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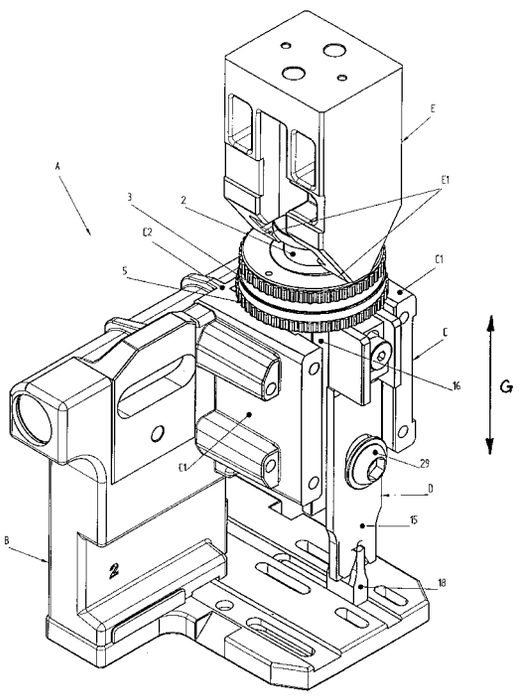
(54) Terminal applicator device for attaching terminal to electric wires or cables

(57) In an applicator device for clinching a metal terminal both on the stripped conductor and on the insulating sheath of a portion of an electric wire or cable the tool-carrying assembly (D), which is designed to be associated to the ram of a press which moves with reciprocating motion, comprises a first ring (3) and a second ring (5) mounted so that they can turn independently of one another to control a fine adjustment of the axial position of the two tools (14, 15) of the assembly, which are designed to carry out clinching of the terminal, respectively, on the conductor and on the insulating sheath of the electric wire. At least the first adjusting ring (3) has an internally threaded annular body, engaged by screwing on a first threaded pin (2), which is axially fixed with respect to a main body (16) of the tool-carrying assembly (D).

Fig.1



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Description

[0001] The present invention relates to applicator devices for attaching terminals on electric wires or cables. In particular, the invention regards an applicator device of the type usable for clinching a metal terminal both on the stripped conductor and on the insulating sheath of a portion of an electric wire or cable.

[0002] In particular, the invention regards an applicator device of the known type, comprising:

- a fixed base structure, and
- a tool-carrying assembly, which is mounted so that it can slide on the base structure along a main axis and is designed to be associated to a control member (for example, a ram of a press), which moves with reciprocating motion along said main axis,

in which said tool-carrying assembly includes:

- a contrast surface, designed to receive the thrust exerted by the ram of the press;
- a first cutting tool and second cutting tool, which extend parallel to said main axis and are mobile with the tool-carrying assembly following upon activation of the press, in order to carry out clinching of a metal terminal respectively on the conductor and on the insulating sheath of an electric wire or cable; and
- means for adjusting the position of the first tool and the second tool, in the direction of said main axis, with respect to said contrast surface,

in which said adjustment means comprise a first ring and a second ring mounted so that they can turn, on the tool-carrying assembly, about said main axis, independently of one another to control, respectively, adjustment of at least one of the two tools and adjustment of at least the other tool, which has the function of clinching to the insulating sheath.

[0003] Applicator devices of the type specified above have been known and used for some time. For instance, a particular solution of applicator device having all the characteristics specified above formed the subject of the Italian patent No. 1 283 130 in the name of the present applicant. In these devices, the adjustment means consisting of the two rotatable rings described above enable easy and fast adjustment of the position of the two tools, which have, respectively, the function of clinching of the terminal to the conductor and to the insulating sheath so as to vary accordingly the final position reached by these tools at the end of the operating stroke of the press. The above adjustment operation may prove necessary for various reasons, and it is advantageous that it can be performed in a simple and fast way, as in the case of the device previously proposed by the present applicant.

[0004] The purpose of the present invention is to further improve the adjustment means of the applicator device, at the same time guaranteeing the possibility of carrying out easy and fast adjustment, and moreover guaranteeing the possibility of making a very fine and precise adjustment, whilst providing a structure that is simple and inexpensive.

[0005] With a view to achieving the above purpose, the subject of the present invention is a device having all the characteristics specified at the beginning of the present description and characterized moreover in that at least said first adjusting ring has a central opening with an internally threaded surface, engaged by screwing on a first threaded pin, which is axially fixed with respect to a main body of the tool-carrying assembly in such a way that a rotation of said first ring causes a variation in the axial position of said first ring with respect to both of the tools, the position of said first ring defining uniquely the position of said contrast surface, to which the thrust of the control member is applied.

[0006] Thanks to the characteristics referred to above, the device according to the invention makes it possible to carry out adjustment of the two tools in a simple, but at the same time extremely fine and precise way.

[0007] According to a first embodiment of the present invention, also said second ring has a central opening with an internally threaded surface, engaged by screwing on a second threaded pin, which is axially fixed with respect to the main body of the tool-carrying assembly, said second ring being operatively in frontal contact with just the tool for clinching on the insulator in such a way that rotation of the second ring causes an axial adjustment of just the second tool with respect to the contrast surface, to which the thrust of the control member is applied.

[0008] According to a second embodiment of the present invention, instead, the aforesaid second ring has a front face presenting a helical plane ramp which is operatively in frontal contact with just the tool for clinching on the insulator, also in this case in such a way that rotation of the second ring causes an axial adjustment of just the second tool with respect to the contrast surface, to which the thrust of the control member is applied.

[0009] According to the preferred embodiment of the present invention, between said first threaded pin and the internal threaded surface of the first ring there are set means for reference and for maintaining the angular position of adjustment of the first ring, comprising a toothing made on one of said two elements and an engagement member carried by the other element and pushed radially by elastic means against said toothing, in such a way as to obtain an indexation of the rotation of the first ring. In the case of the solution described above, which envisages the second threaded pin, preferably also between said second threaded pin and the internal threaded surface of the second ring there are set means for reference and for maintaining the angular

position of adjustment of the second ring, comprising also in this case a toothing made on one of said two elements and an engagement member carried by the other element and pushed radially by elastic means against said toothing, in such a way as to obtain, also in this case, an indexation of the rotation of the second ring.

