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FR-A3- 2 979 564
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Gripping device

Description

5 The invention relates to an anthropomorphic gripping device comprising a base part and gripping fingers for gripping gripping components, which gripping fingers are movably arranged on the base part.

10 Anthropomorphic gripping devices simulate a human hand and comprise an assembly of movable gripping fingers which correspond to human fingers.

Gripping devices of this kind are primarily used for receiving, retaining, relocating or moving components. It has been found that it is difficult to grip relatively heavy components using relatively small gripping devices. In particular, relatively high grip forces
15 are required for this purpose. Securely gripping and handling, between the gripping fingers, components which have a specific weight, which have a center of gravity positioned outside an imaginary line between the gripping fingers and/or on which greater or unpredictable external forces act when handled, is difficult even for anthropomorphic grippers. Gripping pans or pots, for example, has proved problematic in particular for
20 anthropomorphic grippers which are used in kitchen robots, for example. Even gripping bread knives, for example, and using said knives to cut bread is problematic.

A further anthropomorphic gripping device is known from US 20212/059517A1. In this gripping device, a non-movable finger comprises, on the free end thereof, a suction
25 mechanism, by means of which a component to be gripped can also be held using suction.

A non-anthropomorphic gripping device which comprises a magnetic disc, secured by means of a screw connection, for holding a component, is known from FR 2 979 564 A3.

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A non-anthropomorphic gripping device for lifting and moving a cylinder block is known from US 5 588 794 A.

The object of the present invention is that of providing an anthropomorphic gripping device of the kind mentioned at the outset which overcomes the aforementioned disadvantages.

This object is achieved by a gripping device having the features of claim 1.

5

In addition to the gripping fingers, the gripping device therefore also comprises a clamping device which can be actuated independently of the gripping fingers. In particular, gripping components, which are characterized by having no holding segments to interact with the clamping device, can be gripped by the gripping fingers. A grip of this kind is in particular
10 advantageous for relatively small and light components. When large or heavy components must be gripped, the grip force by means of which the gripping fingers are loaded against the component is often not sufficient. Components of this kind, which are designed as clamping components, can be fastened to the base part using the clamping device provided on the base part, and can thus be handled. Clamping components of this kind
15 are therefore characterized in that they provide holding segments, which are suitable for interacting with the clamping device provided on the base part. Depending on the component to be handled, said component can therefore be gripped by the gripping device between the gripping fingers or fastened to the clamping device on the base part.

20 An anthropomorphic gripping device according to the invention can be used in particular in the context of service robots, such as kitchen robots. Objects such as pots, pans, knives or the like can be handled using robots of this kind, something which cannot be achieved using gripping fingers.

25 The clamping device can in particular interact with the holding segment in a positively engaging manner, such that forces can be conveyed to the base part by means of the clamping device and the holding segment.

In this case, it is advantageous for the clamping device to comprise movable locking
30 elements which latch onto the holding segment(s) in a locking position in order to fasten the clamping component to the base part, and which release the holding segment(s) in a release position in order to detach the clamping component from the base part. Providing locking elements of this kind thus allows mechanical locking of each clamping component

to the base part, by means of which locking in particular even relatively heavy clamping components can be securely handled by the gripping device.

5 It is advantageous to provide spring elements which force the locking elements into the locking position or the release position and/or to provide drive means which can move the locking elements into the release position or the locking position. In particular, it has been found to be advantageous for the locking elements to be forced into the locking position by the spring elements. The locking elements can be actuated into the release position in particular in a mechanical, electromagnetic, pneumatic or fluidic manner.

10

It is particularly advantageous for the locking elements to be designed such that they are first forced out of the locking position into the release position by the holding segments, for example counter to the spring force of the spring element, when the clamping component is fastened to the gripping device. It is advantageous if the locking elements automatically snap or click into said locking position when a fastening end position is reached. This can in particular be caused by the spring force of the spring elements. When the locking elements snap or click into place, they can, as previously mentioned, latch onto the holding segments on the side of the clamping element in a preferably secure manner.

