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(54) **FASTENING TOOL**

(57) A fastening tool (1) for driving fastening elements (2) in a driving direction (3) into a workpiece (4), comprising a housing (6) and a press-on element (8) having a press-on face, wherein the press-on element is displaceable with respect to the housing (6) against the driving direction (3) when the fastening tool (1) is pressed against the workpiece (4) in the driving direction (3), the fastening tool (1) further comprising a support structure (12) mounted to the housing (6) and extending in the driving direction (3) along the press-on element (8), wherein the support structure (12) is displaceable with respect to the housing (6) between a closed position, an open position and a release position, and wherein the support structure (12) is removable from the housing (6) from the release position.

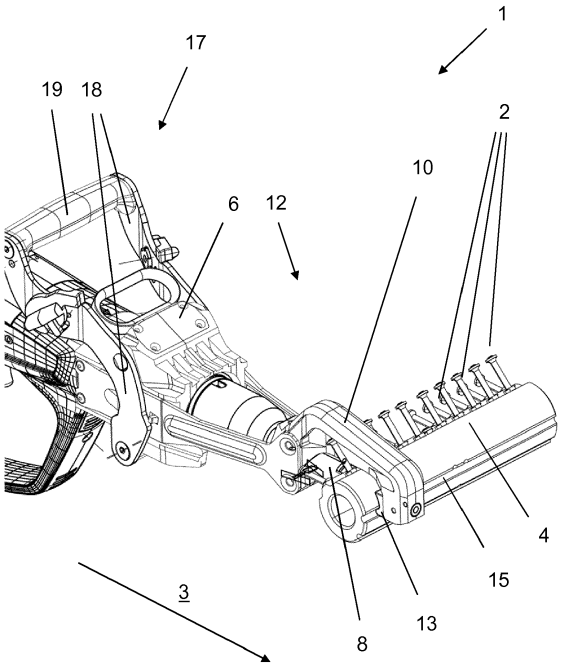

Fig. 1

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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 dimensional size. If a fastening tool provides for support of the workpiece, it may be an object to accommodate workpieces of different sizes within the same tool. It should also be appreciated that there are applications when the workpieces have different cross-sectional area, different shape, or different grades of material.

[0005] Another constraint with workpiece support relates to obstruction. If a fastening tool provides for support of the workpiece, it may employ some support structure arranged in front of a tool nose. Such a support structure could reduce accessibility of an area of the tool nose and make handling the fastening tool more difficult. It should also be appreciated that there are applications when the tool nose needs to be removed from the remaining fastening tool, such as replacing the driving element or other maintenance or repair work.

[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, an open position and a release position, and wherein the support structure is removable from the housing from the release position.

[0008] In a 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.

[0009] In another preferred embodiment, the fastening tool comprises a control element for controlling movement of the support structure with respect to the housing. In an even more 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 comprises a lever hinged to the housing.

[0010] 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 grip.

[0011] In another preferred embodiment, the fastening tool comprises a locking element which has a locking position and a clearance position, wherein the locking element prevents the control element from moving into the release position if the locking element is in the locking position, and wherein the locking element allows movement of the control element into the release position if the locking element is in the clearance position. In an even more preferred embodiment, the locking element engages the stop element in the locking position, wherein the locking element passes by the stop element in the clearance position. In an even more preferred embodiment, the locking element is arranged on the control element, and the stop element is arranged on the support structure. In an alternative embodiment, the locking element is arranged on the support structure, and the stop element is arranged on the control element.

[0012] In another preferred embodiment, the engagement element comprises the stop element. In another preferred embodiment, the locking element is manually movable between the locking position and the clearance position. 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.

[0013] 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

[0014] 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 and a workpiece supported by the support structure,

Fig. 2 illustrates the fastening tool of Fig. 1 with the support structure in a closed position,

Fig. 3 illustrates the fastening tool of Fig. 1 with the support structure in the closed position in a side-view,

Fig. 4 illustrates the fastening tool of Fig. 1 with the support structure in an open position,

Fig. 5 illustrates the fastening tool of Fig. 1 with the support structure in the open position in a side-view,

Fig. 6 illustrates the fastening tool of Fig. 1 with the support structure in a release position, and

Fig. 7 illustrates the fastening tool of Fig. 1 with the support structure in the release position in a side-view.

