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(54) **BURNER HOUSING**

(57) A burner housing, comprising: an internal cartridge housed in an external housing; wherein the internal cartridge defines a plurality of ports selected from the group consisting of: an inlet cooling fluid port, an outlet cooling fluid port; a burner port; particle injection port; a

cooling fluid circuit defined by and/or disposed in the internal cartridge and/or the external housing; and wherein the internal cartridge is made of a first material and the external housing is made from a second material.

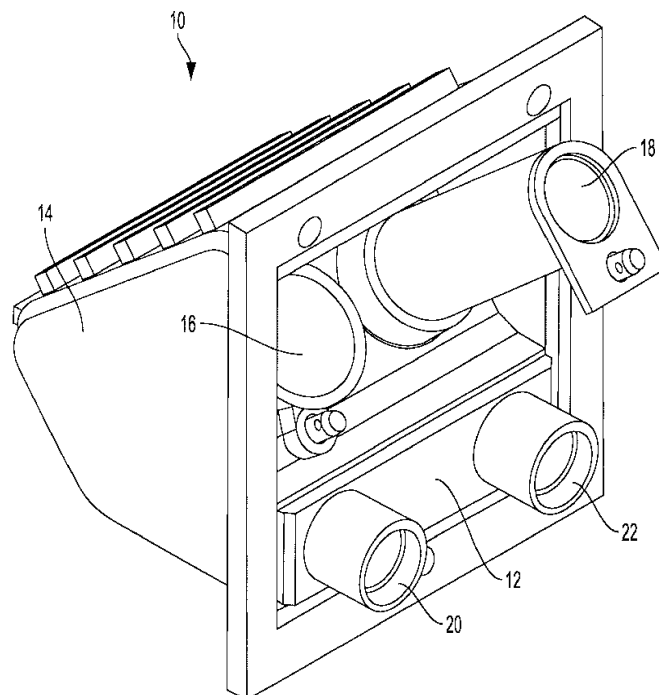


FIG. 1

Description

[0001] This application claims the benefit of patent application U.S. Serial No. 15/803,223 filed November 3, 2017, which is incorporated by reference herein for all purposes.

FIELD OF THE DISCLOSURE

[0002] The present disclosure generally relates to an improved housing for apparatus such as auxiliary burners used in metal melting, refining and processing, for example, steel making in an electric arc furnace (EAF) or blast furnace.

BACKGROUND OF THE DISCLOSURE

[0003] Generally auxiliary burners are used to assist in the steel making process to add thermal energy by the combustion of fuel, the injection of oxidizing gas for melt refining, foamy slag production or post combustion of carbon monoxide, and the injection of particulates for slag and foamy slag production. In many instances, the oxidizing gas is introduced as a high velocity stream that may exceed sonic velocities.

[0004] Existing housings for protecting such auxiliary burners and other apparatus have various deficiencies that detract from the efficiency and economy of the steel-making process.

[0005] In order to overcome the disadvantages associated with typical burner housings, it would be desirable to provide a burner housing having a similar geometry to existing burner housings cans that is capable of housing a burner and/or a particle injector; that provides greater cooling efficiency while using less copper metal.

[0006] It would also be desirable to provide a burner housing of a hybrid design having an internal cartridge made of a first material such as steel and external housing made of a second material such as copper.

BRIEF SUMMARY OF THE DISCLOSURE

[0007] Many other variations are possible with the present disclosure, and those and other teachings, variations, and advantages of the present disclosure will become apparent from the description and figures of the disclosure.

[0008] One aspect of a preferred embodiment of the present disclosure comprises a burner housing, comprising an internal cartridge housed in an external housing; wherein the internal cartridge defines a plurality of ports selected from the group consisting of: an inlet cooling fluid port, an outlet cooling fluid port; a burner port; particle injection port; a cooling fluid circuit defined by and/or disposed in the internal cartridge and/or the external housing; and wherein the internal cartridge is made of a first material and the external housing is made from a second material.

[0009] In another aspect of a burner housing of the present disclosure, the internal cartridge is made of steel and the external housing is made from copper.

[0010] Another aspect of a preferred embodiment of the present disclosure comprises a fluid cooled burner housing, comprising an inlet cooling fluid port; an outlet cooling fluid port; wherein the inlet and outlet cooling fluid ports are in fluid communication to an external cooling fluid source; and a cooling fluid circuit comprising a plurality of cooling panels; wherein each cooling panel houses an individual cooling fluid circuit and has a cooling fluid inlet and outlet in fluid communication with a manifold; wherein the manifold is in fluid communication with the inlet and outlet cooling fluid ports of the burner housing.

[0011] In another aspect of a fluid cooled burner housing of the present disclosure, each individual cooling fluid circuit of each panel comprises one or more pipes.

[0012] In yet another aspect of a fluid cooled burner housing of the present disclosure, each individual cooling fluid circuit of each panel comprises one or more conduits defined within each cooling panel. Preferably, such conduits may be made by drilling or by casting.

[0013] In another aspect of a fluid cooled burner housing of the present disclosure, each individual cooling panel comprises a copper housing.

[0014] In a further aspect of a fluid cooled burner housing of the present disclosure, each individual cooling fluid circuit of each panel comprises one or more pipes. Preferably, such pipes comprise steel.

