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(54) **HOT BLAST CONTROL VALVE FOR A METALLURGICAL INSTALLATION**

HEISSWINDSTEUERUNGSVENTIL FÜR EINE METALLURGISCHE INSTALLATION

SOUPAPE DE RÉGULATION D'AIR CHAUD POUR INSTALLATION MÉTALLURGIQUE

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Description**Technical Field**

5 [0001] The present invention generally relates to a hot blast control valve for a metallurgical installation, in particular for controlling the flow of hot blast of a blast furnace.

Background Art

10 [0002] In blast furnaces, hot air, generally referred to as hot blast, is injected into the furnace for aiding the reduction of ore in the furnace.

[0003] Air is heated to a temperature of up to 1250°C before it is fed as hot blast to the furnace. Reducing gas or hot air may be mixed into the hot blast to further aid the reduction of ore in the furnace. Any valve used to control the flow of hot blast is exposed to extreme conditions in that the temperature of the gas is very high and the gas may also be very aggressive.

15 [0004] It is known to arrange butterfly valves in the feeding conduits of the hot blast to control the flow of hot blast to the furnace. One such butterfly valve is known from JP 09095720 and comprises a disc-shaped control member mounted on a rotation axis centrally arranged in the path of the hot blast. In the closed position, the disc-shaped control member is perpendicular to the flow of hot blast and essentially blocks the path of the hot blast. The control member may then be rotated by 90° into its open position, wherein the control member is essentially parallel to the flow of hot blast, thereby allowing the hot blast to flow through the valve. In fact, the hot blast flows past the control member, on two sides thereof. A disadvantage of such a butterfly valve is that because the rotation axis is centrally arranged in the conduit, the control member is still in the path of the hot blast, even when the control member is in the fully open position. Indeed, even if the flow restriction of the control member is, in the open position, reduced to a minimum, the control member represents an obstruction to the free flow of hot blast through the valve. In addition, in view of the very high temperatures the control member is exposed to, cooling channels are provided for cooling the disc-shaped control member. Such cooling is however often not sufficient to prevent damage to the control member. Consequently, the control member needs replacement after some time. Replacement of the control member is however particularly difficult because access to the control member is only possible once the control valve has been uninstalled and taken out of the conduit. Maintenance time and cost is therefore considerable. A blasting quantity control valve set is also known from JP-A 10 001 705

20 [0005] As seen above, the reliability and durability of hot blast control valves of the butterfly type is compromised by the exposure to such extreme conditions. Such control valves not only have the disadvantage of forming an obstacle in the path of the hot blast, but also require high manufacturing costs and intensive, frequent and costly maintenance operations. It is therefore necessary to provide a better performing hot blast control valve, preferably with a reduction of the costs involved.

Technical Problem

25 [0006] It is an object of the present invention to provide an improved hot blast control valve that does not display the above drawbacks. This object is achieved by a hot blast control valve as claimed in claim 1.

General Description of the Invention

30 [0007] The present invention proposes a hot blast control valve for a metallurgical installation, in particular for controlling the flow of hot blast of a blast furnace. The hot blast control valve comprises a metallic valve housing with a refractory lining in which a gas channel is defined; and a valve member rotatably arranged in the gas channel so as to be able of varying a free passage in the gas channel by rotation of the valve member about a rotation axis between an open position and a closed position. The valve member has an envelope with rotational symmetry about the rotation axis and has a through passage arranged in the valve member in a direction transversely to the rotation axis of the valve member. The through passage has a cross-section substantially identical to that of the gas passage. Furthermore, the through passage is arranged in the valve member so as to be aligned with the gas channel when the valve member is in its open position.

35 [0008] According to an important aspect of the invention, the valve member comprises a cylindrical body portion with a first base and an opposite second base; the first base being provided with connection means for connecting the valve member to a shaft; the cylindrical body portion having a diameter larger than the diameter of the gas channel. The valve member further comprises a hemispherical body portion with a base arranged on the second base of the cylindrical body portion.

[0009] Such a hot blast control valve has the advantage that, when the control member is in its open position, the hot blast can freely flow through the through passage of the control member. Indeed, the control member does not constitute

an obstacle to the flow of hot blast. Contrary to the butterfly-type control valve, which causes a pressure drop of up to 20% when it is in the open position, the pressure drop across an open control valve according to the present invention is negligent. Furthermore, in their closed position, butterfly-type control valves generally present considerable leakage (up to 40%). Due to the particular shape (cylindrical and hemispherical body portions) of the hot blast control valve according to the present invention, such leakage may be considerably reduced. An improved control of the flow of hot blast is therefore possible.

[0010] Preferably, the gas channel and the through passage have circular cross-section and the through passage has a diameter substantially corresponding to the diameter of the gas channel.

[0011] Advantageously, the through passage has an axis perpendicular to the rotation axis of the valve member.

[0012] Preferably, the base of the hemispherical body portion has a diameter corresponding to the diameter of the second base of the cylindrical body portion.

[0013] The base of the hemispherical body portion is advantageously arranged so as to lie on the axis of the gas channel.

[0014] According to an important aspect of the present invention, the connection means preferably comprises a connection shoe on the first base of the cylindrical body portion, the connection shoe forming a circumferential groove with a coupling flange inside the groove, the coupling flange facing the first base of the cylindrical body portion. The coupling flange may be parallel to the first base of the cylindrical body portion. Preferably, however, the coupling flange is at an angle tapering away from the first base towards the outer periphery of the first base.

[0015] According to an embodiment of the present invention, the shaft comprises a clamping means engaging the circumferential groove in the connection shoe, the clamping means being such that a contact surface of the clamping means is in tight contact with the coupling flange of the connection shoe in such a way that rotational movement of the clamping means of the shaft is transmitted to the valve member. Preferably, a refractory insulation paper is arranged between the contact surface of the clamping means and the coupling flange of the connection shoe.

[0016] The clamping means advantageously comprises at least two clamping elements engaging the circumferential groove, the clamping elements being connected to an enlarged head portion of the shaft. A fixation ring is preferably further provided for engaging the at least two clamping elements, thereby avoiding a movement of the clamping elements in a direction radially away from the connection shoe.

