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(54) **BURNER MODULE**

BRENNERMODUL

MODULE DE BRÛLEUR

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Description

[0001] The present invention relates to a burner module, usable for example in a wall boiler.

[0002] A burner module normally comprises a manifold for combustible gas. Such a manifold is typically tubular in shape and essentially comprises a cylindrical conduit closed at the ends.

[0003] The manifold is provided with a plurality of nozzles, i.e. calibrated openings that put the inside of the manifold in communication with the external environment. The nozzles are placed side by side with each other and are aligned along a generatrix of the outer surface of the manifold.

[0004] A plurality of burner modules are juxtaposed one another to define a modular burner.

[0005] The nozzles are intended to allow the emission of combustible gas outside the manifold, so that combustion can take place. In particular, the combustible gas, which flows out of the collector through the nozzles, feeds the burner and the flame develops above the burner module. Additional comburent air, called secondary air, is fed to the flame from the surrounding environment.

[0006] Combustion products comprise, among other compounds, carbon monoxide (CO) and nitrogen oxides (NOx). These two compounds, as known, should be reduced as much as possible.

[0007] The amount of CO and NOx produced by combustion depends on various parameters, including the ratio of fuel to primary air, as well as the amount of secondary air in relation to the flow rate emitted by the nozzles. For example, a limited primary air supply results in a significant lowering of the lamba of the combustible air mixture. This means that the flame temperature, in the sections closest to the flame diffuser, is above the critical value for the formation of nitrogen oxides (NOx). This phenomenon is particularly accentuated towards low power regimes of the boiler and is certainly undesirable for obvious reasons tied to the containment of harmful emissions.

[0008] The design of the burner module is therefore very important to achieve optimal combustion conditions, with low emissions of harmful compounds. In particular, the diameter of the nozzles, their number and the pitch of separation between them, the collector section, must be chosen with extreme care in order to contain the emissions of harmful compounds.

[0009] Currently, the design of the burner modules is substantially done in an empirical manner, developing a model and testing the behaviour thereof during operation. In case of unsatisfactory behaviour, it is necessary to modify the model in one or more geometric parameters, for subsequent tests, until a satisfactory configuration is obtained. Each of US1863100, US20190257253A1, and EP3795899A1 discloses a burner module for a gaseous mixture according to the preamble of claim 1.

[0010] The current design is therefore relatively slow and laborious. Furthermore, in case of modifications required for one or more parameters of the burner module, it does not allow to readily adapt the other parameters for optimal operation.

[0011] The object of the present invention is to offer a burner module that allows to obtain optimal operating conditions, with low emissions of harmful compounds, and that can be quickly designed according to different construction and/or installation needs.

[0012] Features and advantages of the present invention will more fully emerge from the following detailed description of an embodiment of the present invention, as illustrated in a non-limiting example in the accompanying figures, in which:

- figure 1 shows a schematic view of the burner module according to the present invention, in vertical elevation;
- figure 2 shows a top view of the burner module of figure 1;
- figure 3 shows a sectional view on plane A-A of figure 2.

[0013] The burner module according to the present invention comprises a manifold (10), provided with a tubular body (11) that delimits an internal cavity (12). The manifold (10) is provided with an inlet opening (13), through which a combustible gas can be introduced into the tubular body (11).

[0014] A plurality of nozzles (20) are arranged so as to pass through the tubular body (11). In a manner known in the art, each nozzle comprises a threaded body (22), through which a calibrated through opening is obtained, at one end of which an outlet opening (21) of the nozzle (20) is arranged. The threaded body (22) is screwed into a corresponding through opening obtained through the wall of the tubular body (11). The outlet openings (21) have the same diameter (D).

[0015] The outlet openings (21) of the nozzles (20) lie on a common emission plane (P). In particular, the nozzles (20) are aligned along a direction parallel to a longitudinal axis (X) of the tubular body (11). Furthermore, the nozzles (20) are space apart from one another by a constant pitch (P). This step (P) is substantially the distance separating the outlet openings (21) from each other. In practice, each outlet opening (21) is separated from the two adjacent openings by the pitch (P).

