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## (54) External-coupled electronic angle measurement apparatus

(57) The present invention proposes an external-coupled electronic angle measurement apparatus installed on a hand tool (10) including a housing (20), a display element (30), an angle detection system (40) and a coupling portion (50). The housing (20) is movable through the coupling portion (50) to fasten the external-coupled electronic angle measurement apparatus to a desired location of the driving head (12), driving bar (11), sleeve coupling head (13) or hand tool (10) to accurately measure turning angles of a screw driven by the hand tool (10) through the angle detection system (40) and display the result on the display element (30).

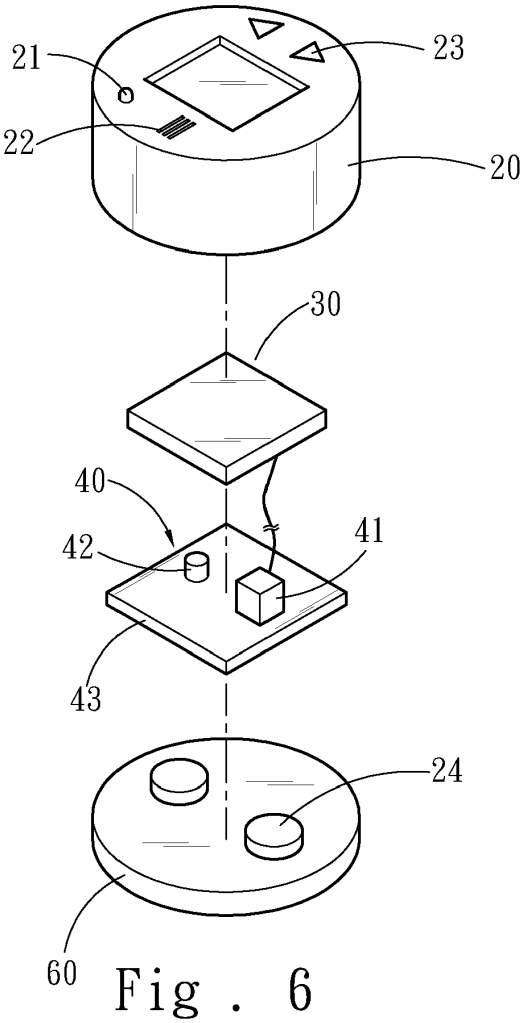


Fig. 6

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## Description

### FIELD OF THE INVENTION

**[0001]** The present invention relates to an external-coupled apparatus of a hand tool and particularly to an external-coupled measurement apparatus to measure turning angles of a hand tool.

### BACKGROUND OF THE INVENTION

**[0002]** Please refer to FIG. 1, to measure the turning angles of a coupler 1a' on a driving head of a conventional wrench 1a, an angle gauge 2 is provided to couple with the coupler 1a'. The angle gauge 2 has indication scales 3 to record the turning angles of the wrench 1a, and then the turning angles of the coupler 1a' can be known. Such an approach involves troublesome operation, and a greater error tends to be occurred.

**[0003]** FIG. 2 illustrates another conventional wrench 1b which also has a coupler 1b' on a driving head and a stem 4 coupled with an angle measurement device 5 which is electrically connected to a control system (not shown in the drawings) and a display device 6 through a transmission cable 5'. The angle measurement device 5 is formed to mate the profile of the stem 4 and can detect the turning angles input to the control system on the wrench 1b and displayed on the display device 6. The angle measurement device 5 has to be incorporated with specific wrench 1b, control system and display device 6 to be used. Compatibility and usability are lower, error probability is higher and the structure is more complex.

**[0004]** An U.S. patent No. 5,589,644 discloses a wrench 1c for measuring turning angles, referring to FIG. 3, which can detect turning angles of a coupler 1c' of a driving head of the wrench 1c through an angle detection system 7, and calibrate fastening tightness of a work piece according to the turning angles of the wrench. The angle detection system is applicable only to the specific wrench 1c and not adaptable to other tools or changeable in terms of use positions arbitrarily, hence results in a higher production cost, and also is more complicated in structure. Thus its usability is limited.

**[0005]** FIG. 4 illustrates another embodiment of the wrench 1d for measuring turning angles according to U.S. patent No. 5,589,644 that has an angle detection system 8 to detect the turning angles of a coupler 1d' of the driving head thereof. The angle detection system is embedded in the wrench 1d and cannot be shared with other tools, thus its applicability also is limited.

### SUMMARY OF THE INVENTION

**[0006]** Therefore, the primary object of the present invention is to provide an external-coupled electronic angle measurement apparatus mountable onto a wide variety of hand tools and enhance compatibility.

**[0007]** The invention provides an external-coupled electronic angle measurement apparatus which comprises a housing, a coupling portion, an angle detection system and a display element. The coupling portion is located on the housing to fasten the external-coupled electronic angle measurement apparatus to a tool. The angle detection system is held in the housing to detect turning angles. The display element is electrically connected to the angle detection system to display the turning angles.

**[0008]** Through the coupling portion, the invention can be easily and quickly installed on different hand tools with random profiles. The angle detection system can accurately measure the turning angles of a screw driven by the hand tool.

**[0009]** The foregoing, as well as additional objects, features and advantages of the invention will be more readily apparent from the following detailed description, which proceeds with reference to the accompanying drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0010]**

FIG. 1 is a perspective view of a conventional wrench.
FIG. 2 is a top view of another conventional wrench.
FIG. 3 is a perspective view of U.S. patent No. 5,589,644.
FIG. 4 is another perspective view of U.S. patent No. 5,589,644.
FIG. 5 is a perspective view of the invention.
FIG. 6 is an exploded view of the invention.
FIG. 7 is a perspective view of an embodiment of the invention.
FIG. 8 is a plane view of another embodiment of the invention.
FIG. 9 is a plane view of yet another embodiment of the invention.
FIGS. 10 through 16D are plane views of other embodiments of the invention.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0011]** Please refer to FIGS. 5, 6 and 7 for an embodiment of the invention. The apparatus of the invention is installed on a hand tool 10 which has a driving bar 11 with a driving head 12 at one end and a sleeve coupling head 13 at one side of the driving head 12 to fasten a screw. The external-coupled electronic angle measurement apparatus includes a housing 20, a display unit 30, an angle detection system 40 and a coupling portion 50. The housing 20 has a holder 60 at the bottom. The coupling portion 50 is an adsorbable element and is fastened to the holder 60, thus the apparatus of the invention can be quickly and movably mounted onto the driving head 12 or the driving bar 11 or the hand tool 10 at a desired

location.

