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

(11) Publication number: **0 206 549**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **86304051.5**

(22) Date of filing: **28.05.86**

(51) Int. Cl.⁴: **F 23 D 14/12**, F 24 C 15/24

(30) Priority: **29.05.85 GB 8513544**

(43) Date of publication of application: **30.12.86**
Bulletin 86/52

(84) Designated Contracting States: **AT BE CH DE FR GB IT LI LU NL SE**

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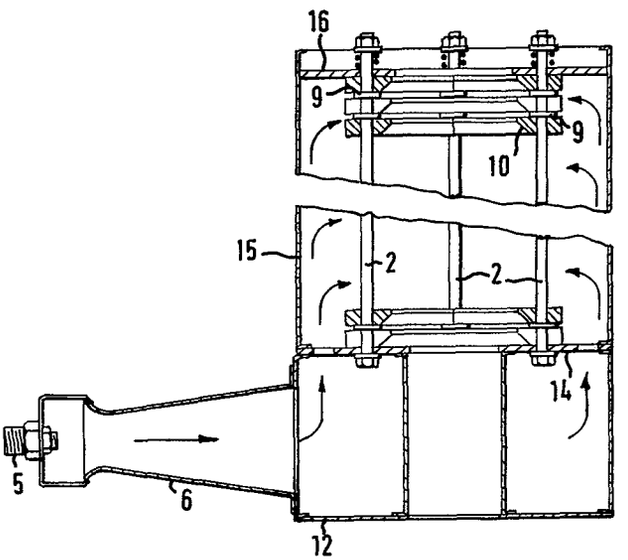
(54) Radiant heat emitters.

(57) A ceramic radiant heat emitter for surface combustion of gas/air mixtures, in which a series of aligned slots extend within the body of the emitter and open at the combustion face to pass the gas/air mixture from a distribution face of the body to the combustion face and secure combustion without striking back of flame into the body, the emitter having a built-up construction of spaced ceramic components in which the slots are formed by gaps between opposed faces of the components.



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RADIANT HEAT EMITTERS

The invention relates to radiant heat emitters or elements, particularly cylindrical elements.

Various methods of construction of cylindrical elements have been suggested by other investigators, making a ceramic fibre cylinder the structure of which is permeable to the gas/air mixture, but these have the disadvantage of being suitable only for use with gas pre-mix systems and moreover resistance to gas flow is of somewhat random nature. Further if such permeable bonded fibre cylinders are kilned at high temperatures (approximately 1000°C) they are subject to high thermal stresses causing cracking in service. If not fired to a high temperature, they are subject to erosion of the combustion surface, necessitating frequent replacement.

Casting from non-permeable materials of, for example, fibre and ceramic clays, has also proved difficult, in arranging for the necessary passages for the gas mixture: withdrawable pins as used for example in the manufacture of elements in our U.K. Patent Specification No. 1 436 842 are complicated and in practice unworkable for a cylindrical element, in the customary conditions of vacuum forming from a slurry of fibre and bonding clay.

We have looked at the problem afresh in the light of the essentials of elements for surface combustion which are: provision for passage of the gas/air mixture, mechanical strength for service, and prevention of striking back of the flame through the element. We have realised that a slotted structure, made up from separate components, can meet these requirements, and will also allow for ready manufacture not only of the cylindrical elements giving the initial problem, but of elements generally.

The invention accordingly provides a ceramic radiant heat emitter for surface combustion of gas/air mixtures, in which a series of aligned slots extend within the body of the emitter and open at the combustion face to pass gas/air mixture from a distribution face of the body to the combustion face and secure combustion without striking back of flame into the body. The construction is built up of spaced ceramic components in which the slots are formed by gaps between opposed faces of the components. Such components have the advantage that they may readily be made suitable to allow assembly of elements in any desired size from standard components. Separate or

integral spacers may be used. Suitable dimensions of the slots are 0.2 to 0.4 to 1.2 or 1.3mm across, so flame cannot strike back. The ceramic construction, particularly when of bonded fibre, gives low heat conductivity.

