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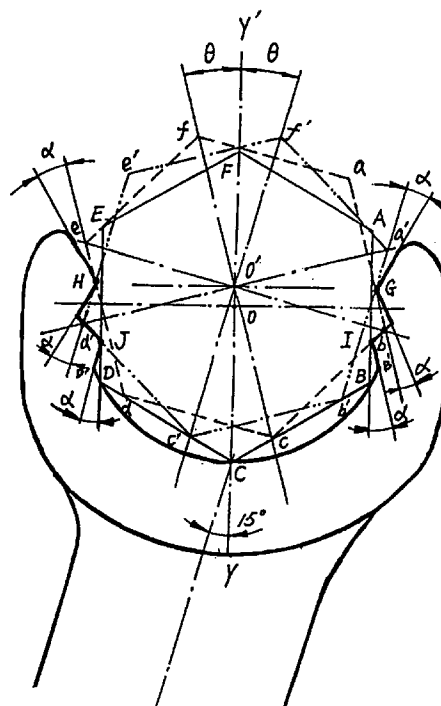
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DE FR GB(30) Priority: **21.06.1993 CN 93216345**(71) Applicant: **Chen, Ruixian****Zhuhai City, Guangdong Province 519000 (CN)**(72) Inventor: **Chen, Ruixian****Zhuhai City, Guangdong Province 519000 (CN)**(74) Representative: **Cohausz & Florack****Patentanwälte****Kanzlerstrasse 8a****40472 Düsseldorf (DE)**(54) **WRENCH**

(57) A new type of usable solid wrench are provided for various hexagonal fastening pieces. The solid wrench is convenient to use in narrow spaces without damaging corners of fastening pieces and slipping. The solid wrench has two working positions each angled relative to the other by an angle of θ ranged from 10 to 22 degrees in the same rotating direction, the moving distance of the center of the two working positions along the center line of the wrench's open end is less than or equal to one third of the hexagonal workpiece's side length, all the bearing points are selected within the range of 0.55 - 0.85 of the corresponding hexagonal work piece's side length. Therefore, the new type of solid wrench is easy to be manufactured and has lower cost for its simple structure.

**Fig 1****EP 0 747 173 A1**

Description

The invention is related to a manual tool applicable to various hexagonal fastening pieces.

Among the retrieved 27 patents related to solid wrenches at home and abroad from Jan. 1990 to June 1993, half of them are of multi-purpose type, some are improved types by adding some accessories, and the others are of rotating - slipping type. All these modifications are concentrated on convenience of usage, multi-purpose and high efficiency. But the results are not satisfied while using the patents when being evaluated with the comprehensive index of utility, good bearing strength, low cost and manufacturing method.

The object of the invention is directed to solve the above problems, and provides a type of solid wrench, whose main technical specifications are satisfied with the international standards, for more convenient to be inserted into working position, without damaging the corner of the fastening pieces and slipping, and for easy to use in narrow spaces less than 30 degrees. Said solid wrench has obvious advantages of manufacturing easily, lower cost, and high comprehensive evaluation index, so that it is easy to be put into production and application.

The technical features of the solid wrench are characterized in that a special geometrical shape is designed at its open end and two bearing edges for providing two working positions, each angled relative to the other by an angle of θ in the same rotating direction, in which θ ranges from 10 to 22 degrees; in that the intake of workpieces is made up of two inclined surfaces.

Fig. 1 shows said geometrical shape of working positions of the solid wrench in accordance with the preferred embodiment of the invention.

Fig. 2 shows said geometrical shape of working positions of the solid wrench in accordance with another preferred embodiment of the invention.

