

Components for a clamping and/or braking device

DESCRIPTION

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TECHNICAL FIELD

10 The disclosure relates to a component for a clamping and/or braking device and to a pneumatic clamping and/or braking device having such a component. Furthermore, the disclosure relates to an elastic element.

BACKGROUND

15 In the production of tool or machine parts, machining machines, in particular work spindles or other machine tools, are used which machine material from a workpiece by means of tools fastened to a shaft, in particular in order to bring it into the desired shape. The shaft can be an axis of rotation or pivot axis of such a machine. Furthermore, tables which rotate or pivot by means of a shaft are used to place tools or workpieces into the suitable machining position or to move workpieces at corresponding rotational speeds. A prerequisite for precise and efficient
20 machining is, inter alia, a high rotational speed of the shaft. Emergency or safety systems therefore have the task of stopping the shaft in the event of a fault or failure of the systems, such as, for example, a power failure or cable breakage, or of holding it in a fixed position and thus fixing it.

25 Common machining machines have electromagnetic, hydraulic or pneumatic clamping and/or braking devices. Such devices have a friction lining which can be frictionally connected to the shaft by means of force transmission. This enables the shaft to be fixed at different speeds.

30 In hydraulic clamping devices, hydraulic oil is applied to a chamber and the rotating shaft or disk is clamped firmly. Passive hydraulic clamps are also known. However, such hydraulic clamps have long reaction times or short reaction times require a very high outlay there. Furthermore, the hydraulic material, in particular hydraulic valves and hydraulic pipes, is costly and requires longer assembly times. The hydraulic oil also involves an additional outlay for maintaining cleanliness in the surroundings of a hydraulic clamp.

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In pneumatic clamping and/or braking devices, compressed air is usually applied to elastic elements, in particular resilient plates, and can overcome some of the abovementioned

disadvantages of hydraulic clamping devices.

EP 1 585 616 B1 and EP 1 651 881 B1 describe pneumatic clamping devices with two annular spring plates, which are introduced into a housing of the clamping devices and form a pressure chamber there, which can be pressurized or ventilated and vented with compressed air in order to change the bending of the spring plates and thereby to change between a closed state of the clamping devices, in which an object to be clamped, such as a rotatable shaft, is clamped, and an open state of the clamping devices, in which the object is free. In practice, however, it has been found that rubberized spring plates of such clamps lift off in the region of the connections when applied with overpressure and can make the clamp leaky or else large amounts of adhesive and/or sealing compound have to be used, which is neither environmentally friendly nor cost-friendly.

SUMMARY

Proceeding from the prior art mentioned at the outset, the disclosure is based on the object of providing means which enable a pneumatic clamping and/or braking device to reliably seal in the region of a connection for the pressure medium.

The object is achieved with a component having the features of independent claim 1, with a clamping and/or braking device having the features of claim 10, and with an elastic element having the features of claim 2. Some of the possible embodiments are described in the dependent claims, in the description and in the figures.

According to the solution according to the invention, a component for a clamping and/or braking device is proposed, the component comprising: a housing part, comprising: a connection opening for a connection of the clamping and/or braking device for applying a pressure medium to a pressure chamber of the clamping and/or braking device, and a stepped housing inner surface, which defines a stepped recess in the housing part adjoining the connection opening; an adhesive and/or sealing compound; an, for example, annular elastic element, wherein the elastic element has a connection seal, which defines an edge of a sealing opening of the connection seal for a fluid connection to the connection opening, and wherein the connection seal forms a connection projection along the edge of the sealing opening, which projection at least partially surrounds the sealing opening; wherein the connection seal is arranged in the stepped recess of the housing part in such a way that the adhesive and/or sealing compound is arranged between the connection projection and the stepped housing inner surface of the housing part.

By virtue of the fact that a stepped recess in the housing part adjoining the connection opening is defined by a stepped housing inner surface, the connection seal forms a connection projection along the edge of the sealing opening, which projection at least partially surrounds the sealing opening, and the connection seal is arranged in the stepped recess of the housing part in such a way that the adhesive and/or sealing compound is arranged between the connection projection and the stepped housing inner surface of the housing part, shearing of a connection between connection seal and housing part is reduced or even entirely prevented by the operation of the device with a pressure medium (for example compressed air). On the one hand, this increases the leak-tightness at the relevant connection and, on the other hand, also reduces the required amount of adhesive and/or sealing compound, which is environmentally friendly and cost-reducing.

The step on the housing inner surface and the connection projection can be formed in a complementary manner. For example, the connection projection can likewise form a step with the rest of the connection seal, which step is complementary to the step on the housing inner side. These two steps can engage in one another when the connection projection is arranged on the housing inner surface. Each of the steps mentioned here can be formed by two (substantially) mutually perpendicular legs (pitch and slope). The number of steps formed by the housing inner surface and/or the connection seal or connection projection can be in each case one, two or more.

The stepped recess adjoining the connection opening comprises a first region, which has a first extent in a plane perpendicular to the longitudinal axis of the connection opening. The stepped recess furthermore comprises a second region adjoining the first region, which has a second extent in a plane perpendicular to the longitudinal axis of the connection opening, wherein the second extent is greater than the first extent.

According to the solution according to the invention, a, for example, annular elastic element is furthermore proposed, wherein the elastic element has a connection seal (20), which defines an edge of a sealing opening of the connection seal, wherein the connection seal forms a connection projection along the edge of the sealing opening, which projection at least partially surrounds the sealing opening, wherein the connection seal has a, for example, round stop element projecting from a side surface that is facing away from the connection projection.

