(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 174 752 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
14.04.2010 Bulletin 2010/15

(51) Int Cl.:
B25B 5/12 *(2006.01)*

(21) Application number: **09012624.4**

(22) Date of filing: **06.10.2009**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
AL BA RS

(30) Priority: **08.10.2008 IT TO20080735**

(71) Applicant: **VEP Automation S.r.l.**
10092 Beinasco (Torino) (IT)

(72) Inventors:
- **Varetto, Ener**
  10057 Sant'Ambrogio (Torino) (IT)
- **Conte, Umberto**
  10135 Torino (IT)

(74) Representative: **Cian, Paolo et al**
Saconney & Cian S.r.l
Corso Vittorio Emanuelle II 14
10123 Torino (IT)

(54) Locking device provided with articulated levers, particularly for clamping workpieces

(57) A clamping device with articulated levers, particularly for locking workpieces, includes a body (12) in which an axially sliding stem (14) is mounted, a main shaft (32) rotatable about a rotation axis (A) transverse to the stem (14) and connected to the stem (14) by means of a first toggle articulation mechanism (26, 30), and a first and second swingable clamping arm (34, 42) that can simultaneously rotate between respective back rest and advanced operative positions. The movement of the second arm (42) is controlled by a linkage (50, 54, 56) including a second toggle articulation mechanism. The second arm (42) is connected to a rotatable secondary shaft (38) coaxial with respect to the main shaft (32), in such a way that both arms (34, 42) swing about the same rotation axis (A).

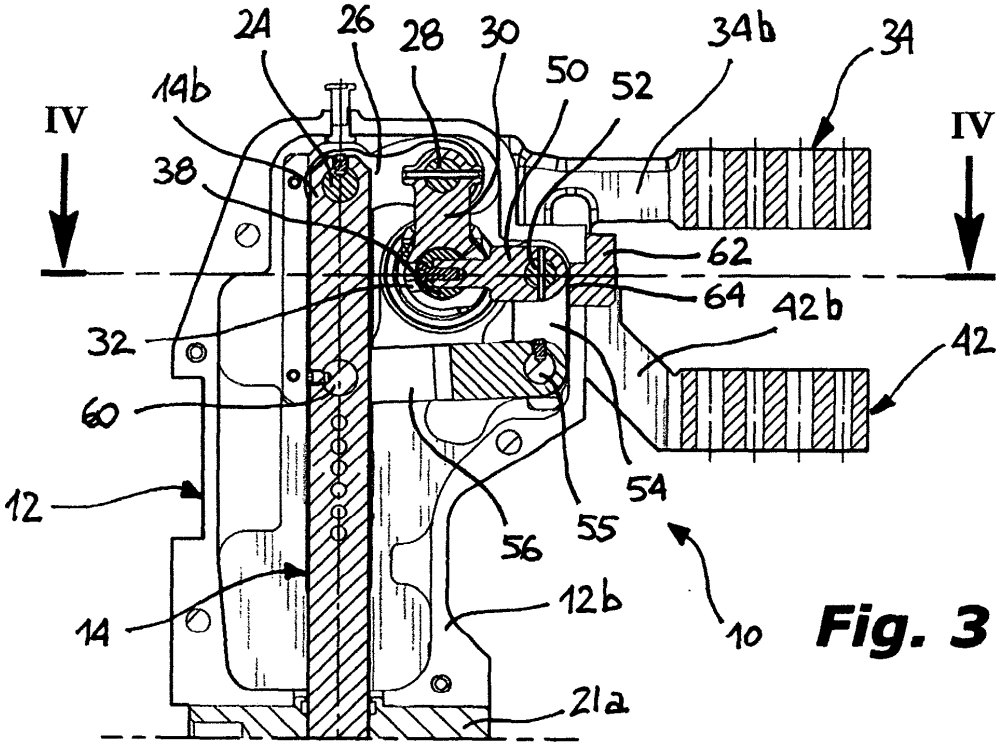

Fig. 3

EP 2 174 752 A1

Description

[0001] The present invention refers to clamping devices with articulated levers, and provided with at least one swingably mounted clamping arm in order to allow at least one workpiece to be locked with respect to the body of the device, when the latter is fixed in a predetermined position.

[0002] US-4 793 602 concerns such a clamping device provided with a pair of clamping arms swingably mounted about two parallel axes separate with respect to the body of the device. The two arms are susceptible to make a simultaneous and symmetrical movement between a back rest position and an advanced locking position with respect to the body, as a result of the sliding of a stem controlled by a pneumatic cylinder associated to the body of the device. The two arms are both connected to the same end of the stem through respective connecting rods, from opposite sides of the body of the device with respect to the stem.

[0003] The clamping device of this document however suffers from the drawback of not allowing an irreversible movement condition of the arms to be reached when the arms are in their advanced locking position, due to which both arms could move towards their back positions following to the application of a push to one of them tending to bring it in the back position, with the consequent release of the workpiece to be locked. Moreover, owing to the fact that the two arms are articulated from opposite sides with respect to the stem that controls their movement, this device is generally cumbersome and not very versatile, being inadequate for allowing the locking of workpieces positioned in different orientations when the body of the device is fixed in a predetermined position.

[0004] More particularly, the invention concerns a locking device of the type mentioned in the preamble of the attached claim 1.

[0005] Such a device is known from the Italian Patent application No. MI2002A001915. It comprises a pair of arms swingably supported by the body of the device about respective parallel and separate axes, both axes being arranged on the same side of the body with respect to the stem that controls their movement. Each arm is associated to a corresponding toggle device, as a result of which the movement of the arms in their advanced position is irreversible. While one of the arms is connected to the control stem in such a way that its swinging movement is controlled directly by the sliding of the stem with respect to the body, the movement of the other arm is controlled by means of a linkage connected to the rotation axis of the first arm, the linkage being disposed outside the body of the device.

[0006] Owing to the fact that the two arms of this known device are articulated about different axes, and since their rotational actuation requires a linkage outside the body, the device of this document is cumbersome and therefore it is not very fit for being employed in small spaces, as is often required for such devices.

