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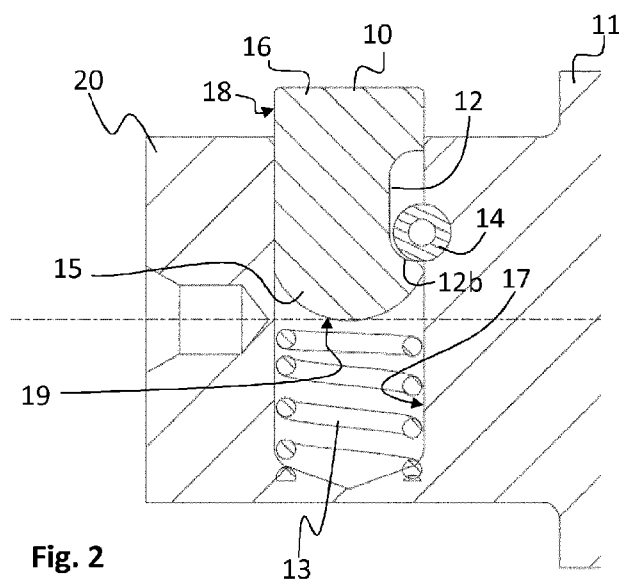
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(54) Title: CONNECTION PART AND POWER TOOL INCLUDING SUCH CONNECTION PART



(57) Abstract: A connection part (20) of a shaft (11) of a power tool for locking a socket to said shaft (11), which connection part has a cross sectional shape that is adapted to fit inside a socket and which comprises: a cylindrical bore (17); a spring element (13) arranged inside said cylindrical bore; and an elongate retainer (10) that is adapted to be arranged inside said cylindrical bore (17) against the action of the spring element (13), wherein the retainer (10) is adapted to be received in an opening in socket that is to be attached onto the connection part (20) of the shaft (11). The retainer (10) is reversible and has two active end parts (15,16) for locking said socket, wherein a first end part (15) has an inclined surface (19) for interaction with the socket so as to press the retainer into the bore (17) against the action of the spring element (13) and thereby allow the socket to slide past the retainer (10), and wherein a second end part (16) has a block portion (18) that prevents the socket from sliding past the retainer (10).

Connection part and power tool including such connection part

The invention relates to a connection part for locking a socket to a shaft of a power tool. Specifically, the invention relates to a connection part with a reversible retainer that may be used to allow rapid coupling of a socket, or if reversed, to allow a rigid connection to a socket for reliable long term connection. The invention also relates to a power tool comprising such a connection part.

10 Background

Power tools such as e.g. screw drivers or the like include an output shaft, which delivers a torque adapted to be delivered to e.g. a joint that is to be tightened. Normally, a socket or a bit holder is arranged on the output shaft for further connection to the screw or nut of the joint to be fastened.

Different types of arrangements exist for the connection between the output shaft and the socket. Generally these may be divided into two groups; a first group for easy coupling of a socket to the shaft, and a second group for a more rigid coupling which involves more interaction and which is intended for long term use of the same socket, i.e. for applications where the socket is seldom removed from the shaft.

A problem is that a tool with a shaft that is adapted for long term use of sockets may due to change of work operation be used in applications where the socket is exchanged at close intervals. In such a case it would be desirable to exchange the connection arrangement of the tool. However, the connection arrangement is often integrated in the shaft of the tool, which in turn is a solid part of the tool.

Hence, there is a need of a more flexible connection arrangement, which allows the operator to manipulate the connection portion such

that it may be adapted to either easy coupling or rigid coupling upon choice of the operator.

Summary of the invention

5 An object of the invention is to provide connection arrangement for connecting a socket to a shaft of a power tool, which arrangement may be adapted to either easy coupling or rigid coupling upon choice of the operator.