To form a cylindrical element the body is suitably a stack ofsuperposed, spaced rings, the slots extending from a gas/air distribution or plenum chamber to the combustion face and the rings being divided in a generally radial direction to avoid thermal stress in service. Conveniently the rings are divided completely into two or more similar parts, assembled on tie rods with the divisions staggered so that the dividions in a given ring are bridged by another ring and a body holding together as a unit is formed. Similar constructions can be used for other shapes of elements, for example flat or shaped plates, with the components in spaced rows and gaps between thecomponents in a row bridged by the components in other rows.

Concave elements may be constructed, or cylindrical elements with combustion taking place on the inner face, the outer face being surrounded by a plenum serving to contain and distribute the gas/air mixture. Concave elements are useful for focusing radiant energy towards a particular plane, or if a part spherical element is constructed on similar principles, towards a particular spot.

Suitable materials include bonded refractory ceramic fibre which is well known in the art and both as such and in relation to the microstructure formed on casting and firing is described in detail in our U.K. Patent Specification No. 1 436 842 the disclosure of which is incorporated herein by reference. The elements retain the high thermal shock resistance, low thermal conductivity and low thermal capacity referred to in that specification.

The elements may be mounted in metal or ceramic holders fed with gas and air by a jet and venturi in per se conventional way orif desired by gas/air premixed systems. When cylindrical they may be of any generally cylindrical shape, round or not, the term being indicative of the possibility of radiation of heat over an arc, whether substantially 360° or smaller if so required.

Elements according to the invention are illustrated by way of example in the accompanying drawings, in which:-

Fig. 1 is a view of a half ring in plan and cross-sectional elevation;

Fig. 2 is a sectional elevation of an element made up from such half rings and mounted for use;

Fig. 3 is a view of components for a further element;

Fig. 4 is a view of that element mounted for use;

Fig. 5 is a view, corresponding to Fig. 1, of components for a third element; and

Fig. 6 is a sectional elevation of that element mounted for use.

The body of the element is formed from cast half rings 1 clamped together by spring loaded screwed tie rods 2 passing through holes 3 and half holes 4 in the half rings. The whole assembly is fed with gas in per se conventional manner by a jet 5 which induces air into a venturi 6 mounted on the same metal base plate as holds the burner element itself. The base plate is referenced 7. As seen in Fig. 2 an end cap 8 closes the element, which is constructed by mounting the half rings so that the gaps between any two half rings are bridged by the next two half rings disposed at 90° to them, the whole being clamped together by the four tie rods with spacers 9 between the half rings determining the gas mixture passage dimensions. These spacers as shown are metal washers but refractory discs or integral spacers are also suitable. The spacing of the half rings will depend on the gas being burned and to some extent the pressure at which it is being delivered to the inner chamber but for example may be 0.9mm in the axial direction, when natural gas (methane) and air is to be used under

atmospheric inspiration. The half rings are dimensioned so that only a very small gap is left between them where the two halves meet. As can be seen, the half rings are chamfered at 10, giving improved performance over a plain construction.

The constructions of Fig. 3 to 6 are generally the same as the above and corresponding reference numerals are used. Figs. 3 and 4 show a concave element and its mounting, the base plate 7 of Fig. 2 being represented by a box 7' on which the assembled element is mounted by metal angles 11. Figs. 5 and 6 show a cylindrical element where the combustion surface is the inner rather than the outer face, and the base plate 7 of Fig. 2 is represented by a mounting having a first distribution annulus 13 at the base feeding through a perforated plate 14 to a second distribution annulus 15 closed by a plate 16 which is a sliding fit within the annulus 15 to accommodate thermal movement.

Slot width in all elements is selected according to the gas/air mixture in use, so that the flow ensures that the flame does not propagate back nor the heat front creep back through the material of the element.

On test, the elements have given good performance with good gas conversion to radiant energy, high average surface temperatures and no evidence of flame

instability. Resistance to thermal shock is satisfactory and surface erosion is superior to low temperature bonded fibre burner elements.