[0010] Once again in the case of the preferred embodiment of the present invention, between said first ring and said second ring there is set a disk fixed with respect to the main body of the tool-carrying assembly, said disk and said first ring having respective teeth designed to enter into contact with one another to define the positions of end-of-travel of rotation of the first ring. In the case of the solution which envisages the second threaded pin, also said second ring has a tooth co-operating with a respective tooth provided on the fixed disk to define the positions of end-of-travel of rotation of the second ring.

[0011] Thanks to the aforesaid characteristics, the device according to the invention is able to meet the requirements of ease and precision of adjustment with a relatively simple structure, of small dimensions and low cost.

[0012] Further characteristics and advantages of the present invention will emerge from the ensuing description with reference to the attached drawings, which are provided purely by way of non-limiting example and in which:

- Figure **1** is a perspective view of a first embodiment of the device according to the present invention;
- Figure **2** is an exploded view of a first part of the device of Figure 1;
- Figure **3** is an exploded view of a second part of the device of Figure 1;
- Figure **4** is a partial cross-sectional view of the device of Figure 1; and
- Figures **5**, **6**, **7** are variants of Figures 2, 3, 4 which refer to a second embodiment of the invention.

[0013] Figures 1-4 illustrate a first example of embodiment of the device according to the invention. In these figures, the reference A designates, as a whole, an applicator device according to the invention designed to apply, by clinching, a metal terminal both on the stripped conductor and on the insulating sheath of a portion (typically, an end portion) of an electric wire or cable. According to a technique in itself known, the device A comprises a fixed base structure, designated as a whole by B, which has a vertical channel-shaped portion C with a C-shaped cross section defined by two parallel walls C1 set at a distance apart and connected at the back by a wall C2.

[0014] Again in a way in itself known, within the portion C of the fixed base structure B there is mounted, so that it can slide vertically, a tool-carrying assembly D, the movement of which is controlled by a connection element E connected to the ram of a press (not illustrated) which moves with reciprocating motion in a direction parallel to the axis of sliding of the tool-carrying assembly D, the said axis being designated by G in the drawings.

[0015] In the present description and in the annexed drawings no detailed illustration of the base structure B and of the various members associated thereto is provided, given that these components are extraneous to the tool-carrying assembly D in so far as these constructional items can be built in any known way and do not, taken in themselves, form part of the scope of the invention. Similar considerations may be made as regards the means designed to feed the metal terminals to the device according to the invention. In any case, an at least partial description of the above components may be found, for example, in the following documents: EP-A-0 542 144, US-A-5 909 913 and US-A-5 577 318.

[0016] As already clarified previously, for the purposes of the present invention what is important is how the tool-carrying assembly D is built and how, in this assembly, it is possible to obtain fine adjustment of the position of the tools associated thereto.

[0017] In what follows, a detailed description will be provided of the tool-carrying assembly D in the embodiment of the invention that is illustrated in Figures 1 to 4.

[0018] The tool-carrying assembly D comprises a main body 16, made of metal material and presenting a prismatic conformation, which is mounted so that it can slide within the channel-section portion C of the base structure B. The main body 16 has (see Figures 3 and 4), on its top surface, a blind hole 17, in which a screw 1 is screwed that has the function of fixing a threaded pin 2 to the main body 16 (see Figures 2 and 4), the said threaded pin 2 having a top head 2a of enlarged diameter, and a threaded bottom portion 2b.

[0019] The threaded pin 2 is secured by the screw 1 to the main body 16 with interposition of a disk 4 (see again Figures 2 and 4), the function of which will emerge clearly from what follows, and a centring hub 6 which is received in a slot 26 (see Figure 3) made on the top surface of the main body 16. The screw 1 passes through the disk 4 and the centring hub 6 with interposition of a bushing 7.

[0020] With reference to Figures 3 and 4, numbers 14 and 15 designate two cutting tools carried by the assembly D, which are used for clinching of the metal terminal respectively to the stripped conductor and to the insulating sheath of an electric wire or cable. The two tools 14, 15 take the form of metal blades and cooperate with an anvil 18 fixed to the base structure B designed to support the metal terminal in order to enable clinching of the terminal on the electric wire or cable.

[0021] The annexed drawings do not illustrate the electric wire or the terminal that is to be clinched onto it, in so far as the said components can be of any known type. An example of such components is provided in Figures 2 and 3 of the document EP-A-0 542 144.

[0022] Again with reference to Figure 3, the first cut-

ting tool 14 designed for clinching the metal terminal on the conductor of the electric wire is rigidly connected to the main body 16 by means of a screw 29 which engages a hole 14a of the tool 14 and a threaded hole 16a of the main body 16 (see also Figure 4). The tool 15, which is used for clinching the terminal to the insulating sheath, is instead able to move in a limited way in a direction parallel to the axis G of the device, in that it has an eyelet 15a slidably engaged on the screw 29 with interposition of a bushing 28 (see Figures 3 and 4). The cutting tool 15 has a top tooth 15b which is in contact with a slider 8. The slider 8 is mounted so that it can slide in a direction parallel to the axis G of the device between two flanges 16b of the main body 16 (see Figure 3) and is limited in said movement by the engagement within an eyelet 8a of its own of the shank of a screw 27 secured to the main body 16 in a direction transverse to the axis G.

[0023] The means for adjustment of the two cutting tools 14, 15 comprise a first ring 3 and a second ring 5, which are mounted so that they can turn independently of one another about the axis G on the tool-carrying assembly D in the way that is described hereinafter.

[0024] The first ring 3, the purpose of which is to control adjustment of the first cutting tool 14 designed for clinching the metal terminal on the copper conductor of the electric wire, has an annular body with a threaded internal surface 3a (see Figure 2, which illustrates the ring 3 also in the reversed position) screwed on the threaded portion 2b of the pin 2.