By virtue of the fact that the connection seal has a stop element projecting from a side surface that is facing away from the connection projection, it is made possible that, when two opposite

elastic elements are installed, an axial fixing is produced by the stop elements of these installed elastic elements, which axial fixing reduces or prevents lifting of the connection seal during operation with the pressure medium.

- 5 The component according to the invention and the elastic element according to the invention consequently bring about the same technical effect of inhibiting or avoiding lifting of the connection seal from the housing part by different means.

10 According to the solution according to the invention, a clamping and/or braking device for clamping and/or braking an object to be clamped and/or braked is furthermore provided, wherein at least two of the components according to the invention are fastened to one another in the device, which components are optionally in each case equipped with an elastic element according to the invention.

- 15 The problem of the fault-prone region around one of the connections, which problem has not been overcome for a long time, could be overcome by aspects of this disclosure.

20 According to one aspect of the disclosure, the elastic element comprises a, for example, annular spring plate, to which the connection seal is fastened, for example vulcanized. The spring plate has a first side surface arranged on a first side of the spring plate and a second side surface (16b) arranged on a second side of the spring plate and facing away from the first side surface. The connection seal extends, for example continuously, from the first side surface of the spring plate around the radially outer edge of the spring plate up to the second side surface of the spring plate, as a result of which the seal encases the radially outer edge of the spring plate at least in sections. As a result, a radial separation point between the spring plate and the connection seal is converted in a manner which promotes stability and is conducive to the seal. The probability of the connection seal being torn open or of the connection seal being detached from the spring plate is reduced as a result. Improved sealing at the relevant connection for application of the pressure medium is also achieved as a result. This encasing can be combined with the stop element in an elastic element, or else can also be present without a stop element in the elastic element (for example in the component according to the invention). The stop element can in turn also be present in an elastic element also without an encasing.

35 According to one aspect, a part of the connection seal projects radially outward from the outer edge of the spring plate, and as a result forms a type of “ear” of the spring plate. The relevant part can be rounded or angular. For example, the relevant part or the “ear” comprises the connection projection and/or the sealing opening. As a result of this formation of a type of

“ear” of the spring plate by the connection seal, the relevant connection can be sealed particularly well without introducing an additional component, which is separated from the elastic element or the spring plate, into the device, which reduces the complexity.

- 5 For example, the connection seal, in particular the connection projection and/or the stop element, is made of an elastic material, for example of rubber.

By means of the means described here individually and in combination, clamps can be provided which reliably and effectively seal in the region of the connection for the pressure
10 medium without the dynamics of opening and closing of the clamp being adversely affected as a result.

If this brief description of the disclosure describes features which are not listed in the patent claims, these features do not constitute essential features in the sense that these features are
15 necessarily to be included in the patent claims in order to describe the disclosure, but these features are particularly prominent realizations of the claimed subject matter, can be combined with any of the patent claims and can also be combined with one another as desired.

BRIEF DESCRIPTION OF THE FIGURES

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FIG. 1A shows a schematic cross section through an inwardly directed, passive pneumatic clamping and/or braking device according to the invention in the closed state.

FIG. 1B shows a schematic cross section through an outwardly directed, passive pneumatic
25 clamping and/or braking device according to the invention in the closed state.

FIG. 2A shows a schematic cross section through an inwardly directed, passive pneumatic clamping and/or braking device according to the invention in the open state.

30 FIG. 2B shows a schematic cross section through an outwardly directed, passive pneumatic clamping and/or braking device according to the invention in the open state.

FIG. 3A shows a schematic cross section through an inwardly directed, active pneumatic clamping and/or braking device according to the invention in the open state.

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FIG. 3B shows a schematic cross section through an outwardly directed, active pneumatic clamping and/or braking device according to the invention in the open state.

FIG. 4A shows a schematic cross section through an inwardly directed, active pneumatic clamping and/or braking device according to the invention in the closed state.

FIG. 4B shows a schematic cross section through an outwardly directed, active pneumatic clamping and/or braking device according to the invention in the closed state.

FIG. 5A shows a cross section through a pneumatic clamping and/or braking device according to the invention in a three-dimensional representation.

FIGS. 5B to 5D show a variant of a component taken from FIG. 5A .

FIGS. 6A to 6C show an embodiment of the housing part according to the invention.

FIGS. 7A to 7C show a first embodiment of the elastic element according to the invention.

FIG. 8 shows a detail of a clamping and/or braking device according to the invention with two components according to the invention.

FIGS. 9A to 9C show a second embodiment of the elastic element according to the invention.

Components which are illustrated in a plurality of figures bear the same reference symbols.

DETAILED DESCRIPTION

The disclosure relates to an annular elastic element and to a housing part for a pneumatic clamping and/or braking device and to a pneumatic clamping and/or braking device having such an annular elastic element.

When the device “clamp” or “clamping device”, the “clamping force” or the operation of “clamping” is referred to in this document, the device of the “brake” or “braking device” or the “braking force” or the operation of “braking” is likewise also comprised.

FIGS. 1A to 5A and 8 schematically show cross sections through such a clamping device according to the invention having a housing 3 which comprises two housing parts 3a, 3b, and having a spring 1 which is arranged in the housing 3 and comprises at least two annular elastic elements 1a, 1b according to the invention.

