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(54) Valve for recirculating combustion gas ducts

(57) A reduction valve for hot air ducts, particularly for supply units for high heat release burners of kilns, is made of refractory material and comprises a hollow element (5) whose opposite longitudinal ends can be connected to the ends of respective ducts (6) and an adjustable flow control member (7) which can be inserted hermetically and transversely in said element (5), the relative position of the flow control member (7) with respect to the hollow element (5) being adapted to determine and adjust the flow-rate of hot air in the ducts (6).

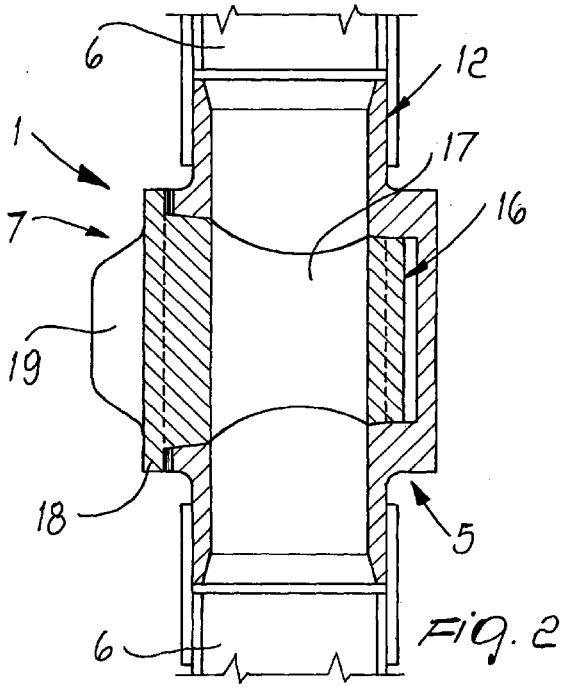

Fig. 2

EP 1 094 275 A1

Description

[0001] The present invention relates to a reduction valve for hot air ducts, particularly for supply units for high heat release burners of kilns.

[0002] Supply units for combustion air for high heat release burners of ceramic kilns are known and have already been disclosed in EPA 99125334.5 by the same Applicant; they allow to use, as comburent air, hot air produced and recovered inside the ceramic factory itself, e.g. air taken from cogeneration systems or from the cooling sections of the kilns themselves.

[0003] These supply units substantially comprise a combustion chamber, which is penetrated by a stem for injecting the gaseous fuel and is connected to a cold air tube with a first reduction valve interposed, and a hot air duct, whose outlet is connected to the combustion chamber downstream of the first valve and is provided with a second adjustable reduction valve.

[0004] The coordinated adjustment of said two valves on the one hand allows to use cold air to ensure cooling of the ignition and flame control systems, as prescribed by safety standards, and on the other hand allows to use exclusively hot air as comburent.

[0005] By providing the hot air duct inside the structure of the kiln itself, thus ensuring its good insulation without altering the normal conditions of the outside environment, it is possible to run the burner exclusively on high-temperature air, with a consequent considerable energy saving.

[0006] These supply units have proved to be effective and allow the factory to achieve considerable profit; nevertheless, their practical use has revealed drawbacks linked to the adjustment of the reduction valve of the hot air duct, by acting on which it is possible to determine the flow-rate and temperature of the comburent.

[0007] These valves are in fact currently of the butterfly type and are made of metallic materials resistant to high temperatures, such as alloy steel.

[0008] The hot air circulating in them can reach an average temperature on the order of 500°C, which causes significant expansions of the elements that compose the valve; if said elements are coupled with small tolerances, in order to ensure perfect fluid-tightness, the valve jams and thus loses its functionality and causes a state of tension which can trigger its cracking.

[0009] In order to obviate these drawbacks, it is possible to provide a loose coupling of the elements that compose the valve of such an extent as to ensure its functionality even in conditions of maximum thermal expansion.

[0010] In this manner, however, fluid-tightness is not ensured; the fluid flows back out through the remaining gaps, especially if the circulating air has a temperature which is on the average lower than the maximum values and therefore the thermal expansions undergone by said elements are smaller.

[0011] The drawbacks noted in the operation of the hot air duct reduction valve and the consequent difficulties in precisely adjusting the flow-rate and temperature of the comburent air that supplies the burner are therefore evident; the firing conditions produced inside the kiln and the quality of the fired product depend on these last factors.

