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Datasheet for the decision of 15 September 2021

Case Number: T 1679/18 - 3.2.01

Application Number: 05733997.0

Publication Number: 1868865

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Language of the proceedings: EN

Title of invention:
SYSTEM FOR CONTROL OF BRAKE ACTUATOR BASED AT LEAST IN PART UPON TIRE/ROAD FRICTION FORCE

Patent Proprietor:
Haldex Brake Products AB

Opponent:
Knorr-Bremse
Systeme für Nutzfahrzeuge GmbH

Headword:

Relevant legal provisions:
EPC Art. 100(c), 111(1)
RPBA 2020 Art. 11, 12(2)

Keyword:
Amendments - extension beyond the content of the application as filed (no)
Remittal to the department of first instance - (yes)

Decisions cited:
G 0002/10, T 0095/97, T 0860/00, T 1906/11

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

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Case Number: T 1679/18 - 3.2.01

D E C I S I O N
of Technical Board of Appeal 3.2.01
of 15 September 2021

Appellant: (Patent Proprietor)	Haldex Brake Products AB P.O. Box 501 261 24 Landskrona (SE)
Representative:	Ström & Gulliksson AB P.O. Box 4188 203 13 Malmö (SE)
Respondent: (Opponent)	Knorr-Bremse Systeme für Nutzfahrzeuge GmbH Moosacher Str. 80 80809 München (DE)
Representative:	LifeTech IP Spies & Behrndt Patentanwälte PartG mbB Elsenheimerstraße 47a 80687 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 9 May 2018 revoking European patent No. 1868865 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	H. Geuss
Members:	W. Marx
	A. Jimenez

Summary of Facts and Submissions

I. The patent proprietor lodged an appeal against the decision of the opposition division revoking the European patent No. 1 868 865.

II. In its decision the opposition division held *i.a.* that the subject-matter of claim 1 of the granted patent extended beyond the disclosure as originally filed.

III. With its grounds of appeal, the patent proprietor re-filed its auxiliary requests 1 to 10 already filed before the opposition division and a new auxiliary request 11.

IV. Oral proceedings before the Board took place on 15 September 2021.

The appellant (patent proprietor) requested that the decision under appeal be set aside and the patent be maintained as granted (main request), or in the alternative, on the basis of one of the auxiliary requests 1 to 11 as filed with the grounds of appeal on 19 September 2018.

The respondent (opponent) requested that the appeal be dismissed.

V. Claim 1 as granted according to the main request reads as follows (amendments with respect to claim 1 as originally filed are marked in strike-through for deletions and by underlining for additions):

"A vehicle brake system comprising:

a brake actuator (144) associated with a wheel, (138) said brake actuator having at least one moveable brake component (14, 16, 32, 203, 214);
a brake control system (136) operative to determine a target rotational velocity of the wheel based at least in part on a relationship between an actual tire/road friction force and a target tire/road friction force, said brake control system (136) determining a target position of the at least one moveable brake component (14, 16, 32, 203, 214) based at least in part upon the target rotational velocity; and
wherein said brake control system (136) is operable to control actuation of said brake actuator (144) based at least in part upon a comparison of the target position of the at least one moveable brake component ~~and at least in part based upon~~ with a current position (104) of the at least one moveable brake component."

VI. The appellant (patent proprietor) essentially argued as follows:

The term "*comparison*" per se was inherent in the concept of feedback control, to which the description related, as agreed by the opposition division.

Moreover, the embodiment of Figs. 7 - 8 encompassed the embodiment shown in Figs. 1 - 6. The schemes shown were not mutually exclusive but concerned the same wheel brake system. Already from the brief description of the drawings, it was apparent that the patent involved only one type of wheel brake. Figs. 1 - 6 were related to control of an individual wheel brake of a vehicle, whereas Figs. 7 - 8 related to control of the entire vehicle brake system, having multiple individual wheel brakes, denoted as "*another embodiment*" only as it added features and functionality on a vehicle level.

This was explicitly mentioned in paragraph [0096] on page 44 (line 4 and last two lines) of the application as filed where the invention was described.

