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**Datasheet for the decision  
of 6 December 2022**

**Case Number:** T 0468/19 - 3.2.01

**Application Number:** 06716983.9

**Publication Number:** 1856584

**IPC:** E21B7/02, E21B15/00

**Language of the proceedings:** EN

**Title of invention:**

SENSOR ASSEMBLY IN A GEARBOX FOR POSITIONING

**Patent Proprietor:**

Epiroc Rock Drills Aktiebolag

**Opponent:**

Sandvik Mining and Construction Oy

**Headword:**

**Relevant legal provisions:**

EPC Art. 52(1), 56

**Keyword:**

Inventive step - (yes) - non-obvious alternative

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**  
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Case Number: T 0468/19 - 3.2.01

**D E C I S I O N**  
**of Technical Board of Appeal 3.2.01**  
**of 6 December 2022**

**Appellant:** Sandvik Mining and Construction Oy  
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**Representative:** Papula Oy  
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**Respondent:** Epiroc Rock Drills Aktiebolag  
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**Representative:** Ehrner & Delmar Patentbyrå AB  
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**Decision under appeal:** Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
14 December 2018 concerning maintenance of the  
European Patent No. 1856584 in amended form.

**Composition of the Board:**

**Chairman** G. Pricolo  
**Members:** V. Vinci  
O. Loizou

## **Summary of Facts and Submissions**

I. The appeal filed by the appellant (opponent) is directed against the interlocutory decision of the opposition division to maintain the European patent No. 1 856 584 in amended form.

II. In its decision the opposition division held that the subject-matter of claim 1 according to the main request filed as auxiliary request 2 during oral proceedings involved an inventive step in the meaning of Articles 52(1) and 56 EPC in view, among others, of the following prior art documents:

U1 : Excerpt from manual for AXERA T-11 drilling rig  
D1 : US 6310455 B1  
D4 : US 5145022  
D7 : US 6697722 B2  
D11: W02004/018805

and common general knowledge.

In the course of the appeal proceedings the appellant (opponent) also referred to documents

D9 : US 3761790  
D19 : US 4799556

already cited during the opposition proceedings, and introduced the following additional evidence:

D20 : ZA 9810055  
D21 : US 3774969  
D22: photo of a printing press  
D23: photo of a woodworking machine

D24 : R. August, R. Kasuba, J.L.Frater, and A. Pintz:  
*"Dynamics of Planetary Gear Trains"*, NASA Contractor  
Report 3793, June 1984; pages i-iv and 1-9

D25 : Robert L. Norton: *"Machine Design, an integrated  
approach"*, pages i-xiii and 723.

- III. With the communication according to Article 15(1) RPBA dated 28 March 2022 the Board informed the parties of its preliminary assessment of the case.

Oral proceedings pursuant to Article 116 EPC were held before the Board on 6 December 2022 by videoconference.

- IV. The appellant (opponent) requested that the decision under appeal be set aside and the patent be revoked in its entirety.

The respondent (patent proprietor) requested that the appeal be dismissed (main request) or, in the alternative, that the patent be maintained in amended form on the basis of one of first to fourth auxiliary requests, filed with the reply to the statement of the grounds of appeal.

- V. Independent claim 1 of the patent as maintained by the opposition division reads as follows:

*"Gearbox and sensor assembly in the gearbox arranged to be used for positioning, where the sensor assembly comprises a relative to a gearbox housing (18) fixed sensor (20),*

*wherein a shaft (28) fixed to an output shaft (26) of the gearbox (14, 16) and connected to the sensor (20) is used when measuring the angle in the gearbox between the gearbox housing (18) and the output shaft (26) of*

*the gearbox (14, 16),*

*where the gearbox (14, 16) is arranged to achieve the rotations for a rotational degree of freedom (Z4, Z5) in a joint (3, 5) of a drill boom (4) in a rock drilling rig (2),*

*where the shaft (28) fixed to the output shaft (26) and connected to the sensor (20) passes through the center of the gearbox (14, 16), and through a central through hole (40) in the gearbox propulsion motor (22) connected to the input shaft of the gearbox (14, 16),*

*where the sensor assembly comprises a control system arranged to receive information about the actual angle in the gearbox (14, 16), characterised in that*

*the control system is arranged to cut down the power to the motor (22) of the gearbox (14, 16) when the gearbox (14, 16) approaches a pre-programmed end position, and*

*that a gear of the gearbox (14, 16) is a planetary gear."*

## Reasons for the Decision

1. The subject-matter of claim 1 of the patent as maintained by the opposition division involves an inventive step in the meaning of Articles 52(1) and 56 EPC as stated in the decision under appeal.
2. With their appeal the appellant (opponent) contested this decision and submitted following inventive step attacks:

### U1 in view common general knowledge or D19

- 2.1 The Board shares the view of the opposition division that the manual for the "AXERA T11 DATA" rock drilling rig labelled U1 represents the closest prior art because, unlike D1, it discloses a gearbox with a sensor assembly used in the joint of a drill boom of a rock drilling rig, thus in accordance with the preamble of claim 1.
- 2.2 It is uncontested that U1, as stated in the appealed decision, does not show the features of the characterizing portion of claim 1, namely that:

*(i) the control system is arranged to cut down the power to the motor (22) of the gearbox (14, 16) when the gearbox (14, 16) approaches a pre-programmed end position,*

and that

*(ii) a gear of the gearbox (14, 16) is a planetary gear.*

2.3 The respondent (patent proprietor) objected the feature analysis of the opposition division and asserted that the hydraulic actuator shown in U1 (see page labelled B2.2) was not a "gearbox" in the meaning commonly ascribed to this technical term by a person skilled in the art, and even less that this presumed gearbox comprised a shaft connected to the sensor and fixed to the output shaft, said shaft connected to the sensor passing through the center of the gearbox as required by the preamble of claim 1.

2.4 Regarding the above controversial points, the Board follows the view of the appellant (opponent) that the interaction of the helicoidal inner and outer splines of the hollow rifled cylinder with the outer splines of the externally rifled bar connected to lower flange and with the ring-shaped gear fixed to the housing of the assembly respectively (see page labeled B2.2 of U1) results in the transmission of the rotational movement of the hollow rifled cylinder according to a predetermined transmission ratio, whereby the hydraulic actuator of U1 can indeed be equated with a gearbox. However, the Board shares the view of the respondent (patent proprietor) that the thin shaft protruding upwardly from the element labelled as "*disc shaped piston part*" in the colored version of page B2.2 and which is uncontroversially meant to be connected to the position sensor of the assembly according to U1, is not connected to the output shaft of the rotary actuator of U1 and does not pass through the center of the gearbox as instead required by claim 1 as maintained.

2.5 The appellant (opponent) put forward that the distinguishing features of the characterising portion of claim 1 were not technically interrelated in such a way to provide a synergistic effect, but rather solved



two unrelated technical problems, namely to improve operational safety when the drill boom approached the programmed end position by introducing a well known "*soft stop*" control (feature (i)), and to provide an alternative gearbox (feature (ii)) for rotating and positioning the drill boom. It was thus concluded that the inventive contribution of features (i) and (ii) of claim 1 had to be assessed separately.

2.6 Regarding feature (i), the appellant (opponent) argued that the idea of introducing a "*soft stop*" in a positioning assembly of a working machine fell within customary practice of a person skilled in the art who knew that it was physically necessary to slow down the movement of a heavy element like a drill boom when it approached a programmed angular end position in order to avoid to pass such end position with the risk of causing collision and/or damages.

2.7 Regarding feature (ii) the appellant (opponent) argued that the person skilled in the art starting from U1 and looking for an alternative gearbox assembly suitable for rotating and angularly positioning the drill boom of a rock drilling rig would definitively consider the possibility to either add a planetary gearbox to the existing hydraulic actuator or to replace it by a planetary gear which, as well known (reference was made in this respect to non-patent literature D24 and D25 the admissibility of which was contested by the respondent (patent proprietor)), provided advantages in terms of space, reduced weight and accuracy of movement which motivated the person skilled in the art to take this step. Furthermore, the appellant (opponent) referred to documents D20 and D21, the admissibility of which was also contested by the respondent (patent proprietor), and observed that planetary gears were

commonly used in heavy mining machines. It was also asserted that, contrary to the view of the opposition division and the respondent (patent proprietor), no major constructional modifications were required in the assembly of U1 in order to introduce a planetary gearbox or to replace the whole hydraulic actuator by a planetary gear. As an example, the appellant (opponent) explained that it was possible to cut teeth around the outer perimeter of the burgundy-coloured thick disc at the lower end of the inner rifled bar (see colored version of page B.2.2 of U1) in such a way to use the resulting teethed gear as the sun gear of the planetary gear which could thus be added to the hydraulic actuator of U1 without requiring any major structural change. In the alternative, the appellant (opponent) considered obvious to replace the whole hydraulic actuator of the assembly of U1 by a planetary gear associated with an additional rotational motor driving the input shaft thereof.

2.8 In order to support the allegation that the introduction of a planetary gear in the assembly of U1 was an obvious choice for the person skilled in the art looking for an advantageous alternative to the hydraulic actuator used in the known assembly, the appellant (opponent) proposed for the first time with their reply dated 03 October 2022 and during oral proceedings the combination of U1 with document D19 which was cited in a different context during the opposition proceedings. The admissibility of this new line of attack and, more in general, the use of document D19 for questioning inventive step was contested by the respondent (patent proprietor) under Article 13(2) RPBA 2020. However, as it will become apparent from the conclusions below, a decision on the disputed admissibility of this new line of attack and

of documents D20, D21, D24 and D25 is not required for the present decision.