[0007] In order to overcome the above mentioned drawbacks, one object of the invention is a device having the features defined in the attached claims.

[0008] By virtue of the fact that the two swingable arms are articulated about the same rotation axis, the device of the invention has a particularly compact structure which is therefore absolutely fit for operating in small spaces.

[0009] According to another aspect of the invention, the linkage that controls the movement of the secondary arm of the device is connected directly to the control stem and is arranged within the body, as a result of which there are not further movable elements protruding from the body other than the swingable arms. In this way, the linkage constituting the control mechanism of the secondary arm is effectively protected by the body of the device.

[0010] According to another aspect of the invention, the main shaft and the secondary shaft both have axial ends protruding from the body, which comprise shaped formations adapted to engage corresponding seats formed in the branches of said arms, in order to allow the arms to be mounted according to a plurality of different positions.

[0011] In this manner, the structure of the device allows the two swingable arms to be mounted according a plurality of different angular positions, in such a manner that it can be adapted to a plurality of locking configurations of different or differently oriented workpieces, also in the case the body of the device is fixed in the same position.

[0012] Further features and advantages of the invention will become more clear from the following detailed description, given by way of non-limitative example only and referring to the attached drawings in which:

figure 1 is a perspective view of a device according to the invention, in a closed configuration in which its arms are in their respective advanced operative positions,

figure 2 is a perspective view of the device of figure 1 sectioned according to a longitudinal median plane,

figure 3 is a sectioned, side elevation view of a detail of figure 2 indicated with arrow III,

figure 4 is a top elevation view of the device sectioned along line IV-IV of figure 3,

figure 5 is a perspective view of the device similar to figure 1, in an open configuration of the arms in their respective back rest positions,

figure 6 is a side elevation view of the device of figure 5 sectioned along a longitudinal median plane, and figures 7 and 8 are perspective views similar to figures 1 and 5, showing a possible modification of the arrangement of the arms of the device, in their advanced and back positions respectively.

[0013] With initial reference to figures 1 to 6, a clamping device with articulated levers, which can be used for locking workpieces, such as sheet metal elements, for ex-

ample during welding operations, is designated 10 as a whole.

[0014] The device 10 comprises a box-shaped body 12, which is defined by two shaped half-shells 12a and 12b coupled to one another.

[0015] A control stem 14 of the device 10 is axially slidably mounted between the two half-shells 12a and 12b, to the lower end 14a of which, with reference to the figures, a piston 16 of an actuator 18 is fixed, which is normally a pneumatic actuator, arranged below the body 12. The piston 16 is slidably and sealingly mounted in a chamber 20 extending between an upper head 21a connected to the half-shells 12a and 12b, and a bottom wall 21b, for actuating the stem 14 according to an alternating movement as a consequence of the feeding of a pressurized fluid from opposite sides of the piston 16 through feeding/discharge ducts 22a and 22b.

[0016] The stem 14, near to its upper end 14b opposite to the piston 16, is rotatably connected by means of a pin 24 to an end of a first pair of connecting rods 26, whose opposite end is rotatably connected in 28 to a first crank 30. The crank 30 is rigidly rotationally connected to a tubular main shaft 32 having axis A, whose axial ends protrude from opposite sides with respect to the body 12. On each end of the shaft 32 a respective branch 34a, 34b of a first fork arm 34 of the device 10 is keyed.

[0017] Conveniently, the axial ends of the tubular shaft 32 have a square cross-section and on the two branches 34a and 34b of the arm 34 respective coaxial seats of correspondingly square shape are formed, in order to allow the arm 34 to be positioned in one of a plurality of prefixed angular positions with respect to the shaft 32, as a result of the fixing by screws of respective removable clamping staples 36a and 36b.

[0018] The assembly formed by the first pair of connecting rods 26 and by the crank 30 constitutes a toggle articulation of the first arm 34, whose function is to make the advanced operative position of the first arm 34 shown in figures 1 to 4 irreversible, in such a manner that the arm 34 cannot move from such position towards its back position in consequence of to a stress applied on it from the outside.

[0019] A second shaft 38 extends coaxially to the axis A inside the tubular shaft 32, the axial ends of said second shaft protruding from opposite sides with respect to the ends of the shaft 32, for allowing the branches 42a and 42b of a second clamping arm 42 to be fixed.

[0020] On the protruding ends of the shaft 38 respective square formations 40 are keyed, and each of the branches 42a, 42b of the second arm 42 has a corresponding square seat 44 adapted to be engaged by a formation 40. In this manner, the second arm 42 can be positioned according to one of a plurality of prefixed angular positions with respect to the shaft 38, following to the screw fixing of respective removable clamping staples 46a and 46b.

[0021] In a central portion of the shaft 38 a bracket 50 radially projecting from the shaft 38 and constituting a second crank of the device 10 is rotationally fixed, for example by means of a screw radial with respect to the axis A. The crank 50 has a transverse hole at its end opposite to the shaft 38, which is engaged by a pin 52 parallel to the axis A. The opposite ends of the pin 52 are rotatably inserted in a pair of holes of a second pair of connecting rods 54 each of which has a further hole for the engagement of a further pin 55 parallel to pin 52.

[0022] According to a constructive modification not shown in the drawings, but within the capacity of the skilled person, the bracket 50 is conveniently formed in one piece with the shaft 38, for example by casting, in such a manner that the second crank of the device 10 consists of an appendage integral with the central portion of the shaft 38, that cantilevers radially with respect to axis A.

[0023] The central part of the pin 55 is rotatably engaged in a first hole of a pair of generally S-shaped auxiliary rods 56, each of which has a second hole in which a respective end of a pin 60 is inserted which diametrically crosses the stem 14 in an intermediate portion thereof between the ends 14a and 14b.