Referring to Figure 1, the solid wrench according to the preferred embodiment of the invention has two working positions, each angled relative to the other by an angle of θ in two rotating directions. The broken lines of the wrench's open end is formed as follows:

YY' is the central line of the wrench's open end. The original position of the regular hexagon ABCDEF which represents a hexagonal fastening piece is shown in Fig. 1, and its center is O. Then, move the hexagon upward along the line YY' for a certain distance so that the center point moves from O to O', in which OO' is not longer than one third of each side of the regular hexagon ABCDEF. Then rotate the regular hexagon in clockwise and counterclockwise directions by an angle of θ , respectively, (θ is selected within the range of 10-22 degrees) resulting two new hexagons abcdef and a'b'c'd'e'f'. In this case, ab and a'b' cross at G, de and d'e' cross at H, AB and bc at I, and DE intersects c'd' at J. The points G, H, I and J are the four bearing points. In order to have the bearing points fall within the range of 0.55 - 0.85 of the side length of the hexagon, OO' is given

as one fifth of the side length and the angle θ as 15 degrees, as shown in Fig. 1. Formation of the broken line of the wrench's open end is illustrated in Figure 1. A relax angle α is provided to avoid damaging the corner of the workpiece as illustrated in Figure 1.

Referring to Figure 2, the solid wrench according to another preferred embodiment of the invention has two, working positions, each angled relative to the other by an angle θ in one rotating direction. The broken line of the wrench's open end is formed as follows:

The central line and original position of the regular hexagon at open end of the wrench are the same with those shown in Figure 1. Then move the hexagon upward along YY' for a given distance so that the center point moves from O to O', in which OO' is not longer than one third of the regular hexagon ABCDEF's side length. Next, rotate the hexagon counterclockwise by an angle of θ (θ is selected within the range of 10-22 degrees) to form another hexagon abcdef. In this case, ab and AB cross at I; de and DE cross at H; and bc and AB at J; make a line through the point J perpendicular to YY' and extend the line which cross DE at K. Points I, H, J, K are the four bearing points. In order to have the bearing points fall within the range of 0.55 - 0.85 of the hexagon's side length, OO' is given as one eighth of the side length and the angle θ as 15 degrees, as shown in Fig. 2. Formation of the broken line at the open end of the wrench is illustrated in Fig. 2. A relax angle α is provided to avoid damaging the corner of the workpiece.

In Figs 1 and 2, an arc is drawn downward with O as the center and half of the length of the diagonal line of the regular hexagon as radius, so as to form the arc linking points B and D at the lower part of the wrench's open end, the arc is extended crossing the broken line of the wrench at B' and D'. All the acute corners of the open end of the wrench are designed as round ones to avoid stress concentration. Tolerance is in conformity with the National Standard, and the torque beared on the two special edges satisfies the C. D. series specifications of the National Standards. The angle between the central line of the wrench's open end and the handle of the wrench is 15 degrees.

With two working positions, each angled relative to the other by an angle of θ in the same rotating direction, the wrench can be rotated continuously without turning its sides when the rotated angle of the wrench's handle is larger than 30 degrees, or can be used by turning its sides in the narrow space where the rotated angle is less than 30 degrees.

The wrench according to the present invention provides advantages that a) it is easy to use because the inclined surfaces at the open end of the wrench can guide the wrench automatically when the wrench is inserted. b) it can enhance the performance of the wrench's bearing greater torque without slipping. Although the number of the corners on the open end of the wrench is more than traditional solid wrench, it is still easy to manufacture and popularize with only a little higher cost than traditional solid wrench. The wrench

shown in Figure 2 is mainly designed for hexagonal fastening pieces with larger size, regardless of using in narrow spaces less than 30 degrees.

The technology for implementing the new type solid wrench is very similar to that of traditional solid wrench, only the procedure for processing the special open end is to be added.