[0015] In another aspect of a fluid cooled burner housing of the present disclosure, each of the inlet cooling fluid port, the outlet cooling fluid port and the manifold comprises steel.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0016] For the present disclosure to be easily understood and readily practiced, the present disclosure will now be described for purposes of illustration and not limitation in connection with the following figures, wherein:

FIG. 1 shows a perspective view of a preferred "flame guard" style hybrid steel and copper burner housing according to the present disclosure;

FIG. 2 shows a side elevational view of the preferred "flame guard" style hybrid steel and copper burner housing of **FIG. 1**;

FIG. 3 shows a front elevational view of the preferred "flame guard" style hybrid steel and copper burner housing of **FIG. 1**;

FIG. 4 shows a perspective view of a preferred "keg" style hybrid steel and copper burner housing according to the present disclosure;

FIG. 5 shows a side elevational view of the preferred "keg" style hybrid steel and copper burner housing of **FIG. 4**;

FIG. 6 shows a perspective view of a preferred "jet box" style hybrid steel and copper burner housing according to the present disclosure;

FIG. 7 shows a schematic view of a preferred cooling fluid circuit produced in the "jet box" style hybrid steel and copper burner housing of **FIG. 6**;

FIG. 8 shows a perspective view of a preferred "concast" style hybrid steel and copper burner housing according to the present disclosure;

FIG. 9 shows a perspective "see through" view of a preferred modular cooling wall segment used in manufacturing the "concast" style hybrid steel and copper burner housing of **FIG. 8**;

FIG. 10 shows a perspective view of a preferred modular cooling wall segment used in manufacturing the "concast" style hybrid steel and copper burner housing of **FIG. 8**;

FIG. 11 shows a schematic view of preferred modular cooling wall segments forming an enclosed cooling wall for use the "concast" style hybrid steel and copper burner housing of **FIG. 8**;

FIG. 12 shows a partial cut-away and partial "see-through" view of preferred modular cooling wall segments as used in the "concast" style hybrid steel and copper burner housing of **FIG. 8**; and

FIG. 13 shows a partial cut-away view of preferred modular cooling wall segments as used in the "concast" style hybrid steel and copper burner housing of **FIG. 8**.

DETAILED DESCRIPTION

[0017] In the following detailed description, reference is made to the accompanying examples and figures that form a part hereof, and in which is shown by way of illustration specific embodiments in which the inventive subject matter may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice them, and it is to be understood that other embodiments may be utilized and that structural, logical, and electrical changes may be made without departing from the scope of the inventive subject matter. Such embodiments of the inventive subject matter may be referred to, individually and/or collectively, herein by the term "disclosure" merely for convenience and without intending to voluntarily limit the scope of this application to any single disclosure or inventive concept if more than one is in fact disclosed.

[0018] The following description is, therefore, not to be taken in a limited sense, and the scope of this disclosure is defined by the appended claims.

[0019] FIGS. 1-3 show a preferred "flame guard" style hybrid burner housing 10 of the present disclosure, such as for a burner for an EAF (Electric Arc Furnace), blast furnace or other type of metallurgical furnace, comprising an internal cartridge 12 housed in an external housing 14; wherein the internal cartridge 12 defines a plurality of ports selected from the group consisting of: an inlet

cooling fluid port 20, an outlet cooling fluid port 22; a burner port 16; media/particle injection port 18; and a cooling fluid circuit defined by and/or disposed in the internal cartridge 12 and/or the external housing 14; and wherein the internal cartridge 12 is made of a first material and the external housing 14 is made from a second material.

[0020] In another aspect of a preferred burner housing 10 of the present disclosure, the internal cartridge 12 is made of steel and the external housing 14 is made from copper. Preferably, external housing 14 is cast out of copper or fabricated out of copper and the remainder of the housing 10 is fabricated from steel and other materials as required. Housing 10 is more cost effective to manufacture than prior "flame guard" style burner housings.

[0021] FIGS. 4-5 show a preferred "keg style" burner housing 10A of the present disclosure, such as for a burner for an EAF (Electric Arc Furnace), blast furnace or other type of metallurgical furnace, of the present disclosure, comprises: an internal cartridge 12 housed in an external housing 14; wherein the internal cartridge 12 defines a plurality of ports selected from the group consisting of: an inlet cooling fluid port 20, an outlet cooling fluid port 22; a burner port 16; media/particle injection port 18; and a cooling fluid circuit disposed between in the internal cartridge 12 and the external housing 14; and wherein the internal cartridge 12 is made of a first material, such as steel, and the external housing 14 is made from a second material, such as copper. Preferably, external housing 14 is cast out of copper or fabricated out of copper and the remainder of the housing 10A is fabricated from steel and other materials as required. Housing 10A is more cost effective to manufacture and operates about 50 degrees F cooler than prior burner housings.

[0022] FIGS. 6-7 show a preferred "jet box" burner housing 10C of the present disclosure, such as for a burner for an EAF (Electric Arc Furnace), blast furnace or other type of metallurgical furnace, of the present disclosure, comprises an external housing 14 for housing a combustion can such as is shown and described in U.S. Provisional Patent Application Serial No. 62/416,807 filed November 3, 2016, incorporated by reference herein for all purposes. Alternatively, housing 10C may house an internal cartridge (not shown, but as described above with respect to FIGS. 1-5) defines a plurality of ports selected from the group consisting of: an inlet cooling fluid port, an outlet cooling fluid port; a burner port; media/particle injection port. Burner housing 10C preferably defines a cooling fluid circuit 17 as shown in FIG. 7 disposed between external housing 14 and the contained combustion can or cartridge as the case may be. Preferably, external housing is made from copper while the combustion can has its own hybrid construction of copper and steel. Alternatively, the combustion can may be made primarily of copper. Also, a steel cartridge may be used instead of a combustion can.