The example shown in Fig. 4 concerned solving the problem of the unstable characteristics of certain brakes, as achieved by feedback control of the position of a moveable brake component, which was even explained as being "*critically necessary*" (see paragraphs [0073] to [0075] and [0077]). According to Fig. 7 the wheel controller 140 output the commanded target position based on the target rotational velocity to the brake actuator 144. This was then applied by the actuator using feedback control (fast inner loop 110) comparing the current with the commanded position of the moveable brake component. In the sections of the description relating to Figs. 7 and 8 (see paragraph [0082]: "*As discussed above, the ideal goal of the wheel brake controller is to regulate the wheel rotational velocity of each wheel ...*"; also paragraph [0090]) it was explicitly stated how the brake system 136, comprising the actuator 144 with the moveable brake component, controlled the braking of each wheel of the vehicle. This equalled how the target position, or any other primary command that was to be achieved by the actuator 144, was derived (see also paragraph [0093]). This regulation was not to be confused with how the control of the brake actuator 144 (or more specifically movement of a brake component thereof) was performed to achieve the target braking torque or the target position, and how unstable braking characteristics due the self-energizing characteristics of the brake were avoided (see paragraph [0092]: "*... the task of the EMB brake actuator 144, as shown in Figure 7, is to achieve a commanded brake torque ... or a commanded EMB position*").

Original claim 1 already disclosed a control based on the target and current positions. The skilled person reading the application learnt from Fig. 4 (indicating a fast position control loop 110) that, on a brake level, a position command of a moveable brake component was derived from primary commands. Fig. 7 represented a scheme on system level. On this more general level, the fast position control loop 110 was performed inside the EMB actuator 144, whereas the outside of module 144 related to the system or primary command level. The additional signals 120 shown in Fig. 4 concerned the outer loop and formed part of the wheel controller 140. Fig. 1 was linked to Figs. 4 and 7. Fig. 1 showed a brake controller 100, position indicative commands 102, and pos/vel/acc sensors and signals 104 and 106, i.e. corresponded to the modules of the inner position control loop 110 of Fig. 4. An explicit link between Fig. 1 and Fig. 7 was given in paragraph [0050] (of the brief description of the drawings) and by various hints throughout the specification (paragraph [0073],[0096]).

VII. The arguments of the respondent may be summarised as follows:

In claim 1 as originally filed, actuation of the brake controller was generally based on two quantities, namely target position and current position. According to amended claim 1 as granted, control was limited to a (not explicitly disclosed) comparison of these two quantities. An implicit disclosure did not include all subject-matters that may or may not be obvious from the teaching of the respective document. According to the established Case Law a skilled person would consider a disclosure **implicit** and thus part of its content (see G 2/10) if it was **necessarily** implied by the patent

application as a whole (see e.g. T 860/00; also e.g. T 95/97). The question to be answered was therefore whether the amendment was a necessary consequence of the disclosure of the original documents.

The feedback control referred to by the appellant did not necessarily involve a comparison, but only that a result of the controlling was fed back and available as further input to base at least partly a control thereon (as also indicated in Figure 4). In particular:

- Paragraph [0073] ("*As discussed above, control based on feedback is critically necessary ...*") referred back to paragraph [0009] stating that feedback control was only critically necessary "*in cases (2) and (3)*" described before, i.e. not in case (1) of a self-releasing brake, so it was not a necessary consequence and thus not unambiguously disclosed. Paragraphs [0073] and [0074] (referring to the disadvantageous force feedback control in the prior art) might teach any feedback, including a feedback of rotational velocity.
- A comparison of position values was not derivable from paragraph [0075] or [0092] of the application as filed, specifying the aim of the control to "*achieve the desired position*" or to "*achieve a commanded EMB position*". Although Fig. 4 showed a feedback of position, Fig. 7 (blocks 140, 144, 138) rather taught a feedback control feeding back the rotational velocity of the wheel, not the position of the brake component. Paragraph [0091] even stated that "*the EMB brake actuator 144 may be controlled without direct use of feedback*". The aim of control to achieve a desired/commanded position could relate to a calibration scheme, i.e. position was not necessarily controlled via feedback.