The clamping device 10 according to the invention comprises the following: a first component according to the invention and a second component according to the invention, each of the components comprises one or more elastic elements 1a, 1b according to the invention and one or more housing parts 3a, 3b. The housing parts 3a, 3b form parts of the housing 3 of the device and are arranged with respect to one another and fastened to one another in such a way that inner surfaces of the housing parts 3a, 3b together delimit an interior space within the housing 3 and the stop elements of the elastic elements 1a, 1b of the two components are designed to come into abutment with one another; one or more clamping elements 8, wherein each clamping element has a clamping surface 7; a spring 1 which is arranged in the interior space and comprises the elastic element 1a of the first component and the elastic element 1b of the second component, wherein the elastic elements 1a, 1b are clamped within the interior space in such a way that a first pressure chamber 4 is formed in the interior space between the elastic elements 1a, 1b and the inner surfaces of the housing parts 3a, 3b (the first pressure chamber 4 can be arranged outside the spring 1), wherein the first pressure chamber 4 can be vented and can be applied with overpressure by a pressure medium which can be supplied to the housing parts 3a, 3, wherein the spring 1 is designed such that, when the first pressure chamber 4 is ventilated or vented or the first pressure chamber 4 is applied with overpressure, a bending of at least one of the elastic elements 1a, 1b is variable and the device 10 thereby changes between an open state, in which an object 5 to be clamped is spaced apart from the one or more clamping surfaces 7, and a closed state, in which at least one of the one or more clamping surfaces 7 transmits a clamping and/or braking force to the object 5. The device 10 according to the invention comprises the means mentioned at the outset which permit reliable operation of the device. These means are explained in more detail in conjunction with FIGS. 6 to 9.

FIGS. 1A, 1B, 4A and 4B each show such clamping devices 10 in the closed state in that the clamping surface 7 of the clamping element 8 touches the circumference of the object 5. The clamping element 8 is also referred to as a clamping lip. The clamping element 8 can be formed in one piece with the remaining parts of the housing part 3a, 3b or can be a component of the housing part 3a, 3b which is structurally separated from the remaining parts.

The clamping force or action of the clamping surface 7 on the object 5 to be clamped takes place in a clamping plane which is spanned by two vectors which each form a radius of the annular elastic elements 1a, 1b or annular recess 11 (cf. FIG. 5A). The axis 9 can run through the center point of the ring of the components described here as annular and can therefore be referred to as the main axis of the clamping device 10 which can run perpendicularly to the clamping plane. When “inner” and “outer” projection, edge or end are referred to in this document, the

inner edge, projection or end is closer to the axis 9 than the corresponding outer edge, projection or end. The same can also apply to other components.

The clamping device 10 can be configured rotationally symmetrically about this main axis 9.

5 The main axis 9 can run approximately or precisely centrally through an opening of the clamping device 10 (opening 14 in FIG. 5B). In FIGS. 1A, 4A, the object 5 to be clamped, for example a rotatable shaft of a machine or a table, is placed within the opening 14 and the clamping force of the clamping device is therefore directed radially inward towards the main axis 9 (perpendicularly to the main axis 9) within the clamping plane. In FIGS. 1B, 4B, the
10 object 5 to be clamped is placed outside the clamping device 10 and the clamping force of the clamping device is therefore directed radially outward away from the main axis 9 (perpendicularly to the main axis 9) within the clamping plane.

In FIGS. 1A, 2A, 3A, 4A, the clamping element 8 is located between spring 1 and opening 14 or
15 main axis 9. In FIGS. 1B, 2B, 3B, 4B, on the other hand, the object 5 to be clamped at least partially surrounds the clamping device 10, so that the clamping element 8 is located there between object 5 and opening 14 or main axis 9. In FIGS. 1B, 2B, 3B, 4B, a component which at least partially fills the opening 14 and through which the main axis 9 extends can be introduced into opening 14 instead of the object 5 to be clamped.

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In FIGS. 1A to 5A, the spring 1 is clamped in each case between two contact surfaces (101 and 102 in FIGS. 5C and 5D) within the housing 3 of the clamping devices 10 and extends between the two contact surfaces. In the pressureless initial state of the device 10 in FIGS. 1A to 2B, the spring 1 can be slightly bent in order to be fixed firmly in the housing 3 in this state and the
25 same can apply to any other state of the device 10, wherein the degree of bending of the spring 1 depends on the state in which the device 10 is located. If the device 10 is in a state in which the spring 1 is bent (for example bent more than in the pressureless initial state, such as in the open state), venting of an inner pressure chamber 2 of the spring 1 and ventilation of an outer pressure chamber 4 can lead to at least partial relaxation of the spring 1 while the spring 1
30 presses against the radial contact surfaces, the spacing of which increases somewhat, so that the housing 3 is elastically deformed in the region of the clamping element 8 or the clamping surface 7 as a result and the clamping surface 7 thereby touches the object 5 and is pressed against the object 5 with a (predefined) clamping force in order to clamp the object 5 firmly. The object 5 is clamped firmly and the clamping device 10 is in the closed state, as shown in
35 FIGS. 1A and 1B. In the closed state of the device 10, the spring 1 can still be slightly bent even after the partial relaxation in order to be fixed firmly in the housing 3 in this state.

In this case, the clamping element 8 can be an elastic element, such as, for example, a spring fork, which, in the pressureless initial state of the device 10, is moved by the spring force of the (slightly) bent spring 1 from an initial position, in which the elastic element is relaxed, into a braced position, for example by bending the spring fork 8, until, in the pressureless initial state, an equilibrium is produced between a restoring force of the elastic element 8 and the spring force of the spring 1. In this equilibrium, the clamping surface 7 can press against the object 5.

By additional application of compressed air (for example with 4 bar or 6 bar) to the outer pressure chamber 4 in the closed state, there is the optional possibility of increasing the clamping force by a predetermined value. This is indicated in FIGS. 1A, 1B by the optional additional compressed air pump (booster) 6 and the hatching (compressed air) in the outer pressure chamber 4. The outer pressure chamber 4 can be connected by means of an opening in the housing 3 to a port I (also referred to as “close”), to which the compressed air pump 6 can be connected.

