(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 903 890 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
03.11.2021 Bulletin 2021/44

(21) Application number: **20171547.1**

(22) Date of filing: **27.04.2020**

(51) Int Cl.:
A62B 19/00 *(2006.01)* ***A62B 23/02*** *(2006.01)*
A62B 9/04 *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Universität Wien**
1010 Vienna (AT)

(72) Inventor: **DRAGOSITS, Mathias**
A-1090 Vienna (AT)

(74) Representative: **Grünecker Patent- und Rechtsanwälte**
PartG mbB
Leopoldstraße 4
80802 München (DE)

(54) **FILTER DEVICE FOR A RESPIRATORY MASK**

(57) The present disclosure provides a filter device kit for a respiratory mask, comprising a base member comprising an inner surface and an outer surface, the outer surface comprising a first fastening means configured for fastening the filter device to the respiratory mask, a cap member comprising an inner surface and an outer surface and a filter material, in particular, a non-woven filter material, wherein the base member and the cap member are configured to be detachably fastened to each other with the filter material positioned between the inner surface of the base member and the inner surface of the cap member. Further, it is provided a filter device comprising the filter device kit, wherein the base member and the cap member are detachably fastened to each other with the filter material positioned between the inner surface of the base member and the inner surface of the cap member.

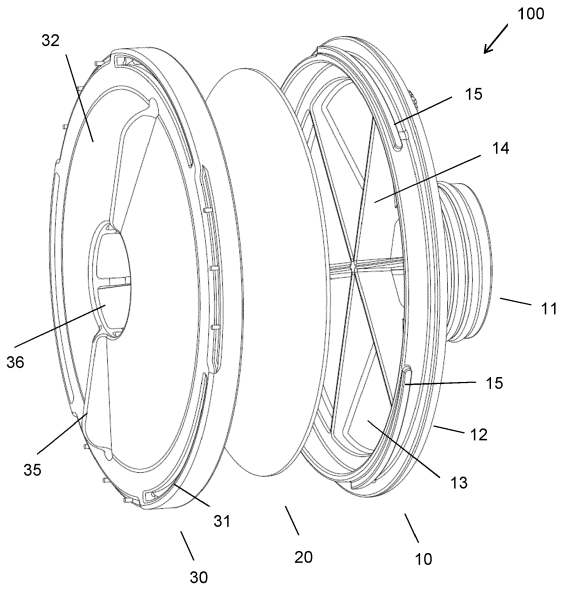

Fig. 1a

EP 3 903 890 A1

Description

Field of the Invention

[0001] The invention relates to a filter device for a respiratory mask, in particular, for the use with a respiratory mask comprising a screw thread for fastening the filter device to the mask.

Background of the Invention

[0002] Respiratory masks, full masks well as half masks, represent important protection means in a variety of situations, for example, in hospital environments. Particularly, respiratory masks comprising particle filters may be employed in situations in that protection against malicious microorganisms, for example, bacteria and viruses as the Covid 19 corona virus, is needed.

[0003] However, sufficiently reliable respiratory masks are typically relatively complex in terms of construction and, particularly, filter devices used for the masks have to stand strict requirements with respect to the efficiency of the filtering and sustainability in harsh environments. In the art, a variety of filter devices for respiratory masks, for example, filter devices that allow for the fastening to masks by RD40 screw threads are known. Such filter devices cannot be reused after completion of a particular operation and are expensive in terms of the costs of the material used and the manufacturing process involved.

[0004] Consequently, there is a need for providing a filter device (kit) for a respiratory mask that can be easily and speedily produced at low costs and, nevertheless, provides reliable protection to the wearer of a mask equipped with the filter device against malicious microorganisms.

Description of the Invention

[0005] In order to address the above-mentioned need the present invention provides a filter device kit for a respiratory mask, comprising a) a base member comprising an inner surface and an outer surface, the outer surface comprising a first fastening means configured for fastening the filter device to the respiratory mask, b) a cap member comprising an inner surface and an outer surface and c) a filter material, in particular, a non-woven filter material. The base member and the cap member are configured to be detachably fastened to each other with the filter material positioned between the inner surface of the base member and the inner surface of the cap member. When attached to a respiratory mask the outer surface of the base member is in contact with the mask via the first fastening means.

[0006] Further, it is provided a filter device comprising such a filter device kit for a respiratory mask in an assembled state, wherein the base member and the cap member are detachably fastened to each other with the filter material positioned between the inner surface of the base member and the inner surface of the cap member.

[0007] The components of the filter device kit can be easily assembled and disassembled. The filter material can be removed after application and replaced by new similar filter material. Before re-usage of the filter device the components of the same can be easily cleaned/sterilized. The filter material can be a relatively inexpensive commonly available material that can be easily supplied. Particularly, the filter material may be free of activated carbon.

