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(54) **Combustion head, in particular for gas burners**

Brennerkopf insbesondere für Gasbrenner

Tête de combustion notamment pour brûleurs à gaz

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- **PATENT ABSTRACTS OF JAPAN vol. 12 no. 137 (M-690) ,26 April 1988 & JP-A-62 258917 (MIURA ) 11 November 1987,**
- **PATENT ABSTRACTS OF JAPAN vol. 13 no. 365 (M-859) ,15 August 1989 & JP-A-01 121609 (MIURA) 15 May 1989,**



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## Description

**[0001]** The present invention relates to a combustion head, in particular for gas burners comprising the features set forth in the preamble of claim 1.

**[0002]** A combustion head of this kind is disclosed in CH 452 464. The combustion head in question is conceived in particular for employment in small boilers and similar heating apparatuses for home use. However, the innovatory concepts suggested by the present invention can be validly adopted to produce any other type of burner, be it an atmospheric or an aerated burner with forced ventilation, to be also employed in furnaces or heating systems of an industrial type.

**[0003]** It is known that burners normally used in boilers, furnaces or other heating systems for domestic and/or industrial use fed with gaseous fuel essentially consist of an internally hollow mixing body generally of a box-shaped structure, provided with means for the controlled admission of a combustible gas and combustion air drawn from the surrounding atmosphere. Associated with the upper part of the mixing body is a combustion head in which a plurality of ports is formed for delivery of the combustible gas-combustion air mixture from the inside of the mixing body.

**[0004]** In burners of the most widely spread type, said delivery ports essentially consist of mere through holes having a round or shaped configuration, formed through a metal plate constituting the combustion head. The combustible gas-combustion air mixture is fired at the exit of said through holes, thereby forming a plurality of flames arising from the external surface of the combustion head. While the combustion heads of the above type are adopted in many situations, they however have some drawbacks in terms of burning efficiency. In particular, the air-gas mixing carried out within the mixing body does not always appear sufficiently efficient to ensure an optimal and intimate mingling of the two components, which is essential for achieving a correct burning.

**[0005]** There are also burners the combustion head of which essentially consists of a wire net having meshes of an appropriate size to give the outgoing gas-air mixture such a speed that the risk of backfire towards the mixing body is avoided. In burners of this type, burning gives rise to a continuous flame front substantially covering the whole eternal surface of the combustion head. In addition, heat resulting from combustion taking place in direct contact with the wire net causes said net to become incandescent and, as a result, to dissipate heat by radiation. Hence it follows that the combustion heads of this type ensure a combustion of better quality as compared with those described beforehand, but on the other hand they have a drawback too in that the wire nets, in addition to being very expensive, exhibit a structural brittleness that in many cases makes it inconvenient to use them.

**[0006]** Also provided are other burners the combustion head of which substantially consists of one or more plates made of a ceramic material having a honeycomb structure and obtained by moulding. These ceramic plates have a greater structural strength than the previously described wire nets, but they involve high production costs too and, in addition, have a reduced resistance to thermal shocks. Furthermore, also in burners provided with such a type of combustion head, the gas-air mixing carried out within the mixing body does not prove to be sufficient for ensuring an optimal combustion development, above all in the cases in which the air and gas flow rate values must be adjusted for achieving a flame modulation.

**[0007]** Burners have been also manufactured in which the combustion head essentially consists of a porous ceramic material or a non-woven fabric formed of ceramic material fibres. This type of combustion head has a greater resistance to thermal shocks as compared with that of the ceramic material plates. However, also porous ceramic materials and non-woven fabrics involve high production costs and above all do not allow a precise measurement of the delivery ports embodied by the hollow spaces created between the various ceramic material fibres or particles having a random orientation. Therefore very thick porous materials or non-woven fabrics need to be adopted. But, on the other hand, an important thickness appears to be inappropriate, due to the flow resistance induced on the outgoing mixture, for use on burners of the atmospheric type requiring air to be fed by forced ventilation. An important thickness also involves the installation of auxiliary air and/or gas filtering devices, in order to avoid the risk that dust or other impurities may obstruct the hollow spaces between the ceramic fibres or particles, thereby impairing the burner operation.

**[0008]** The Patent document GB 2259566, discloses a burner, particularly suitable for wall-mounted boilers, comprising an air mixing body which is engaged by a box-shaped holding body receving inside a plurality of granular elements. The granular elements are joined to each other in the corresponding tangency points and disposed according to a lattice made triangular meshes. The box-shaped holding body comprises a bottom provided with a plurality of trough apertures.

**[0009]** More in particulary, a perimetrical edge of the bottom of the box-shaped holding body is associated on an upper perimetrical edge of the mixing body.

**[0010]** It is a main object of the present invention to substantially solve the problems of the known art by providing a combustion head combining a low production cost capable of justifying its employment also on burners of small-sized apparatuses for home use, and excellent qualities in terms of flexibility of use, burning efficiency, structural strength and resistance to thermal shocks.

**[0011]** The above objects that will become more apparent in the course of the present description are substantially achieved by a combustion head, in particular

for gaseous fuel burners, comprising the features recited in the characterizing portion of claim 1.

**[0012]** The invention will be best understood from the detailed description of embodiments of a combustion head, in particular for gas burners, according to the present invention, taken hereinafter by way of example with reference to the accompanying drawings, in which:

- Fig. 1 is a diagrammatic perspective view of a burner provided with a combustion head made in accordance with the invention;
- Fig. 2 is a section taken along line II-II in Fig. 1;
- Fig. 3 is a plan view to an enlarged scale of one portion of the combustion head in question;
- Fig. 4 is a section taken along line IV-IV in Fig. 3;
- Fig. 5 is a plan view to an enlarged scale of one portion of the combustion head made according to an alternative embodiment of the invention;
- Fig. 6 is a section taken along line VI-VI in Fig. 5
- Fig. 7 is an enlarged sectional view of a ceramic ball belonging to a combustion head obtained according to a further embodiment of the invention;
- Fig. 8 is a perspective view in split of another example embodying the present invention.