[0017] The at least two clamping elements can be connected to the enlarged head portion by means of screws; the screws being preferably provided with spring means for pulling the clamping elements towards the enlarged head portion, the screws being preferably provided with a sleeve for limiting the travel of the screw.

[0018] In order to cool the shaft and the connection means, the shaft is advantageously provided with cooling channels for feeding cooling fluid to the enlarged head portion of the shaft.

[0019] An intermediate plate may be arranged between the at least two clamping elements and the enlarged head portion of the shaft. Such an intermediate plate may be provided with an auxiliary shaft engaging in a matching recess arranged in the connection shoe of the valve member so as to create a form-fit connection. Such an arrangement may be useful for ensuring that the valve member is entrained by the form-fit connection provided by the auxiliary shaft in the unlikely event that the frictional connection between the contact surface and the coupling flange fails.

[0020] The clamping elements and/or the fixation ring and/or the intermediate plate and/or the auxiliary shaft is preferably made from heat-resistant steel. Heat-insulating material may be arranged in gaps between various elements of the clamping means. The valve member is advantageously formed in one piece from refractory or ceramic material.

[0021] The metal valve housing preferably comprises a lateral opening for operating the valve member via the shaft; the lateral opening having a diameter at least slightly bigger than the diameter of the cylindrical body portion of the valve member. Such a lateral opening allows for the valve member to be easily retracted from the valve housing for maintenance purposes. There is no need to remove the valve housing in order to access the valve member to be serviced.

[0022] Any bearings for the shaft are preferably located outside the metal valve housing, thereby not subjecting the bearings to the extremely harsh conditions reigning in the metal valve housing. The bearings hence have prolonged lifetime.

[0023] An annular groove may be arranged in a peripheral area of the first base of the valve member, an annular sheet engaging the annular groove to form a labyrinth seal. Such a labyrinth seal allows preventing large quantities of hot blast from entering the connection arrangement and travelling towards the main sealing arrangement. The lifetime of the main sealing arrangement may thereby be prolonged.

Brief Description of the Drawings

[0024] A preferred embodiment of the invention will now be described, by way of example, with reference to the accompanying drawing, in which

Fig. 1 is a cut through a hot blast control valve according to the present invention;

Fig.2 is an enlarged view of the connection between valve member and shaft of Fig.1; and

Fig.3 is a perspective view of a valve member according to a preferred embodiment of Fig.1.

Description of Preferred Embodiment

[0025] Fig.1 schematically shows a hot blast control valve for installation in a hot blast conduit. The hot blast control valve 10 comprises a metal valve housing 12 with an entry end 14 and an exit end 16, each of which comprises a connection flange 18 for connection to the conduit (not shown). Internally, the valve housing 12 comprises a refractory lining 20 in which a gas channel 22 is defined for feeding hot blast from the entry end 14 to the exit end 16.

[0026] A valve member 24 is rotatably arranged in the gas channel 22 for varying the free passage therein by rotation of the valve member 24 about a rotation axis 26 between an open position and a closed position. The valve member 24 has an envelope with rotational symmetry about the rotation axis 26. The envelope of the valve member 24 will be more closely described later.

[0027] The valve member 24 comprises a through passage 28 with a cross-section substantially identical to that of the gas passage 22. The through passage 28 is arranged such that, when the valve member 24 is in its open position as shown in Fig.1, the through passage 28 is in alignment with the gas channel 22 and forms a continuation of the gas channel 22 such that the hot blast can freely flow from the entry end 14 to the exit end 16 of the hot blast control valve 10.

[0028] The valve member 24 comprises a cylindrical body portion 30 with a first base 32 with a connection shoe 34 for connecting the valve member 24 to a shaft 36. The connection between shaft 36 and valve member 24 will be more closely described later when referring to Fig.2.

[0029] The valve housing 12 is provided with a lateral opening 38 for allowing the shaft 36 from penetrating from outside the valve housing into the valve housing and connect to the valve member 24. The lateral opening 38 is dimensioned so as to allow for the valve member 24 to be retracted from the valve housing 12 through this lateral opening 38. The maintenance or replacement of the valve member 24 can thereby be performed easily and quickly. There is no need to disconnect the hot blast control valve 10 from the conduit at connection flanges 18 to access the valve member 24. The assembly comprising the valve member 24 and the shaft 36 is maintained in position by connecting a shaft support assembly 40 to a connection flange 42.

[0030] The shaft support assembly 40 comprises, amongst others, the shaft bearings 44 and the main sealing arrangement 46 (preferably in the form of a packing box). It should be noted that these elements are all arranged outside the valve housing 12, i.e. away from the aggressive conditions reigning inside the valve housing 12.

[0031] Referring now to Fig.2, the connection between shaft 36 and valve member 24 can be more closely described. On a central portion of the first base 32, the valve member 24 comprises a connection shoe 34 forming a circumferential groove 50 with a slanted coupling flange 52 inside the groove 50. The shaft 36 comprises clamping means engaging the circumferential groove 50. The clamping means are formed by at least two clamping elements 54 with a nose 56 for engaging the circumferential groove 50. The nose 56 of the clamping elements 54 has a cross-section essentially corresponding to the cross-section of the groove 50 of the connection shoe 34. A contact surface 58 of the nose 56 is in tight contact with the coupling flange 52 of the connection shoe 34, such that rotational movement of the clamping elements 54, which are rotationally fixed to the shaft 36, is transferred via the contact surface 58 and coupling flange 52 to the valve member 24. A refractory insulation paper 60 may be sandwiched between the contact surface 58 and the coupling flange 52 to further improve the force transfer from the shaft 36 to the valve member 24.

[0032] The at least two clamping elements 54 are prevented from moving radially outwards by means of a fixation ring 62 engaging a circumferential recess 64 arranged in the clamping elements 54.