[0008] For example, the filter material comprises or consists of a multi-layer non-woven material. The separation efficiency may be properly adjusted by the selection of the material. According to an embodiment the non-woven material is a material designed for a conventional vacuum cleaner filter bag. Such material may comprise polymer fibers, for example, polypropylene and /or polyethylene fibers, for example. In this case, an outer layer of the non-woven material of the conventional vacuum cleaner filter bag material is directed towards the inner surface of the base member and an inner layer of the non-woven material of the conventional vacuum cleaner filter bag material is directed towards the inner surface of the cap member in the filter device that is ready for operation. The outer layer is a layer that would form the outer surface of a vacuum cleaner filter bag and the inner layer would form an inner surface of the vacuum cleaner filter bag, if the vacuum cleaner filter bag material was used for the formation of a vacuum cleaner filter bag. Thereby, noxious particles that might be formed in the inner layers of vacuum cleaner filter bags are prevented from entering the mask to which the filter device is attached in operation.

[0009] Particularly, the base member and the cap member may be formed as monolithic pieces. They may be made of a thermoplastic material, for example, by molding, particularly, injection molding or direct compression molding. Moldings made from plastic can be easily manufactured at relatively low costs. The thermoplastic material may be or comprise at least one of polypropylene, polyether ether ketone (PEEK), polyoxymethylene copolymer (POM-C), polyphenylensulfone (PPSU), polyamide (PA), polycarbonat (PC), polybuthylenterephthalat (PBT), polyethylenterephthalat each of which provides a high chemical and bacterial/viral resistance.

[0010] The inner and outer surfaces of the base and cap members as well as the filter material may exhibit substantially circular shapes.

[0011] According to an embodiment the first fastening means of the outer surface of the base member comprises an external thread, in particular, an external thread mating with an internal thread of the respiratory mask for which it is used. The threads facilitate secure fastening of the filter device to the respiratory mask. In particular, the filter device (kit) may be used for RD40 masks (in accordance with the standard EN 143) comprising RD40 screw threads (in accordance with the standard EN 148-1). Such masks are commonly available and the inventive filter device (kit) may be readily used as a (P3) filter device for such masks.

[0012] The base member and the cap member may be fastened to each other in different ways. According to an embodiment, the base member comprises a second fastening means and the cap member comprises a third fastening means, wherein the second fastening means and third fastening means provide latching functions (either radially or axially) and are configured for cooperatively forming a coupling. Such a coupling allows for easily and quickly assembling the base and cap members with the filter material arranged therebetween and disassembling the base and cap members. In particular, the coupling allows for fastening the base member and the cap member to each other without the need for any tools. The outer surface of the cap member may comprise handling means that allow a user to readily fasten and release the coupling.

[0013] Moreover, the coupling can provide haptic and acoustic feedback for the securing operation. Optical feedback may be given by markers formed on both the base member and the cap member and secure fastening of the base member and the cap member to each other may be indicated by the relative positions of such markers with respect to each other.

[0014] According to an alternative embodiment the base member and the cap member may be fastened to each other by means of screws with the filter material arranged therebetween. In this case, the base and cap members may comprise borings. At least the borings formed in one of the base member and the cap member may be provided with internal threads for accommodating the screws. A particularly secure fastening of the base member and the cap member to each other may be provided by means of the screws. According to an example the screws can be self-tapping screws. Further, counternuts may be provided for securing the screws.

[0015] In all of the above-described embodiments ribs may be formed on the inner surface of the base member and/or the inner surface of the cap member in order to facilitate the positioning of the filter material between the inner surfaces of the base and cap members and improving the filter efficiency of the filter material.

[0016] Moreover, the base member or the cap member may be formed at least partially from a transparent material in order to allow for verifying the accurate fitting of the filter material within the assembled base and cap members.

[0017] As already mentioned above, the filter device may be designed for multiple use. After each operation the filter material has to be replaced. The life time of the filter device is limited due to material wearing and reliable filtering can only be guaranteed for a particular number of operations. In order to log the number of previous operations the filter device may comprises some (mechanical) counter means for counting a number of usages. The counter means may comprise counter rods formed on the (outer surface of the) base member and/or cap member that can be broken away by user after completion of an operation. When no counter rod is left, the filter device has to be discarded, for example.

[0018] Furthermore, it is provided a respiratory mask system comprising a respiratory mask (half mask or full mask, particularly, comprising an RD40 thread for connection to a filter device) and a filter device according to one of the above-described embodiments that is connected to the respiratory mask via the first fastening means, particularly, via the external thread of the base member of the filter device mentioned above.

[0019] Further, it is provided a method of manufacturing a filter device for a respiratory mask comprising the steps of providing a base member, a cap member and a filter material, in particular, a non-woven filter material, arranging the filter material between an inner surface of the base member and an inner surface of the cap member and fastening the base member and cap member to each other. The named components, i.e., the base member, cap member and filter material, may show one or more of the above-mentioned properties.

