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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 (11), wherein the press-on element (8) 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 press-on extension element (20) extending in the driving direction (3) behind the press-on face (11), wherein the press-on extension element (20) is displaceable with respect to the press-on element (8) against the driving direction (3) when the fastening tool (1) is pressed against the workpiece (4) in the driving direction (3).

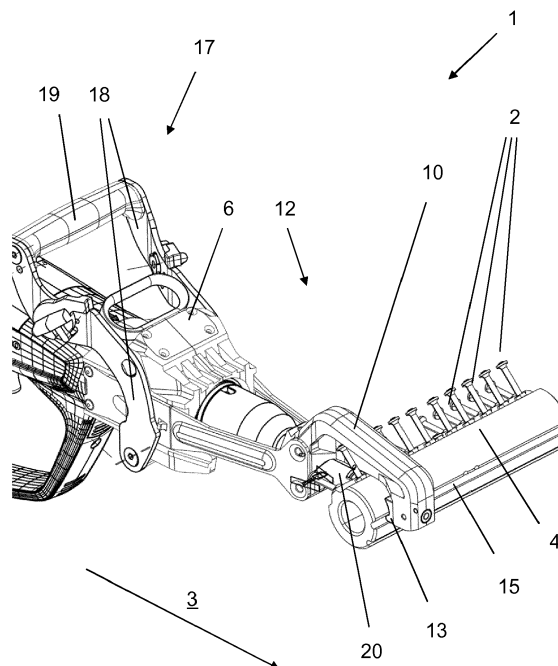


Fig. 1

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 press-on extension element extending in the driving direction behind the press-on face, wherein the press-on extension element is displaceable with respect to the press-on element against the driving direction when the fastening tool is pressed against the workpiece in the driving direction.

[0008] In a preferred embodiment, the fastening tool comprises a press-on spring biasing the press-on element in the driving direction with respect to the housing. In another preferred embodiment, the fastening tool comprises a press-on extension spring biasing the press-on extension element in the driving direction with respect to the press-on element. In an even more preferred embodiment, the press-on spring has a press-on spring stiffness, wherein the press-on extension spring has a press-on extension spring stiffness which is greater than the press-on spring stiffness.

[0009] In another preferred embodiment, the fastening tool comprises a support structure mounted to the housing and protruding in the driving direction behind the press-on face. In an even more preferred embodiment, the support structure is displaceable with respect to the housing between a closed position and an open position. In another preferred embodiment, the support structure comprises a support element for clamping 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.

[0010] In another preferred embodiment, the support structure is displaceable in the driving direction with respect to the press-on element. 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 comprises a lever hinged to the housing. In another preferred embodiment, the control element comprises a grip.

[0011] 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 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. In another preferred embodiment, the press-on extension element comprises a sleeve guided on the press-on element.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] 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, and

Fig. 2 illustrates the fastening tool and workpiece of Fig. 1 in a cross-sectional side-view.

DETAILED DESCRIPTION

[0013] Figs. 1 and 2 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 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 drawn 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.

[0014] 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. 1 and 2. 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. In not-shown embodiments, the fastening tool comprises a separate guide channel extending

along the press-on element in the driving direction.

[0015] 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.

[0016] 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 is displaceable in the driving direction 3 with respect to the housing 6 between a closed position and an open position. 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. 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.

[0017] The fastening tool 1 comprises a press-on extension element 20 extending in the driving direction 3 behind the press-on face 11 (not shown in Fig. 2) and comprising a sleeve 21 guided on the press-on element 8, and a flange 22. An extension press-on face 23 is formed as a front face of the press-on extension element 20 pointing in the driving direction 3. The press-on extension element 20 is displaceable with respect to the press-on element 8 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 comprises a press-on spring 24 biasing the press-on element 8 in the driving direction 3 with respect to the housing 6. To this end, a rear end of the press-on spring 24 bears against the housing 6 and a front end of the press-on spring 24 bears against the press-on element 8. The fastening tool 1 further comprises a press-on extension spring 25 biasing the press-on extension element 20 in the driving direction 3 with respect to the press-on element 8. To this end, a rear end of the press-on extension spring 24 bears against the press-on element 8 and a

front end of the press-on extension spring 24 bears against the press-on extension element 20, in particular the flange 22. A spring stiffness of the press-on extension spring 25 is greater than a spring stiffness of the press-on spring 24.