[0023] Preferably, external housing 14 of housing 10C is cast out of copper or fabricated out of copper and the remainder of the housing 10C is fabricated from copper and/or steel and other materials as required. Housing 10C is more cost effective to manufacture, uses less copper and operates cooler than prior burner housings of similar design.

[0024] FIGS. 8-13 show a preferred "concast style" burner housing 10D of the present disclosure, the cooling fluid circuit comprises a plurality of modular cooling panels 30 preferably cast out of copper; wherein each modular cooling panel 30 houses its own cooling fluid circuit 31 (which may be internal pipes cast or cooling channels defined by the panel) and has a cooling fluid inlet 32 and outlet 34 in fluid communication with a baffle or manifold 40; wherein the baffle or manifold 40 is in fluid communication with the inlet and outlet cooling fluid ports 20, 22 of the burner housing 10. Housing 10D is more cost effective to manufacture and requires fewer welds than prior burner housings of similar design. Further, a large part of the manufacturing of housing 10D can be done offsite and easily assembled onsite.

[0025] In another aspect of a preferred burner housing 10D of the present disclosure, the structure of housing 10D other than modular cooling panels 30 and including inlet cooling fluid port 20, outlet cooling fluid port 22 and manifold 40 are preferably made from steel.

[0026] It will be appreciated that this background description has been created by the inventors to aid the reader, and is not to be taken as an indication that any of the indicated problems were themselves appreciated in the art. While the described principles can, in some respects and embodiments, alleviate the problems inherent in other systems, it will be appreciated that the scope of the protected innovation is defined by the attached claims, and not by the ability of any disclosed feature to solve any specific problem noted herein.

Claims

1. A burner housing, comprising:

an internal cartridge housed in an external housing;
 wherein the internal cartridge defines a plurality of ports selected from the group consisting of: an inlet cooling fluid port, an outlet cooling fluid port; a burner port; particle injection port; a cooling fluid circuit defined by and/or disposed in the internal cartridge and/or the external housing; and
 wherein the internal cartridge is made of a first material and the external housing is made from a second material.

2. The burner housing of claim 1, wherein the internal cartridge is made of steel and the external housing

is made from copper.

3. A fluid cooled burner housing, comprising:

an inlet cooling fluid port;
 an outlet cooling fluid port;
 wherein the inlet and outlet cooling fluid ports are in fluid communication to an external cooling fluid source; and
 a cooling fluid circuit comprising a plurality of cooling panels; wherein each cooling panel houses an individual cooling fluid circuit and has a cooling fluid inlet and outlet in fluid communication with a manifold; wherein the manifold is in fluid communication with the inlet and outlet cooling fluid ports of the burner housing.

4. The fluid cooled burner housing of claim 3, wherein each individual cooling fluid circuit of each panel comprises one or more pipes.

5. The fluid cooled burner housing of claim 3 or claim 4, wherein each individual cooling fluid circuit of each panel comprises one or more conduits defined within each cooling panel.

6. The fluid cooled burner housing of claim 4 or claim 5, wherein each of the conduits is made by drilling or by casting.

7. The fluid cooled burner housing of any one of claims 3 to 6, wherein each individual cooling panel comprises a copper housing.

8. The fluid cooled burner housing of claim 7, wherein each individual cooling fluid circuit of each panel comprises one or more pipes.

9. The fluid cooled burner housing of claim 8, wherein the one or more pipes comprise steel.

10. The fluid cooled burner housing of any one of claims 3 to 9, wherein each of the inlet cooling fluid port, the outlet cooling fluid port and the manifold comprises steel.

11. The fluid cooled burner housing of any one of claims 7 to 10, wherein each of the inlet cooling fluid port, the outlet cooling fluid port and the manifold comprises steel.