[0020] Further features and exemplary embodiments as well as advantages of the present disclosure will be explained in detail with respect to the drawings. It is understood that the present disclosure should not be construed as being limited by the description of the following embodiments. It should furthermore be understood that some or all of the features described in the following may also be combined in alternative ways.

Figures 1a and 1b show an exemplary embodiment of a filter device (kit) in accordance with the present invention.

Figure 2 shows another exemplary embodiment of a filter device (kit) in accordance with the present invention.

[0021] The present invention provides a filter device kit and a filter device for use with a respiratory mask. The filter device kit can be easily assembled in order to obtain the filter device. The filter device kit and filter device include a filter material that can be commonly purchased. For example, the material is a non-woven material of the same kind that is used for the manufacturing of conventional vacuum cleaner filter bags. After operation the filter device can be opened

and the filter material can be replaced with another one. The provided filter device is suitable for application in hospitals. At a first use it can be even used in operating rooms. Other suitable applications relate to police actions, fire service actions, military actions, etc.

[0022] An exemplary embodiment of a filter device (kit) 100 for a respiratory mask is shown in Figures 1a and 1b. The filter device (kit) 100 comprises a base member 10, a circular filter material (layer) 20 and a cap member 30. Air can enter through the cap member 30, can be filter by the filter material 20 and enter a mask through the base member 10 that is attached to the mask. The base member 10 and the cap member 30 may be moldings made from a thermoplastic material and they may consist of or comprise polypropylene. The filter material 20 may consist of or comprise a non-woven material, in particular, a polymer material, and more particularly, a multi-layer non-woven/polymer material of the same kind that is used for the manufacturing of conventional vacuum cleaner filter bags. In principle, depending on the actual applications any non-woven material may be suitable that shows pore sizes that are small enough to block passage of microorganisms against that protection is sought through the filter material into the mask that is used in combination with the filter device. It is noted that usually there is some distribution of pore sizes in a non-woven material and the largest pores present have to be smaller than the diameter of the microorganism (for example, 60 to 140 nm) that has to be prevented from entering the mask. Experiments can be performed in order to find out whether a particular non-woven material is suitable for protection against a particular kind of microorganism or not. Separation efficiencies of 90 % or more may be achieved, for example.

[0023] For example, protection against the Covid 19 corona virus can be provided by selecting a non-woven material with pore sizes smaller than the diameter of this kind of virus. The filter material may be a MicroPor material as it is supplied by the Wolf PVG GmbH & Co. KG, for example. One particular example for the filter material is the material used for Melitta MicroPor plus vacuum cleaner filter bags. It is even envisaged that in particular emergency situations and/or a temporary severe shortage of filter material conventional non-woven vacuum cleaner filer bags are converted (by appropriate cutting) to a filter material usable for the inventive filter device.

[0024] It is noted that the vacuum cleaner filter bag material that may be used for the filter material 20 has to be positioned between the base member 10 and the cap member 30 such that the outer layer of the vacuum cleaner filter bag material (that would form the outer surface of a vacuum cleaner filter bag if used for that purpose) has to be directed towards the base member 10 and the inner layer of the vacuum cleaner filter bag material (that would form the inner surface of a vacuum cleaner filter bag if used for that purpose) has to be directed towards the cap member 30. In other words, in operation the outer layer of the vacuum cleaner filter bag material is positioned downstream of the inner layer of the vacuum cleaner filter bag material. Thereby, it can be prevented that noxious particles released from the inner layer, for example, glass fiber material, granulate material etc. comprised in the inner layer, is carried into the mask.

[0025] The base member 10 comprises an external thread 11 formed on an outer surface 12 of the same. The external thread 11 of the base member 10 may be configured to mate with a corresponding internal thread of a respiratory mask. Particularly, the internal thread of the respiratory mask can be an RD40 thread in accordance with the standard EN 143. On an inner surface 13 of the base member 10 ribs 14 are formed for facilitating the positioning and improving the filter efficiency of the filter material 20.

[0026] Furthermore, the base member 20 of the filter device (kit) 100 comprises fastening means 15 for secure attachment to the cap member 30. The fastening means 15 may cooperatively interact with corresponding fastening means 31 formed in the cap member 30 in order to provide a coupling. The fastening means 15 of the base member 20 and the corresponding fastening means 31 formed in the cap member 30 may (radially or axially) latch with each other for closure of the filter device 100. The cap member 30 shows an outer surface 32 and an inner surface 33. In the filter device 100 the filter material 20 is positioned between the inner surface 33 of the cap member 30 and the inner surface 13 of the base member 10. Ribs 34 are formed on the inner surface 33 of the cap member 30. In the embodiment shown in Figures 1a and 1b, the outer surface 32 of the cap member 30 comprises handling means 35 for facilitating the locking and releasing of the coupling. In fact, locking and releasing of the coupling can be achieved by an appropriate turning operation by the hand of a user without any need for additional tools. Locking and releasing of the coupling may be achieved by turning the cap member 30 by means of the grip-like handling means 35 by a 1/8 to 1/3 turn, for example, a 1/6 turn, in clockwise and anticlockwise direction, respectively.