CLAIMS

1. A ceramic radiant heat emitter for surface combustion of gas/air mixtures, in which a series of aligned slots extend within the body of the emitter and open at the combustion face to pass the gas/air mixture from a distribution face of the body to the combustion face and secure combustion without striking back of flame into the body, the emitter having a built-up construction of spaced ceramic components in which the slots are formed by gaps between opposed faces of the components.

2. A radiant heat emitter according to claim 1, wherein the body is a stack of superposed, spaced rings, the spaces between opposed faces of the rings forming the slots which extend from a distribution face to the combustion face, the rings being divided in a generally radial direction to avoid hoop stress in service.

3. A radiant heat emitter according to claim 1 or 2, having the components in divided sets with the slots defined between the opposed faces of adjacent sets, each set comprising a plurality of components assembled on tie rods passing through the components

with components in a given set positioned staggered in relation to those in the sets opposed to them so that a body holding together as a unit is formed.

4. A radiant heat emitter according to any preceding claim, wherein the slots are 0.2 to 1.3mm across.

5. A self-aerating burner comprising a ceramic radiant heat emitter according to any preceding claim fed with gas/air mixture by means of a gas jet directed into a venturi, the mixture entering a distribution chamber for passage through the radiant heat emitter.

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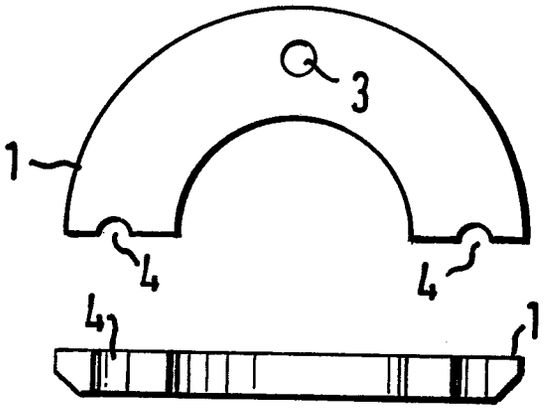