**[0013]** Referring to the drawings, and in particular to Fig. 1, a combustion head especially for gaseous fuel, according to the invention has been generally identified by reference numeral 1.

**[0014]** The combustion head 1 is associated with a burner 1a which in a manner known per se comprises an internally hollow mixing body 2 into which feeding means 3 for a combustible gas-combustion air mixture opens. In the embodiment shown, said feeding means 3 essentially comprises a feed manifold 4 along which a plurality of nozzles 5 is distributed. Through said nozzles a combustible gas coming from a pipe 4a terminating at the manifold itself is delivered in the form of a plurality of parallel and suitably spaced jets. The nozzles 5 are such oriented that they direct the gas jets to an inlet slot 6 formed along one side of the mixing body 2.

**[0015]** A lead-in portion 7 and a spread portion 8 extend from the side edges of the inlet slot 6 and they have an extension respectively converging and diverging along the feed direction of the gas ejected from nozzles 5. Said lead-in and spread portions, 7 and 8, preferably integrated in the mixing body structure 2, substantially form an admission nozzle the operation of which is based, in a manner known per se, on the Venturi effect, so that the gas ejected from nozzles 5 is subjected to entrain, through the inlet slot 6, a given air percentage drawn from the surrounding atmosphere. Obviously, the air feeding may also occur by forced ventilation, said forced ventilation taking the place of, or being in addition to said admission nozzle.

**[0016]** In an original manner the combustion head 1, located on top of the mixing body 2 so as to form a closure for same, is essentially comprised of a plurality of balls 10 of a predetermined diameter, preferably of ceramic material, physically interconnected with each other in succession at points of mutual tangency. The balls 10, distributed in one or more superposed layers and preferably fastened to each other by a sintering process or gluing, substantially define a filter bed formed with a lattice of intercommunicating alveoli 11 defining close to the external surface 9 of the combustion head 1, a plurality of delivery ports 12 homogeneously distributed over the whole extension of the external surface itself.

**[0017]** The gas-air mixture admitted to the mixing body 2 will be therefore forced to pass through the combustion head 1 and will then emerge from the delivery ports 12 to be fired at the external surface 9 of said combustion head.

**[0018]** Advantageously, the surfaces of balls 10 confining each delivery port 12 mutually diverge in an exponential progression along the mixture outlet direction, thereby involving an important velocity reduction in the mixture flow coming out of the delivery ports. In this manner, even in the presence of high flow rates of the gas-air mixture, burning of the mixture will take place substantially within the confined spaces between the ball surfaces diverging from the delivery ports 12, thereby giving rise to a substantially continuous flame front extending over the whole external surface 9 of the combustion head 1.

**[0019]** In addition, the balls 10 belonging to each of the different superposed layers are distributed to advantage according to a symmetrically staggered positioning relative to the balls belonging to the adjoining layers. In this way, the mixture from the mixing body 2, while crossing the combustion head 1, is divided into a plurality of flows which are forced to follow a tortuous path of travel between the various alveoli 11 and are consequently subjected to movement in a turbulent state, which will cause a perfect homogenizing of the mixture to be fired.

**[0020]** To the ends of the present invention, balls 10 may be replaced by granular elements of varying shapes, for example obtained by grinding a ceramic material into a given particle size and subsequently distributed in superposed layers to form said filter bed. At all events the use of balls is preferred because by suitably selecting the ball diameter it is possible to establish the sizes of the alveoli 11 and delivery ports 12 in a very precise manner, depending on requirements. In particular, the ball diameter is provided to be included between 1 mm and 10 mm, so that the alveolus and port sizes will be big enough to enable passage of impurities possibly present in the mixture and small enough to ensure a mixture velocity capable of avoiding any risk of backfire at the delivery ports 12.

**[0021]** Obviously, the mutual placement of balls 10 in the individual layers does not represent a limitation to the ends of the present invention. By way of example, figures 2 and 3 show a first solution in which the balls 10 provided in each layer are distributed in a geometrical

lattice having triangular meshes. In this case the combustion head 1 has at least three ball layers, so that none of the delivery ports 12 can directly communicate with the inside of the mixing body 2 and therefore each delivery port 12 can be reached by the mixture after the latter has passed through several alveoli 11 disposed at mutually staggered locations.

**[0022]** In the alternative embodiment shown in figures 4 and 5 the balls 10 of each layer are on the contrary distributed following a geometrical lattice formed of square meshes. In this case the arrangement of at least two ball layers is sufficient to enable the mixture to reach the delivery ports 12 after following a tortuous path across the combustion head 1.

**[0023]** While the burner 1a is in operation, the intimate contact between the flame and the balls 10 causes an important heat transmission to the balls. However, since the balls 10 are in contact with each other at the tangency points alone, and since the balls of the underlying layers are constantly cooled by the mixture flow coming from the mixing body 2, heat transmitted to the external surface 9 is substantially confined to said surface so that it encounters a great difficulty in spreading by conduction on the underlying ceramic material.

**[0024]** This situation is very advantageous for the achievement both of a combustion of good quality and a good resistance to thermal shocks by the combustion head 1. In this connection it should be pointed out that the heat concentration on the external surface 9 causes said surface to become incandescent when only small amounts of heat have been built up, thereby achieving an efficient heat dissipation by radiation. This first of all involves an advantageous limitation of the flame temperature, and consequently inhibits production of nitric oxides and/or other harmful products of combustion. In addition, due to the reduced amount of the built up heat, there is an advantageous limitation in the thermal expansions and/or shrinkages undergone by the combustion head 1 as a result of temperature changes and therefore there is an excellent resistance to stresses due to thermal shocks.

**[0025]** In order to further increase this resistance to thermal shocks, the use of internally hollow balls 10 may be provided, as shown in Fig. 6, so that a further reduction of the ball mass is achieved and therefore a reduction in the heat amount therein stored during burning.

**[0026]** According to the invention shown in Fig. 8, the combustion head 1 comprises a box-shaped holding body 13 having at least one bottom 14 provided with a plurality of through apertures 14a defining a substantially reticular structure, and at least one side wall 15 extending perimetrically from said bottom 14 with which it defines a housing 16 for receiving said plurality of granular elements consisting in this case (as already said) of balls 10 of a predetermined diameter.