10 This object is achieved by the invention according to claim 1, which relates to a connection part of a shaft of a power tool for locking a socket to said shaft, which connection part has a cross sectional shape that is adapted to fit inside a socket and which comprises: a cylindrical bore; a spring element arranged inside said cylindrical bore; and an elongate retainer that is adapted to be arranged inside
15 said cylindrical bore against the action of the spring element, wherein the retainer is adapted to be received in an opening in the socket that is to be attached onto the connection part of the shaft. The retainer is reversible and has a first and a second end part for locking said socket, wherein a first end part has an inclined surface for interaction with the socket so as to press the retainer into the
20 bore against the action of the spring element and thereby allow the socket to slide past the retainer, and wherein a second end part has a block portion that prevents the socket from sliding past the retainer.

Other features and advantages of the invention will be apparent from the figures and from the detailed description of the shown embodiment.

25 Short description of the drawings

In the following detailed description reference is made to the accompanying drawings, of which:

Fig. 1 shows a sectional view of a first embodiment of a connection part according to the invention in a first mode;

Fig. 2 shows a sectional view of the first embodiment of the connection part according to the invention in a second mode;

Fig. 3 shows a sectional view of a second embodiment of the connection part according to the invention;

5 **Fig. 4** shows a perspective view of the connection part according to the second embodiment of the invention; and

Fig. 5 shows a perspective view of a connection part according to a third embodiment of the invention.

Detailed description of the shown embodiment of the invention

10 In fig. 1 a connection part 20 of a shaft 11 according to an embodiment of the invention is shown. The connection part 20 includes a cylindrical bore 17 in which a retainer 10 is arranged in order to lock a socket (not shown) to said shaft 11.

The socket to be arranged on the shaft 11 has a shape that allows it
15 to fit tightly outside the shaft 11. Often the shaft 11 and the socket have a quadratic cross section, but it may just as well have a cross section that is rectangular, hexagonal, star shaped or the like. The socket comprises an opening through one of its sides for receiving the retainer 10. Once the socket is located on the shaft and the retainer
20 10 has been introduced into said opening the socket will be locked to the shaft 11.

The retainer 10 has a cylindrical shape and is adapted to be inserted into the cylindrical bore 17 against the action of a spring element 13 that is arranged in a bottom part of the bore 17. The spring element
25 may be any kind of spring that provides a spring action, such as e.g. a leaf spring, a tubular spring, a spiral spring, or even a spongy material. In the shown embodiment the retainer includes a groove 12 along one of its sides for interaction with a pin 14 that is insertable into a part of said cylindrical bore. The pin 14 may be
30 manipulated from one side of the shaft (not shown), such that it may

be withdrawn from the cylindrical bore 17. When the pin 14 is removed from the cylindrical bore 17 the retainer 10 will be free to move in and out of the cylindrical bore 17.

As an alternative to the shown groove 12 several grooves may be
5 arranged around the periphery of the retainer 10, or a groove that runs all around the width of the retainer 10 as waist may be arranged. The groove is arranged to allow a certain translational movement of the retainer 10 with respect to the pin 14 in and out of the
10 cylindrical bore 17 in the shaft 11 of the power tool. As is apparent from the figures the length of the groove 12 is about twice as long as the width of the pin 14.

The retainer 10 according to the shown embodiment of the invention has two active ends 15,16 for locking said socket, wherein a first end 15 has an inclined surface 19 for easy removal of the socket, and wherein
15 a second end 16 has a cylindrical block portion 18 that provides a rigid coupling when connected to the opening in the socket.

The groove 12 is arranged to allow the retainer 10 to be completely contained inside the cylindrical bore 17. The spring element 13 is arranged to be in contact with one of the end parts 15,16 of the
20 retainer 10 so as to push the retainer 10 outwards such that the opposite end part 16,15 thereof reaches out of the bore 17 as a result of the spring action.