**[0012]** The angle detection system 40 is held in the housing 20 to detect turning angles of the sleeve coupling head 13, and includes an electronic angle measurement device 41 and a signal processing system 42, and is installed on a circuit board 43. The electronic angle measurement device 41 can be a gyroscope. The display element 30 is located on the housing 20 and electrically connected to the angle detection system 40 to display the turning angles of the sleeve coupling head 13.

**[0013]** Refer to FIG. 8 for another embodiment of the invention. The coupling portion 50A can be a magnetic element. FIG. 9 shows yet another embodiment in which the coupling portion 50B can be a sucking disc. FIG. 10 shows one of other embodiments that the coupling portion 50C can be a gripper. Through adsorption of the s magnetic element or sucking disc, or clipping of the gripper, the external-coupled electronic angle measurement apparatus can be fastened on the driving head 12, driving bar 11 or hand tool 10 at a desired location.

**[0014]** FIG. 11 illustrates another embodiment of the invention in which the coupling portion 50D can be at least one cavity to be wedged in by a mating boss or profile formed on the driving head 12, driving bar 11 or hand tool 10 at a desired location, thus the external-coupled electronic angle measurement apparatus can be fastened. FIG. 12 shows yet another embodiment in which the coupling portion 50D has screw threads 51 formed on the surface of the cavity to allow the apparatus to be fastened through a screw 52.

**[0015]** FIG. 13 shows another embodiment in which the coupling portion 50E can be at least one boss to be wedged in a mating cavity 53 formed on the driving head 12, driving bar 11 or hand tool 10 at a desired location. The profiles of the boss and cavity 53 are not limited to the same, partially matched and mutually latched can hold the apparatus of the invention. FIG. 14 shows still another embodiment in which the coupling portion 50E has screw threads 54 formed on the surface of the boss to fasten the apparatus by screwing.

**[0016]** FIG. 15 shows yet another embodiment in which the coupling portion 50F can be at least one through holes to receive a fastening element 99 to fasten the driving head 12, driving bar 11 or hand tool 10 at a desired location and to further fasten the external-coupled electronic angle measurement apparatus of the invention.

**[0017]** FIGS. 16A through 16D illustrate other embodiments in which the coupling portion 50G includes two sets located at two opposite sides of the apparatus in an up and down, left and right, front and rear, or coaxial manner. The two sets of the coupling portion 50G at the two sides can be cavities both, bosses both or one cavity and one boss to be latched to fasten the driving head 12, driving bar 11 or hand tool 10 at a desired location and to further fasten the external-coupled electronic angle measurement apparatus in varying combinations.

**[0018]** As a conclusion, the turning angles of the hand tool 10 can be measured by the angle detection system 40, and the external-coupled electronic angle measurement apparatus of the present invention can be disassembled and fastened to the driving head 12, driving bar 11 or hand tool 10 at a desired location. When the hand tool 10 is turned, the angle detection system 40 measures the turning angles of the sleeve coupling head 13. Hence when measuring the turning angles is desired, fasten the apparatus of the invention on the driving head 12, driving bar or hand tool 10 at a desired location, and easily disassemble the apparatus to be stored when not in use. Such a structure provides greater adaptability and usability, and is easier to store and applicable to various types of hand tools to meet requirements of users.

## Claims

1. An external-coupled electronic angle measurement apparatus, **characterized by**:

   a housing (20);
   a coupling portion (50) mounted onto the housing (20) to fasten the external-coupled electronic angle measurement apparatus to a hand tool (10);
   an angle detection system (40) held in the housing (20) to detect turning angles; and
   a display element (30) electrically connected to the angle detection system (40) to display the turning angles.

2. The external-coupled electronic angle measurement apparatus of claim 1, wherein the coupling portion (50) is an adsorbable element.

3. The external-coupled electronic angle measurement apparatus of claim 1, wherein the coupling portion (50A) is a magnetic element.

4. The external-coupled electronic angle measurement apparatus of claim 3, wherein the magnetic element is a magnet.

5. The external-coupled electronic angle measurement apparatus of claim 1, wherein the coupling portion (50B) is a sucking disc.

6. The external-coupled electronic angle measurement apparatus of claim 1, wherein the coupling portion (50C) is a gripper.

7. The external-coupled electronic angle measurement apparatus of claim 1, wherein the coupling portion (50D) is a cavity.

8. The external-coupled electronic angle measurement apparatus of claim 7, wherein the cavity includes

screw threads (51).

**9.** The external-coupled electronic angle measurement apparatus of claim 1, wherein the coupling portion (50E) is a boss.

**10.** The external-coupled electronic angle measurement apparatus of claim 9, wherein the boss includes screw threads (54).

**11.** The external-coupled electronic angle measurement apparatus of claim 1, wherein the coupling portion (50F) is a through hole.

**12.** The external-coupled electronic angle measurement apparatus of claim 1, wherein the coupling portion (50G) includes two sets located on two opposite sides of the external-coupled electronic angle measurement apparatus.

**13.** The external-coupled electronic angle measurement apparatus of claim 12, wherein the two sets of the coupling portion (50G) are positioned coaxially.

**14.** The external-coupled electronic angle measurement apparatus of claim 13, wherein two sets of the coupling portion (50G) are respectively a cavity and a boss.

**15.** The external-coupled electronic angle measurement apparatus of claim 1, wherein the angle detection system (40) includes a signal processing system (42) and an electronic angle measurement device (41) which is a gyroscope.

