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

(11) **EP 3 831 537 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
09.06.2021 Bulletin 2021/23

(51) Int Cl.:
B25C 7/00 *(2006.01)*

(21) Application number: **19213400.5**

(22) Date of filing: **04.12.2019**

(84) Designated Contracting States:
AL 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 RS SE SI SK SM TR
Designated Extension States:
BA ME
KH MA MD TN

(71) Applicant: **Hilti Aktiengesellschaft**
9494 Schaan (LI)

(72) Inventors:
- **Foser, Thomas**
  9496 Balzers (LI)
- **Hasler, Claudio**
  9488 Schellenberg (LI)
- **Schrepfer, Patrick**
  9630 Wattwil (CH)
- **Feeser, Markus**
  7303 Mastrils (CH)

(74) Representative: **Hilti Aktiengesellschaft**
Corporate Intellectual Property
Feldkircherstrasse 100
Postfach 333
9494 Schaan (LI)

(54) FASTENING TOOL

(57) A fastening tool (1) for driving fastening elements (2) in a driving direction (3) into a workpiece (4) comprises a housing (6) and a press-on element (8) having a press-on face (11), wherein the press-on element is displaceable with respect to the housing against the driving direction when the fastening tool is pressed against the workpiece in the driving direction. The fastening tool further comprises a support structure (12) mounted to the housing and extending in the driving direction along the press-on element, wherein the support structure is displaceable with respect to the housing between a closed position and an open position. The fastening tool further comprises a control element (17) for controlling movement of the support structure with respect to the housing, wherein the control element is displaceable with respect to the housing between a first position and a second position. The fastening tool further comprises a locking element (28) which has a locking position and a clearance position, wherein the locking element locks the control element in the first position if the locking element is in the locking position, and wherein the locking element releases the control element from the first position if the locking element is in the clearance position.

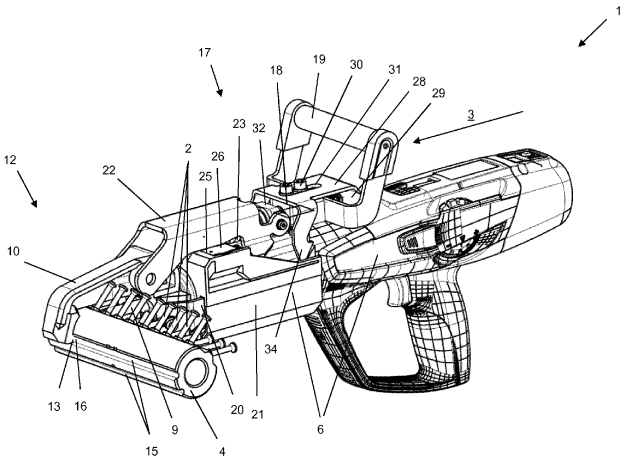

Fig. 3

EP 3 831 537 A1

Description

TECHNICAL FIELD

[0001] Described herein is a fastening tool for driving fastening elements in a driving direction into a workpiece, comprising a housing and a press-on element having a press-on face, wherein the press-on element is displaceable with respect to the housing against the driving direction when the fastening tool is pressed against the workpiece in the driving direction. Also described herein are associated parts and methods of use thereof.

BACKGROUND ART

[0002] In many applications, there is the need to join to, or couple with, elements. One such application is joining two elements by driving a fastening element into one or both of the elements, thereby using a fastening tool as mentioned above. The fastening tool is pressed against one of the elements, hereinafter referred to as a workpiece, then a driving mechanism is triggered which may drive a driving element onto the fastening element to drive the fastening element into the workpiece. When such a fastening tool is pressed against the workpiece, the workpiece may move back and thus require support from behind. As described in WO 2018/048315 A1, the fastening tool may provide such a support.

[0003] Multiple driving mechanisms are known to be used in fastening tools, comprising for example: combustion of explosive powder or fluid/gaseous combustibles, compressed air, spring drives, flywheels, electromagnetic drives, screwing, and combinations thereof. Any of those driving mechanisms are known to be used in portable hand-held fastening tools.

[0004] One constraint with workpiece support relates to recoil. When a fastening element is driven into a workpiece, or a driving element is driven onto a fastening element, a hand-held fastening tool may be subject to great acceleration forces away from the workpiece and any support structure supporting the workpiece. If a fastening tool provides for support of the workpiece, it may be an object to reduce any damage to the tool, or the support structure, caused by such forces.

[0005] Another constraint with workpiece support relates to handling. If a fastening tool provides for controlling movement of any support structure with respect to a housing of the fastening tool, it may employ some control element associated with such a support structure. Such a control element could reduce accessibility of an area of the tool nose, or inadvertently be activated, and make handling the fastening tool more difficult.

[0006] Offering an alternative design that addresses some or all of the above constraints or at least offers the public a choice may be useful.

SUMMARY

[0007] The above constraints are addressed by a fastening tool for driving fastening elements in a driving direction into a workpiece, comprising a housing and a press-on element having a press-on face, wherein the press-on element is displaceable with respect to the housing against the driving direction when the fastening tool is pressed against the workpiece in the driving direction, the fastening tool further comprising a support structure mounted to the housing and extending in the driving direction along the press-on element, wherein the support structure is displaceable with respect to the housing between a closed position and an open position.

[0008] According to one aspect, the support structure comprises a support-structure spring biasing the support structure against the driving direction with respect to the housing when the support structure is in the closed position. In a preferred embodiment, the fastening tool comprises a control element for controlling movement of the support structure with respect to the housing. In another preferred embodiment, the fastening tool comprises a damping element associated with the support-structure spring. In an even more preferred embodiment, the support structure comprises the damping element. In an alternative embodiment, the control element comprises the damping element. In another alternative embodiment, the housing comprises the damping element.

[0009] In another preferred embodiment, the fastening tool further comprises a control element for controlling movement of the support structure with respect to the housing. In an even more preferred embodiment, the support-structure spring biases the support structure against the driving direction with respect to the control element when the support structure is in the closed position. In another preferred embodiment, the support structure comprises a spring bearing, wherein the support-structure spring is mounted on the spring bearing. Even more preferred, the support structure comprises a support element for clasping the workpiece, wherein the support structure comprises a link linking the spring bearing to the support element. In another preferred embodiment, the support-structure spring is mounted on the control element. In an alternative embodiment, the support-structure spring is mounted on the housing.