[0016] The burner module also comprises a pair of brackets (30), provided to enable the attachment of the manifold (10) to a support structure, not shown. Such a support structure, for example, is a suitable attachment element provided in a wall boiler or in a water heater or, in general, an attachment element provided in the device in which the burner module is installed. Preferably, but not necessarily, the brackets (30) are positioned at the ends of the tubular body (11). In the embodiment depicted, the brackets (30) have a joint portion (32), at which they are connected to the tubular body (11), closing the ends thereof.

[0017] The brackets (30) also have an attachment portion (31), provided to enable the connection to said support structure of the device in which the installation of the burner module is envisaged. The attachment portions lie on the same connection plane (S), parallel to the emission plane (E). The attachment to said support structure is located on said connection plane.

[0018] The connection plane (S) and the emission plane (E) are spaced apart by a main height (H). In other words, the main height (H) is the distance separating the connection plane (S) and the emission plane (P).

[0019] Following extensive research, the Applicant has identified a dimensional parameter (R) that is extremely relevant for the correct design of the burner module, i.e. for the containment of the compounds emitted by the combustion of the mixture.

[0020] The dimensional parameter (R) is given by the product between said main height (H), said pitch (P) and the diameter (D) of the outlet openings (21) of the nozzles (20). The dimensional parameter (R) is therefore a volume.

[0021] If the dimensions (H,P,D) whose product defines the dimensional parameter (R) are measured in millimetres, the Applicant has found that a value of (R) comprised between 71 and 84 mm^3 allows NOx emissions to be contained well below 90 mg/kWh, and CO emissions to be contained well below 1000 ppm.

[0022] In practice, if:

$$R=H*P*D;$$

$$71 < R < 84 \text{ mm}^3,$$

[0023] nOx emissions remain well below 90 mg/kWh, and CO emissions remain well below 1000 ppm.

[0024] Thanks to the identification of the dimensional parameter (R), the design of a burner module is considerably simplified.

[0025] For example, given the diameter of the outlet openings (21), which is typically a function of the type of fuel used and depends on the conformation of the nozzles (20), and the main height (H) being known, which depends on the position and on the installation required for the burner module, obtaining the optimal pitch (P) at which to place the nozzles (20) is immediate. For example, in the case of natural gas, the diameter of the openings (21) is comprised between about 0.9 and 1.5 mm, as a function of the operating pressure.

[0026] Conversely, if the conformation of the nozzles (20) requires a predetermined mounting pitch (P), the dimensional parameter (R) allows the optimal main height (H) to be obtained.

[0027] Preferably, said dimensional parameter (R) is comprised between 75 and 80, i.e.:

$$75 < R < 80.$$

[0028] Within this range comprised between 75 and 80, NOx remains below 85mg/kWh, while CO remains below 800 ppm.

[0029] A plurality of burner modules according to the present invention may be arranged to form a modular burner. The burner modules are arranged side by side with each other with the same emission plane (P) and the same connection plane (S). In a preferred embodiment, the modular burner comprises twenty-one burner modules.

[0030] Examples of further particularly effective configurations for a modular burner, comprising a plurality of burner modules according to the present invention, provide for nineteen or thirty-one burner modules. In all cases, the combustion conditions are optimal, with reduced emissions of harmful compounds.

[0031] The burner module according to the present invention has important advantages over the prior art.

[0032] First of all, the burner module allows to obtain optimal combustion conditions, containing the amount of harmful compounds emitted, in particular NOx and CO.

[0033] In addition, the definition of the dimensional parameter (R) allows to greatly simplify the design of the burner module, ensuring the certainty of containing the amount of harmful compounds emitted, without the need to make prototypes to test the operation thereof.

Claims

1. A burner module for a gaseous mixture, comprising:

   a manifold (10), provided with a tubular body (11) that delimits an internal cavity (12);
   a plurality of nozzles (20), arranged so as to pass through the tubular body (11), each of which has an outlet opening (21);
   an emission plane (P), on which the outlet openings (21) of the nozzles (12) lie;
   a pair of brackets (30), provided to enable the attachment of the manifold (10) to a support structure, and which have an attachment portion (31) for attaching to said support structure;
   a connection plane (S), on which the attachment portions (31) lie and on which the attachment to said support structure is located;
   wherein the outlet openings (21) of the nozzles have an equal diameter (D);
   wherein the nozzles (20) are spaced apart from one another by a constant pitch (P);
   wherein the connection plane (S) and the emission plane (P) are parallel to each other and are spaced apart by a main height (H);
   characterised in that:
   a dimensional parameter (R) given by the prod-