DETAILED DESCRIPTION

[0015] Figs. 1, 2, 3, 4, 5, 6 and 7 show a fastening tool 1 for driving fastening elements 2 along a setting axis 14 in a driving direction 3 into a workpiece 4. 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 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 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.

[0016] 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 Fig. 1. 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, 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.

[0017] In not-shown embodiments, the fastening tool comprises a separate guide channel extending along the press-on element in the driving direction.

[0018] 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 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 not-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.

[0019] 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.

[0020] 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 carriage 20, 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. 2 and 3), 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 Fig. 1. In the open position of the support structure 12 (Figs. 4 and 5), 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. 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 (Figs. 6 and 7), 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.

[0021] 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 two levers 18 hinged to the housing 6, and a grip 19. The control element 17 has a first position (Figs. 2 and 3) in which the control element 17 locates the support structure 12 in the closed position, a second position (Figs. 4 and 5) in which the control element 17 locates the support structure 12 in the open position, and a release position (Figs. 6 and 7) in which the control element 17 releases the support structure 12 to be removed from the housing 6. In order to displace the support structure 12 between the closed position and the open position by movement of the control element 17, the fastening tool comprises a compulsory guide 22. The compulsory guide 22 comprises a control arm 23, e.g. comprised by the lever 18, and two guide elements 24, e.g. comprised by the support structure 12. The guide elements 24 engage the control arm 23 such that movement of the control arm 23 causes movement of the guide elements 24. In not-shown embodiments, the support structure comprises the control arm, and the guide element comprises the guide element.

[0022] The fastening tool 1 further comprises a locking element 25 which has a locking position and a clearance position. The locking element 25 comprises a latch 26 for latching in the locking position and/or the clearance position. In the locking position (Fig. 5), the locking element 25 engages a stop element which, in the present embodiment, is arranged on the support structure and e. g. comprised by one of the guide elements. The locking element 25 thus prevents the control element 17 from moving into the release position if the locking element 25 is in the locking position. In not-shown embodiments, the locking element is arranged on the support structure, and the stop element is arranged on the control element. In the clearance position (Fig. 7), the locking element 25 may pass by the stop element, thus allowing movement of the control element 17 into the release position. If the locking element 25 is manually movable between the locking position and the clearance position, a user is able to remove, without the need of a tool, the support structure 12 and then the press-on element 8 from the remaining fastening tool 1, e.g. for replacing the driver 5 or a component of the driving device 7.

[0023] 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, 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 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. 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 fastening tool 1 is now ready to drive the fastening element 2, which is now arranged within the guide channel 9, into the workpiece 4. 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 posi-

tion.

[0024] In order to access the press-on element 8, such as for removing it from the remaining fastening tool 1, the locking element 25 is turned clock-wise in Fig. 5 to its clearance position. The control element 17 is then pushed further forward in the driving direction 3 to its release position. Since the guide elements 24 do not engage the control arms 18 anymore, the support structure 12 can be further displaced in the driving direction 3 with respect to the housing 6 until it is completely removed from the housing 6. In order to mount the support structure 12 to the housing 6 later, it is attached on the housing 6 such that the carriage 20 slides rearward against the driving direction 3 in the track 21 until the control arms 18 abut on the guide elements 24 as shown in Fig. 6. Then, the locking element 25 is turned to its locking position and the control element 17 is pulled back to its open position. The fastening tool 1 is now ready to be pressed on a workpiece 4.

[0025] The foregoing description of exemplary embodiments of the invention have 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, an open position and a release position, and wherein the support structure is removable from the housing from the release position.

2. A fastening tool according to claim 1, wherein the support structure protrudes in the driving direction behind the press-on face.