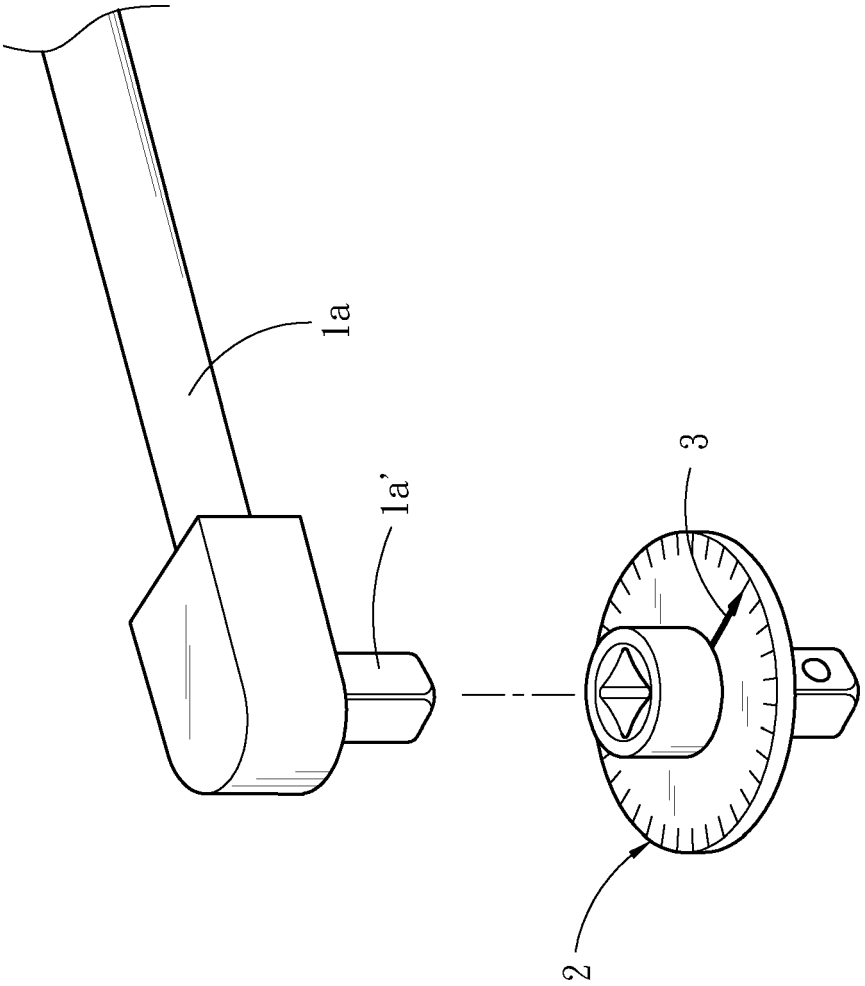


Fig. 1
PRIOR ART

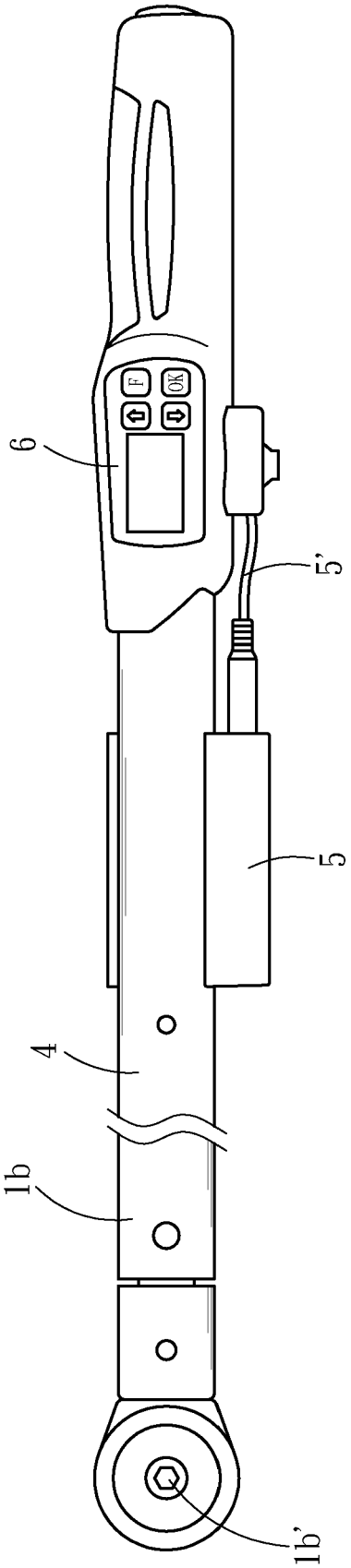


Fig. 2
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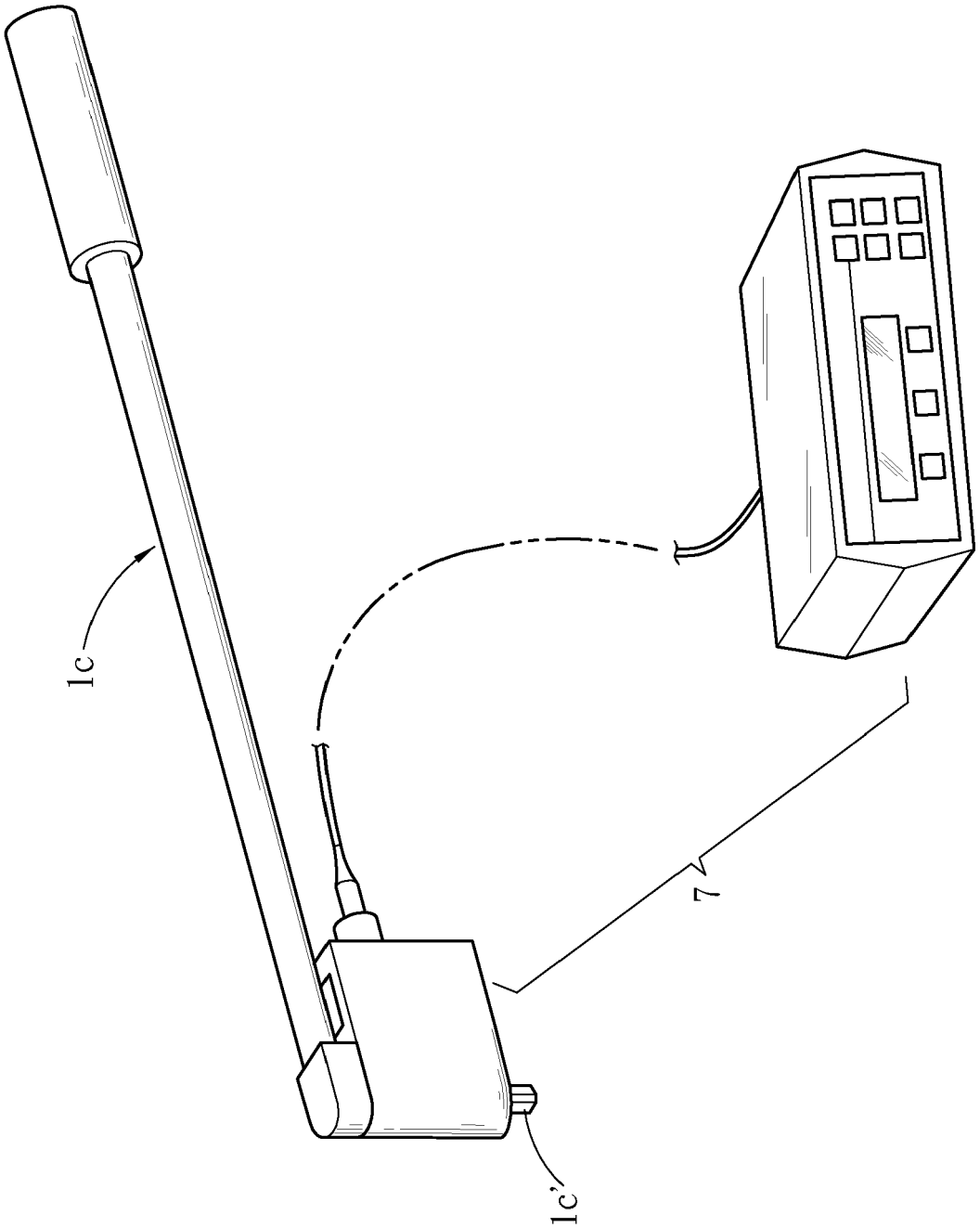