As a result, it is possible, for example, to actuate the device 10 such that a change takes place between a braked movement (in the pressureless state) of the applied object 5 and complete clamping of the object (in the case of sufficient application of pressure).

Even if two pressure chambers 2, 4 are shown and described here by way of example, the clamping device 10 can also be operated with a single pressure chamber which can be, for example, the inner pressure chamber 2 or the outer pressure chamber 4.

FIGS. 2A and 2B show the clamping devices 10 from FIGS. 1A and 1B in each case in the open state in which the clamping surface 7 does not touch the circumference of the object 5 or is spaced apart from the circumference of the object 5. The inner pressure chamber 2 can be connected by means of an opening in the housing 3 to a port II (also referred to as “open”), to which a compressed air pump 6 can be connected.

By application of compressed air (for example 4 bar or 6 bar) to the inner pressure chamber 2 by the compressed air pump 6 and venting of the outer pressure chamber 4, the spring 1 is bent or braced to a greater extent (convexly) compared with the closed state from FIGS. 1A, 1B and there is a radial shortening of the spring 1 or of the distance between the two bearing surfaces. The clamping surface 7 lifts off from the object 5 in order to release the clamping. The object 5 is freely movable (for example rotatable about axis 9 or movable linearly along axis 9) and the clamping device 10 is open.

It is possible to change back and forth between the closed state and the open state of the device 10 .

Such pneumatic clamps 10 have a number of advantages over hydraulic clamps.

By using the combination of elastic component, here a spring 1 together with elastic elements 1 a, 1 b, and compressed air, for example very short reaction times are achieved during switching between the open and closed state and a secure clamping of the object 5 is likewise brought about. The spring 1 can be of plate-shaped configuration, as shown in more detail in FIG. 5, wherein two elastic elements 1a, 1b lying one on top of the other form the spring 1 and the inner pressure chamber 2 of the spring 1 between the plates 1a, 1b. The plates 1a, 1b can likewise be annular, as shown in FIG. 5, and can optionally additionally have radial slots, so that a change in the inner diameter is possible with particularly low forces. The elastic elements 1a, 1b can be coated with rubber, at least in the region of slots, in order to produce the leak-tightness required for the compressed air. The elastic elements 1a, 1b are generally of such pressure-resistant and thus elastically bendable form and are arranged in the housing 3 of the clamping device 10 in such a way that the inner pressure chamber 2 is formed within the spring 1 between the elastic elements 1a, 1b and the outer pressure chamber 4 is formed between each elastic element 1a, 1b and the housing 3 or the housing parts 3a, 3b of the clamping device 10 . FIG. 5 shows a three-dimensional view of a clamping device 10 similar to FIGS. 1A and 2A .

By ventilation or application of compressed air to the outer pressure chamber 4 and venting of the inner pressure chamber 2, as shown in FIG. 1A, the spring 1 is at least partially relaxed and brings about a clamping force on the object 5 to be clamped, in particular on the circumference of a shaft 5 . As a result, in the event of an energy or pressure failure, the object 5 is clamped or the shaft 5 is immediately brought to a standstill and therefore offers a safety clamping. Such pneumatic clamps 10 can, depending on the magnitude, achieve holding torques of several 100 Nm and up to several 1000 Nm, which can be further increased by additional application of compressed air to the outer pressure chamber 4, as indicated in FIG. 1A by a pressure pump 6 (booster). Here, a compressed air of a few bar (for example 4 bar or 6 bar) is sufficient for providing a multiple of the holding torques which are achieved without a booster. In this case, use is made of the fact that small transverse bends of the plates 1a, 1b (perpendicular to the longitudinal axis thereof) during switching between the open and closed state of the clamp 10 generate large spring forces which can be used for clamping or for releasing prestressed clamping devices 10. This enables secure clamping and release even of rapidly rotating machine shafts 5.

In the case of pneumatic material, the costs and the assembly outlay are also lower in comparison with the hydraulic material, and the use of compressed air does not involve any additional outlay at all for producing cleanliness in the system. Such pneumatic clamps also enable a small overall size, since a small transverse bend and a small (change in the) longitudinal extent of the spring, and therefore small volumes of the pressure chambers, are sufficient to apply the required clamping forces.

In the case of pneumatic clamps, a distinction is made in principle between passive clamping devices 10, as shown in FIGS. 1A to 2B, and active clamping devices 10, as shown in FIGS. 3A to 4B.

In the pressureless initial state, the spring 1 can be bent to different extents (transversely) and therefore be shortened radially to different extents. The inner side of the housing 3 can be adapted to the bend of the elastic elements 1a, 1b or can define said bend. A corresponding stop surface for the elastic elements 1a, 1b can be formed, for example, by a housing inner wall. The housing inner wall can be formed in a complementary manner (for example concavely) to a (for example convex) bend of the elastic elements 1a, 1b.

In the case of passive clamping devices 10, in the pressureless initial state, the spring 1 is generally bent or is prestressed slightly elastically (for example convexly) and the clamping devices 10 can be closed (FIGS. 1A, 1B). The clamping device 10 is opened only by application of force from the inside via application of compressed air to the inner pressure chamber 2 (FIGS. 2A, 2B). In most cases, the spring 1 is bent somewhat in the pressureless initial state, with the result that, in the case of clamping or in the case of a pressure drop, the spring force which is given by the energy stored in the spring 1 is transmitted to the object 5 to be clamped as a clamping force, in order to clamp the object 5 .

