine Leistung zwischen 5 und 15 W hat.

7. Gefriertruhe nach Anspruch 6, wobei der Heizwiderstand für einen Zeitraum von zwischen 2 und 6 Minuten pro Stunde aktiviert ist.

8. Gefriertruhe nach einem der vorhergehenden Ansprüche, wobei die Leitung (18, 24) mit einem ersetzbaren Filter (19) bereitgestellt ist.

9. Gefriertruhe nach einem der vorhergehenden Ansprüche, wobei der Frostsammelbehälter (14) einen Basisabschnitt (21) und einen Deckelabschnitt (29) aufweist, die entfernbar zusammengesetzt sind.

10. Gefriertruhe nach Anspruch 9, wobei der Basisabschnitt (21) des Frostsammelbehälters (14) eine Form hat, die zu einem Ende (18b) der Leitung (18) passt.

11. Gefriertruhe nach einem der vorhergehenden Ansprüche, wobei der Frostsammelbehälter (14) mit einer internen Schicht oder einer Scheibe (31) aus Metall bereitgestellt ist.

12. Gefriertruhe nach einem der vorhergehenden Ansprüche, wobei der Frostsammelbehälter (14) mit einem internen Filter (35) und/oder einer internen Wand (33) bereitgestellt ist, die einen Labyrinth-Durchgang für eine Luftströmung bilden.

#### Revendications

1. Congélateur (10) comprenant une armoire (10a) définissant une cavité refermable par une porte (10b), et dans laquelle ladite cavité communique avec l'atmosphère ambiante au moyen d'un conduit (18, 24),

- caractérisé en ce que** ce conduit (18, 24) est pourvu d'un récipient collecteur de givre (14) monté de manière amovible à une extrémité (18b, 24b) dudit conduit (18, 24) dans la cavité et ayant au moins une ouverture (14a) pour permettre l'écoulement d'air, **caractérisé en ce que** ledit récipient (14) est un récipient collecteur de givre lorsqu'il est placé dans le congélateur (10) et est à même de permettre le retrait du givre du récipient, manuellement ou par fusion, lorsque le récipient est retiré du congélateur (10), **en ce que** ledit conduit (18, 24) est aménagé dans la porte (10b), **en ce que** la porte, dans sa configuration fermée, est horizontale, ledit récipient collecteur de givre (14) étant monté sur la chemise interne (12) de la porte (10b) et **en ce que** le récipient collecteur de givre (14) présente une pluralité d'ouvertures (14a) sur sa paroi latérale.
2. Congélateur selon la revendication 1, dans lequel ce conduit (18, 24) est pourvu d'un dispositif de chauffage (22).
  3. Congélateur selon la revendication 1, dans lequel le récipient collecteur de givre (14) a une forme ronde et les ouvertures (14a) sont ménagées dans sa paroi circulaire.
  4. Congélateur selon l'une quelconque des revendications précédentes, dans lequel le conduit (18) présente l'extrémité (18b) en regard de la cavité en forme d'entonnoir ayant une surface croissante en section transversale vers la cavité.
  5. Congélateur selon la revendication 4, dans lequel le dispositif de chauffage (22) est une résistance de chauffage aménagée sur la surface externe du conduit (18, 24).
  6. Congélateur selon la revendication 2 ou 5, dans lequel la résistance de chauffage a une puissance comprise entre 5 et 15 W.
  7. Congélateur selon la revendication 6, dans lequel la résistance de chauffage est activée pendant une période comprise entre 2 et 6 minutes par heure.
  8. Congélateur selon l'une quelconque des revendications précédentes, dans lequel le conduit (18, 24) est pourvu d'un filtre remplaçable (19).
  9. Congélateur selon l'une quelconque des revendications précédentes, dans lequel le récipient collecteur de givre (14) présente une partie de base (21) et une partie couvrante (29) assemblées l'une à l'autre de manière amovible.
  10. Congélateur selon la revendication 9, dans lequel la
- partie de base (21) du récipient collecteur de givre (14) a une forme correspondant à une extrémité (18b) du conduit (18).
11. Congélateur selon l'une quelconque des revendications précédentes, dans lequel le récipient collecteur de givre (14) est pourvu d'une couche interne ou d'un disque (31) de métal.
  12. Congélateur selon l'une quelconque des revendications précédentes, dans lequel le récipient collecteur de givre (14) est pourvu d'un filtre interne (35) et/ou d'une paroi interne (33) créant un passage labyrinthique pour l'écoulement d'air.