[0024] The assembly formed by the crank 50, by the second pair of connecting rods 54 and by the two auxiliary rods 56 constitutes a toggle articulation of the second arm 42, whose function is to make the advanced operative position of the second arm 42 shown in figures 1 to 4 irreversible, in such a way that the arm 42 in this position cannot move towards its back position as a result of stress applied on it from the outside.

[0025] A counter element 62 is connected to the body 12, which is fixed through screws in a seat 64, and on which the branches 34a and 34b of the arm 34 and the branches 42a and 42b of the arm 42 rest from opposite sides, respectively, by means of adjustable supports constituted by screws 66.

[0026] In operation of the device 10, starting from the configuration shown in figures 1 to 4, both arms 34 and 42 are in their advanced operative positions for clamping a workpiece (not shown). As a consequence of the pressurized fluid being fed into the chamber 20 of the actuator 18 through the duct 22a, the piston 16 moves towards the bottom wall 21b thus axially driving the stem 14 downwards.

[0027] This sliding of the stem 14 causes, by means of the first pair of connecting rods 26, a rotation of the first crank 30 and of the tubular shaft 32, with the consequent rotation of the first clamping arm 34 that moves towards its back rest position. In the initial phase of this rotation, the toggle articulation of the first arm 34 constituted by the crank 30 and by the pair of connecting rods 26 passes a "dead center position" corresponding to the advanced position of the arm 34, in which the movement of arm 34 is irreversible.

[0028] Simultaneously, the sliding of the stem 14 causes, by means of the pair of auxiliary rods 56 and of the second pair of connecting rods 54, an angular movement of the second crank 50 and of the corresponding shaft

38, with the consequent rotation of the second clamping arm 42 that moves towards its back rest position. Also in this case, in the initial phase of the angular movement of the arm 42, the corresponding toggle articulation constituted by the crank 50, by the pair of connecting rods 54 and by the two rods 56, must pass a "dead center position" that makes the advanced position of the arm 42 irreversible.

[0029] At the end of the sliding stroke of the stem 14, both clamping arms 34 and 42 reach the respective rest positions shown in figures 5 and 6.

[0030] From this position, further pressurized fluid being fed into the chamber 20 through the duct 22b causes the upward movement of the piston 16 and therefore the corresponding axial sliding of the stem 14, so as to cause the swinging of the arms 34 and 42 towards their corresponding advanced operative positions until the configuration shown in figures 1 to 4 is reached.

[0031] Figures 7 and 8 show the device 10 with the corresponding arms 34 and 42 mounted in another angular position, in their advanced or clamping positions and in their back or opening positions, respectively. The different mounting configuration is easily reached following to the removal of the clamping staples 36a and 36b of the arms 34a and 34b, and of the clamping staples 46a and 46b of the arms 42a and 42b, to the new positioning of the arms 34 and 42 with respect to the square ends of the shafts 32 and 38, and to the clamping of the staples 36a, 36b, 46a and 46b in the new position of the arms 34 and 42.

[0032] In order to make this configuration completely operative, the counter element 62 is fixed in the seat 68 formed in the body 12, by means of the fixing thereof through screws, in such a manner that it stands in a position interposed between the arms 34 and 42, so as to allow the arms 34 and 42 to rest on it from opposite sides in their new advanced operative position.

Claims

1. Clamping device with articulated levers, particularly for locking workpieces, including:

   - a body (12) in which a stem (14) is axially slidably mounted, the sliding thereof being controlled by control means (16, 18) associated with the body (12),
   - a main shaft (32) rotatable about an axis of rotation (A) which is transverse to the stem (14) and which is connected to it by a first toggle articulation mechanism (26, 30),
   - a first swingable clamping arm (34), connected to the main shaft (32) and susceptible to move between a back rest position and an advanced operative position with respect to the body (12), and
   - a second swingable clamping arm (42), associated with the body (12) and adapted to rotate simultaneously with the first arm (34) between a back rest position and an advanced operative position, whose swinging movement is controlled by a linkage (50, 54, 56) which includes a second toggle articulation mechanism,

   characterized in that the second arm (42) is connected to a secondary shaft (38) which is rotatable and coaxial with the main shaft (32), whereby both arms (34, 42) are swingable about the same axis of rotation (A).

2. Device according to claim 1, **characterized in that** said main shaft (32) is a tubular shaft and **in that** said secondary shaft (42) extends on the inside of the main shaft (32).

3. Device according to claim 1, **characterized in that** a first crank (30) is fixed to said main shaft (32), which is connected to the control stem (14) by a first pair of connecting rods (26).

4. Device according to any one of claims 1 to 3, **characterized in that** said linkage (50, 54, 56) is connected directly to the control stem (14).

5. Device according to claim 4, **characterized in that** said linkage (50, 54, 56) is arranged entirely on the inside of said body (12).

6. Device according to any one of claims 1 to 5, **characterized in that** said linkage is connected to a second crank (50) fixed to the secondary shaft (38), and comprises a second pair of connecting rods (54) and a pair of auxiliary rods (56), said second pair of connecting rods (54) being connected at one end to said crank (50) and at the another end to said pair of auxiliary rods (56) by means of respective pins (52, 55), one end of said pair of auxiliary rods (56) being connected to the control stem by another pin (60).

7. Device according to claim 6, **characterized in that** said second crank (50) is formed integrally with the secondary shaft (38) and extends radially cantilevered from a central portion thereof.

8. Device according to claim 6 or 7, **characterized in that** both said main shaft (32) and said secondary shaft (38) have axial ends projecting from the body (12), which ends comprise shaped formations adapted to engage corresponding seats formed in branches (34a, 34b, 42a, 42b) of said arms (34, 42), in order to allow the arms (34, 42) to be mounted according to a plurality of different positions.

9. Device according to claim 8, **characterized in that** said shaped formations have a square shape.

10. Device according to any one of claims 1 to 9, **characterized in that** the body (12) has a plurality of seats (64, 68) for selectively fastening a counter element (62) on which both arms (34, 42) rest in the respective advanced operative positions.

