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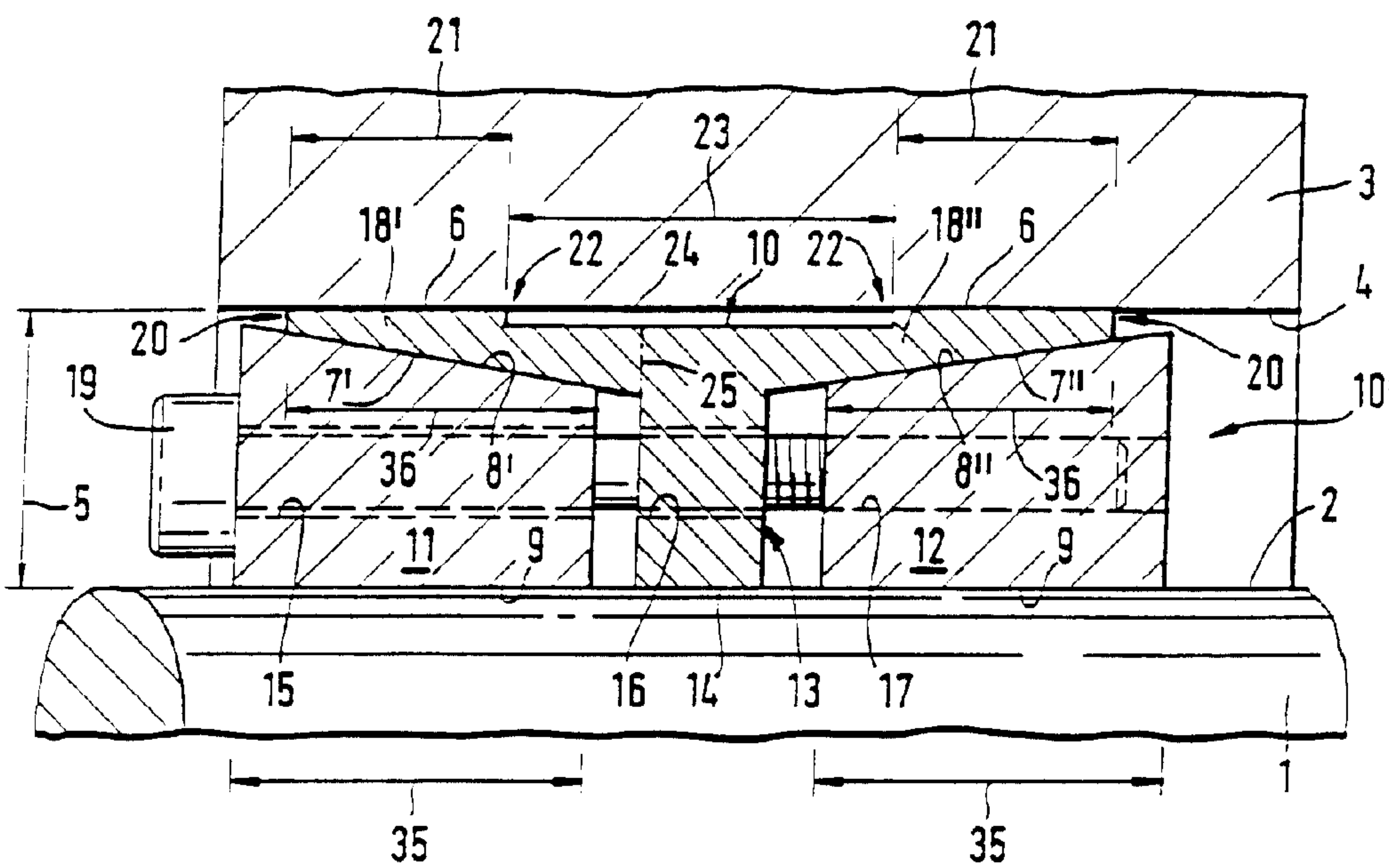
(54) Titre : SYSTEME DE SERRAGE A CONES
(54) Title: CONE CLAMPING SET



(57) Abrégé/Abstract:
The cone clamping set (100) is used, for example, to connect a shaft (1) to a hub (3) and is disposed in the radial intermediate space (5) between the cylindrical outer peripheral surface (2) of the shaft (1) and the cylindrical inner peripheral surface (4) of the hub (3). The cone clamping set comprises inner cone rings (11, 12) with a cylindrical inner peripheral surface and a conical outer peripheral surface (8', 8'') and a thin-walled outer cone ring (10, 18', 18'') with conical inner peripheral surfaces (7', 7'') abutting the outer peripheral surfaces (8', 8'') of the inner cone ring (11, 12), and with a cylindrical outer peripheral surface (6) for abutting the inner peripheral surface (4) of the hub (3). Distributed over the periphery are axial tightening screws (19) which draw the cone rings (11, 12) axially towards each other. Owing to a radial shoulder (24) or peripheral groove, the axial extension of the zone (21) of the cylindrical outer peripheral surface (6) of the outer cone ring (10) in which the radial clamping forces are transmitted to the inner periphery of the recess (4) in the hub (3) is less than the axial extension of the zone (35) in which the radial clamping forces act against the outer periphery (2) of the shaft (1), such that the surface pressure on the surfaces (4, 6) is increased.