3. A fastening tool according to claim 2, wherein the support structure comprises a support element for clasping the workpiece.

4. A fastening tool according to claim 3, wherein the support element comprises a support face supporting the workpiece against the driving direction during driving a fastening element into the workpiece.

5. A fastening tool according to claim 4, 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.

6. A fastening tool according to any of the preceding claims, wherein the support structure is displaceable in the driving direction with respect to the press-on element.

7. A fastening tool according to any of the preceding claims, further comprising a control element for controlling movement of the support structure with respect to the housing.

8. A fastening tool according to claim 7, wherein the control element has a first position in which the control element locates the support structure in the closed position, and/or a second position in which the control element locates the support structure in the open position, and/or a release position in which the control element releases the support structure to be removed from the housing.

9. A fastening tool according to any of claims 7 to 8 wherein the control element comprises a lever hinged to the housing.

10. A fastening tool according to any of claims 7 to 9, further comprising a compulsory guide for moving the support structure between the closed position and the open position by movement of the control element.

11. A fastening tool according to claim 10, wherein 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.

12. A fastening tool according to any of claims 7 to 11, further comprising a locking element which has a locking position and a clearance position, wherein the locking element prevents the control element from moving into the release position if the locking

element is in the locking position, and wherein the locking element allows movement of the control element into the release position if the locking element is in the clearance position.

13. A fastening tool according to claim 12, further comprising a stop element, wherein the locking element engages the stop element in the locking position, and wherein the locking element passes by the stop element in the clearance position.

14. A fastening tool according to claim 11, comprising a locking element as defined in any of claims 12 to 13, wherein the engagement element comprises the stop element.

15. A fastening tool according to any of claims 12 to 14, wherein the locking element is manually movable between the locking position and the clearance position.