FIG.1

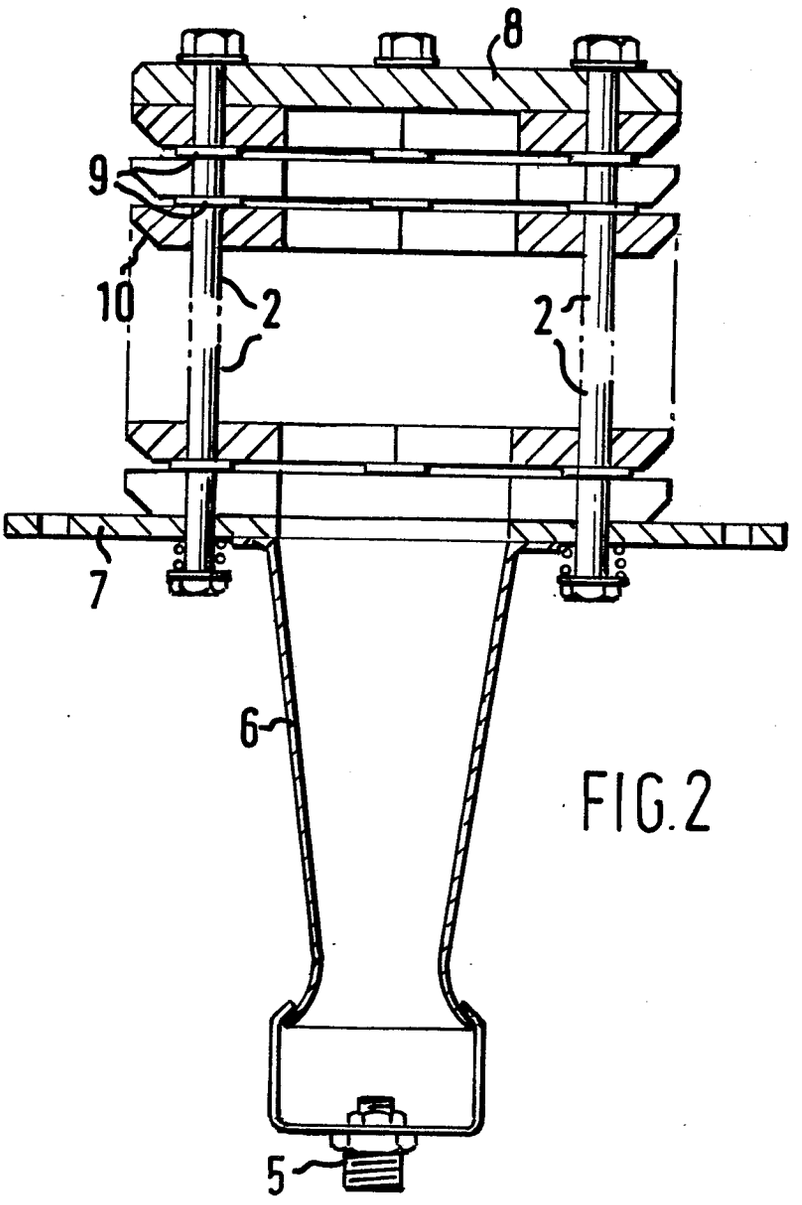

FIG.2

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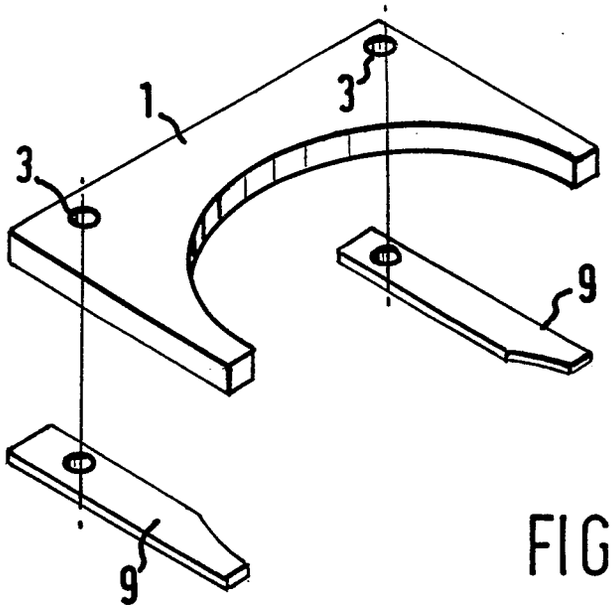