[0012] The aim of the present invention is to eliminate the above noted drawbacks of conventional types of valve by providing a reduction valve for hot air ducts, particularly for supply units for high heat release burners of kilns, which allows to eliminate the risks of jamming and breakage, maintains its functionality unchanged and ensures tightness with respect to the hot air that flows through it regardless of the temperature conditions reached by said air.

[0013] Within the scope of this aim, an object of the present invention is to provide a structure which is simple, relatively easy to provide in practice, safe in use, effective in operation, and relatively low in cost.

[0014] This aim and this object are both achieved by the present reduction valve for hot air ducts, particularly for supply units for high heat release burners of kilns, characterized in that it is made of refractory material and comprises a hollow element the opposite longitudinal ends whereof can be connected to the ends of respective ducts and an adjustable flow control member which can be inserted hermetically and transversely in said element, the relative position of the flow control member with respect to the hollow element being adapted to determine and adjust the flow-rate of hot air in the ducts.

[0015] Further characteristics and advantages of the present invention will become better apparent from the detailed description of a preferred but not exclusive embodiment of a reduction valve for hot air ducts, particularly for supply units for high heat release burners of kilns, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a partially sectional view of a reduction valve for hot air ducts according to the invention, inserted in a supply unit of a high heat release burner for kilns;
Figure 2 is a sectional view of the valve according to the invention;
Figure 3 is a sectional view of the hollow element of the valve according to the invention;
Figure 4 is a plan view of the element of Figure 3;
Figure 5 is a sectional view of the flow control member of the valve according to the invention;
Figure 6 is a plan view of the flow control member of Figure 5.

[0016] With reference to the figures, 1 generally designates a reduction valve for hot air ducts inserted in the supply unit 2 of a high heat release burner 3 of a kiln 4.

[0017] The reduction valve 1 is made of refractory material in order to ensure its regular operation regardless of the temperature conditions of the hot air that flows through it.

[0018] The valve 1 is constituted by a hollow element 5, whose opposite longitudinal ends are respectively connected to the ends of first and second ducts 6, and by an adjustable flow control member 7 which can be inserted transversely and hermetically in the hollow element 5.

[0019] The first and second ducts 6 convey the hot combustion air, recovered for example from the cooling regions of the kiln 4, into the combustion chamber 8 of the burner 3; the relative position of the flow control member 7 with respect to the hollow element 5 determines and adjusts the flow-rate of hot air introduced by the ducts 6 into the chamber 8.

[0020] The chamber 8 is connected to a cold air duct 9, the tubular stem 10 entering said chamber while being further connected to a respective duct 11 for feeding fuel.

[0021] The hollow element 5 is constituted by a hollow cylinder 12 which is advantageously made of refractory material and is arranged between the first and second ducts 6 and is substantially coaxial thereto.

[0022] The hollow cylinder 12 is laterally provided with a transverse dead hole 13 in which the flow control member 7 can be inserted hermetically.

[0023] In order to ensure the hermetic coupling between the hollow cylinder 12 and the flow control member 7, the walls 14 of the dead hole 13 are substantially inclined and converge towards the bottom 15, which instead has a cylindrical shape.

[0024] The flow control member 7 is constituted by a hollow body 16 which is conveniently made of refractory material and is crossed at its central region by a transverse through hole 17.

[0025] Moreover, in the hollow body 16, the end that lies outside the dead hole 13 (Figures 1 and 2) is provided with a closure cap 18 on which grip means 19 are formed.

[0026] By acting on the grip means 19, it is possible to rotate the flow control member 7 inside the dead hole 13, thus adjusting the position of the flow control member 7 with respect to the hollow element 5 and producing the full or partial alignment of the through hole 17 and of the hollow cylinder 12 and/or the closure of the through hole 17.

[0027] Advantageously, the hollow body 16 is substantially frustum-shaped and the cap 18 is arranged at its larger end.

[0028] The maximum dimensions of the through hole 17 correspond to the internal dimensions of the transverse cross-section of the hollow cylinder 12, and the alignment of the through hole 17 with the hollow cylinder 12 corresponds to the maximum flow-rate of hot air; starting from this configuration, a partial rotation of the flow control member 7 inside the dead hole 13 produces a corresponding partial closure of the through hole 17 and of the hollow cylinder 12 and accordingly leads to a reduction in the flow-rate of hot air introduced in the chamber 8.