**[0027]** The box-shaped holding body 13 is thoroughly made of a suitably shaped reticular element. It should be noted that the box-shaped holding body 13 is received in a perimetric seat 2b defined by an upper edge 2a of the mixing body so that it substantially acts as a closure for the mixing body. Associated with the holding body 13 is a closing element 17 disposed on the opposite side from the bottom wall 14 and also provided with a plurality of through apertures 17a defining a substantially reticular structure. The closing element 17 too is made of a reticular element which is suitably shaped so that its shape matches that of the side wall 15 of the holding body 13.

**[0028]** By virtue of the presence of the box-shaped body 13 and respective closing element 17, the granular elements or balls 10 can be disposed within the housing 16 without a mutual fixing being required.

**[0029]** According to another preferential solution, the use of an additional covering element 18 associated with the side wall 15 of the holding body 13 may be provided. It is located a given distance from the closing element 17, away from the bottom wall 14. This additional covering element 18 too, designed to be brought to incandescence by the flame in order to dissipate heat by radiation, is provided with a plurality of through apertures 18a and can be made starting directly from a reticular element.

**[0030]** Advantageously, an annular seal 19 is interposed between the side wall 15 of the box-shaped body 13 and the upper edge 2a of the mixing body 2. Seal 19 is adapted to ensure an efficient tightness to the connection between the box-shaped body and the mixing body and at the same time, due to its intrinsic capability of being deformed, can compensate for the thermal expansions to which the other components of the combustion head 1 are subjected, thereby avoiding the occurrence of inner stresses capable of impairing the structural integrity of the combustion head.

**[0031]** Clamping means consisting for example of an annular gripping element 20 having a C-shaped transverse section causes the final fastening between the upper edge 2a of tho mixing body 2, the side wall 15 of the holding body 13, the closing element 17 and the additional closing element 18, if present.

**[0032]** It should be pointed out that the combustion head made following the above alternative solution is of easy manufacture and installation.

**[0033]** In greater detail, for manufacturing this combustion head the box-shaped holding body 13 is first made, for example starting from a reticular element or a plate suitably provided with through holes conveniently distributed to form a substantially netlike structure.

**[0034]** At this point, said plurality of granular elements 10 may be introduced into the housing 16 so as to define the filter bed provided with intercommunicating alveoli or hollow spaces 11.

**[0035]** In order to promote compactness of the granular elements 10 poured into the holding body 13, during or after this operation the holding body may be submitted to advantage to a further step involving a vibrating action.

**[0036]** Subsequently, the closing element 17 is put on top of the granular elements and associated therewith and the additional closing element 18, if any, is put close to the upper edge of the side wall 15 of the holding body 13.

**[0037]** At this point the holding body 13 can be associated with the perimetric housing 16 defined by the upper edge 2a of the mixing body 2, upon optional interposition of the annular seal 19.

**[0038]** In accordance with the solution shown in Fig. 8, the box-shaped holding body 13, closing element 17 and additional closing element 18 are fastened to the upper edge 2a of the mixing body 2 after carrying out a folding operation of the respective perimetric edges and a subsequent operation involving clamping of the perimetric edges by the annular gripping element 20.

**[0039]** The present invention achieves the intended purposes.

**[0040]** The combustion head in question, due to its particular structural configuration, is in fact capable of ensuring an optimal efficiency in carrying out the combustion process on the external surface 9. The combustion thoroughly takes place in the spaces defined by the upper surface portions of the balls at the outside of the delivery ports, which is advantageous for the combustion quality. Thus an optimal control of the stoichiometric ratio in the gas-air mixture is ensured, together with the maintenance of a fire temperature adapted to avoid the formation of nitric oxides and/or other harmful products of combustion.

**[0041]** The combustion quality is also improved by the intimate mixing taking place between the air and gas following passage of the mixture through the lattice of alveoli defined by the different ball layers.

**[0042]** In addition, due to the restrained thermal inertia given to the combustion head in question, which inertia can be further reduced if internally hollow balls are used, it is possible to reach an exceptional resistance to thermal shocks occurring for example on firing of the burner and/or as a result of an accidental dropping of cold liquids onto the combustion head.

**[0043]** It should be recognized that the combustion head according to the invention can be mass produced at low manufacturing costs. Actually, it is noted that hollow or solid balls made of ceramic material are easily available on the market. In addition the manufacturing cost can be further reduced if, instead of balls, granular elements of different configuration obtained by grinding of scrap material from other industrial processes are used.

**[0044]** Obviously, many modifications and variations may be made to the present invention without departing from the scope as defined in the claims. For example, the combustion head may be made of several plate-like portions formed by said balls or granular elements of different shapes, disposed consecutively side by side and supported by a bearing framework.

**[0045]** In addition, for producing particular types of burners, the balls may be distributed in a tubular configuration, instead of having a flat configuration as shown in the accompanying drawings. in the case of a cylindrical tubular configuration, the balls may advantageously have a diameter increasingly growing from the inner to the outer layers in order to ensure that also the balls belonging to the outermost layers should be touching at the respective tangency points.

## Claims

1. A combustion head in particular for gas burners, comprising an internally hollow mixing body (2) and means (3) for feeding a combustible gas-combustion air mixture into the mixing body (2), which combustion head (1) is provided with delivery ports (12) through which the combustible gas-combustion air mixture is ejected from the mixing body (2) and fired, a plurality of granular elements (10) physically interconnected with each other in succession at points of mutual tangency, to substantially define a filter bed having a lattice of hollow spaces (11) intercommunicating with each other and defining on an external surface (9) of the combustion head (1), a plurality of said delivery ports (12) distributed over the whole extension of the external surface itself, a box-shaped holding body (13) having at least one bottom (14) provided with a plurality of through apertures (14a) defining a substantially reticular structure, and at least one side wall (15) extending perimetrically from said bottom (14) with which it defines a housing (16) for receiving said plurality of granular elements (10); at least one closing element (17) associated with the side wall (15) of the holding body (13) on the opposite side from the bottom wall (14), said closing element (17) too being provided with a plurality of through apertures (17a) defining a substantially reticular structure; characterized in that said box-shaped holding body (13) is formed of a reticular element and is received in a perimetric seat (2b) defined by an upper edge (2a) of said mixing body (2).