Fig. 3
PRIOR ART

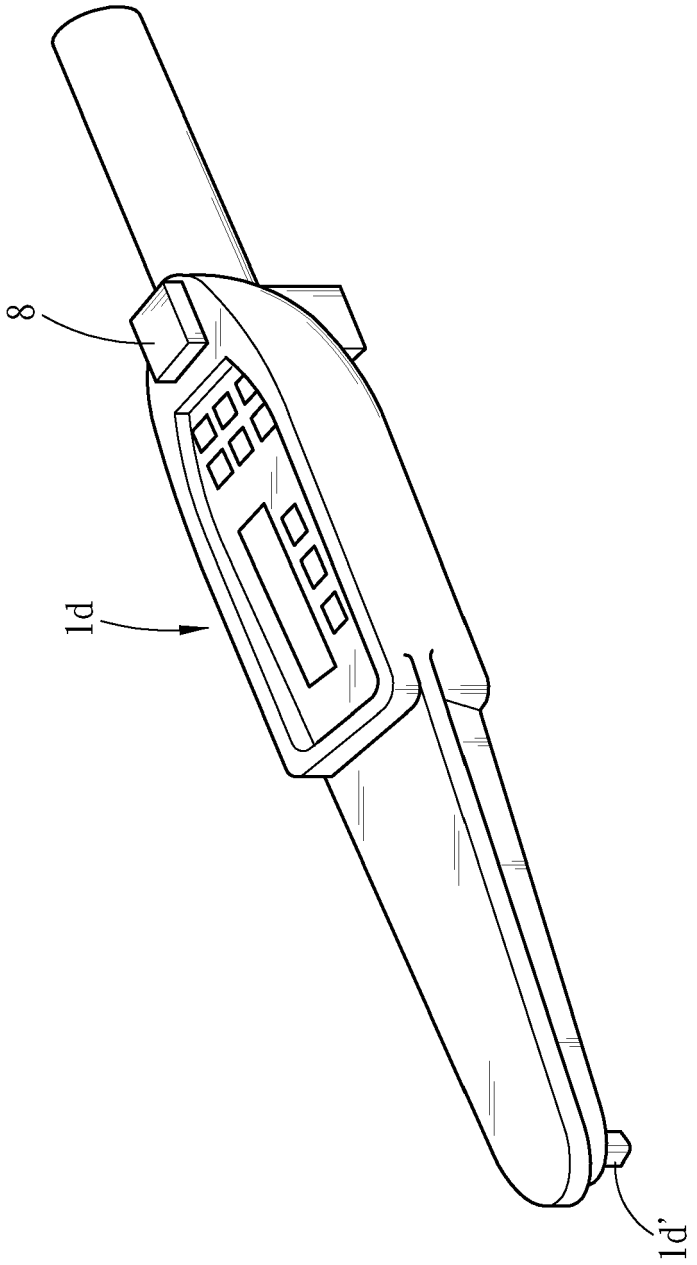


Fig. 4
PRIOR ART

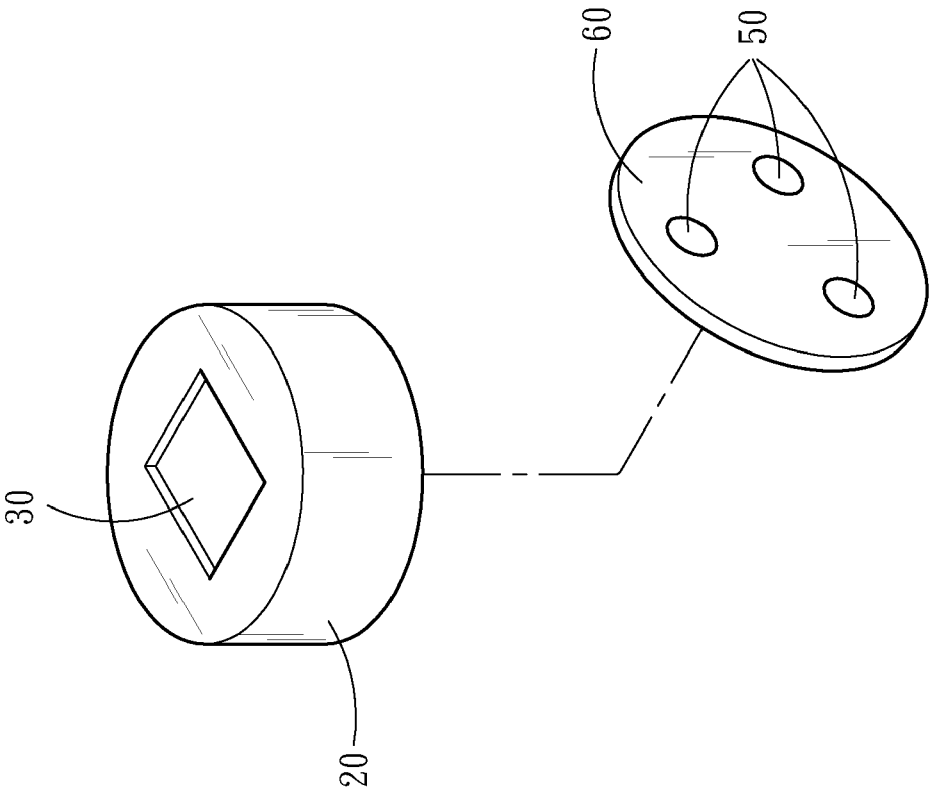


Fig. 5

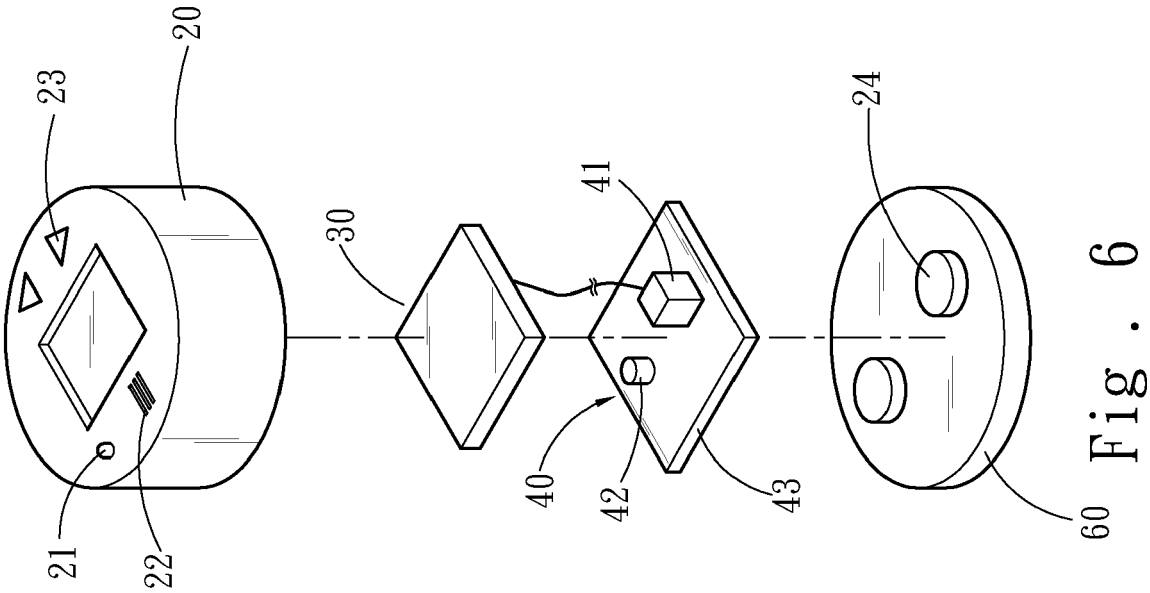


Fig. 6

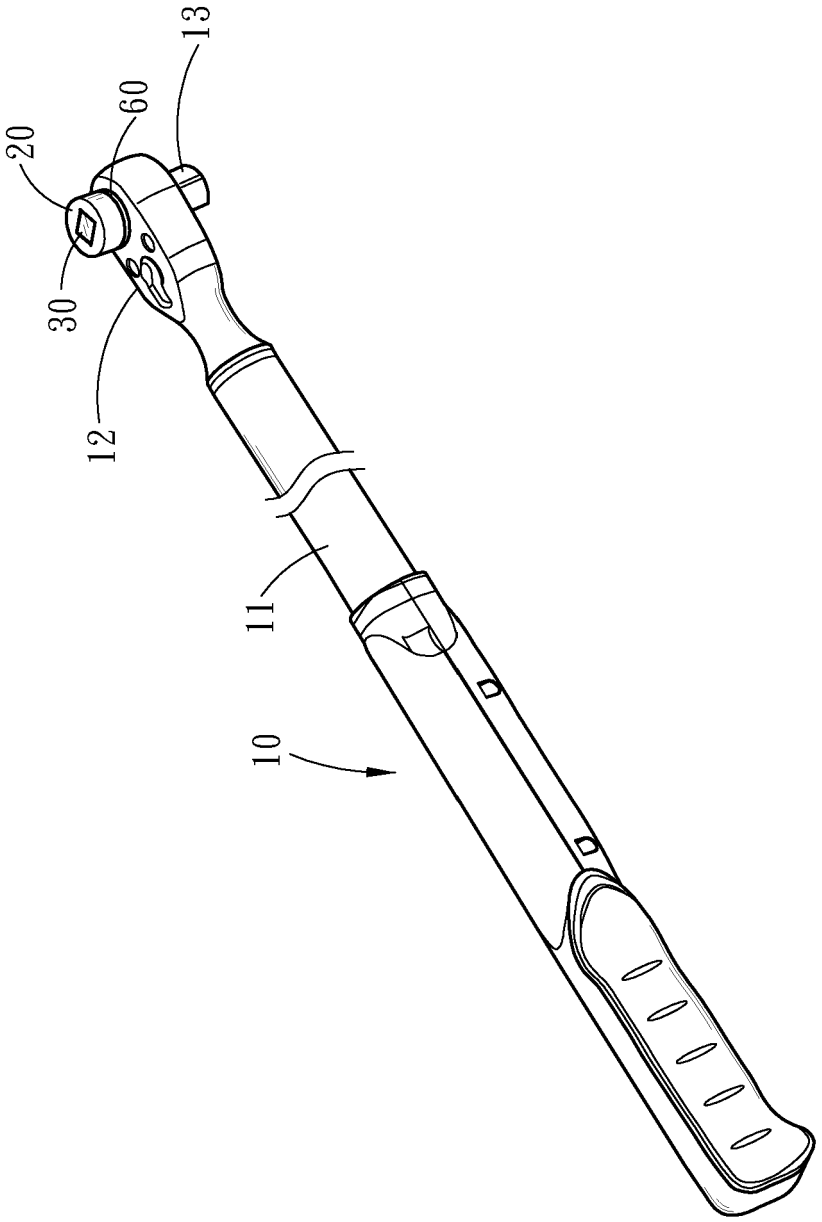


Fig. 7

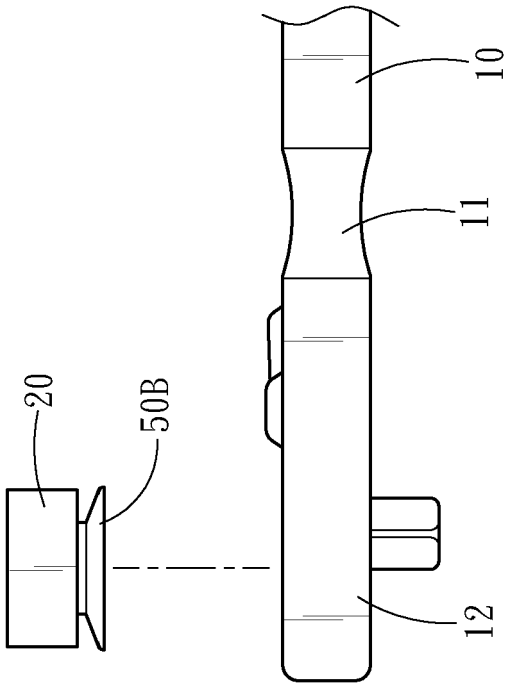