[0033] The clamping elements 54 are connected to an enlarged head portion 66 of the shaft 36 by means screws 68. The screws 68 pull the clamping elements 54 towards the enlarged head portion 66. By doing so, the screws 68 also pull the contact surface 58 tightly against the coupling flange 52 so as to ensure good contact between the clamping elements 54 and the connection shoe 34 of the valve member 24. The enlarged head portion 66 may be formed in one piece with the shaft 36. Preferably, however, the enlarged head portion 66 is formed separately and fixed to the shaft 36 by welding.

[0034] An intermediate plate 70 is furthermore arranged between the clamping elements 54 and the enlarged head portion 66. A form-fit connection between the intermediate plate 70 and the valve member 24 is provided by an auxiliary shaft, e.g. a polygon shaft 72 provided on the intermediate plate 70, in alignment with the rotation axis 26 of the shaft 36, and a corresponding polygon recess 74 in the connection shoe 34 of the valve member 24. In the unlikely event that the frictional connection between the contact surface 58 and the coupling flange 52 fails, entrainment of the valve member 24 can be effected by means of the form-fit connection provided by the polygon shaft 72.

[0035] In the enlarged head portion 66 and the intermediate plate 70, the screw 68 is preferably guided through a sleeve 76 contacting the clamping element 54 and thereby limiting the travel of the screw 68. The sleeve 76 prevents the screw 68 from being over-tightened and thereby potentially damaging the clamping element 54 or the connection

shoe 34. The spring is preferably further provided with pretensioned spring means 78 between the intermediate plate 70 and the screw head 80. The spring means 78, which may be in the form of disc springs, ensures that the load on the contact zone (coupling flange 52 and contact surface) is limited to a predetermined tension. Indeed, due to temperature variations, the load on the contact zone may vary. Due to the spring means 78 and the sleeve 76, this load cannot exceed a predetermined threshold.

[0036] Cooling water may be supplied to the enlarged head portion 66 of the shaft 36 through the shaft 36 itself. At the head of the shaft, the cooling water is radially spread and collected by any known means.

[0037] A further important aspect of the present invention is the slow heat transfer from the valve member 24 to the shaft 36. Indeed, the valve member 24 which is arranged in direct contact with the hot blast may easily reach temperatures in the region of 1200°C. In order to endure this, the valve member 24 is preferably made from refractory or ceramic material. The various elements between the valve member 24 and the shaft 36, i.e. clamping elements 54, fixation ring 62, intermediate plate 70 and the polygon shaft 72 are made from heat-resistant steel, thereby reducing heat transfer to the shaft 36. In order to further reduce heat transfer, gaps 82 are provided between the various elements and insulation material, such as e.g. insulation felt, is arranged in these gaps 82. The interaction of the various elements and the insulation material allows the temperature of the shaft 36 to be as low as 40°C.

[0038] As indicated above, the sealing of the hot blast control valve 10 is mainly performed by the main sealing arrangement 46 arranged outside the valve housing 12. An additional sealing may however be provided by an annular sheet 84 arranged parallel and coaxial to the rotation axis 26. The annular sheet 84 comprises a protrusion 86 engaging an annular groove 88 arranged in a peripheral part of the first base 32 of the valve member 24. The protrusion 86 engaging the annular groove 88 forms a labyrinth seal preventing large quantities of hot blast from entering the connection arrangement and travelling towards the main sealing arrangement 46.

[0039] A preferred embodiment of a valve member 24 is shown in Fig.3. The shown valve member 24 has an outer envelope formed by a cylindrical body portion 30, with a first base 32 and an opposite second base 90, and a hemispherical body portion 92 connected with its base to the second base 90 of the cylindrical body portion 30. The base of the hemispherical body portion 92 and the second base 90 have identical diameter. The first base 32 comprises the connection shoe 34 for connection with the shaft. Preferably, the hemispherical body portion 92, the cylindrical body portion 30 and the connection shoe 34 are formed in one piece. The through passage 28 is arranged such that its central axis 94 lies in the plane comprising the second base 90.

Legend of Reference Numbers:

10	hot blast control valve	34	connection shoe
12	valve housing	36	shaft
14	entry end	38	lateral opening
16	exit end	40	shaft support assembly
18	connection flange	42	connection flange
20	refractory lining	44	shaft bearings
22	gas channel	46	main sealing arrangement
24	valve member	50	circumferential groove
26	rotation axis	52	coupling flange
28	through passage	54	clamping element
30	cylindrical body portion	56	nose
32	first base	58	contact surface
60	refractory insulation paper	78	spring means
62	fixation ring	80	screw head
64	circumferential recess	82	gap
66	enlarged head portion	84	annular sheet
68	screw	86	protrusion
70	intermediate plate	88	annular groove
72	polygon shaft	90	second base
74	polygon recess	92	hemispherical body portion
76	sleeve	94	central axis

Claims

1. A hot blast control valve (10) for a metallurgical installation, in particular for controlling the flow of hot blast of a blast furnace, said hot blast control valve (10) comprising:

a metallic valve housing (12) with a refractory lining (20) in which a gas channel (22) is defined;
 a valve member (24) rotatably arranged in said gas channel (22) so as to be able of varying a free passage in said gas channel (22) by rotation of said valve member (24) about a rotation axis (26) between an open position and a closed position; said valve member (24) having an envelope with rotational symmetry about said rotation axis (26);
 a through passage (28) arranged in said valve member (24) in a direction transversely to said rotation axis (26) of said valve member (24); wherein said through passage (28) has a cross-section substantially identical to that of said gas channel (22); and wherein said through passage (28) is arranged in said valve member (24) so as to be aligned with said gas channel (22) when said valve member (24) is in its open position
characterised in that said valve member (24) comprises

- a cylindrical body portion (30) with a first base (32) and a second base (90) opposite said first base (32); said first base (32) being provided with connection means for connecting said valve member (24) to a shaft (36); said cylindrical body portion (30) having a diameter larger than the diameter of said gas channel (22); and
- a hemispherical body portion (92) with a base arranged on said second base (90) of said cylindrical body portion (30)

wherein said through passage (28) is arranged to pass through said cylindrical body portion (30) and said hemispherical body portion (92) of said valve member (24).