In figure 1, the retainer 10 is shown in a first operational mode, in which the first end 15 of the retainer 10, which has an inclined
25 surface 19, extends out of the cylindrical bore 17 of the shaft 11. In this first operational mode, the socket may be translated in and out of connection with the shaft 11 without manipulation of the retainer 10. The inclined surface 19 of the first end 15 will make sure that the retainer 10 will be pushed downwards against the action of the
30 spring element 13 as a result of that the socket will come in contact with the inclined surface 19. In order for this to function it is preferred that the whole of the portion that extends out of the

cylindrical bore 17 is rounded. Hence, the extension of the groove 12 is such that no part of the cylindrical portion extends out of the cylindrical bore 17. In a preferred embodiment, the inclined surface 19 is a rounded surface. It may for instance have a convex or a spherical shape.

In figure 2, the retainer 10 is shown in a second operational mode, in which the second end 16 of the retainer 10, which comprises a block portion 18, extends out of the cylindrical bore 17 of the shaft 11. In this second operational mode, the socket may not be translated in and out of connection with the shaft 11 without manipulation of the retainer 10. Instead, in this operational mode the retainer 10 needs to be pushed downwards in order to allow for the socket to be translated in and out of position on the shaft 11. The retainer 10 may be manipulated from the outside, e.g. by pushing it further into the bore 17. This may be done by means of pin that may be introduced through the opening in the socket or outside of the socket depending on the current position of the socket. The block portion 18 of the retainer 10 will interact with a surface, preferably a flat surface, of the socket, which will block the socket from moving past the retainer 10. In the shown embodiment the block portion 18 comprises a cylindrical extension portion of the body of the retainer 10 that extends outside of the cylindrical bore 17. The block portion 18 may however consist of any shape that blocks the socket with respect to the socket.

In the shown embodiment the groove 12 is asymmetrically arranged with respect to the extension of the retainer 10. Namely, the extension of the groove is such that a distance between a first stop 12a (see fig. 1) of the groove 12 and the second end part 16 is greater than a distance between an opposite second stop 12b (see fig. 2) of the groove 12 and the first end part 15. This asymmetry results in that the second end 16 of the retainer 10 will be allowed to extend a little bit further out of the cylindrical bore 17 than the first end 15. This results in an even more secure locking of the socket to the

shaft 11 in the second mode of operation of the retainer 10, i.e. when the second end 16 thereof is arranged towards the opening of cylindrical bore 17.

Figure 3 shows a sectional view of a second embodiment of the retainer 10 mounted inside the cylindrical bore 17 of the shaft 11. In the figure the retainer is positioned such that the second end 16 extends out of the cylindrical bore 17. The first end 15, which is identical to the rounded first end 15 of the first embodiment, is in contact with the spring element 13.

The second end 16 of the second embodiment has a block portion 18 of a smaller diameter compared to the rest of the retainer 10 and to the block portion 18 of the first embodiment. The smaller block portion 18 is advantageous in that it minimizes the risk of contact between the retainer and the bore of the socket arranged on the connection part 20. Namely, as the connection part 20 and/or the socket which is to be connected to the connection part 20 of the output shaft 11 is exposed to wear a gap may form between the pieces such that they may tilt with respect to each other. If this gap becomes bigger than the allowance between the retainer 10 and through hole of the socket the retainer 10 may be exposed to the forces acting between the connection part 20 and the socket. In a worst case scenario such forces may cause a rupture of the retainer 10.

In figure 4 the second embodiment of the retainer 10 is shown in a perspective view. In this view a bore 21 is shown, which is provided to house the pin 14 that holds the retainer 10 in place. As is visible in figure 4 the block portion 18 of the second embodiment has a circular cross section of a smaller diameter than the diameter of the main portion of the retainer, which is adapted to fit tightly inside the cylindrical bore 17 of the shaft 11. Further, the block portion 18 is co-axially located with respect to the body portion of the retainer 10 and hence extends from the centre of it.