Fig. 9

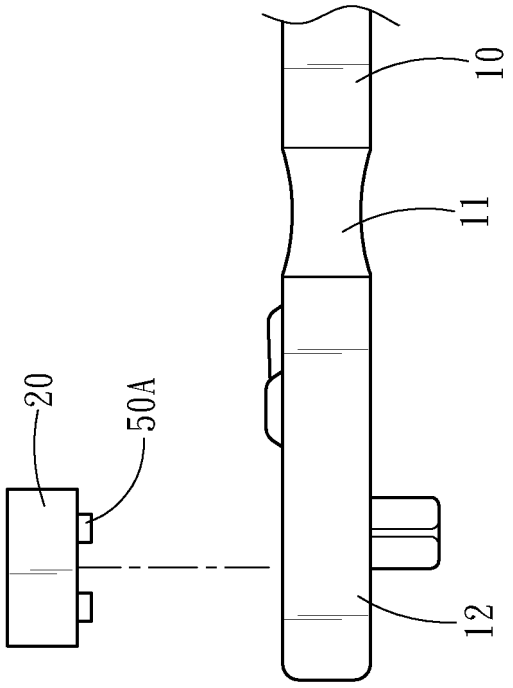


Fig. 8

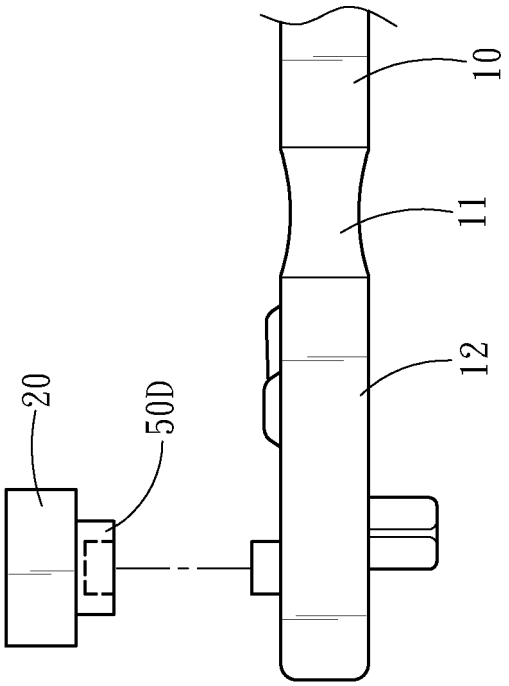


Fig. 11

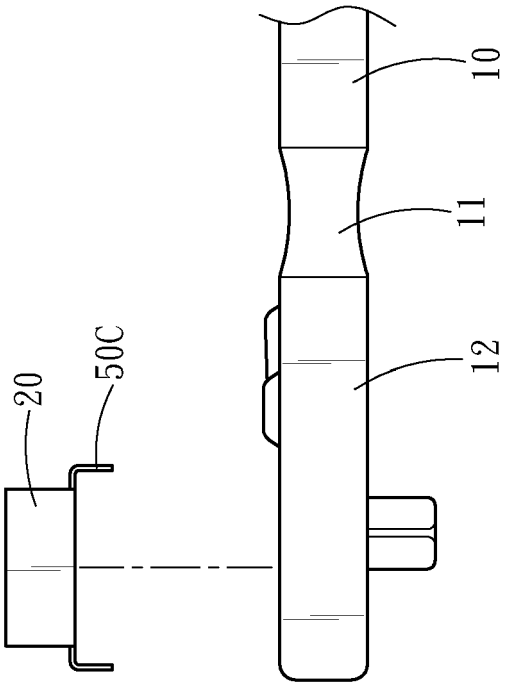


Fig. 10

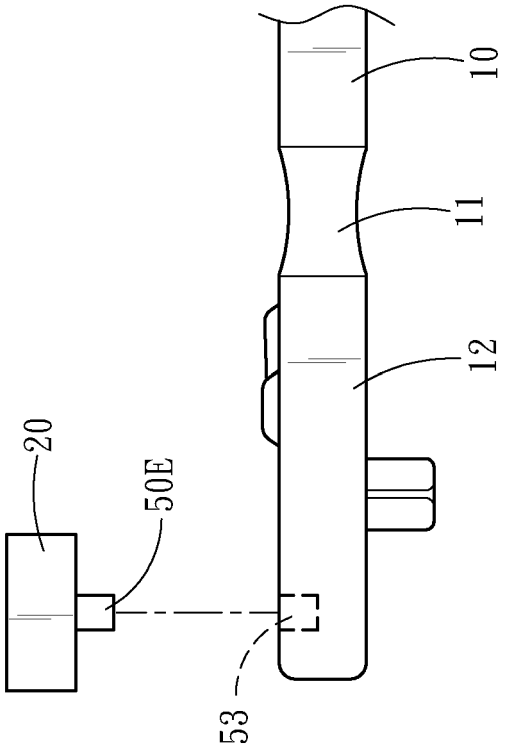


Fig. 13

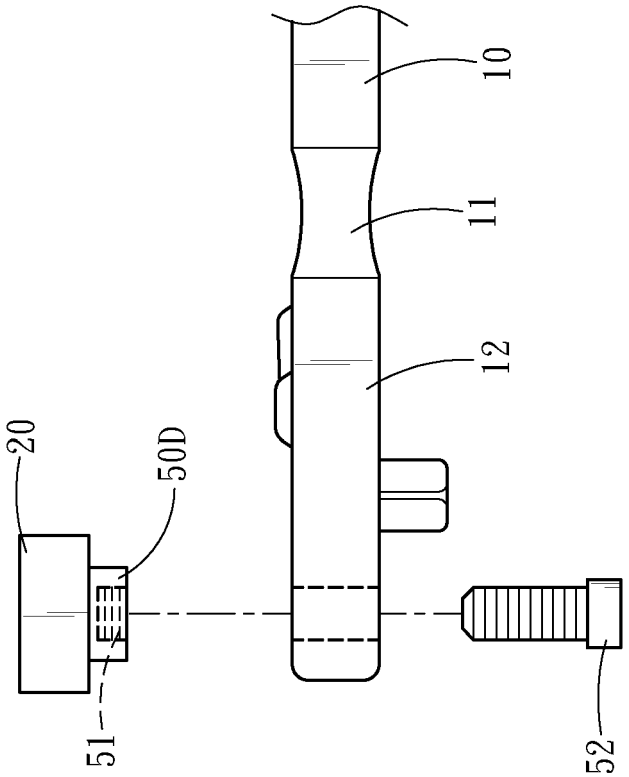