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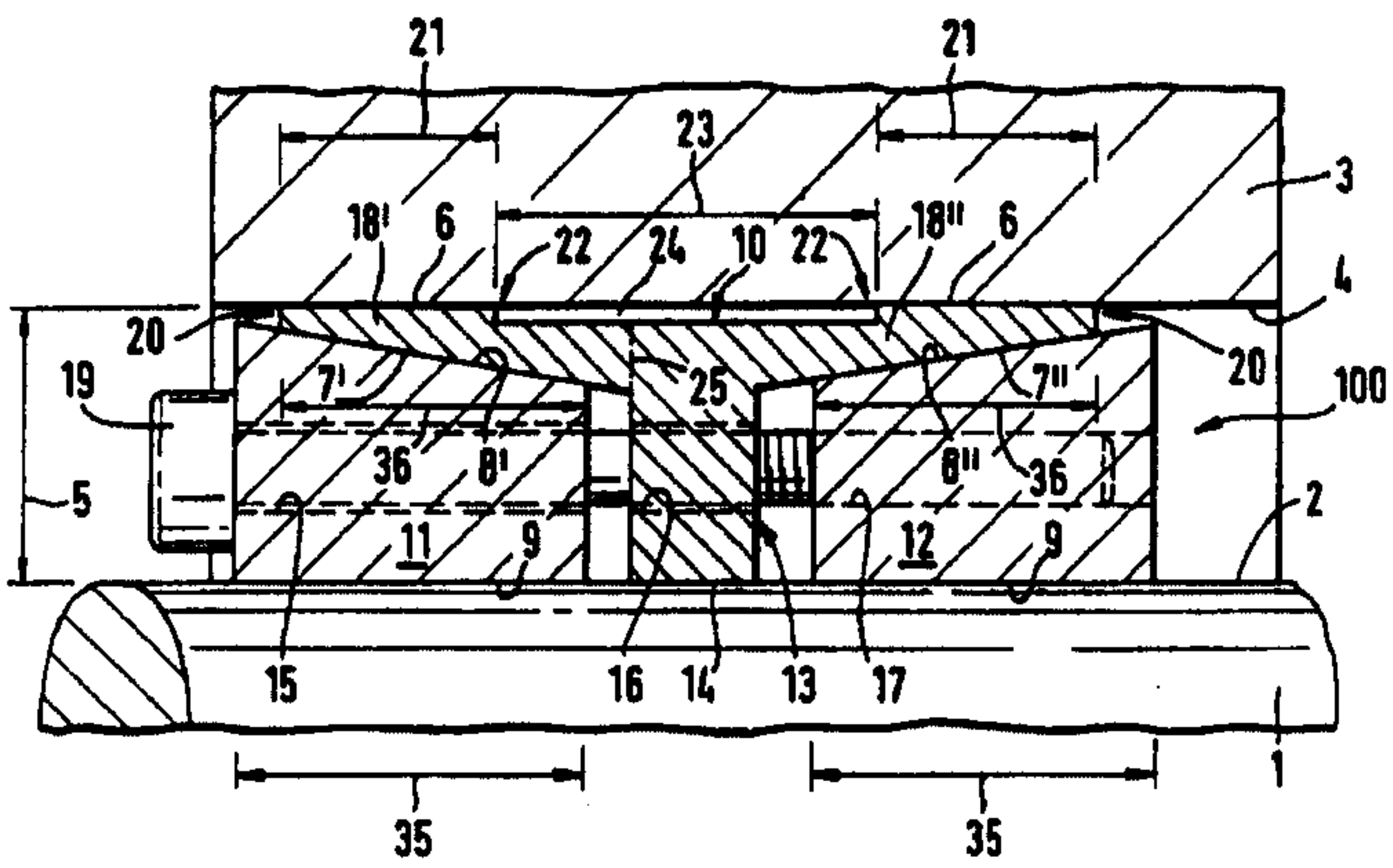
(54) Bezeichnung: KONUSSPANNSATZ

(57) Abstract



The cone clamping set (100) is used, for example, to connect a shaft (1) to a hub (3) and is disposed in the radial intermediate space (5) between the cylindrical outer peripheral surface (2) of the shaft (1) and the cylindrical inner peripheral surface (4) of the hub (3). The cone clamping set comprises inner cone rings (11, 12) with a cylindrical inner peripheral surface and a conical outer peripheral surface (8', 8'') and a thin-walled outer cone ring (10, 18', 18'') with conical inner peripheral surfaces (7', 7'') abutting the outer peripheral surfaces (8', 8'') of the inner cone ring (11, 12), and with a cylindrical outer peripheral surface (6) for abutting the inner peripheral surface (4) of the hub (3). Distributed over the periphery are axial tightening screws (19) which draw the cone rings (11, 12) axially towards each other. Owing to a radial shoulder (24) or peripheral groove, the axial extension of the zone (21) of the cylindrical outer peripheral surface (6) of the outer cone ring (10) in which the radial clamping forces are transmitted to the inner periphery of the recess (4) in the hub (3) is less than the axial extension of the zone (35) in which the radial clamping forces act against the outer periphery (2) of the shaft (1), such that the surface pressure on the surfaces (4, 6) is increased.