uct between said main height (H), said pitch (P) and the diameter (D) of the outlet openings (21) of the nozzles (20), measured in millimetres, is comprised between 71 and 84, i.e.:

$$R=H*P*D;$$

$$71 < R < 84.$$

2. The burner module according to claim 1, wherein said dimensional parameter (R) is comprised between 75 and 80, i.e.:

$$75 < R < 80.$$

3. A modular burner, comprising a plurality of burner modules according to one of the preceding claims, arranged side by side with a same emission plane (P) and a same connection plane (S).

4. The modular burner according to claim 3, comprising twenty-one burner modules according to claim 1 or 2.

5. The modular burner according to claim 3, comprising nineteen burner modules according to claim 1 or 2.

6. The modular burner according to claim 3, comprising thirty-one burner modules according to claim 1 or 2.

Patentansprüche

1. Brennermodul für ein gasförmiges Gemisch, umfassend:

einen Verteiler (10), der mit einem rohrförmigen Körper (11) versehen ist, der einen inneren Hohlraum (12) begrenzt;
eine Vielzahl von Düsen (20), die so angeordnet sind, dass sie durch den rohrförmigen Körper (11) hindurchtreten, von denen eine jede eine Auslassöffnung (21) aufweist;
eine Emissionsebene (P), auf der die Auslassöffnungen (21) der Düsen (12) liegen;
ein Paar Halterungen (30), die bereitgestellt sind, um die Anbringung des Verteilers (10) an einer Stützstruktur zu ermöglichen, und die einen Anbringungsabschnitt (31) zur Anbringung an der Stützstruktur aufweisen;
eine Verbindungsebene (S), auf der die Anbringungsabschnitte (31) liegen und auf der sich die Anbringung an der Stützstruktur befindet;
wobei die Auslassöffnungen (21) der Düsen einen gleichen Durchmesser (D) aufweisen;
wobei die Düsen (20) durch einen konstanten Abstand (P) voneinander beabstandet sind;
wobei die Verbindungsebene (S) und die Emissionsebene (P) parallel zueinander sind und durch eine Haupthöhe (H) voneinander beabstandet sind;
dadurch gekennzeichnet, dass:
ein durch das Produkt gegebener Bemaßungsparameter (R) zwischen der Haupthöhe (H), dem Abstand (P) und dem Durchmesser (D) der Auslassöffnungen (21) der Düsen (20), gemessen in Millimetern, im Bereich zwischen 71 und 84 liegt, d.h.:

$$R=H*P*D;$$

$$71 < R < 84.$$

2. Brennermodul nach Anspruch 1, wobei der Bemaßungsparameter (R) im Bereich zwischen 75 und 80 liegt, d. h.:

$$75 < R < 80.$$

3. Modularer Brenner, umfassend eine Vielzahl von Brennermodulen nach einem der vorhergehenden Ansprüche, die Seite an Seite mit einer gleichen Emissionsebene (P) und einer gleichen Verbindungsebene (S) angeordnet sind.

4. Modularer Brenner nach Anspruch 3, umfassend einundzwanzig Brennermodule nach Anspruch 1 oder 2.

5. Modularer Brenner nach Anspruch 3, umfassend neunzehn Brennermodule nach Anspruch 1 oder 2.

6. Modularer Brenner nach Anspruch 3, umfassend einunddreißig Brennermodule nach Anspruch 1 oder 2.

Revendications

1. Module de brûleur pour un mélange gazeux, comprenant :

un collecteur (10), pourvu d'un corps tubulaire (11) qui délimite une cavité interne (12) ;
une pluralité de buses (20), disposées de manière à traverser le corps tubulaire (11), chacune d'entre elles comportant une ouverture de sortie (21) ;
un plan d'émission (P), sur lequel reposent les ouvertures de sortie (21) des buses (12) ;
une paire de supports (30), prévus pour permet-