Figure 5 shows a third embodiment of the retainer 10 in a perspective view. This third embodiment differs from the two other embodiments in that the block portion 18 has an elongate shape, comprising two mutually opposed short ends 22 and two mutually opposed elongate sides 23. The elongate shape is such oriented that there will be an allowance between the elongate sides 23 and the through hole of the socket in the lateral direction such that they will be allowed to rotate slightly with respect to each other without risking contact between the retainer 10 and the through hole of the socket. The short ends 22 of the elongate block portion 18 will however make sure that there is none or only a small gap in the axial direction. This tight fitting will effectively block the block portion 18 and the through hole of the socket from mutual longitudinal movement. This is advantageous as it makes sure that the socket will not move in the axial direction with respect to the shaft 11.

In the shown embodiment the block portion 18 has an oval or elliptical shape. A similar effect could however be achieved with any type of elongate shape.

In order to make sure that the retainer will be correctly positioned inside the cylindrical bore 17 of the shaft 11 the grooves 12 only extend along one side, or possibly two opposed sides, of the retainer 10. Thus, the retainer 10 may only be fixed in a position in which the elongate block portion will extend in the axial direction of the shaft 11.

Above, the invention has been described with reference to one specific embodiment. The invention is however not limited to this embodiment. It is obvious to a person skilled in the art that certain variation may be made within the scope of the invention, which is defined by the following claims.

Claims

1. A connection part (20) of a shaft (11) of a power tool for locking a socket to said shaft (11), which connection part (12) has a cross sectional shape that is adapted to fit inside a socket and which
5 comprises:

- a cylindrical bore (17);
- a spring element (13) arranged inside said cylindrical bore; and
- an elongate retainer (10) that is adapted to be arranged inside said cylindrical bore (17) against the action of the spring element
10 (13), wherein the retainer (10) is adapted to be received in an opening in socket that is to be attached onto the connection part (20) of the shaft (11), **characterised in** that the retainer (10) is reversible and has a first and a second end part (15,16) for locking said socket, wherein the first end part (15) has an inclined surface
15 (19) for interaction with the socket so as to press the retainer into the bore (17) against the action of the spring element (13) and thereby allow the socket to slide past the retainer (10), and wherein the second end part (16) has a block portion (18) that prevents the socket from sliding past the retainer (10).

20 2. The connection part (20) of claim 1, wherein the retainer (10) includes a groove (12) along at least one of its sides for interaction with a locking pin (14) that is insertable into a part of said cylindrical bore (17), and wherein the groove (12) is arranged to allow a certain translational movement of the retainer (10) with
25 respect to the locking pin (14) in and out of the cylindrical bore (17) in the shaft (11) of the power tool.

3. The connection part (20) of claim 2, wherein the groove (12) is arranged to allow the retainer (10) to be completely contained inside the cylindrical bore (17), and wherein the spring element (13) is
30 arranged to be in contact with one of the end parts (15,16) of the retainer (10) so as to push the retainer (10) such that the opposite end part (16,15) thereof reaches out of the bore (17).

4. The connection part (20) according to anyone of the preceding claims, wherein the extension of the groove (12) is such that a distance between a first stop (12a) of the groove (12) and the second end part (16) is greater than a distance between an opposite second stop (12b) of the groove (12) and the first end part (15), such that the second end part (16) of the retainer (10) will be allowed to extend a little bit further out from the cylindrical bore (17) than the first end part (15).

5. The connection part (20) according to anyone of the preceding claims, wherein the block portion (18) of the second end part (16) has a smaller width than a main section of the retainer (10).