In the case of active clamping devices 10, in the pressureless initial state (FIGS. 3A, 3B), the spring 1 is curved transversely outward to a greater extent, in particular to a greater extent, than in the case of passive clamping devices, with the result that the distance between the two radial bearing surfaces is shortened and the clamping device 10 is opened. No clamping force is brought about via clamping surface 7 on the object 5 . The object is free since the clamping surface 7 does not touch the object 5 or is spaced apart from the object 5 .

By plastic deformation of the elastic elements 1a, 1b, in the case of the same housing 3, the spring 1 can be curved transversely outward to a greater extent and therefore shortened radially

to a greater extent in the pressureless initial state than in the case of passive clamping devices. This smaller radial extent of the elastic elements 1a, 1b in the pressureless initial state can lead to an open state of the clamping device 10 in the pressureless initial state. Even in the case of plastic deformation, the elastic elements 1a, 1b are elastically bent and press against the bearing surfaces in order for the spring to be fixed in the housing. The interior space of the housing or the recesses can accommodate the curvature brought about to a greater extent by plastic deformation in the initial state.

The clamping force now has to be induced actively from the outside, as shown in FIGS. 4A and 4B, in order to transfer the clamp into the closed state. Here, compressed air is introduced into the outer pressure chamber 4 by a compressed air pump 6 and therefore compressed air is applied to the spring 1 from the outside in such a way that the spring 1 is actively relaxed, the curvature of the spring 1 is reduced, the distance between the two bearing surfaces is increased, and the housing 3 is elastically deformed in the region of the clamping element 8 or the clamping surface 7, with the result that the clamping surface 7 touches the object 5 and brings about a clamping force on the object 5 and the object 5 is clamped firmly as a result. The active clamping device 10 is then in the closed state.

Depending on the field of application and prescribed safety regulations, use is therefore made of an active or passive clamping system 10. If a safety clamping is primarily desired, a passive clamping device is generally used. With such pneumatic passive clamping systems, it is possible, even in the pressureless state, during corresponding installation of the device in an overall device, to generate a predetermined clamping force with which the object 5 to be clamped is acted on. As a result of the application of overpressure or negative pressure, the forces which are transmitted to this object can be increased, reduced or completely cancelled, which opens up diverse applications. If, on the other hand, a deliberate operation, such as a tool change, is primarily intended to be carried out with the clamping device, an active clamping device is generally used.

As illustrated in FIG. 5A, the housing 3 of the clamping devices 10 according to the invention comprises two housing parts 3a, 3b which are fastened to one another by fastening means, such as for instance screws, and are mounted in such a way that, in the mounted state, the two housing parts 3a, 3b define the interior space 13 between the housing parts 3a, 3b within the housing 3 in which the spring 1 together with its annular elastic elements 1a, 1b according to the invention are arranged. The housing parts 3a, 3b each define a recess 11 which is likewise annular and which serve to receive the annular elastic elements 1a, 1b, as illustrated in FIGS. 5A to 5D. At least part of the first contact surface 101 of the housing part can run (substantially)

perpendicularly to the radial direction R of the annular recess 11 and/or part of the second contact surface 102 of the housing part can run (substantially perpendicularly) to the radial direction R of the annular recess 11 .

5 An opening 14 (FIG. 5B) extends through the center of the housing 3, into which opening the object 5 to be clamped, such as for instance a shaft, can be introduced. The housing can extend up to 360° around this opening and at least partially encloses the object 5 in at least one plane which is referred to as the clamping plane. The central main axis 9 of the clamping devices runs centrally through the opening 14 and perpendicularly to the clamping plane. In clamping
10 devices according to FIGS. 1A, 2A, 3A, 4A, 5A, the main axis 9 runs centrally through the shaft along the longitudinal axis thereof.

Located along the circumference of the housing 3 or the opening 14 is one or more of the clamping surfaces 7 which, in the case of elastic deformation of the housing 3 in the region of
15 the clamping element 8 or the clamping surface 7, brings about the clamping force on the outer circumference of the object 5 and can clamp the object 5 as a result. For effective opening and closing of the clamping device 10 in relation to the object 5 to be clamped, without risk of damage to the object 5, a symmetrical distribution of the clamping force along the clamping surface 7 or along the circumference of the object 5 is desirable. A non-symmetrical
20 distribution of the clamping force can lead to damage to the object 5 . For example, one or both contact surfaces 101, 102 are of circular configuration within the clamping plane. For example, the clamping surface 7 is of circular configuration within the clamping plane. The clamping element 8 can be of annular configuration. All annular or circular components described here can each have, individually or in combination, as the center point, the point of intersection of
25 the main axis 9 with the clamping plane (e.g. center point of the opening 14).

FIG. 5B shows an embodiment of the component 40, 50 according to the invention (here with the upper housing part 3a from FIG. 5A), wherein the relevant housing part 3a of the component has an annular recess 11 for clamping the annular elastic element 1a, and wherein
30 the housing part 3a has an inner surface (cf. 105 in FIG. 7) defined by the recess 11 . The annular recess 11 defines, for example, an annular opening 12 in the housing part, wherein the annular opening is formed between a first annular edge 12a of the housing part and a second annular edge 12b of the housing part. The elastic element 1a can be clamped between the first annular edge 12a and the second annular edge 12b .

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When the elastic element 1a is introduced with the first side surface (cf. 16c in FIG. 6C) facing the inner surface through the opening 12 into the recess 11 and is clamped in the recess 11, the

first pressure chamber 4 is formed between the inner surface and the elastic element 1a. The elastic element according to the invention here has the means mentioned at the outset which permit reliable and effective sealing at the port II. These means are explained in more detail in conjunction with FIGS. 6 to 9 .