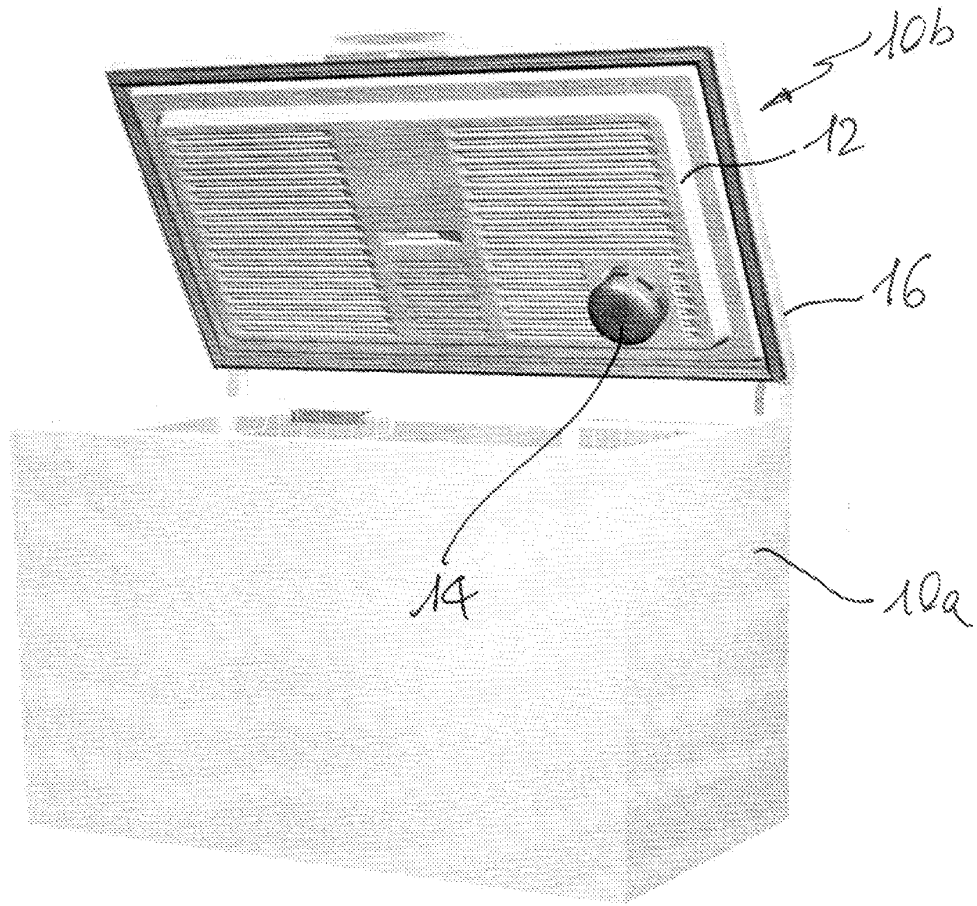


Fig. 1

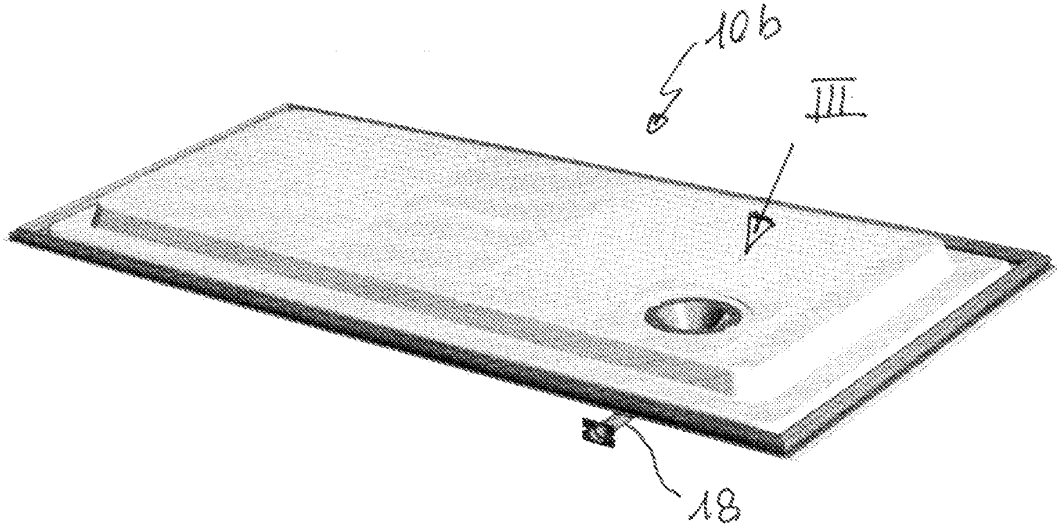