[0027] In operation, air can enter the filter device 100 through an opening 36 formed in the cap member 30. The air flows through the filter material 20 and the filtered air enters a respiratory mask attached to the filter device 100 via the external thread 11 through a central opening 16 of the external thread 11 of the base member 10.

[0028] The base member 10 and/or the cap member 30 of the above-described filter device (kit) 100 may comprise a transparent portion or may be formed from a transparent material. Thereby, proper positioning of the filter material 20 can be verified.

[0029] The above-described filter device 100 may represent a particle filter, in particular, a P3 filter. It can be used multiple times. After one operation it can be opened, the filter material 20 can be replaced and, subsequently, the filter device 100 can be closed again (by means of the coupling) for another. Completion of the closing operation may be indicated acoustically by a click sound. Moreover, markers may be provided at the outer surfaces 12, 23 of the base

member 10 and the cap member 30 that indicate (by correspondences of the positions) secure closing.

[0030] It goes without saying that before replacement of the filter material the base member 10 and the cap member 30 have to be cleaned. Cleaning may be performed together with cleaning of a used respiratory mask within the same cleaning process. Depending on the materials chosen for the base member 10 and the cap member 30 and the actual application of the filter device appropriate physical and/or chemical cleaning can be performed. During an exemplary cleaning process, the base member 10 and the cap member 30 are subject to cleaning by a Sekusept cleaner®, for example, in a 0.1 to 1 % solution at a temperature of at most 65° C for a duration of about 15 minutes followed by some rinsing process. After the rinsing another cleaning process by means of Incidin Rapid ® may be performed, for example, in a 1.5 % solution at a temperature of at most 65° C for a duration of about 15 minutes followed by another rinsing process. Subsequently, the base member 10 and the cap member 30 are subject to a drying process, again, at a temperature of at most 65° C.

[0031] The overall number of operations is limited due to material wearing. In order to provide a user with information on the number of previously performed operations of the filter device 100 a counter means A may be formed somewhere on the outer surface 12 of the base member 10 and/or the outer surface 32 of the cap member 30 (see Figure 1b). The counter means A may comprise counter sticks configured to be broken away by a user. For example, up to ten counter sticks may be formed on or attached to the outer surface of the base member 10 of the filter device (kit) 100. After an operation of the filter device 100 a counter stick is broken away to indicate that an operation has been performed. When no counter stick is left the filter device has to be discarded/recycled.

[0032] Figure 2 illustrates another embodiment of a filter device (kit) 200 according to the present invention. The filter device (kit) 200 comprises a base member 210, a circular filter material (layer) 220 and a cap member 230. The same filter material as described with respect to the embodiment illustrated in Figures 1a and 1b can be used for the filter material 220. The same material as described with respect to the embodiment illustrated in Figures 1a and 1b can be used for the base member 210 and the cap member 230 of the filter device (kit) 200.

[0033] The base member 210 comprises an external thread 211 formed on an outer surface 212 of the same. The external thread 211 of the base member 210 may be configured to mate with a corresponding internal thread of a respiratory mask. Particularly, the internal thread of the respiratory mask can be an RD40 thread in accordance with the standard EN 143. On an inner surface 213 of the base member 210 ribs 214 are formed for facilitating the positioning and improving the filter efficiency of the filter material 220. In operation the ribs 214 may contact an outer layer/surface 221 of a conventional vacuum cleaner filter bag material that may be used for the filter material 220.

[0034] Furthermore, the base member 210 of the filter device (kit) 200 comprises borings for accommodating screws 240. Different from the embodiment illustrated in Figures 1a and 1b the embodiment shown in Figure 2 does not comprise a coupling. Rather, the base member 210 of the filter device (kit) 200 and the cap member 230 of the filter device (kit) 200 are fastened to each other by means of the screws 240 that allow for a very secure fastening. The screws 240 may be made of a metal or plastic material.

[0035] The cap member 230 comprises an outer surface 232 and an inner surface 233 and it may also comprise ribs (not shown in Figure 2) formed on the inner surface 233. In operation the ribs of the inner surface 233 of the cap member 230 may contact an inner layer/surface 221 of a conventional vacuum cleaner filter bag material that may be used for the filter material 220. The cap member 230 comprise through borings 231 through which the screws 240 can extend towards the borings 215 formed in the base member 210. The screws 240 can be fastened to the borings 215 formed in the base member 210 through the through the borings 231 formed in the cap member 230 by a means of any conventional screw driver tool.

[0036] In operation, air can enter the filter device 200 through an opening 234 formed in the cap member 230. The air flows through the filter material 220 and the filtered air enters a respiratory mask to which the filter device 200 is connected via the external thread 211 through a central opening 216 of the external thread 211 of the base member 210.

