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- **Ericson, Scott**
Texarkana, TX 75503-9491 (US)
- **Tynes, Rodney W.**
Shrevport, LA 71118-4213 (US)
- **Perryman, Roy**
Nashville, TX 75569-2233 (US)
- **Ferguson, Christofer**
Wake Village, TX 75501-0267 (US)

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(71) Applicant: **Electrolux Home Products, Inc.**
Cleveland, Ohio 44135-0920 (US)

(74) Representative: **Svahn, Göran et al**
AB Electrolux
Group Intellectual Property
105 45 Stockholm (SE)

(72) Inventors:
• **Warfel, Paul A.**
Texarkana, TX 75503-0014 (US)

(54) **Exhaust gas muffler**

(57) The present invention includes a muffler for attachment to an engine that includes an inlet for receiving exhaust gases into the muffler, a catalyst assembly (123) located within the muffler, and a fastener tube (137,140) for fastening the muffler to the engine. A fastener tube cover (152) covers the fastener tube and includes an outlet for exiting exhaust gases. The outlet includes a directional louver (154) that directs the exiting exhaust gases. The fastener tube cover (152) can retain a spark arrestor (149) which maintains maximum spark particle size in the exiting exhaust gases.

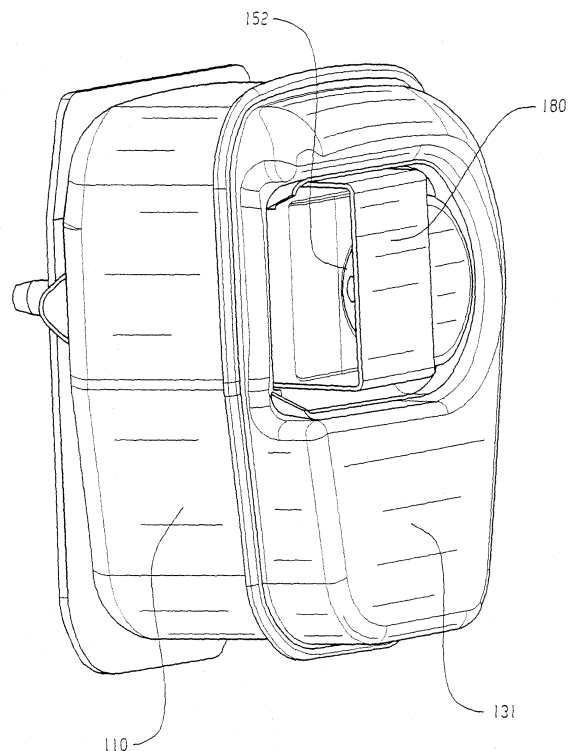


Fig. 4

Description

BACKGROUND OF THE INVENTION

[0001] The present invention is directed to an exhaust gas muffler for an engine and especially for engines used for portable tools such as a chain saw or the like.

[0002] Exhaust gas mufflers for internal combustion engines are well known for a long time, and have mainly been used for cars. For portable tools, such as chain saws, they have been available on the market to a small extent since the end of the 1980's. The exhaust gases are delivered to an exhaust gas muffler from an exhaust port of a cylinder. The exhaust gases are processed there and discharged out. Now it is known to utilize an oxidizing catalyst in order to reduce pollutants such as hydrocarbons, carbon monoxide, and the like. The invention can provide a front outlet catalyst muffler that combines parts to save parts, weight, and simplify the design.

BRIEF SUMMARY OF THE INVENTION

[0003] The present invention includes a muffler for attachment to an engine that includes an inlet for receiving exhaust gases into the muffler, a catalyst assembly located within the muffler, and a fastener tube for fastening the muffler to the engine. A fastener tube cover covers the fastener tube and includes an outlet for exiting exhaust gases. The outlet includes a directional louver that directs the exiting exhaust gases. The fastener tube cover can retain a spark arrestor, which maintains maximum spark particle size in the exiting exhaust gases.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] The invention can be understood with reference to the following drawings. The components in the drawings are not necessarily to scale. Also, in the drawings, like reference numerals designate corresponding parts throughout the several views.