11. Device according to claim 10, **characterized in that** an adjustable support member (66) is interposed between each branch (34a, 34b, 42a, 42b) of said arms (34, 42) and said counter element (62).

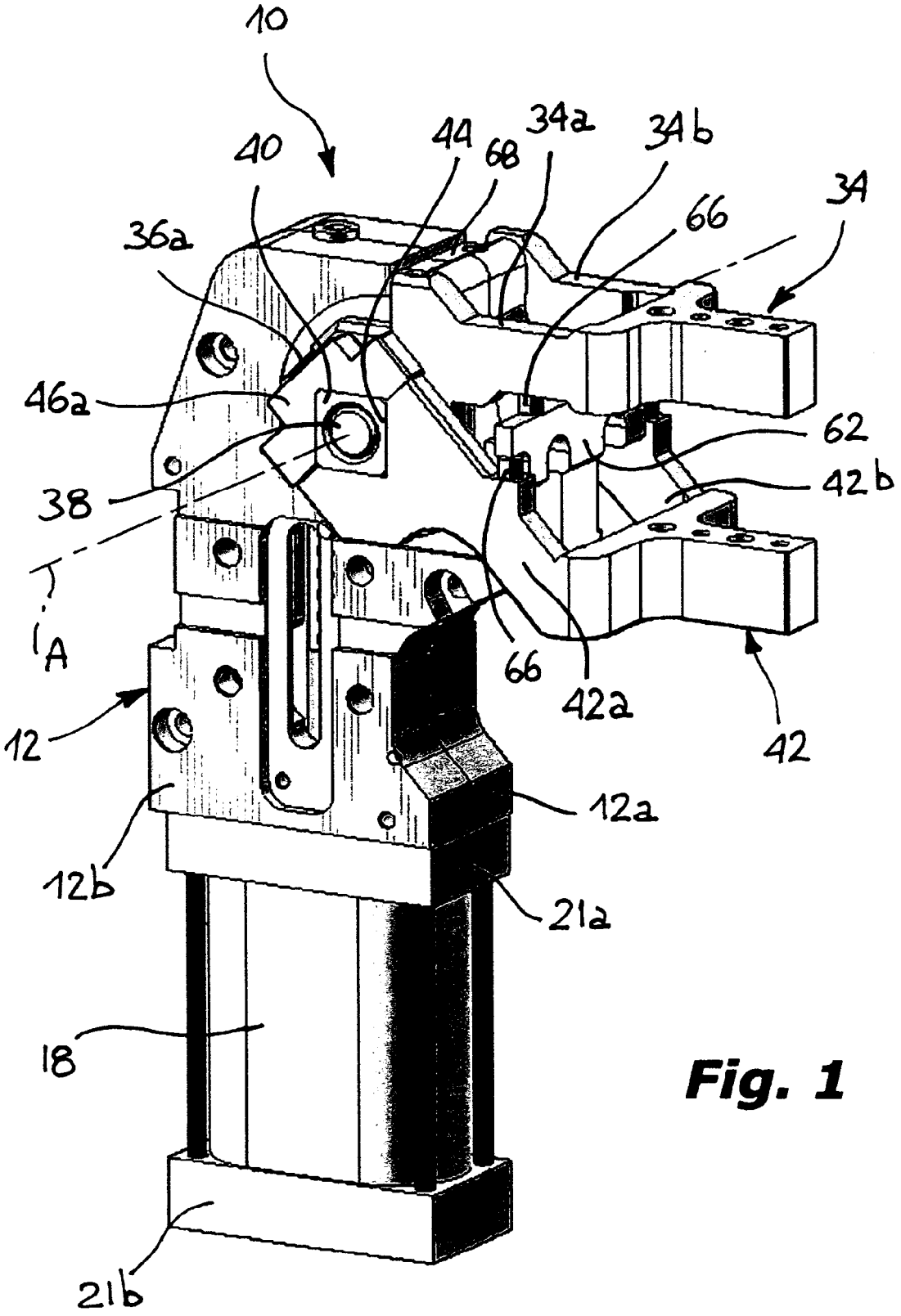
10
40
44
68
34a
34b
66
34
36a
46a
62
42b
38
I
I
A
66
42a
42
12
12a
12b
21a
18
21b