2. The hot blast control valve according to claim 1, wherein said gas channel (22) and said through passage (28) have circular cross-section and said through passage (28) has a diameter substantially corresponding to the diameter of said gas channel (22), wherein said through passage (28) preferably has an axis perpendicular to said rotation axis (26) of said valve member (24).
3. The hot blast control valve according to claim 1 or 2, wherein said base of said hemispherical body portion (92) has a diameter corresponding to the diameter of said second base (90) of said cylindrical body portion (30), wherein said base of said hemispherical body portion (92) is preferably arranged so as to lie on the axis of said gas channel (22).
4. The hot blast control valve according to any of claims 1 to 3, wherein said connection means comprises a connection shoe (34) on said first base (32) of said cylindrical body portion (30), said connection shoe (34) forming a circumferential groove (50) with a coupling flange (52) inside said groove (50), said coupling flange (52) facing said first base (32) of said cylindrical body portion (30).
5. The hot blast control valve according to claim 4, wherein said shaft (36) comprises a clamping means (54) engaging said circumferential groove (50) in said connection shoe (34), said clamping means (54) being such that a contact surface (58) of said clamping means (54) is in tight contact with said coupling flange (52) of said connection shoe (34) in such a way that rotational movement of said clamping means (54) of said shaft (36) is transmitted to said valve member (24), wherein a refractory insulation paper (60) is preferably arranged between said contact surface (58) of said clamping means (54) and said coupling flange (52) of said connection shoe (34).
6. The hot blast control valve according to claim 5, wherein said clamping means (54) comprises at least two clamping elements (54) engaging said circumferential groove (50), said clamping elements (54) being connected to an enlarged head portion (66) of said shaft (36), wherein said clamping means (54) preferably comprises a fixation ring (62) engaging said at least two clamping elements (54) for avoiding a movement of said clamping elements (54) in a direction radially away from said connection shoe (34).
7. The hot blast control valve according to claim 6, wherein said at least two clamping elements (54) are connected to said enlarged head portion (66) by means of screws (68); said screws (68) being preferably provided with spring means (78) for pulling said clamping elements (54) towards said enlarged head portion (66), said screws (68) being preferably provided with a sleeve (76) for limiting the travel of said screw (68).

8. The hot blast control valve according to claim 6 or 7, wherein said shaft (36) is provided with cooling channels for feeding cooling fluid to said enlarged head portion of said shaft (36).
9. The hot blast control valve according to any of claims 6 to 8, wherein said clamping means (54) comprises an intermediate plate (70) arranged between said at least two clamping elements (54) and said enlarged head portion (66) of said shaft (36), wherein said intermediate plate (70) is preferably provided with an auxiliary shaft engaging in a matching recess arranged in said connection shoe (34) of said valve member (24) so as to create a form-fit connection.
10. The hot blast control valve according to any of claims 6 to 9, wherein said clamping elements (54) and/or said fixation ring (62) and/or said intermediate plate (70) and/or said auxiliary shaft is made from heat-resistant steel.
11. The hot blast control valve according to any of claims 5 to 10, wherein heat-insulating material is arranged in gaps between various elements of said clamping means (54).
12. The hot blast control valve according to any of the previous claims, wherein said valve member (24) is formed in one piece from refractory or ceramic material.
13. The hot blast control valve according to any of claims 1 to 12, wherein said metal valve housing (12) comprises a lateral opening (38) for operating said valve member (24) via said shaft (36); said lateral opening (38) having a diameter at least slightly bigger than the diameter of said cylindrical body portion (30) of said valve member (24).
14. The hot blast control valve according to any of claims 1 to 13, wherein any bearings (44) for said shaft (36) are located outside said metal valve housing (12).
15. The hot blast control valve according to any of claims 1 to 14, wherein an annular groove (88) is arranged in a peripheral area of said first base (32) of said valve member (24), an annular sheet (84) engaging said annular groove (88) to form a labyrinth seal.

Patentansprüche

1. Heißwindsteuerventil (10) für eine metallurgische Anlage, insbesondere zur Steuerung des Heißwindstroms eines Hochofens, wobei das Heißwindsteuerventil (10) Folgendes umfasst:

ein Metallventilgehäuse (12) mit einer feuerfesten Auskleidung (20), in welcher ein Gaskanal (22) definiert ist; ein Ventilelement (24), das derart drehbar im Gaskanal (22) angeordnet ist, dass es einen freien Durchgang im Gaskanal (22) durch Drehung des Ventilelements (24) um eine Drehachse (26) zwischen einer offenen Stellung und einer geschlossenen Stellung verändern kann; wobei das Ventilelement (24) eine Hüllkurve mit Rotationssymmetrie um die Drehachse (26) aufweist; einen Durchlass (28), der im Ventilelement (24) in einer quer zur Drehachse (26) des Ventilelements (24) verlaufenden Richtung angeordnet ist; wobei der Durchlass (28) einen Querschnitt aufweist, der im Wesentlichen identisch mit dem des Gaskanals (22) ist; und wobei der Durchlass (28) derart im Ventilelement (24) angeordnet ist, dass er auf den Gaskanal (22) ausgerichtet ist, wenn sich das Ventilelement (24) in seiner offenen Stellung befindet,

dadurch gekennzeichnet, dass das Ventilelement (24) Folgendes umfasst:

- einen zylindrischen Körperabschnitt (30) mit einer ersten Basis (32) und einer zweiten Basis (90) gegenüber der ersten Basis (32); wobei die erste Basis (32) mit einem Verbindungsmittel zum Verbinden des Ventilelements (24) mit einer Welle (36) versehen ist; wobei der zylindrische Körperabschnitt (30) einen Durchmesser aufweist, der größer als der Durchmesser des Gaskanals (22) ist; und
- einen halbkugelförmigen Körperabschnitt (92) mit einer Basis, die auf der zweiten Basis (90) des zylindrischen Körperabschnitts (30) angeordnet ist,

wobei der Durchlass (28) derart angeordnet ist, dass er durch den zylindrischen Körperabschnitt (30) und den halbkugelförmigen Körperabschnitt (92) des Ventilelements (24) hindurchgeht.