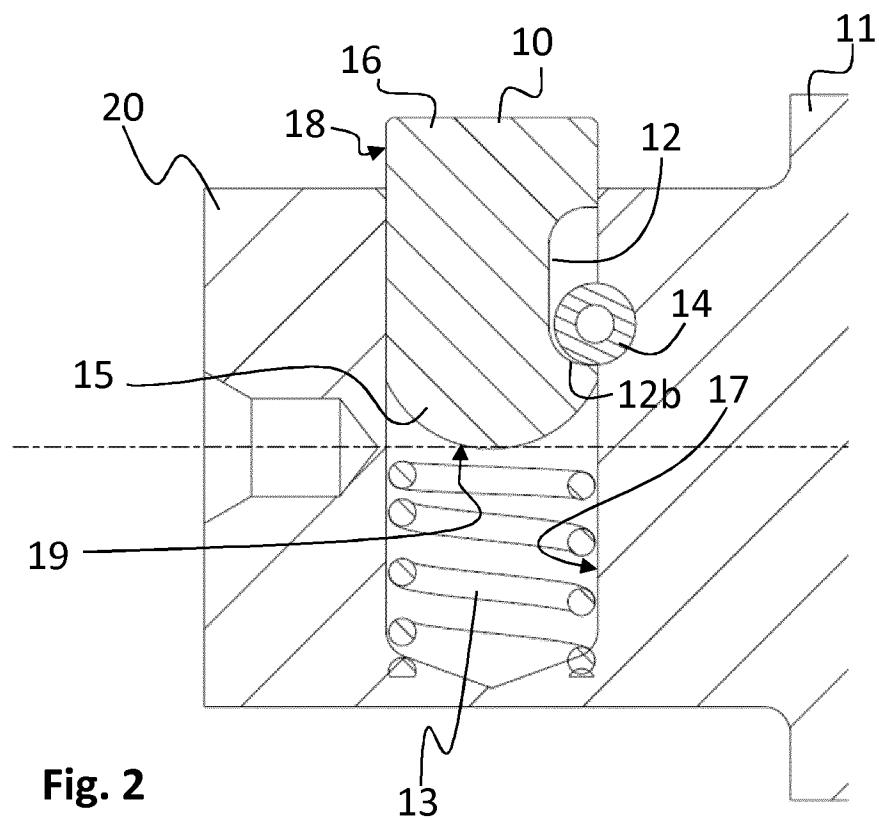
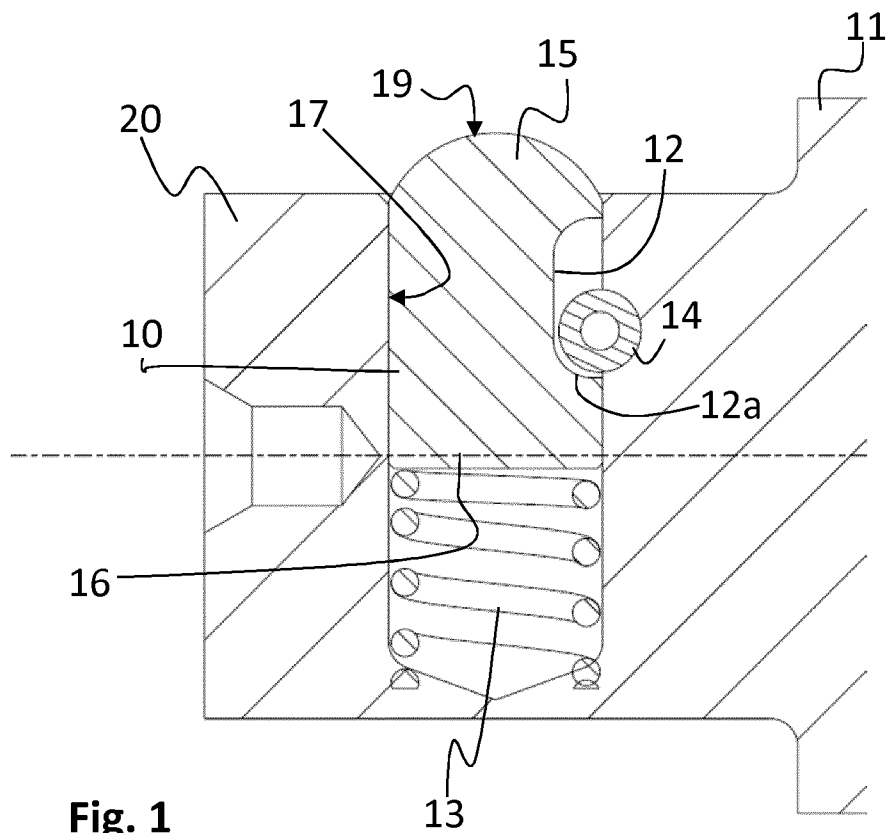
6. The connection part (20) according to claim 5, wherein the block portion (18) of the second end part (16) has a circular cross section of a smaller diameter than the main section of the retainer (10).