Fig. 1

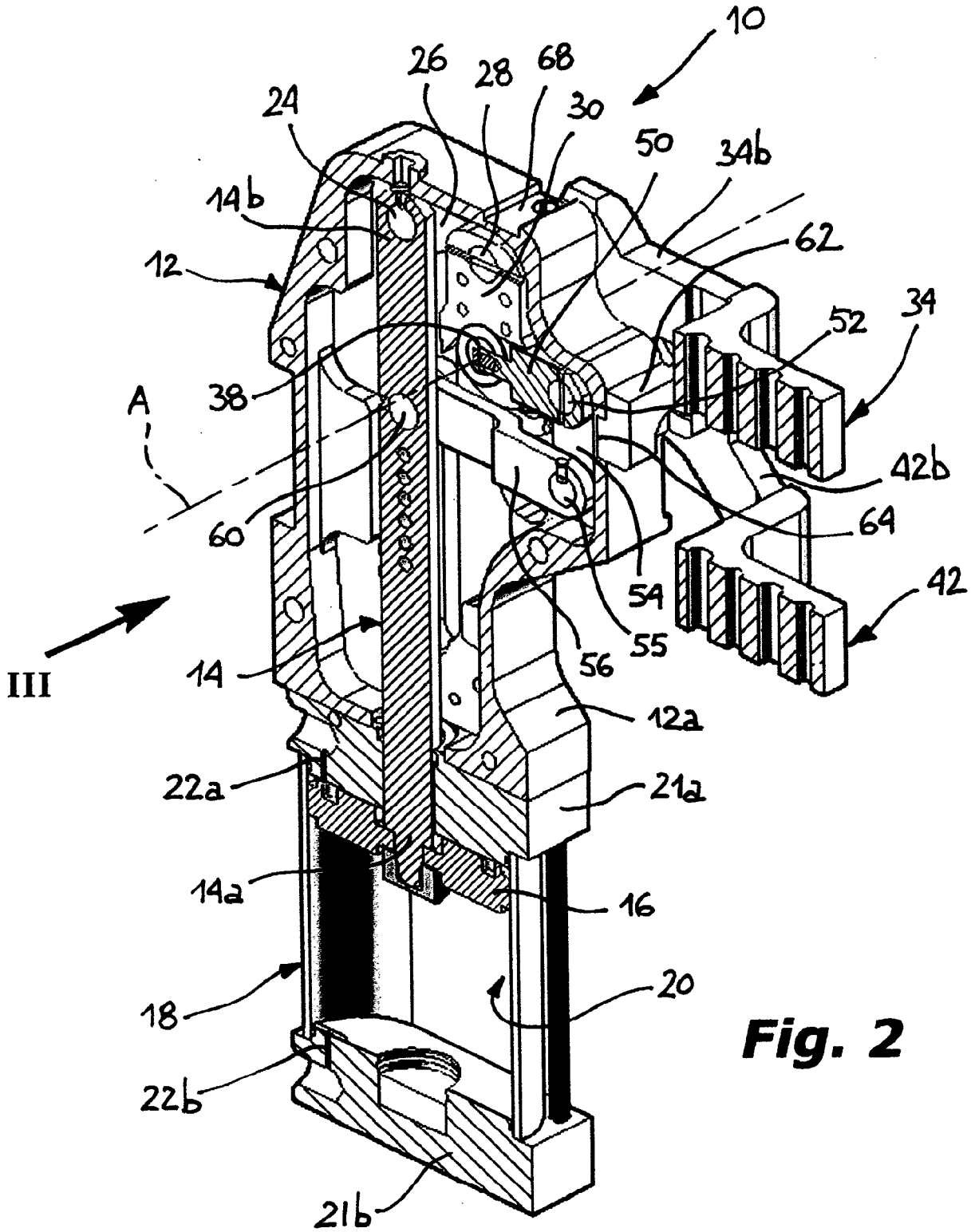
10
26
28
68
30
24
50
34b
14b
62
12
52
34
38
A
42b
64
60
54
42
III
14
56
55
12a
22a
21a
14a
16
18
20
22b
21b

Fig. 2

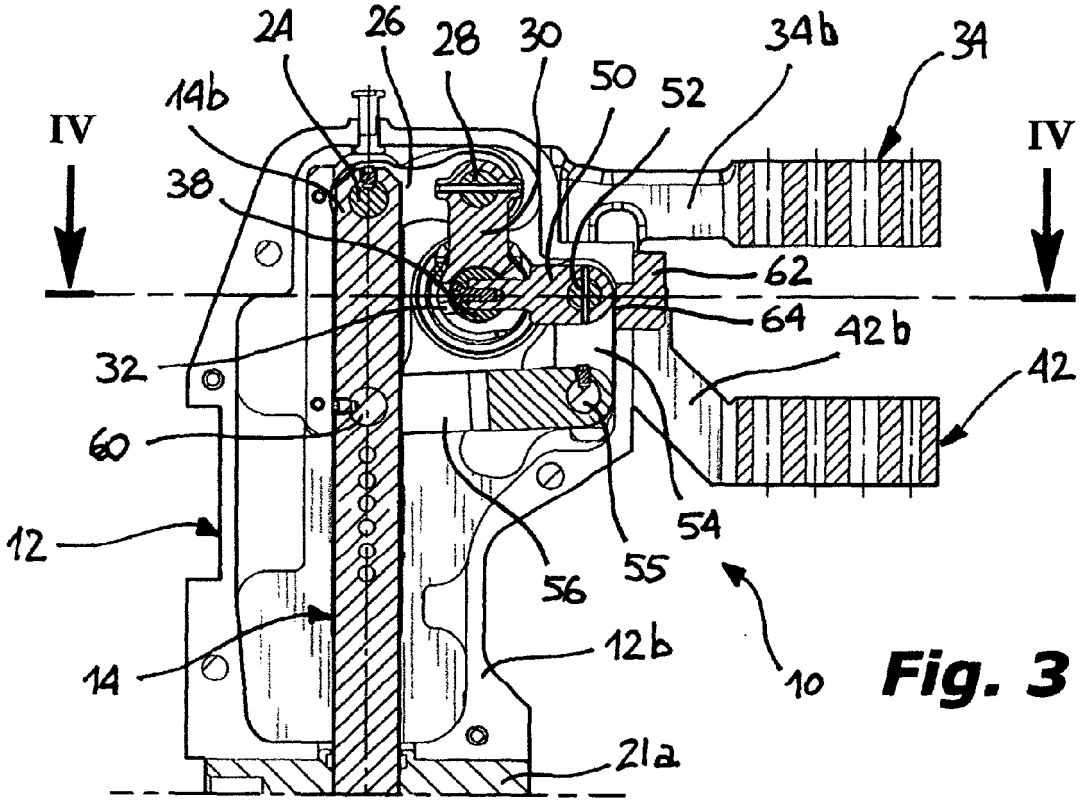
IV
IV
24
26
28
30
34b
34
14b
50
52
38
62
64
42b
42
32
60
12
54
56
55
12b
14
10
21a