[0018] 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 and/or the press-on extension element 20 which then are put over a fastening element 2. Since the press-on extension element 20 extends in the driving direction 3 behind the press-on face 11 of the press-on element 8, the extension press-on face 23 abuts the workpiece 4 at first. The press-on extension element 20 is thus moved against the driving direction 3 with respect to the press-on element 8 against the press-on spring 24. Also, the press-on element 8 is moved against the driving direction 3 with respect to the housing 6 against the press-on extension spring 25. Since the press-on extension spring 25 has a greater spring stiffness than the press-on spring 24, the press-on spring 24 will be more compressed than the press-on extension spring 25. After the press-on spring 24 is completely compressed such that the press-on element 8 is in the pressed-on position, releasing a driving-in operation of the fastening tool 1, the press-on extension element 20 is further moved against the driving direction 3 until the support structure reaches its closed position (shown in Figs. 1 and 2). It is to be noted that now the press-on extension element 20 is pressed on the workpiece 4. Depending on a size, such as a diameter, of the workpiece 4, the press-on element 8 may also be pressed on the workpiece 4 (as shown in Fig. 2). In not-shown embodiments comprising a smaller workpiece than that shown in Figs. 1 and 2, only the press-on extension element 20 may be pressed on the workpiece. Therefore, it is to be understood that the press-on extension element 20 compensates for different sizes of workpieces. It ensures that the press-on element 8 will reach the pressed-on position for several different sizes of workpieces. 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 position.

[0019] 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.

5 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
10 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.

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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 press-on extension element extending in the driving direction behind the press-on face, wherein the press-on extension element is displaceable with respect to the press-on element against the driving direction when the fastening tool is pressed against the workpiece in the driving direction.
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2. A fastening tool according to claim 1, further comprising a press-on spring biasing the press-on element in the driving direction with respect to the housing.
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3. A fastening tool according to any of the preceding claims, further comprising a press-on extension spring biasing the press-on extension element in the driving direction with respect to the press-on element.
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4. A fastening tool according to claims 2 and 3, wherein the press-on spring has a press-on spring stiffness, and wherein the press-on extension spring has a press-on extension spring stiffness which is greater than the press-on spring stiffness.
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5. A fastening tool according to any of the preceding claims, further comprising a support structure mounted to the housing and protruding in the driving direction behind the press-on face.
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6. A fastening tool according to claim 5, wherein the support structure is displaceable with respect to the housing between a closed position and an open po-
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sition.

7. A fastening tool according to any of claims 5 to 6, wherein the support structure comprises a support element for clasping the workpiece. 5
8. A fastening tool according to claim 7, wherein the support element comprises a support face supporting the workpiece against the driving direction during driving a fastening element into the workpiece. 10
9. A fastening tool according to claim 8, 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. 15
10. A fastening tool according to any of claims 5 to 9, wherein the support structure is displaceable in the driving direction with respect to the press-on element. 20
11. A fastening tool according to any of claims 5 to 10, further comprising a control element for controlling movement of the support structure with respect to the housing. 25
12. A fastening tool according to claim 11, wherein the control element comprises a lever hinged to the housing. 30
13. A fastening tool according to any of claims 11 to 12, wherein the control element comprises a grip.
14. 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. 35
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15. A fastening tool according to any of the preceding claim, wherein the press-on extension element comprises a sleeve guided on the press-on element. 45