Conical Clamping Set

The invention involves a conical clamping set of a type that corresponds to the characterizing clause of Claim 1.

Clamping sets of this type are known in many cases both as simple clamping sets and as double-cone clamping sets, e.g. from DE-GM 71 33 914, 77 27 308 and 75 12 290, as well as from US-PS 3 958 888.

The invention's problem resulted from clamping sets that correspond to Fig. 4 of US-PS 3 958 888. The double-cone ring is the external cone ring there, and it fits in a hub bore hole with its cylindrical outer-circumference surface. The conical inner-circumference surfaces are arranged in such a way that the largest wall thickness of the double-cone ring is in the center. A centering crosspiece is provided in the middle, which extends up to the shaft, and consequently makes a centering of the hub possible vis-à-vis the shaft. The clamping screws axially reach through the two individual conical rings; the screws reach through the clearance holes in the one conical ring and in the centering crosspiece, and reach into the threaded holes of the opposite conical ring. The individual conical rings have, on the whole, a larger wall thickness than the double-cone ring in a radial direction in the transfer area of the clamping forces because they take in the clamping screws, so the double-cone ring changes dimensions easily and readily fits into the inner circumference of the recess in the external component. "Thin-walled" should mean, here and in further contexts, that the radial wall thickness at every point in the zone in which the radial forces are transferred is at most half of the radial wall thickness of the internal conical ring; in general, however, only one-third or one-fourth of this wall thickness.

If, for example, a belt driving drum for belt conveyors is attached to a shaft with a conical clamping set of this type, the shaft experiences a substantial bending stress through the pull of the conveyor belt; the bending stress can lead to a noticeable deflection of the shaft. This in turn has the consequence that the outer-circumference surface of the external double-cone ring can slightly move away from the inner-circumference surface of the hub on the external side of the bending, even if the conical clamping set was initially completely tight when the bracing at the edge took place.

This intermittent movement of the external double-cone ring away from the hub bore hole suffices to allow moisture to penetrate at this point, which leads to the feared frictional corrosion there that can make later disassembly of the conical clamping set impossible because the joint surfaces are rusted together. In the case of the example of the belt driving drum, the water comes from the axially external side, which is exposed to the weather.

The point at which the moving away occurs remains at the same spot with the rotation of the shaft, so a ring-shaped rust zone is formed.

The penetration of the moisture and the subsequent formation of frictional corrosion primarily arises on the outside of the conical clamping set, so in a zone lying on the axial edge of it, on the radially external circumferential surface fitting into the hub, because lower surface pressure prevails there, and the forces arising because of the bending exceed the clamping forces at this point to begin with.

The problem of avoiding an appearance of frictional corrosion of this type is at the root of the invention.

The invention provides a conical clamping set for connecting an inner component having a cylindrical outer-circumference surface, to an external component having a recess that defines a cylindrical inner-circumference surface, which clamping set is intended to be located in the radial clearance between said cylindrical outer-circumference surface and said cylindrical inner-circumference surface, said clamping set comprising: two inner conical rings, each with a cylindrical inner-circumference surface intended for application to the cylindrical outer-circumference surface of the inner component and a conical outer-circumference surface, a thin-walled, external, double-cone ring with conical, inner-circumference surfaces, which taper towards each other and which fit against the outer-circumference surface of respective ones of said inner conical rings, and have the same cone angle, said double cone ring having a cylindrical outer-circumference surface, intended for application on the inner-circumference surface of the external component, and a plurality of circumferentially spaced axial clamping screws by means of which the inner conical rings can be axially pulled towards one another while sliding over the conical inner-circumferential surfaces of said double cone ring and expanding radially, while generating radial clamping forces acting against the outer circumference surface of the inner component and the inner circumference surface of the recess of the external component, wherein the double-cone ring has a circumferential radial relief located centrally in the cylindrical outer-circumference surface thereof, said relief occupying an axial section such that the axial length of the zone of the cylindrical outer-circumference surface of the external conical ring, in which radial clamping forces are transferred to the inner-circumference surface of the recess of the external component, is smaller than the axial length of the zone, in which radial clamping forces act against the outer-circumference surface of the inner component.

The invention also provides a conical clamping set for connecting an inner component having a cylindrical outer-circumference surface, to an external component having a recess that defines a cylindrical inner-circumference surface, which clamping set is intended to be located in the radial clearance between said cylindrical outer-circumference surface and said cylindrical inner-circumference surface, said clamping set comprising: two thin-walled conical rings, each having a conical inner-circumference surface and a thick-walled end, said thick-walled ends being oriented towards each other, and a cylindrical outer-circumference surface, two inner conical rings, each having two conical outer-circumference surfaces, fitting on respective inner-circumference surfaces of the outer conical rings and having the same cone angle, and an inner-circumference surface and circumferentially distributed axial clamping screws by means of which said inner conical rings can be axially pulled against one another while sliding over the conical surfaces of the outer conical rings and expanding radially, while generating radial clamping forces acting against the outer circumference of the inner component and the inner circumference of the recess of the external component, wherein the outer-circumference surface of each external conical ring is relieved to a smaller diameter over an axial length, such that radial clamping forces are transferred to the inner-circumference surface of the recess of the external component over an axial length that is smaller than the axial length over which radial clamping forces act against the outer-circumference surface of the inner component.