Fig. 2

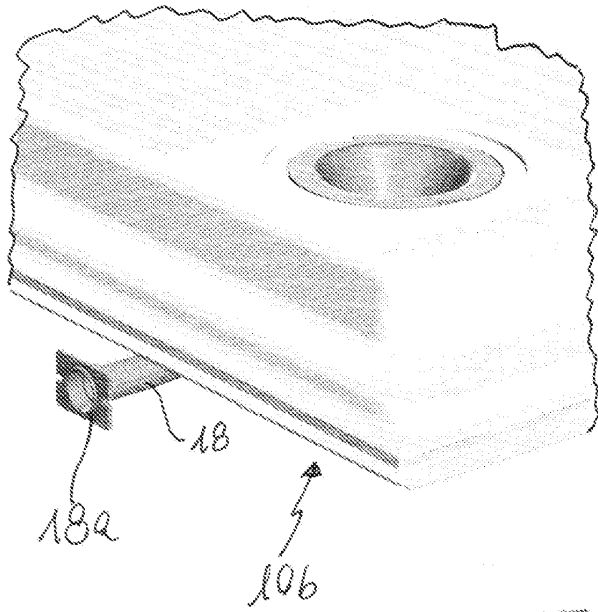


Fig. 3

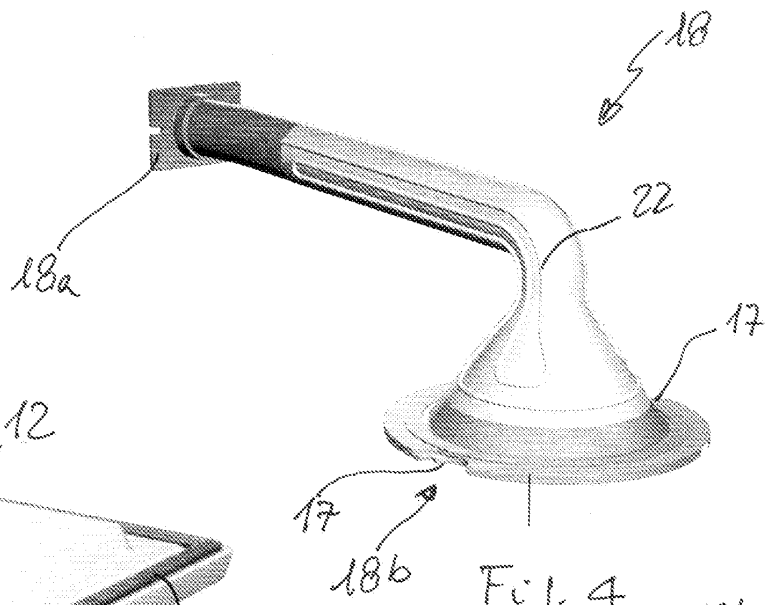