[0010] According to another aspect, the fastening tool further comprises a control element for controlling movement of the support structure with respect to the housing, wherein the control element is displaceable with respect to the housing between a first position and a second position, and the fastening tool further comprises a locking element which has a locking position and a clearance position, wherein the locking element locks the control element in the first position if the locking element is in the locking position, and wherein the locking element releases the control element from the first position if the locking element is in the clearance position.

[0011] In a preferred embodiment, the locking element

is manually movable between the locking position and the clearance position. In an even more preferred embodiment, the control element comprises a control-element grip, and wherein the locking element comprises an activation element associated with the control-element grip, or reachable by a hand gripping the control-element grip.

[0012] In another preferred embodiment, the locking element is mounted on the control element. In an even more preferred embodiment, the control element comprises a guide guiding a movement of the locking element between the locking position and the clearance position. Even more preferred, the locking element moves linearly between the locking position and the clearance position. In an alternative embodiment, the locking element comprises a second lever hinged to the control element. In another alternative embodiment, the locking element is mounted on the housing. In an even more preferred embodiment, the locking element comprises a second lever hinged to the housing.

[0013] In a generally preferred embodiment, the support structure protrudes in the driving direction behind the press-on face. In an even more preferred embodiment, the support structure comprises a support element for clasping the workpiece. In an even more preferred embodiment, the support element comprises a support face supporting the workpiece against the driving direction during driving a fastening element into the workpiece. In an even more preferred embodiment, the support structure comprises a support protrusion for engaging the workpiece, or a depression in the workpiece, wherein the support face is arranged on the support protrusion. In another preferred embodiment, the support structure is displaceable in the driving direction with respect to the press-on element.

[0014] In another preferred embodiment, the support structure is displaceable with respect to the housing between a closed position, an open position and a release position, wherein the support structure is removable from the housing from the release position. In another preferred embodiment, the control element has a first position in which the control element locates the support structure in the closed position. In another preferred embodiment, the control element has a second position in which the control element locates the support structure in the open position. In another preferred embodiment, the control element has a release position in which the control element releases the support structure to be removed from the housing. Even more preferred, the release position is identical to the open position. In another preferred embodiment, the control element is mounted on the housing. In an even more preferred embodiment, the control element comprises a first lever hinged to the housing.

[0015] In another preferred embodiment, the fastening tool comprises a compulsory guide for moving the support structure between the closed position and the open position by movement of the control element. In an even more preferred embodiment, the compulsory guide comprises a control arm and at least one guide element engaging the control arm such that movement of the control arm causes movement of the guide element and/or vice versa. In an even more preferred embodiment, the control element comprises the control arm, and the support structure comprises the guide element. In an alternative embodiment, the support structure comprises the control arm, and the guide element comprises the guide element. In another preferred embodiment, the control element comprises a control-element grip.

[0016] In another preferred embodiment, the fastening tool comprises a driver and a driving device for driving the driver onto a fastening element to drive the fastening element into the workpiece. In an even more preferred embodiment, the press-on element is removable from the remaining fastening tool for replacing the driver or a component of the driving device.

[0017] In another preferred embodiment, the press-on element is displaceable up to a pressed-on position, wherein the press-on element releases a driving-in operation of the fastening tool if the press-on element is in the pressed-on position, and wherein the press-on element prevents a driving-in operation of the fastening tool if the press-on element is out of the pressed-on position. In another preferred embodiment, the press-on element comprises a guide channel for guiding a fastening element when the fastening element is driven into the workpiece.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Further aspects and advantages of the fastening tool, associated parts and a method of use thereof will become apparent from the ensuing description that is given by way of example only and with reference to the accompanying drawings in which:

Fig. 1 illustrates a fastening tool having a support structure shown in an open position in a perspective view,

Fig. 2 illustrates the fastening tool of Fig. 1 with the support structure in an intermediate position in a perspective view,

Fig. 3 illustrates the fastening tool of Fig. 1 with the support structure in a closed position and a workpiece supported by the support structure in a perspective view,

Fig. 4 illustrates the fastening tool of Fig. 1 with the support structure in the closed position and a workpiece supported by the support structure in a perspective view with omitted parts,

Fig. 5 illustrates the fastening tool of Fig. 1 with the support structure in the closed position and a

workpiece supported by the support structure in a side-view, and

Fig. 6 illustrates the fastening tool of Fig. 1 and a workpiece supported by the support structure during fastening in a side-view.

DETAILED DESCRIPTION

[0019] Figs. 1, 2, 3, 4, 5 and 6 show a fastening tool 1 for driving fastening elements 2 (Figs. 3, 4, 5, and 6) along a setting axis 14 in a driving direction 3 into a workpiece 4 (Figs. 3, 4, 5, and 6). The driving elements 2 are formed as nails. In not-shown embodiments, the driving elements are formed as e.g. bolts, pins, clips, cranks or screws. The fastening tool 1 comprises a schematically shown driver 5 (Fig. 1, hidden in the remaining Figs.) which is formed as e.g. a setting piston or screwdriver bit. Further, the fastening tool 1 comprises a housing 6 and, received in the housing 6, a schematically shown driving device 7 (Fig. 1, hidden in the remaining Figs.) for driving the driver 5 onto a fastening element 2 to drive the fastening element 2 into the workpiece 4. The driving device 7 comprises e.g. a gas- or powder-actuated combustion drive, an air-pressure drive, or a spring-, flywheel or electrodynamic driven electric drive having, in particular, an electric motor and an electric battery.