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As shown in FIGS. 5C and 5D, the illustrated elastic element 1a of the spring 1 extends from a first contact surface 101 within the housing part 3a to a second contact surface 102 within the housing part 3a and can touch the latter. The first contact surface 101 here is arranged radially further outward than the second contact surface 102, as seen from the center point of the opening 14 .

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FIG. 5C shows the section of the housing part 3a illustrated in FIG. 5B in which the upper plate 1a of the spring 1 meets the first contact surface 101 and is in contact with the latter, for example. FIG. 5D shows the section of the housing part 3a illustrated in FIG. 5B in which the upper plate 1a of the spring 1 meets the second contact surface 102 and is in contact with the latter, for example. However, it is also possible for one or more further components, via which the elastic element 1a exerts its spring force on the contact surfaces 101, 102, to be located in each case radially between the elastic element 1a and one or more of the contact surfaces 101, 102.

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As can be seen in FIGS. 5B, 5D, the elastic element 1a is clamped in the recess 11 between inner sides of the housing part 3a. Each of the plates of the spring 1 is introduced in the direction of the main axis 9 of the clamping devices 10 through the opening 12 into the recess 11 of the respectively associated housing part during installation along inner surfaces of the housing part 3a until the respective plate butts against a stop 112, 122 at the end of each of the two contact surfaces 101, 102 and therefore cannot be introduced further into the recess 11 . Since the extent of the elastic element 1a in the clamping plane or in the radial direction of the annular recess can be greater than the extent of the interior space defined by the housing part, the plate 1a can be bent or prestressed in the pressureless initial state.

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FIGS. 6A to 6C show an embodiment of the housing part according to the invention.

FIG. 6A in this case shows a plan view of the housing part 3a, 3b. FIG. 6B shows an enlarged view of the region indicated by means of a rectangle in FIG. 6A around the connection opening 15 . FIG. 6C shows a cross section through a section of the housing part 3a, 3b along the dashed line A-A in FIG. 6A .

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The housing part 3a, 3b comprises: a connection opening 15 for the connection II of the clamping and/or braking device 10 for applying a pressure medium to the pressure chamber 2 of the clamping and/or braking device 10, and a stepped housing inner surface 17a, which defines a stepped recess 17b in the housing part 3a, 3b adjoining the connection opening 15 .

5 The step can be formed by two (substantially) mutually perpendicular legs (pitch and slope), as shown in FIG. 6C . The number of steps is arbitrary (one, two or more).

The stepped recess 17b adjoining the connection opening 15 comprises a first region 17c, which has a first extent in a plane perpendicular to the longitudinal axis of the connection opening 15
10 . The stepped recess 17b furthermore comprises a second region 17d adjoining the first region, which has a second extent in a plane perpendicular to the longitudinal axis of the connection opening, wherein the second extent is greater than the first extent, as a result of which the one, two or more steps are formed.

15 FIGS. 7A to 7C show a first embodiment of the elastic element according to the invention. In this embodiment, a stop element 18 is present, but the encasing of the radially outer edge of the spring plate 16 is optional.

FIG. 7A in this case shows a plan view of the inner side of the elastic element 1a, 1b. FIG. 7B
20 shows an enlarged view of the region indicated by means of a rectangle in FIG. 7A around the sealing opening 23 . FIG. 7C shows a cross section through a section of the elastic element 1a, 1b along the dashed line C-C in FIG. 7A .

The, for example, annular elastic element 1a, 1b has a connection seal 20, which defines an
25 edge 22 of a sealing opening 23 of the connection seal 20 for a fluid connection to the connection opening 15 (for example, the pressure medium flows through openings 15 and 23 when the pressure chamber 2 is applied), and wherein the connection seal 20 forms a, for example, round connection projection 21 along the edge 22 of the sealing opening 23, which projection at least partially surrounds the, for example, round sealing opening 23 .

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The elastic element 1a, 1b comprises a, for example, annular spring plate 16, to which the connection seal 20 is fastened, for example vulcanized.

A part of the connection seal 20 projects radially outward from the outer edge of the spring
35 plate 16, wherein the part comprises the connection projection 21 and the sealing opening 23 . The part of the connection seal 20 that projects radially outward from the radially outer edge of the spring plate 16 comprises a part of the stop element 18 .

The connection seal 20 has a, for example, round stop element 18 projecting from the second side surface 24 on a second side surface 24 that is facing away from the connection projection 21 . The first side surface of the connection seal 20 faces the inner surface 105 of the housing part.

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The spring plate 16 has a first side surface 16a arranged on a first side 16c of the spring plate 16 and a second side surface 16b arranged on a second side 16d of the spring plate 1 and facing away from the first side surface 16a .

10 The stop element 18 is located on the second side 16d of the spring plate 16 and the connection projection 21 is located on the first side 16c of the spring plate 16 .

The connection seal 20, in particular the connection projection 21 and/or the stop element 18, can be made of an elastic material, for example of rubber.

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FIG. 8 shows a detail of a clamping and/or braking device according to the invention with two components according to the invention according to FIGS. 6 and 7 .

20 Therein, the connection seal 20 of each component 40, 50 is arranged in the stepped recess 17 of the respective housing part 3a, 3b in such a way that the adhesive and/or sealing compound 30 is arranged between the respective connection projection 21 and the respective stepped housing inner surface 17a of the housing part 3a, 3b and thus the respective housing part is adhesively bonded and/or sealed against the connection seal 20 in the region of the port II by means of the steps and the adhesive and/or sealing compound 30 .