7. The connection part (20) according to claim 5, wherein the block portion (18) of the second end part (16) has an elongate cross section in an axial direction of the shaft (11), such that it has a greater extension in the longitudinal direction of the shaft (11) than in the lateral direction of the shaft (11).

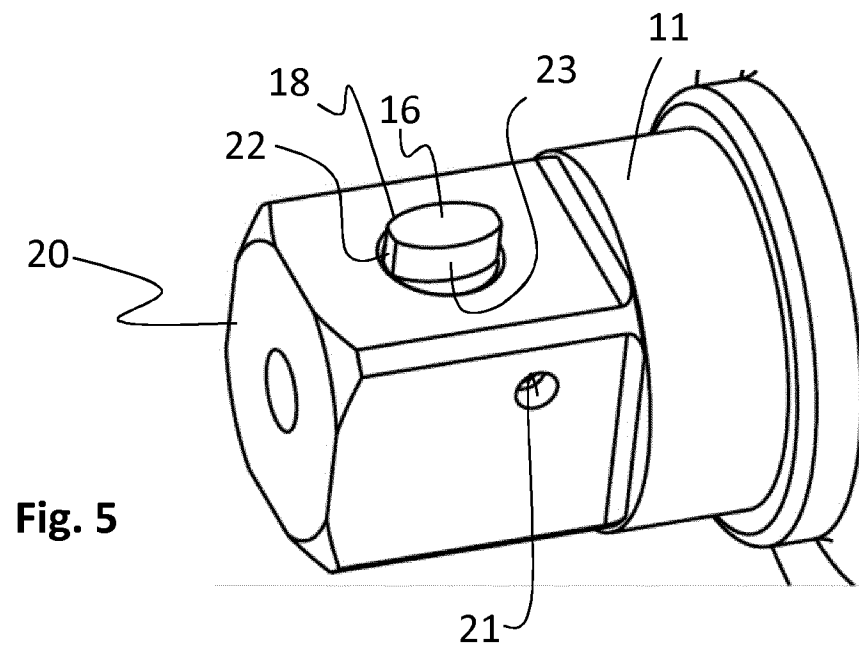
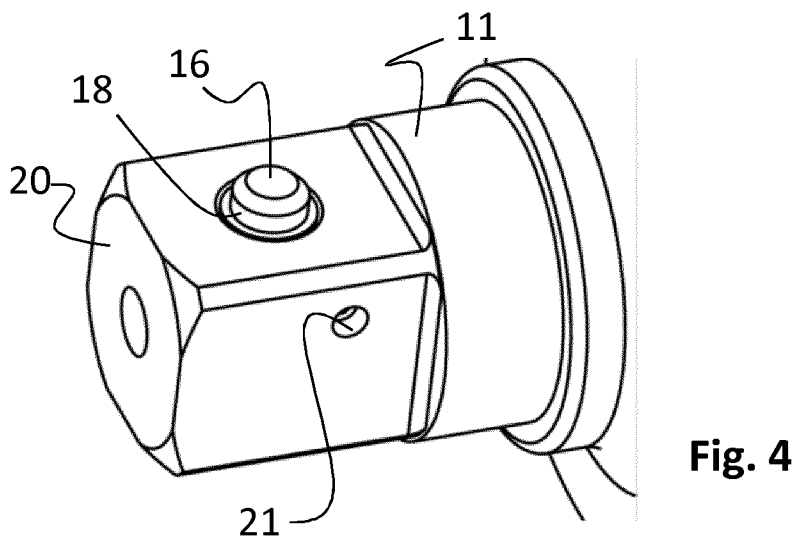
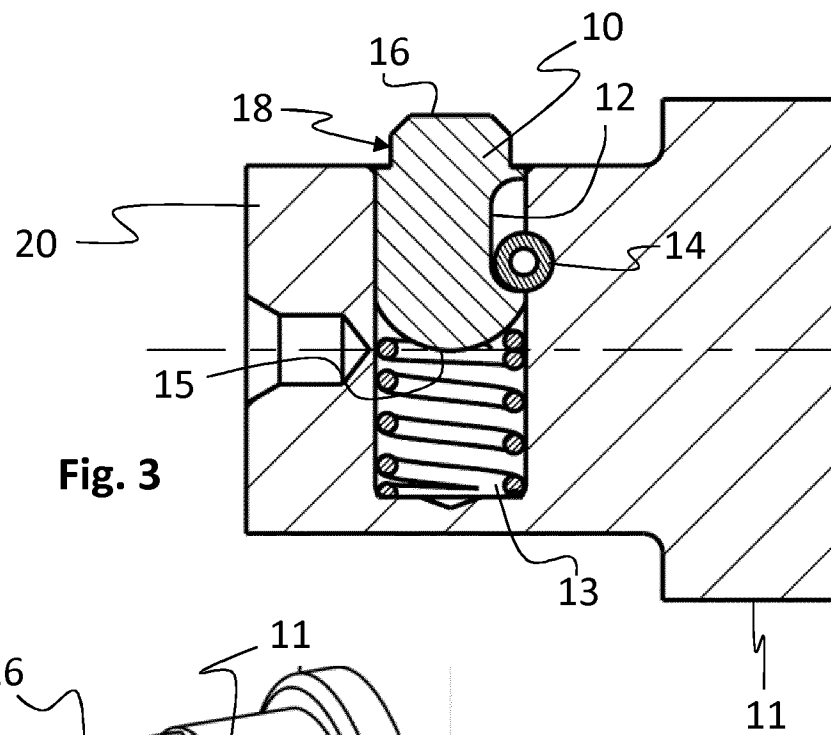
8. The connection part (20) according to claim 7, wherein the block portion (18) of the second end part (16) is oval.

