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

(11) EP 1 496 309 A2

# (12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
**12.01.2005 Bulletin 2005/02**

(51) Int Cl.[7]: **F23D 14/02**, F23D 14/70, F23D 14/46

(21) Application number: **04253731.6**

(22) Date of filing: **22.06.2004**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PL PT RO SE SI SK TR**
Designated Extension States:
**AL HR LT LV MK**

(30) Priority: **08.07.2003 GB 0315891**

(71) Applicant: **Aeromatix Limited**
**Beverley, East Yorkshire HU17 9BZ (GB)**

(72) Inventor: **Parsons, Robert William Tanner**
**Belper, Derbyshire DE56 OHT (GB)**

(74) Representative: **Watkins, Rosalind Philippa**
**Swindell & Pearson**
**48 Friar Gate**
**Derby DE1 1GY (GB)**

## (54) Gas Burner

(57) A gas burner (22) for use with a cylindrical heat exchanger having a substantially circular inlet aperture includes a circular burner head (24) having a circular entry side face (26) and an opposite circular exit side face (28), the burner head (24) being made of a ceramic material through which a gas and air mixture may pass from the entry side face (26) to the exit side face (28). The gas burner (22) includes means for introducing a gas and air mixture to the entry side face (26) of the burner head (24) so that the mixture may pass through the burner head (24) and burn on exiting from the exit side face (26) of the burner head (24). The gas burner (22) further includes a baffle plate (36) having a plurality of orifices (37) and is locatable on the entry side face (26) of the burner head (24). The gas burner (24) also includes a body member (40) which includes means for connecting the burner head (24) and the baffle plate (36) to the cylindrical heat exchanger over the inlet aperture.

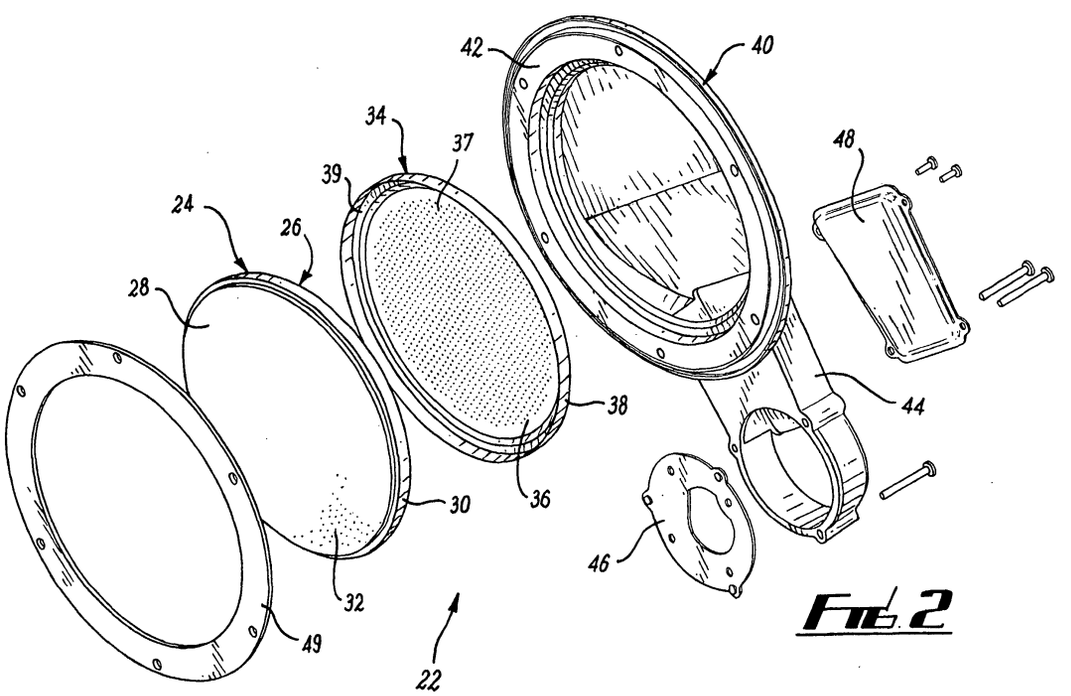



FIG. 2

EP 1 496 309 A2

## Description

**[0001]** The invention relates to a gas burner and particularly but not exclusively to a gas burner for use in a domestic heating appliance. The burner may be of the "premix" type, meaning that all the air required for complete combustion is mixed with the fuel gas prior to burning.