Claims

1. A new type of usable solid wrench comprising a head with its top end opened (open end) and a handle.
Wherein the wrench has two working positions, each angled relative to the other by an angle of θ selected within the range of 10 - 22 degrees in the same rotating direction;
the moving distance of the center of the two working positions along the center line of the wrench's open end is less than or equal to one third of the corresponding hexagonal workpiece's side length; and
all the bearing points fall within the range of 0.55 - 0.85 of the corresponding hexagonal workpiece's side length.
2. The solid wrench according to claim 1, wherein: relax angles are provided between bearing sides of the hexagonal workpiece and the wrench corresponding to bearing points, respectively, in which each angle is more than or equal to 3 degrees.
3. The solid wrench according to claim 1 or claim 2 characterized in that:
the moving distance of the center of the regular hexagon along the center line of the wrench's open end is one fifth of the regular hexagon's side length; and in that said angle θ obtained by rotating the hexagon in clockwise or counterclockwise direction is 15 degrees.
4. The solid wrench according to claim 1 or 2 characterized in that:
the moving distance of the center of the regular hexagon along the center line of the wrench's open end is one eighth of the regular hexagon's side length; and said angle θ is 15 degrees.

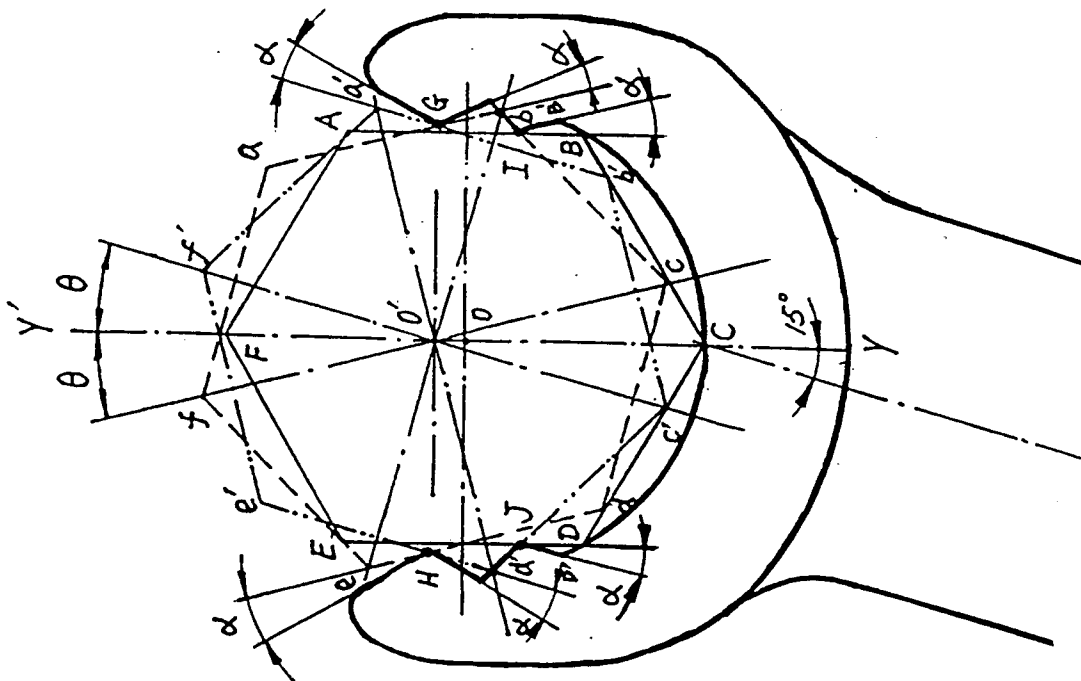


Fig 1

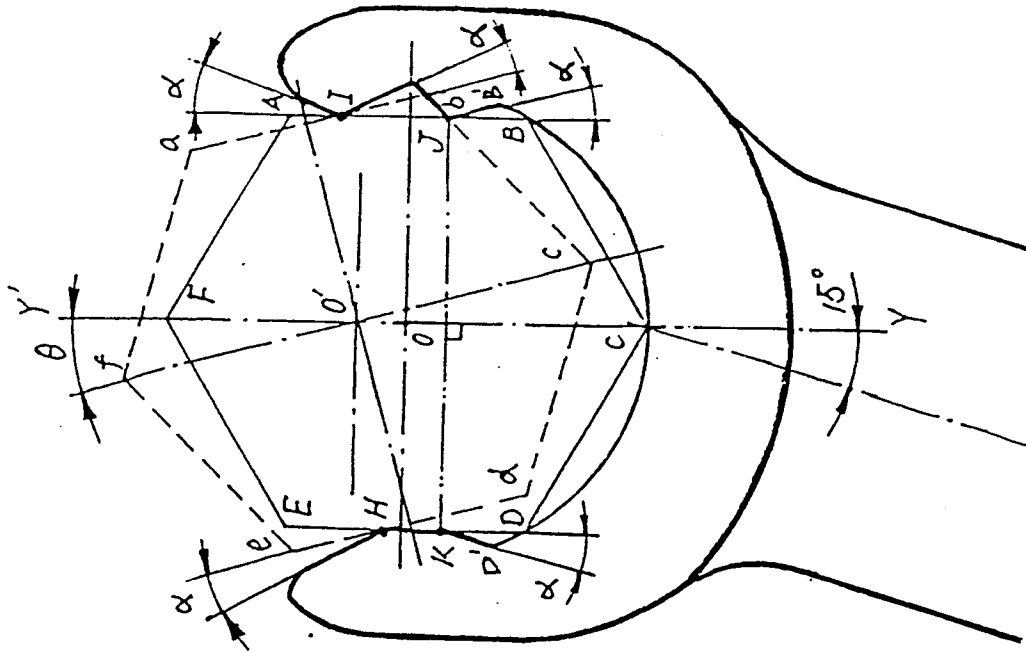


Fig 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN 94/00032

A. CLASSIFICATION OF SUBJECT MATTER		
IPC ⁶ B25B 13/08		
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)		
IPC ⁶ B25B 13/00, B25B 13/02, B25B 13/04, B25B 13/08		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Chinese invention and utility models from 1985 to —		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