[0029] The flow control member 7 can further be associated with actuation and adjustment means of the automatic type, which are not shown in the above figures since they are of the conventional type.

[0030] In practice it has been found that the described invention achieves the intended aim and object.

[0031] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0032] All the details may further be replaced with other technically equivalent ones.

[0033] In practice, the materials used, as well as the shapes and the dimensions, may be any according to requirements without thereby abandoning the scope of the protection of the appended claims.

[0034] The disclosures in Italian Patent Application No. MO99A000236 from which this application claims priority are incorporated herein by reference.

[0035] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A reduction valve for hot air ducts, particularly for supply units for high heat release burners of kilns, characterized in that it is made of refractory material and comprises a hollow element (5) whose opposite longitudinal ends can be connected to the ends of respective ducts (6), and an adjustable flow control member (7) which can be inserted hermetically and transversely in said element (5), the relative position of the flow control member (7) with respect to the hollow element (5) being adapted to determine and adjust the flow-rate of hot air in the ducts (6).

2. The valve according to claim 1, characterized in that said hollow element (5) is constituted by a hollow cylinder (12) made of refractory material which is arranged substantially coaxially to said ducts (6) and is provided laterally with a transverse dead hole (13) for the hermetic insertion of said flow control member (7).

3. The valve according to one or more of the preceding claims, characterized in that the walls (14) of said dead hole (13) are substantially inclined, converge towards a cylindrical bottom (15) and are

adapted to ensure hermetic coupling between said cylinder (12) and said flow control member (7).

4. The valve according to one or more of the preceding claims, characterized in that said flow control member (7) comprises a hollow body (16) made of refractory material, in which one end thereof is provided with a closure cap (18) with grip means (19) provided thereon and which is crossed, in its median region, by a transverse through hole (17), the rotation of said flow control member (7) with respect to said element (5) being adapted to determine the full or partial alignment of said through hole (17) and of said hollow cylinder (12) and/or the closure of the through hole (17).

5. The valve according to one or more of the preceding claims, characterized in that said hollow body (16) is substantially frustum-shaped and in that said cap (18) is arranged at the larger end.

6. The valve according to one or more of the preceding claims, characterized in that the maximum dimensions of said through hole (17) correspond to the internal dimensions of the transverse cross-section of said hollow cylinder (12).

7. The valve according to one or more of the preceding claims, characterized in that said flow control member (7) is associated with actuation and adjustment means of the automatic type.