Fig. 4

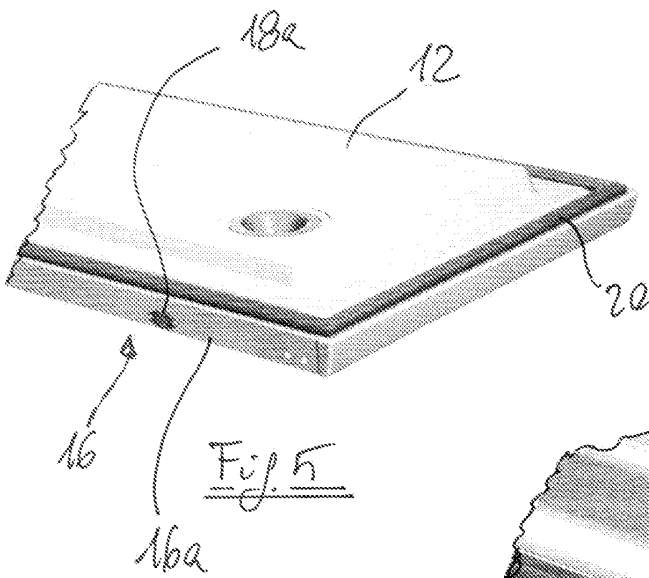


Fig. 5

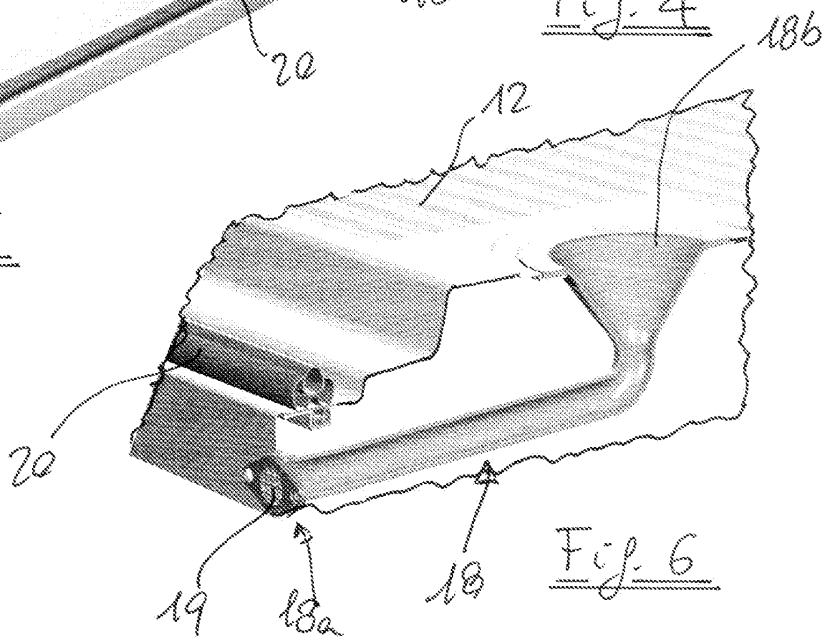