Fig. 1 is an exploded view of an exhaust gas muffler; Fig. 2 is an exploded isometric view of an exhaust gas muffler; Fig. 3 is a detail view of a fastener tube cover; and Fig. 4 is an isometric view of an exhaust gas muffler with a cover.

DESCRIPTION OF AN EXAMPLE EMBODIMENT

[0005] A catalyst muffler with a front outlet design provides improvements over current catalyst mufflers for small gasoline powered engines. Referring to Fig. 1, shown is an exploded view of the muffler according to an embodiment of the present invention. Exhaust gas mixture travels through a cylinder port 102 of a back plate 101 and enters a diffuser 116 that is located within

a muffler body 110. A series of smaller openings in the diffuser 116 allow the exhaust gas to exit the diffuser to the area between the diffuser and a catalyst assembly 123. The exhaust gas then passes through a catalyst screen 122 of the catalyst assembly 123. Precious metal (s) (PM) trapped on the surface of the catalyst screen 122 come in contact with the exhaust gas. The interaction with the PM converts approximately 10 g/hp-h of HC and NO_x to other gases. The catalyst screen 122 is captured between the edges of a first catalyst bulkhead 119 and a second catalyst bulkhead 125 to allow the greatest surface contact with the exhaust gas while transferring the least amount of thermal energy back to the muffler body 110. The PM amount can be varied to get different conversion rates. A crimping operation is used to connect the bulkheads 119, 125 to the screen 122 and allow for thermal expansion.

[0006] Referring next to Fig. 2, shown is an isometric view of an exhaust gas muffler that shows a portion of the pathway that the exhaust gas takes. After passing through the catalyst assembly 123 (see Fig. 1), the exhaust gas is in a muffler shell 170. A muffler cover 131 and the muffler body 110 combine to form the muffler shell 170. From the muffler shell 170, the exhaust gas exits thorough exhaust ports, such as a first exhaust port 161 and a second exhaust port 162, in the muffler cover 131. In the current embodiment, these exhaust ports are located in a pocket 175. The pocket 175 also contains a first fastener entrance port 138 (Fig. 1) of a first fastener tube 137 and a second fastener entrance port 141 (Fig. 1) of a second fastener tube 140. This pocket 175 allows for a volume as the exhaust gas exits the muffler shell 170 and passes through the spark arrestor 149. Once the exhaust gas passes through the spark arrestor 149, the exhaust gas enters a volume defined by a fastener tube cover 152. This is the space between the muffler cover 131 and the fastener tube cover 152.

[0007] The fastener tube cover 152 is designed to control direction and diffuse the exhaust gas as it leaves the muffler. This yields a lower plane temperature that is within the parameters set forth within SAE J335, which is a standard established by the USDA for the Society of Automotive Engineers to prevent forest fires. The fastener tube cover's 152 effectiveness is enhanced by the size of an outlet 155 of the fastener tube cover 152, the deflection plate 158 in the center of the outlet 155, the slope of the fastener tube cover 152, and by a flush surface created by the fastener tube cover 152 and the muffler cover 131. In addition, the fastener tube cover 152 comprises a directional louver 154 that helps direct exiting exhaust gases. All of these features cause the gases exhausted from the outlet 155 to cling to the fastener tube cover 152 and limit the temperature of the gases exhausted through the outlet 155.

[0008] Referring back to Fig. 1, shown is a first fastener tube 137 and a second faster tube 140 that are used to fasten the muffler to the engine in the current embodiment. Each fastener tube has a fastener en-

trance port, such as 138 and 141, for facing away from the engine and a fastener exit port, such as 139 and 142, for facing towards the engine. A first fastener 143 is threaded through the first fastener tube 137 then fastened to the engine. Likewise, a second fastener 146 is threaded through the second fastener tube 140 then fastened to the engine. In the current embodiment, the fasteners are bolts. However, other fastening devices, such as screws, could be used in the alternative to attach the muffler to the engine.