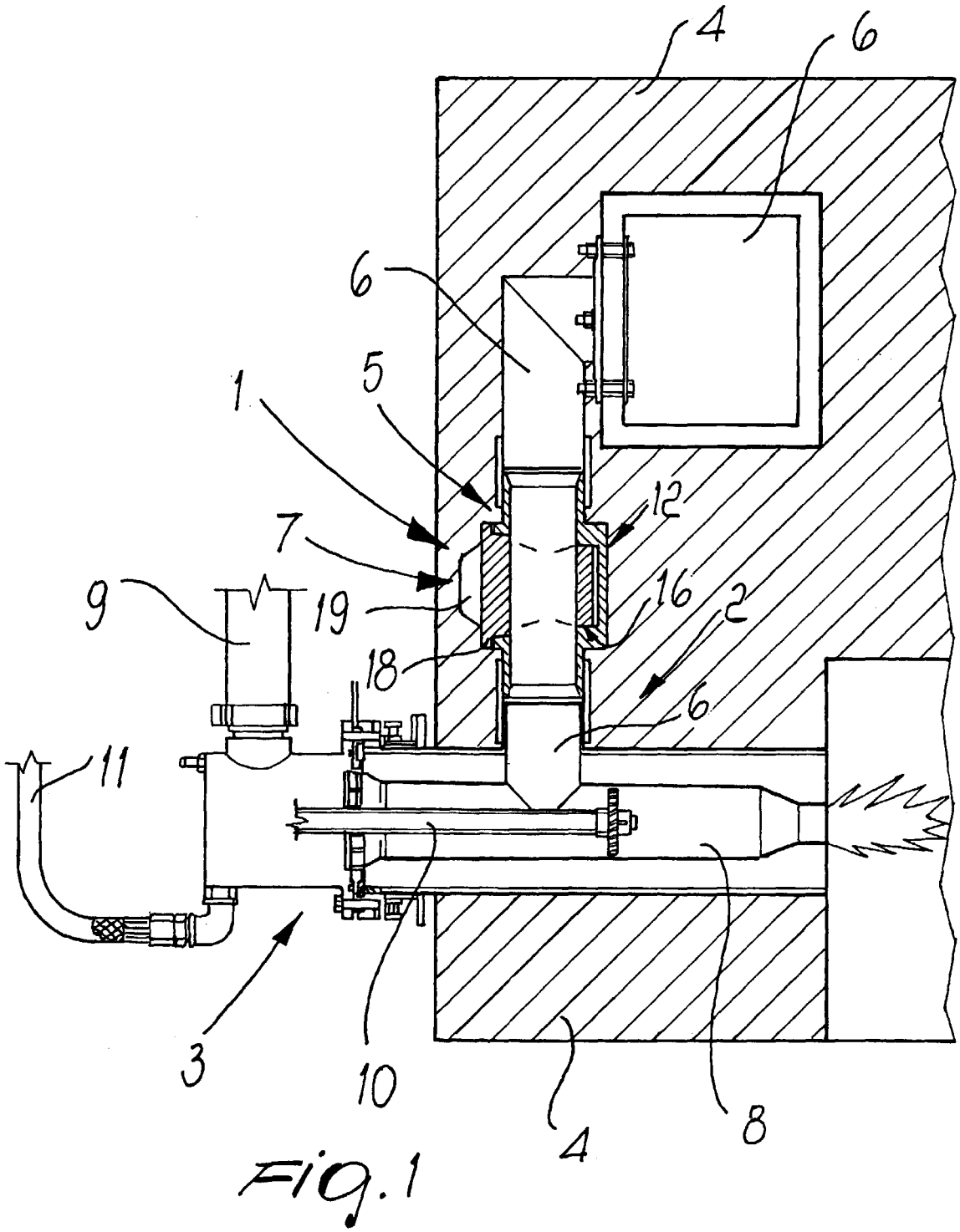

Fig. 1

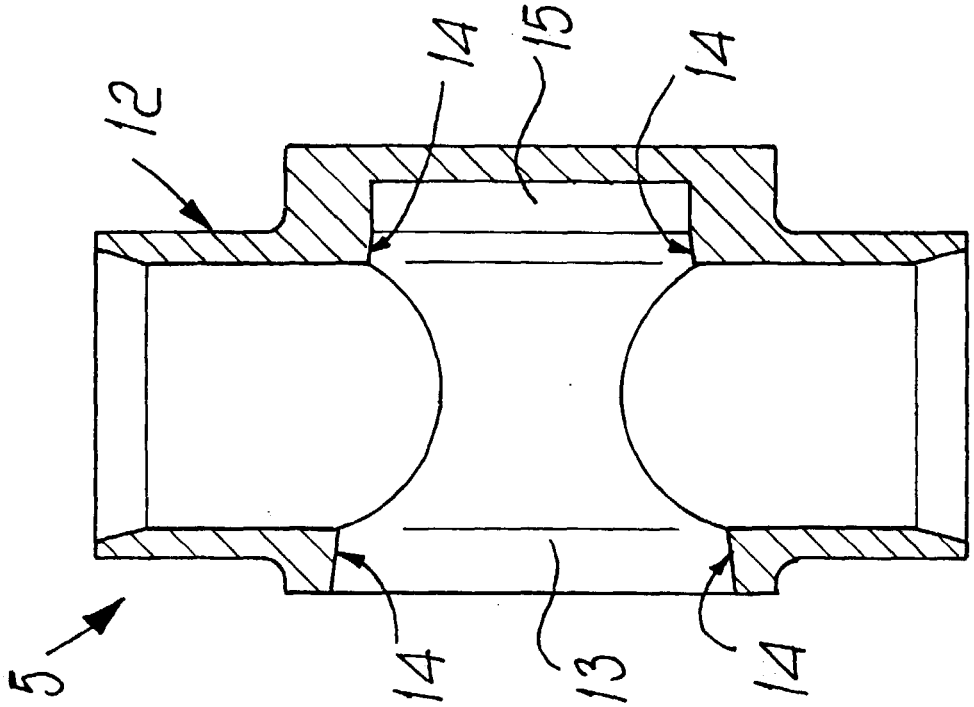

Fig. 3

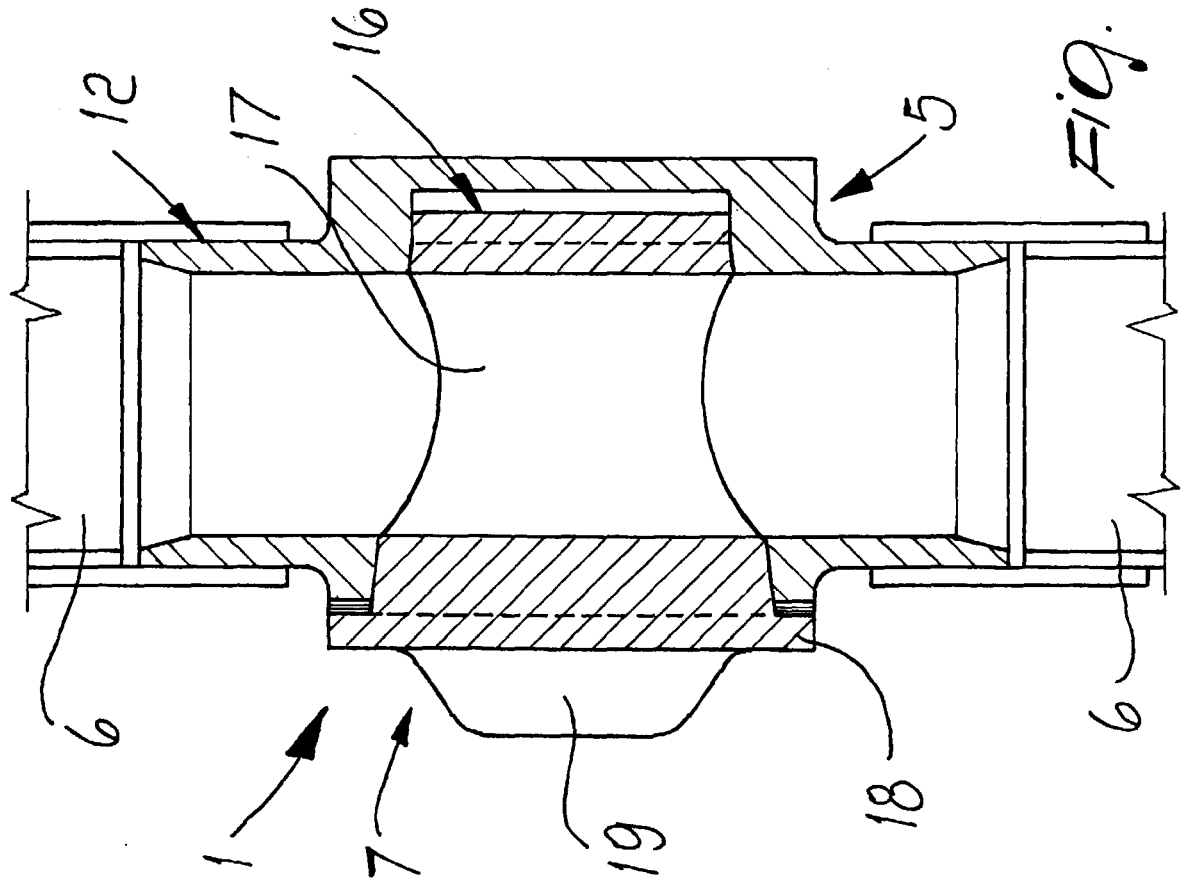

Fig. 2

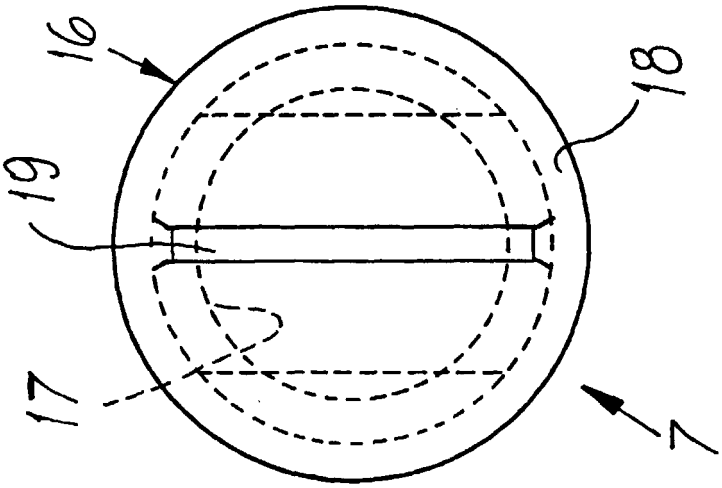

Fig. 6