2. A combustion head according to claim 1, characterized in that said granular elements consist of balls (10) of a predetermined diameter.

3. A combustion head according to claim 1, characterized in that said granular elements (10) are made of a ceramic material.

4. A combustion head according to claim 2, characterized in that said balls (10) are internally hollow.

5. A combustion head according to claim 2, characterized in that said predetermined diameter for each of said balls (10) has value included between 1 mm

and 10 mm.

**6.** A combustion head according to claim 1, characterized in that said granular elements (10) are joined to each other by sintering at the corresponding tangency points.

**7.** A combustion head according to claim 1, characterized in that said granular elements (10) are joined to each other by gluing at the corresponding tangency points.

**8.** A combustion head according to claim 2, characterized in that at least one ball layer is provided, in which balls are distributed following a geometric lattice made of triangular meshes.

**9.** A combustion head according to claim 2, characterized in that at least one ball layer is provided in which balls (10) are distributed following a geometric lattice made of square meshes.

**10.** A combustion head according to claim 8, characterized in that said balls (10) are distributed in at least three layers overlying each other, the balls belonging to each layer having a symmetrically staggered positioning relative to the adjacent balls belonging to the other adjoining layers.

**11.** A combustion head according to claim 9, characterized in that said balls (10) are distributed in at least two layers overlying each other, the balls belonging to each layer having a symmetrically staggered positioning relative to the adjacent balls belonging to the adjoining layer.

**12.** A combustion head according to claim 1, characterized in that said granular elements (10) are interconnected with each other by mutual contact at said tangency points.

**13.** A combustion head according to claim 1, characterized in that said closing element (17) is formed of a reticular element.

**14.** A combustion head according to claim 1, characterized in that it comprises an additional closing element (18) associated with said side wall (15) of the holding body (13) and located a given distance from said closing element (17), away from said bottom wall (14), said additional covering element (18) being provided with a plurality of through apertures (18a) defining a substantially reticular structure.

**15.** A combustion head according to claim 14, characterized in that said additional covering element (18) is formed of a reticular element.

**16.** A combustion head according to claim 1, characterized in that it comprises an annular seal (19) operatively interposed between said side wall (15) of the box-shaped body (13) and said upper edge (2a) of the mixing body (2).

**17.** A combustion head according to claim 1, characterized in that it further comprises clamping means (20) for fastening to each other said upper edge (2a) of the mixing body (2), side wall (15) of the holding body (13) and closing element (17).

**18.** A combustion head according to claim 17, characterized in that said clamping means comprises an annular gripping element (20) having a substantially C-shaped transverse section.

**19.** A method of manufacturing and setting up a combustion head, as defined in claim 1, characterized in that it comprises the following steps:

- manufacturing a box-shaped holding body (13) having at least one bottom wall (14) provided with a plurality of through apertures (14a) defining a substantially netlike structure, and at least one side wall (15) extending perimetrically from said bottom wall (14) and defining a housing (16) therewith;
- pouring a plurality of granular elements (10) into said housing (16) so as to substantially make a filter bed formed with a lattice of hollow spaces (11) intercommunicating with each other and defining a plurality of said delivery ports (12);.
- associating with said granular elements (10), on top of the same, a closing element (17) provided with a plurality of through apertures (17a) defining a substantially reticular structure, after said manufacturing step another step being provided in which the box-shaped holding body (13) is engaged in a perimetric seat (2b) defined by an upper edge (2a) of said mixing body (2).

**20.** A method according to claim 19, characterized in that, concurrently with the step of pouring the granular elements (10), the box-shaped holding body is submitted to a step involving a vibrating action.

**21.** A method according to claim 19, characterized in that the box-shaped holding body (13) is engaged in the perimetric seat (2b) upon interposition of an annular seal extending between the side wall of the holding body and said upper edge of the mixing body (2).

**22.** A method according to claim 19, characterized in that after said step of associating the closing element (17) with the holding body (13) another associating step is provided in which an additional cov-

ering element (18) is put on top of the closing element (17) and is spaced apart a given distance therefrom, away from said bottom wall (14), said additional covering element (18) being provided with a plurality of through apertures (18a) defining a substantially reticular structure.

**Patentansprüche**

1. Brennkopf, insbesondere für Gasbrenner, umfassend einen innen hohlen Mischkörper (2) und Mittel (3) zur Zuführung einer Mischung von gasförmigen Brennmitteln/Verbrennungsluft in den Mischkörper (2), wobei der Mischkopf (1) mit Abgabeöffnungen (12) versehen ist, über welche die Mischung gasförmiger Brennstoff/Verbrennungsluft durch den Mischkörper (2) ausgestoßen und gezündet wird, eine Vielzahl von, eines nach dem anderen in Stellen gegenseitiger Berührung verbundenen kornförmigen Elementen (10), die im wesentlichen ein, ein Netz von Zwischenräumen (11) aufweisendes Filterbett festlegen, die miteinander verbunden sind und an einer Außenfläche (9) des Brennkopfes (1) eine Vielzahl von Abgabeöffnungen (12) festlegen, die gemäß der gesamten Abwicklung der Außenfläche selbst verteilt sind; ein Gehäuse (13) mit mindestens einem Boden (14), das mit einer Vielzahl von eine im wesentlichen netzförmige Struktur festlegenden Durchgangsöffnungen (14a) und mit mindestens einer Seitenwand (15) versehen ist, die sich umlaufend von dem Boden (14) erstreckt und mit diesem letzteren eine Aufnahme (16) zur Aufnahme der Vielzahl von kornförmigen Elementen (10) festlegt; mindestens ein Schließelement (17), das der Seitenwand (15) des Gehäuses (13) gegenüber der Bodenwand (14) abgewandten Seite zugeordnet ist, wobei das Schließelement (17) gleichfalls mit einer Vielzahl von Durchgangsöffnungen (17a) versehen ist, die eine im wesentlichen netzförmige Struktur festlegen;
dadurch gekennzeichnet, dass das Gehäuse (13) aus einem netzförmigen Element besteht und im Bereich eines umlaufenden Sitzes (2b) aufgenommen ist, der durch einen oberen Rand (2a) des Mischkörpers (2) festgelegt ist.