20 The clamping device as such can also be designed as a magnetic clamping device. The holding segments can be fastened to the base part by means of magnetic forces. This has the advantage that no mechanically movable components must be provided for fastening the clamping component to the base part.

25 In this case, it is advantageous for the magnetic forces to be provided by permanent magnets and for the magnetic forces to be compensated by electromagnetic fields in order to detach the clamping component from the base part. The electromagnetic fields can in particular be generated by electromagnets provided in or on the base part. By supplying a corresponding current to the electromagnets, the magnetic field generated by the permanent magnets can be neutralized, whereby the clamping component can be detached from the base part.

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The clamping device can also be designed as a suction clamping device, the holding segments being fastened by forces provided by negative or positive pressure. It is in

particular conceivable for the clamping component to be fastened to the base part by means of negative pressure.

5 It is also conceivable for the clamping device to be designed as a bayonet clamping device in which, in order to carry out the clamping process, the holding segment is moved first along a straight line, which preferably extends orthogonally with respect to the surface of the portion of the base part which comprises the clamping device, and then about a rotational axis into a locking position.

10 The clamping device as such can in particular comprise a clamping receptacle for receiving a clamping projection, which is provided on the component to be fastened and which comprises the holding segment. The clamping projection is then inserted into the clamping receptacle and locked there in order to fasten the clamping component. The locking can in particular be carried out using locking elements, as has been set out.

15 However, magnetic or pneumatic locking in particular is also possible.

It is however conceivable for the clamping mechanism to comprise a clamping projection for engaging in a clamping receptacle provided on the clamping component to be fastened. This is in particular advantageous if the clamping component is not intended to
20 comprise a projection, for example so that said component can also be handled manually. In this case, the clamping projection, together with, for example, locking elements which are to be provided, is arranged on the base part.

The object mentioned at the outset is also achieved by a gripping system which comprises
25 a gripping device according to the invention and a corresponding clamping component, the clamping component comprising holding segments which interact with the clamping device. The system is thus characterized in that the clamping components can be securely fastened to the gripping device, and handled thereon, by providing corresponding holding segments.

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Further details and advantageous embodiments of the invention can be found in the following description, on the basis of which various embodiments of the invention are described in more detail.

In the drawings:

- Fig. 1 and Fig. 2 are different views of a gripping device according to the invention,
- 5 Fig. 3 shows a clamping component,
- Fig. 4 is detail of a section through the clamping component, as shown in Fig. 3, in the fastening end position,
- 10 Fig. 5 shows a second gripping device according to the invention and a clamping component,
- Fig. 6 shows the gripping device according to Fig. 5 having a clamping component fastened thereto, and
- 15 Fig. 7 shows a clamping component in the form of a kitchen knife.

The gripping device 10 shown in Fig, 1 and 2 is designed as an anthropomorphic gripper modelled on a human hand. A total of four gripping fingers 14, extending in parallel with one another, are provided on a base part 12, which gripping fingers each comprise three finger elements 16 which are arranged so as to be movable relative to one another. A further gripping finger 18 is also provided on the base part 12, which gripping finger is intended to correspond to the human thumb.

25 The base part 12 comprises a palm portion 20 on the side of the base part 12 on which the gripping finger 18 is provided. As is clear in Fig. 1 and 2, a clamping device 22 is provided on the palm portion 20. The clamping device 22 is designed as a clamping projection, i.e. the clamping device is provided on the palm portion 20 and protrudes therefrom. The clamping device 22 comprises a cuboid housing 24 in which two locking

30 elements 26 are provided, which can be moved toward and away from one another. Spring elements are provided in the housing 24, which spring elements force the locking elements 26 axially outwards and away from one another. The locking elements 26 can then be moved toward one another counter to the spring force of said spring elements. Drive means (not shown) are also provided, by means of which the locking elements can

be moved out of the locking position shown in Fig. 1 and 2 into a release position, in which release position the locking elements are displaced toward one another in the housing 24. The drive means can be electrical, mechanical, pneumatic or fluidic, for example.