[0025] The top face 3b (Figure 2) of the first ring 3 defines the contrast surface to which the thrust exerted by the ram of the press is applied by means of the connection element E. The said element has, in a way of itself known, two bottom feet E1 which engage under the head 2a of the threaded pin 2 with an axial play with respect to the distance existing between the head 2a and the threaded portion 2b of the pin 2 (see Figure 4). In this way, during operative travel downwards of the ram of the press, the thrust is transmitted from the connection element E to the top face of the ring 3, thus causing, by means of the pin 2, the disk 4, and the centring hub 6, movement of the main body 16 with the tools 14, 15 associated thereto. During return travel upwards of the ram of the press, the two feet E1 engage under the head 2a of the pin 2, pushing the entire tool-carrying assembly D upwards.

[0026] A rotation of the first ring 3 with respect to the threaded pin 2 determines a variation in the axial position of the ring 3 with respect to the pin 2 as a result of the threaded connection existing between the pin 2 and the ring 3. Consequently, the position of the two tools 14, 15 with respect to the contrast surface 3b of the ram of the press is varied. In this way, an adjustment of the tool 14 designed for clinching the terminal onto the conductor of the wire is obtained without altering the relative position between the tool 14 and the other tool 15 designed for clinching the terminal onto the insulating sheath.

[0027] The positions of end-of-travel of rotation of the ring 3 are defined by the engagement of a tooth 21, which projects radially from the peripheral edge of the fixed disk 4, with a tooth 23 that protrudes radially inwards from a bottom skirt 3c of the first ring 3 (see Figure 2).

[0028] Moreover provided are indexing means for indexation of the rotation of the ring 3. These means comprise a toothing 3d (see the enlarged view in Figure 2) made on the crest of the thread in the inner surface 3a of the ring 3. The said toothing co-operates with an engagement tooth 10 that is inserted into a housing 19 (Figure 2) of the threaded pin 2 and is pushed radially by a helical spring 12 against the toothing 3d. Of course, the maximum possible displacement upwards of the ring 3 with respect to the threaded pin 2b is not in any case such as to disengage the tooth 10, which is housed at the base of the threaded pin 2, from the inner surface of the ring 3. The same of course applies also as regards engagement of the end-of-travel tooth 23 of the ring 3 on the tooth 21 of the fixed disk 4.

[0029] Finally, the outer surface of the ring 3 carries a knurling 3e as an aid to gripping the ring and further preferably has a graduated scale (not illustrated) which serves as a reference of the angular position of the ring.

[0030] In what follows, the conformation and arrangement of the second ring 5 will be described. Also this ring has an annular body mounted so that it can turn about the centring hub 6 between the top surface of the main body 16 and the bottom surface of the disk 4 (see Figures 2 and 4). The ring 5 has, on its bottom face (also illustrated in Figure 2), a helical plane ramp 24a, which is in operative contact with the slider 8 (Figures 3 and 4) that controls the position of the tool 15 for clinching of the terminal to the insulating sheath of the electric wire. A rotation of the second ring 5, which is in an axially fixed position with respect to the main body 16, consequently causes a variation in the axial position of the slider 8 and of the tool 15 controlled by the latter, the said tool 15 thus changing its position with respect to the tool 14, which is fixed with respect to the main body 16. Also in this case, the positions of end-of-travel of rotation of the ring 5 are defined by the engagement of an arrest member 9, received in a top slot 20b (Figure 2) of the centring hub 6, on an internal radial tooth 24 of the second ring 5. The arrest element 9 extends axially also through a radial slot 25 of the disk 4 to provide a reference for the correct angular position of mounting of the disk 4 with respect to the centring hub 6, the angular position of which is, instead, uniquely determined by engagement within the slot 26 on the top surface of the main body 16. Also for the ring 5 there are provided indexing means for indexation of rotation, the said means comprising a toothing 5a made on the inner surface of the ring 5, which co-operates with an engagement tooth 11 that is inserted in a front slot 20a of the centring hub 6, located in a position diametrically opposite to the slot

20b, and that is pushed radially against the toothing 5a by a helical spring 13 set between the engagement element 11 and the wall of the bushing 7. Finally, also the ring 5 has, on its outer surface, a knurling 5b (Figure 2) and preferably a graduated scale (not illustrated).

[0031] As is evident from the foregoing description, in the device illustrated in Figures 1 to 4, the position of the cutting tool 14 for clinching of the terminal to the copper conductor of the electric wire may be varied by rotation of the first ring 3 as a result of its threaded connection on the pin 2. During the movement of adjustment, the tool 15 for clinching of the terminal to the insulating sheath of the electric wire moves together with the tool 14, without therefore there occurring a variation in the relative position of the two tools. When, instead, it is desired to vary only the position of the tool 15 for clinching the terminal to the insulating sheath of the electric wire, it is necessary to act on the second ring 5, which determines the desired movement of adjustment as a result of the frontal engagement between the helical ramp 24a and the slider 8.

[0032] There will now follow a description of the structure and operation of the second embodiment of the device according to the invention, illustrated in Figures 5-7. In these figures, the parts that are the same as the parts of Figures 1 to 4 or have corresponding functions are designated by the same reference numbers.

[0033] The main difference of the embodiment illustrated in Figures 5-7 with respect to the first embodiment described previously lies in the fact that, in the case of the device illustrated in Figures 5-7 also the second adjustment ring 5 has an annular body with an internal thread 50 (Figure 5) screwed on a second threaded pin 70, which is also rigidly connected to the main body 16 of the tool-carrying assembly D. In addition, as may be seen from Figures 5 and 7, the threaded pin 2 of the first embodiment is replaced by two separate elements: an internally threaded bushing 2b, which performs the function of the threaded portion 2b of the pin 2 of Figure 2, and a bushing 2 inserted through the threaded bushing 2b and having a top head 2a that performs the function of the head 2a of the pin 2 of Figure 2. The bushing 2 is moreover inserted through the central hole of the fixed disk 4 and through the central through hole of the second threaded pin 70. The assembly made up of the bushing 2, the threaded bushing 2b, the disk 4, and the second threaded pin 70 is rigidly connected to the main body 16 by means of the screw 1. As in the case of the first embodiment, the first adjustment ring 3 is engaged by screwing on the first threaded pin 2b in such a way that a rotation of the ring 3 causes an axial displacement of the top face 3b of the ring 3, on which there is applied the thrust exerted by the ram of the press, with respect to the main body 16 to which are associated the two cutting tools 14, 15. Also in this case, the outer surface of the ring 3 has a knurling 3e and is preferably provided with a graduated scale (not illustrated). Also in this case, rotation of the ring 3 is indexed by means of engagement, on a toothing made on the crest of the internal thread of the ring 3, which is altogether similar to the knurling 3d (illustrated in Figure 2), of an engagement element 10 that is housed in an internal slot 19 of the ring 3 and is pushed by a spring 12 against the thread of the threaded bushing 2b. The spring 12 is withheld externally by a threaded grub screw 110. The threaded grub screw 110 also performs the function of co-operating with a tooth 21 projecting upwards from the peripheral edge of the fixed disk 4 to define the positions of end-of-travel of rotation of the ring 3. The fixed disk 4 also has a tooth 9 which projects downwards from its peripheral edge, in a position diametrically opposite to the tooth 21, and which co-operates with a radial tooth 24 made on a top end surface of the second ring 5 to define the positions of end-of-travel of rotation of said ring.

