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(71) Applicants
Leybold-Heraeus GmbH, Bonnerstrasse 504, 5000 Cologne, Federal Republic of Germany
(72) Inventors
Gerhard Jokisch, Hans-Peter Kabelitz, Heinz Plate
(74) Agents
Stevens, Hewlett & Perkins

(54) Clamping ring for flange connections

(57) A clamping ring 1 for clamping together mating connection flanges with an interposed metal sealing ring (not shown) comprises two or three clamping members 2, 3. Three or four pairs of clamping faces 11, 12, 13 and 14 are distributed along the periphery of the ring and occupy a total of between 30% and 70% of the periphery. In a further embodiment the pairs of clamping faces can be pivotally connected to the clamping members.

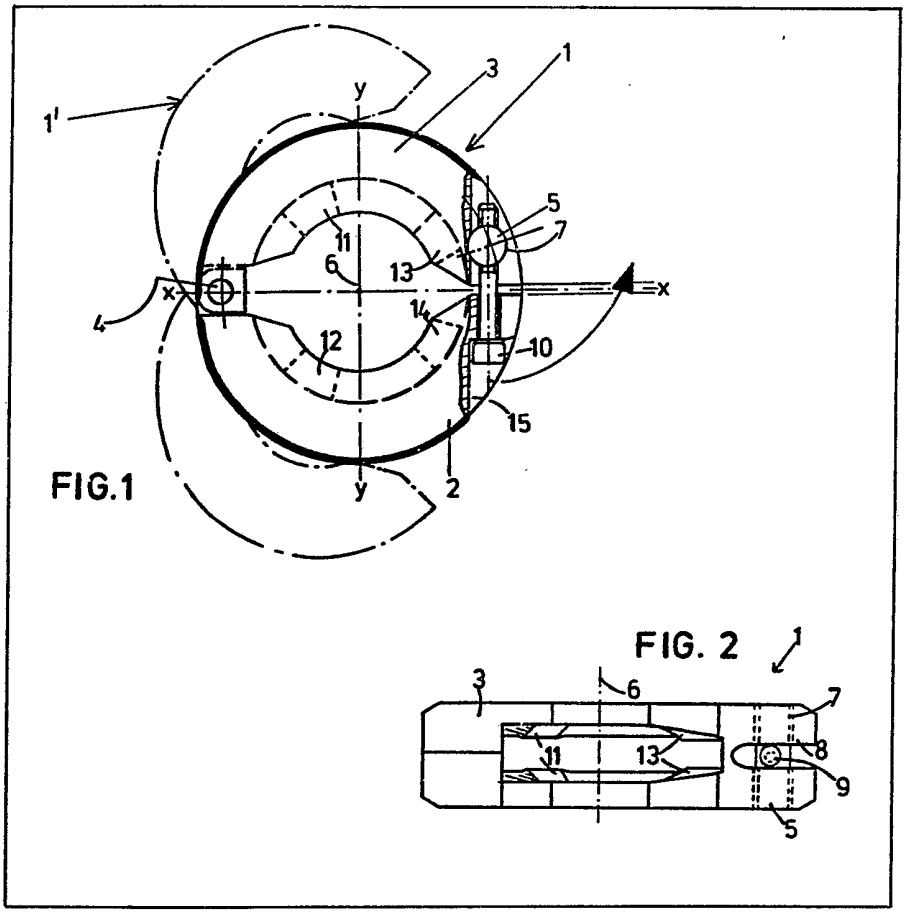

FIG.1

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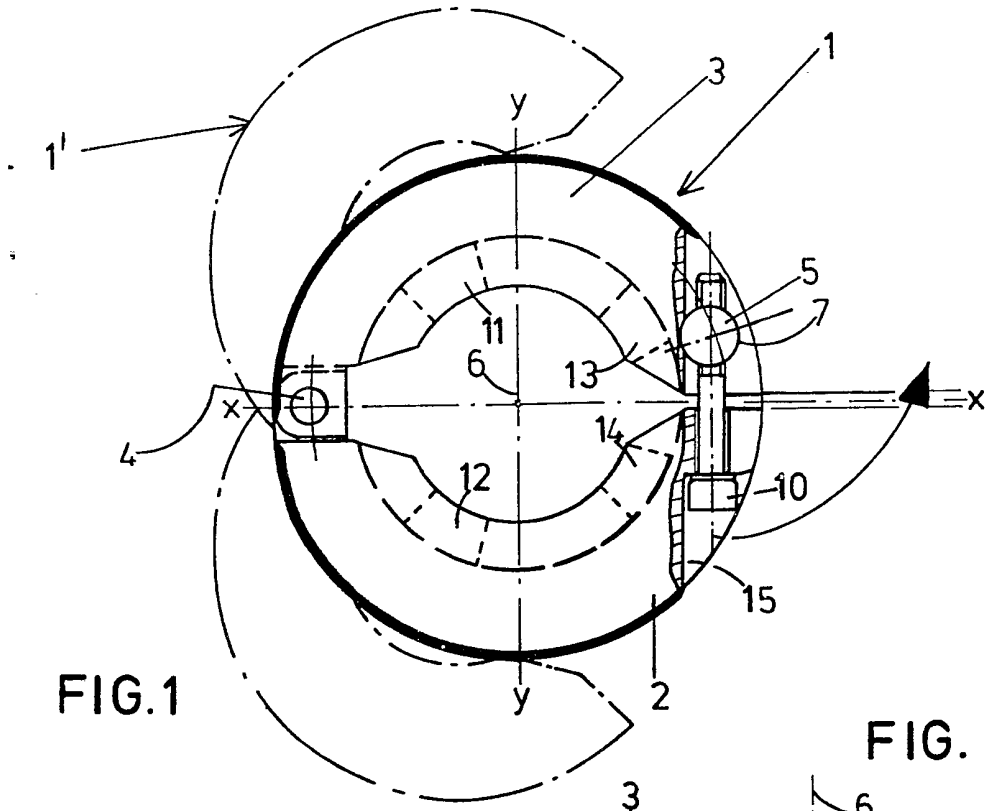
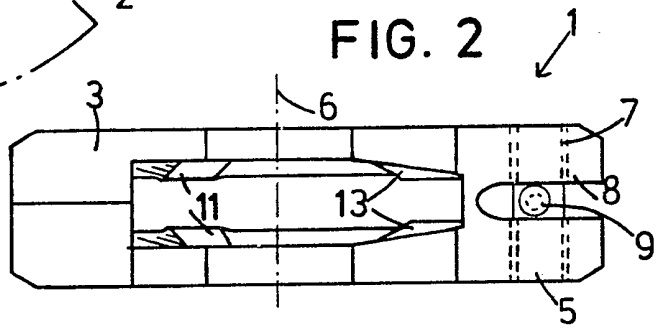
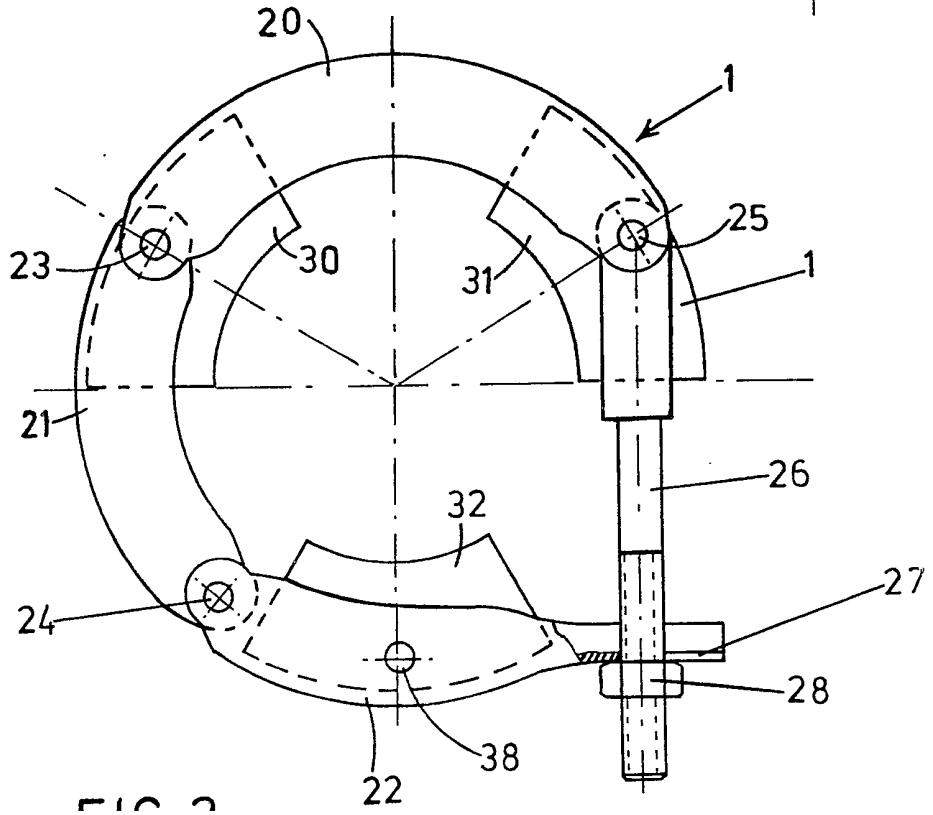