2.9 The appellant (opponent) argued that document D19, disclosing a joint for the drill boom of a rock drilling rig, provided an explicit hint to the possibility to replace the hydraulic actuator used therein to rotate the drill boom by a gearbox of the kind comprising "*intermeshing gears*" and to separate the rotation and holding functions of the joint (see column 1, lines 53-54 and column 4, lines 9-11). The appellant (opponent) observed that D19 additionally stressed the importance of having a joint and associated gearbox characterized by a lightweight and compact structure (reference was made to column 3, lines 48-50), thereby implicitly pointing at a gearbox having a coaxial arrangement of the input and output shafts which, as well known, minimized the overall dimensions. The appellant (opponent) further observed that it was well known that the above mentioned functional and structural requirements were fulfilled by planetary gearboxes (reference was made in this respect to evidence D24 and D25). Finally it was again pointed out that D20 and D21 showed that planetary gears were commonly used also in heavy mining machines. In view of the above the appellant (opponent) concluded that the person skilled in the art looking for an advantageous alternative to the hydraulic actuator of U1 was certainly motivated and directed by the information contained in D19 and in view of common technical knowledge (see D20, D21, D24, D25) to select, among all the possible "*intermeshing gears*" a planetary gear and to introduce it in the assembly of U1 for rotating and positioning the drill boom thereby achieving, without inventive step, the subject-matter

of claim 1 as maintained by the opposition division.

2.10 The arguments of the appellant (opponent) are not convincing:

Irrespective of the the assessment of the inventive contribution of the distinguishing feature (i) alleged by the respondent (patent proprietor), the Board is of the opinion that the step of introducing a planetary gear in the assembly of U1 or to replace the whole hydraulic actuator thereby according to distinguishing feature (ii) is not rendered obvious by the cited prior art documents even taking common general knowledge into account.

2.11 The Board concurs with the appellant (opponent) that starting from U1 and in view of the distinguishing feature (ii) the partial problem to be solved by the contested patent consists in identifying an alternative to the hydraulic actuator described therein suitable for rotating and positioning the drill boom of a rock drilling rig. In fact, as noticed by the appellant (opponent), the patent disclosure does not present any particular and unforeseeable advantage linked to the selection, among several alternatives, of a planetary gear. However, the Board points out that according to established Case Law of the Boards of Appeal it is not necessary for an inventive step to be present to show that an improvement over the prior art - substantial or gradual - is achieved, whereby a mere but non-obvious alternative solving the same technical problem as in the prior art, i.e. how to control the rotation and position of the drill boom of a rock drilling rig, may also involve an inventive step in the meaning of Articles 52(1) and 56 EPC. This is the case here for

the following reasons:

- 2.12 The Board concurs with the opposition division and the respondent (patent proprietor) that, because of the major structural changes and adaptation required, the person skilled in the art is not encouraged to add a planetary gear to the hydraulic actuator of U1 or to replace the latter by a planetary gear. Contrary to the interpretation of the functionality of the hydraulic actuator shown on page B2.2 of U1 given by the appellant (opponent), the Board agrees with the respondent (patent proprietor) that the burgundy-coloured thick disc of the hydraulic actuator is meant to be flanged to the end of the boom and hence does not rotate at all as incorrectly asserted the appellant (opponent). In fact, as convincingly explained by the respondent (patent proprietor) at the oral proceedings by referring to pages A3.1 and A4.1 and B2.2 of U1, the rotation of the hollow rifled cylinder induced by the axial movement of the piston of the hydraulic actuator determines the rotation of the housing (element depicted in blue on colored page B2.2) which is in turn flanged to the feeding beam of the rock drilling rig, while the thick disc stays stationary. Therefore cutting teeth into the thick disc at the lower end of the internal rifled bar to use the resulting gear as sun gear of a planetary gear as proposed by the appellant (opponent) does not make any technical sense. Also replacing the whole hydraulic actuator of U1 by a planetary gear driven by an additional rotational motor cannot be seen as an obvious modification because it is not immediately apparent how such a planetary gear could be arranged within the existing structure of the joint of U1 without major modifications. In any case these non-trivial modifications would not directly lead to the subject-matter of claim 1 because a further

non obvious step would be required, namely to connect the shaft fixed to the sensor to the output shaft of the planetary gear and arrange it in such a way that it passes through the center of the gearbox as required by claim 1 as maintained. For these reasons the Board judges that the argumentation proposed by the appellant (opponent) suffers from an unallowable ex post facto approach which makes use of the foreknowledge of the solution according to the contested patent which, as such, cannot convincingly demonstrate the alleged lack of inventive step.