A fast position control loop located in the EMB actuator of Fig. 7 was not originally disclosed. Fig. 7 disclosed the possibility that the determination of the target position was performed based on the target rotational velocity as defined in claim 1, which was not disclosed in conjunction with Figs.4, 5. In the absence of any clear disclosure or relationship between the components shown in Fig. 7 (wheel controller 140) and Fig. 4 (brake controller 100), both embodiments could not be combined (cf. "*gold standard*" established in G 2/10; see also T 1906/11, according to which the relevant technical question was whether the skilled person "*would derive from that amended version any additional technical information*"; see also T 248/12, T 1791/12). Thus, granted claim 1 contained new technical information which was not provided from the documents as originally filed. In more detail:

- The feedback control of Figs. 4 and 5 was different from the feedback control of Fig. 7. According to Fig. 5, the commanded position signal was derived from a brake torque command and not based on the rotational velocity specified in granted claim 1. This was also in contradiction with original claim 1, which had to be understood by Fig. 7 not disclosing a feedback in position. When controlling the rotational velocity of the wheel, a commanded position was achieved based on a different control scheme. Fig. 1 did not show any control loop.
- As stated in paragraph [0095] of the application as filed, the target signals of the wheel controller 140 (such as commanded brake torque or position) could be derived directly from the driver, which implied further possibilities, so the feedback control of position of Fig. 4 was not necessarily implied in Fig. 7 which disclosed a feedback control of rotational velocity.

- In Fig. 7, a feedback of position might be situated in the slow control loop of the control system 136, not in the EMB actuator 144 (which according to the appellant included the fast position control loop).

Reasons for the Decision

1. Patent as granted (main request)

1.1 The ground for opposition under Article 100(c) EPC does not prejudice the maintenance of the European patent, since the subject-matter of claim 1 as granted according to the main request does not extend beyond the content of the application as filed.

1.2 Firstly, the Board concurs with the assessment of the opposition division that the originally disclosed term "*feedback control*" (see e.g. paragraphs [0073], [0074] of the description as originally filed) implies a comparison between a target value and a current value.

Moreover, as to the value to be compared, the feedback control is further specified in paragraph [0073] to be a control "*based upon the position of one or more brake system components*". Paragraph [0074] then explicitly refers to the "*fast position control loop 110*" as shown in Fig. 4 (see also paragraph [0076]) and also to the "*feedback from the position signal in the control loop*". The Board therefore considers that a "*position feedback control*" is originally disclosed, which implies a comparison between a target position and a current position as specified in claim 1 as granted.

1.2.1 The respondent contested that the amended feature in granted claim 1 ("*a comparison of the target position of the at least one moveable brake component with a current position*") was necessarily implied by the patent application as a whole and a necessary consequence of the disclosure of the original documents, as required according to the established Case Law.

1.2.2 Although the original disclosure indicates in its introductory section on self-energized brakes that a control based on feedback is not required in all three cases of dimensioning a self-energizing brake (see paragraphs [0008] and [0009]), it cannot be derived therefrom that a more specific disclosure of the invention disclosed thereafter in the application documents in relation to Fig. 4 (as set out above) is not a valid basis of disclosure. The decisions cited by the respondent in this respect are therefore considered not applicable in the present case.

1.2.3 Moreover, the Board cannot follow the respondent that the position signal representing a current position was only available as a further input to the brake control system. Allegedly, any feedback control might be taught in paragraphs [0073] and [0074], including a feedback of rotational velocity as taught by Fig. 7, or the aim of the control "*to achieve a desired/commanded position*" (see paragraphs [0075], [0092]) could also relate to a calibration scheme or a control without direct use of feedback (see paragraph [0091]).