2. Brennkopf nach Anspruch A dadurch gekennzeichnet, dass die bodenförmigen Elemente aus Kugeln (10) vorgegebenen Durchmessers bestehen.

3. Brennkopf nach Anspruch 1, dadurch gekennzeichnet, dass die kornförmigen Elemente (10) in Keramik ausgeführt sind.

4. Brennkopf nach Anspruch 2, dadurch gekennzeichnet, dass die Kugeln (10) innen hohl sind.

5. Brennkopf nach Anspruch 2, dadurch gekennzeichnet, dass der vorgegebene Durchmesser für jede der Kugeln (10) einen Betrag zwischen 1 mm und 10 mm besitzt.

6. Brennkopf nach Anspruch 1, dadurch gekennzeichnet, dass die kornförmigen Elemente (10) miteinander durch Sinterung an den jeweiligen Berührungspunkten vereint sind.

7. Brennkopf nach Anspruch 1, dadurch gekennzeichnet, dass die kornförmigen Elemente (10) miteinander durch Verkleben an den jeweiligen Berührungsstellen vereint sind.

8. Brennkopf nach Anspruch 2, dadurch gekennzeichnet, dass mindestens eine Schicht von Kugeln (10) vorgesehen ist, die gemäß einem geometrischen Netz mit rechteckigen Maschen verteilt sind.

9. Brennkopf nach Anspruch 2, dadurch gekennzeichnet, dass mindestens eine Kugelschicht vorgesehen ist, in der die Kugeln (10) gemäß einem geometrischen Netz mit quadratischen Maschen verteilt sind.

10. Brennkopf nach Anspruch 8, dadurch gekennzeichnet, dass die Kugeln (10) längs mindestens drei zueinander aufeinander liegenden Schichten verteilt sind, wobei die jeder Schicht angehörenden Kugeln eine Positionierung aufweisen, die gegenüber den anliegenden, den benachbarten Schichten angehörenden Kugeln symmetrisch versetzt sind.

11. Brennkopf nach Anspruch 9, dadurch gekennzeichnet, dass die Kugeln (10) längs mindestens zwei zueinander übereinander liegenden Schichten verteilt sind, wobei die einer jeden Schicht angehörenden Kugeln eine Positionierung aufweisen, die gegenüber den anliegenden, den benachbarten Schichten angehörenden Kugeln symmetrisch versetzt sind.

12. Brennkopf nach Anspruch A dadurch gekennzeichnet, dass die kornförmigen Elemente (10) über einen gegenseitigen Kontakt in den Berührungsstellen miteinander verbunden sind.

13. Brennkopf nach Anspruch A dadurch gekennzeichnet, dass das Schließelement (17) aus einem netzförmigen Element besteht.

14. Brennkopf nach Anspruch 1, dadurch gekennzeichnet, dass er ein Hilfsabdeckelement (18) umfasst, das der Seitenwand (15) des Gehäuses (13) zugeordnet und mit einem vorgegebenen Abstand von diesem Schließelement (17) in Entfernung von der Bodenwand (14) angeordnet ist, wobei das Hilfsab-

deckelement (18) mit einer Vielzahl von Durchgangsöffnungen (18a) versehen ist, die eine im wesentlichen netzförmige Struktur festlegen.

**15.** Brennkopf nach Anspruch 14, dadurch gekennzeichnet, dass das Hilfsabdeckelement (18) aus einem netzförmigen Element besteht.

**16.** Brennkopf nach Anspruch 1, dadurch gekennzeichnet, dass er eine Ringdichtung (19) umfasst, die wirksam zwischen der Seitenwand (15) des Gehäuses (13) und dem oberen Rand (2a) des Mischkörpers (2) zwischengeschaltet ist.

**17.** Brennkopf nach Anspruch 1, dadurch gekennzeichnet, dass er überdies Spannmittel (20) zur gegenseitigen Befestigung des oberen Randes (2a) des Mischkörpers (2), der Seitenwand (15) des Gehäuses (13) und des Schließelementes (17) umfasst.

**18.** Brennkopf nach Anspruch 17, dadurch gekennzeichnet, dass die Spannmittel ein ringförmiges Klammerelement (20) umfassen, das eine im wesentlichen "C"-förmig ausgebildeten Querschnitt aufweist.

**19.** Verfahren zur Ausführung und den Einbau eines Brennkopfes, so wie im Anspruch 1 definiert, dadurch gekennzeichnet, dass es folgende Arbeitsschritte umfasst:

- Anfertigung eines Gehäuses (13) mit mindestens einer Bodenwand (14), die mit einer Vielzahl von durchgehenden Öffnungen (14a), die eine im wesentlichen netzförmige Struktur festlegen, und mit mindestens einer Seitenwand (15) versehen ist, die umlaufend von der Bodenwand (14) sich erstreckt und mit diesen letzteren eine Aufnahme (16) festlegt;
- Einfüllung in dieser Aufnahme (16) einer Vielzahl von kornförmigen Elementen (10), um im wesentlichen ein Filterbett zu bilden, das ein Netz von Zwischenräumen (11) aufweist, die miteinander in Verbindung stehen und eine Vielzahl von Abgabeöffnungen (12) festlegen;
- Zuordnung oberhalb der kornförmigen Elemente (10) eines Schließelementes (17), das mit einer Vielzahl von Durchgangsöffnungen (17a) versehen ist, die eine im wesentlichen netzförmige Struktur festlegen,

wobei nach dem Anfertigungsschritt ein weiterer Arbeitsschritt vorgesehen ist, bei dem das Gehäuse (13) in einem Umfangssitz (2b) in Eingriff steht, der durch den oberen Rand (2a) des Mischkörpers (2) festgelegt ist.