2. Heißwindsteuerventil nach Anspruch 1, wobei der Gaskanal (22) und der Durchlass (28) einen kreisförmigen Quer-

schnitt aufweisen und der Durchlass (28) einen Durchmesser aufweist, der im Wesentlichen dem Durchmesser des Gaskanals (22) entspricht, wobei der Durchlass (28) vorzugsweise eine Achse aufweist, die senkrecht zur Drehachse (26) des Ventilelements (24) ist.

- 5 **3.** Heißwindsteuerventil nach Anspruch 1 oder 2, wobei die Basis des halbkugelförmigen Körperabschnitts (92) einen Durchmesser aufweist, der dem Durchmesser der zweiten Basis (90) des zylindrischen Körperabschnitts (30) entspricht, wobei die Basis des halbkugelförmigen Körperabschnitts (92) vorzugsweise derart angeordnet ist, dass sie auf der Achse des Gaskanals (22) liegt.
- 10 **4.** Heißwindsteuerventil nach irgendeinem der Ansprüche 1 bis 3, wobei das Verbindungsmittel einen Verbindungsschuh (34) auf der ersten Basis (32) des zylindrischen Körperabschnitts (30) umfasst, wobei der Verbindungsschuh (34) eine umlaufende Nut (50) mit einem Kupplungsflansch (52) in der Nut (50) bildet, wobei der Kupplungsflansch (52) der ersten Basis (32) des zylindrischen Körperabschnitts (30) zugewandt ist.
- 15 **5.** Heißwindsteuerventil nach Anspruch 4, wobei die Welle (36) ein Klemmmittel (54) umfasst, das die umlaufende Nut (50) im Verbindungsschuh (34) in Eingriff nimmt, wobei das Klemmmittel (54) derart beschaffen ist, dass eine Kontaktfläche (58) des Klemmmittels (54) derart in engem Kontakt mit dem Kupplungsflansch (52) des Verbindungsschuhs (34) ist, dass eine Drehbewegung des Klemmmittels (54) der Welle (36) auf das Ventilelement (24) übertragen wird, wobei ein feuerfestes Isolierpapier (60) vorzugsweise zwischen der Kontaktfläche (58) des Klemmmittels (54) und dem Kupplungsflansch (52) des Verbindungsschuhs (34) angeordnet ist.
- 20 **6.** Heißwindsteuerventil nach Anspruch 5, wobei das Klemmmittel (54) mindestens zwei Klemmelemente (54) umfasst, die die umlaufende Nut (50) in Eingriff nehmen, wobei die Klemmelemente (54) mit einem vergrößerten Kopfabschnitt (66) der Welle (36) verbunden sind, wobei das Klemmmittel (54) vorzugsweise einen Befestigungsring (62) umfasst,
- 25 der die mindestens zwei Klemmelemente (54) in Eingriff nimmt, um eine Bewegung der Klemmelemente (54) in einer radial von dem Verbindungsschuh (34) fortgehenden Richtung zu vermeiden.
- 30 **7.** Heißwindsteuerventil nach Anspruch 6, wobei die mindestens zwei Klemmelemente (54) mittels Schrauben (68) mit dem vergrößerten Kopfabschnitt (66) verbunden sind; wobei die Schrauben (68) vorzugsweise mit Federmitteln (78) versehen sind, um die Klemmelemente (54) zu dem vergrößerten Kopfabschnitt (66) hinzuziehen, wobei die Schrauben (68) vorzugsweise mit einer Hülse (76) zur Begrenzung der Bewegung der Schraube (68) versehen sind.
- 35 **8.** Heißwindsteuerventil nach Anspruch 6 oder 7, wobei die Welle (36) mit Kühlkanälen versehen ist, um Kühlfluid zum vergrößerten Kopfabschnitt der Welle (36) zu leiten.
- 40 **9.** Heißwindsteuerventil nach irgendeinem der Ansprüche 6 bis 8, wobei das Klemmmittel (54) eine Zwischenplatte (70) umfasst, die zwischen den mindestens zwei Klemmelementen (54) und dem vergrößerten Kopfabschnitt (66) der Welle (36) angeordnet ist, wobei die Zwischenplatte (70) vorzugsweise mit einer Zusatzwelle versehen ist, die eine im Verbindungsschuh (34) des Ventilelements (24) angeordnete passende Aussparung in Eingriff nimmt, um eine formschlüssige Verbindung zu bilden.
- 45 **10.** Heißwindsteuerventil nach irgendeinem der Ansprüche 6 bis 9, wobei die Klemmelemente (54) und/oder der Befestigungsring (62) und/oder die Zwischenplatte (70) und/oder die Zusatzwelle aus hitzebeständigem Stahl bestehen.
- 50 **11.** Heißwindsteuerventil nach irgendeinem der Ansprüche 5 bis 10, wobei wärmeisolierendes Material in Zwischenräumen zwischen verschiedenen Elementen des Klemmmittels (54) angeordnet ist.
- 55 **12.** Heißwindsteuerventil nach irgendeinem der vorangehenden Ansprüche, wobei das Ventilelement (24) einstückig aus feuerfestem oder keramischem Material ausgebildet ist.
- 13.** Heißwindsteuerventil nach irgendeinem der Ansprüche 1 bis 12, wobei das Metallventilgehäuse (12) eine seitliche Öffnung (38) zum Betreiben des Ventilelements (24) über die Welle (36) umfasst; wobei die seitliche Öffnung (38) einen Durchmesser aufweist, der zumindest etwas größer als der Durchmesser des zylindrischen Körperabschnitts (30) des Ventilelements (24) ist.
- 14.** Heißwindsteuerventil nach irgendeinem der Ansprüche 1 bis 13, wobei etwaige Lager (44) für die Welle (36) außerhalb des Metallventilgehäuses (12) angeordnet sind.