[0009] Mufflers mounted directly to small engines can loosen over time due to the inherent engine vibration and the contracting and expansion of the metal muffler components due to the heat cycling. One method to address this problem is to use flanged tubes, such as the first fastener tube 137 and the second fastener tube 140. These flanged tubes significantly reduce the amount of metal compressed under the mounting fasteners, such as the first fastener 143 and the second fastener 146. The fastener tubes also shield the fasteners from the exhaust gases in the diffuser 116. Another use for the fastener tubes is to significantly reduce the mounting fastener exposure to the catalyst heat. Additionally, the fastener tubes can be used to clamp the muffler body 110 to the muffler cover 131.

[0010] However, when using fastener tubes, a problem exists. The fastener tubes provide receptacles for debris such as sawdust to collect. Such collected debris can be problematic, accordingly, a cover, such as the fastener tube cover 152, is used to prevent debris from entering the fastener tubes. In the current invention, in addition to preventing debris from entering the fastener tubes, the fastener tube cover 152 can be used to hold a spark arrestor 149 in place, and to serve as an exhaust gas outlet. These multiple uses reduce the amount of components necessary to create a muffler. This eases assembly and lowers cost. Also, in the current embodiment, the location of the fastener tube cover 152 on the front of the muffler allows for easier servicing of the spark arrestor 149.

[0011] Referring to Fig. 3, shown is the fastener tube cover 152. There is an outlet 155 that is part of the fastener tube cover 152. In the current embodiment, the outlet 155 has a deflection plate 158 in the center of the outlet 155. However, in the alternative, the deflection plate 158 could be off-center. The fastener tube cover 152 also comprises a directional louver 154 that helps direct exiting exhaust gases. As can be seen in Fig. 3, the fastener tube cover 152 is sloped. This design creates a flush surface between the fastener tube cover 152 and the muffler cover 131 (see Fig. 1). These features of the fastener tube cover 152 cause the gases exhausted from the outlet 155 to cling to the fastener tube cover 152.

[0012] Referring next to Fig. 4, shown is a cover 180 that could be added over the outlet 155 (Fig. 1) of the fastener tube cover 152 for increased exhaust gas directional control and to serve as additional protection

from the exhaust heat. The cover 180 could be part of the fastener tube cover 152 or a separate part. If the cover 180 is a separate part, the cover 180 could be retained by the same fastener, such as the weld stud 134 (Fig. 1), used to retain the fastener tube cover 152.

[0013] Focusing for the moment on Fig. 1, the backplate 101 is attached to a cylinder portion of the engine. An opening 103 in the backplate 101 allows part of the cylinder to contact the muffler body 110 to help prevent the muffler from picking up a resonate vibration and loosening the fasteners that hold the muffler to the engine. As mentioned previously, the cylinder port 102 of the backplate 101 allows the exhaust gas to travel from the engine to the muffler body 110. Between the backplate 101 and the muffler body 110 is a gasket 107 which ensures proper sealing. A first doubler 113 is located between the muffler body 110 and the diffuser 116 to allow a better seal. On the other side, a second doubler 128 is located between the catalyst assembly 123 and the muffler cover 131 to serve as a thermal barrier. The diffuser 116 is located inside the catalyst assembly 123 which is located within the muffler body 110.

[0014] The diffuser 116 serves as a first chamber in the muffler and channels the exhaust gases inside the catalyst assembly 123 where the exhaust gases are directed to the catalyst screen 122 by holes and slots in the diffuser 116. This gives more uniform exhaust gas distribution, which ensures that the entire catalyst screen 122 is used to the best of its potential. The diffuser 116 also can serve as a spacer inside the muffler to prevent the muffler body 110 and the muffler cover 131 from collapsing. Once the exhaust gas leaves the diffuser 116, the exhaust gas enters the surrounding catalyst assembly 123.

[0015] The catalyst assembly 123 comprises a first catalyst bulkhead 119, a second catalyst bulkhead 125 and a catalyst screen 122. A flat catalyst screen 122 is formed around a round mandrel and crimped in the edges of the catalyst bulkheads to form the catalyst assembly 123. This shape allows the greatest surface contact with the exhaust gas while transferring the least amount of thermal energy back to the muffler. In the current embodiment, a stainless steel wire cloth is coated with the PM to form the catalyst screen 122.