9. A power tool comprising a shaft (11) for connection to a socket, **characterised in** that the shaft (11) of the power tool comprises a connection part (20) according to any of the preceding claims.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/053282

A. CLASSIFICATION OF SUBJECT MATTER
INV. B25B23/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B25B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 118 696 A (VALTER RESARE CONNY) 21 January 1964 (1964-01-21)	1,5-7,9
Y	column 1, line 54 - column 2, line 9; figures 1,2	2-4
Y	----- WO 2012/166609 A1 (BOSCH GMBH ROBERT [DE]; HAMAN BRIAN [US]) 6 December 2012 (2012-12-06) paragraph [0035] - paragraph [0036]; figures 9,10	2-4
A	----- US 2002/152848 A1 (JOHNSON THEODORE L [US]) 24 October 2002 (2002-10-24) paragraph [0031]; figures 2-5	2-4
A	----- US 5 595 099 A (PUSATERI DANIEL S [US]) 21 January 1997 (1997-01-21) column 1, line 51 - line 63; figure 4 ----- -/-	2-4



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

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04/04/2014

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/053282

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 752 514 A (SCHOEPS K) 14 August 1973 (1973-08-14) column 3, line 3 - line 14; figure 5 -----	1
A	US 2 721 090 A (KAMAN FRANK A) 18 October 1955 (1955-10-18) column 3, line 19 - line 45; figures 3,5 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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