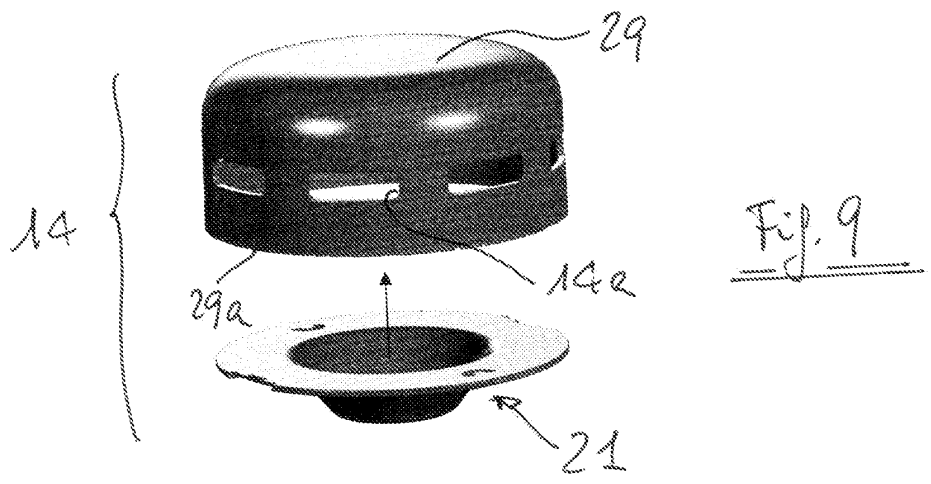
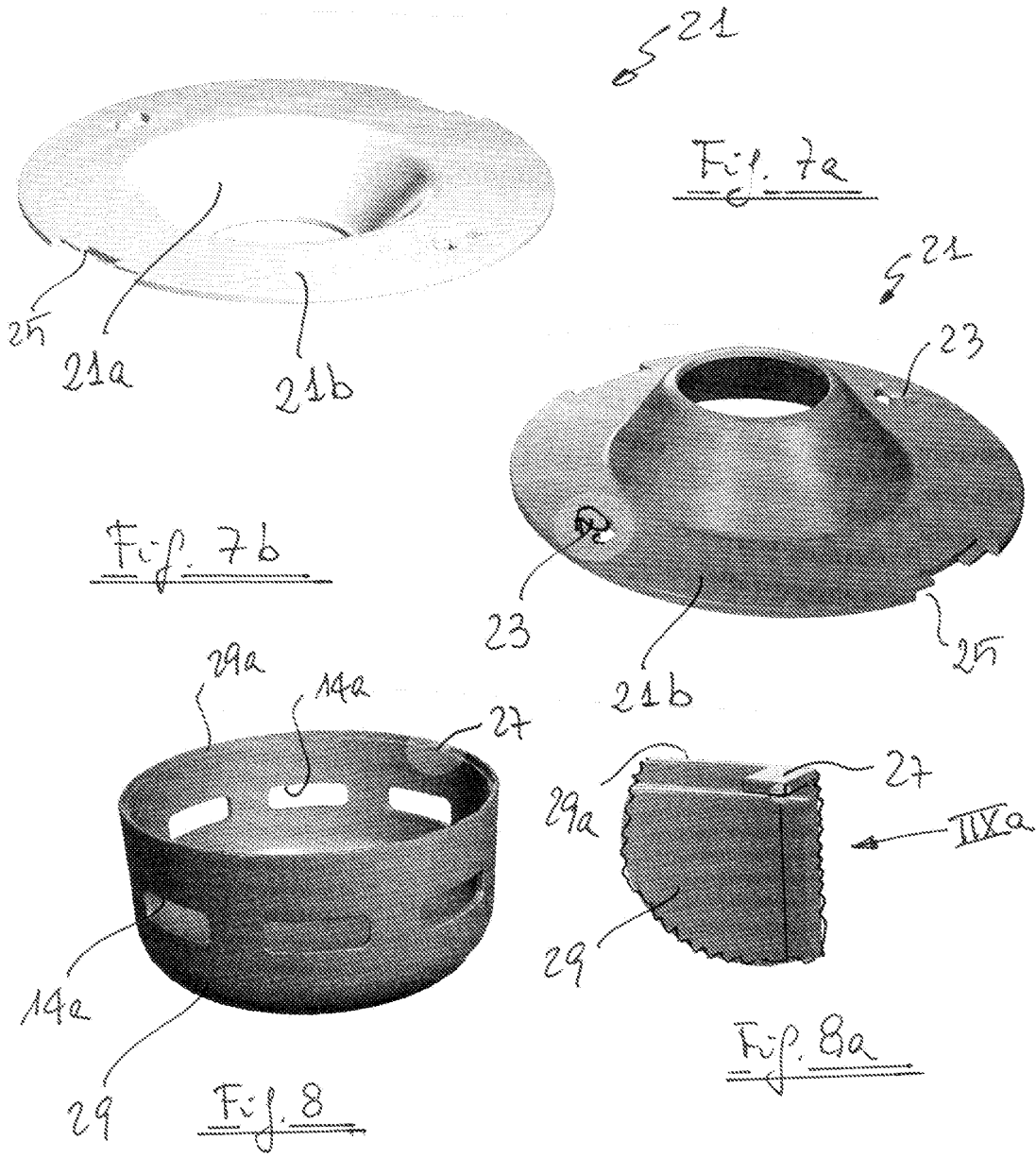