In the present case, the person skilled in the art, having knowledge of control systems, reading that the position signal is used as feedback in "fast *position control loop 110*" (see paragraph [0074]) will

understand immediately that the brake controller of Fig. 4 does not only receive the current position signal, but also a commanded or target position to achieve the desired position of the brake component. This is even explicitly stated in the original application (see paragraph [0075]) and shown in Fig. 4. Moreover, having a feedback control of position in a position control loop implies for the skilled person that the brake controller evaluates whether target position and current position are matching, which requires a comparison between a target position and a current position, as specified in granted claim 1.

1.2.4 The Board also notes that the patent specification as a whole nowhere suggests a different meaning, diverging from the common understanding in the field of control systems, with regard to the terms "*position feedback control*" or "*position control loop*". On the contrary, as explicitly stated in the introductory part of the application as filed (paragraph [0010]) when describing how feedback control was performed in the known prior art, feedback control was performed by "***comparing*** *a setpoint value of a frictional force with the actual value of the frictional force*" and "*disadvantageous for a number of reasons*". Reading paragraphs [0073] and [0074] on this background, it is immediately clear that the disadvantageous force feedback control known in the prior art (comparing a setpoint or target force with an actual or current force) is replaced by a position feedback control, which compares a target position with a current position, as specified in claim 1 as granted.

1.3 Secondly, the Board does not agree with the finding in the contested decision that the first embodiment according to Fig. 4 did not fall within the scope of the granted claim ("*target position ... based at least*

in part upon the target rotational velocity") and the second embodiment in Fig. 7 was not controlled based on a comparison between a target position and a current position of a moveable brake component.

1.3.1 The respondent argued that a fast position control loop within the EMB actuator of Fig. 7 was not originally disclosed. Allegedly, Fig. 7 showed that the target position was determined based on the target rotational velocity as defined in claim 1, but not in conjunction with Figs. 4, 5. Both embodiments could not be combined, as it was unclear how wheel controller 140 of Fig. 7 related to brake controller 100 of Fig. 4.

1.3.2 According to established Case Law of the Boards of Appeal (as also referred to by the respondent) and the "*gold standard*" established in decision G 2/10, any amendment can only be made within the limits of what a skilled person would derive directly and unambiguously, using common general knowledge, and seen objectively and relative to the date of filing, from the whole of the documents (description, claims and drawings) as filed. After the amendment the skilled person may not be presented with new technical information (see also e.g. T 1906/11).

1.3.3 The Board concurs with the appellant that the embodiments shown in Figs. 4 and 7 are not mutually exclusive but concern the same wheel brake system. The brief description of the drawings of the application as filed (paragraphs [0044] to [0051]) already makes clear that only one type of wheel brake is disclosed, namely a brake of a vehicle as shown in Figs. 1 and 2. According to paragraphs [0047] and [0050], Fig. 4 relates to a "*system for controlling the application of a brake of a vehicle shown in FIGS. 1 and 2*", and

Fig. 7 relates to a "*system for controlling the application of multiple brakes of a vehicle shown in FIGS. 1 and 2*".

First of all, the Board finds that Figs. 1 and 4 relate to one and the same embodiment. Both Fig. 1 and Fig. 4 show - with identical terms and even same reference numerals - a brake controller 100 controlling the brake via a motor 32 on the basis of sensor signals 104 (including a position signal) of sensors 106 and position indicative commands 102. In Fig. 4, these components constitute the fast position control loop 110, which receives as an input the position indicative commands 102 and internally feeds back position signals 104 from sensors 106 to the brake controller 100. Fig. 1 provides a schematic view of a brake system with additional details of the mechanical construction of the disc brake 10 actuated by motor 32, according to paragraph [0044] also "*incorporating a system for controlling the application of a brake of a vehicle in according with the present invention*". Fig. 4 shows in more detail (see paragraph [0047]) the system for controlling brake application, namely a control scheme of motor actuation including the fast position control loop 110. A link between Figs 1 and 4 is also explicitly provided in the text of the description as originally filed (see paragraphs [0073] - [0077]). The brake 10 of Fig. 1 is said to include a brake controller 100 which controls actuation of brake 10 via motor 32 based upon the position (paragraph [0073]), in particular by "*using the position signal as feedback in the fast position control loop 110*" which is "*described in more detail below*" (as stated in paragraph [0074]), namely when referring to Fig. 4 starting with paragraph [0077].