The axial zones in which the radial clamping forces are transferred are normally approximately equal at the inner component, for example the shaft, and the external component, for example the hub. This leads to the surface pressure on the outside being lower than that on the inside, i.e. on the shaft, because of the larger radius and the corresponding larger surface available for transferring force. The idea that is at the root of the invention consists in reducing the axial zones on the outside that are available for the transfer of the radial forces and to artificially increase the surface pressure on the outside in this way. Even fairly high bending forces thereby no longer exceed the increased clamping forces when there are normally-occurring bending conditions, and the application of contact of the clamping set remains in the external edge area, so none of the moisture that causes the frictional corrosion can penetrate. This means that fairly high bending can be tolerated without the ability to function being impaired. Experience has shown that, in the case of bending loads that come about in practice, a contact application tension or surface pressure of 70 - 80 N/mm^2 remaining, when there is bending, on the side external to the bending is still sufficient to prevent the penetration of water and can consequently prevent frictional corrosion. This remaining surface pressure only arises, because of the arrangement in accordance with the invention, when there are fairly large bending moments. The artificial increase of the surface pressure in the recess of the outer component contributes to better support in this recess and moreover takes a burden off the clamping screws.

The reduction of the outer zone can take place, for example, in such a way that the surface pressure in the recess of the external component, so the hub for example, has approximately the same magnitude as that on the inner component, so the shaft for example.

The effect of the invention is brought to bear in a particularly consistent way by ensuring that the outer conical rings are unslit. Penetration of moisture along the slot into the interior of the clamping set is thus prevented.

Design examples of the invention are presented in the drawing.

Figs. 1 and 2 show broken-out sections of the upper part of a clamping arrangement of this type going through the axis of a clamping arrangement.

In Fig. 1, the double-cone clamping set designated in its entirety with 100 is for bracing a shaft 1 representing an inner component with a cylindrical outer circumference 2 with a hub 3 representing an external component with a recess with a cylindrical inner-circumference surface 4. The diameter of the inner circumference 4 is larger than the outer diameter of the shaft 1, and the clamping set 100 is housed in the ring-shaped clearance 5 that is formed.

The clamping set 100 includes a double-cone ring 10 with a cylindrical outer-circumference surface 6 and two conical inner-circumference surfaces 7 ', 7 ' ', which are arranged in such a way that their largest radial wall thickness lies in the center, viewed axially. The outer conical surfaces 8 ', 8 ' ' of two individual conical rings 11, 12, which fit in a contact application area on the outer-circumference surfaces 9 of the shaft 1 with their cylindrical inner-circumference surfaces 9, interact with the conical surfaces 7 ', 7 ' '; the contact application area simultaneously forms the zone 35 of force transfer. The conical rings 11, 12 have, viewed radially, substantially thicker walls than the double-cone ring 10 in the area of its conical surfaces 7 ', 7 ' ' '. The ratio of the radial extensions is at least three to one at every point of the conical surface 7 '. The double-cone ring 10 includes, in a certain sense, two thin-walled conical ring parts 18 ', 18 ' ' that are connected with each other.

The double-cone ring 10 has a centering crosspiece 13 projecting radially inwards between the conical surfaces 7 ', 7 ' '; the centering crosspiece rests with its cylindrical inner-circumference surface 14 on the outer-circumference surface 2 of the shaft 1 and serves to center the hub 3 on the shaft 1. Axial clamping screws 19 that are next to each other and distributed over the circumference are provided that reach through clearance holes 15 in the conical ring 11 and 16 in the centering crosspiece, and reach into the threaded holes 17 in the conical ring 12. When the clamping screws 19 are tightened, the conical rings 11, 12 are pulled against each other and slide down in the process with their conical surfaces 8 ', 8 ' ' on the conical surfaces 7 ', 7 ' ' of the double-cone ring 10 having the same cone angle and a corresponding radius. In the process, the conical ring pairs 18 ', 11 or 18 ' ', 12, as the case may be, expand radially and are applied with the cylindrical surfaces 6 or 9 on the cylindrical surfaces 4 or 2, respectively, under considerable surface pressure, so parts 1 and 3 are stuck together with each other.

The cone angle of the conical surfaces 7 ', 8 ' or 7 ' ', 8 ' ' can lie outside or inside of the self-locking area; in the latter case, axial forcing screws have to exist if the clamping set 100 is to be able to be disassembled again.

Two critical points on the external radial and external axial edge of the double-cone ring 10 are designated with 20 in Fig. 1. When there is a heavy deflection of the shaft 1, it can happen that the forces that arise because of this become greater than the radial clamping forces, and the

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double-cone ring moves away from the inner-circumference surface 4 in the external areas of its conical ring parts 18, 18 '. Moisture can then penetrate there, which can lead to frictional corrosion, which can make a disassembly of the conical ring 100 impossible or make it very difficult in any case.

