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D E C I S I O N
of 24 July 2000

Case Number: T 0758/98 - 3.2.6

Application Number: 94850149.9

Publication Number: 0642891

IPC: B25B 23/14

Language of the proceedings: EN

Title of invention:

Method and device for tightening threaded joints

Applicant:

ATLAS COPCO TOOLS AB, NACKA

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (yes)"

Decisions cited:

-

Catchword:

-



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Boards of Appeal

Chambres de recours

Case Number: T 0758/98 - 3.2.6

D E C I S I O N
of the Technical Board of Appeal 3.2.6
of 24 July 2000

Appellant: ATLAS COPCO TOOLS AB, NACKA
105 23 Stockholm (SE)

Representative: Pantzar, Tord
Atlas Copco Tools AB
Patent Department
105 23 Stockholm (SE)

Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 14 May 1998
refusing European patent application
No. 94 850 149.9 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: P. Alting van Geusau
Members: M. Bidet
C. Holtz

Summary of Facts and Submissions

- I. European patent application No. 94 850 149.9 (publication No.0 642 891) was refused by the Examining Division by the decision under appeal dispatched on 14 May 1998.

The reasons given for the refusal were that the subject-matter of independent claims 1 and 6 did not satisfy the requirements of Article 52(1) in combination with Article 56 EPC having regard to document

D1: EP-A-0 419 435

and the knowledge of the skilled person.

The Examining Division took the view that, when starting from the prior art disclosed in D1 the distinguishing features of the method and apparatus of the independent claims 1 and 6 laid within the customary practice of the skilled person. Moreover, the selection of a solution involving the memorisation of a set value did not in any way result in effects beyond those generally associated with such solutions and for this reason was not inventive either.

- II. Additionally, the following documents were cited in the search report:

D2: US-A-5 215 270

D3: EP-A-0 419 436 and

Patent abstracts of Japan, JP-A-04 201 022.

III. An appeal against that decision was filed on 1 July 1998 together with the statement of the grounds. The appeal fee was paid on the same day.

In his statement of grounds, the appellant submitted that D1 constituted an erroneous specification which did not form any source of information on which a skilled technician would base any development work. Moreover, although the tensioning rate could be adjusted, it was not at all adapted to the actual screw joint characteristics. In contrast thereto, the method according to the present invention comprised a determination of the instantaneous torque resistance growth per time unit during the entire tensioning phase and the rotational speed was continuously adapted in relation to the determined torque resistance growth per time unit. D1 did not give any exploitable hint to the skilled person that would lead him to the method and the device according to the subject-matter of claims 1 and 6 of the present application.

IV. The appellant requested as main request that the decision under appeal be set aside and that a patent be granted on the basis of the following documents:

Claims: 1 to 6 filed on 22 August 1997

Description: pages 1, 1a, 2-5, 5a, 6-9 filed on 23 December 1996,

Drawings: sheets 1/4 to 4/4 as originally filed.

By way of auxiliary request, the appellant requested that the patent be granted on the basis of a new claim 1 based on the combination of claims 1 and 5 of

the main request.

V. Claim 1 reads as follows:

"A method for tightening threaded joints to a desired pretension level by means of a manually operated power nutrunner with a handle, comprising the measures of rotating the joint through a running down phase and a tensioning phase, sensing during rotation of the joint the momentary torque resistance in the joint, and terminating the rotation at the attainment of said desired pretension level, characterised by the measures of determining during the entire tensioning phase the instantaneous torque resistance (M) growth per time unit, comparing said growth with desired values stored in a programmable control unit (PCU), and adapting continuously the rotation speed (n) of the nutrunner in relation to said determined instantaneous torque growth per time unit so as to obtain the same reaction force (F) characteristics in the nutrunner handle for all joints, regardless of differences in torque resistance (M) growth per angle of rotation between the joints."

Claim 6 reads as follows:

"Power nutrunner with a handle for tightening threaded joints in accordance with the method defined in claims 1-5, comprising a motor, an output shaft drivingly coupled to the motor and connectable to a threaded joint to be tightened, a power supply unit (PU) including a power supply switching unit (SWU) connected to the motor, and a programmable power control means (PCU) connected to said power supply switching unit (SWU) and including torque and rotation sensing means (TSU), characterised in that said power control means

(PCU) comprises means for determining during the entire tensioning phase the instantaneous torque growth per time unit, and means for adapting continuously the rotation speed (n) of the nutrunner output shaft in relation to the instantaneous torque growth per time unit and to a desired torque growth per time unit stored in said programmable control means (PCU), so as to obtain the same reaction force (F) characteristics in the nutrunner handle for all joints, regardless of differences in torque resistance (M) growth per angle of rotation between the joints."

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*
 - 2.1 Claim 1 according to the main request is based on claim 1 as originally filed and contains the following additional features:
 - the operated power nutrunner is provided with a handle (disclosed in page 3 of the application as originally filed, last full paragraph, first sentence and page 6, line 19),

 - determining the instantaneous torque resistance growth per time unit during the entire tensioning phase (supported by page 6, penultimate paragraph, line 2), and

 - comparing said growth with desired values stored in a programmable control unit (PCU) (disclosed

also on page 6, penultimate paragraph, lines 1 to 4).