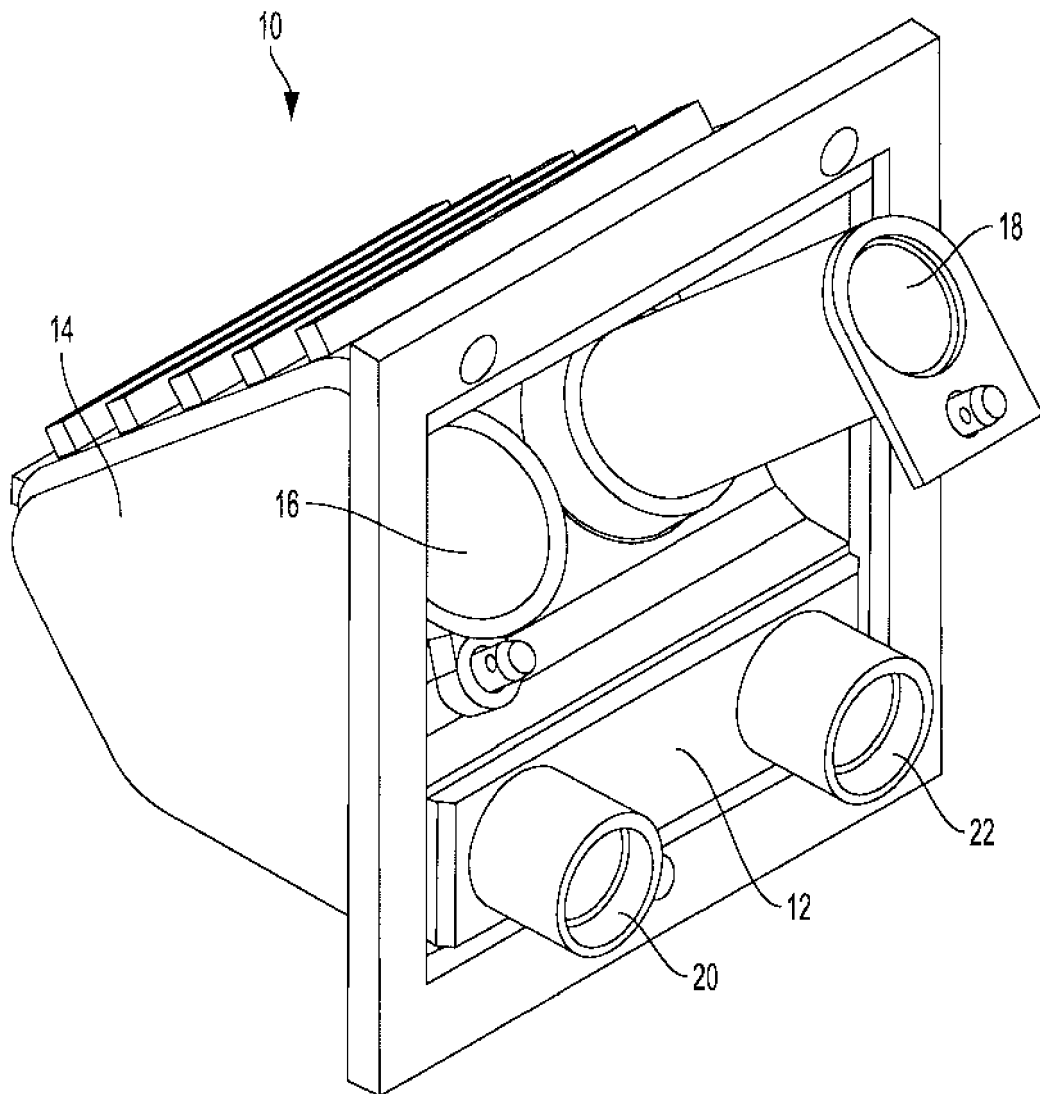


FIG. 1

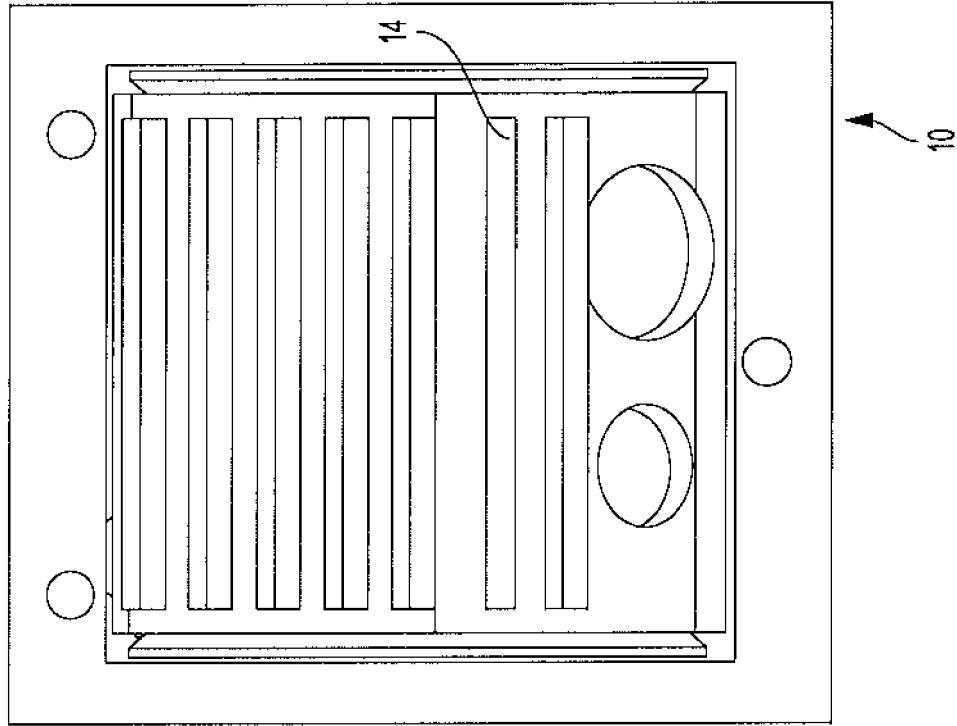


FIG. 3

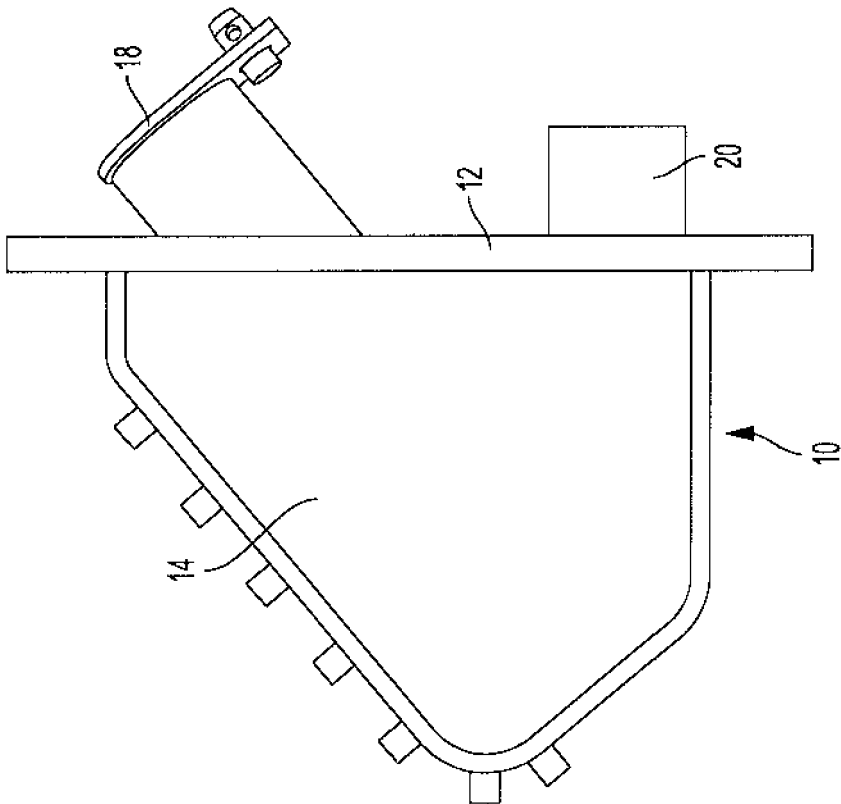


FIG. 2