The conical rings 11, 12 and the conical ring parts 18 ', 18 ' ' are normally adjacent to each other on axial sections 36. The section 36 gets closer to the length of the conical rings 11, 12, especially when there is a heavily-tightened clamping set 100 or an unfavorable position of the tolerances. The surface pressures on the conical surfaces 7 ', 8 ' and 7 ' ', 8 ' ', or between the cylindrical outer-circumference surface 6 and the inner circumference 4, are then significantly lower then between the inner-circumference surfaces 9 and the outer-circumference surface 2 of the shaft 1 because of the larger radii.

To artificially increase the surface pressure on the outside and to counteract the movement away at the points 20, step-down areas 22 are provided in the area of the sections 36 in the cylindrical outer-circumference surface of the double-cone ring 10; the outer-circumference surface 6 on a section 23 is stepped down between these areas to a lower radius or diameter. The depth of the stepping down or of the flat circumference slot 24 has to only be great enough that an application of the double-cone ring 10 to the inner-circumference surface 4 no longer takes place in the section 23. A magnitude of 1 mm suffices. It is important that the step-down areas 22 lie in the sector in which radial clamping forces would be transferred without the step-down areas 22.

The parts of the circumference surface 6 put in the section 23 would normally have played a part in the transfer of radial clamping forces, especially in the areas axially covered up with the conical rings 11, 12. When there is the same tightening of the clamping screws 19, these portions are now distributed over zones 21, i.e. the axially external areas of the outer-circumference surface 6 that are at a standstill in the area of the semi-conical rings 18 ', 18 ' ', so that the radial application becomes stronger close to the critical points 20, and forces brought about through any deflections of the shaft 1, directed towards the semi-conical rings 18 ', 18 ' ' moving away from the inner-circumference surface 4 can no longer, or no longer so easily, exceed these application forces. Because of this, the clamping set 100 remains closed at the axially external edges of the double-cone ring 10 vis-à-vis the inner-circumference surface 4, so no moisture can penetrate. The zones 21 are axially shorter than the length 35 of the conical rings 11, 12, which correspond to the zone of force transfer on the shaft 1.

The double-cone ring 10 is, in any case, not slit in the area of its semi-conical rings 18 ', 18' ' for the same purpose, so that moisture cannot penetrate through the slot. The centering crosspiece 13 and the two conical rings 11, 12 can, on the other hand, be slit for the avoidance of force losses.

The double-cone clamping set 100 depicted in Fig. 1 is only a design example; a simple conical clamping set could also be involved, which arises, for example, by the double-cone ring 10 being thought of as cut off at the point marked in the dot-and-dash pattern line 25. The function of holding the clamping set closed when there is bending stress on the right, critical point 20 with a heavy deflection of the shaft 1 is also provided then.

A double-cone clamping set 200 is reproduced in Fig. 2, in which functionally equivalent parts carry the same reference figures. A double-cone ring 30 is provided, which is an inner conical ring in that case and which fits on the shaft 1 with its cylindrical inner-circumference surface 29. The centering crosspiece 33 projects outwards in this case and fits with its cylindrical outer-circumference surface 34 on the cylindrical inner-circumference surface 4 of the external component, or the hub 3. The two conical rings 31, 32, which the clamping screws 19 act on, are provided in this case both with conical inner-circumference surfaces 39 ', 39 ' ' that interact with the conical outer-circumference surfaces 40 ', 40 ' ' of the double-cone ring 30, as well as with the conical outer-circumference surfaces 28 ', 28 ' '. They interact with the conical inner-circumference surfaces 27 ', 27 ' ' of two separate, unslit, external conical rings 38 ', 38 ' ', which fit with their cylindrical outer-circumference surfaces 26 on the inner circumference 4 of the hub 3. The external conical rings 38 ' and 38 ' ' fit with their inner faces against the centering crosspiece 33. The critical points 20 are positioned here on the radially and axially outer edge of the conical rings 38 ' and 38 ' '.

Step-down areas 22 are also provided here in the cylindrical outer-circumference surfaces 26 in the contact application areas. The cylindrical outer-circumference surfaces 26, to the inner end of the conical rings 38 ', 38 ' ' that are more thick-walled, are lowered at a section 43 to a smaller diameter at the step-down areas, so no application of pressure takes place there and the application force or surface pressure increases in the remaining zones 21 of the transfer of radial force, in order to protect the critical points 20 against opening up when there is a bending stress on the shaft 1. The axial length of the zone 21 is also smaller than the axial length of the zone 35 here, in which the inner conical rings 31, 32 transfer the radial clamping force inwards against the shaft.