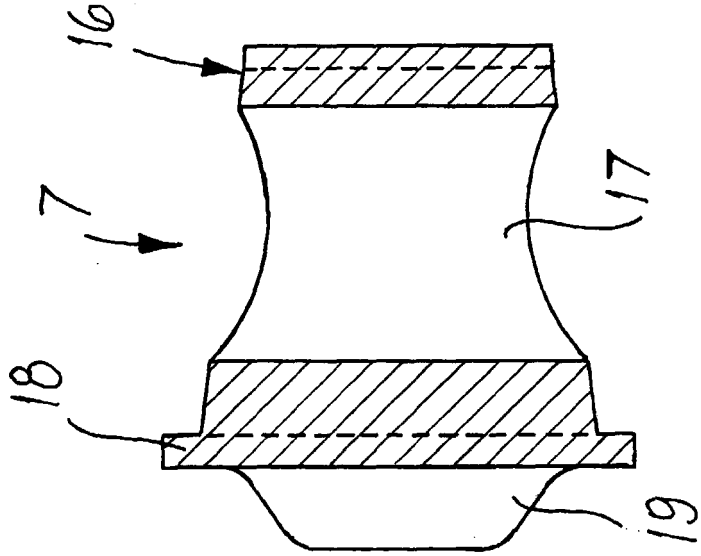

Fig. 5

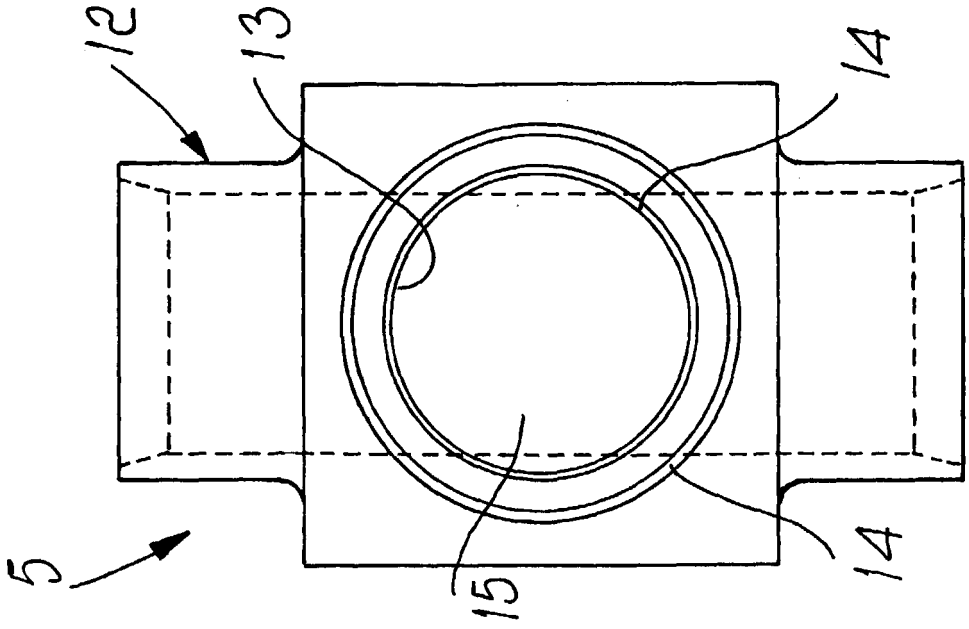

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 00 12 2222

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 January 2001	Mougey, M

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Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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