[0034] Whilst in the case of the first embodiment illustrated in Figures 1-4, the second ring 5 always remains in the same axial position and determines the displacement of the cutting tool 15 by means of its helical plane ramp 24a, in the case of the second embodiment illustrated in Figures 5-7, the second adjustment ring 5 changes its axial position following upon its rotation, in so far as it is engaged by screwing on the second threaded pin 17. As may be clearly seen in Figure 7, the axial displacement of the second ring 5 has, however, no effect on the axial position of the first ring 3 and, instead, directly causes a displacement of the tool 15 by means of the direct engagement of the bottom surface of the ring 5 on the top end of the slider 8 (Figure 7). Consequently, also in this case adjustment of the ring 5 only causes a movement of adjustment of the tool 15, without affecting the position of the tool 14 used for clinching the terminal to the copper conductor.

[0035] The fixed disk 4 has, also in the vicinity of its centre, two tabs 230, 240 which are respectively turned upwards and turned downwards, one of these tabs engaging a seat 270 in the threaded bushing 2b, and the other tab engaging a seat 280 on the top end of the second threaded pin 70 so as to provide a reference for the correct angular position of the two threaded pins 2b, 70. The pin 70, in turn, rests on the top surface of the main body 16 and has a prismatic ridge 290 engaged within the top slot 26 of the main body 16 so as to provide a reference for the correct angular position of the second threaded pin 70 with respect to the main body 16.

[0036] Also rotation of the second ring 5 is indexed, in that the thread on the inner surface 50 of the ring 5 also has a knurling similar to the knurling 3d that may be seen in Figure 2. The said knurling is engaged by an engagement element 11 which is received in a slot 20 made at the top on the second threaded pin 70 and which is pressed radially outwards by a spring 13 against the inner threaded wall of the ring 5. Furthermore, also the ring 5 has an external knurling 5b and preferably a graduated scale (not illustrated). Finally, the part for supporting the two cutting tools 14, 15 is alto-

gether identical to the one illustrated in Figure 3 for the first embodiment of the invention.

[0037] Also the operation of the second embodiment is altogether similar to that of the first embodiment, except for the differences referred to above as regards the threaded connection of the second ring 5 on the second threaded pin 70 and for the way in which the second ring 5 causes a movement of adjustment of the second cutting tool 15.

[0038] Of course, without prejudice to the principle of the invention, the details of construction and the embodiments may vary widely with respect to what is described and illustrated herein purely by way of example, without thereby departing from the scope of the present invention.

Claims

1. An applicator device for clinching a metal terminal both on the stripped conductor and on the insulating sheath of a portion of an electric wire or cable, said device comprising:

- a fixed base structure (B), and
- a tool-carrying assembly (D), which is mounted so that it can slide on the base structure (B) along a main axis (G) and is designed to be associated to a control member, for example a ram of a press, which moves with reciprocating motion along said main axis (G),

in which said tool-carrying assembly includes:

- a contrast surface (3b), designed to receive the thrust exerted by the ram of the press;
- a first cutting tool (14) and a second cutting tool (15), which extend parallel to said main axis (G) and are mobile with the tool-carrying assembly (D) following upon activation of the press, in order to carry out clinching of a metal terminal respectively on the conductor and on the insulating sheath of an electric wire or cable; and
- means for adjusting the position of the first tool (14) and the second tool (15), in the direction of said main axis (G), with respect to said contrast surface (3b),

in which said adjustment means comprise a first ring (3) and a second ring (5) mounted so that they can turn on the tool-carrying assembly (D), about said main axis (G), independently of one another to control, respectively, adjustment of at least one of the two tools (14, 15) and adjustment of at least the other tool (15), which has the function of clinching the terminal to the insulating sheath,

characterized in that:

at least said first adjusting ring (3) has a central opening with an internally threaded surface, engaged by screwing on a first threaded pin (2b), which is axially fixed with respect to a main body (16) of the tool-carrying assembly in such a way that a rotation of said first ring (3) causes a variation in the axial position of said first ring (3) with respect to both of the tools (14, 15), the position of said first ring (3) defining uniquely the position of said contrast surface (3b), to which the thrust of the control member is applied.

2. The device according to Claim 1, **characterized in that** also said second ring (5) has a central opening with an internally threaded surface, engaged by screwing on a second threaded pin (70), which is axially fixed with respect to a main body (16) of the tool-carrying assembly (D), said second ring (5) being operatively in contact with just the tool (15) for clinching on the insulator in such a way that rotation of the second ring (5) causes an axial adjustment of just the second tool (15) with respect to the contrast surface (3b) to which the thrust of the control member is applied.

3. The device according to Claim 1, **characterized in that** said second ring (5) has a front face presenting a helical plane ramp (24a) which is operatively in frontal contact with just the tool (15) for clinching on the insulator in such a way that rotation of the second ring (5) causes an axial adjustment of just the second tool (15) with respect to the contrast surface (3b) to which the thrust of the control member is applied.

