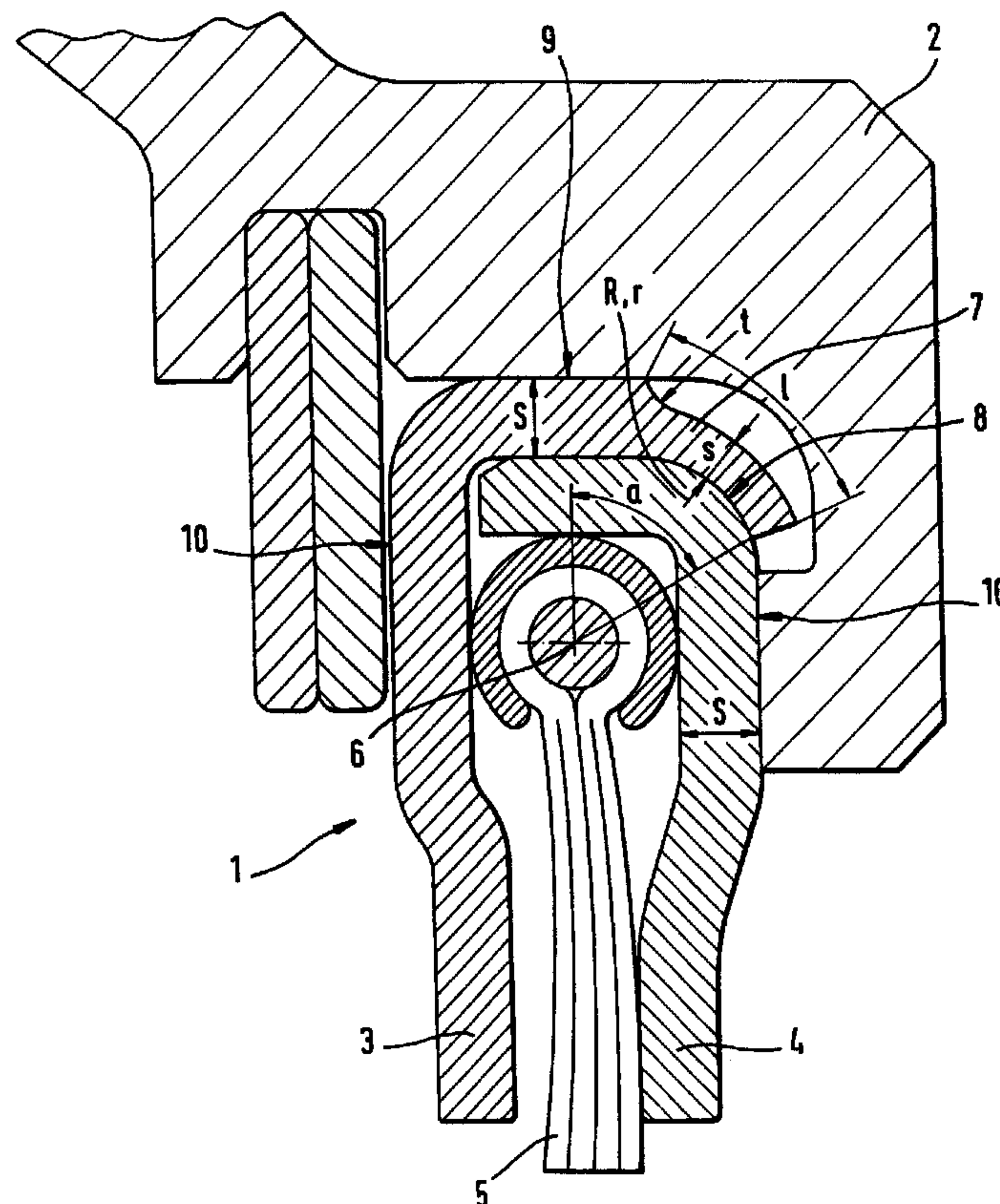




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(54) Titre : JOINT-BROSSE AVEC PLAQUE FRONTALE ET PLAQUE D'APPUI
(54) Title: BRUSH SEAL WITH FRONT PANEL AND SUPPORTING PLATE



(57) Abrégé/Abstract:

Disclosed is a brush-hair seal for sealing a rotor against an enclosure having a bore for the rotor to extend therethrough and comprising a front plate and a bearing plate affixed thereto and between which a multitude of hair is maintained in such a way that their free ends emerge above the bearing plate. In order to simplify the manufacture, the front plate and the bearing plate are connected via a sealing chamber.



ABSTRACT OF THE DISCLOSURE

Disclosed is a brush-hair seal for sealing a rotor against a enclosure having a bore for the rotor to extend therethrough and comprising a front plate and a bearing plate affixed thereto and between which a multitude of hair is maintained in such a way that their free ends emerge above the bearing plate. In order to simplify the manufacture, the front plate and the bearing plate are connected via a sealing chamber.

BRUSH SEAL WITH FRONT PANEL AND SUPPORTING PLATE

The invention is directed to a brush seal having front panel and supporting plate.