[0037] The base member 210 and/or the cap member 230 of the above-described filter device (kit) 200 may comprise a transparent portion or may be formed from a transparent material. Thereby, proper positioning of the filter material 220 can be verified.

[0038] The above-described filter device 200 may represent a particle filter, in particular, a P3 filter. It can be used multiple times. After one operation it can be opened by unlocking and removing the screws 240, the filter material 220 can be replaced and, subsequently, the filter device 200 can be closed again by inserting and locking the screws 240 for another operation. Cleaning may be performed before reuse as described above with reference to Figures 1a and 1b. The screws 240 may be cleaned during the same cleaning procedure performed for cleaning the base member 210 and the cap member 230. A similar counter means as counter means A described with reference to Figure 1b may be provided also for the filter device (kit) 200.

Claims

1. A filter device kit (100, 200) for a respiratory mask, comprising

   a base member (10, 210) comprising an inner surface and an outer surface, the outer surface comprising a first fastening means (11, 211) configured for fastening the filter device to the respiratory mask;
   a cap member (30, 230) comprising an inner surface and an outer surface; and
   a filter material (20, 220), in particular, a non-woven filter material (20, 220);
   and wherein
   the base member (10, 210) and the cap member (30, 230) are configured to be detachably fastened to each other with the filter material (20, 220) positioned between the inner surface of the base member (10, 210) and the inner surface of the cap member (30, 230).

2. A filter device (100, 200) comprising the filter device kit for a respiratory mask according to claim 1, wherein the base member (10, 210) and the cap member (30, 230) are detachably fastened to each other with the filter material (20, 220) positioned between the inner surface of the base member (10, 210) and the inner surface of the cap member (30, 230).

3. The filter device kit (100, 200) according to claim 1 or the filter device (100, 200) according to claim 2, wherein the first fastening means (11, 211) of the outer surface of the base member (10, 210) comprises an external thread, in particular, an external thread mating with an internal thread of the respiratory mask.

4. The filter device kit (100, 200) or the filter device (100, 200) according to claim 3, wherein the external thread is configured for mating with an internal RD 40 thread.

5. The filter device kit (100, 200) or the filter device (100, 200) according to one of the preceding claims, wherein the filter material (20, 220) comprises or consists of a multi-layer non-woven material.

6. The filter device kit (100, 200) or the filter device (100, 200) according to claim 5, wherein the non-woven material is a material designed for a conventional vacuum cleaner filter bag and wherein an outer layer of the non-woven material of the conventional vacuum cleaner filter bag is directed towards the inner surface of the base member (10, 210) and an inner layer of the non-woven material of the conventional vacuum cleaner filter bag is directed towards the inner surface of the cap member (30, 230).

7. The filter device kit (100, 200) or the filter device (100, 200) according to one of the preceding claims, wherein the base member (10, 210) and the cap member (30, 230) are made of or comprise a thermoplastic material, in particular, at least one of polypropylene, polyether ether ketone, polyoxymethylene copolymer, polyphenylensulfone, polyamide, polycarbonat, polybuthylenterephthalat, polyethylenterephthalat.

8. The filter device kit (100) or the filter device (100) according to one of the preceding claims, wherein the base member (10) comprises a second fastening means (15) and the cap member (30) comprises a third fastening (31) means, wherein the second fastening means (15) and third fastening means (31) are configured for cooperatively forming a coupling.

9. The filter device kit (100) or the filter device (100) according to claim 8, wherein the outer surface of the cap member (30) comprises handling means (35).

10. The filter device kit (200) or the filter device (200) according to one of the claims 1 to 8, wherein the base member (210) comprises first borings (215) and the cap member (30, 230) comprises second borings (231) and further comprising screws (240) for fastening the base member (210) to the cap member (230) via the first and second borings (215, 231).

11. The filter device kit (100, 200) or the filter device (100, 200) according to one of the preceding claims, wherein ribs (14, 214, 34) are formed on the inner surface of the base member (10, 210) and/or the inner surface of the cap member (30, 230).

12. The filter device kit (100, 200) or the filter device (100, 200) according to one of the preceding claims, wherein the base member (10, 210) or the cap member (30, 230) is formed at least partially from a transparent material.

13. The filter device kit (100, 200) or the filter device (100, 200) according to one of the preceding claims, further comprising counter means for counting a number of usages.

14. Respiratory mask system comprising a filter device (100, 200) according to claim 2 or one of the claims 3 to 13 in combination with claim 2 and a respiratory mask connected to the filter device (100, 200) via the first fastening means (11, 211).

15. A method of manufacturing a filter device (100, 200) for a respiratory mask, comprising the steps of

providing a base member (10, 210), a cap member (30, 230) and a filter material (20, 220), in particular, a non-woven filter material (20, 220);
arranging the filter material (20, 220) between an inner surface of the base member (10, 210) and an inner surface of the cap member (30, 230); and
fastening the base member (10, 210) and cap member (30, 230) to each other.