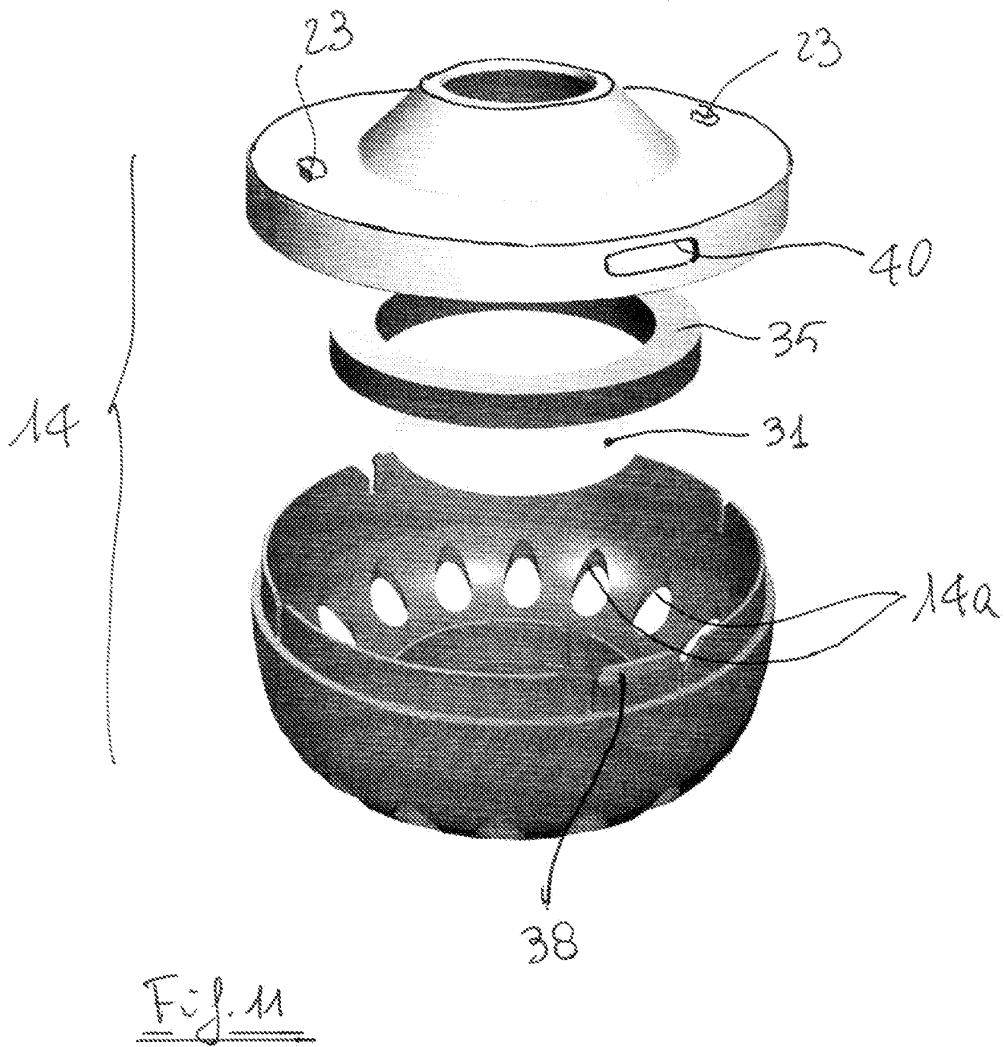
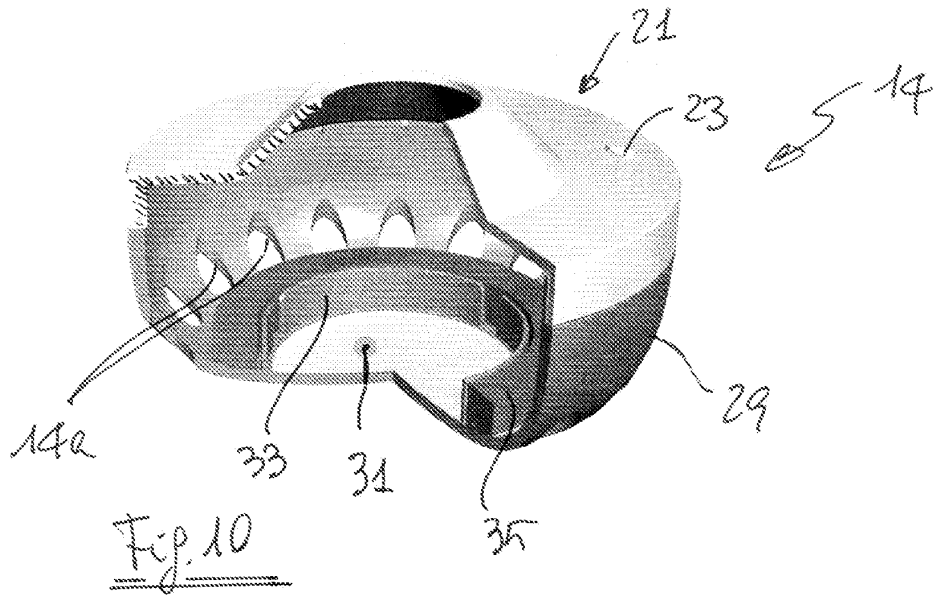