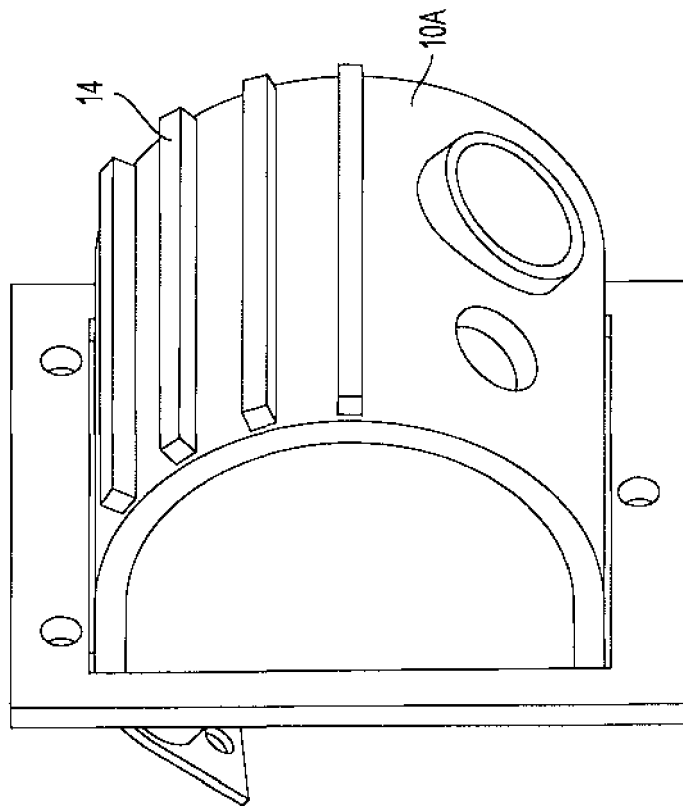


FIG. 5

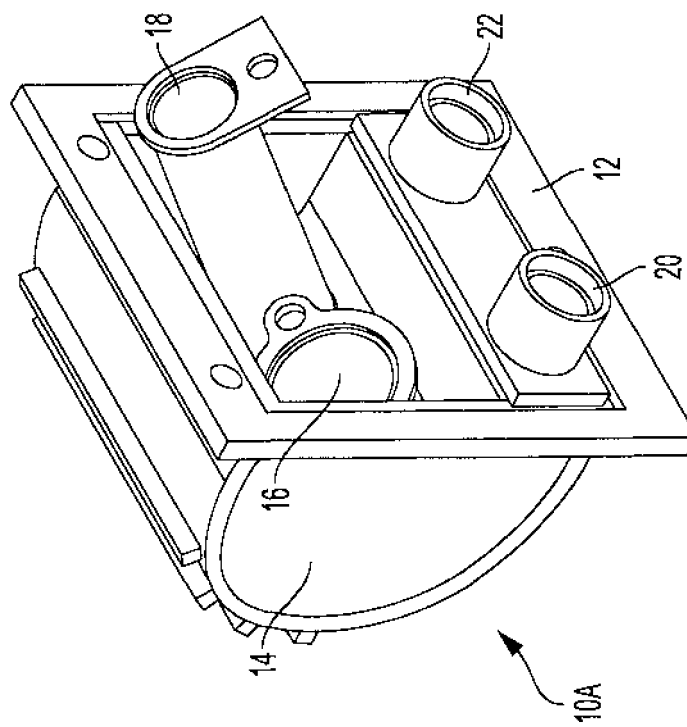


FIG. 4

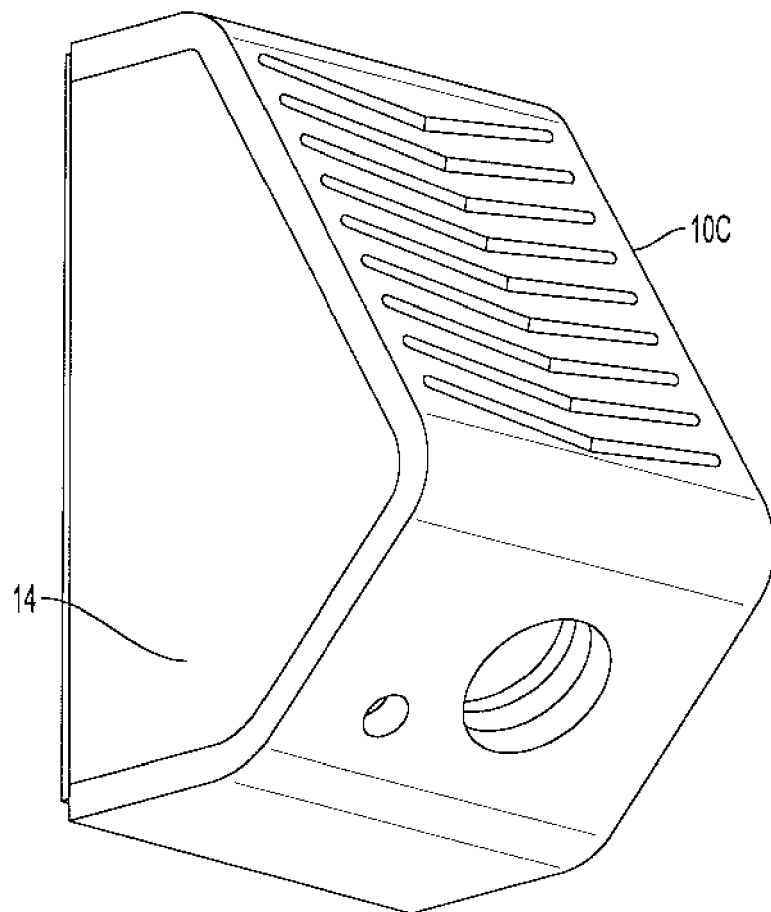


FIG. 6