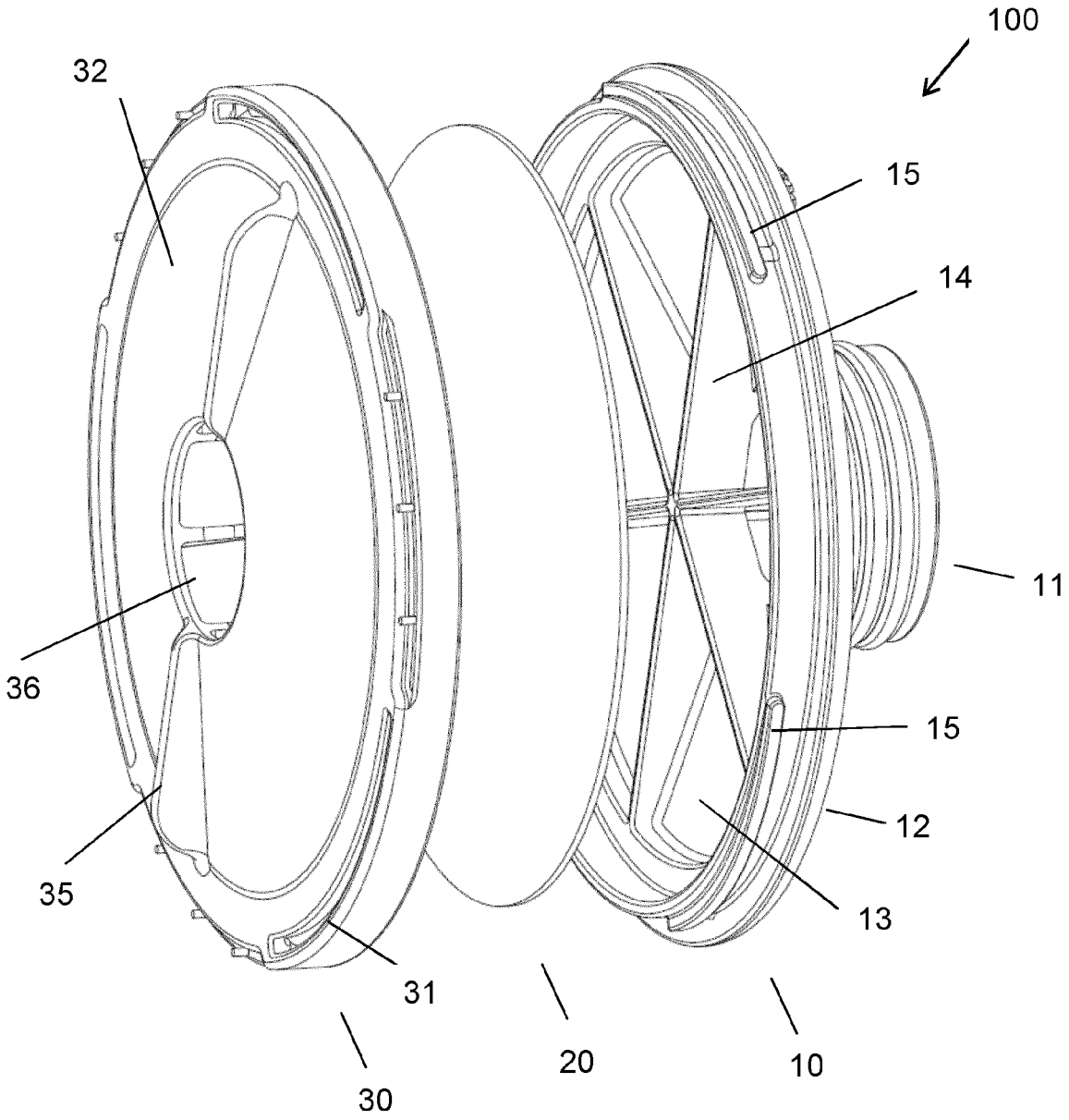

Fig. 1a

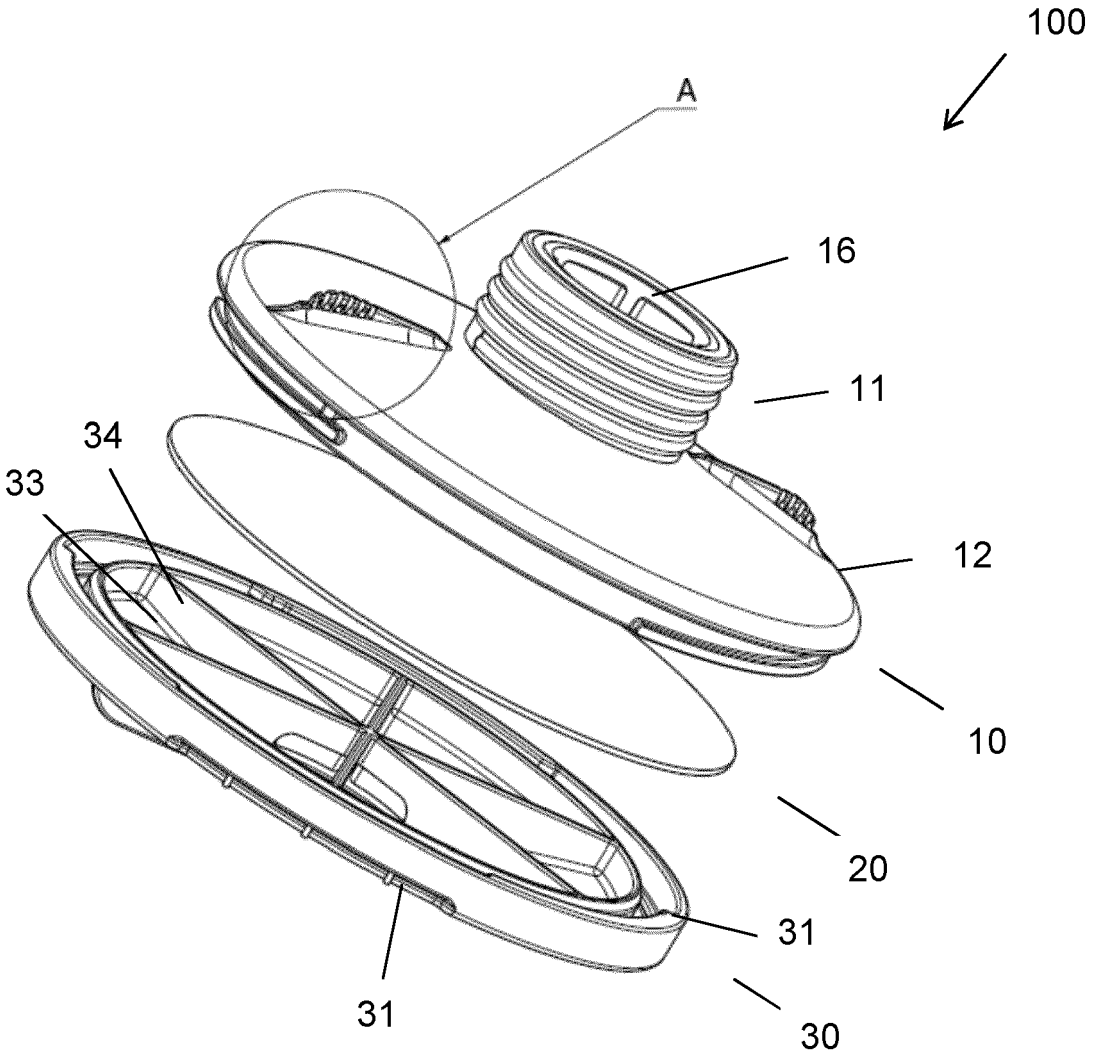

Fig. 1b

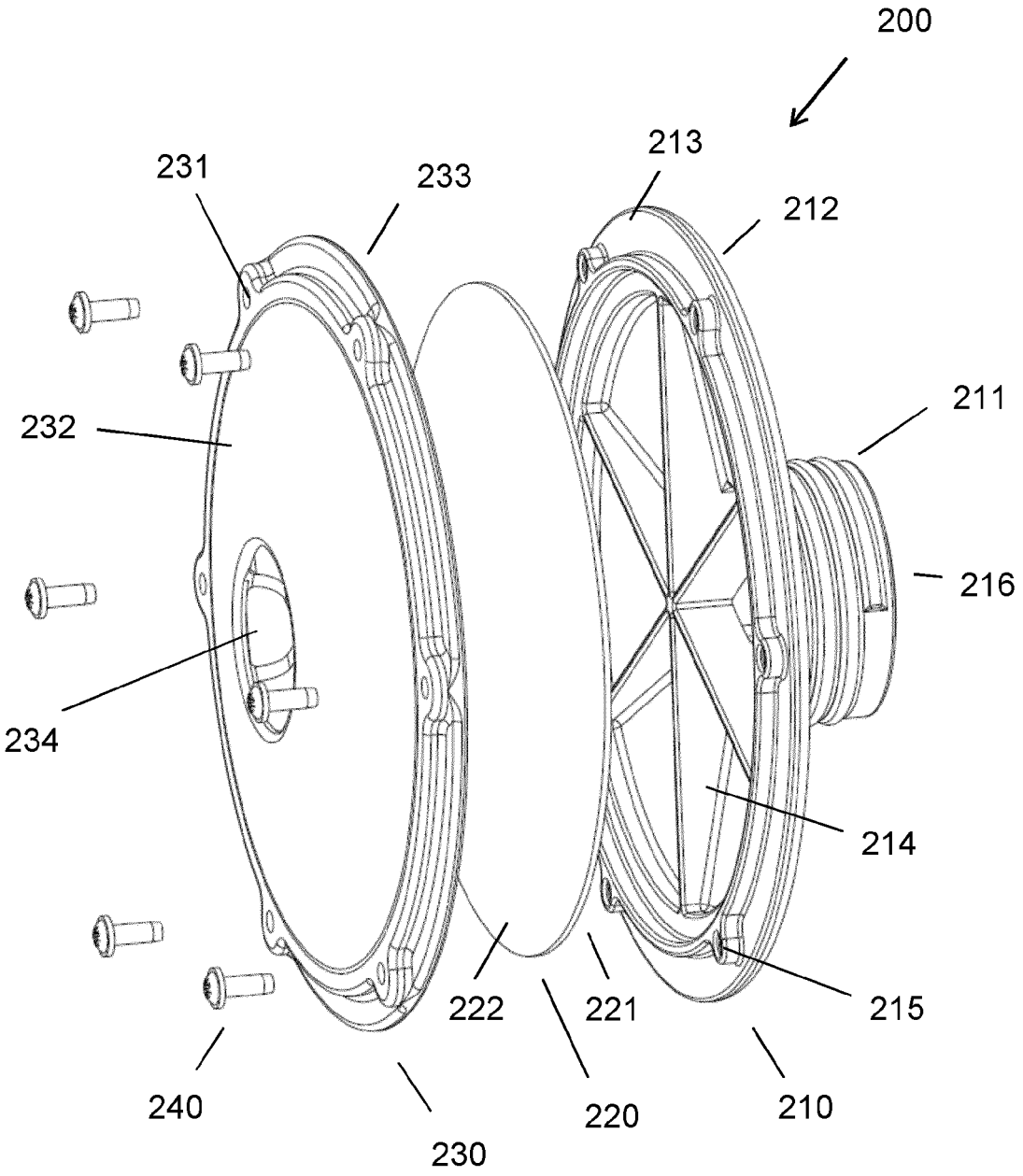
200
213
231
233
212
211
232
216
234
214
222
221
215
240
220
210
230

Fig. 2

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 20 17 1547

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2007/101990 A1 (HACKE GERHARD A [CA] ET AL) 10 May 2007 (2007-05-10) * figures 2,3 * * paragraph [0027] - paragraph [0030] * * paragraph [0034] - paragraph [0035] *	1-15	INV. A62B19/00 A62B23/02 A62B9/04
X	WO 2017/087353 A1 (3M INNOVATIVE PROPERTIES CO [US]) 26 May 2017 (2017-05-26) * claims * * figures 1-3 * * page 5, line 10 - line 30 * * page 13, line 28 - page 14, line 11 *	1-15	
X	US 2014/144110 A1 (WOOD PETER [CA] ET AL) 29 May 2014 (2014-05-29) * paragraph [0043] * * figures 1,2 *	1-15	