5 Fig. 3 shows a clamping component 28 which is to be handled by the gripping device 10. Said clamping component 28 comprises a holding segment 30 in the form of a clamping receptacle, which is provided for interacting with the clamping device 22. The holding segment 30 comprises two latching portions 32 which are latched onto by the locking elements 26, when said portions are fastened to the base part 12, as shown in Fig. 4.

10

The locking elements 26 are designed so as to be wedge-shaped on the upper face thereof which faces away from the palm portion 20, such that, when the gripping device 10 or the clamping device 22 moves into the holding segment 30, said locking elements are forced out of the locking position shown in Fig. 1 and 2, counter to the spring force of the spring elements, toward one another into a release position, and such that the spring pretension causes said locking elements to automatically click into the locking position when the fastening end position shown in Fig. 4 is reached. In this way, the clamping component 28 is securely fastened to the base part 12.

20 As already mentioned, in order to detach the clamping component 28, the locking elements 26 can be moved toward one another using the drive means, whereby said locking elements engage in the housing 24. The clamping device 22 can thereby be moved out of the holding segment 30.

25 As a result of the cuboid design of the clamping device 22 and the corresponding complementary design of the holding segment 30, a positive engagement occurs between the clamping device and the holding segment. Transverse forces and moments can thus be securely absorbed into the base part from the component to be gripped.

30 The gripping device 40 shown in Fig. 5 and 6 corresponds to the gripping device 10, corresponding components being denoted by corresponding reference signs. In contrast to the gripping device 10, in the gripping device 40 the clamping device 22 is designed as a magnetic clamping device. In this case, the clamping device 22 comprises a relatively strong permanent magnet which interacts with a ferromagnetic holding segment 30 which

is provided on the clamping component 28. In order to fasten the clamping component 28 to the base part 12, the clamping device 22 therefore engages in the holding segment 30, which is designed as a clamping receptacle. The clamping component 28 is then fastened by means of magnetic forces. In order to detach the fastened clamping component, it is conceivable for electromagnets to be provided in the clamping device 22 or in the base part 12, by means of which electromagnets electromagnetic fields can be generated, which compensate or neutralize the magnetic forces which fasten the clamping component 28 to the base part 12. The clamping component 28 can then be detached from the gripping device 10.

10

Fig. 7 shows a clamping component 28 which is designed as a knife. The holding segment 30 which, depending on the embodiment, interacts either with the gripping device 10 or with the gripping device 40 in order to fasten the clamping component 28, is clearly shown.

15

The gripping devices 10 and 40 are advantageous in that not only can said devices can grip small and light components, but components which are relatively heavy or bulky can also be securely fastened to the gripping device by means of the clamping device 22.

Patentkrav

1. Antropomorf gribeindretning (10, 40) med en basisdel (12) omfattende et håndfladeafsnit (20) og med på basisdelen (12) bevægeligt indrettede gribefingre (14) til at gribe gribekomponenter, idet gribefingrene (14) hver består af et eller
5 flere fingerelementer (16), idet en fastspændingsindretning (22) med forskydelige låseelementer (26), der kan aktiveres uafhængigt af gribefingrene under drift af gribeindretningen (10, 40, 50), yderligere er tilvejebragt i eller på håndflade-
afsnittet (20), hvilke låseelementer interagerer med mindst et holdeafsnit (30) tilvejebragt på en fastspændingskomponent (28) til fastgørelse af
10 fastspændingskomponenten (28) på basisdelen (12),
idet låseelementerne (26) er udformet således, at fastspændingskomponenten (28) belastes mod håndfladeafsnittet (20) i en låseposition, idet håndfladeafsnittet (20) omfatter en kontaktflade, på hvilken fastspændingskomponenten (28) fastgjort på håndfladeafsnittet (20) kan hvile, således at afhængigt af
15 komponenten, der skal håndteres, kan denne gribes mellem gribefingrene eller fastgøres til håndfladeafsnittet (20) ved hjælp af fastspændingsindretningen.