CLAIMS:

1. A conical clamping set (100) for connecting an inner component having a cylindrical outer-circumference surface (2), to an external component having a recess that defines a cylindrical inner-circumference surface (4), which clamping set is intended to be located in the radial clearance (5) between said cylindrical outer-circumference surface (2) and said cylindrical inner-circumference surface (4), said clamping set comprising:

two inner conical rings (11, 12), each with a cylindrical inner-circumference surface (9) intended for application to the cylindrical outer-circumference surface (2) of the inner component (1) and a conical outer-circumference surface (8', 8''),

a thin-walled, external, double-cone ring (10, 18', 18'') with conical, inner-circumference surfaces (7', 7''), which taper towards each other and which fit against the outer-circumference surface (8', 8'') of respective ones of said inner conical rings (11, 12), and have the same cone angle, said double cone ring having a cylindrical outer-circumference surface (6), intended for application on the inner-circumference surface (4) of the external component (3),

and a plurality of circumferentially spaced axial clamping screws (19) by means of which the inner conical rings (11, 12) can be axially pulled towards one another while sliding over the conical inner-circumferential surfaces (7', 8', 7'', 8'') of said double cone ring and expanding radially, while generating radial clamping forces acting against the outer circumference surface (2) of the inner component (1) and the inner circumference surface (4) of the recess of the external component (3), wherein the double-cone ring (10) has a circumferential radial relief (24) located centrally in the cylindrical outer-circumference surface (6) thereof, said relief occupying an axial section (23) such that the axial length of the zone (21) of the cylindrical outer-circumference surface (6) of the external conical ring (10; 18', 18''), in which radial clamping forces are transferred to the inner-circumference surface (4) of the recess of the external component, is smaller than the axial length of the zone (35), in which radial clamping forces act against the outer-circumference surface (2) of the inner component.

2. A conical clamping set according to Claim 1, wherein the double-cone ring (10; 18', 18'') has a centering crosspiece (13) projecting radially inwards at a midpoint in its length, which crosspiece has a cylindrical inner-circumference surface (14) for application to the outer-circumference surface (2) of the inner component (1); said clamping screws (19) extending through clearance holes (15) in the centering crosspiece.

3. A conical clamping set (200) for connecting an inner component having a cylindrical outer-circumference surface (2), to an external component having a recess that defines a cylindrical inner-circumference surface (4), which clamping set is intended to be located in the radial clearance (5) between said cylindrical outer-circumference surface (2) and said cylindrical inner-circumference surface (4), said clamping set comprising:

two thin-walled conical rings (38', 38''), each having a conical inner-circumference surface (27', 27'') and a thick-walled end, said thick-walled ends being oriented towards each other, and a cylindrical outer-circumference surface (26),

two inner conical rings (31, 32), each having two conical outer-circumference surfaces (28', 28''), fitting on

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respective inner-circumference surfaces (27', 27'') of the outer conical rings (38', 38'') and having the same cone angle, and an inner-circumference surface (39', 39'')

and circumferentially distributed axial clamping screws (19) by means of which said inner conical rings (31, 32) can be axially pulled against one another while sliding over the conical surfaces of the outer conical rings and expanding radially, while generating radial clamping forces acting against the outer circumference of the inner component and the inner circumference of the recess of the external component,

wherein the outer-circumference surface (26) of each external conical ring (38', 38'') is relieved to a smaller diameter over an axial length (43), such that radial clamping forces are transferred to the inner-circumference surface (4) of the recess of the external component over an axial length that is smaller than the axial length over which radial clamping forces act against the outer-circumference surface (2) of the inner component.

4. A conical clamping set according to Claim 3, wherein an inner, double-cone ring (30) is provided, having a cylindrical inner-circumference surface (29) for application to the cylindrical outer-circumference surface (2) of the inner component and having a centering crosspiece (33) projecting radially outwards at a midpoint in the length and having cylindrical outer-circumference surface (34) for application to the cylindrical inner-circumference surface (4) of the external component (3) between the external conical rings (38', 38'').

5. A conical clamping set according to any one of Claims 1 through 4, wherein the axial lengths of the zones (21) and (35) are co-ordinated with each other in such a way that the surface pressures at the inner circumference of the external component

and at the outer circumference of the inner component are essentially equal.

6. A conical clamping set according to any one of Claims 1 through 5, wherein the outer conical rings (18', 18'', 38', 38'') are unslit in the axial direction.