X	US 2015/314147 A1 (FLEMING RICHARD JAMES [GB] ET AL) 5 November 2015 (2015-11-05) * paragraph [0026] - paragraph [0032] * * figures *	1-15	TECHNICAL FIELDS SEARCHED (IPC) A62B
A	CN 105 615 049 B (LI BAI) 8 September 2017 (2017-09-08) * abstract *	13	
A	EP 3 124 083 A1 (XIAOMI INC [CN]) 1 February 2017 (2017-02-01) * claims *	13	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 September 2020	Cardin, Aurélie

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 17 1547

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-09-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007101990 A1	10-05-2007	CA 2567266 A1	09-05-2007
		US 2007101990 A1	10-05-2007
WO 2017087353 A1	26-05-2017	CN 108348791 A	31-07-2018
		EP 3377184 A1	26-09-2018
		JP 2018538042 A	27-12-2018
		KR 20180073705 A	02-07-2018
		US 2018353783 A1	13-12-2018
		WO 2017087353 A1	26-05-2017
US 2014144110 A1	29-05-2014	CA 2797323 A1	29-05-2014
		US 2014144110 A1	29-05-2014
US 2015314147 A1	05-11-2015	AU 2015255038 A1	27-10-2016
		BR 212016025436 U2	06-02-2018
		CN 206315375 U	11-07-2017
		EA 201691812 A1	30-06-2017
		EP 3137172 A1	08-03-2017
		GB 2526390 A	25-11-2015
		HK 1210979 A1	13-05-2016
		US 2015314147 A1	05-11-2015
		US 2017274227 A1	28-09-2017
		WO 2015166212 A1	05-11-2015
CN 105615049 B	08-09-2017	NONE	
EP 3124083 A1	01-02-2017	CN 105029769 A	11-11-2015
		EP 3124083 A1	01-02-2017
		JP 2017536525 A	07-12-2017
		KR 20170023781 A	06-03-2017
		US 2017028231 A1	02-02-2017
		WO 2017020510 A1	09-02-2017

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82