FIG.1

FIG. 2





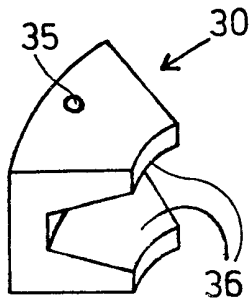


FIG.4

SPECIFICATION

Clamping ring for flange connections

The invention relates to a clamping ring for clamping together mating connection flanges having an interposed metal sealing ring and comprising a plurality of clamping members having a substantially U-shaped, inwardly open cross section.

A large number of clamping rings are known. When they are used for connecting flanges having an interposed rubber seal, the forces to be applied thereby to the flanges are not particularly great. Such clamping rings therefore generally consist of two parts which are interconnected at one side by a double hinge and are interconnectible at the other side by means of a wing nut. The required pressing forces can be produced even with a relatively small wing nut.

If, however, the clamping ring is to be used for connecting flanges having an interposed metal sealing ring, then considerably higher pressing forces have to be produced. Ever-increasing use is being made of metal sealing rings in the production of vacuum joints because they undergo subsequent gassing to a considerably less extent, can be baked out, and remain tight even at considerably lower pressures.

In the assembly of small flange connections that can be baked out and incorporate metal seals, the following requirements, important as regards the operation of the connections, have to be met:

a) Thermal expansion of the flanges and of the seal in both the axial and the radial directions should not be inhibited by the clamping ring.

b) The edge pressure on the clamping faces must be kept low during the application of the clamping ring because of the risk of seizing.

c) The clamping ring force should be distributed as evenly as possible along the periphery of the flanges.

d) The clamping ring must be capable of being closed in a simple manner.

e) The clamping ring should be simple and inexpensive to produce.

These requirements are not fully met by the known clamping rings. For example, a three-part clamping ring is known which has three separate screw connections at intervals of 120°. Because of the large number of parts that are to be interconnected by screw connections, its assembly often presents considerable difficulties. In difficult installation conditions, it is often not possible to reach all the screw connections arranged at intervals of 120°.

In a further clamping ring, only two clamping-ring halves each made of high quality metal are provided, and these halves are each releasable and closable at their ends by means of a screw connection. During the assembly of a clamping ring of this kind, it is therefore still necessary to tighten or loosen two screws. Since the clamping ring is made of high-quality steel, the seal must consist of a relatively strong material so that the forces caused by the differing thermal expansions can be absorbed in a resilient manner. This connection cannot therefore be used with aluminium flanges. Finally, this clamping ring has only two pairs of relatively small faces for bearing on the faces, and this results in a high surface pressure.

In two further known arrangements, two clamping-ring halves are connected at one side by a double hinge. In one of these arrangements, an eccentric lever at the other side is used for opening and closing the clamping ring, and in the other arrangement a wing nut is used for the purpose. Although these known clamping rings can be rapidly assembled, they require a great deal of space since, for the purpose of applying the necessary high forces, the eccentric lever must be relatively long and the wing nut relatively wide. These relatively large parts render assembly difficult particularly in unfavourable installation conditions. A further disadvantage associated with the two last-mentioned arrangements is that they lie, over practically their entire periphery, against the flanges that are to be interconnected. Thus, although uniform distribution of force is achieved, the disadvantage arises that, because of the almost semi-circular shape of the pressure faces, the corners, in particular, of the pressure faces are overloaded when the clamping ring is applied. Finally, there is the disadvantage that the double-hinge connections of the clamping ring halves result in increased production costs.

The object of the present invention is to provide a clamping ring of the initially stated kind which meets the above-mentioned requirements as fully as possible and substantially avoids the described disadvantages associated with the prior art clamping rings.