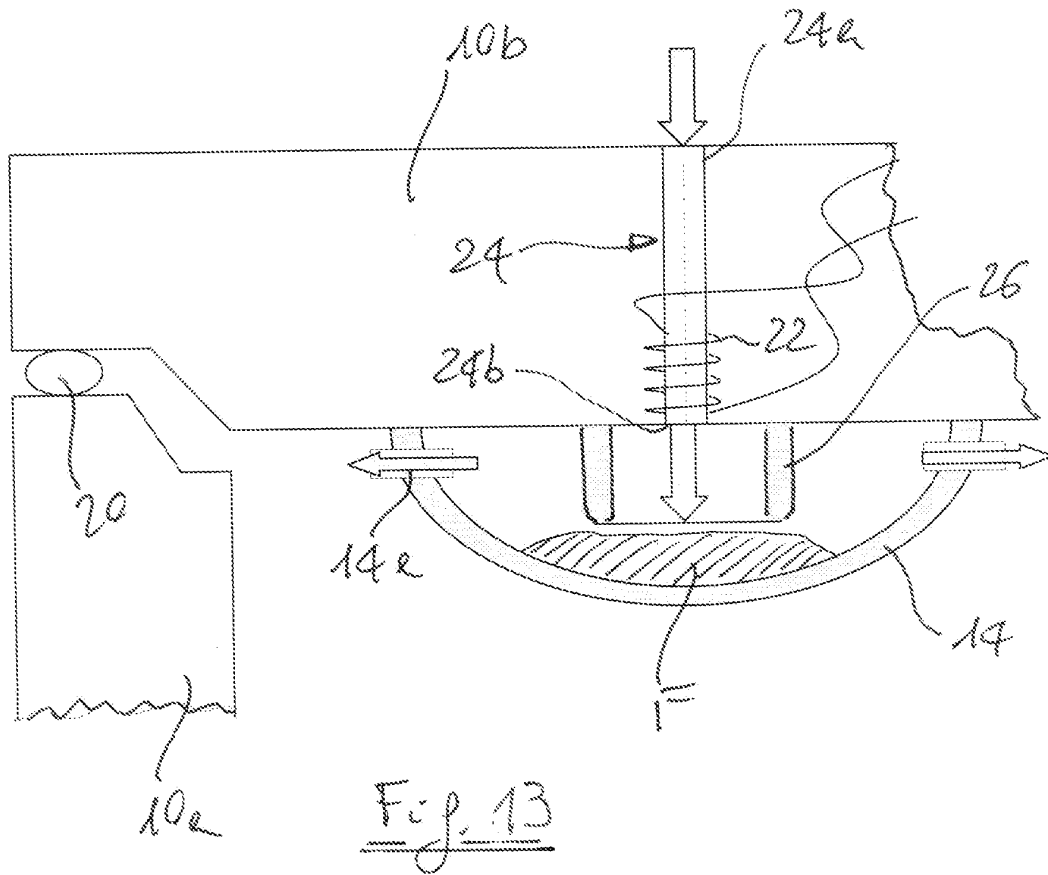
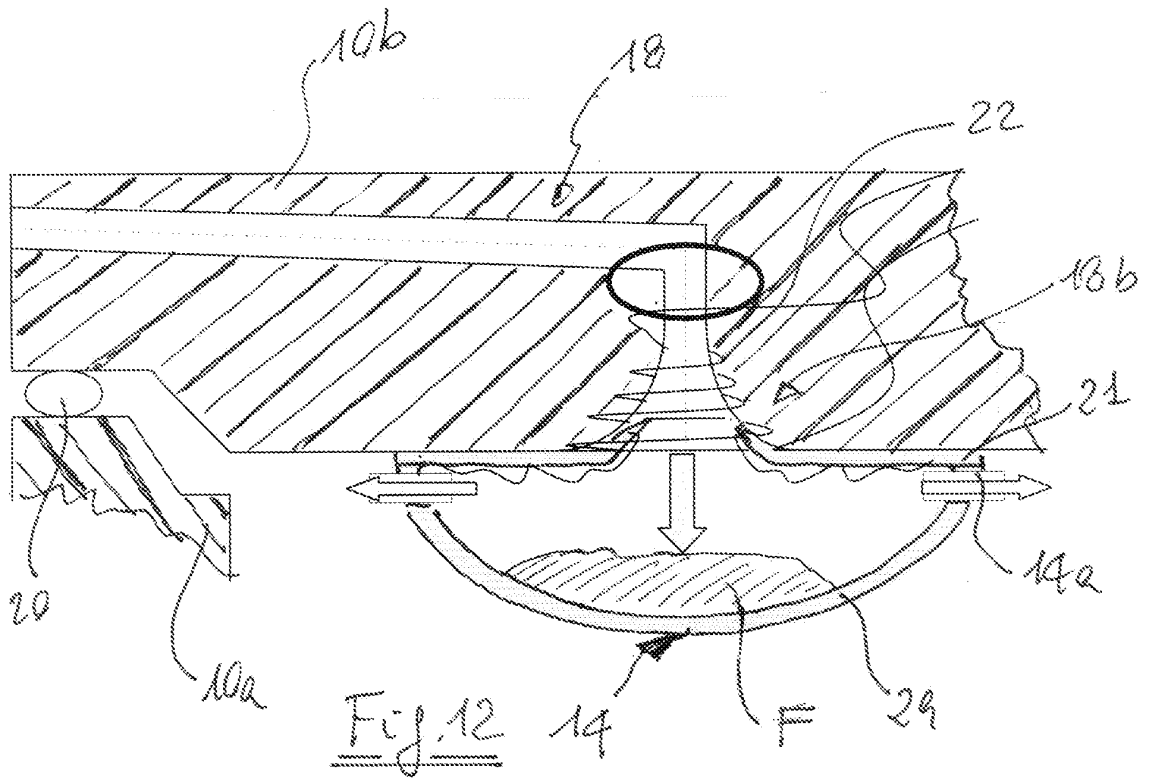


Fig. 6









**REFERENCES CITED IN THE DESCRIPTION**

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