**20.** Verfahren nach Anspruch 19, dadurch gekennzeichnet, dass in Begleitung mit dem Arbeitsschritt des Einfüllens der kornförmigen Elemente (10) das Gehäuse einem Schüttelarbeitsschritt unterliegt.

**21.** Verfahren nach Anspruch 19, dadurch gekennzeichnet, dass das Gehäuse (13) in einem umlaufenden Sitz (2b) in einer Zwischenschaltung einer Ringdichtung in Eingriff steht, die sich zwischen der Seitenwand des Gehäuses und dem oberen Rand des Mischkörpers (2) erstreckt.

**22.** Verfahren nach Anspruch 19, dadurch gekennzeichnet, dass, nach dem Schritt der Zuordnung des Schließelementes (17) zu dem Gehäuse (13), ein weiterer Arbeitsschritt der Zuordnung vorgesehen ist, bei der das Hilfsabdeckelement (18) oberhalb mit einem vorgegebenen Abstand vom Schließelement (17) in Entfernung von der Bodenwand (14) angeordnet wird, wobei das Hilfsabdeckelement (18) mit einer Vielzahl von Durchgangsöffnungen (18a) versehen ist, die eine im wesentlichen netzartige Struktur festlegen.

## Revendications

**1.** Tête de combustion, notamment pour brûleurs à gaz, comprenant un corps de mélange creux à son intérieur (2) et des moyens (3) d'alimentation d'un mélange gaz combustible-air comburant dans le corps de mélange (2), ladite tête de combustion (1) étant pourvue d'orifices distributeurs (12) à travers lesquels le mélange gaz combustible-air comburant est éjecté du corps de mélange (2) et incendié; une pluralité d'éléments granulaires (10) physiquement reliés les uns à la suite des autres à des points de tangence réciproque, pour définir essentiellement un lit filtrant ayant un treillis d'espaces vides (11) communicant entre eux et définissant sur une surface extérieure (9) de la tête de combustion (1) une pluralité desdits orifices distributeurs (12) répartis sur toute l'extension de la surface extérieure elle-même; un corps contenant en forme de boîtier (13) ayant au moins un fond (14) pourvu d'une pluralité d'ouvertures de passage (14a) définissant une structure essentiellement réticulaire et au moins une paroi latérale (15) s'étendant dudit fond (14) le long de son pourtour et définissant avec ce fond un logement (16) pour recevoir ladite pluralité d'éléments granulaires (10); au moins un élément de fermeture (17) associé à la paroi latérale (15) du corps contenant (13) sur le côté opposé par rapport à la paroi de fond (14), ledit élément de fermeture (17) aussi étant pourvu d'une pluralité d'ouvertures de passage (17a) définissant une structure essentiellement réticulaire; caractérisée en ce que ledit corps contenant en forme de boîtier (13) se compose d'un élément réticulaire et est reçu dans un siège

périmétral (2b) défini par un bord supérieur (2a) dudit corps de mélange (2).

**2.** Tête de combustion selon la revendication 1, caractérisée en ce que lesdits éléments granulaires se composent de sphères (10) d'un diamètre prédéterminé.

**3.** Tête de combustion selon la revendication 1, caractérisée en ce que lesdits éléments granulaires (10) sont réalisés en matière céramique.

**4.** Tête de combustion selon la revendication 2, caractérisée en ce que lesdites sphères (10) sont creuses à leur intérieur.

**5.** Tête de combustion selon la revendication 2, caractérisée en ce que ledit diamètre prédéterminé pour chacune desdites sphères (10) a une valeur comprise entre 1 mm et 10 mm.

**6.** Tête de combustion selon la revendication 1, caractérisée en ce que lesdits éléments granulaires (10) sont unis les uns aux autres par sintérisation à leurs points de tangence correspondants.

**7.** Tête de combustion selon la revendication 1, caractérisée en ce que lesdits éléments granulaires (10) sont unis les uns aux autres par collage à leurs points de tangence correspondants.

**8.** Tête de combustion selon la revendication 2, caractérisée en ce qu'on prévoit au moins une couche de sphères, dans laquelle les sphères sont distribuées suivant un treillis géométrique formé de mailles triangulaires.

**9.** Tête de combustion selon la revendication 2, caractérisée en ce qu'on prévoit au moins une couche de sphères, dans laquelle les sphères (10) sont distribuées suivant un treillis géométrique formé de mailles carrées.

**10.** Tête de combustion selon la revendication 8, caractérisée en ce que lesdites sphères (10) sont distribuées dans au moins trois couches superposées, les sphères appartenant à chaque couche ayant un positionnement symétriquement décalé par rapport aux sphères adjacentes appartenant aux autres couches attenantes.

**11.** Tête de combustion selon la revendication 9, caractérisée en ce que lesdites sphères (10) sont distribuées dans au moins deux couches superposées, les sphères appartenant à chaque couche ayant un positionnement symétriquement décalé par rapport aux sphères adjacentes appartenant à la couche attenante.

**12.** Tête de combustion selon la revendication 1, caractérisée en ce que lesdits éléments granulaires (10) sont reliés les uns aux autres par contact réciproque auxdits points de tangence.

**13.** Tête de combustion selon la revendication 1, caractérisée en ce que ledit élément de fermeture (17) se compose d'un élément réticulaire.

**14.** Tête de combustion selon la revendication 1, caractérisée en ce qu'elle comporte un élément de fermeture supplémentaire (18) associé à ladite paroi latérale (15) du corps contenant (13) et placé à une distance donnée dudit élément de fermeture (17), à l'écart de ladite paroi de fond (14), ledit élément de fermeture supplémentaire (18) étant pourvu d'une pluralité d'ouvertures de passage (18a) définissant une structure essentiellement réticulaire.

**15.** Tête de combustion selon la revendication 14, caractérisée en ce que ledit élément de fermeture supplémentaire (18) se compose d'un élément réticulaire.