[0016] After passing through the catalyst assembly 123, the exhaust gas is in the muffler shell 170 (see Fig. 2). From the muffler shell 170, the exhaust gas exits through exhaust ports that are located in the muffler cover 131. Before leaving the muffler through the outlet 155 of the fastener tube cover 152, the exhaust gas must pass through a spark arrestor 149. In the current embodiment, the spark arrestor 149 is located between the muffler cover 131 and the fastener tube cover 152. The spark arrestor 149 is required to meet maximum spark particle size in the exiting exhaust gas as required by SAE J335. There is a first hole 153 in the fastener tube cover. There is a second hole 150 in the spark arrestor 149. An attacher can fasten the spark arrestor 149 and

the fastener tube cover 152 to the muffler. In the current embodiment, a weld stud 134 combined with a nut (not shown) can serve as the attacher. The weld stud 134 can thread through the second hole 150 and the first hole 153. The nut is threadingly engaged with the weld stud 134 to hold the spark arrestor 149 and the fastener tube cover 152 in place. However, alternative suitable attacher devices could be used to fasten the fastening opening cover 152 and spark arrestor 149 to the muffler. [0017] Although the invention is shown and described with respect to certain preferred embodiments, it is obvious that equivalents and modifications will occur to others skilled in the art upon the reading and understanding of the specification. The present invention includes all such equivalents and modifications, and is limited only by the scope of the claims.

Claims

1. A muffler for attachment to an engine comprising:

a fastener tube for fastening the muffler to the engine;
 a fastener entrance port of the fastener tube;
 a fastener exit port of the fastener tube;
 the fastener entrance port of the fastener tube for facing away from the engine;
 the fastener exit port of the fastener tube for facing the engine;
 a fastener tube cover covering the fastener entrance port of the fastener tube; and
 the fastener tube cover comprises an outlet for exiting exhaust gases.

2. The muffler for attachment to an engine of claim 1 wherein the outlet has a directional louver that directs exiting exhaust gases.

3. The muffler for attachment to an engine of claim 1 wherein the outlet comprises a deflection plate.

4. The muffler for attachment to an engine of claim 1 wherein the outlet comprises a hood.

4. The muffler for attachment to an engine of claim 1 wherein the fastener tube cover can retain a spark arrestor which maintains maximum spark particle size in the exiting exhaust gases.

6. The muffler for attachment to an engine of claim 1 further comprising an exhaust port and the exhaust port is on a common side with the fastener entrance port.

7. The muffler for attachment to an engine of claim 6 wherein the exhaust port and the fastener entrance port face away from the engine.

8. The muffler for attachment to an engine of claim 6 wherein the exhaust port and the fastener entrance port are on a common surface of the common side.

9. The muffler for attachment to an engine of claim 6 wherein the exhaust port and the fastener entrance port are on a non-coplanar surface.

10. A muffler comprising:

an attacher;
 a fastener tube cover;
 a spark arrestor;
 the attacher retains the fastener tube cover; and
 the attacher retains the spark arrestor.

11. The muffler of claim 10 wherein the fastener tube cover comprises an outlet for exiting exhaust gases.

12. A muffler comprising:

a fastener tube cover for covering a fastener tube;
 the fastener tube cover further comprises an outlet for exhaust gases to exit through; and
 the outlet has a directional louver that directs the exiting exhaust gases.

13. The muffler of claim 12 wherein the outlet further comprises a deflection plate.

14. The muffler of claim 12 wherein the outlet further comprises a hood.

15. A muffler for attachment to an engine comprising:

an inlet for receiving exhaust gases into the muffler;
 a catalyst assembly located in the muffler;
 a fastener tube for fastening the muffler to the engine;
 a fastener entrance port of the fastener tube;
 a fastener exit port of the fastener tube;
 the fastener entrance port of the fastener tube for facing away from the engine;
 the fastener exit port of the fastener tube for facing the engine
 a fastener tube cover covering the fastener entrance port of the fastener tube;
 the fastener tube cover further comprises an outlet for exit of the exhaust gases from the muffler;
 the fastener tube cover and the fastener entrance port of the fastener tube are on a com-

mon side; and
the outlet has a directional louver that directs
the exiting exhaust gases into a desired direc-
tion.

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16. The muffler for attachment to an engine of claim
15 wherein the fastener tube cover can retain a
spark arrestor which maintains maximum spark par-
ticle size in the exiting exhaust gases.