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PATENT AGENTS

Fig. 1

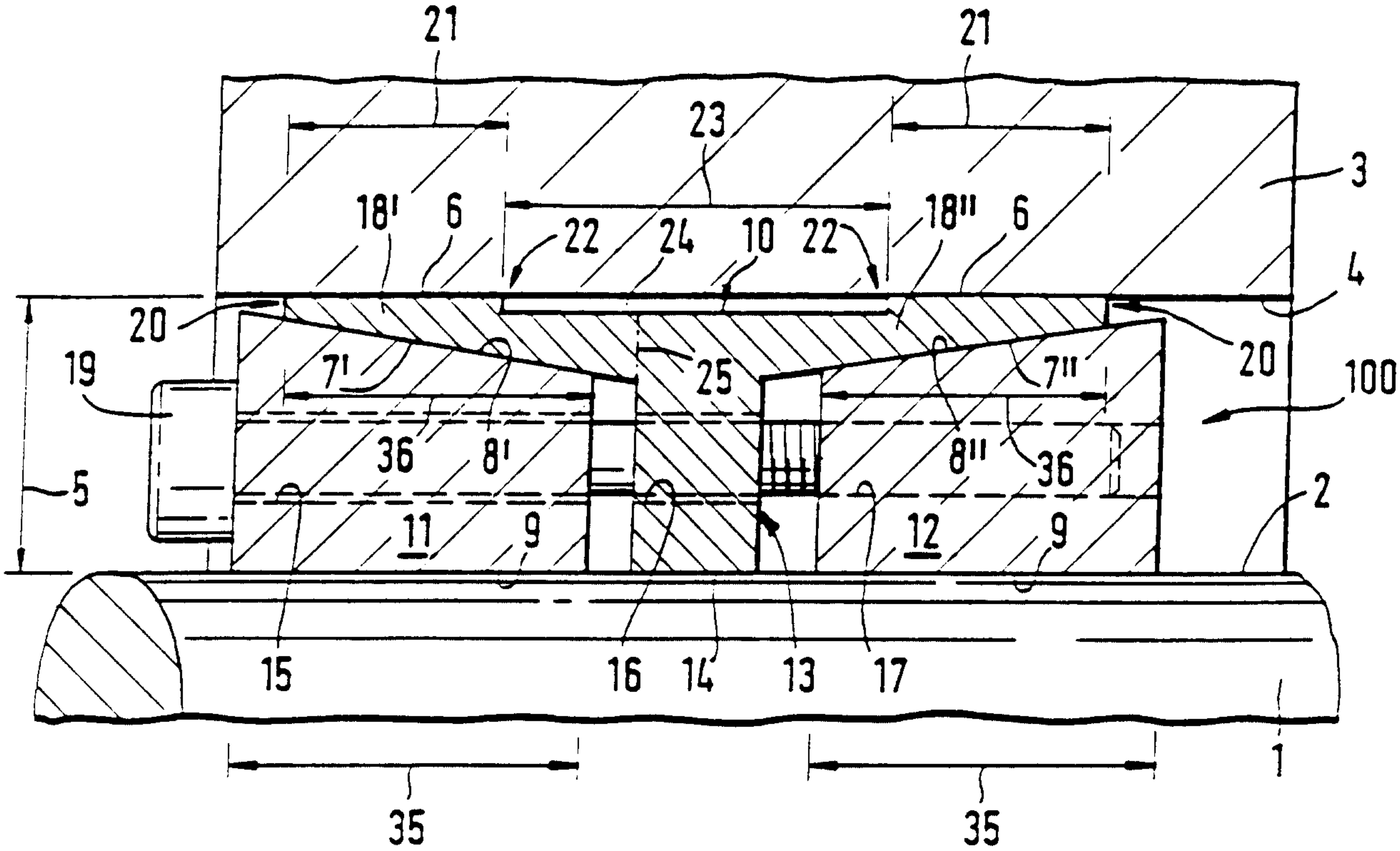
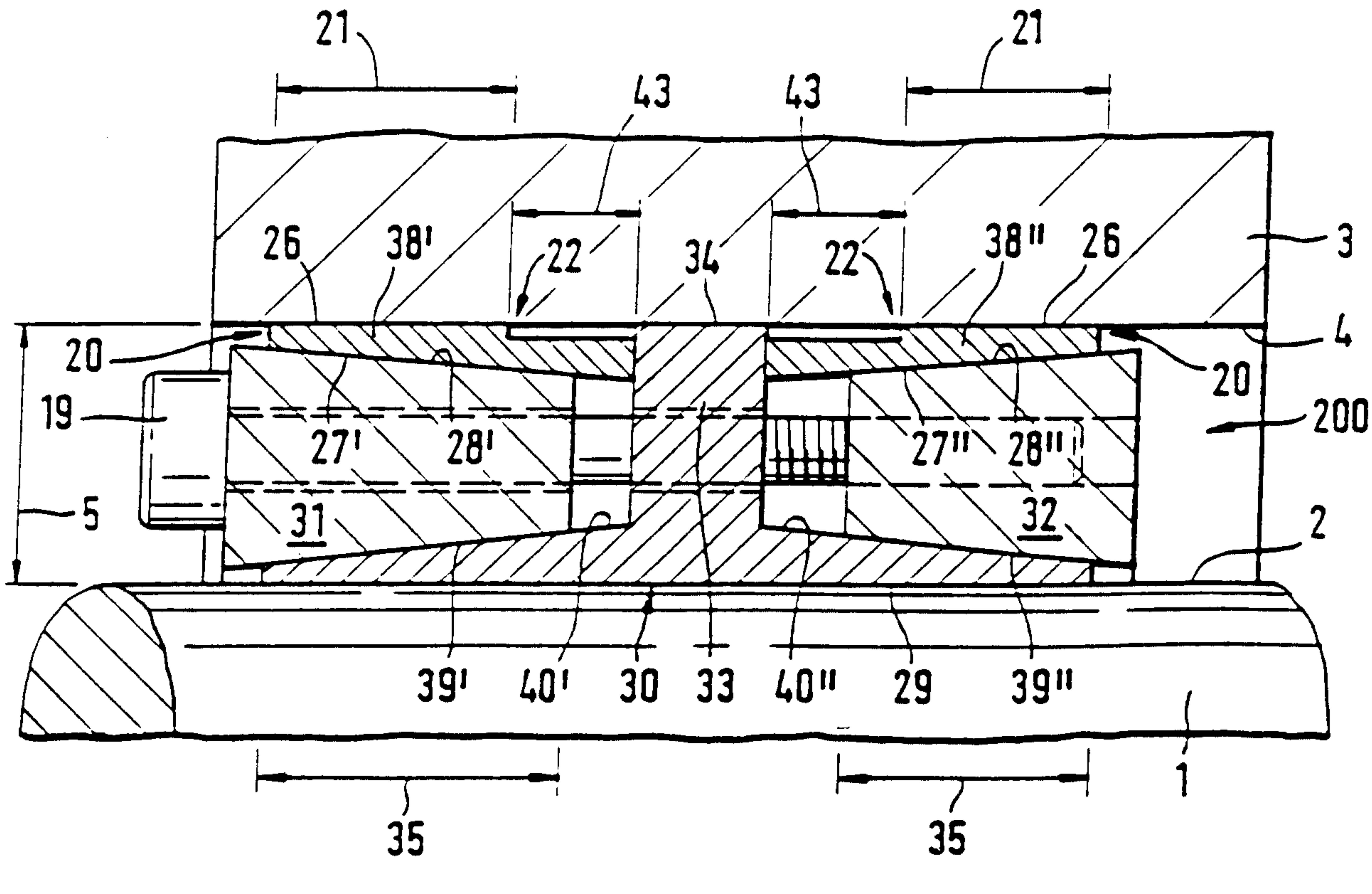