Fig. 12

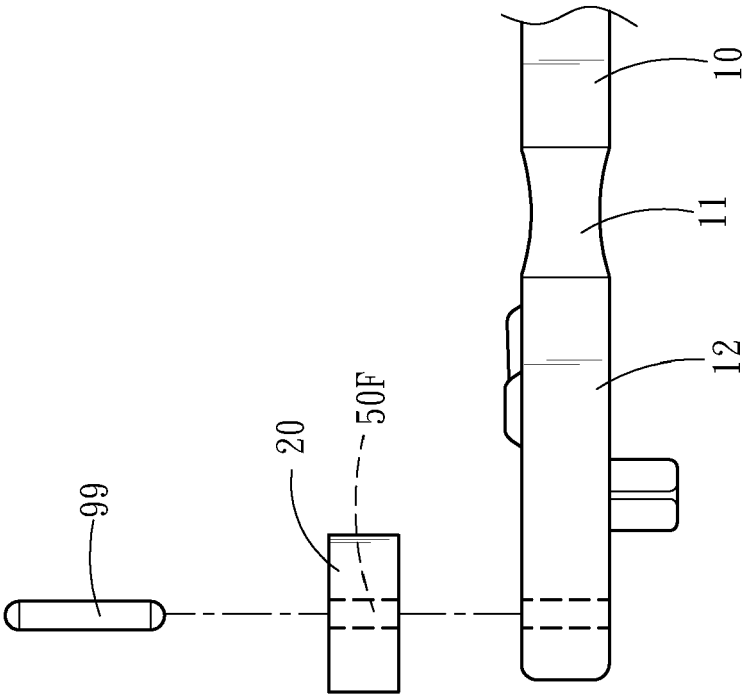


Fig. 15

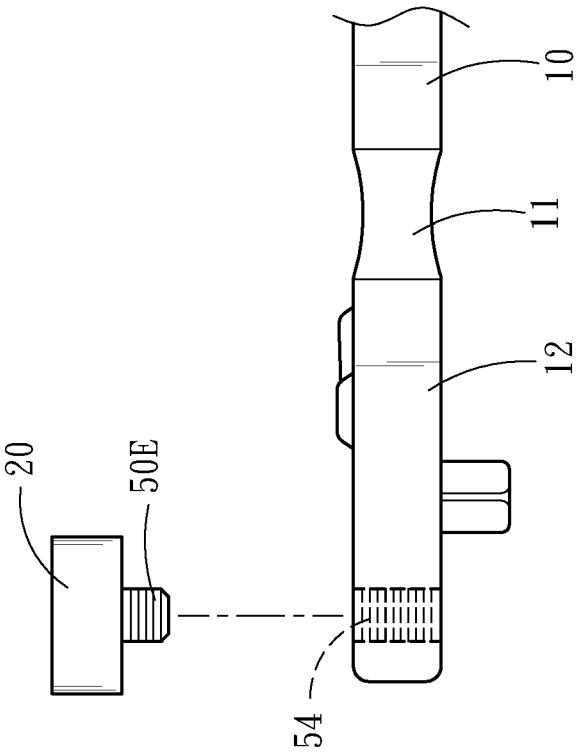


Fig. 14

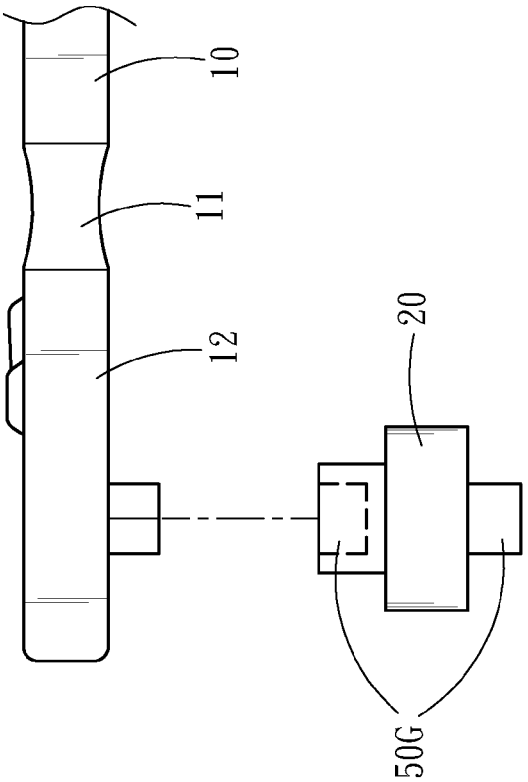


Fig. 16B

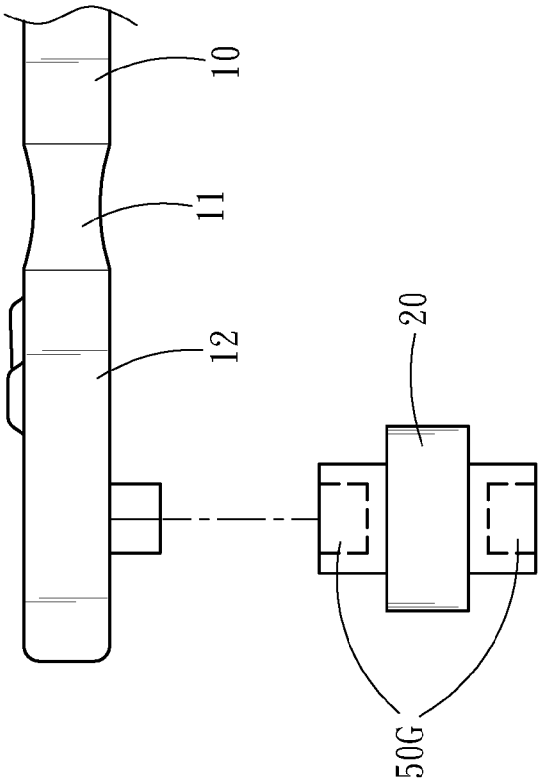


Fig. 16A