According to the invention this object is achieved by a clamping ring for clamping together mating connection flanges having an interposed metal sealing ring, which clamping ring comprises a plurality of clamping members having a substantially U-shaped, inwardly open cross-section, the adjacent ends of two clamping members are releasably connected by a screw connection and remaining ends of the clamping members, are interconnected by simple hinges, and three or four pairs of clamping faces provided on the insides of the limbs of the U of the clamping members, the clamping faces being substantially uniformly distributed along the periphery of the clamping ring and occupying a total of between 30% and 70% of the periphery, and the material of the clamping ring and of the metal sealing ring having substantially the same coefficient of thermal expansion.

A clamping ring designed in this manner requires no great space since it is only necessary to release or tighten a simple screw connection. On the basis of the results of numerous tests it has been found that pairs of clamping faces that are distributed substantially uniformly on the periphery and occupy 30 to 70% and preferably 40 to 50% of the peripheral dimension represent an optimum compromise which caters for the need

for uniform distribution of force, not-too-high surface pressure, the lowest possible surface friction during the closing operation, and the prevention of high edge pressure at the beginning of the closing operation. Particularly, when the clamping ring consists only of two clamping members of identical shape as regards the clamping faces, the production costs are low, especially when only single hinges are provided.

Two embodiments of a clamping ring in accordance with the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is an elevational view of a two-member clamping ring in accordance with the invention;

Figure 2 is a plan view of the clamping ring of Figure 1;

Figure 3 is an elevational view of a three-member clamping ring according to the invention with displaceable clamping jaws; and

Figure 4 is a perspective view of a single clamping jaw.

The clamping ring 1 illustrated in Figures 1 and 2 comprises two clamping ring halves 2 and 3 which are interconnected by a single hinge at one side with the aid of a cylindrical pin 4. The dash-dot lines 1′ represent the contour of the clamping ring 1 in its open position. Figure 1 also shows two axes at right-angles to each other and designated by the letters x and y.

At the side opposite the hinge pin 4, the clamping ring halves 2 and 3 can be releasably interconnected by means of a screw connection which comprises a cylindrical hinge pin 5 pivotally mounted in a bore 7 parallel with the central axis 6 of the clamping ring 1. The axis 6 is at right-angles to the plane formed by the x- and y- axis. A slot 8 is milled in the two ring-halves 2 and 3 and accommodates a screw 10 engaged within a threaded bore 9 in the hinge pin 5. The screw 10 expediently has a socket cheese-head. The clamping ring halves 2 and 3 have a U-shaped, inwardly open cross-section. The limbs of the clamping ring halves are provided with a total of four pairs of clamping faces 11, 12, 13 and 14. The clamping faces are inclined faces which are raised above the area surrounding them and which ascend in the radially outward direction. The pairs 13 and 14 of clamping faces are disposed directly in the zone of the screw connection 10 and, in the clamped condition, form substantially a single pair of clamping faces. The pairs 11 and 12 of clamping faces are each arranged symmetrically and at such distance therefrom that, in the clamped condition, a bearing surface is created which is distributed substantially uniformly over the entire periphery. The pairs 11 and 12 of clamping faces are as close as possible to the y-axis. The peripheral extent of the pairs 11 and 12 of the clamping faces is in each case less than the sum of the peripheral extent of the third bearing face consisting of the portions 13 and 14 of the clamping-face pairs. In this way, the faces which rub against each other during the closing operation are kept small. The entire peripheral extent of the pairs of clamping faces is approximately 40%, and this suffices to prevent seizing.

The clamping ring halves have an almost identical shape. They differ only in the bore 7 for accommodating the nut piece 5 and provided in the clamping ring half 3, and in a stepped widening 15 of the milled slot 8 in the half 2. The step thus formed is used for supporting the head of the screw 10.

The clamping ring 1 illustrated in Figure 3 has three clamping members 20, 21 and 22. Between the clamping members 20 and 21 on the one hand and 21 and 22 on the other, single hinges 23 and 24 respectively are provided. The free ends of the clamping members 22 and 20 are releasably interconnectible with the aid of a screw connection which comprises a threaded pin 26 pivotally mounted at the free end of the clamping member 20 on a spingle 25 and which, in the closed position, engages in a slot 27 formed at the free end of the clamping member 22. The pressure-applying force is produced by tightening a nut 28.