**[0002]** A conventional domestic heating boiler includes a flat, rectangular gas burner positioned below a flat, rectangular heat exchanger, the distance between the burner and the heat exchanger being sufficient to ensure that the combustion process is complete before the products of combustion are cooled by the heat exchanger. This configuration results in unwanted heat losses through the boundaries of this combustion space, unless these boundaries are water cooled as part of the heat exchanger.

**[0003]** An improvement of the above arrangement has been provided by using a cylindrical burner positioned axially within a cylindrical heat exchanger including hollow coils, carrying water. This eliminates many of the above losses, although some heat loss does occur at the circular ends of the cylindrical combustion space. Conventional burners for the above arrangement include a cylindrical wall defining a central cavity for receiving the gas and air mixture. The cylindrical wall surrounding the cavity is provided with through holes which act as flame ports through which the gas and air mixture may pass for combustion. Such a burner would conventionally be made of metal, usually stainless steel. The burner would be mounted on a die cast front plate and connected to a fan via a two piece die cast inlet duct.

**[0004]** According to the invention there is provided a gas burner adapted for use with a cylindrical heat exchanger having a substantially circular inlet aperture, the burner including:

a circular burner head including a circular entry side face and an opposite circular exit side face, the burner head being made of a ceramic material through which a gas and air mixture may pass from the entry side face to the exit side face;
means for introducing a gas and air mixture to the entry side face of the burner head so that the mixture may pass through the burner head and burn on exiting from the exit side face of the burner head;
a baffle plate for location on the entry side face of the burner head, the baffle plate including a plurality of orifices passing therethrough; and
a body member including means for connecting the burner head and the baffle plate to the cylindrical heat exchanger, over the inlet aperture.

**[0005]** The ceramic burner head preferably includes a planar circular entry side face and a planar circular exit side face. The thickness of the burner head may be between 10mm and 30mm and is preferably between 10mm and 15mm. Preferably the burner head is shaped and sized to substantially close the inlet aperture of the heat exchanger. The burner head preferably includes a plurality of apertures extending from the entry side face to the exit side face, the gas and air mixture being able to pass through the apertures. The apertures are preferably between 0.5mm and 1.5mm in diameter and spaced about 2 to 3mm apart.

**[0006]** The baffle plate is preferably generally planar and circular and the orifices may be between 1 mm and 2mm in diameter. The baffle plate may be spaced between 1 mm and 3mm from the entry side face of the burner head.

**[0007]** The body member may include a generally circular closure part, which preferably includes a rim portion around its perimeter, for connecting to a rim portion around the perimeter of the circular inlet of the heat exchanger. The gas burner may further include a ring shaped gasket for positioning between the respective rims of the body member and the inlet of the heat exchanger.

**[0008]** The means for introducing the gas and air mixture to the burner head may include an elongate inlet duct, which preferably forms part of the body member. Preferably the closure part and the inlet duct of the body member are formed as a single unitary component. The body member may be die cast.

**[0009]** The burner may further include a closure plate for closing a back of the inlet duct.

**[0010]** According to the invention, there is further provided a cylindrical heat exchanger having a circular inlet aperture and including a burner according to any of the preceding definitions, the burner being located so as to substantially close the inlet duct.

**[0011]** An embodiment of the invention will be described for the purpose of illustration only with reference to the accompanying drawings in which:

Fig. 1 is a diagrammatic sketch of a cylindrical heat exchanger for a domestic gas boiler;

Fig. 2 is a diagrammatic exploded view of a gas burner according to an embodiment of the invention; and

Fig. 3 is a diagrammatic end view of the gas burner of Fig. 2.

**[0012]** Referring to Fig. 1, a heat exchanger 10 is generally cylindrical, including a plurality of coils 12. The coils may be of cylindrical or oval cross section and carry water which absorbs heat from a combustion chamber 14 located within the cylinder defined by the coils.