4. The device according to Claim 1, **characterized in that** between said first threaded pin (2b) and the internal threaded surface (3a) of said first ring (3) there are set means for reference and for maintaining the angular position of adjustment of the first ring (3), comprising a toothing (3d) made on one of said two elements and an engagement member (10) carried by the other element and pushed radially by elastic means (12) against said toothing (3d), in such a way as to obtain an indexation of the rotation of the first ring.

5. The device according to Claim 2, **characterized in that** between said second threaded pin (70) and the internal threaded surface (50) of said second ring (5) there are set means for reference and for maintaining the angular position of adjustment of the second ring (5), comprising a toothing made on one of said two elements and an engagement member (11) carried by the other element and pushed radially by elastic means (13) against said toothing, in such a way as to obtain an indexation of the rotation

of the second ring.

6. The device according to Claim 1, **characterized in that** between said first ring (3) and said second ring (5) there is set a disk (4) fixed with respect to the main body (16) of the tool-carrying assembly, said disk (4) and said first ring (3) having respective teeth (21, 23; 21, 110) designed to enter into contact with one another to define the positions of end-of-travel of rotation of the first ring.

7. The device according to Claim 2, **characterized in that** between said first ring (3) and said second ring (5) there is set a disk (4) fixed with respect to the main body (16) of the tool-carrying assembly (D), said disk (4) and said first ring (3) having respective teeth (21, 110) designed to enter into contact with one another to define the positions of end-of-travel of rotation of the first ring, said disk (4) and said second ring (5) moreover having respective teeth (9, 24) designed to enter into contact with one another to define the positions of end-of-travel of rotation of the second ring.