**16.** Tête de combustion selon la revendication 1, caractérisée en ce qu'elle comporte une garniture d'étanchéité (19) interposée de manière opérationnelle entre ladite paroi latérale (15) du corps en forme de boîtier (13) et ledit bord supérieur (2a) du corps de mélange (2).

**17.** Tête de combustion selon la revendication 1, caractérisée en ce qu'elle comporte en outre des moyens de blocage (20) pour la fixation réciproque dudit bord supérieur (2a) du corps de mélange (2), de ladite paroi latérale (15) du corps contenant (13) et de l'élément de fermeture (17).

**18.** Tête de combustion selon la revendication 17, caractérisée en ce que lesdits moyens de blocage comportent un élément d'agrafage (20) ayant une forme en coupe transversale sensiblement en "C".

**19.** Méthode pour la fabrication et la mise en oeuvre d'une tête de combustion, comme définie dans la revendication 1, caractérisée en ce qu'elle comporte les étapes suivantes:

- fabriquer un corps contenant en forme de boîtier (13) ayant au moins une paroi de fond (14) pourvue d'une pluralité d'ouvertures de passage (14a) définissant une structure sensiblement réticulaire, et au moins une paroi latérale (15) s'étendant de ladite paroi de fond (14) le long de son pourtour et définissant avec cette dernière un logement (16);
- verser une pluralité d'éléments granulaires (10) dans ledit logement (16) de manière à former

essentiellement un lit filtrant présentant un treillis d'espaces vides (11) communiquant entre eux et définissant une pluralité desdits orifices distributeur (12);

- associer auxdits éléments granulaires (10), audessus de ces derniers, un élément de fermeture (17) pourvu d'une pluralité d'ouvertures de passage (17a) définissant une structure essentiellement réticulaire,

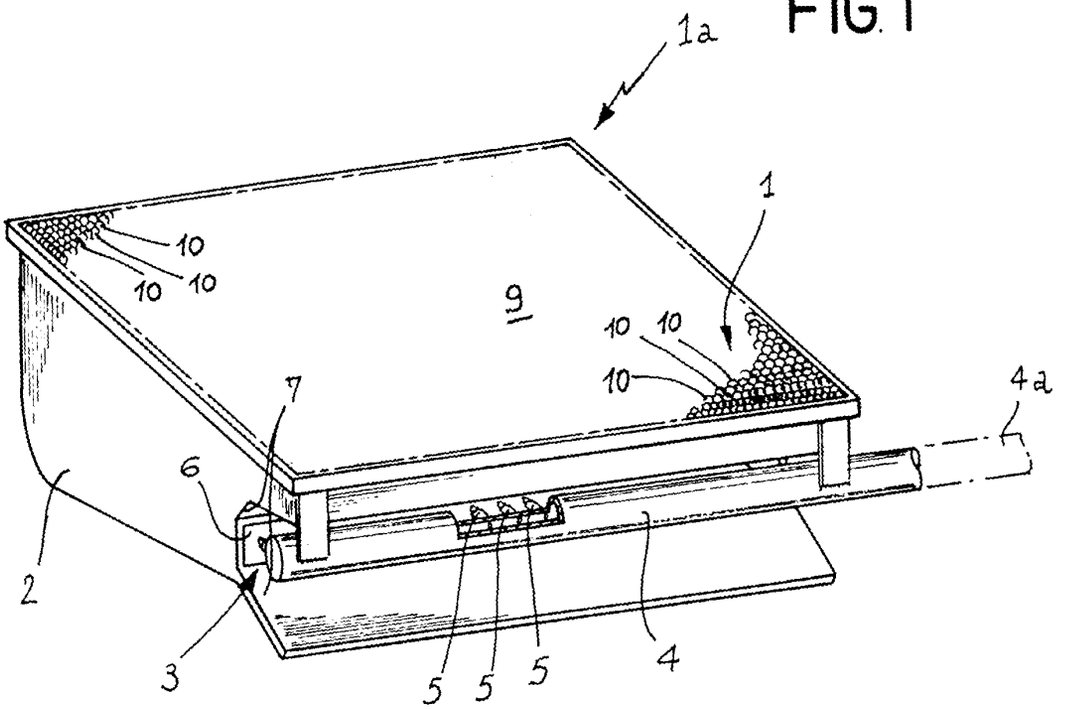
après cette étape de fabrication étant prévue une autre étape, dans laquelle le corps contenant en forme de boîtier (13) est engagé dans un siège périmétral (2b) défini par un bord supérieur (2a) dudit corps de mélange (2).

**20.** Méthode selon la revendication 19, caractérisée en ce que le corps contenant en forme de boîtier est soumis à une étape impliquant une action vibrante, simultanément à l'étape de verser les éléments granulaires (10).

**21.** Méthode selon la revendication 19, caractérisée en ce que le corps contenant en forme de boîtier (13) est engagé dans le siège périmétral (2b) après l'interposition d'une garniture d'étanchéité s'étendant entre la paroi latérale du corps contenant et ledit bord supérieur du corps de mélange (2).

**22.** Méthode selon la revendication 19, caractérisée en ce que, après ladite étape d'associer l'élément de fermeture (17) au corps contenant (13), on prévoit une autre étape d'association dans laquelle un élément de fermeture (18) supplémentaire est mis audessus de l'élément de fermeture (17) et est éloigné de ce dernier d'une distance donné, à l'écart de ladite paroi de fond (14), ledit élément de fermeture supplémentaire (18) étant garni d'une pluralité d'ouvertures de passage (18a) définissant une structure essentiellement réticulaire.