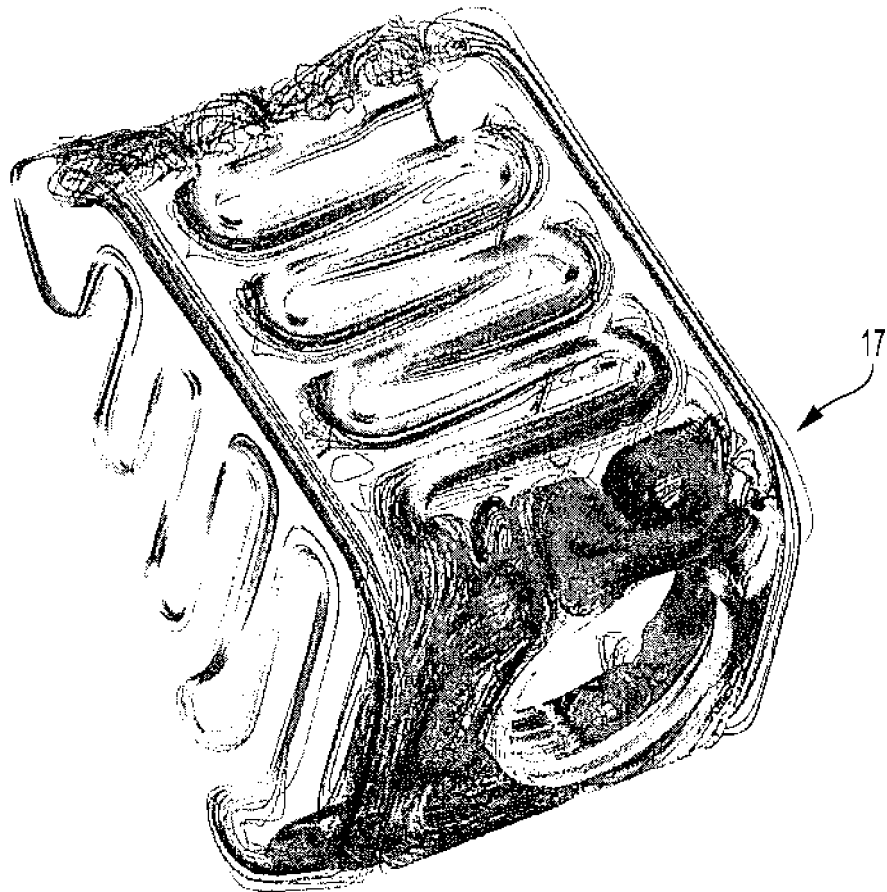


FIG. 7

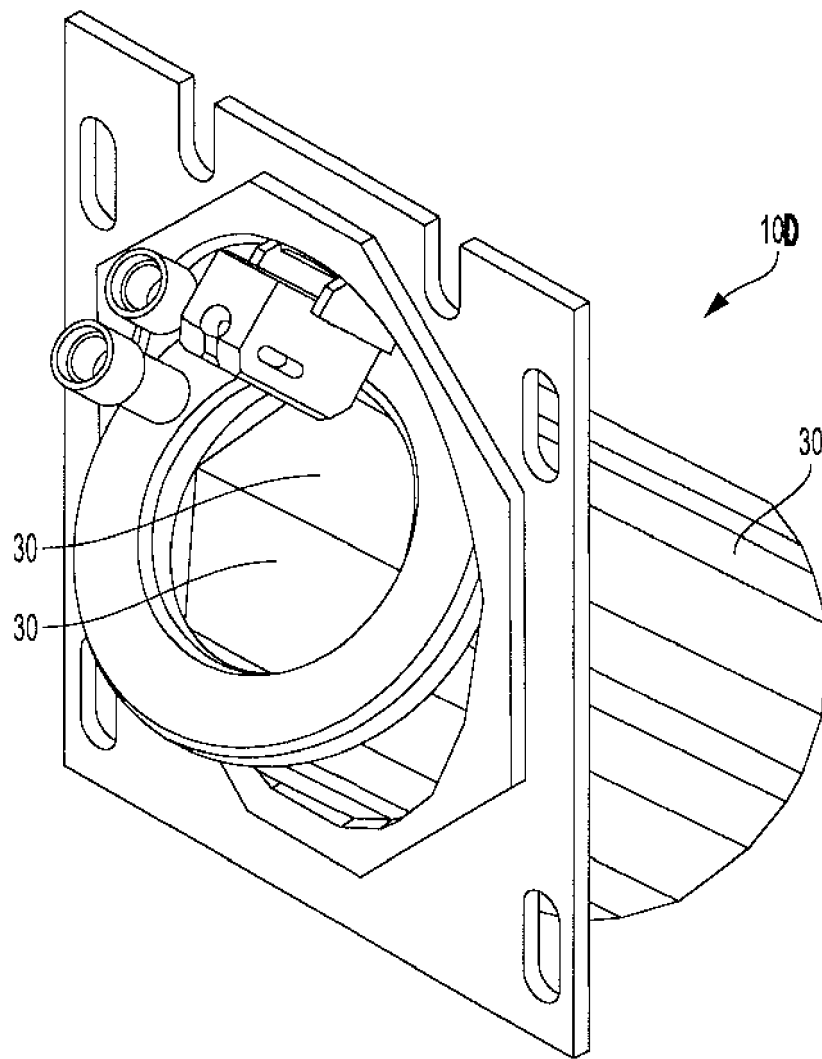


FIG. 8

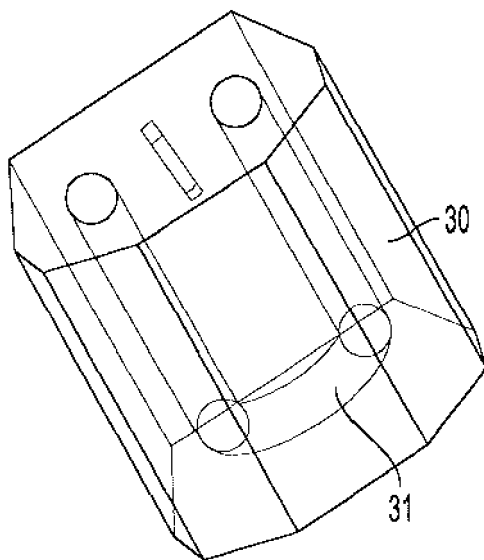


FIG. 9