2. Gribeindretning (10, 40) ifølge krav 1, **kendetegnet ved, at** fastspændingsindretningen (22) omfatter forskydelige låseelementer (26), som til
20 fastgørelse af fastspændingskomponenten (28) på basisdelen (12) låser holdeafsnittet (30, 32) i en låseposition, og som til frakobling af fastspændingskomponenten (28) fra basisdelen (12) frigør holdeafsnittet (30, 32) i en frigørelsesposition.

25 **3.** Gribeindretning (10) ifølge krav 1 eller krav 2, **kendetegnet ved, at** der er tilvejebragt fjederelementer (64), som presser låseelementerne (26) ind i låsepositionen eller frigørelsespositionen, og/eller at der er tilvejebragt drevorganer, med hvilke låseelementerne (26) kan bevæges til frigørelsespositionen eller låsepositionen.

30

4. Gribeindretning (10) ifølge krav 1, 2 eller 3, **kendetegnet ved, at** låseelementerne (26) er udformet således, at de ved fastgørelse af fastspændingskomponenten (28) på gribeindretningen (10) først presses ud fra låsepositionen til frigørelsespositionen af holdeafsnittet (30, 32), og at de

derefter, når de når en fastgørelsesendeposition, falder i hak eller klikker ind i låsepositionen.

5. Gripeindretning (40) ifølge et af de foregående krav, **kendetegnet ved, at**
5 fastspændingsindretningen (22) er udformet som en magnetfastspændingsindretning, idet en fastgørelse af holdeafsnittet til basisdelen udføres ved hjælp af magnetiske kræfter.

6. Gripeindretning (40) ifølge krav 5, **kendetegnet ved, at** de magnetiske
10 kræfter tilvejebringes af permanentmagneter, og at til frakobling af fastspændingskomponenten (28) fra basisdelen (12) kompenseres de magnetiske kræfter ved hjælp af elektromagnetiske felter.

7. Gripeindretning ifølge et af de foregående krav, **kendetegnet ved, at**
15 fastspændingsindretningen er udformet som en sugefastspændingsindretning, idet en fastgørelse af holdeafsnittet udføres ved hjælp af kræfter tilvejebragt gennem under- eller overtryk.

8. Gripeindretning ifølge et af de foregående krav, **kendetegnet ved, at**
20 fastspændingsindretningen er udformet som en bajonetfastspændingsindretning, hvor, for at udføre fastspændingen, bevæges holdeafsnittet først langs en lige linje og derefter omkring en drejeakse til en låseposition.

9. Gripeindretning (50) ifølge et af de foregående krav, **kendetegnet ved, at**
25 fastspændingsindretningen (54) omfatter en fastspændingsmodtager (56) til at modtage et fastspændingsfremspring (58) tilvejebragt på fastspændingskomponenten (28).

10. Gripeindretning (10, 40) ifølge et af de foregående krav, **kendetegnet ved,**
30 **at** fastspændingsindretningen (22) omfatter et fastspændingsfremspring (24) til at gå i indgreb med en fastspændingsmodtager (30) tilvejebragt på fastspændingskomponenten (28).

11. Gripeindretning (10, 40) ifølge et af de foregående krav, **kendetegnet ved,**
35 **at** fastspændingsindretningen (22) interagerer formluttende med holdeafsnittet

(30) således, at kræfter og momenter kan overføres til basisdelen via fastspændingsindretningen (22) og holdeafsnittet (30).

12. Gribesystem omfattende en gribeindretning (10, 40) ifølge et af de
5 foregående krav og en fastspændingskomponent (28), idet fastspændingskomponenten (28) omfatter mindst et med fastspændingsindretningen interagerende holdeafsnit (30, 32).