[0020] Further, the fastening tool 1 comprises a press-on element 8 having a press-on face 11 and which is displaceable against the driving direction 3 with respect to the housing 6. When the press-on element 8 is pressed against the workpiece 4 in the driving direction 3, the press-on element 8 is displaceable up to a pressed-on position shown in Figs. 3, 4, and 5. If the press-on element 8 is in the pressed-on position, it releases a driving-in operation of the fastening tool 1. If the press-on element 8 is out of the pressed-on position as shown in Fig. 1, the press-on element 8 prevents a driving-in operation of the fastening tool 1. The press-on element 8 comprises a guide channel 9 in which a fastening element 2 is guided when driven into the workpiece 4. In not-shown embodiments, the fastening tool comprises a separate guide channel extending along the press-on element in the driving direction.

[0021] As shown, the workpiece 4 is formed as a coupler sleeve for coupling elongated elements such as tubes or rods, e.g. reinforcing bars for concrete. The workpiece 4 and/or the elements to be connected and/or the fastening elements are made of a metal, such as iron, or an alloy, such as steel. In the embodiment shown, the fastening elements 2 are driven tangentially into a gap between an inner face of the workpiece 4 and an outer face of the elongated elements, such that the elongated elements are tightly connected to the workpiece 4. The fastening elements 2 are pre-mounted to the workpiece 4, e.g. inserted in prefabricated holes, such as bores. In non-shown embodiments, the fastening elements are fed one-by-one or collated to the guide channel. To this end, the fastening tool may comprise a magazine opening out into the guide channel.

[0022] The fastening tool 1 comprises a support structure 12 mounted to the housing 6 and protruding in the driving direction 3 behind the press-on face 11. The support structure 12 comprises a support element 10 for clasping the workpiece 4. The support element 10 comprises a support protrusion 13 for engaging one of two depressions 15 in the workpiece 4. A support face 16 supporting the workpiece 4 against the driving direction 3 during driving a fastening element 2 into the workpiece 4 is arranged on the support protrusion 13. A safe pressing the fastening tool 1 against the workpiece 4 is thus ensured. The support structure 12 is also displaceable in the driving direction 3 with respect to the press-on element 8.

[0023] The support structure 12 is displaceable in the driving direction 3 with respect to the housing 6 between a closed position, an open position and a release position. To this end, the support structure comprises a carriage 20 fixed to the support element 10, the housing 6 comprises a track 21 which is formed e.g. as a groove, and the carriage 20 slides in the driving direction 3 in the track 21. In the closed position of the support structure 12 (Figs. 3, 4, and 5), a distance between the support face 16 and the press-on face 11 is small in order to hold the workpiece 4 between the support element 10 and the press-on element 8 and press the press-on element 8 onto the workpiece 4, as shown in Figs. 3, 4, and 5. In the open position of the support structure 12 (Fig. 1), a distance between the support face 16 and the press-on face 11 is large ensuring capability of moving the workpiece 4 into and out of a space between the support element 10 and the press-on element 8. With respect to the housing 6, the support structure 12 is displaced in the driving direction 3 from the closed position to the open position, and against the driving direction from the open position to the closed position. From the release position of the support structure 12, which in the present embodiment is at the same position as the open position, the support structure 12 is displaced even further in the driving direction 3 in order to remove the support structure 12 from the housing 6.

[0024] The fastening tool 1 comprises a control element 17 for controlling movement of the support structure 12 with respect to the housing 6. The control element 17 comprises a first lever 18 hinged to the housing 6, and a control-element grip 19 fixed to the first lever 18. The control element 17 has a first position (Figs. 3, 4, 5, and 6) in which the control element 17 locates the support structure 12 in the closed position, and a second position (Fig. 1) in which the control element 17 locates the support structure 12 in the open position.

[0025] The support structure 12 further comprises a support-structure spring 23 which biases the support structure 12 against the driving direction 3 with respect to the housing 6 and control element 17 when the support structure 12 is in the closed position (Fig. 3, 4, 5, and 6).

While the control element 17 is in its first position, the support structure 12 may be moved in the driving direction 3 with respect to the housing 6 and control element 17 against a biasing force of the support-structure spring 23. The support structure 12 comprises two first stops 24 facing in the driving direction 3, and the housing 6 comprises two second stops 25 facing against the driving direction 3. The fastening tool 1, particularly the housing 6, comprises two damping elements 26 associated with the support-structure spring. The damping elements 26 are each arranged between one of the first stops 24 and one of the second stops 25 when the control element is in its first position and/or the support structure 12 is in its closed position (Fig. 3). In non-shown embodiments, the support structure and/or the control element comprises one, two or more damping elements. When the support structure 12 is moved in the driving direction 3 with respect to the housing 6 and control element 17 against the biasing force of the support-structure spring 23, the first stops 24 may abut on the damping elements 26 and compress the damping elements 26 between the first stops 24 and the second stops 25, such that the damping elements 26 may absorb some of the energy of the moving support structure 12. The damping elements 26 may comprise a friction brake such as a hydraulic damping system or an element e.g. made of an elastomer or rubber.

[0026] In order to displace the support structure 12 linearly between the closed position and the open position by a pivoting movement of the control element 17, the support structure 12 comprises a link 22. The support structure 12 comprises a spring bearing 32 on which the support-structure spring 23 is mounted, and which is linked to the support element 10 by the link 22. On its opposite end, the support-structure spring 23 is mounted on the control element 17 close to a hinge 27 hinging the first lever 18 to the housing 6. In a non-shown embodiment, the support-structure spring is mounted on the housing.

[0027] The fastening tool 1 further comprises a locking element 28 which has a locking position (shown in the Figs.) and a clearance position (not shown), and which is linearly movable between the locking position and the clearance position. The locking element 28 locks the control element 17 in the first position if the locking element 28 is in the locking position, and releases the control element 17 from the first position if the locking element 28 is in the clearance position. To this end, the locking element 28 comprises a latch 34 latching to a pin 33 at the housing 6 in the locking position. Further, the locking element comprises a locking-element spring 35 biasing the locking element 28 into its locking position. The locking element 28 comprises an activation element 29 associated with the control-element grip 19 such that the activation element 29 is reachable by a hand gripping the control-element grip 19. Pressing the activation element 29 e.g. with a thumb pushes the locking element 28 from the clearance position to the locking position against a biasing force of the locking-element spring 35.