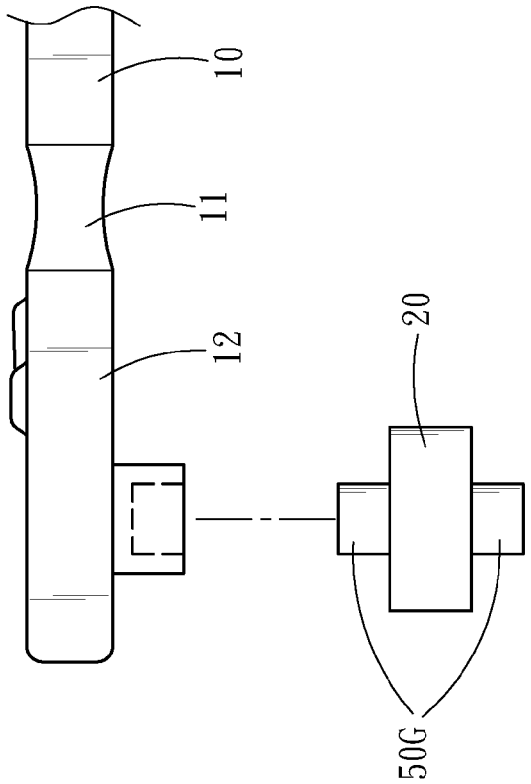


Fig. 16D

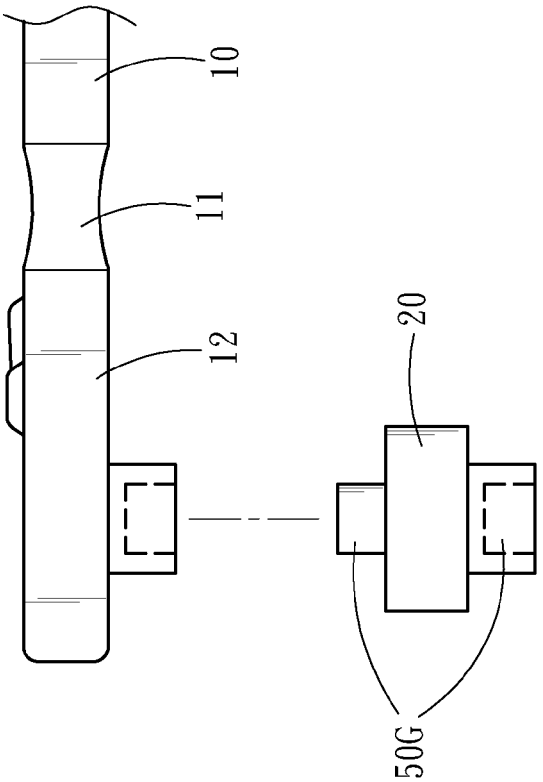


Fig. 16C

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Application Number
EP 10 16 5326

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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 18 January 2011 | Kühn, Thomas |

CATEGORY OF CITED DOCUMENTS

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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 16 5326

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