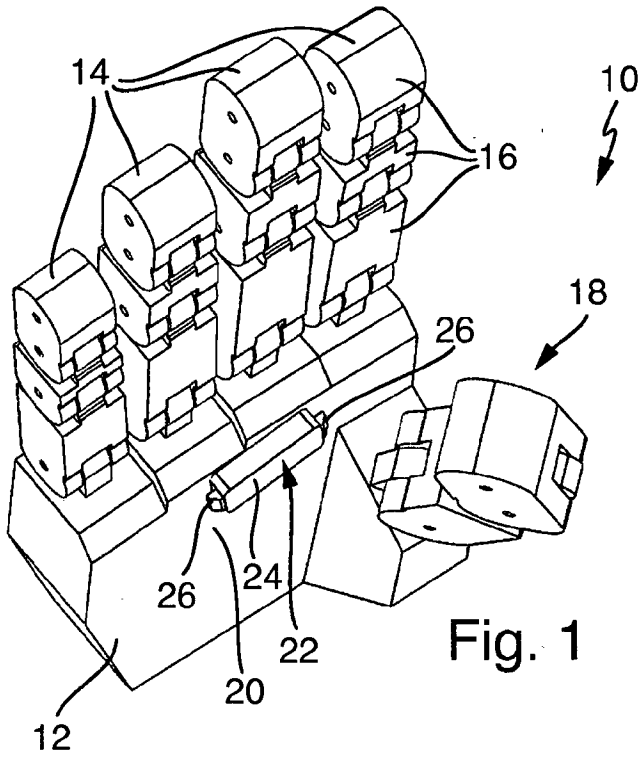


Fig. 1

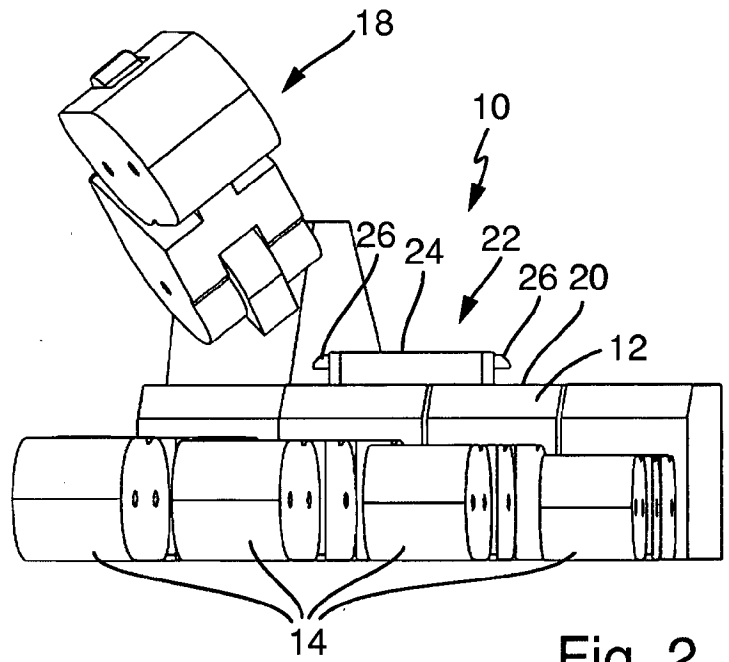


Fig. 2

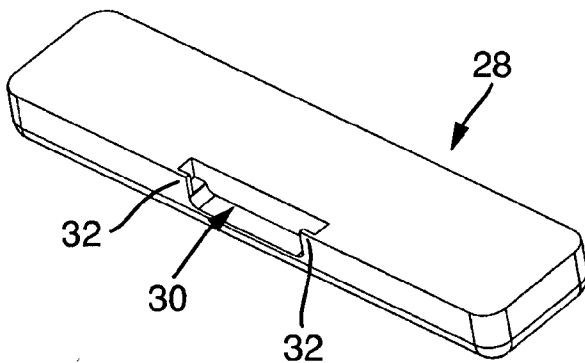


Fig. 3