tre la fixation du collecteur (10) à une structure de soutien, et qui comportent une partie de fixation (31) pour la fixation à ladite structure de soutien ;
un plan de raccordement (S), sur lequel reposent les parties de fixation (31) et sur lequel se situe la fixation à ladite structure de soutien ;
dans lequel les ouvertures de sortie (21) des buses ont un diamètre égal (D) ;
dans lequel les buses (20) sont espacées les unes des autres d'un pas constant (P) ;
dans lequel le plan de raccordement (S) et le plan d'émission (P) sont parallèles l'un à l'autre et sont espacés d'une hauteur principale (H) ;
caractérisé en ce que :
un paramètre dimensionnel (R) donné par le produit entre ladite hauteur principale (H), ledit pas (P) et le diamètre (D) des ouvertures de sortie (21) des buses (20), mesuré en millimètres, est compris entre 71 et 84, c'est-à-dire :

$$R = H*P*D ;$$

$$71 < R < 84.$$

2. Module de brûleur selon la revendication 1, dans lequel ledit paramètre dimensionnel (R) est compris entre 75 et 80, c'est-à-dire :

$$75 < R < 80.$$

3. Brûleur modulaire, comprenant une pluralité de modules de brûleur selon l'une des revendications précédentes, disposés côte à côte avec un même plan d'émission (P) et un même plan de raccordement (S).