Many different brush seals are known that, for example, are utilized in gas
5 turbines in order to seal the interspace between a housing and a rotor rotating at a comparatively high speed against leakage. Given such seals, the ends of the bristles, which are combined to form a dense bristle packet, project beyond the inside edge of the supporting plate and thus seal an interspace - to be kept optimally small - between the inside edge of the supporting plate and the rotor surface. When a high difference
10 pressure is adjacent at the seal, then the supporting plate arranged at the low-pressure side supports the bristles to prevent sagging toward the low-pressure side.

For manufacturing a brush seal essentially composed of a front panel, a supporting plate and a bristle packet arranged therebetween, welding methods were previously utilized with which, in particular, the front panel and supporting plate
15 forming the (seal) housing are welded to one another.

Given a brush seal disclosed by EP 0 453 315, for example, the front panel, the bristle packet and the supporting plate are connected with a weld that extends over the outer circumference of the brush seal. Since the outer circumferential surface is a fitting surface and must proceed planarly and
20 perpendicularly relative to the two outer lateral surfaces of the front panel and of the supporting plate for an exactly fitting arrangement of the brush seal with reference to the housing and to the rotor, additional processing steps, for example grinding, are necessary due to the weld. This leads to higher manufacturing costs and longer throughput times during manufacture.

25 It also proves disadvantageous given the utilization of welding processes that the comparatively thin front panel and supporting plates frequently warp due to non-uniform temperature distributions.

DE 39 07 614 A1 discloses a brush seal having a wire bundle held in a slotted tube, whereby the tube is held together by two supporting rings joined to form
30 a housing by one or more clamp lips that are attached to the one supporting ring and embrace the second supporting ring at the outside upon production of the clamping

force. The positioning of the clamp lips ensues with a curling or, respectively, rolling process. The manufacture of the two supporting rings is not disclosed, nor is the provision of a fit surface at the brush seal housing.

The invention is based on the object of creating a brush seal whose (seal)
5 housing can be simply manufactured in fabrication-oriented terms, i.e. with optimally few processing procedures.

In one aspect, the invention provides a brush seal for sealing a rotor relative to a housing, comprising a front panel and a supporting plate that are arranged at a distance from one another and are to be attached to the housing, and between which a multitude of
10 bristles are held such that their free ends project beyond the supporting plate, whereby the front panel or the supporting plate comprises a free end fashioned as beaded lip and the two plates are joined to one another by cold joining upon formation of a seal housing, characterized in that the front panel and supporting plate comprising the beaded lip comprises an outer circumferential surface fashioned as fit surface, proceeding
15 wherefrom the thickness (S) of the front panel and supporting plate is reduced to the thickness (s) of the beaded lip, and the beaded lip is beaded over the contour of the other plate in an arc of 60° through 90° that suffices for the firm joining of the two plates.

This yields the advantage that the (seal) housing is manufactured without the application of heat and no warping as a consequence of different temperature
20 distributions occurs. The additional processing of the outer circumferential or, respectively, fitting surface that is always required given welding is thus eliminated. The front panel and supporting plate are composed of deep-drawn sheet metal that are manufactured with exact fit, so that no further processing steps are required at the fit seat.

25 A free end of the front panel or of the supporting plate is fashioned as beaded lip. The free end thereby lies at a rectangular section relative to the main propagation plane of the front panel or, respectively, supporting plate that is inwardly angled off upon respective formation of an outside edge with an outside radius R. The beaded lip thereby embraces the outside edge of the respectively other plate to
30 such an extent that a rigid and reliable frictional connection of the two plates exists.

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The beaded lip comprises a thickness s reduced compared to the thickness S of the material of the front panel or supporting plate. The thickness s , just like the length l of the beaded lip, is to be selected dependent on the thickness of the material
5 as well as on the shape of the plates, the structural height of the brushes, the bending radii, etc.

Preferably, the thickness s of the beaded lip amounts to approximately $2/3$ of the thickness S of the material of the front panel or supporting plate.

It is also advantageous that the arc is circular and the corresponding
10 bending radius r is equal to 1.1 through 1.5 times the thickness S of the material of the front panel or supporting plate.

Preferably, the bending radius r is equal to the outside radius R at the outside edge of the front panel or supporting plate.

The front panel and supporting plate can be composed of sheet steel, whereby special steels can also be utilized.

5 The bristles or, respectively, the bristle packet are preferably clamped non-positively by the cold joining of the front panel and supporting plate. As a result thereof, the bristles not only seal but a co-rotation of the bristle packet given extreme brushing of the rotor is also avoided. In order to enhance the coefficient of friction, a C-tube serving for the acceptance of the bristles or the inside surfaces of the front
10 panel and supporting plate can, for example, be roughened, knurled or can be provided with notches.