Document D1 and common general knowledge or D19

2.13 The appellant (opponent) considered D1 as an alternative and technically meaningful closest prior art for the subject-matter of claim 1. It was pointed out that this document disclosed a gearbox and sensor assembly comprising a planetary gear to be used for positioning movable parts of a working industrial machine as, for example, a printing press or a woodworking machine. In the appellant's (opponent's) view and contrary to the opinion of the opposition division, these machines have dimensions and are subjected to loads comparable to those of rock drilling rigs (reference was made to the photos labelled D22 and D23 filed with the statement of grounds of appeal). Furthermore, it was observed that no applicable loads or dimensions of the rock drilling rig were presented in claim 1, whereby no limitation in this respect could be enforced. The appellant (opponent) thus concluded that as the gearbox and sensor assembly of D1 was inherently suitable for use in a joint of a drill boom of a rock drilling rig, it was justified to consider this document as closest prior art. The appellant (opponent) did not contest that D1 did not disclose a

controller "arranged to cut down the power to the motor (22) of the gearbox (14, 16) when the gearbox (14, 16) approaches a pre-programmed end position" according to the first characterizing feature of claim 1 as maintained (feature (i)). However, they expressed the view that the adaptation of the controller of the assembly of D1 required to allow a "soft stop" of a movable element approaching a pre-programmed end position represented a trivial measure for the same reasons presented in the context of the line of inventive step attack using U1 as the closest prior art document. The appellant (opponent) further argued that starting from D1 as closest prior art and in view of the absence of any mention of rock drilling rig in D1, the technical problem underlying the contested patent could only be seen in suggesting an alternative use for this known positioning assembly. It was finally asserted that the idea to use the assembly of D1 in a rock drilling rig was an obvious possibility taking into account that the loads to which this kind of mining machines were subjected in operation were allegedly comparable to those of at least some of the industrial machines explicitly mentioned in D1. Therefore, in the appellant's (opponent's) view, there was no reason to rule out the use of the gearbox and sensor assembly of D1 in the joint of a drill boom of a rock drilling rig and/or to disregard the teaching of this prior art document when assessing inventive step. The appellant (opponent) came to the same conclusion in view of the combination of D1 with D19 and reverse which were discussed in their reply dated 03 October 2022.

2.14 Also these arguments are not convincing:

Regardless of the assessment of the distinguishing

feature (i), the Board concurs with the respondent (patent proprietor) that D1 cannot be considered an appropriate starting point for correctly assessing inventive step of the subject-matter of claim 1 as stake. In this respect the Board follows the argument of the respondent (patent proprietor) that the person skilled in the art, in view of the specific applications presented in column 1, lines 7-15 of D1 and of the structural and operational specifications inherent to this kind of machines, would not consider to use the disclosed rotation and positioning assembly to control the position of the joint operating the drill boom of a rock drilling rig which, contrary to the view of the appellant (opponent), is subjected to heavier loads and more hostile and critical environmental conditions compared to those of printing presses or woodworking machinery. Furthermore, as also convincingly pointed out by the respondent (patent proprietor), the output shaft of the machines mentioned in D1 carries out multiple revolutions/spinning while the drill boom of a rock drilling rig usually undergoes rotations  $\leq 180^\circ$ . In this respect the Board does not read paragraph [0014] of the contested patent cited by the appellant (opponent) in support of their position and mentioning rotations  $> 360^\circ$  as meaning that the drill boom can also carry out multiple rotations/spinning as it is the case of the output shaft of the machines mentioned in D1. In conclusion, as for the reasons above D1 cannot be considered as meaningful closest prior art compared to U1. These lines of inventive step attack are not convincing and cannot question the assessment of the opposition division that the subject-matter of claim 1 involves an inventive step over the prior art.



D4 and D7

2.15 With their written submissions, the appellant (opponent) shortly discussed the technical content of these additional documents, whereby it is not clear whether they were considered to represent alternative starting points for the contested patent or merely in combination with U1 or D1. In any case, the Board concurs with the respondent (patent proprietor) that this evidence relates to systems for controlling the position of the output shaft of machines that also work under very different load and operation conditions compared to the loads and operation conditions of a joint suitable for the drill boom of a rock drilling rig, i.e. the control of the movement of the vehicle's rear wheels (D4) or the control of the position of the shaft of an industrial sewing machine (D9). Consequently, the allegation of the appellant (opponent) that the person skilled in the art would consider these known solutions when looking for an alternative gearbox and sensor assembly suitable for being used in a joint operating the drill boom of a rock drilling rig does not appear convincing for the same reasons presented in respect of D1.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:



A. Vottner

G. Pricolo

Decision electronically authenticated