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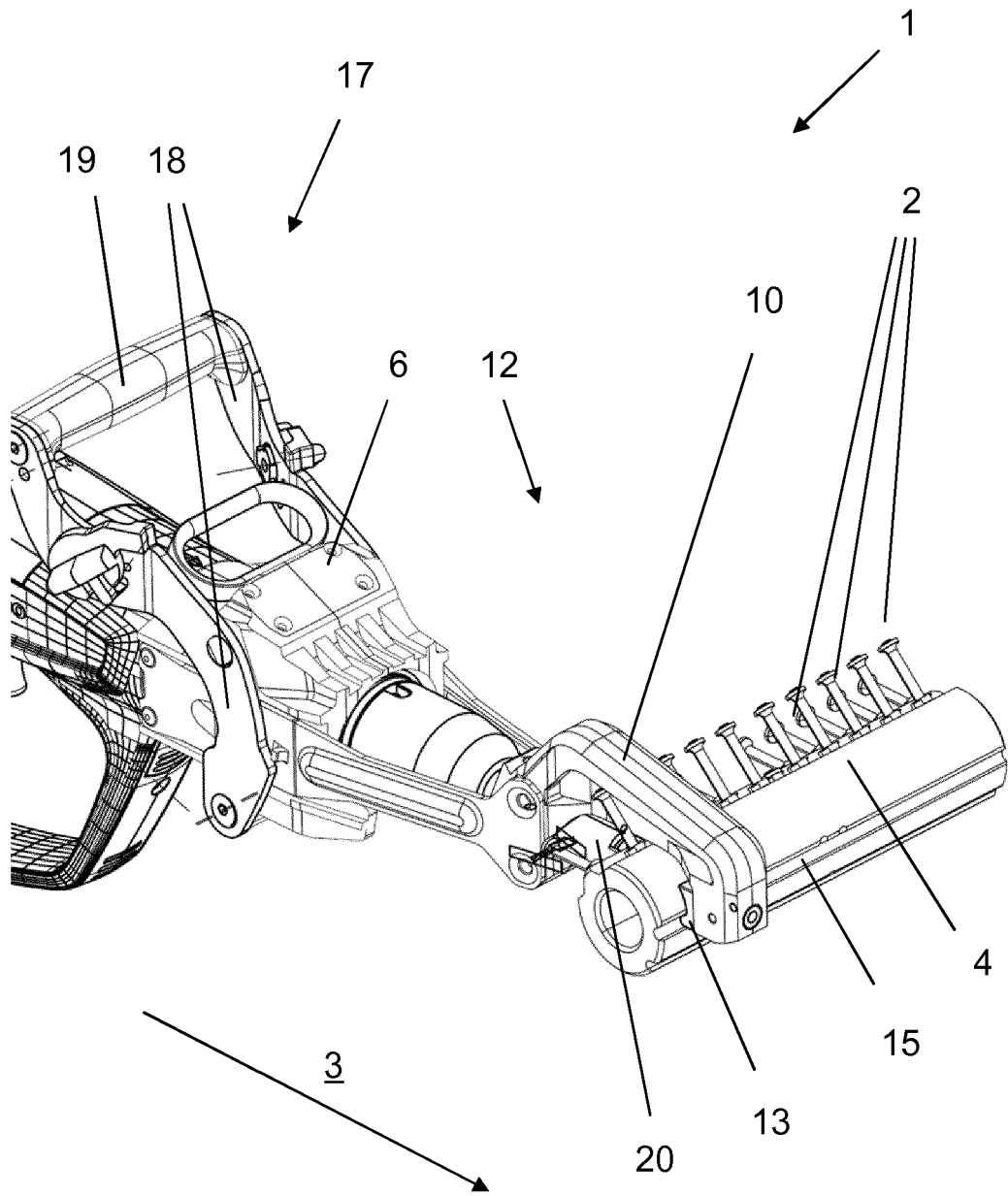