**[0013]** The combustion chamber 14 is conventionally heated by means of a gas burner including a cylindrical stainless steel burner head 16 which locates within the combustion chamber 14, concentric with and spaced from the coils 12. A circular inlet 18 of the heat exchang-

er 10 is closed by a metallic burner mounting plate (not illustrated). Heat losses can occur through the burner mounting plate, which can also become excessively hot.

**[0014]** Referring to Figs. 2 and 3, there is illustrated a gas burner 22 according to one embodiment of the invention. The gas burner 22 does not fit inside the cylindrical combustion chamber 14, but rather fits over the circular inlet 18.

**[0015]** The gas burner 22 includes a burner head 24 which is circular in plan view, as viewed in the axial direction of the heat exchanger in use. The burner head 24 has a planar circular entry side face 26 and a planar circular exit side face 28. A cylindrical edge 30 joins the two faces 26 and 28. The burner head 24 is made of a ceramic material, and is provided with a plurality of orifices 32 which act as flame ports (just a few of which are shown in Fig. 2). The flame ports extend through the burner head 24 from the entry side face 26 to the exit side face 28. The diameter of the flame ports 32 is around 1.2mm and they are spaced about 2 to 3mm apart.

**[0016]** Located adjacent to the entry side face 26 of the burner head 24 is a baffle member 34. The baffle member 34 includes a generally circular planar baffle plate 36 and a cylindrical lip 38 which stands out of the plane of the baffle plate 36 and extends from its perimeter at right angles to the baffle plate. The lip 38 fits around the cylindrical edge 30 of the burner head 24. The lip 38 is provided with a small shoulder 39 on which the burner head 24 locates, this resulting in the entry side face 26 of the burner head 24 being spaced a small distance from the baffle plate 36. For example, the distance may be between 1 and 3mm.

**[0017]** The baffle plate 36 is provided with a plurality of holes 37 passing therethrough. The holes have a diameter of about 1-3mm and are located about 4mm to 6mm apart.

**[0018]** The gas burner 22 further includes a body member 40 which includes a generally circular closure part 41 having a generally cylindrical rim 42 at its outer perimeter. The body member 40 further includes an inlet duct 44 communicating with the closure part 41, for connecting to a fan (not shown) via a fan mounting plate 46. The fan mounting features may be rotated to accommodate different angular orientations of the burner. The body member 40 is a unitary component which may be die cast. A small closure plate 48 is provided for closing an outer side of the duct 44.

**[0019]** The gas burner 22 further includes a ring shaped gasket 49, of a resilient material.

**[0020]** In use, the rim 42 of the body member 40 is affixed by screws or other fixing means to a complementary shaped rim 50 defined around a perimeter of the circular inlet 18 of the combustion chamber 14 (see Fig. 1). The gasket 49 locates between the respective rims, ensuring an airtight seal. The burner head 24 and the baffle member 34 are accommodated within the closure part 41 of the body member 40, thereby closing the circular inlet 18. The baffle plate 36 in this position is parallel to and spaced slightly from the entry side face 26 of the burner head 24.

**[0021]** In use, a premix of gas and air is forced by the fan through the inlet duct 44 of the body member 40, through the holes 37 in the baffle plate 36 and then through the flame ports 32 in the burner head 24, to burn on exiting the exit side face 28 of the burner head 24. The holes 37 in the baffle plate 36 create regions of different pressures of the gas and air mixture at the entry side face 26 of the burner head 24. The high pressure regions result in the establishment of main flames, while the low pressure regions establish smaller flames which retain the main flames on the burner.

**[0022]** The ceramic burner head 24 can tolerate temperatures of up to around 1200°C as compared to abut 600°C for conventional stainless steels. This means that combustion can occur in a richer condition and without damage to the burner. This provides greater versatility for the burner.

**[0023]** Further, because the circular burner head 24 entirely occupies the circular inlet of the heat exchanger, and because of the low thermal conductivity of ceramics, the very high combustion temperatures can be contained. This prevents the heating of adjacent components with the associated safety and efficiency implications. This helps to achieve the levels of efficiency necessary for modern "condensing" boilers.