15. Heißwindsteuerventil nach irgendeinem der Ansprüche 1 bis 14, wobei eine Ringnut (88) in einem Randbereich der ersten Basis (32) des Ventilelements (24) angeordnet ist, wobei ein ringförmiges Flachstück (84) die Ringnut (88) in Eingriff nimmt, um eine Labyrinthdichtung zu bilden.

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Revendications

1. Vanne (10) de commande de vent chaud pour une installation métallurgique, en particulier pour commander le flux de vent chaud d'un haut-fourneau, ladite vanne (10) de commande de vent chaud comprenant :

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un logement (12) métallique de vanne avec un garnissage (20) réfractaire dans lequel un canal (22) de gaz est défini ;

un élément (24) de vanne agencé de façon rotative dans ledit canal (22) de gaz de façon à être apte à faire varier un passage libre dans ledit canal (22) de gaz par rotation dudit élément (24) de vanne autour d'un axe (26) de rotation entre une position ouverte et une position fermée ;

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ledit élément (24) de vanne ayant une enveloppe avec une symétrie de rotation autour dudit axe (26) de rotation ; un passage (28) traversant agencé dans ledit élément (24) de vanne dans un sens transversal audit axe (26) de rotation dudit élément (24) de vanne ; dans laquelle ledit passage (28) traversant a une section transversale substantiellement identique à celle dudit canal (22) de gaz ;

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et dans laquelle ledit passage (28) traversant est agencé dans ledit élément (24) de vanne de façon à être aligné avec ledit canal (22) de gaz lorsque ledit élément (24) de vanne est dans sa position ouverte

caractérisée en ce que ledit élément (24) de vanne comprend

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- une partie (30) de corps cylindrique avec une première base (32) et une deuxième base (90) opposée à ladite première base (32) ; ladite première base (32) étant prévue avec un moyen de connexion pour connecter ledit élément (24) de vanne à un arbre (36) ; ladite partie (30) de corps cylindrique ayant un diamètre plus grand que le diamètre dudit canal (22) de gaz ; et

- une partie (92) de corps hémisphérique avec une base agencée sur ladite deuxième base (90) de ladite partie (30) de corps cylindrique

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dans laquelle ledit passage (28) traversant est agencé de façon à passer à travers ladite partie (30) de corps cylindrique et ladite partie (92) de corps hémisphérique dudit élément (24) de vanne.

2. Vanne de commande de vent chaud selon la revendication 1, dans laquelle ledit canal (22) de gaz et ledit passage (28) traversant ont une section transversale circulaire et ledit passage (28) traversant a un diamètre correspondant substantiellement au diamètre dudit canal (22) de gaz, dans laquelle ledit passage (28) traversant a préférablement un axe perpendiculaire audit axe (26) de rotation dudit élément (24) de vanne.

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3. Vanne de commande de vent chaud selon la revendication 1 ou 2, dans laquelle ladite base de ladite partie (92) de corps hémisphérique a un diamètre correspondant au diamètre de ladite deuxième base (90) de ladite partie (30) de corps cylindrique, dans laquelle ladite base de ladite partie (92) de corps hémisphérique est préférablement agencée de façon à comprendre l'axe dudit canal (22) de gaz.

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4. Vanne de commande de vent chaud selon l'une quelconque des revendications 1 à 3, dans laquelle ledit moyen de connexion comprend un talon (34) de connexion sur ladite première base (32) de ladite partie (30) de corps cylindrique, ledit talon (34) de connexion formant une rainure (50) circonférentielle avec une bride (52) de couplage à l'intérieur de ladite rainure (50), ladite bride (52) de couplage faisant face à ladite première base (32) de ladite partie (30) de corps cylindrique.

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5. Vanne de commande de vent chaud selon la revendication 4, dans laquelle ledit arbre (36) comprend un moyen (54) de pince engageant ladite rainure (50) circonférentielle dans ledit talon (34) de connexion, ledit moyen (54) de pince étant tel qu'une surface (58) de contact dudit moyen (54) de pince est en contact étroit avec ladite bride (52) de couplage dudit talon (34) de connexion de telle manière qu'un mouvement de rotation dudit moyen (54) de pince dudit arbre (36) est transmis audit élément (24) de vanne, dans laquelle un papier (60) d'isolation réfractaire est préférablement agencé entre ladite surface (58) de contact dudit moyen (54) de pince et ladite bride (52) de couplage dudit talon (34) de connexion.

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6. Vanne de commande de vent chaud selon la revendication 5, dans laquelle ledit moyen (54) de pince comprend

au moins deux éléments (54) de pince engageant ladite rainure (50) circonférentielle, lesdits éléments (54) de pince étant connectés à une partie (66) de tête élargie dudit arbre (36), dans laquelle ledit moyen (54) de pince comprend préférentiellement une bague (62) de fixation engageant lesdits au moins deux éléments (54) de pince pour éviter un mouvement desdits éléments (54) de pince dans une direction radialement opposée audit talon (34) de connexion.