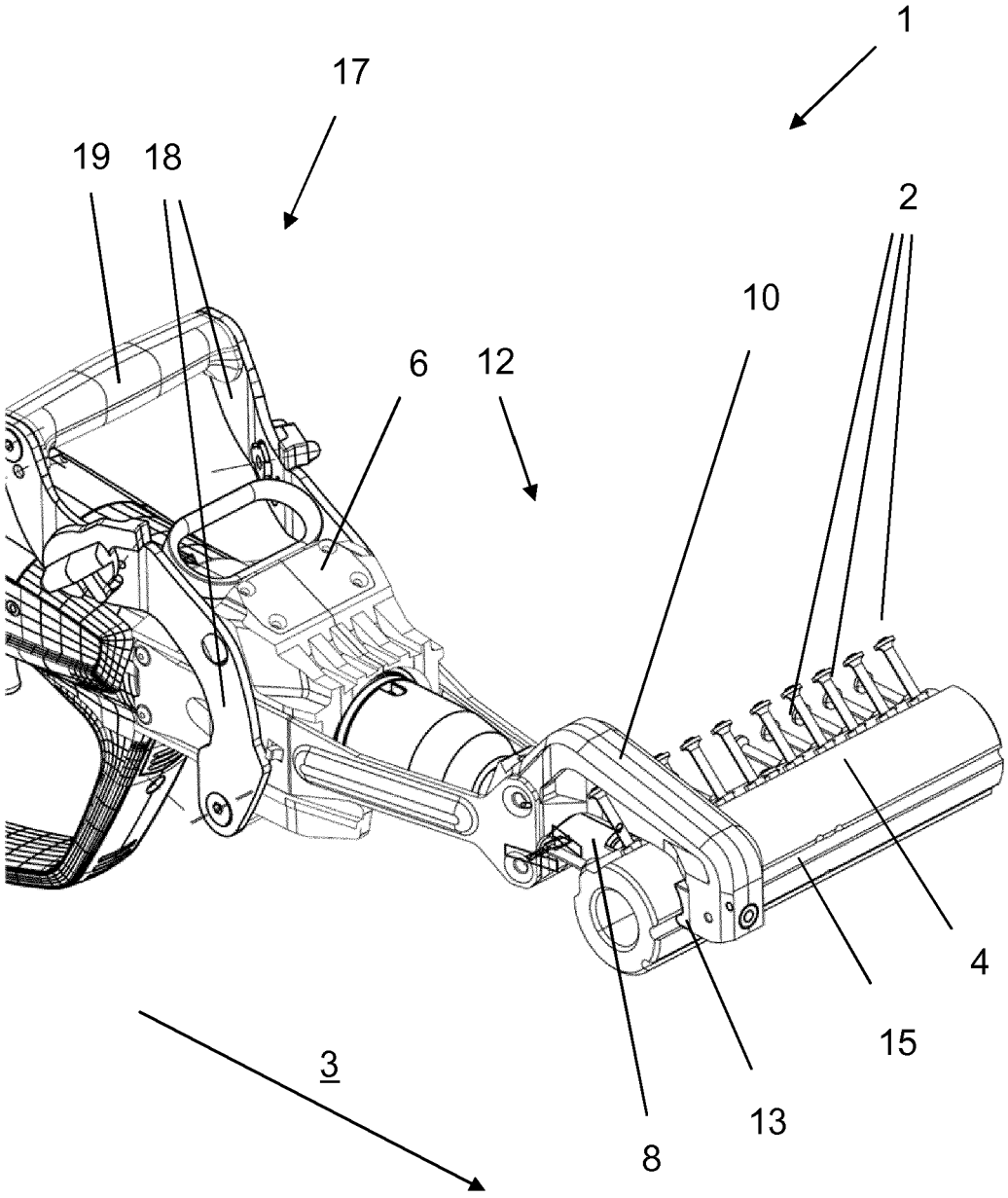

Fig. 1

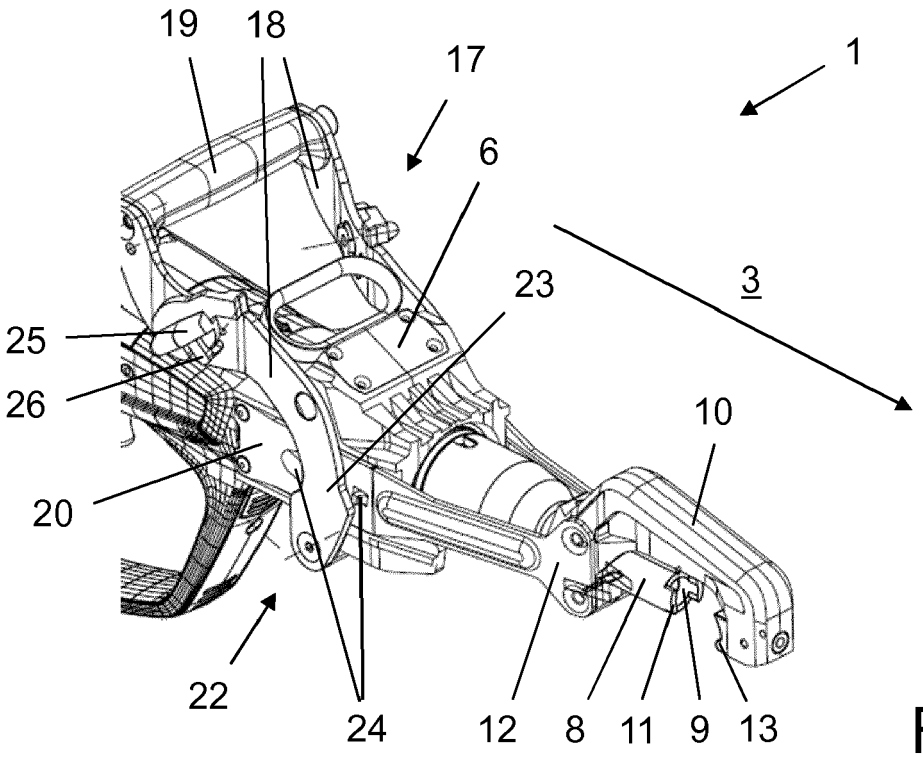
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Fig. 2