**[0024]** Ceramics also have very low thermal expansion coefficient as compared to stainless steel and this avoids the high fatigue stresses which can be associated with the cyclic operation of steel burners.

**[0025]** Surprisingly, the inventors have realised that the circular burner head described above is at least as efficient as a cylindrical burner, when used with a cylindrical heat exchanger. Further, a single design of cylindrical burner is able to meet the heat input requirements of a range of different domestic boilers. Many cylindrical heat exchangers are modular, with additional coils being added as the heat output requirement increases, and the prior art cylindrical burners are required to be of different lengths as appropriate.

**[0026]** Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

## Claims

1. A gas burner (22) adapted for use with a cylindrical heat exchanger (10) having a substantially circular inlet aperture (18), the burner (22) including:

a circular burner head (24) including a circular entry side face (26) and an opposite circular exit side face (28), the burner head (24) being made of a ceramic material through which a gas and air mixture may pass from the entry side face (26) to the exit side face (28);
means for introducing a gas and air mixture to the entry side face (26) of the burner head (24) so that the mixture may pass through the burner head (24) and burn on exiting from the exit side face (28) of the burner head (24);
a baffle plate (36) for location on the entry side face (26) of the burner head (24), the baffle plate (26) including a plurality of orifices (37) passing therethrough; and
a body member (40) including means for connecting the burner head (24) and the baffle plate (36) to the cylindrical heat exchanger (10), over the inlet aperture (18).

**2.** A gas burner according to claim 1, wherein the ceramic burner head (24) includes a planar circular entry side face (26) and a planar circular exit side face (28).

**3.** A gas burner according to claim 1 or claim 2, wherein the thickness of the bumer head (24) is between 10mm and 30mm.

**4.** A gas burner according to claim 3, wherein the thickness of the burner head (24) is between 10mm and 15mm.

**5.** A gas burner according to any of the preceding claims, wherein the burner head (24) is shaped and sized to substantially close the inlet aperture (18) of the heat exchanger (10).

**6.** A gas burner according to any of claims 2 to 5, wherein the burner head (24) includes a plurality of apertures (32) extending from the entry side face (26) to the exit side face (28), the gas and air mixture being able to pass through the apertures (32).

**7.** A gas burner according to claim 6, wherein the apertures (32) are between 0.5mm and 1.5mm in diameter and spaced about 2 to 3mm apart.

**8.** A gas burner according to any of the preceding claims, wherein the baffle plate (36) is generally planar and circular.

**9.** A gas burner according to any of the preceding claims, wherein the orifices (37) are between 1 mm and 2mm in diameter.

**10.** A gas burner according to claim 2 or any of claims 3 to 9 when dependent on claim 2, wherein the baffle plate (36) is spaced between 1 mm and 3mm from the entry side face (26) of the burner head (24).

**11.** A gas burner according to any of the preceding claims, wherein the body member (40) includes a generally circular closure part (41).

**12.** A gas burner according to claim 11, wherein the circular closure part (41) includes a rim portion (42) around its perimeter, for connecting to a rim portion (50) around the perimeter of the circular inlet (18) of the heat exchanger (10).

**13.** A gas burner according to claim 12, wherein the gas burner (22) further includes a ring shaped gasket (49) for positioning between the respective rims of the body member (40) and the inlet (18) of the heat exchanger (10).

**14.** A gas burner according to any of the preceding claims, wherein the means for introducing the gas and air mixture to the bumer head (24) includes an elongate inlet duct (44).

**15.** A gas burner according to claim 14, wherein the elongate inlet duct (44) forms part of the body member (40).

**16.** A gas burner according to any of claims 11 to 13 and 14 or 15, wherein the closure part (41) and the inlet duct (44) of the body member (40) are formed as a single unitary component.

**17.** A gas burner according to any of the preceding claims, wherein the body member (40) is die cast.

**18.** A gas burner according to any of claims 14 to 17, wherein the burner further includes a closure plate (48) for closing a back of the inlet duct (44).