WPI Wrench hexagonal two working position narrow space		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US,A,5,131,312 (RICHARD J. MACOR) 21 July 1992 (21.07.92) column 3, line 8 to 27, figure 1	1
Y	CN, 2,071,566U (Qi Ming-Yuan) 18 July 1990 (18.07.90) page 3, line 1 to 12, figure 1	1
Y	CN, 2,037,289 (Zheng Chao) 19 April 1989 (19.04.89), figure 1	2-4
Y	CN, 2,100,285 (Beijing Dong Bei Wang tool Manufacturing) 11 September 1991 (11.09.91) figure 3, figure 4	2-4
Y	US,A,02,671,368 (FRITZ DEIBOD, GENEVA) 09 March 1954 (09.03.54) figure 10	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 "E" earlier document but published on or after the international filing date "I" document which may throw doubts on priority claims (s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "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		Date of mailing of the international search report
12 July 1994 (12.07.94)		04 AUG 1994 (04.08.94)
Name and mailing address of the ISA/ Chinese Patent Office, 6 Xitucheng Rd. Jimen Bridge, Haidian District, 100088 Beijing, China		Authorized officer Zhang Yong ling
Facsimile No. (86-1)2019451		Telephone No. 2093744

Form PCT/ISA/210(second sheet)(July 1992)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN 94/00032

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Form PCT/ISA/210(continuation of second sheet)(July 1992)

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Information patent family members

International application No.
PCT/CN 94/00032

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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CN2037289U	10. 05. 89	None	
CN2071566U	2. 02. 91	None	
CN2100285U	01. 04. 92	None	
US,A,5,131,312	21. 07. 92	CA2075566A1 EP5445522A1 DE R1 FR R1 GB 41 IT R1 JP5305575	08. 05. 93 09. 06. 93 19. 11. 93
US,A,2,671,368	09. 03. 54	DBP1088437 GB916436	01. 03. 53 06. 10. 54

Form PCT/ISA/210(patent family annex)(July 1992)