Fig. 3

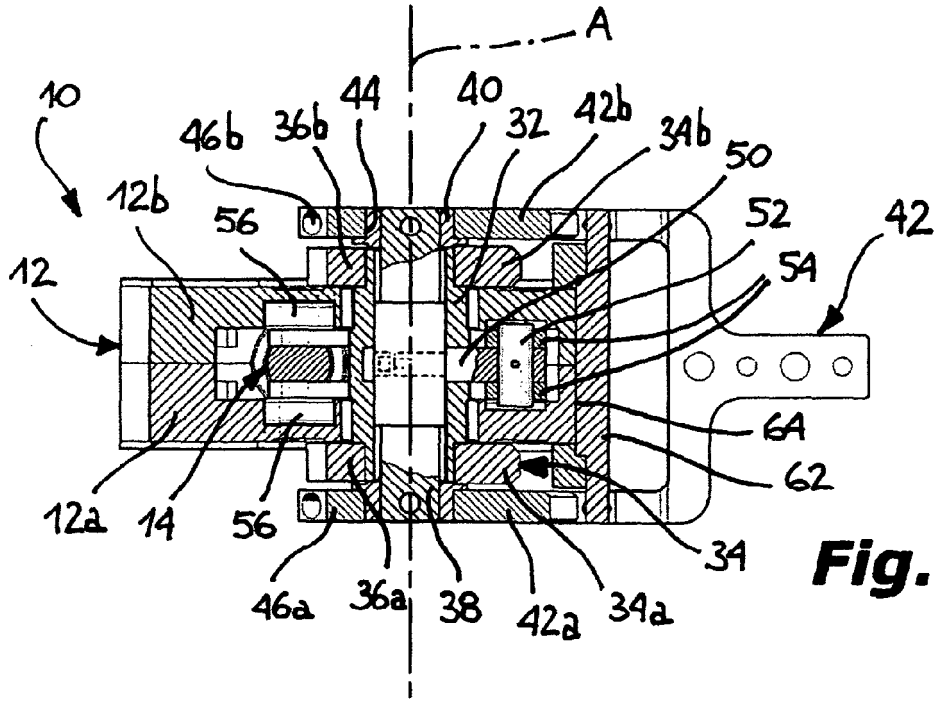
A
10
44
40
46b
36b
32
42b
34b
50
12b
56
52
42
12
54
6A
62
12a
14
56
34
46a
36a
38
42a
34a

Fig. 4

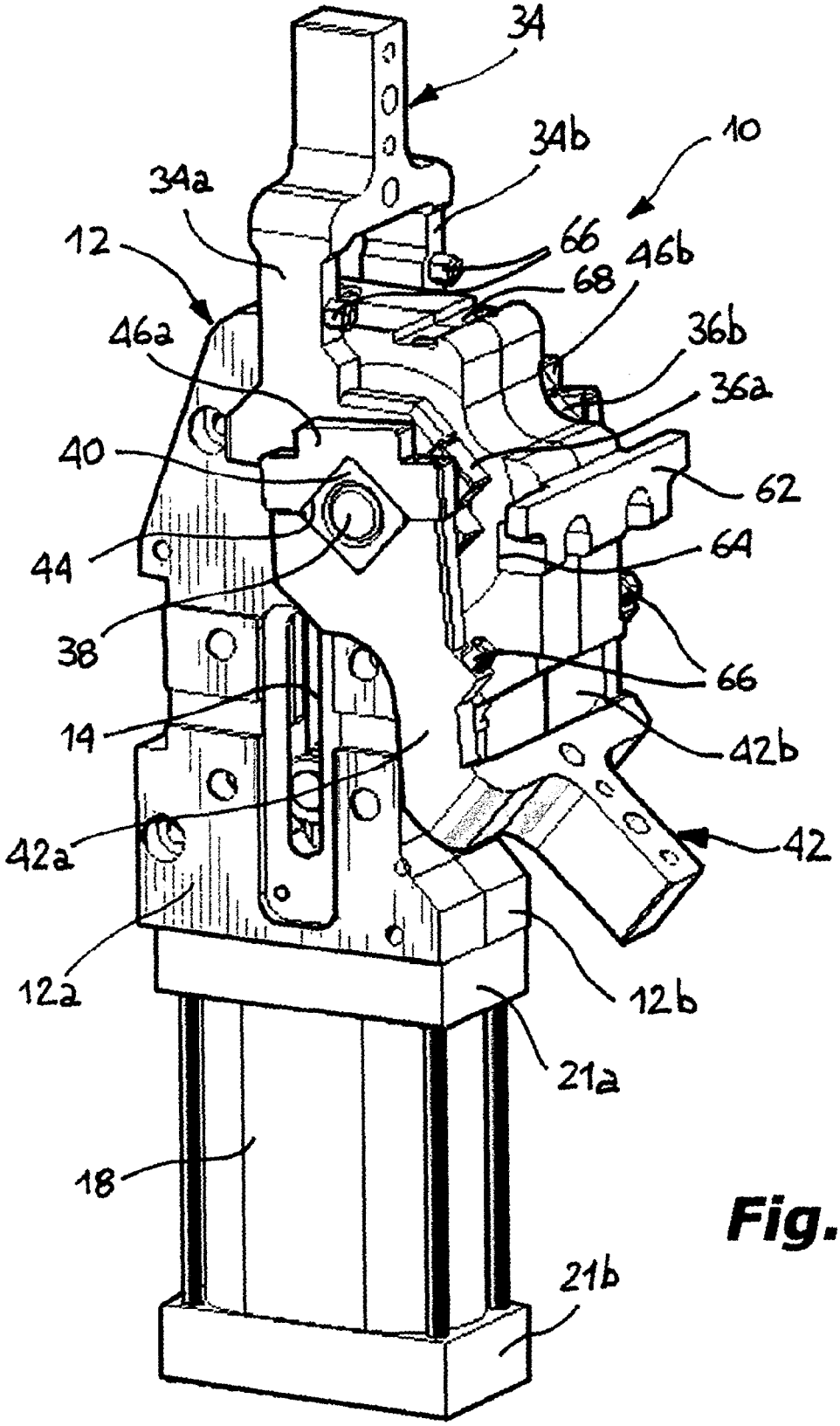
34
34b
10
34a
66
12
68
46b
46a
36b
36a
40
62
64
44
38
66
14
42b
42a
42
12a
12b
21a
18
21b