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30 The connection seal 20 forms a connection projection 21 along the edge 22 of the sealing opening 23, which projection at least partially surrounds the sealing opening 23, wherein the connection seal 20 has a, for example, round stop element 18 projecting from the side surface 24 on a side surface 24 that is facing away from the connection projection 21 (cf. FIG. 7C). The stop elements 18 of the elastic elements 1a, 1b of the two components 40, 50 are designed to come into mutual abutment when the first pressure chamber 4 is applied with overpressure (cf. dashed ellipse in FIG. 8), in order thereby to at least inhibit or prevent lifting of the respective connection seal 20, in particular of the respective connection projections 21, from the housing inner surface 17a (cf. FIG. 7C) of the respective components 40, 50 .

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FIGS. 9A to 9C show a second embodiment of the elastic element according to the invention.

In this embodiment, an encasing of the spring plate 16 is present at the radially outer edge of the spring plate, but the stop element 18 is optional.

FIG. 9A in this case shows a plan view of the outer side of the elastic element 1a, 1b. FIG. 9B shows an enlarged view of the region indicated by means of a rectangle in FIG. 9A around the sealing opening 23 . FIG. 9C shows a cross section through a section of the elastic element 1a, 1b along the dashed line E-E in FIG. 9A .

An, for example, annular elastic element 1a, 1b is disclosed, wherein the elastic element 1a, 1b has a connection seal 20, which defines an edge 22 of a sealing opening 23 of the connection seal 20, wherein the connection seal 20 forms a connection projection 21 along the edge 22 of the sealing opening 23, which projection at least partially surrounds the sealing opening 23 . The elastic element 1a, 1b comprises a, for example, annular spring plate 16, to which the connection seal 20 is fastened, for example vulcanized. The spring plate 16 has a first side surface 16a arranged on a first side 16c of the spring plate 16 and a second side surface 16b arranged on a second side 16d of the spring plate 16 and facing away from the first side surface 16a . The connection seal 20 extends, for example continuously, from the first side surface 16a of the spring plate 16 around the radially outer edge of the spring plate 16 up to the second side surface 16b of the spring plate 16 and thereby encases the radially outer edge of the spring plate 16 at least in sections, as illustrated by the arrows in FIG. 9C . As a result, the transition between port II or openings 15, 23 and the first pressure chamber 4 between the elastic element and the housing part is sealed even better and the connection seal 20 is attached more robustly to the spring plate 16 (cf. FIGS. 6C, 8, 9C).

By means of the means described here individually and in combination, clamps can be provided which can be operated reliably and effectively (for example in a saving manner with respect to adhesive and/or sealing compound, with a reduced number of components) in the region of the connection (in particular port II) without the dynamics of opening and closing of the clamp being adversely affected as a result.

Embodiments of the subject matter claimed by the appended claims are described in the description and in the figures. The optional features disclosed in the above description, the claims and the drawings can be used both individually and in any desired combination for the embodiment of the subject matter claimed here in accordance with the appended claims in its various configurations.

The various aspects and embodiments described above can be combined in order to create yet

further embodiments. These and other changes can be made to the embodiments in the light of the above detailed description. In general, the terms used in the following claims should not be construed as limiting the claims to the specific aspects and embodiments disclosed in the description and the claims, but rather as encompassing all possible embodiments together with
5 the full scope of equivalents to which these claims are entitled.

CLAIMS

1. A component (40, 50) for a clamping and/or braking device (10), the component
5 comprising:
a housing part (3a, 3b), comprising:
a connection opening (15) for a connection (II) of the clamping and/or braking
device (10) for applying a pressure medium to a pressure chamber (2) of the
clamping and/or braking device (10), and
10 a stepped housing inner surface (17a), which defines a stepped recess (17b) in
the housing part (3a, 3b) adjoining the connection opening (15);
an adhesive and/or sealing compound (30);
a preferably annular elastic element (1a, 1b), wherein the elastic element (1a, 1b) has a
connection seal (20), which defines an edge (22) of a sealing opening (23) of the
15 connection seal (20) for a fluid connection to the connection opening (15), and wherein
the connection seal (20) forms a connection projection (21) along the edge (22) of the
sealing opening (23), which projection at least partially surrounds the sealing opening
(23);
wherein the connection seal (20) is arranged in the stepped recess (17) of the housing
20 part (3a, 3b) in such a way that the adhesive and/or sealing compound (30) is arranged
between the connection projection (21) and the stepped housing inner surface (17a) of
the housing part (3a, 3b).
2. A preferably annular elastic element (1a, 1b), wherein the elastic element (1a, 1b) has a
25 connection seal (20), which defines an edge (22) of a sealing opening (23) of the
connection seal (20), wherein the connection seal (20) forms a connection projection
(21) along the edge (22) of the sealing opening (23), which projection at least partially
surrounds the sealing opening (23), wherein the connection seal (20) has a preferably
round stop element (18) projecting from a side surface (24) that is facing away from the
30 connection projection (21).
3. The component (40, 50) or the elastic element (1a, 1b) according to claim 1 or 2,
wherein the elastic element (1a, 1b) comprises a preferably annular spring plate (16), to
which the connection seal (20) is fastened, preferably vulcanized.
35
4. The component (40, 50) or the elastic element (1a, 1b) according to claim 3, wherein a

part of the connection seal (20) projects radially outward from the outer edge of the spring plate (16), preferably wherein the part comprises the connection projection (21) and/or the sealing opening (23).