FIG. 1



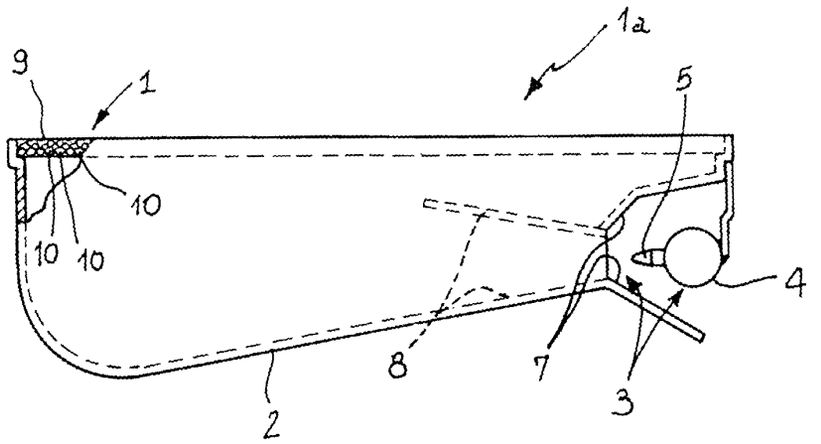




FIG. 2

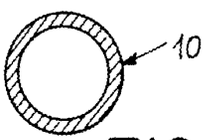



FIG. 7

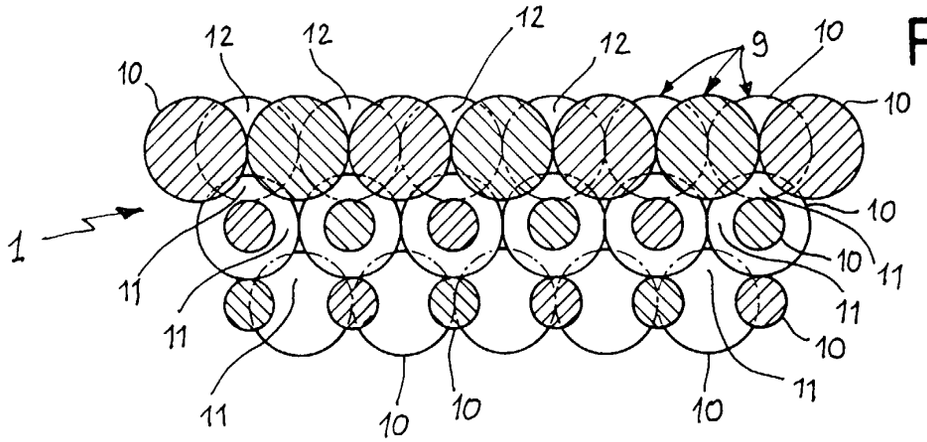



FIG. 4

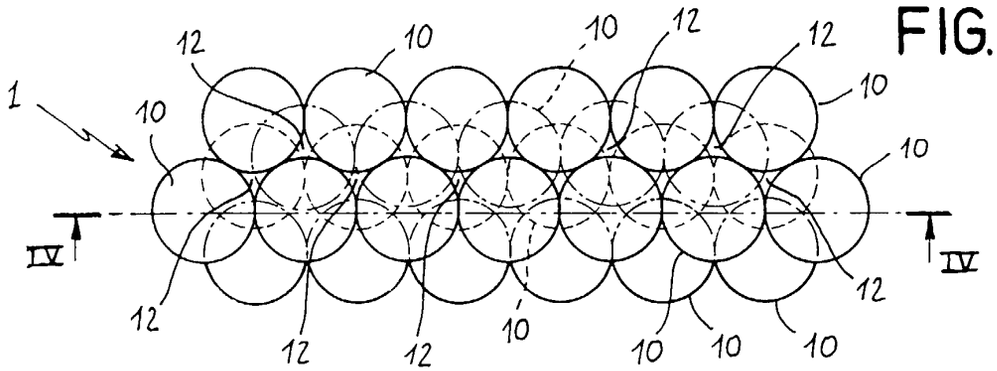



FIG. 3

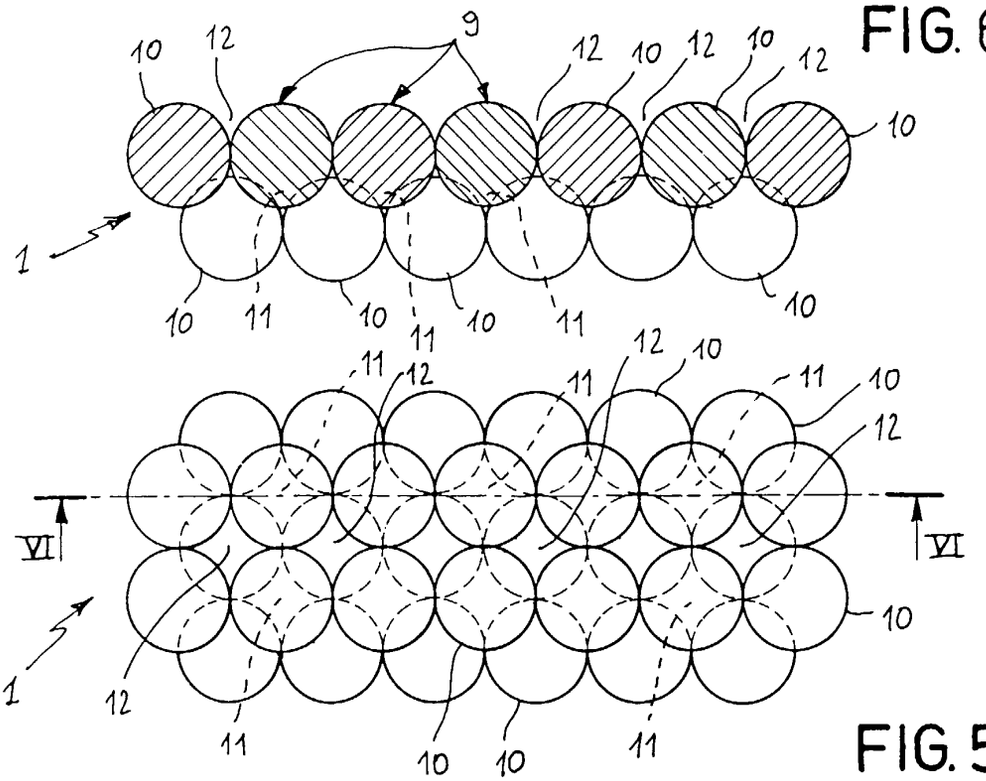



FIG. 6

FIG. 5

FIG.8