Fig. 5

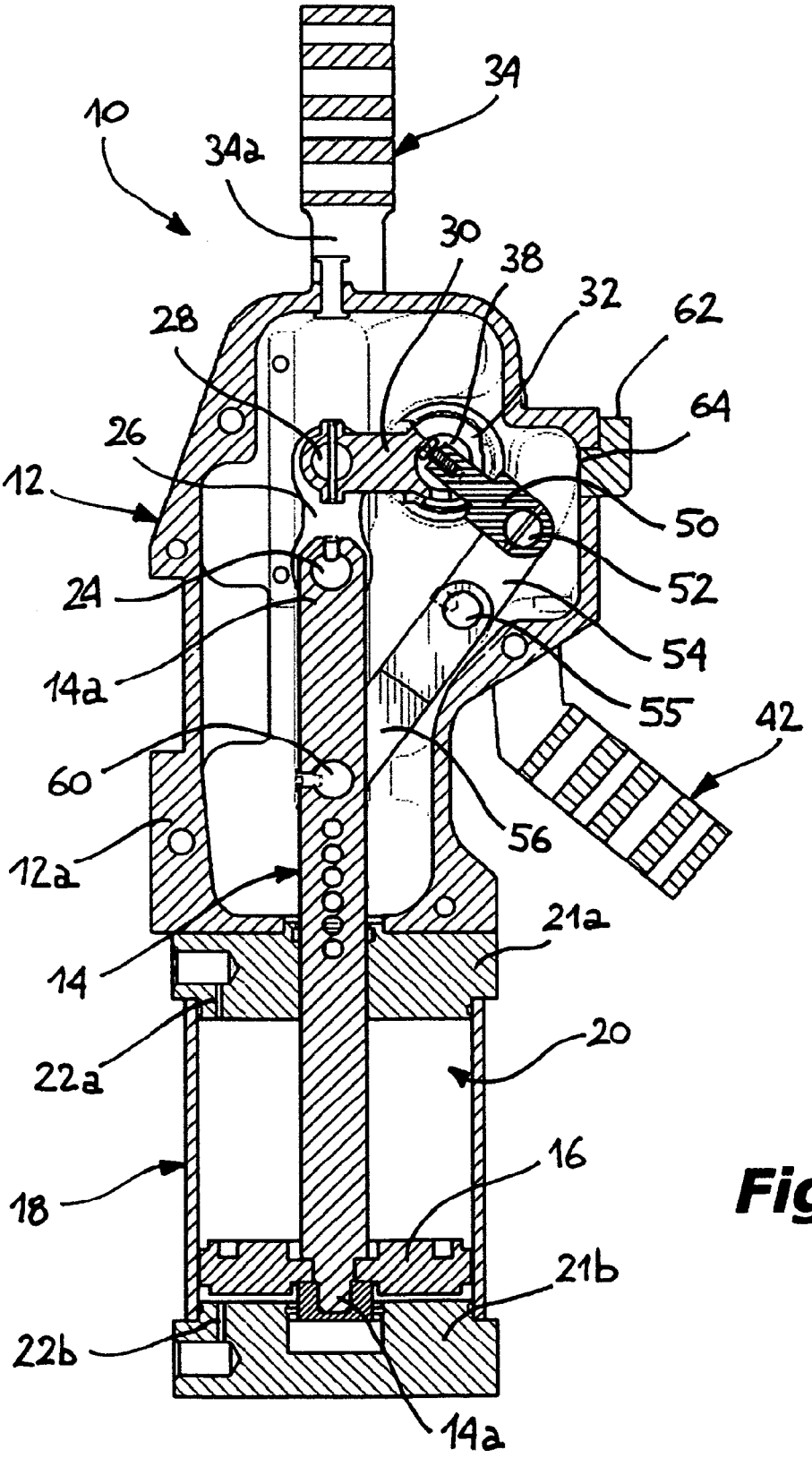
10
34
34a
30
38
32
62
28
64
26
12
50
52
24
54
14a
55
42
60
56
12a
21a
14
20
22a
16
18
21b
22b
14a

Fig. 6

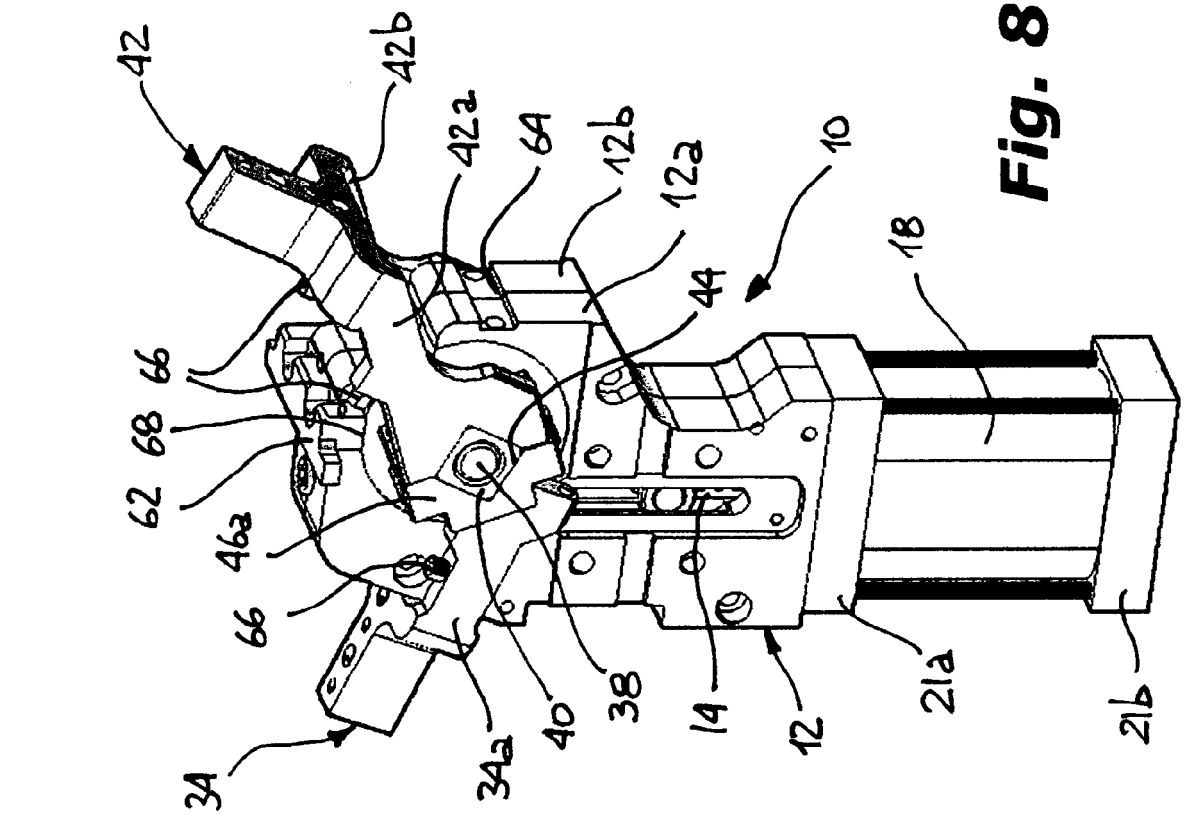
42
42b
42a
64
12b
12a
10
18
44
66
68
62
46a
66
34
34a
40
38
14
12
21a
21b