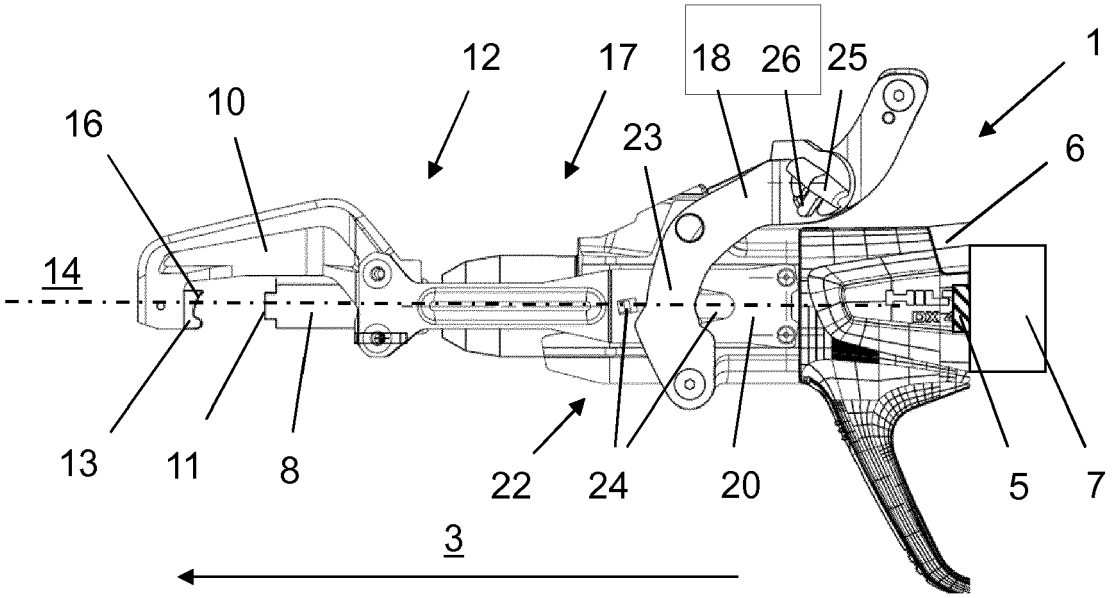
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Fig. 3

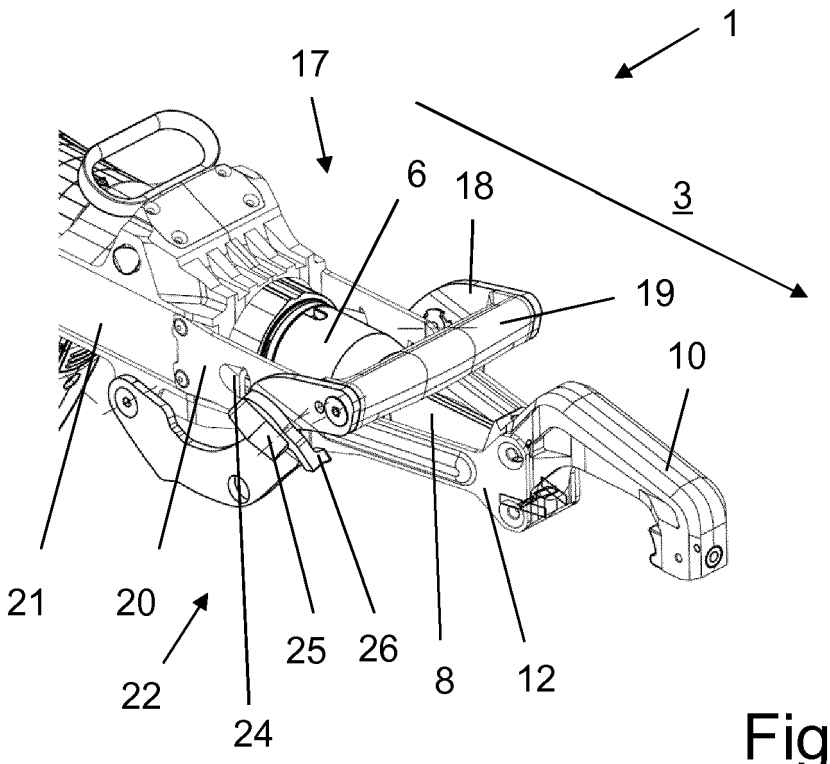
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Fig. 4