- 5 5. The component (40, 50) or the elastic element (1a, 1b) according to any one of the preceding claims, wherein the connection seal (20) has a preferably round stop element (18) projecting from a second side surface (24) that is facing away from the connection projection (21).
- 10 6. The component (40, 50) or the elastic element (1a, 1b) according to any one of the preceding claims 3-5, wherein the spring plate (16) has a first side surface (16a) arranged on a first side (16c) of the spring plate (16) and a second side surface (16b) arranged on a second side (16d) of the spring plate (16) and facing away from the first side surface (16a).
- 15 7. The component (40, 50) or the elastic element (1a, 1b) according to claim 6, wherein the connection seal (20) extends from the first side surface (16a) of the spring plate (16) around the radially outer edge of the spring plate (16) up to the second side surface (16b) of the spring plate (16), preferably continuously, and thereby encases the radially
20 outer edge of the spring plate (16) at least in sections.
8. The component (40, 50) or the elastic element (1a, 1b) according to claim 6 or 7, wherein the stop element (18) is located on the second side (16d) of the spring plate (16) and/or the connection projection (21) is located on the first side (16c) of the spring
25 plate (16).
9. The component (40, 50) or the elastic element (1a, 1b) according to any one of the preceding claims 4 to 8, wherein the part of the connection seal (20) that projects radially outward from the outer edge of the spring plate (16) comprises a part of the
30 stop element (18).
10. A clamping and/or braking device (10) for clamping and/or braking an object to be clamped and/or braked, comprising:
 a first component (40) according to any one of the preceding claims and a second
35 component (50) according to any one of the preceding claims;
 wherein the housing parts (3a, 3b) of the two components (40, 50) are arranged with respect to one another and fastened to one another in such a way that inner surfaces (105) of the housing parts (3a, 3b) together delimit an interior space within the housing (3) and the elastic elements (1a, 1b), preferably their stop elements (18), of the two

components (40, 50) are designed to come into abutment with one another;
one or more clamping elements (8), wherein each clamping element has a clamping surface (7);

a spring (1) arranged in the interior space and comprising the elastic element (1a) of
the first component (40) and the elastic element (1b) of the second component (50),
wherein the elastic elements (1a, 1b) are clamped within the interior space in such a
way that a first pressure chamber (4) is formed in the interior space between the elastic
elements (1a, 1b) and the inner surfaces (105) of the housing parts (3a, 3b), wherein the
first pressure chamber (4) is ventable and actuatable with overpressure of a pressure
medium that is supplyable to the housing parts (3a, 3b),
wherein the spring (1) is designed such that, when the first pressure chamber (4) is
ventilated or vented or the first pressure chamber (4) is applied with overpressure, a
bending of at least one of the elastic elements (1a, 1b) is variable and the device (10)
thereby changes between an open state, in which an object (5) to be clamped is spaced
apart from the one or more clamping surfaces (7), and a closed state, in which at least
one of the one or more clamping surfaces (7) transmits a clamping and/or braking force
to the object (5).

11. The clamping and/or braking device (10) according to claim 10, wherein the stop
elements (18) of the elastic elements (1a, 1b) of the two components (40, 50) are
designed to come into mutual abutment when the first pressure chamber (4) is applied
with overpressure, preferably in order thereby to at least inhibit or prevent lifting of the
respective connection seal (20), in particular of the respective connection projections
(21), from the housing inner surface (17a) of the respective components (40, 50).

12. The clamping and/or braking device (10) according to any one of the preceding claims
10 to 11, wherein the clamping and/or braking force is caused by the inner or outer edge
of at least one of the spring plates (16) of the elastic elements (1a, 1b) being supported
on one of the inner surfaces (105) and the outer or inner edge (16a, 16b) of the at least
one spring plate (16) pressing on the clamping element.

13. The clamping and/or braking device (10) according to any one of the preceding claims
10 to 12, wherein the first spring plate (16) of the first elastic element (1a) is designed,
by the application of the first pressure chamber (4) with overpressure, to reduce its
bending in order, when the inner or outer edge of the first spring plate (16) is supported
on the inner surface (105) of the first housing part, to press with the outer or inner edge
of the first spring plate (16) on one of the clamping elements such that a transmission

of the clamping and/or braking force from the clamping surface of the clamping element to the object (5) to be clamped and/or braked is thereby caused and the device (10) changes from the open state to the closed state

5 and/or

wherein the device (10) is designed such that, by the venting of the first pressure chamber or by the application of the first pressure chamber (4) with overpressure, one of the clamping elements moves away from a portion of one of the inner surfaces (105) and/or the bending of at least one of the spring plates (16) of the elastic elements decreases, and the device (10) thereby changes from the open state to the closed state.

10 14. The clamping and/or braking device (10) according to any one of the preceding claims 10 to 13, wherein the inner space comprises a second pressure chamber (2), wherein
15 the second pressure chamber (2) is arranged within the spring (1) between the elastic elements, preferably wherein the device (10) is designed such that, by the ventilating of the second pressure chamber (2) or by the application of the second pressure chamber (2) with overpressure, one of the clamping elements (8) moves towards a portion of one of the inner surfaces (105) and/or the bending of at least one of the spring plates (16)
20 of the elastic elements increases, and the device (10) thereby changes from the closed state to the open state.

15. The clamping and/or braking device (10) according to any one of the preceding claims 10 to 14 or the component (40, 50) according to any one of the preceding claims 1 or 3
25 to 9, wherein the connection seal (20) and/or the adhesive and/or sealing compound (30) of at least one of the components (40, 50) substantially seals the connection (II) of the clamping and/or braking device (10) for applying a pressure medium to the preferably second pressure chamber (2) of the clamping and/or braking device (10).