Moreover, the embodiment shown in Fig. 7 is explicitly said (paragraph [0050]) to relate to brakes of a vehicle as shown in Figs. 1 and 2, i.e. (as set out above) to a brake 10 comprising a brake controller 100 and a fast position control loop 110. Thus, the system for controlling multiple brakes of a vehicle according to Fig. 7 is linked to the embodiment according to Figs. 1 and 4. The wheel controller 140 shown in Fig. 7 provides (according to one alternative described in paragraph [0093]) a commanded or target EMB position based on the target rotational velocity to the EMB actuator 144, as required by claim 1. The task of EMB actuator 144 is (see paragraph [0092]) to achieve the commanded EMB position. In view of the clear link between the embodiment according to Figs. 1 and 4 (relating to the control scheme for an individual wheel brake) and the control scheme on vehicle level shown in Fig. 7 as argued above, position feedback control as represented by the fast inner loop 110 shown in Fig. 4 must be performed within the EMB actuator 144 shown in Fig. 7. The Board agrees with the appellant that regulation of the rotational velocity of each wheel disclosed in relation to Fig. 7 (e.g. paragraph [0082]) must not be confused with how the control of brake actuator 144 is performed to achieve the target position (as stated in paragraph [0092]). As finally summarised in paragraph [0096] of the application as filed, the invention according to the patent application "*relies on sensor feedback to control application of the brake*" (on wheel brake level) and "*regulates wheel velocity of multiple wheels such that whole vehicle control is optimized*" (on vehicle level).

1.3.4 For the reasons set out above, the Board does not follow the respondent that Fig. 1 did not show any control loop and that the feedback control disclosed in

Figs. 4 and 5 was different from the feedback control of Fig. 7. The command conversion routine 112 of Fig. 4 as described in Fig. 5 even shows the different command values output by wheel controller 140 as represented in Fig. 7 (e.g. a brake torque command or a position command), so it is clear for the skilled person which conversion has to take place in EMB actuator 144 for each of the alternative command outputs. In particular, if the wheel controller 140 already provides the commanded position, no conversion is required at all (as stated in paragraph [0079]). In this case, the EMB actuator 144 of Fig. 7 incorporates only the fast position control loop 110 of Fig. 4 and thus a feedback in position. At any rate, the commanded position is achieved within actuator 144 based on the control scheme of Fig. 4, i.e. in the fast position control loop 110 and not based on a different control scheme.

The respondent also argued that the feedback control of position of Fig. 4 was not necessarily implied in Fig. 7, since further possibilities were implied, e.g. (see paragraph [0095]) that the target signals could be derived directly from the driver. However, the criterion of being "necessarily implied" is relevant when assessing an implicit disclosure, but does not apply when assessing whether an amended feature is originally disclosed on the basis of a clear link between different parts of the description, as set out above. In the present case, different alternatives might be disclosed in relation to Figs. 4 and 7. Nevertheless, the subject-matter as specified in claim 1 as granted is originally disclosed at least by one of the alternatives as set out further above.

1.3.5 The board therefore holds that the skilled person is not presented with new technical information in view of

the amendment in granted claim 1 as compared to the original disclosure in the application as filed.

2. Remittal to the department of first instance

2.1 The contested patent has been opposed also on the grounds for opposition set out in Article 100(a) and Article (b) EPC, which have not been dealt with in the contested decision.

2.2 Under Article 111(1) EPC, the Board may in the present case either proceed further with the case, or remit it to the opposition division for further prosecution. The Board sees no reason to conduct a complete examination of the patent for compliance with Articles 100(a) and (b) EPC for which no decision of the first instance exists yet (cf. Article 11 RPBA 2020 in conjunction with Article 12(2) RPBA 2020).

2.3 Consequently, the Board considers it appropriate to exercise its discretion under Article 111(1) EPC to remit the case to the department of first instance for further prosecution.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the opposition division for further prosecution.

The Registrar: The Chairman:

D. Magliano H. Geuss

Decision electronically authenticated