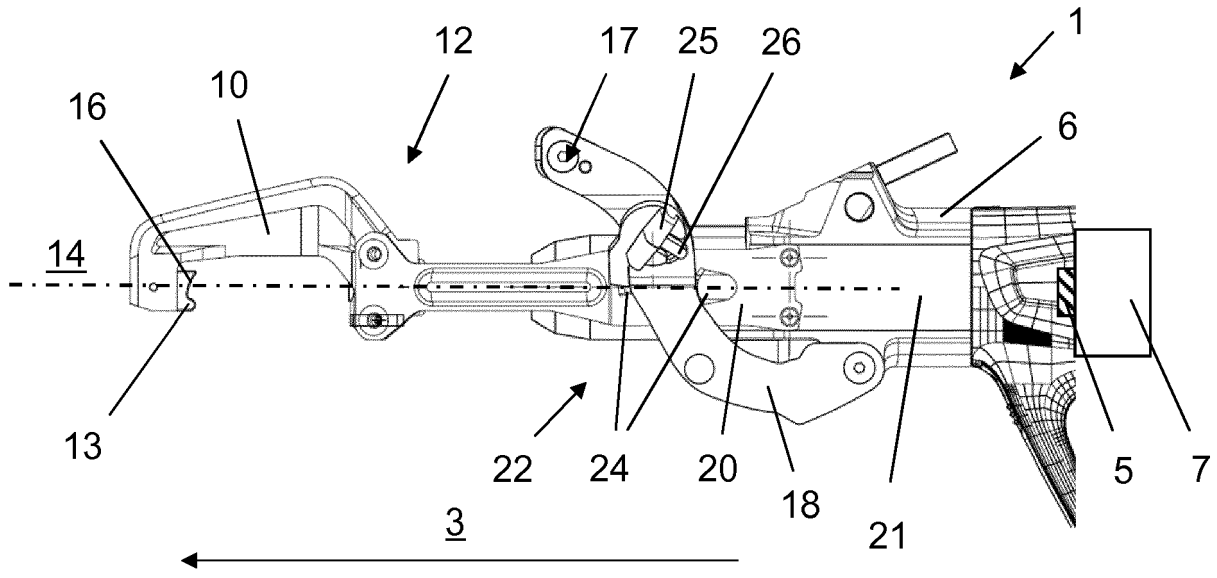
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Fig. 5

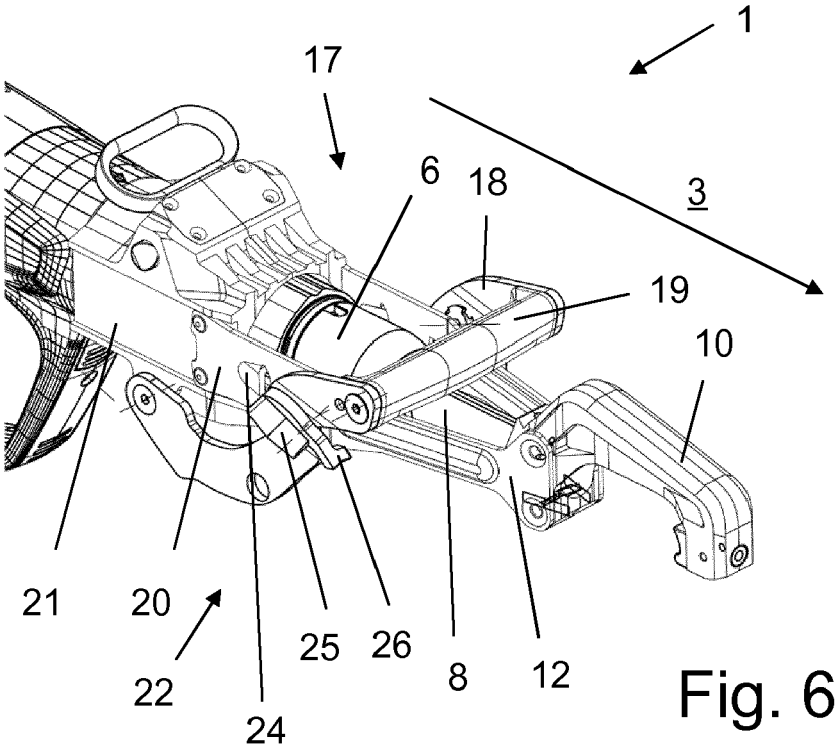
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Fig. 6