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17. The muffler for attachment to an engine of claim
15 further comprising an exhaust port and the ex-
haust port is on a common side with the fastener
entrance port.

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18. The muffler for attachment to an engine of claim
15 wherein the outlet comprises a hood.

19. The muffler for attachment to an engine of claim
18 wherein the hood is removable from the fastener
tube cover. 20

20. A fastener tube cover for a fastener tube of a
muffler having an exhaust port, the fastener tube
cover comprising: 25

a fastener tube cover for covering the fastener
tube;
an outlet in the fastener tube cover for exiting
exhaust gases; and 30

the outlet comprises a directional louver for direct-
ing exiting exhaust gases into a desired direction.

21. The fastener tube cover for a fastener tube of a 35
muffler having an exhaust port of claim 20 wherein
the fastener tube cover can retain a spark arrestor.

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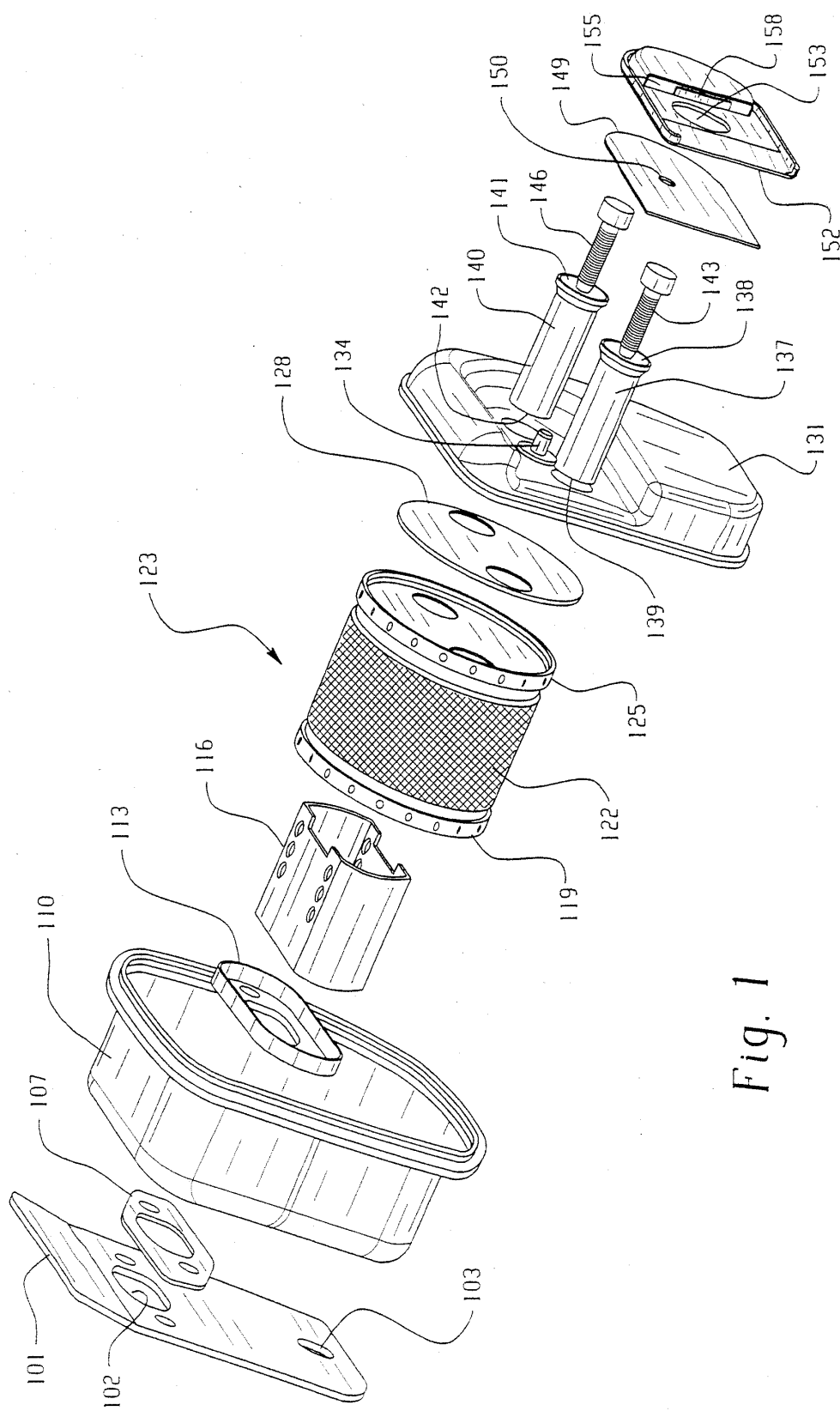