- 5 7. Vanne de commande de vent chaud selon la revendication 6, dans laquelle lesdits au moins deux éléments (54) de pince sont connectés à ladite partie (66) de tête élargie au moyen de vis (68) ; lesdites vis (68) étant préférentiellement prévues avec un moyen (78) de ressort pour tirer lesdits éléments (54) de pince vers ladite partie (66) de tête élargie, lesdites vis (68) étant préférentiellement prévues avec un manchon (76) pour limiter le déplacement de ladite vis (68).
- 10 8. Vanne de commande de vent chaud selon la revendication 6 ou 7, dans laquelle ledit arbre (36) est prévu avec des canaux de refroidissement pour alimenter un fluide de refroidissement jusqu'à ladite partie de tête élargie dudit arbre (36).
- 15 9. Vanne de commande de vent chaud selon l'une quelconque des revendications 6 à 8, dans laquelle ledit moyen (54) de pince comprend une plaque (70) intermédiaire agencée entre lesdits au moins deux éléments (54) de pince et ladite partie (66) de tête élargie dudit arbre, dans laquelle ladite plaque (70) intermédiaire est préférentiellement prévue avec un arbre auxiliaire s'engageant dans un renforcement correspondant agencé dans ledit talon (34) de connexion dudit élément (24) de vanne de façon à créer une connexion à adéquation de formes.
- 20 10. Vanne de commande de vent chaud selon l'une quelconque des revendications 6 à 9, dans laquelle lesdits éléments (54) de pince et/ou ladite bague (62) de fixation et/ou ladite plaque (70) intermédiaire et/ou ledit arbre auxiliaire sont constitués d'un acier résistant à la chaleur.
- 25 11. Vanne de commande de vent chaud selon l'une quelconque des revendications 5 à 10, dans laquelle une matière d'isolation thermique est agencée dans des espaces entre divers éléments dudit moyen (54) de pince.
- 30 12. Vanne de commande de vent chaud selon l'une quelconque des revendications précédentes, dans laquelle ledit élément (24) de vanne est formé en une seule pièce à partir d'une matière réfractaire ou céramique.
- 35 13. Vanne de commande de vent chaud selon l'une quelconque des revendications 1 à 12, dans laquelle ledit logement (12) métallique de vanne comprend une ouverture (38) latérale pour faire fonctionner ledit élément (24) de vanne par l'intermédiaire dudit arbre (36) ; ladite ouverture (38) latérale ayant un diamètre au moins légèrement plus grand que le diamètre de ladite partie (30) de corps cylindrique dudit élément (24) de vanne.
- 40 14. Vanne de commande de vent chaud selon l'une quelconque des revendications 1 à 13, dans laquelle de quelconques paliers (44) pour ledit arbre (36) sont situés à l'extérieur dudit logement (12) métallique de vanne.
- 45 15. Vanne de commande de vent chaud selon l'une quelconque des revendications 1 à 14, dans laquelle une rainure (88) annulaire est agencée dans une zone périphérique de ladite première base (32) dudit élément (24) de vanne, une tôle (84) annulaire engageant ladite rainure (88) annulaire pour former un joint à labyrinthe.