Fig. 1

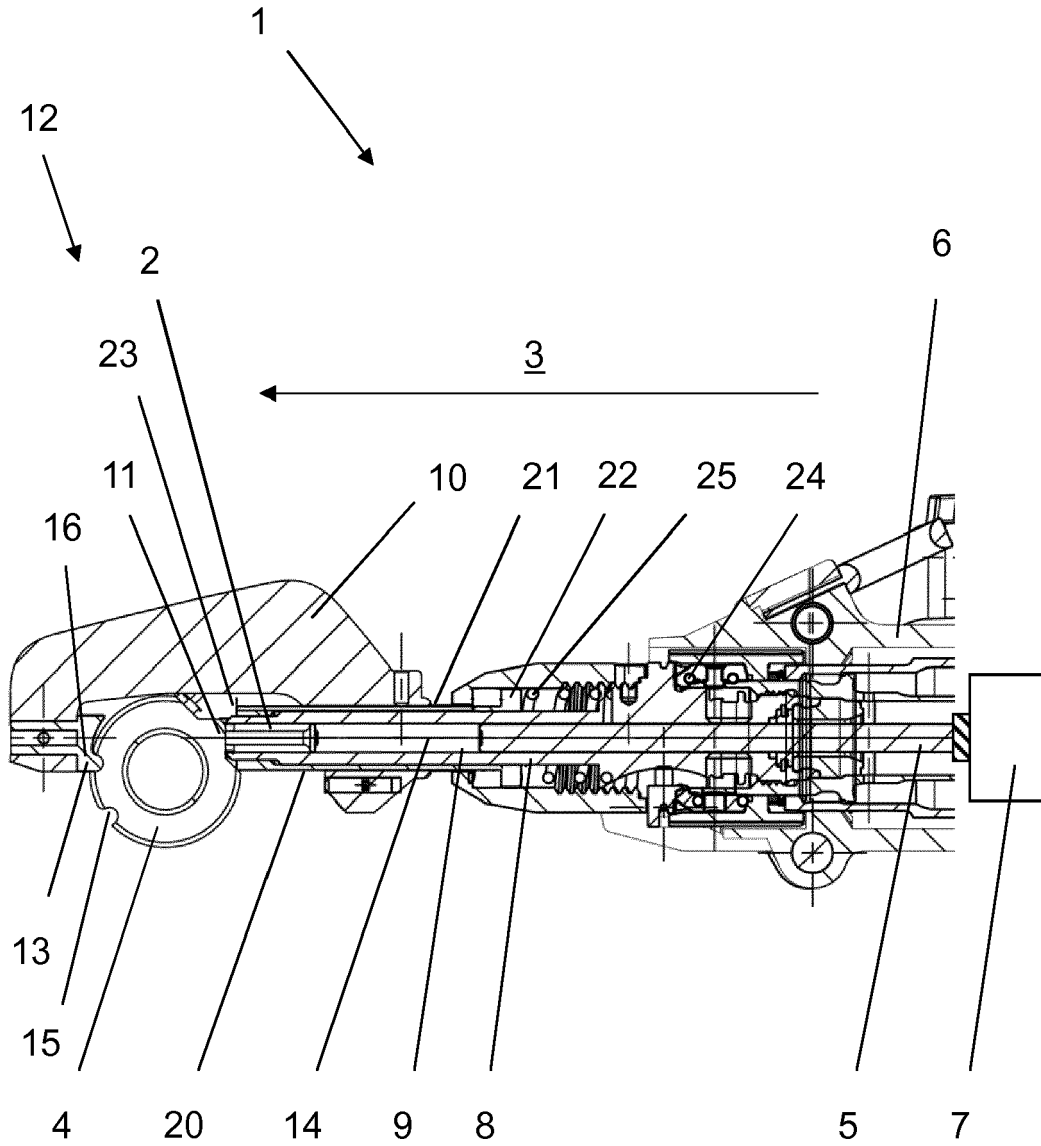


Fig. 2



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Application Number
EP 18 21 1930

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Y	* column 3, line 63 - column 4, line 57 * * column 5, line 8 - column 6, line 66 * * figures 1-5 *	5-14	
Y	----- 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 *	5-14	
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A	----- US 1 699 519 A (AMOS BROWN) 22 January 1929 (1929-01-22) * page 1, line 69 - page 2, line 71 * * figures 1,4 *	1-15	TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 4 October 2019	Examiner 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	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 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
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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