Fig. 1

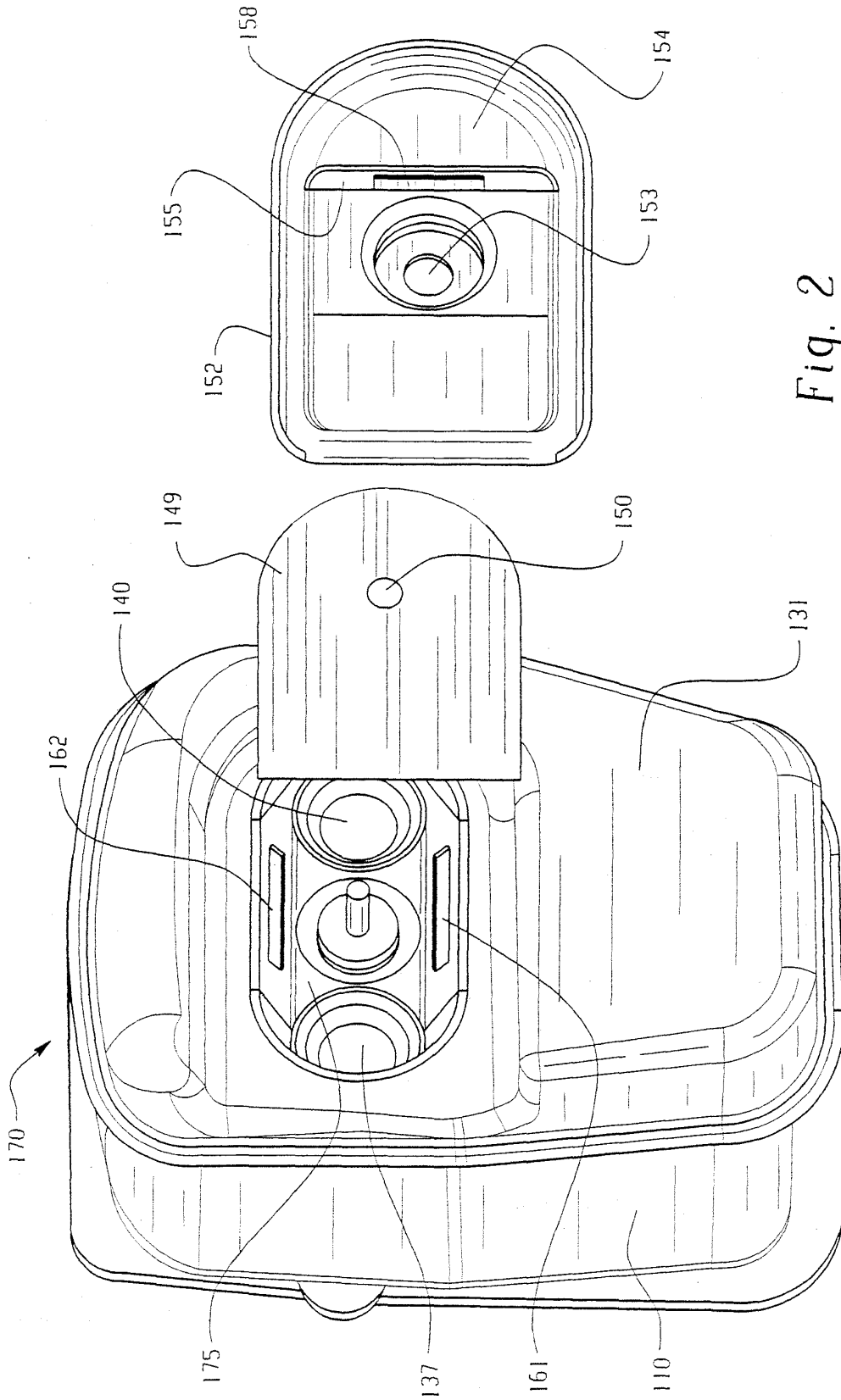


Fig. 2

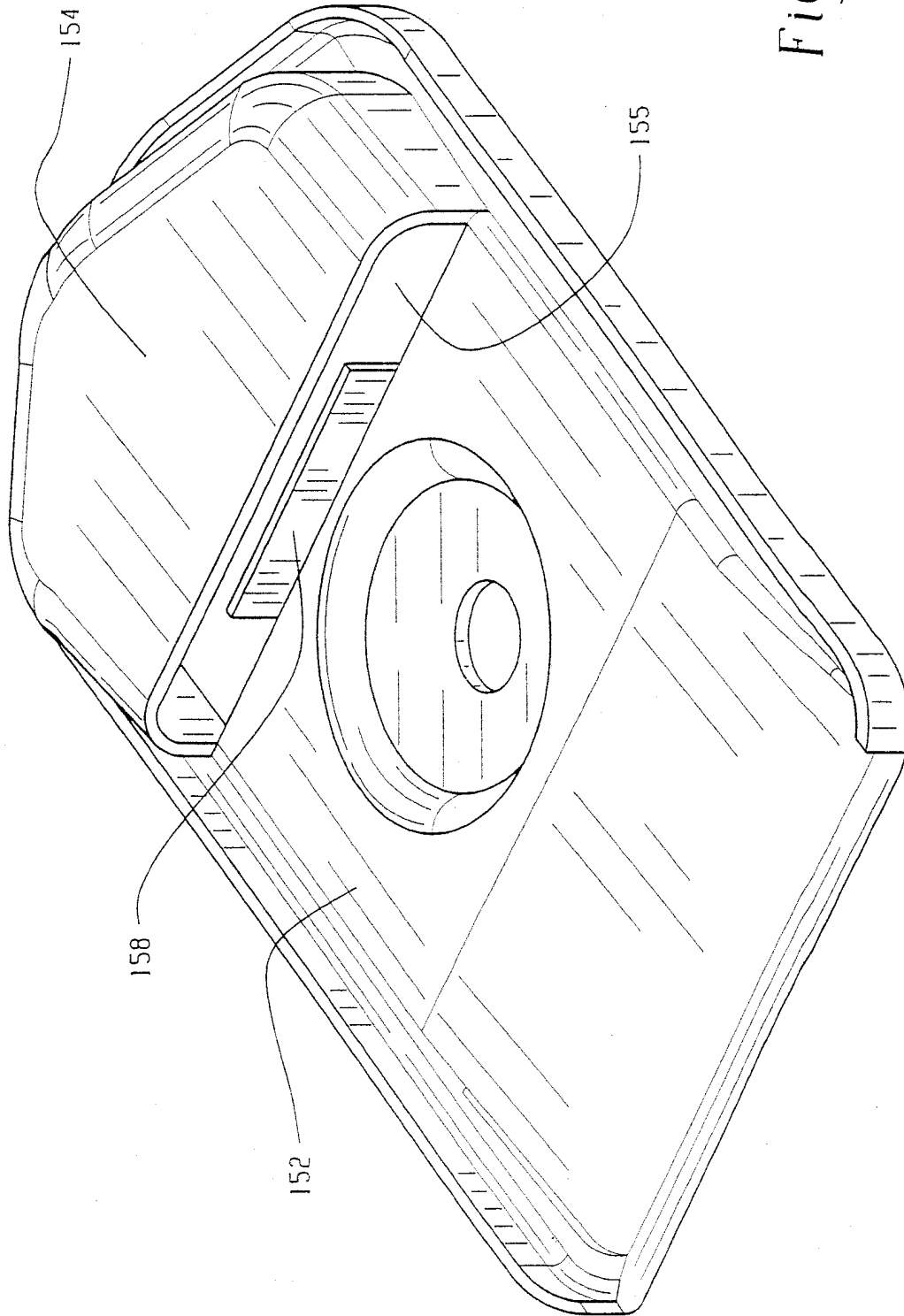


Fig. 3

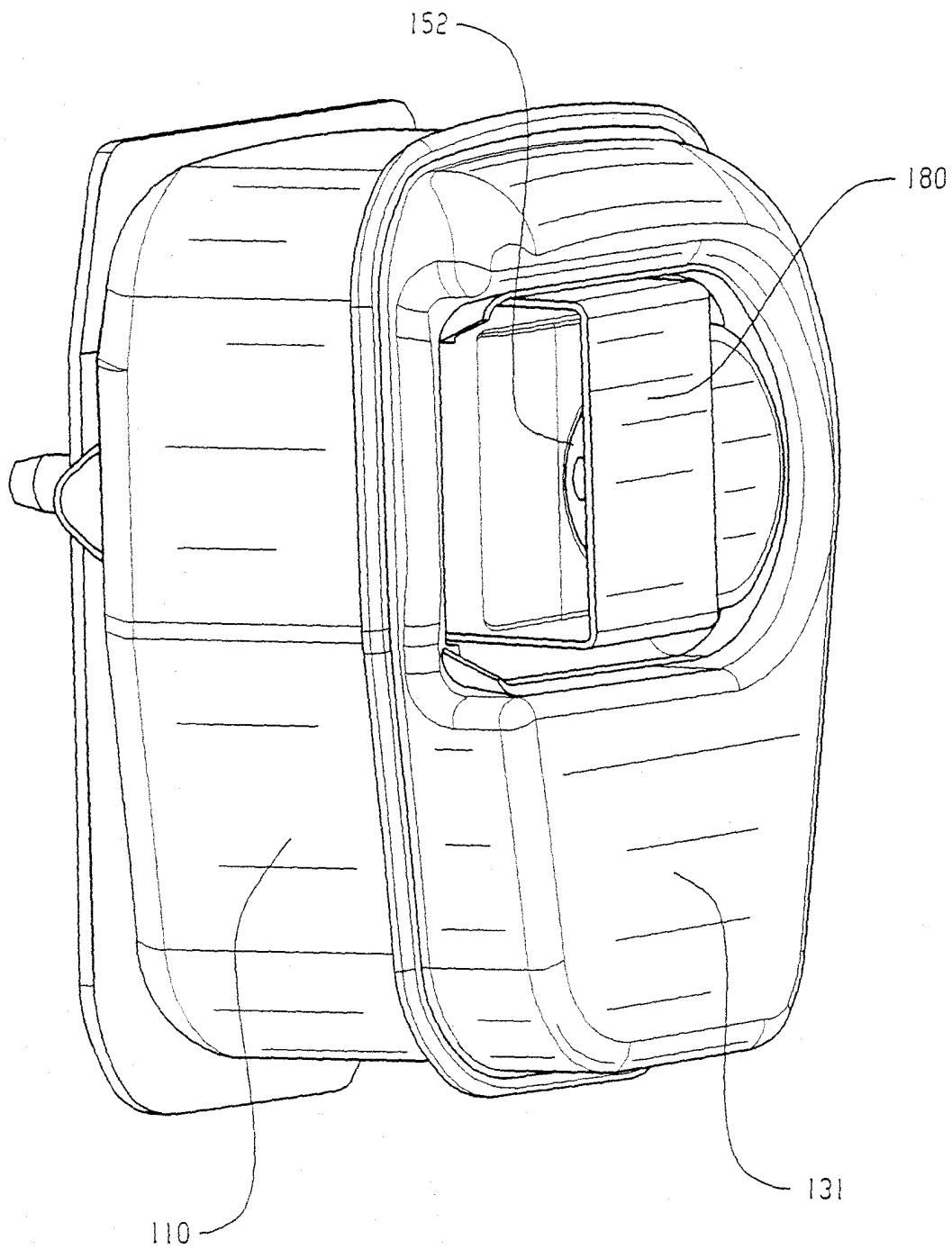


Fig. 4



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Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 44 5034

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Place of search Munich		Date of completion of the search 15 July 2005	Examiner Tatus, W
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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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
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