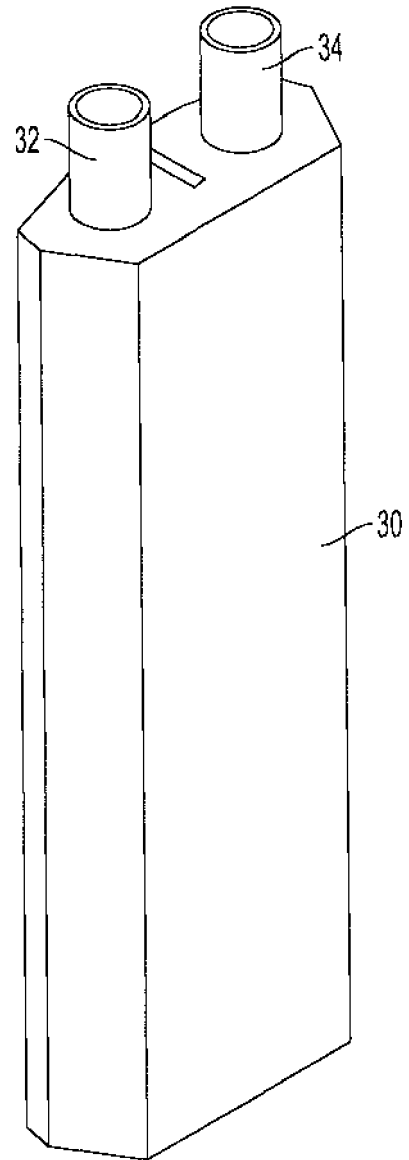


FIG. 10

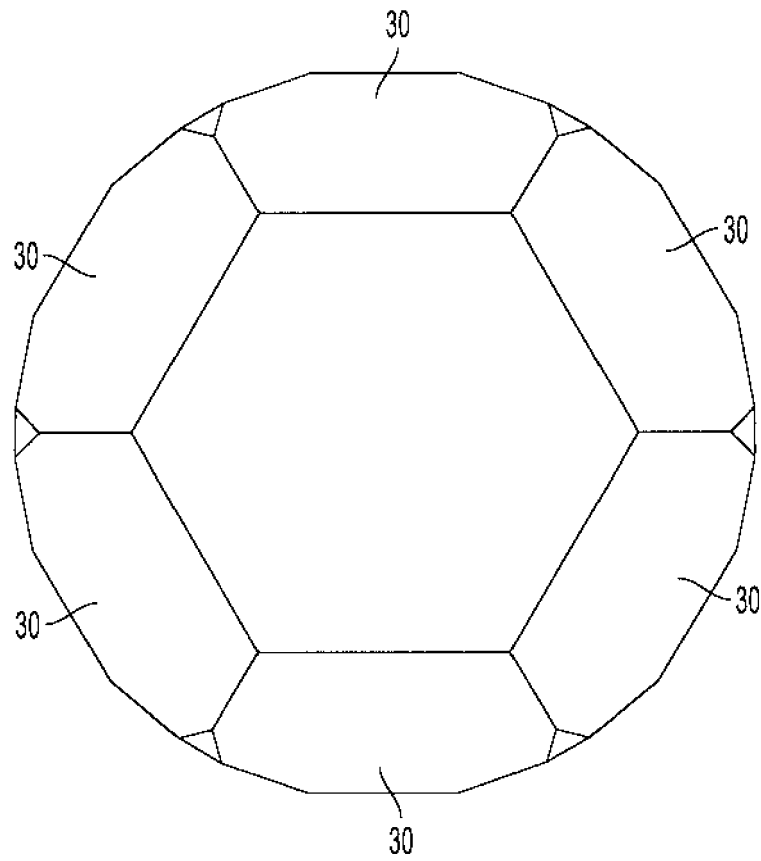


FIG. 11

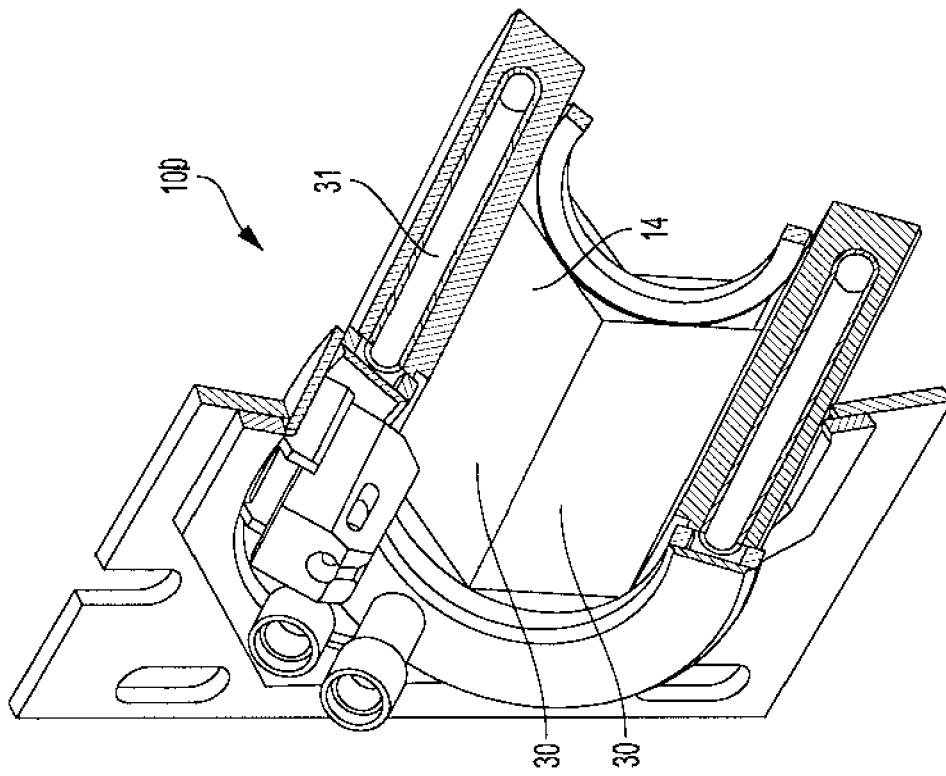