In another aspect, the invention provides a brush seal for sealing a rotor against a housing comprising a pair of members including a front panel and a supporting plate, each of said members being an annular member of a sheet material with a cylindrical
15 flange with an outer cylindrical circumferential surface, one of the pair of members having the outer cylindrical circumferential surface being connected to the lateral surface by an outside curved edge with a radius of curvature R , the outer cylindrical circumferential surface of the other member of said pair of members forming a fitting surface for engaging in a cylindrical surface of the housing, the cylindrical flange of said
20 other member terminating in a beaded lip having a thickness less than the thickness of the sheet material, said members being joined together with the cylindrical flange of the one member being received within the cylindrical flange of the other member and with a plurality of bristles disposed between the pair of members with the bristles having a free end extending inwardly beyond an inner edge of each of said members, said pair of
25 members being joined together by the beaded lip extending in a circular arc of 60° to 90° and embracing the outside curved edge of said one member.

Further preferred developments of the invention are described in the subclaims.

30 The invention is explained in greater detail below with reference to a drawing (Figure 1) that shows a schematic cross sectional view of an exemplary embodiment of the inventive brush seal.

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Figure 1 shows a brush seal referenced 1 overall that is clamped in a housing 2 through which a rotor (not shown) extends. The brush seal 1 comprises a housing essentially constructed of a front panel 3 and of a supporting plate 4 and also comprises a multitude of tightly packed bristles 5 that are firmly clamped between the front panel 3 and the supporting plate 4 in 6 in a slotted C-tube 11.

Given a difference pressure adjacent at the brush seal 1, the front panel 3 is arranged at the high-pressure side and the supporting plate 4 is arranged at the low-pressure side. The bristles 5 clamped at one side extend between the front panel 3 and the supporting plate 4 and have their free ends remote from the clamping location 6 extending beyond inside edges of the front panel 3 and of the supporting plate 4. The ends of the bristles 5 touch the rotor surface and thus seal an annular interspace between the supporting plate 4 and the rotor.

In the present exemplary embodiment, the front panel 3 and the supporting plate 4 have the same thickness S of material. A beaded lip 7 that has a lower thickness s is fashioned at a free end of the front panel 3. The thickness s amounts to approximately $2/3$ of the thickness S of the material. The material erosion ensues at the outwardly directed lateral surface of the front panel 3.

The beaded lip 7 does not completely embrace the outside edge 8 of the supporting plate 4 but only in a deformation angle A of approximately 65° . A rigid and firm, non-positive connection between the front panel and supporting plate 3 or, respectively, 4 is created with this deformation angle, this simultaneously assuring that the bristles 5 are also firmly clamped between the front panel and the supporting plate 3 or, respectively, 4.

The bending radius r is equal to the outside radius R of the outside edge 8, so that the beaded lip 7 conforms to the contour of the supporting plate 4 or, respectively, the outside edge 8 thereof that, however, is fashioned planar at the outer (circumferential) surface 9 adjoining the beaded lip 7.

This outer (circumferential) surface 9 adjoining the beaded lip 7 is a fit surface that must be planar for an exactly fitted attachment of the brush seal 1 between the housing 2 and the rotor, and it must generally proceed perpendicular to the two outer lateral surfaces 10 of the front panel and supporting plate 3 or, respectively, 4. The thickness s , the radius t [sic] and the length l of the beaded lip 7 are therefore to be selected such that the aforementioned demands made of the fit surface 9 are met after the cold joining or, respectively, working.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A brush seal for sealing a rotor against a housing comprising a pair of members including a front panel and a supporting plate, each of said members being an annular member of a sheet material with a cylindrical flange with an outer cylindrical circumferential surface, one of the pair of members having the outer cylindrical circumferential surface being connected to the lateral surface by an outside curved edge with a radius of curvature R , the outer cylindrical circumferential surface of the other member of said pair of members forming a fitting surface for engaging in a cylindrical surface of the housing, the cylindrical flange of said other member terminating in a beaded lip having a thickness less than the thickness of the sheet material, said members being joined together with the cylindrical flange of the one member being received within the cylindrical flange of the other member and with a plurality of bristles disposed between the pair of members with the bristles having a free end extending inwardly beyond an inner edge of each of said members, said pair of members being joined together by the beaded lip extending in a circular arc of 60° to 90° and embracing the outside curved edge of said one member.
2. A brush seal according to claim 1, wherein the thickness of the beaded lip amounts to approximately $2/3+L$ of the thickness of the sheet material of the other member.
3. A brush seal according to claim 2, wherein the circular arc has a radius of curvature equal to 1.1 to 1.5 times the thickness of the sheet material of said pair of members.
4. A brush seal according to claim 3, wherein the radius of curvature of the bead is equal to the radius R of said outside curved edge of the one member.
5. A brush seal according to any one of claims 1 to 4, wherein the cylindrical circumferential surface of the other member extends perpendicular to the outer lateral surfaces of the pair of members.

6. A brush seal according to any one of claims 1 to 5, wherein the pair of members are composed of deep-drawn steel sheet.
7. A brush seal according to any one of claims 1 to 6, wherein the arc of the beaded lip has a radius of curvature r equal to 1.1 to 1.5 times the thickness of the sheet material of said members.
8. A brush seal according to claim 7, wherein the radius r is equal to the radius R of the outside curved edge of said one member.

1 / 1

Fig. 1