In the embodiment shown in Figure 3, the pairs of clamping faces are formed by elements which are movably i.e. pivotally mounted on the clamping members. Provided for this purpose are clamping jaws 30, 31 and 32, one of which only is also illustrated in Figure 4. In the closed position of the clamping ring 1, the clamping jaws are uniformly distributed along the periphery and occupy approximately 50% of the peripheral length. They are hinged to the insides of the limbs of the U-shaped clamping members 20 to 22. For this purpose, the clamping jaws have a bore 35 which affords passage to a hinge pin. The clamping jaws themselves likewise have a substantially U-shaped cross-section and, at the insides of the limbs of the U they carry inclined pairs 36 of clamping faces.

The hinge pin used for mounting the clamping jaw 30 is the hinge pin which interconnects the clamping members 20 and 21. The hinge pin holding the clamping jaw 31 is the hinge pin 25 for mounting the threaded pin 26. The clamping jaw 32 is arranged approximately at the middle of the clamping member 22, and mounted on a hinge pin 38.

The clamping ring shown in Figures 3 and 4 offers the advantage of minimum surface friction during the closing operation, but is relatively expensive to produce because of its many component parts. However, it also has all the advantages of the clamping ring of Figures 1 and 2, i.e. it requires little space for fitting and removal and, because of the special arrangement of the clamping faces, the clamping force can be introduced into the clamping ring parts in a direct, uniform and almost loss-free manner. The material of the clamping rings is expediently selected to suit the material of the particular metal sealing rings used, but not illustrated, so that problems of thermal expansion do not arise. Since aluminium

sealing rings are generally used, aluminium is also the preferred material for the clamping members. Furthermore, the connecting elements (hinge pins, clamping screws, threaded pins and the like) can be made of high-quality steel for reasons of strength. In the case of the construction illustrated in Figures 3 and 4, there exists the possibility of making only the clamping jaws 31, 32 and 33 of aluminium. The clamping members 20, 21 and 22 may be made of high-quality steel without any special problems of thermal expansion arising.

CLAIMS

1. A clamping ring for clamping together mating connection flanges having an interposed metal sealing ring, which clamping ring comprises a plurality of clamping members having a substantially U-shaped, inwardly open cross-section, the adjacent ends of two clamping members are releasably connected by a screw connection and remaining ends of the clamping members are interconnected by simple hinges, and three or four pairs of clamping faces are provided on the insides of the limbs of the U of the clamping members, the clamping faces being substantially uniformly distributed along the periphery of the clamping ring and occupying a total of between 30% and 70% of the periphery, and the material of the clamping ring and of the metal sealing ring having substantially the same coefficient of thermal expansion.

2. A clamping ring according to Claim 1, which comprises two clamping members of identical shape as regards the clamping faces.

3. A clamping ring according to Claim 2, in which a pair of the clamping faces extend symmetrically of and from each side of the single hinge connection, and a further pair of clamping faces is provided in the zone of the screw connection, a portion of each of the further pair of clamping faces being formed immediately in the zone of those ends of the clamping members facing the screw connection.

4. A clamping ring according to Claim 3, in which the peripheral extent of the pairs of clamping faces located in the zone of the hinge connection is in each case less than the sum of the peripheral extents of the portions of the pairs of clamping faces located in the zone of the screw connection.

5. A clamping ring according to any one of the preceding claims, in which the pairs of clamping faces are formed by raised inclined faces on the insides of the limbs of the U.

6. A clamping ring according to any one of the preceding claims, in which the pairs of clamping faces are formed by elements which are themselves movably retained on the limbs of the U.

7. A clamping ring according to Claim 6, in which the pairs of clamping faces are formed by clamping jaws pivotally mounted on the clamping members.

8. A clamping ring according to Claim 7, in which at least one hinge, serving to connect clamping members, is also used for mounting a clamping jaw.

9. A clamping ring according to any one of the preceding claims, in which the screw connection includes a hinge pin mounted in the end of one of the clamping members, which hinge pin either is provided with a screw thread and thus forms a nut, or carries a threaded pin.

10. A clamping ring according to Claims 7 and 9, in which the hinge pin also serves as the mounting for a said clamping jaw.

11. A clamping ring according to any one of the preceding claims, in which the connecting elements (hinge pins, screw connections) are made of high-alloy steel, and the remaining parts of aluminium.

12. A clamping ring according to Claim 6 or Claim 7, in which only the elements carrying the clamping faces are made of aluminium, and the remaining elements are made of high-alloy steel.

13. A clamping ring for clamping together mating connection flanges, substantially as hereinbefore described with reference to Figures 1 and 2 or Figures 3 and 4 of the accompanying drawings.

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