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(54) **Title:** RATCHET WRENCHES

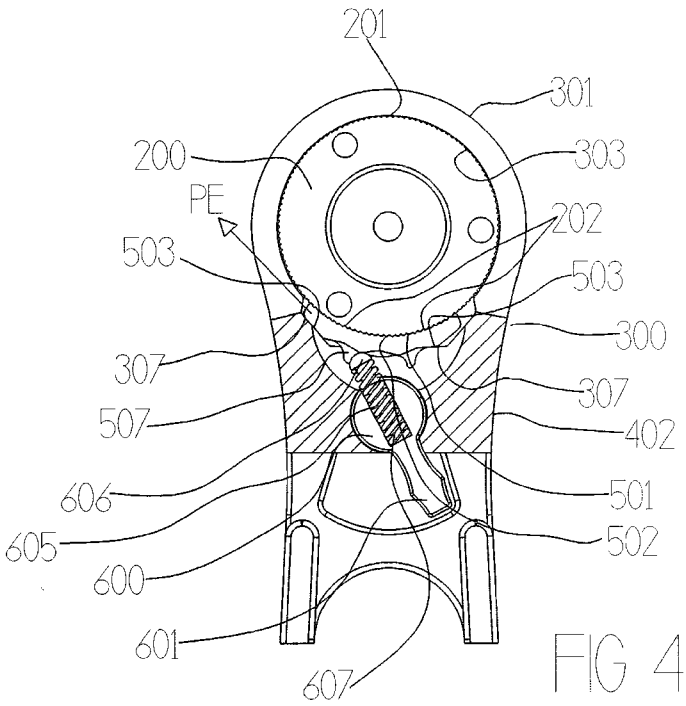


FIG 4

(57) **Abstract:** The ratchet mechanism comprises a head portion with a circular central housing, the inner surface adjoining the handle portion having a further recess characterized by a plurality of engagement ramp profiles arranged not unlike low angled gear teeth within the recess arc. A pawl is located within the recess, with a corresponding plurality of engagement ramp profiles abutting the recess engagement ramp profiles and incorporating an inner facing toothed face of similar corresponding pitch and profiles as the drive element teeth in order that they can mechanically mesh into one another when ratchet is operated in the drive direction, the pawl inward force being substantially evenly distributed along the pawl toothed front face by the use of several similar engagement ramp profiles urging all the pawl teeth into the required locking engagement with the drive element simultaneously.

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[Continued on next page]

TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2019/000129

A. CLASSIFICATION OF SUBJECT MATTER
INV. B25B13/46
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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2004/216565 A1 (CHEN TERENCE [TW]) 4 November 2004 (2004-11-04) figures 1-4	1,3,5,6, 12-17 4,18
X	US 2018/043512 A1 (ZHANG MING LIANG [US] ET AL) 15 February 2018 (2018-02-15) figures 15,16	1,2,15
X	US 2003/019335 A1 (HU BOBBY [TW]) 30 January 2003 (2003-01-30) figure 7	1,15

☐ 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 application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(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
16 January 2020	31/03/2020

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Hartnack, Kai

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2019/000129

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-6, 12-18

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-6, 12-18

A ratchet wrench comprising:a handle having a head end;a head portion connected to said head end and provided with a circular drive element housing, said head portion having a pawl recess disposed between said drive element housing and said head end;a drive element at least partially housed in said drive element housing and having a toothed portion comprising teeth disposed circumferentially about said drive element; anda pawl located within the pawl recess, the pawl having a plurality of engagement ramp profiles configured to engage respective ramp surfaces provided in said pawl recess and a toothed face facing into said central housing and provided with a plurality of teeth configured to mesh with oppositely disposed teeth of said drive element toothed portion,wherein the arrangement is such that, in use, when a drive force is applied to said handle, a plurality of said engagement ramp profiles engage with the respective ramp surfaces to urge the pawl into locking engagement with the drive element,
characterized by
the further design of the pawl, in particular the interaction of the ramp profiles with the ramp surfaces of the pawl recess.

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2. claims: 7-11

A ratchet wrench comprising:a handle having a head end;a head portion connected to said head end and provided with a circular drive element housing, said head portion having a pawl recess disposed between said drive element housing and said head end;a drive element at least partially housed in said drive element housing and having a toothed portion comprising teeth disposed circumferentially about said drive element; anda pawl located within the pawl recess, the pawl having a plurality of engagement ramp profiles configured to engage respective ramp surfaces provided in said pawl recess and a toothed face facing into said central housing and provided with a plurality of teeth configured to mesh with oppositely disposed teeth of said drive element toothed portion,wherein the arrangement is such that, in use, when a drive force is applied to said handle, a plurality of said engagement ramp profiles engage with the respective ramp surfaces to urge the pawl into locking engagement with the drive element,
characterized by
the design of the drive element, in particular the design of teeth and the mounting of the drive element in the wrench head.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2019/000129

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2004216565 A1	04-11-2004	NONE	
US 2018043512 A1	15-02-2018	CN 109693201 A	30-04-2019
		US 2018043512 A1	15-02-2018
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