FIG. 13

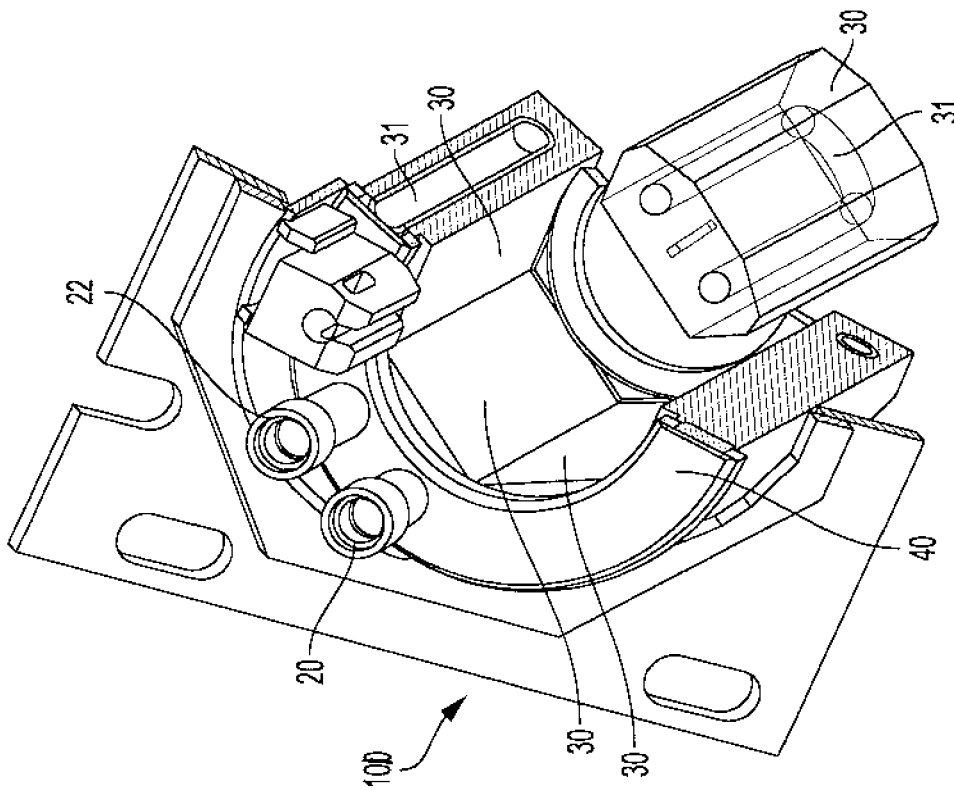


FIG. 12

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 15803223 B [0001]
- US 62416807 B [0022]