[0028] The locking element 28 is mounted on the control element 17. The control element 17 comprises a guide 30 guiding the linear movement of the locking element 28 between the locking position and the clearance position. In the example shown, the guide 30 comprises two screws and the locking element 28 comprises an elongate hole 31 in which the guide 30, or screws, may run when the locking element 28 moves between the locking position and the clearance position. In non-shown embodiments, the locking element is mounted on the housing and/or comprises a second lever hinged to the control element and/or housing.

[0029] In order to drive a fastening element 2 into the workpiece 4, a user approaches the workpiece 4 with the fastening tool 1, wherein the support structure 12 is in its open position (Fig.1), such that the support element 10 clasps the workpiece 4 and the support protrusion is inserted into the depression 15 of the workpiece 4. The user then pulls the control-element grip 19 of the control element 17 against the driving direction such that the support structure 12 is moved against the driving direction 3 with respect to the housing 6, thus reducing a distance between the support face 16 and the press-on element 8 which then is put over a fastening element 2 (Fig. 2). The press-on element 8 abuts the workpiece 4 and is moved against the driving direction 3 with respect to the housing 6. When the press-on element 8 is in the pressed-on position, it releases a driving-in operation of the fastening tool 1. The support-structure spring 23 has a spring stiffness sufficiently great to substantially prevent compression of the support-structure spring 23 during manual handling the fastening tool 1.

[0030] The fastening tool 1 is now ready to drive the fastening element 2, which is arranged within the guide channel 9, into the workpiece 4 (Figs. 3, 4, 5). When a fastening element 2 is driven into the workpiece 4, the housing 6 may be subject to recoil, wherein the support structure 12 may move in the driving direction 3 with respect to the housing 6 and control element 17 against the biasing force of the support-structure spring 23. The spring stiffness of the support-structure spring 23 is sufficiently small to enable compression of the support-structure spring 23 and the damping elements 26 caused by recoil during driving the fastening element 2. Any damage to the fastening tool 1, or the support structure 12, caused by such recoil may thus be reduced or avoided.

[0031] In order to thereafter loosen the fastening tool 1 from the workpiece 4, the user may push the control element 17 in the driving direction 3 back to its open position. To this end, the user may use the thumb of the hand gripping the control-element grip 19 for pushing the locking element 28 from its locking position to its clearance position against the biasing force of the locking-element spring 35.

[0032] The foregoing description of exemplary embodiments of the invention has been presented for purposes of illustration and of description. It is not intended to be

exhaustive or to limit the invention to the precise form disclosed, and modifications and variations are possible in light of the above teachings or may be acquired from practice of the invention. The functionality described may be distributed among modules that differ in number and distribution of functionality from those described herein. Additionally, the order of execution of the functions may be changed depending on the embodiment. The embodiments were chosen and described in order to explain the principles of the invention and as practical applications of the invention to enable one skilled in the art to utilize the invention in various embodiments and with various modifications as suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto and their equivalents.

Claims

1. A fastening tool for driving fastening elements in a driving direction into a workpiece, comprising a housing and a press-on element having a press-on face, wherein the press-on element is displaceable with respect to the housing against the driving direction when the fastening tool is pressed against the workpiece in the driving direction, the fastening tool further comprising a support structure mounted to the housing and extending in the driving direction along the press-on element, wherein the support structure is displaceable with respect to the housing between a closed position and an open position, the fastening tool further comprising a control element for controlling movement of the support structure with respect to the housing, wherein the control element is displaceable with respect to the housing between a first position and a second position, the fastening tool further comprising a locking element which has a locking position and a clearance position, wherein the locking element locks the control element in the first position if the locking element is in the locking position, and wherein the locking element releases the control element from the first position if the locking element is in the clearance position.

2. A fastening tool according to claim 1, wherein the locking element is manually movable between the locking position and the clearance position.

3. A fastening tool according to claim 2, wherein the control element comprises a control-element grip, and wherein the locking element comprises an activation element associated with the control-element grip, or reachable by a hand gripping the control-element grip.

4. A fastening tool according to any of the preceding claims, wherein the support structure protrudes in the driving direction behind the press-on face.

5. A fastening tool according to claim 4, wherein the support structure comprises a support element for clasping the workpiece.

6. A fastening tool according to claim 5, wherein the support element comprises a support face supporting the workpiece against the driving direction during driving a fastening element into the workpiece.

7. A fastening tool according to claim 6, wherein the support structure comprises a support protrusion for engaging the workpiece, or a depression in the workpiece, and wherein the support face is arranged on the support protrusion.

8. A fastening tool according to any of the preceding claims, wherein in the first position, the control element locates the support structure in the closed position, and/or in the second position, the control element locates the support structure in the open position.

9. A fastening tool according to claim 8, wherein the support structure comprises a support-structure spring biasing the support structure against the driving direction with respect to the housing when the support structure is in the closed position.

10. A fastening tool according to any of the preceding claims, wherein the control element is mounted on the housing.

11. A fastening tool according to claim 10, wherein the control element comprises a first lever hinged to the housing.

12. A fastening tool according to any of the preceding claims, wherein the locking element is mounted on the control element.

13. A fastening tool according to claim 12, wherein the control element comprises a guide guiding a movement, or linear movement, of the locking element between the locking position and the clearance position.

14. A fastening tool according to any of the preceding claims, wherein the locking element is mounted on the housing, or comprises a second lever hinged to the housing.

15. A fastening tool according to any of the preceding claims, wherein the press-on element is displaceable up to a pressed-on position, wherein the press-on element releases a driving-in operation of the fastening tool if the press-on element is in the pressed-

on position, and wherein the press-on element prevents a driving-in operation of the fastening tool if the press-on element is out of the pressed-on position.