Fig. 2



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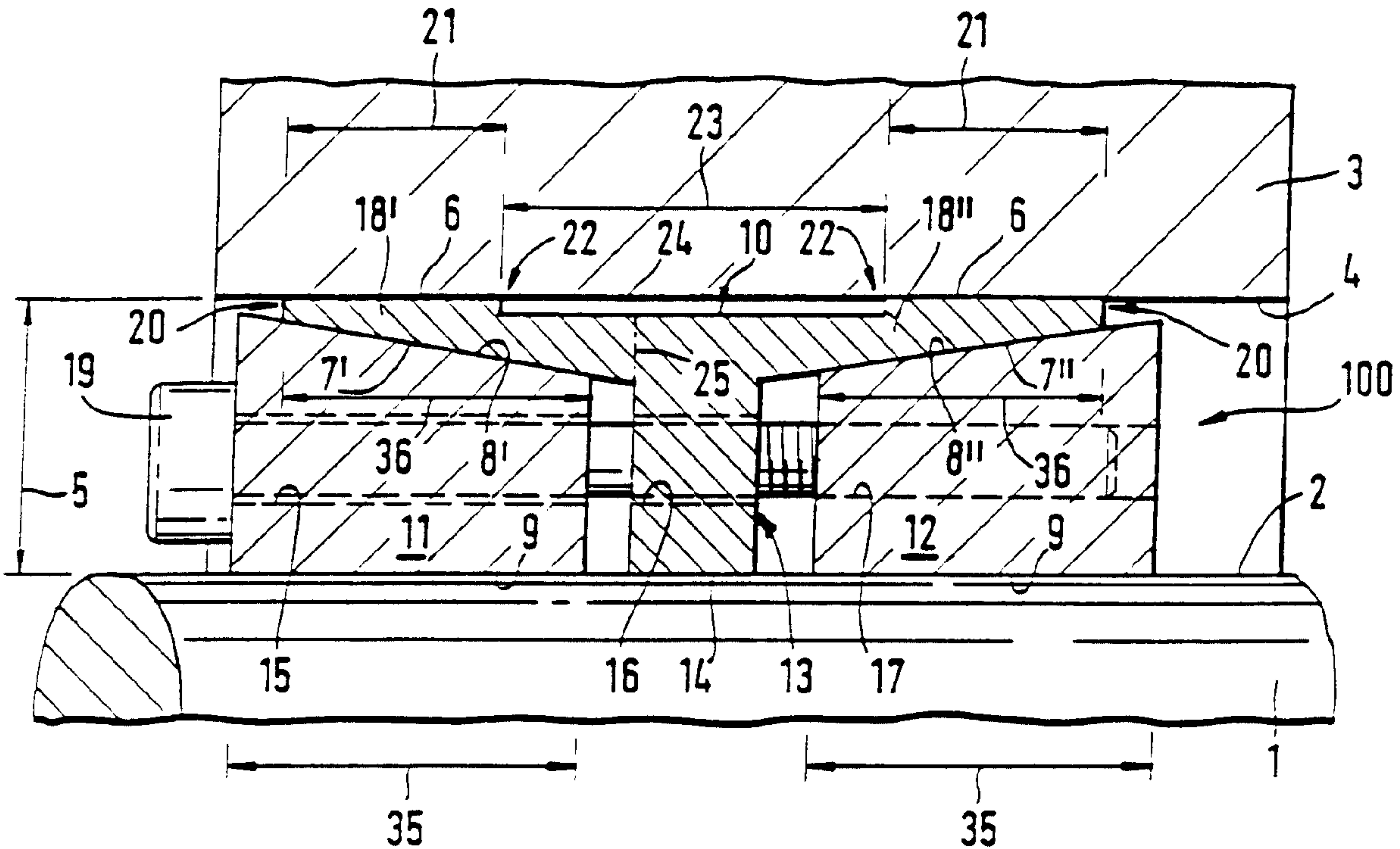

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