8. The device according to Claim 1, substantially as described with reference to Figures 1-4 of the attached drawings.

9. The device according to Claim 1, substantially as described with reference to Figures 5-7 of the attached drawings.

Fig.1

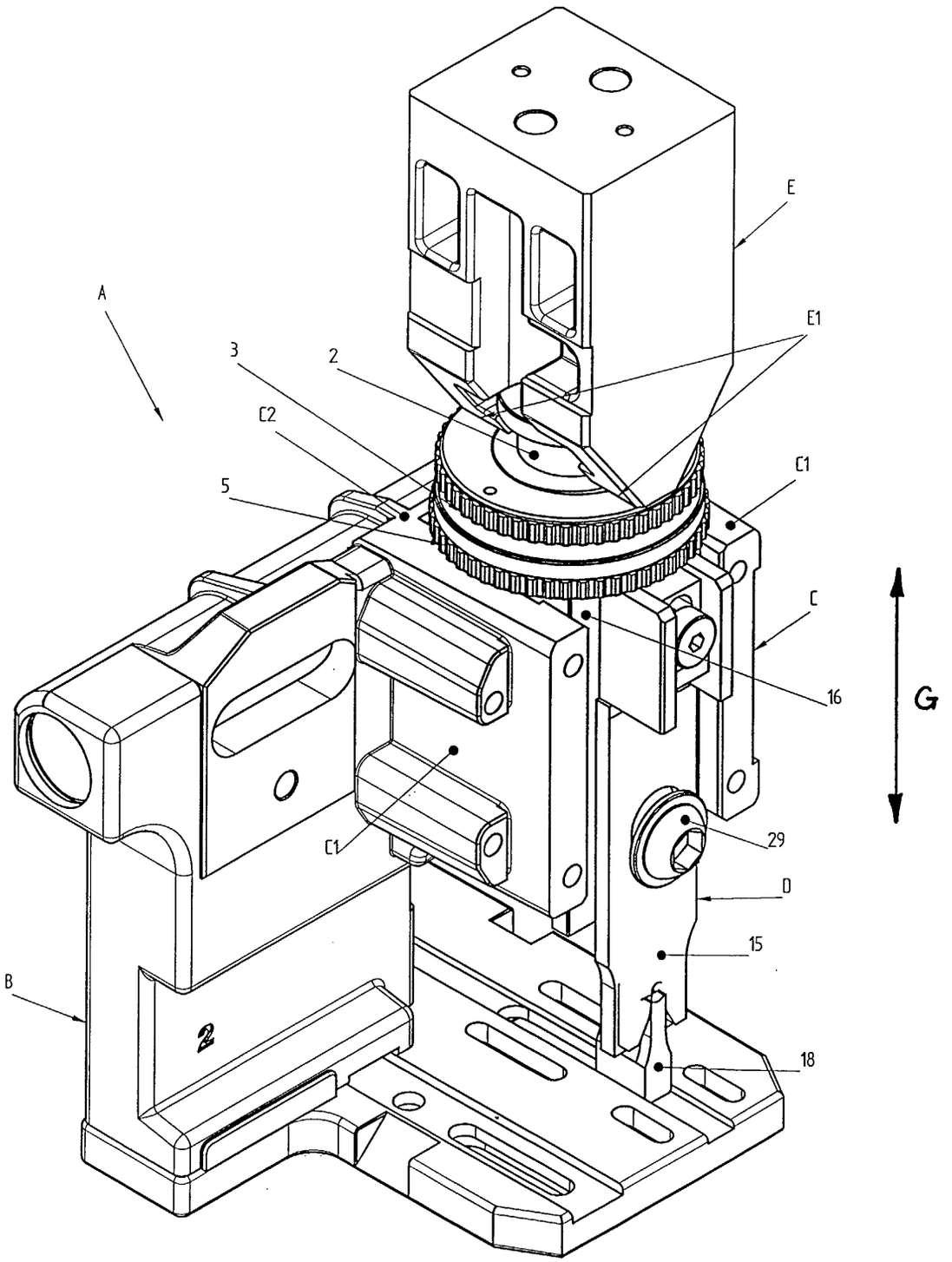

Fig.2

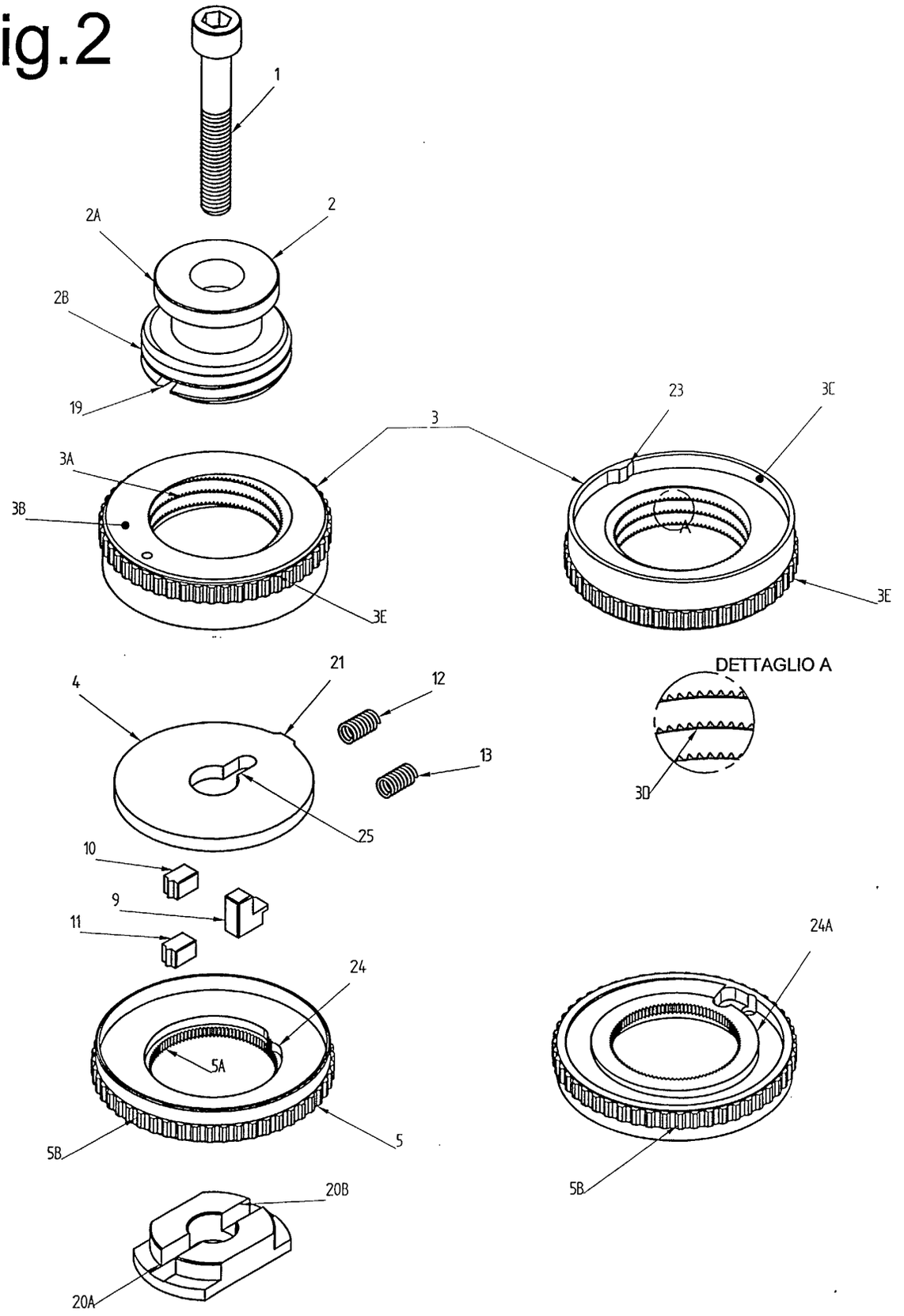
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Fig.3