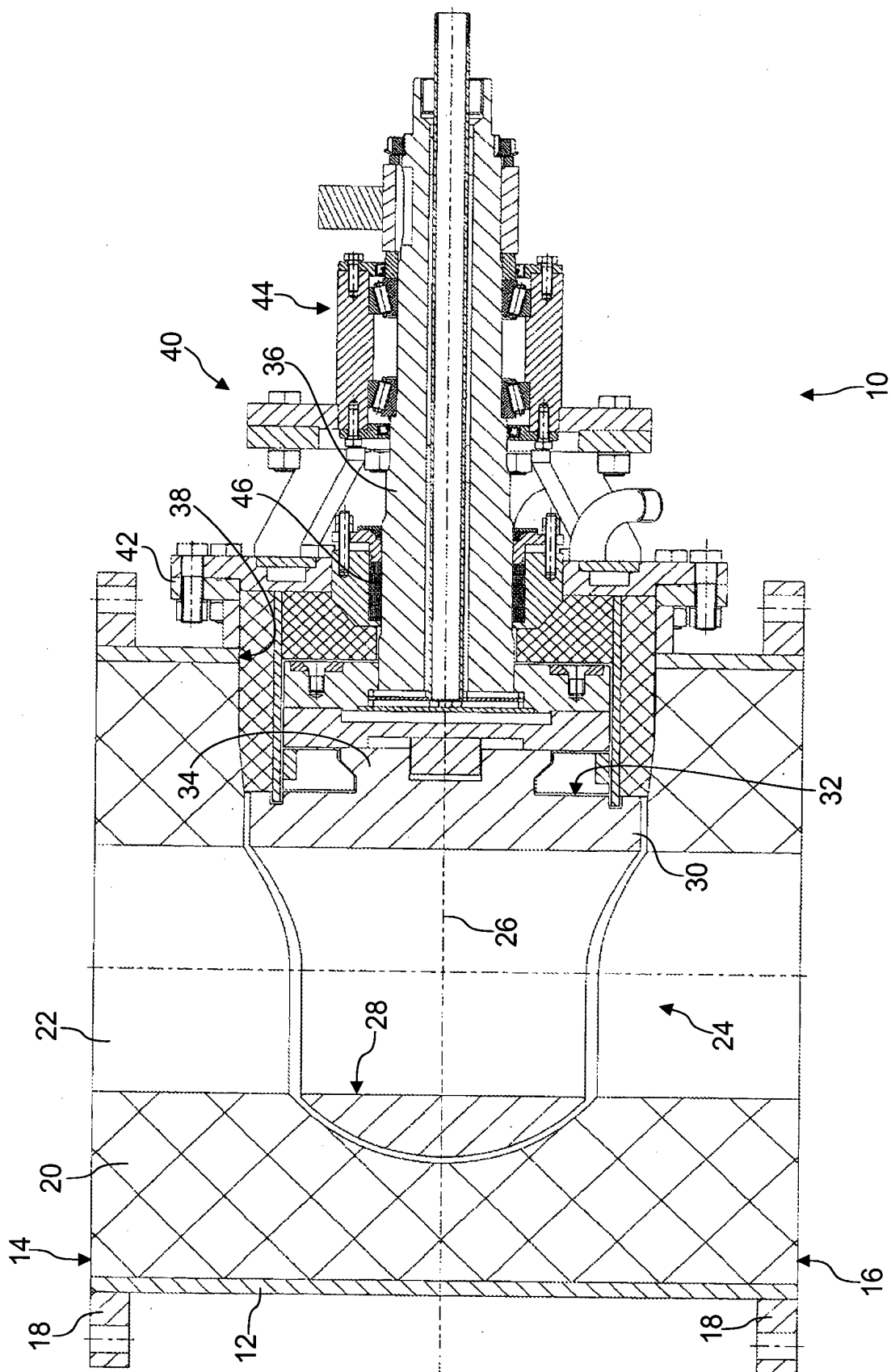


Fig. 1

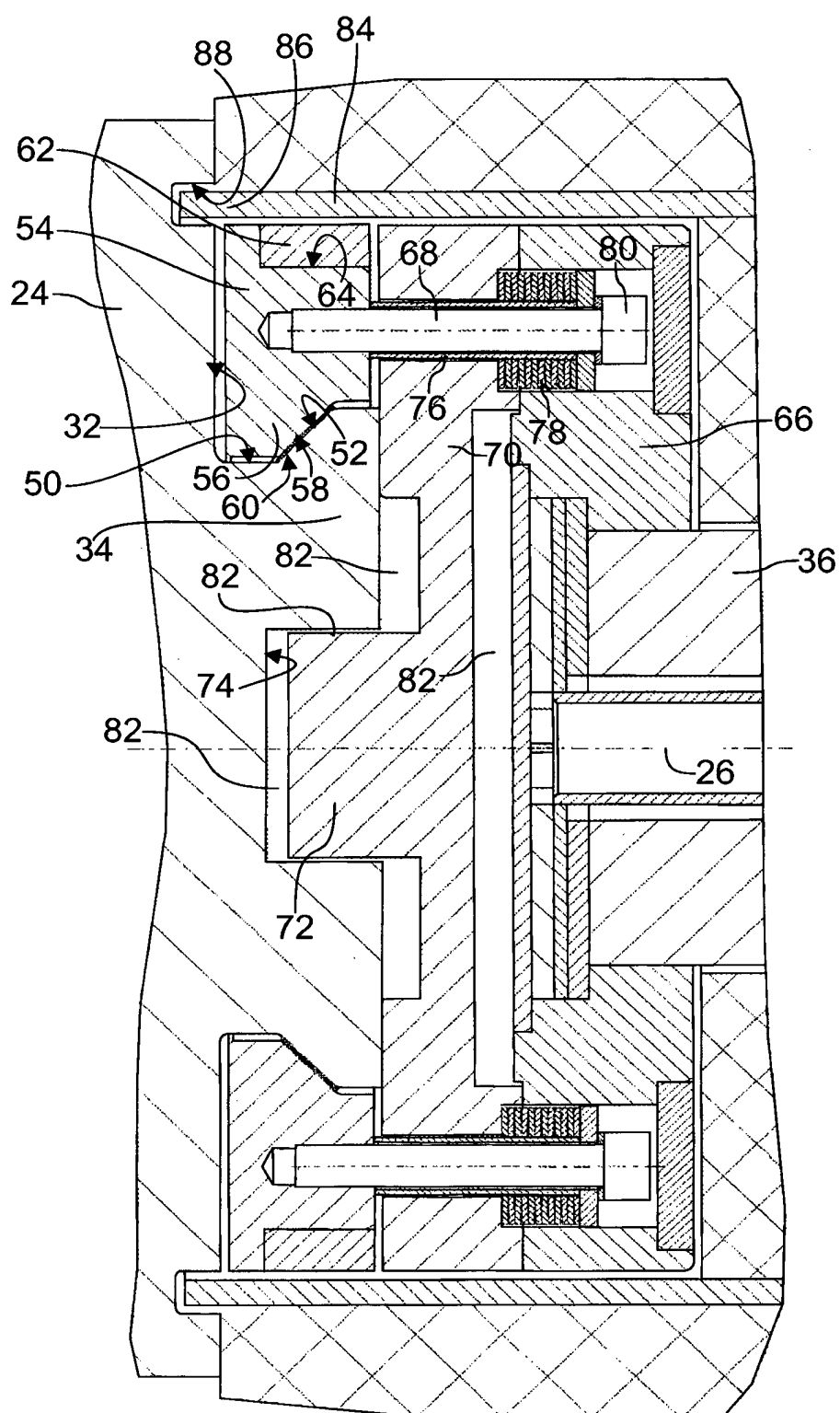


Fig. 2

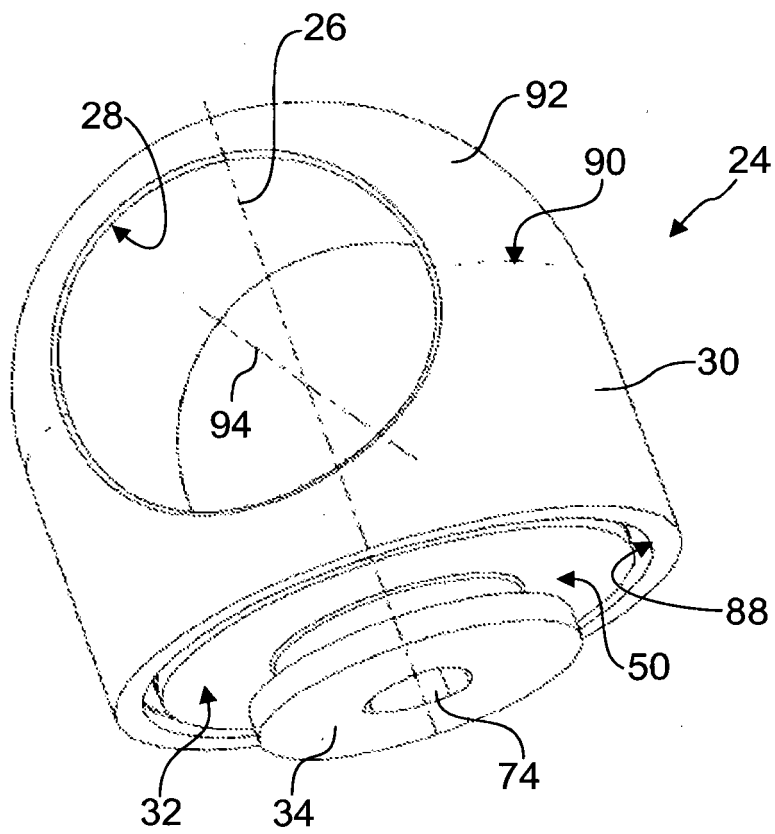


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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