2.2 Similar amendments have been made to claim 6 to conform to the method according to claim 1. It was further specified that the power supply unit (PU) includes a power supply switching unit (SWU) connected to the motor (disclosed on page 9 of the originally filed application).

2.3 Claims 2 to 5 dependent to claim 1 correspond to original claims 2, 3, 4 and 7.

The content of these claims is clarified so that these claims do not give rise to objections under Article 84 EPC.

2.4 The description was amended to include on page 5 references to the prior art not limited to D1. These amendments also do not give rise to objections under the EPC.

3. *Novelty*

Having examined the available prior-art documents, the Board is satisfied that none of them discloses a method for tightening threaded joints to a desired pretension level comprising all the features specified in claim 1. More particularly, there is no disclosure of comparing the instantaneous torque resistance (M) growth per time unit with desired values stored in a programmable control unit and to adapt continuously the rotation speed of the nutrunner so that the reaction force remains the same for all joints, namely for joints with stiff torque resistance as well for joints with soft

torque resistance.

The subject-matter of claim 1 is therefore novel within the meaning of Article 54 EPC.

4. *Inventive step*

4.1 A method for tightening threaded joints to a desired pretension level by means of a manually operated power runner with a handle, comprising the measures of rotating the joint through a running down phase and a tensioning phase, sensing duration rotation of the joint, the momentary torque resistance in the joint, and terminating the rotation at the attainment of said desired pretension levels is known from D1.

4.2 Although D1 indicates that the applied torque is gradually increased along a straight line in the torque growth diagram of Figure 1, which would imply a feed-back (closed loop) control of the torque, actually only open loop control is described: "by adjusting means 16 a desired value of the torque changing speed may be set" (column 4, lines 3 to 6).

Therefore, the Board agrees with the appellant that the disclosure of D1 is erroneous because, not being adapted to the actual screw joint characteristic at all, no gradual increase along a straight line can possibly be arrived at under all circumstances.

Therefore the Board cannot follow the Examining Division's opinion according to which the first characterising feature of claim 1 is known from D1.

4.3 Starting from this prior art document, the technical

problem to be solved by the present invention is to provide a method for tightening threaded joints by a manually operated power nutrunner in which the discomfort reaction force impulse is given a character which is equal at all joints, regardless of differences in torque rate, i.e. torque resistance growth per angle of rotation (see the paragraph bridging the pages 4 and 5 of the application).

- 4.4 The Board is satisfied that the solution given by the features of the characterising part of claim 1 solves the problem effectively. More particularly, by continuously adapting the rotation speed of the nutrunner per time unit during the entire tensioning phase by a comparison of the actual torque growth per time unit with the desired stored values the resultant reaction force impulse in the nutrunner may be changed. The adaptation i.e. the desired stored values is so conducted that the resulting torque resistance felt in the nutrunner handle is the same independently of the stiffness of the joints.
- 4.5 The board is of the opinion that documents D2 and the Patent abstract of Japan JP-A-04 201 022 do not relate to manually operated nutrunners, making them less relevant than documents D1 and D3. The main issue arising in the present case is thus whether the subject-matter of claim 1 is inventive over the teaching of the documents D1 and D3.
- 4.6 Document D3 discloses a method for tightening threaded joints to a predetermined pretension level making use of a manually supported power nut runner. This known method also comprises the steps of rotating the joint through a running down phase and a tensioning phase

(so-called two step tightening process see column 3, lines 5 to 7). Furthermore, in one embodiment the actual torque resistance applied in the joint by the nutrunner is sensed (see description, column 3, lines 8 to 11).

However, torque sensing is carried out not to determine a torque resistance growth per time unit but to avoid any overshoot of torque and parallel thereto to avoid over-reactions from the operator, when the desired torque value is attained.

- 4.7 Furthermore, according to Figure 2 of D3 the torque applied after the desired pretensioning level has been attained is decreased gradually and adjusted to adapt the torque application characteristics of the tool to the reaction ability of each operator.
- 4.8 Therefore, the skilled person who wished to solve the problem underlying the subject-matter of Claim 1 under consideration would not find any exploitable suggestion in D3 leading him to adapt the rotational speed of the nutrunner from the beginning of the tensioning phase up to the attainment of the desired pretension level on the basis of the instantaneous torque resistance growth per time unit.

For these reasons, even if the skilled person starting from D1 would consider D3, no suggestions leading to the characterising features are derivable from this document.

- 4.9 Therefore, the state of the art as illustrated by the documents cited in the search report fail to provide the skilled person with an indication towards the

adaptation of the rotation speed as specified in the characterising part of claim 1. The same applies to the subject-matter of claim 6.

5. Summarising, in the Board's judgment, the proposed solution to the technical problem underlying the present application defined in independent claims 1 and 6 is inventive and therefore these independent claims as well as the dependent claims 2 to 5 relating to preferred embodiments within the meaning of Rule 29(3) EPC can form the basis for grant of a patent.

The description and drawings are in agreement with the actual wording and scope of the claims. Hence these documents are also suitable for grant of a patent.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant a patent with the following documents:

Claims: 1 to 6 filed on 22 August 1997 with letter of 14 August 1997;

Description: pages 1, 1a, 2 to 5, 5a, 6 to 9 filed on 23 December 1996 with letter of 20 December 1996, and

Drawings: sheets 1/4 to 4/4 as originally filed.

The Registrar:

The Chairman:

M. Patin

P. Alting van Geusau