FIG 3

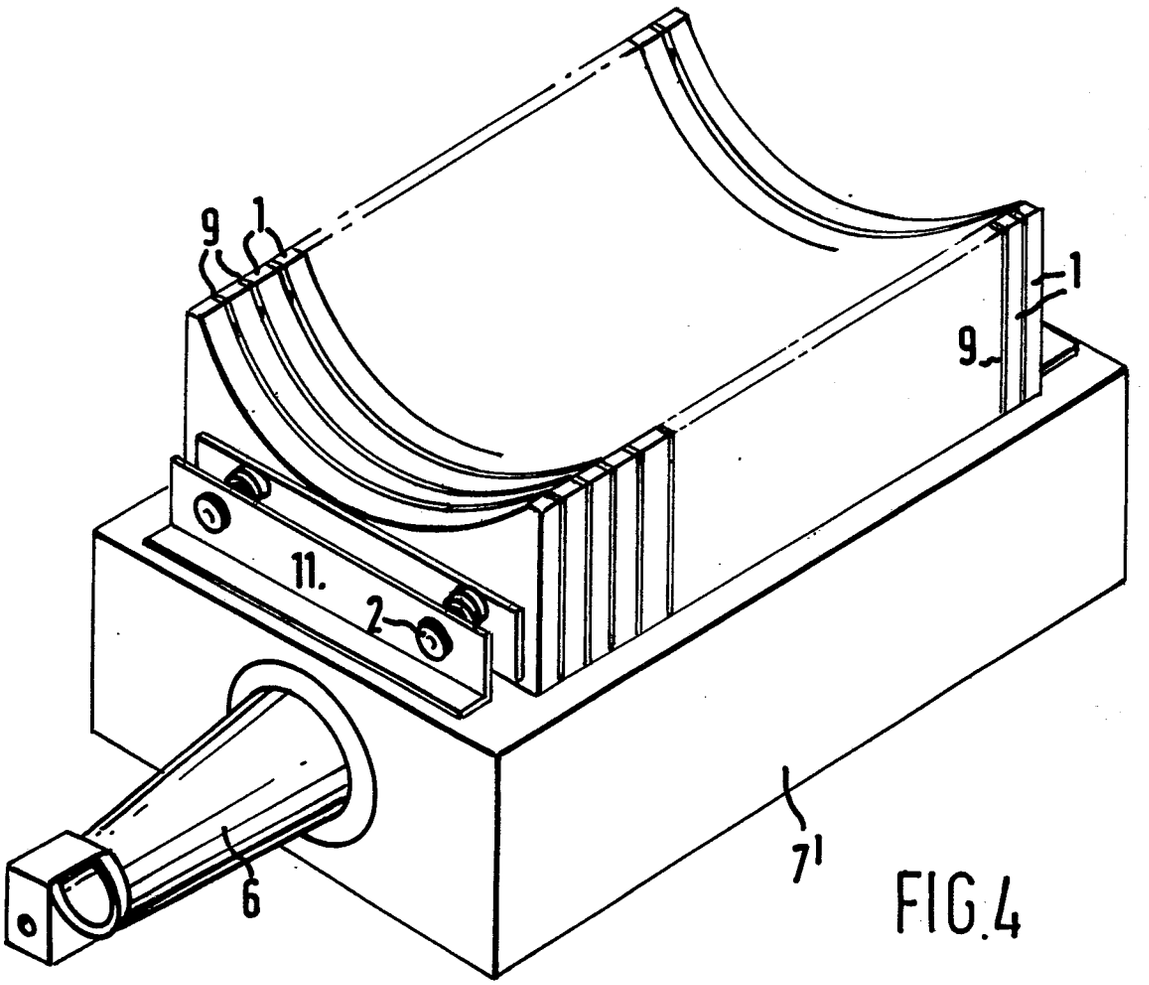

FIG.4

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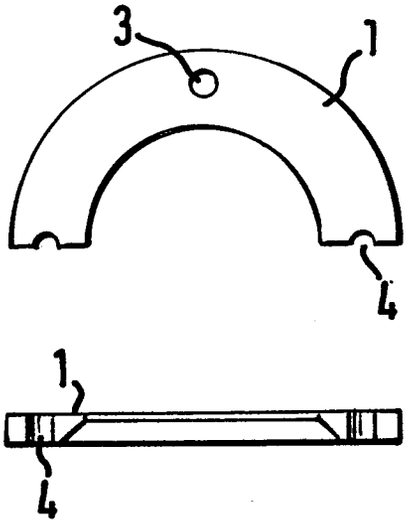