Fig. 8

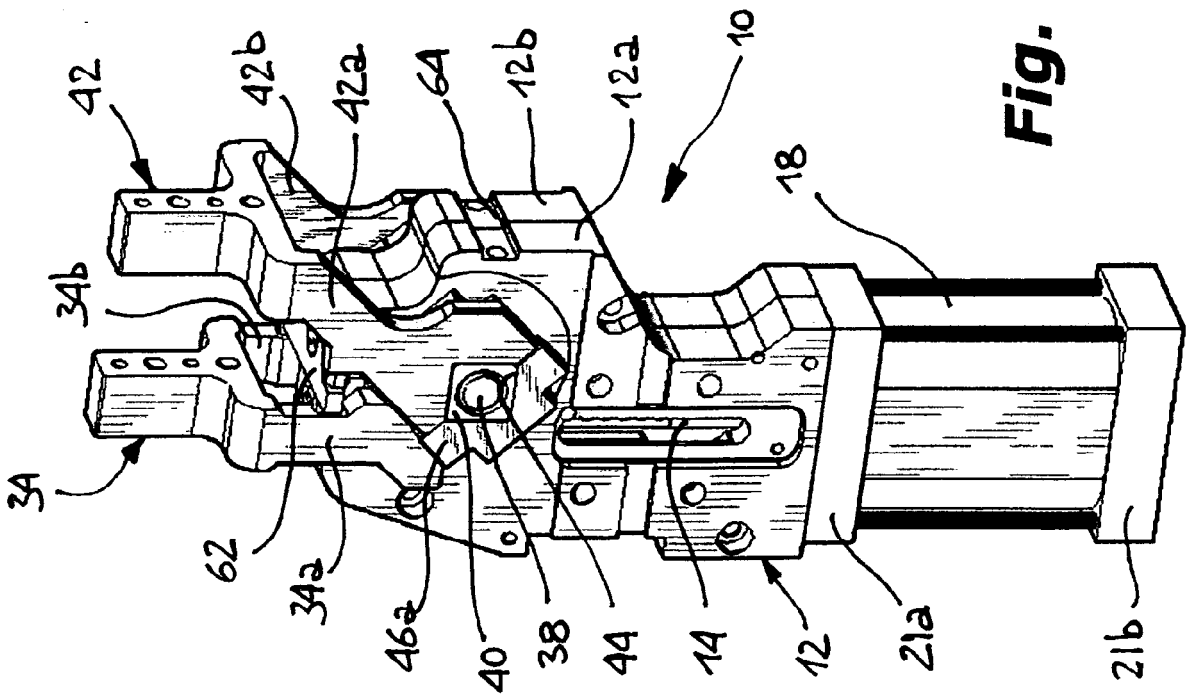
42
42b
42a
64
12b
12a
10
18
34b
34
62
34a
46a
40
38
44
14
12
21a
21b

Fig. 7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 09 01 2624

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 398 114 A (NOTHELFER GMBH [DE]) 17 March 2004 (2004-03-17) * paragraphs [0014] - [0018] * * figures 1-5 *	1	INV. B25B5/12
A	EP 1 174 226 A (BTM CORP [US]) 23 January 2002 (2002-01-23) * paragraphs [0006] - [0020] * * figures 1-9 *	1	
A	EP 0 876 885 A (KOMAX HOLDING AG [CH]) 11 November 1998 (1998-11-11) * column 2, line 27 - line 45 * * column 3, line 26 - line 39 * * figures 1,-5,12-14 *	1	
A	US 4 728 137 A (HAMED NIHAD [US] ET AL) 1 March 1988 (1988-03-01) * figures 1-10 *	1	
D,A	US 4 793 602 A (MCPHERSON ALEXANDER W [US]) 27 December 1988 (1988-12-27) * column 2, line 34 - column 3, line 15 * * figures 1,4 *	1	TECHNICAL FIELDS SEARCHED (IPC) B25B B25J B23Q
A	US 6 290 210 B1 (HORN EDWARD R [US] ET AL) 18 September 2001 (2001-09-18) * column 4, line 28 - column 7, line 13 * * figures 1-6 *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	30 November 2009	Schultz, Tom

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 01 2624

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

30-11-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1398114 A	17-03-2004	DE 10242058 A1	01-04-2004
EP 1174226 A	23-01-2002	US 6412845 B1	02-07-2002
EP 0876885 A	11-11-1998	AT 210007 T	15-12-2001
		CH 692778 A5	31-10-2002
		DE 59705668 D1	17-01-2002
		US 6042166 A	28-03-2000
US 4728137 A	01-03-1988	NONE	
US 4793602 A	27-12-1988	EP 0313947 A2	03-05-1989
US 6290210 B1	18-09-2001	US 2002084564 A1	04-07-2002

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 4793602 A **[0002]**
- IT MI20021915 A **[0005]**