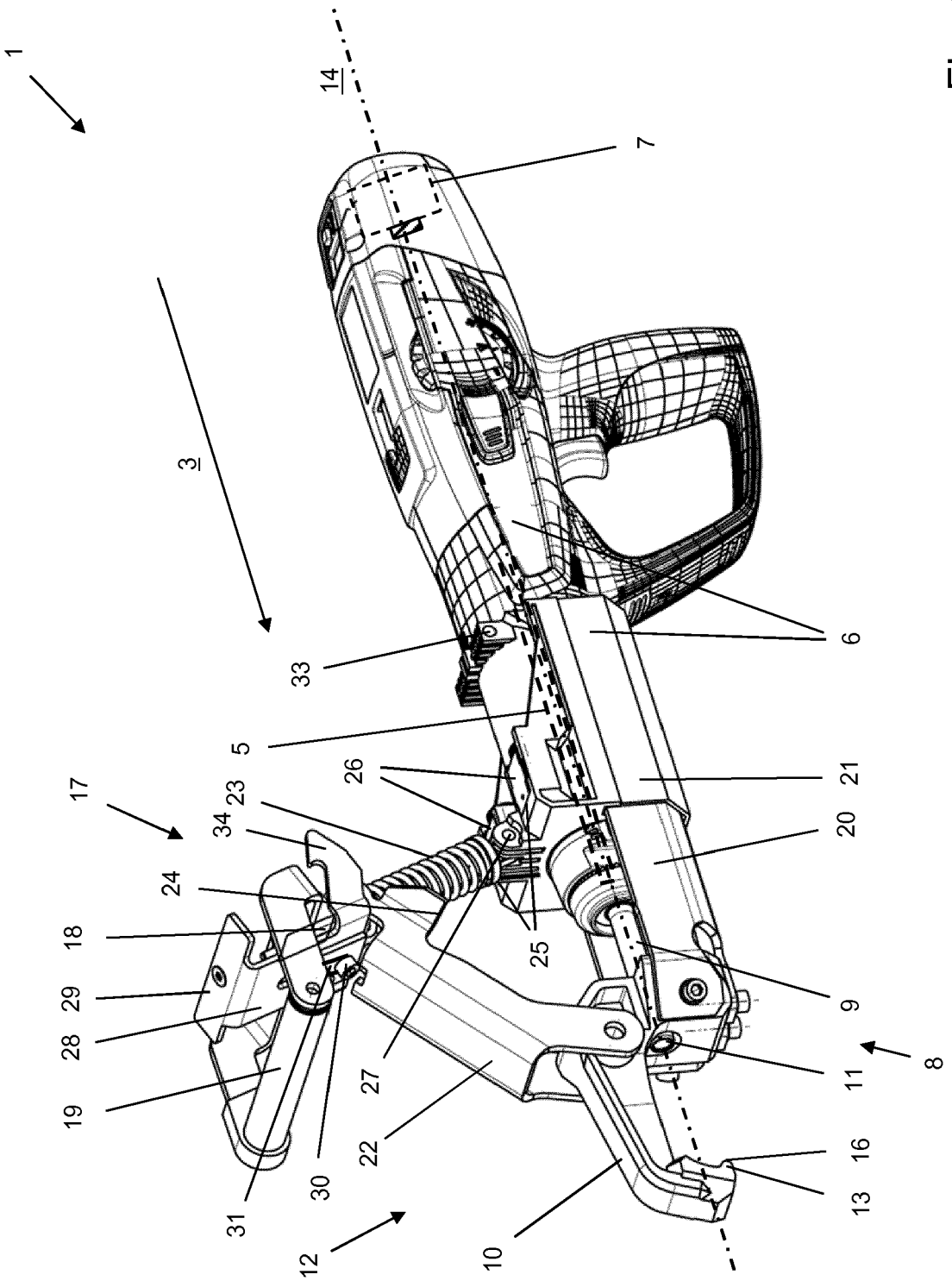
1
14
7
3
33
6
5
26
21
17
23
34
20
24
18
25
29
9
28
8
27
11
19
22
16
30
13
31
12
10