FIG.5

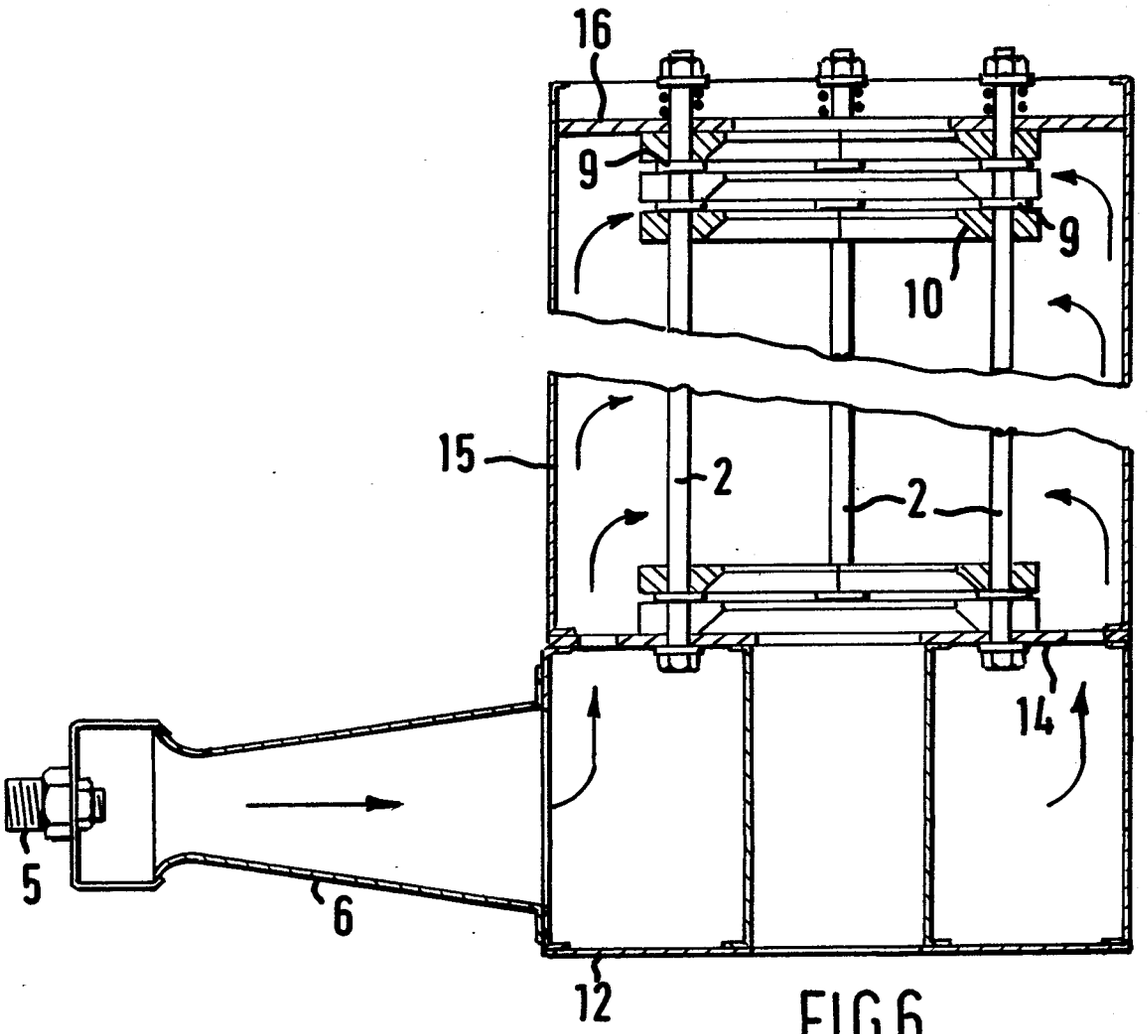

FIG.6

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EUROPEAN SEARCH REPORT

0206549
Application number

DOCUMENTS CONSIDERED TO BE RELEVANT

EP 86304051.5

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	US - A - 1 978 517 (AUTOGAS CORPOR.) * Totality * --	1,5	F 23 D 14/12 F 24 C 15/24
Y	DE - B2 - 2 917 982 (KÜHN) * Fig. 1 * --	1	
Y	FR - A - 2 190 249 (SOCIETE POUR L'UTILISATION RATIONELLE) * Fig. 3 * --	1	
A	US - A - 2 632 503 (STANDARD OIL) * Column 2, line 28 - column 3, line 8 * --	1,3	
A	US - A - 3 881 858 (FITZGERALD) * Fig. 1; column 2, line 69 * --	1,4	TECHNICAL FIELDS SEARCHED (Int. Cl.4) F 23 D F 24 C
D,A	GB - A - 1 436 842 (COOPER) * Claim 1; fig. 1 * ----	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	09-09-1986	SCHMIDT

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

& : member of the same patent family, corresponding document

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