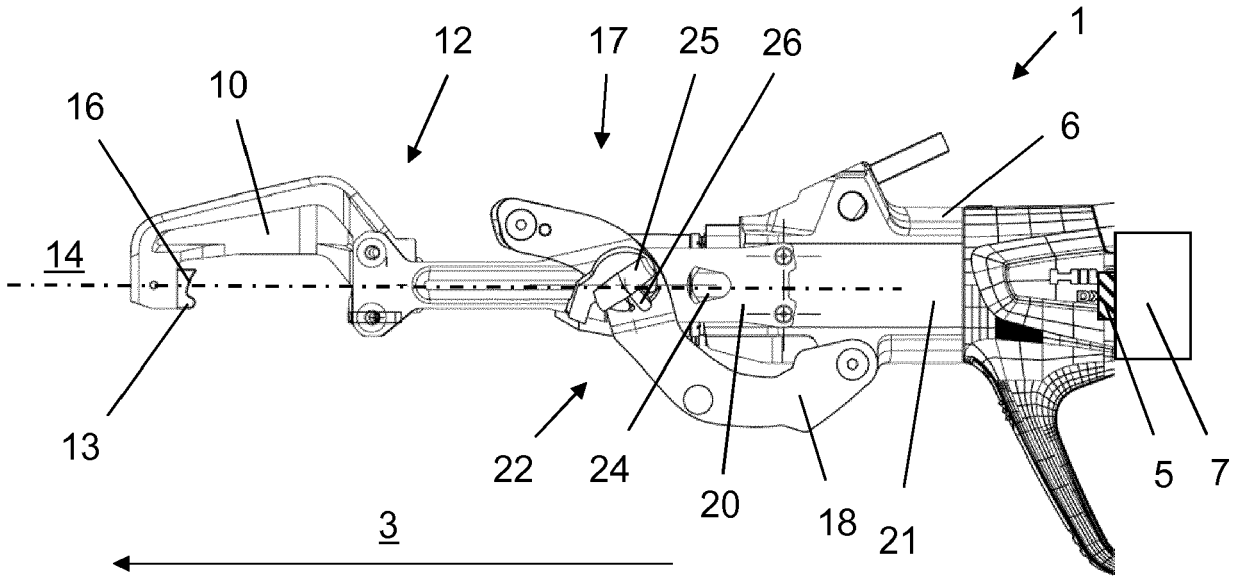
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Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 18 21 1960

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 2017/297188 A1 (HUANG WEN-SHENG [TW] ET AL) 19 October 2017 (2017-10-19) * paragraphs [0032], [0034], [0035] * * figures 1-3,5,6 * -----	1-11 12	INV. B25C7/00
A	US 2009/095789 A1 (GOSIS ANATOLY [US] ET AL) 16 April 2009 (2009-04-16) * paragraphs [0035] - [0039], [0042], [0046], [0048], [0063] * * figures 1,19-21 * -----	1	
A	EP 2 708 338 A2 (STANLEY FASTENING SYS LP [US]) 19 March 2014 (2014-03-19) * paragraphs [0014] - [0026] * * figures 2-5 * -----	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	9 July 2019	Bonnin, David

CATEGORY OF CITED DOCUMENTS

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