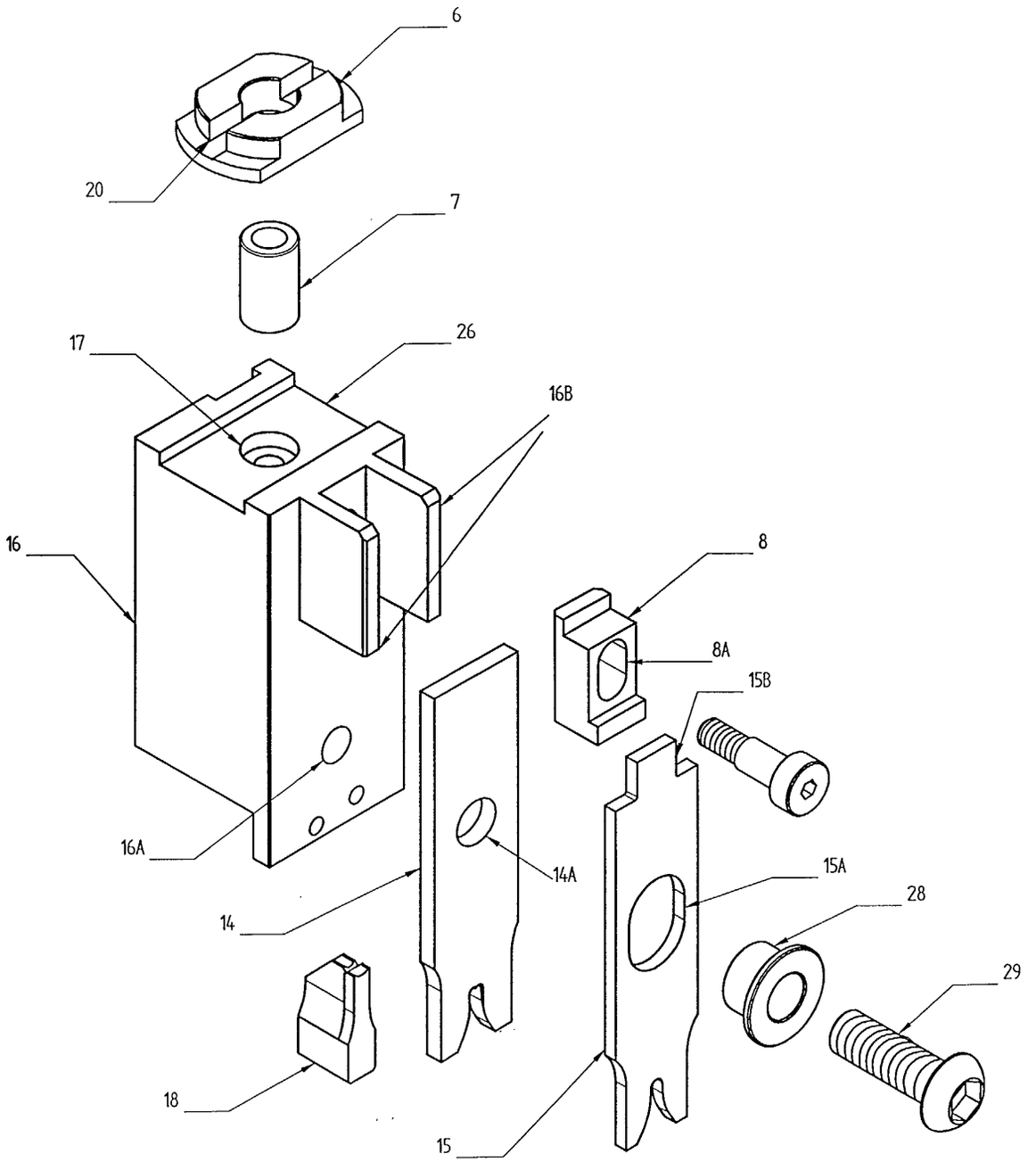


Fig.4

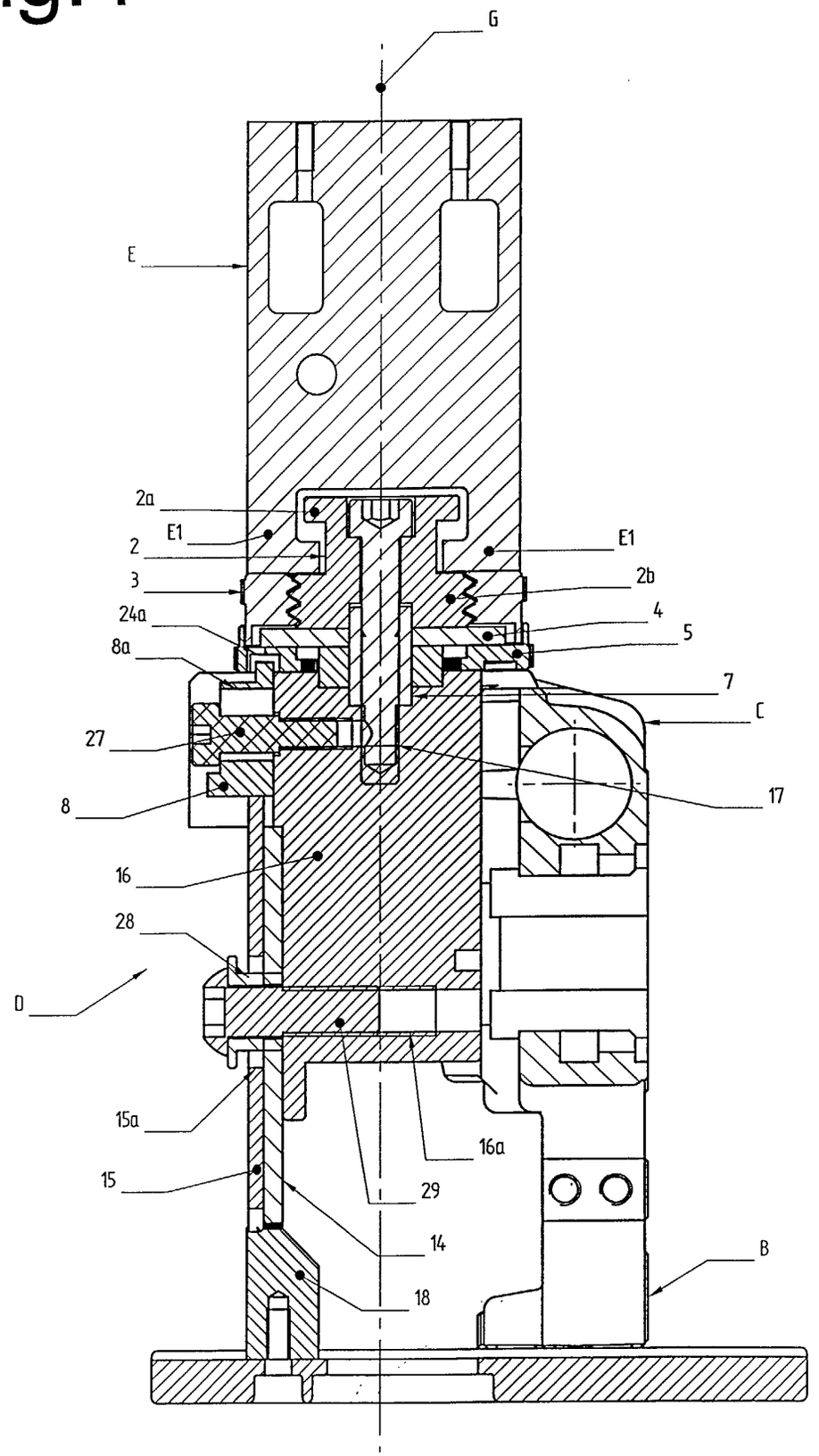
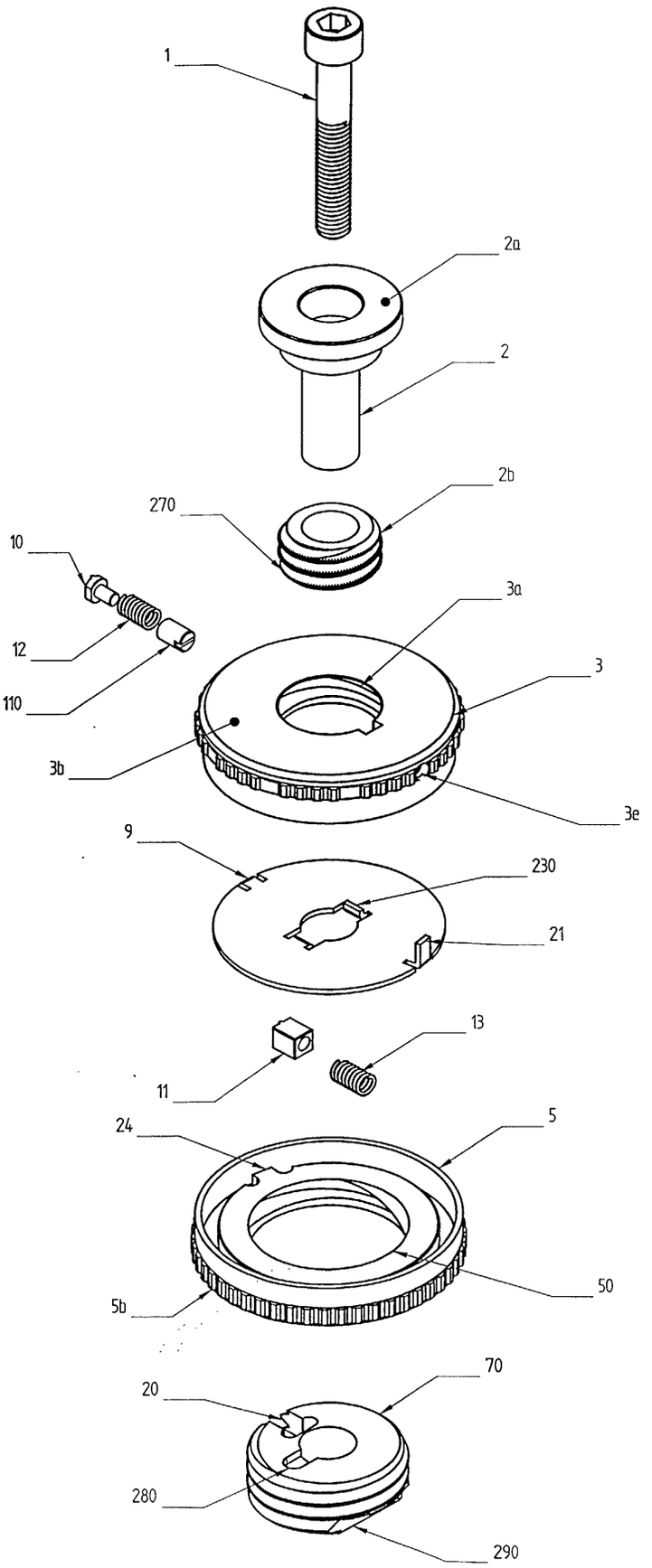