**19.** A cylindrical heat exchanger (10) having a circular inlet aperture (18) and including a burner (22) according to any of the preceding claims, the burner (22) being located so as to substantially close the inlet duct (18).

**20.** Any novel subject matter or combination including novel subject matter disclosed herein, whether or not within the scope of or relating to the same invention as any of the preceding claims.

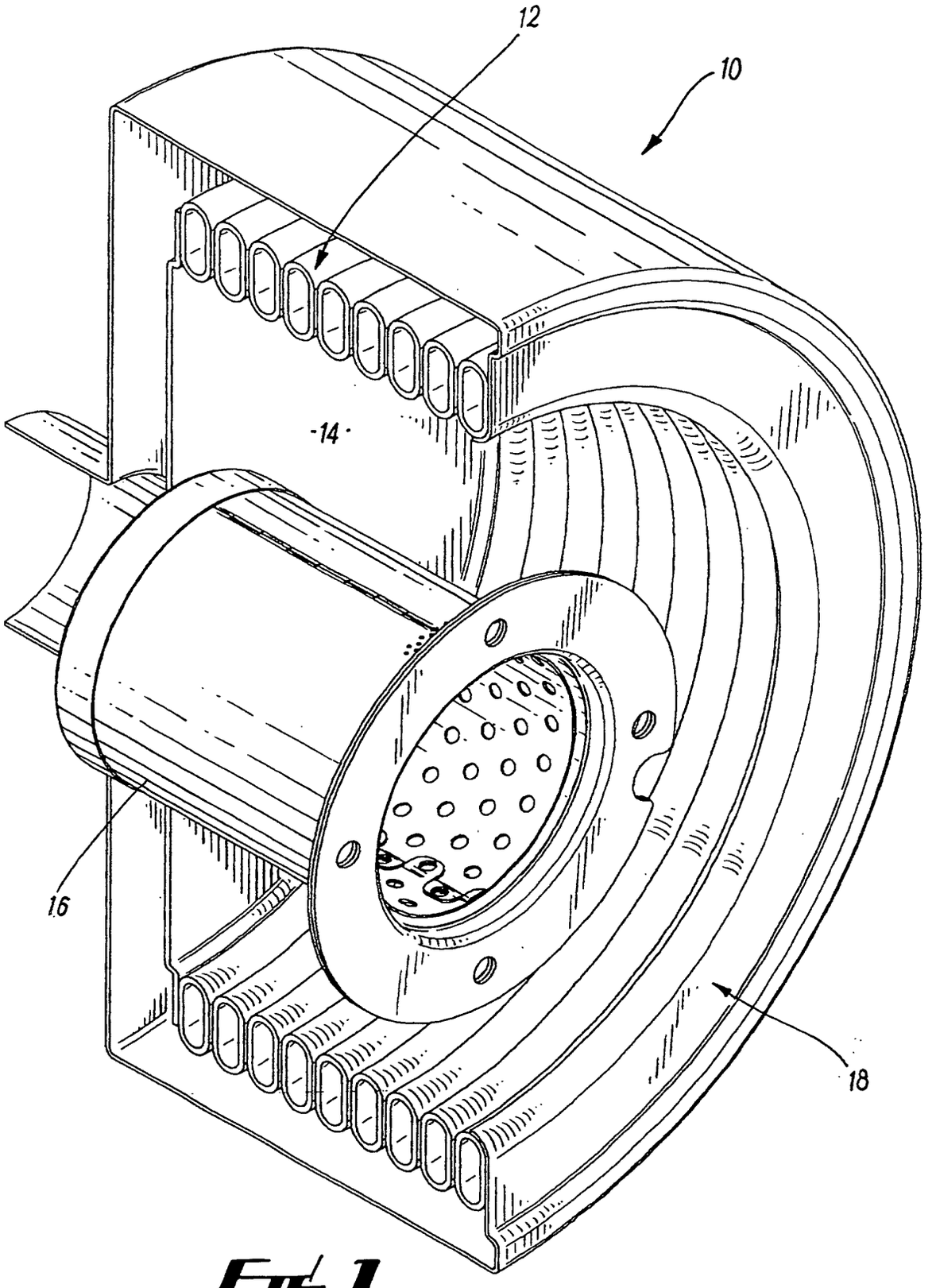



FIG. 1

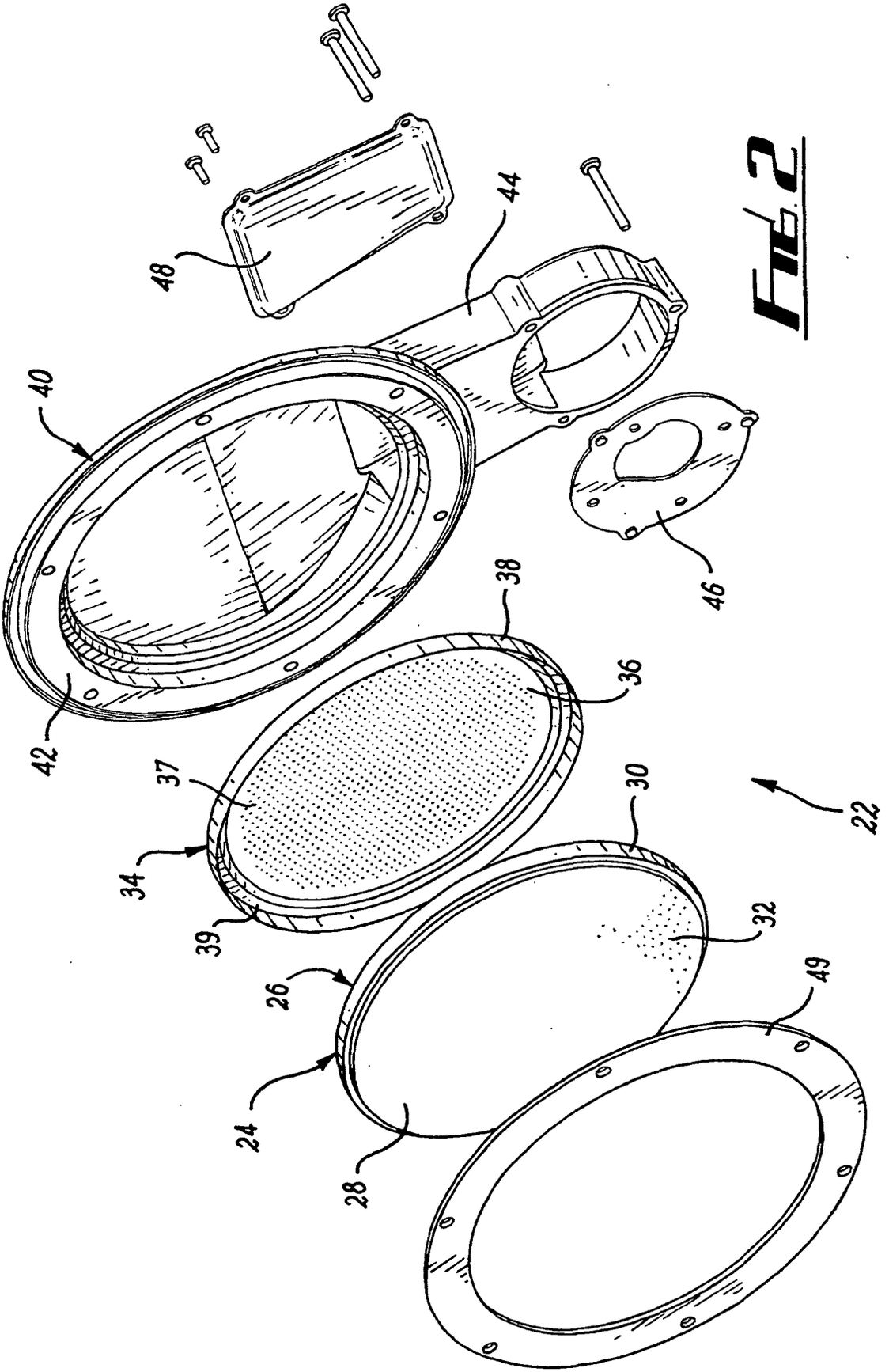
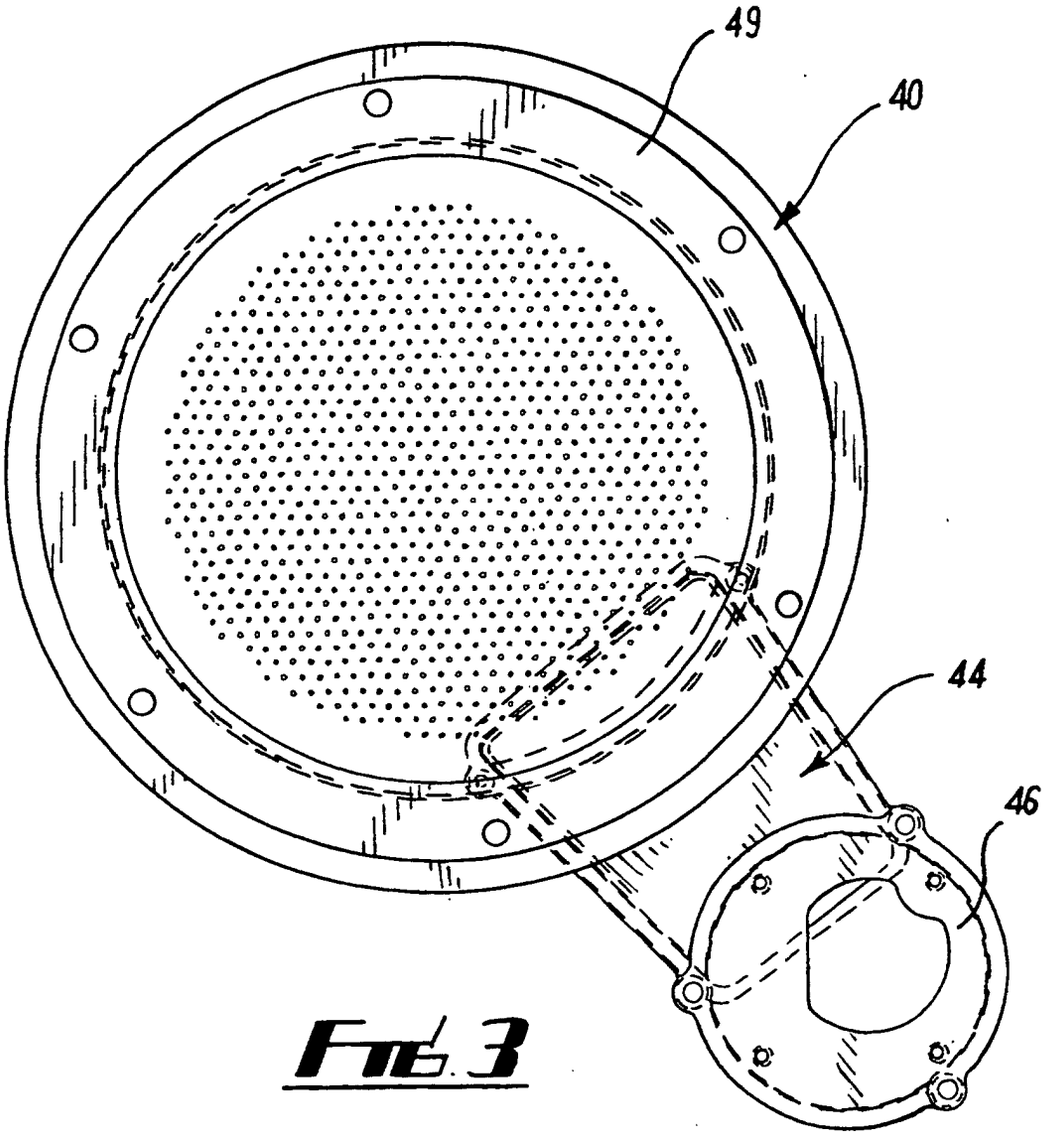



Fig. 2




Фиг. 3