4. Brûleur modulaire selon la revendication 3, comprenant vingt-et-un modules de brûleur selon la revendication 1 ou 2.

5. Brûleur modulaire selon la revendication 3, comprenant dix-neuf modules de brûleur selon la revendication 1 ou 2.

6. Brûleur modulaire selon la revendication 3, comprenant trente-et-un modules de brûleur selon la revendication 1 ou 2.

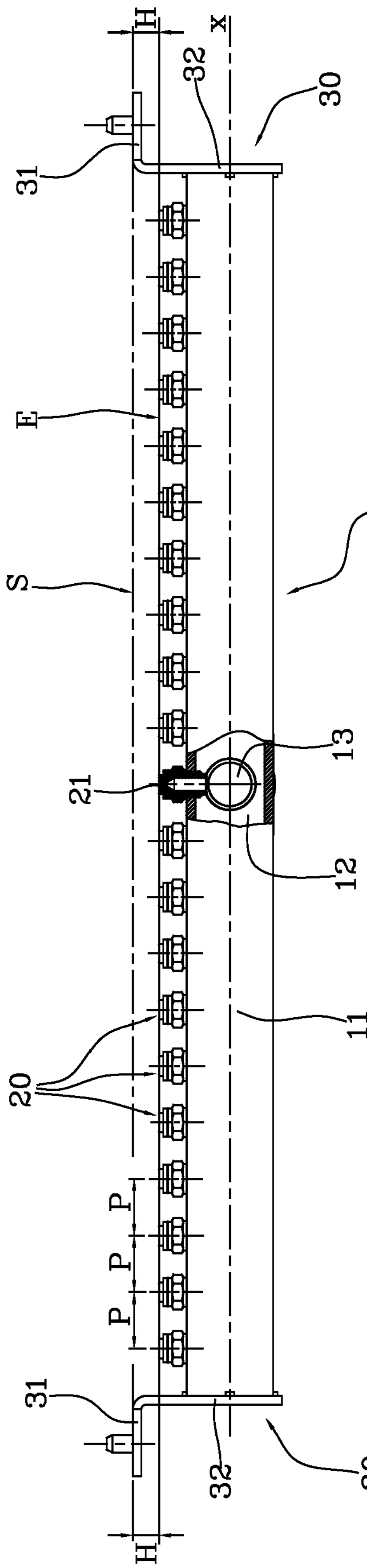

Fig.1

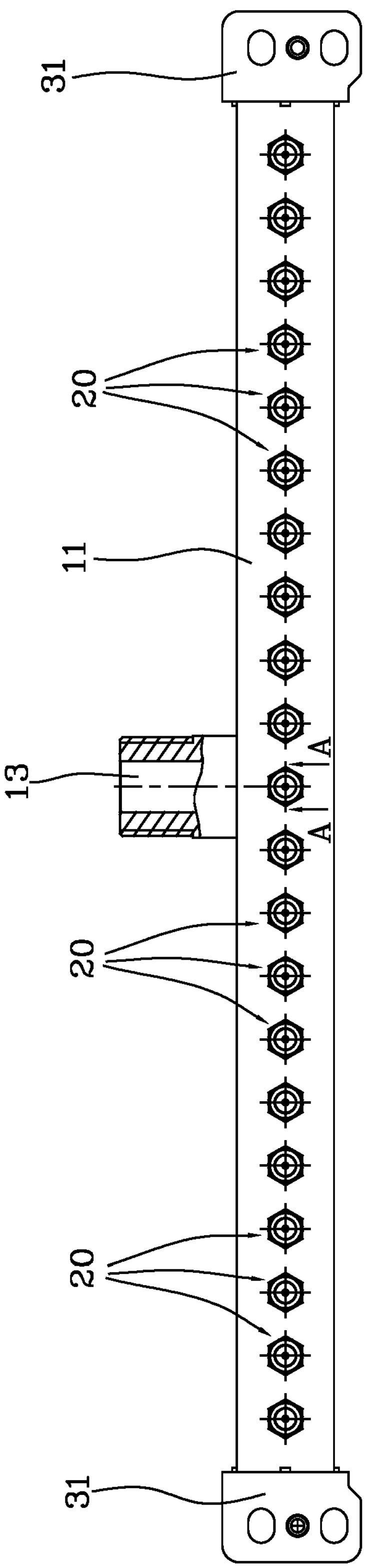

Fig.2

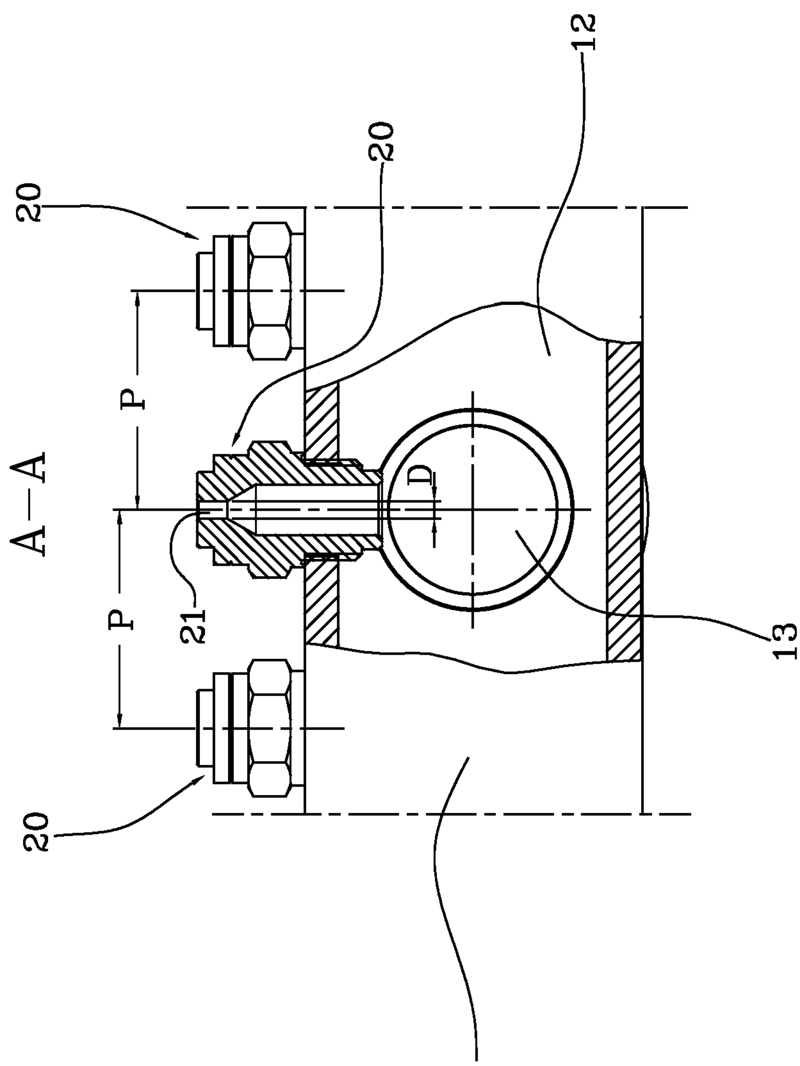

Fig.3

REFERENCES CITED IN THE DESCRIPTION

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