Fig.5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290

Fig.6

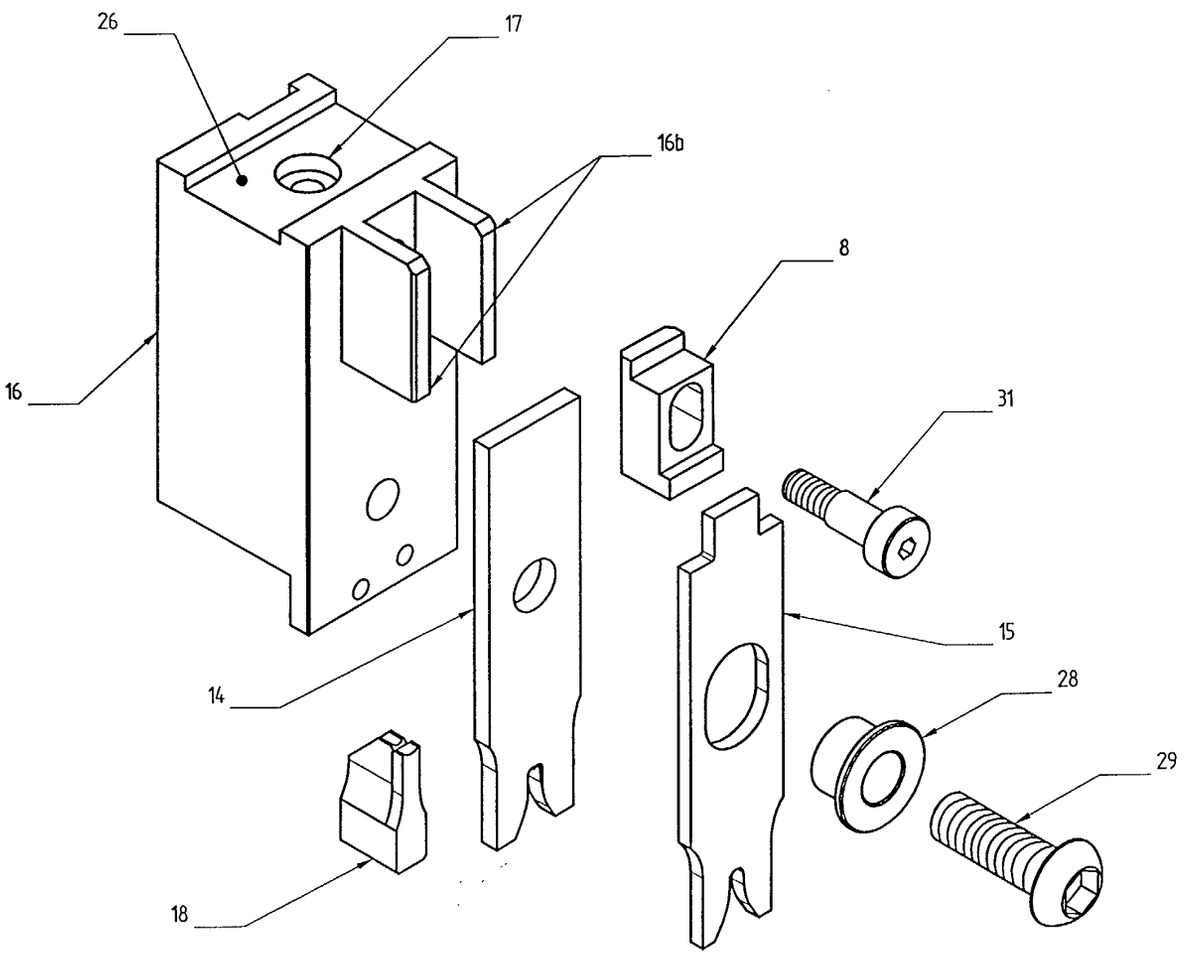

Fig.7