Fig. 1

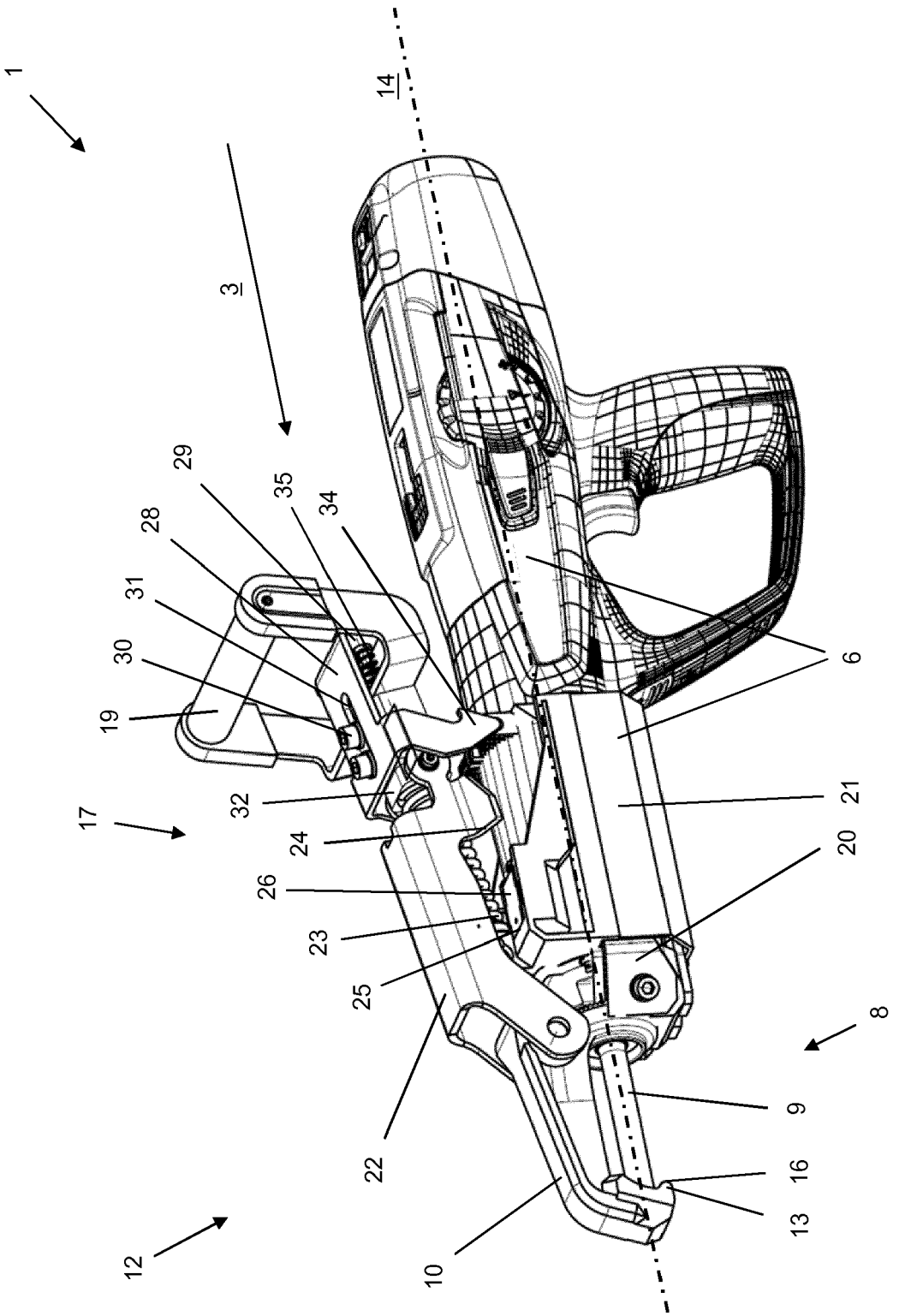

Fig. 2

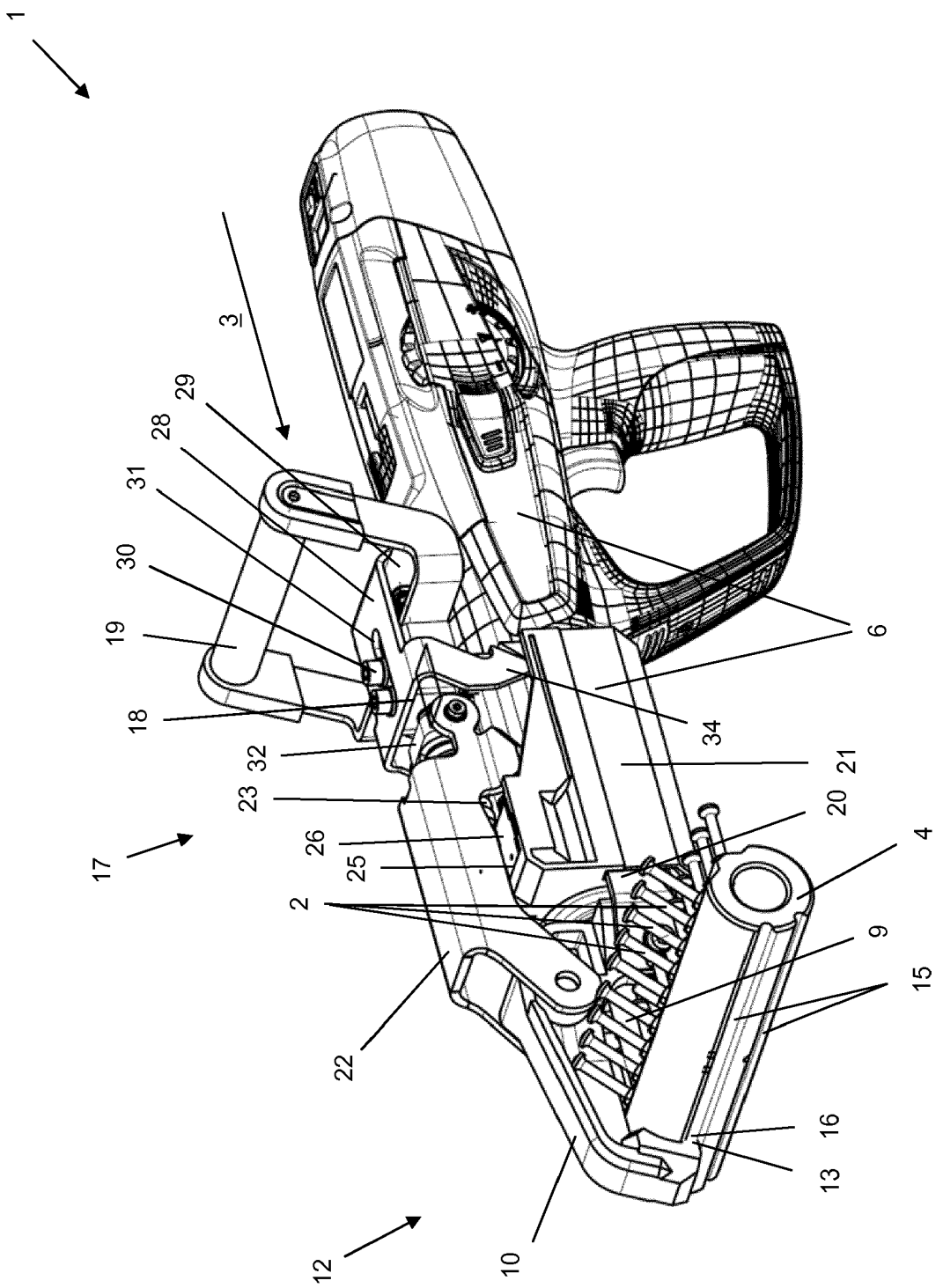

Fig. 3

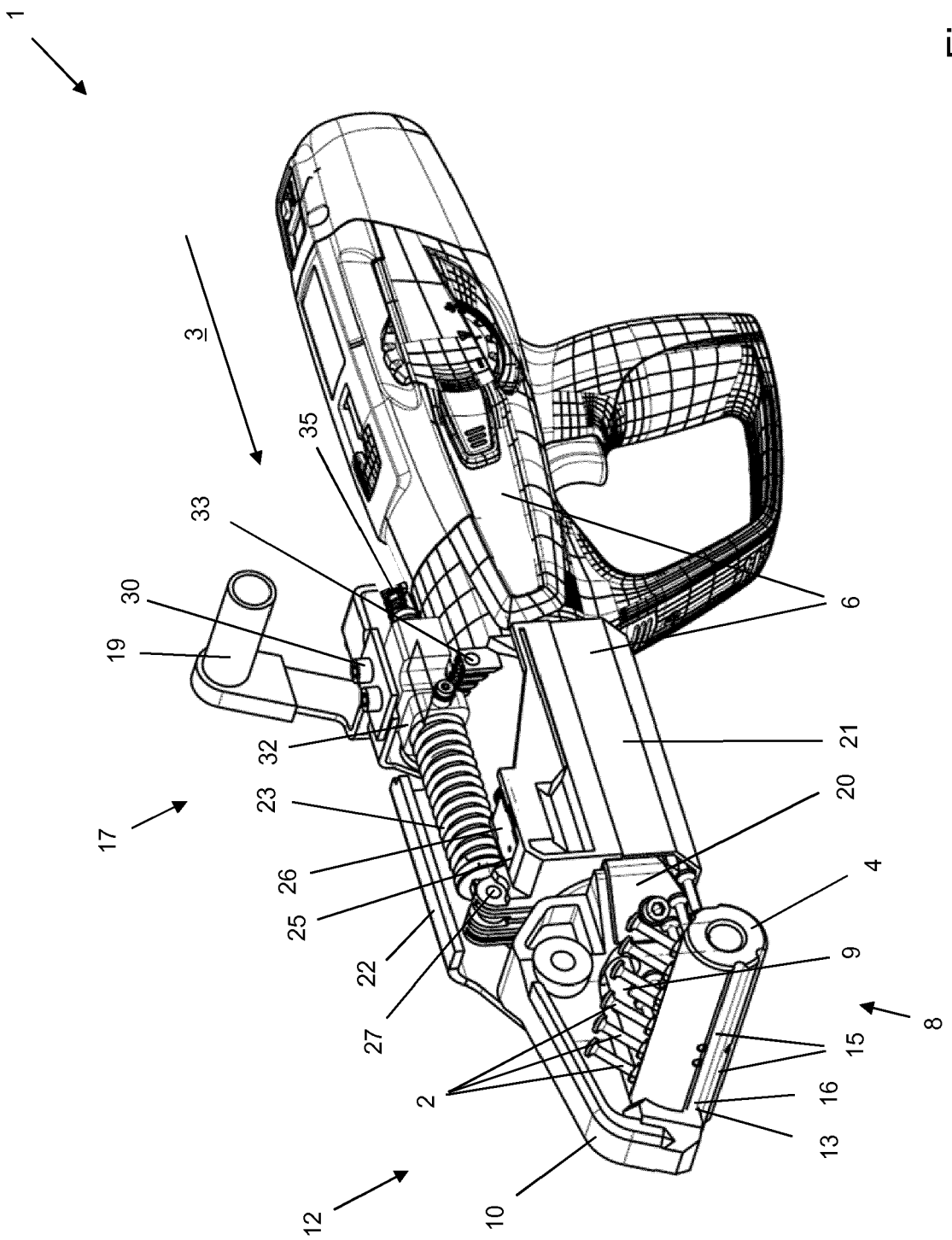

Fig. 4

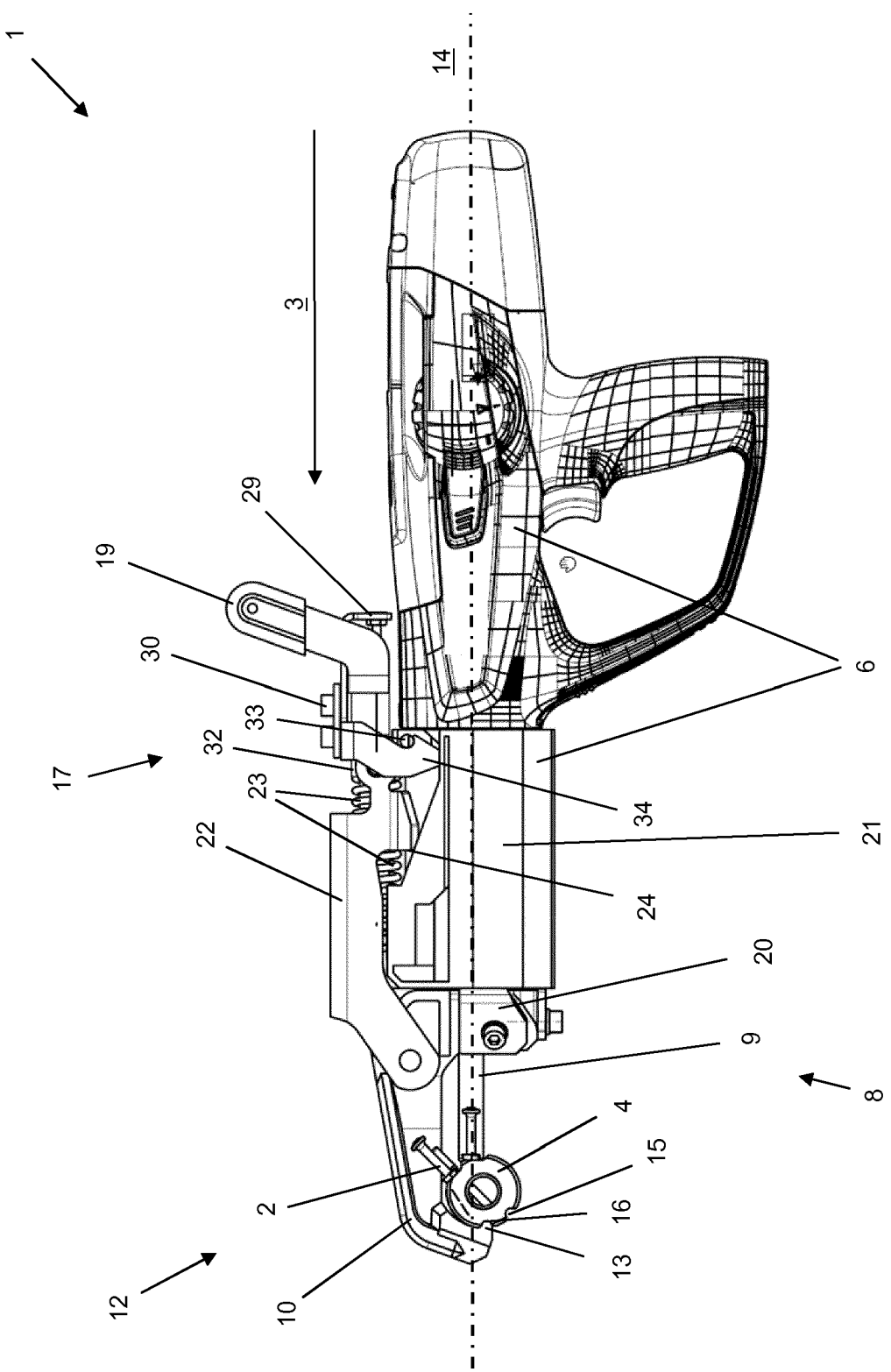

Fig. 5

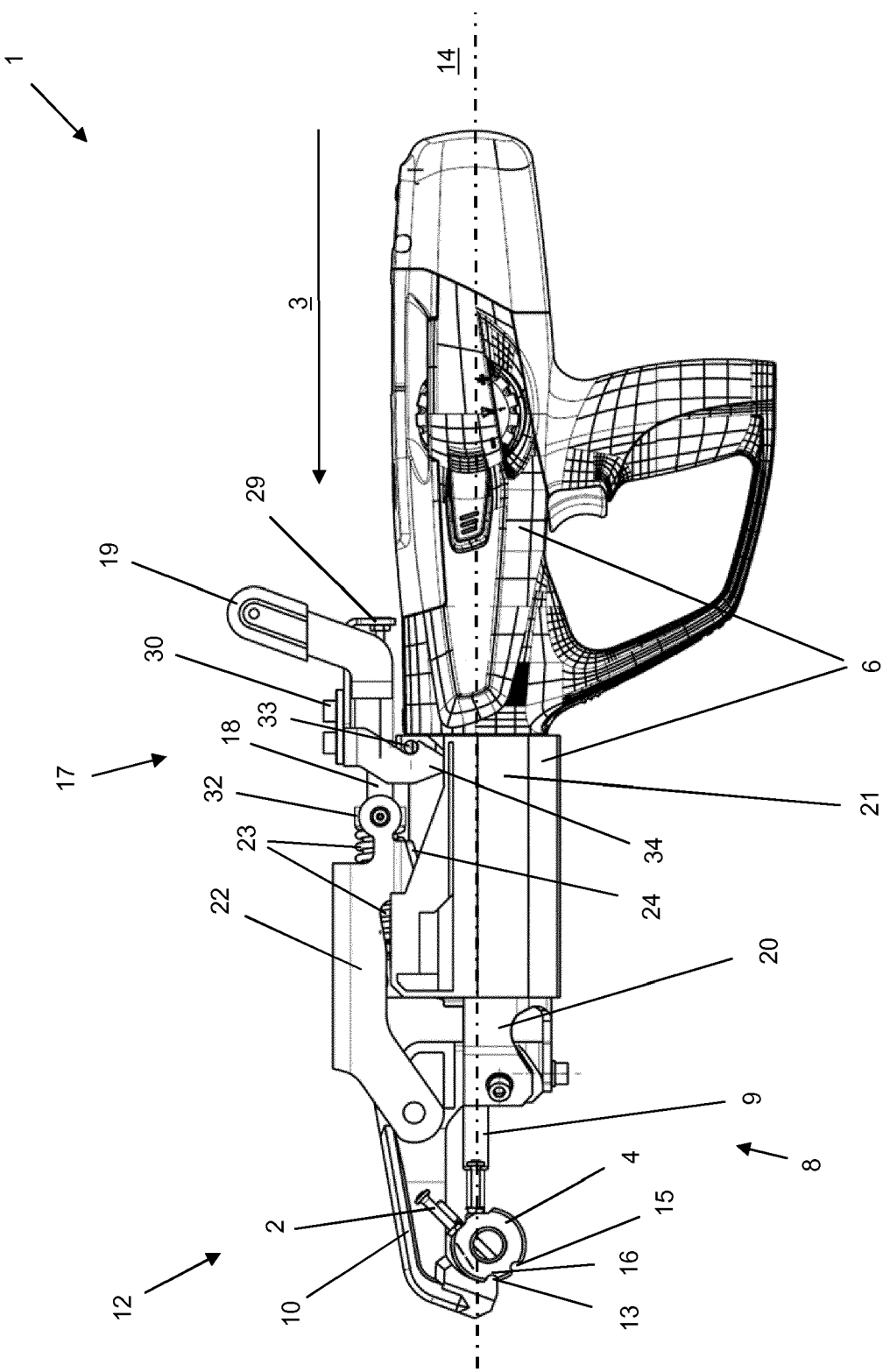

Fig. 6

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 21 3400

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
E	EP 3 666 471 A1 (HILTI AG [LI]) 17 June 2020 (2020-06-17) * paragraphs [0015], [0016], [0019], [0021], [0022] * * figures 1-5 *	1-8, 10-15	INV. B25C7/00
A	US 2014/131414 A1 (GARCIA RICARDO M [US] ET AL) 15 May 2014 (2014-05-15) * paragraphs [0025], [0027], [0029], [0031], [0040] * * figures 1-3 *	9	
A	US 2017/297188 A1 (HUANG WEN-SHENG [TW] ET AL) 19 October 2017 (2017-10-19) * paragraphs [0035], [0042] * * figures 1,3 *	1	

TECHNICAL FIELDS SEARCHED (IPC)

B25C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 June 2020	Bonnin, David

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 19 21 3400

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.

17-06-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3666471 A1	17-06-2020	NONE	
US 2014131414 A1	15-05-2014	NONE	
US 2017297188 A1	19-10-2017	NONE	

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

- WO 2018048315 A1 **[0002]**