Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 11 August 2022

Case Number: T 1897/20 - 3.5.03

Application Number: 16161620.6

Publication Number: 3073342

IPC: G05D1/02, A01D34/00

Language of the proceedings: EN

Title of invention:
Control apparatus for autonomously navigating utility vehicle

Applicant:
HONDA MOTOR CO., LTD.

Headword:
Mower's turning pattern/HONDA

Relevant legal provisions:
EPC Art. 56
RPBA 2020 Art. 12(2), 12(4), 12(6)

Keyword:
Admittance of requests filed with the appeal - main and auxiliary requests I to VI (no): fresh case
Inventive step - auxiliary requests VII and VIII (no)

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 1897/20 - 3.5.03

D E C I S I O N
of Technical Board of Appeal 3.5.03
of 11 August 2022

Appellant: (Applicant)	HONDA MOTOR CO., LTD. 1-1, Minami-Aoyama 2-chome, Minato-ku, Tokyo, 107-8556 (JP)
Representative:	Weickmann & Weickmann PartmbB Postfach 860 820 81635 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 22 April 2020 refusing European patent application No. 16161620.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair	K. Bengi-Akyürek
Members:	R. Gerdes
	C. Heath

Summary of Facts and Submissions

I. The examining division refused the present patent application on the grounds that the subject-matter of claim 1 of the applicant's main and first auxiliary requests did not involve an inventive step (Article 56 EPC) in view of the following prior-art documents:

D2: US 2012/0265391 A1 and
D3: US 2013/0006419 A1.

II. The applicant (appellant) appealed against this decision and requested that the decision under appeal be set aside and that a patent be granted based on the claims of a **main request** or **auxiliary requests I to VIII** submitted with the statement of grounds of appeal.

III. Oral proceedings before the board were held by videoconference on 11 August 2022.

The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request or one of auxiliary requests I to VIII, all filed with the grounds of appeal. Auxiliary requests VII and VIII were the subject of the decision under appeal.

At the end of the oral proceedings, the board's decision was announced.

IV. Claim 1 of the **main request** reads as follows:

"An apparatus for controlling operation of an autonomously navigating utility vehicle (1) equipped

with a prime mover (18) to travel about a working area (AR) delineated by a boundary wire (2) laid thereat in order to perform work autonomously,

wherein

a working region establishing unit (43) that divides the working area (AR) into multiple regions (ARn) by an imaginary boundary line (L) and establishes a preferential working region (ARa) among the divided regions in the working area (AR);

a GPS position detector (55) that produces an output indicating a position of the vehicle (1); and

a travel controlling unit (44) that controls operation of the prime mover (18) to make the vehicle (1) travel autonomously only in the preferential working region (ARa) established by the working region establishing unit (43), the travel controlling unit (44) discriminating whether the vehicle (1) has reached the imaginary boundary line (L) based on the output of the position detector (55), and when it is discriminated that the vehicle (1) has reached the imaginary boundary line (L), controlling operation of the prime mover (18) to make the vehicle (1) turn toward inside of the preferential working region (ARa),

characterized in that

the imaginary boundary line (L) establishing the preferential working region (ARa) is designated by an operator,

and that, when it is discriminated that the vehicle (1) has reached the imaginary boundary line (L), the travel direction of the vehicle (1) is detected by an output of a geomagnetic orientation sensor (54) and then, a desired turning direction of the vehicle (1) is determined."

V. Claim 1 of **auxiliary request I** differs from claim 1 of the main request in its last paragraph which reads as follows (amendments indicated by underlining):

"and that, when it is discriminated that the vehicle (1) has reached the imaginary boundary line (L), the travel direction of the vehicle (1) is detected by an output of a geomagnetic orientation sensor (54) <u>of 2-axis or 3-axis structure</u> and then, a desired turning direction of the vehicle (1) is determined."

VI. Claim 1 of **auxiliary request II** reads as follows:

"An apparatus for controlling operation of an autonomously navigating utility vehicle (1) equipped with a prime mover (18) to travel about a working area (AR) delineated by a boundary wire (2) laid thereat in order to perform work autonomously, comprising:

a working region establishing unit (43) configured to divide the working area (AR) into multiple regions (ARn) with an imaginary boundary line (L) designated by an operator on an input unit (25) and configured to establish a preferential working region (ARa) among the divided regions in the working area (AR) on a working area map (MP) comprised of an array of multiple cells (2a);

a position detector (55) configured to produce an output indicating a position of the vehicle (1); and

a travel controlling unit (44) configured to control operation of the prime mover (18) to make the vehicle (1) travel autonomously in the preferential working region (ARa) established by the working region establishing unit (43), the travel controlling unit (44) being configured to discriminate whether the

vehicle (1) has reached the imaginary boundary line (L) based on the output of the position detector (55), and when it is discriminated that the vehicle (1) has reached the imaginary boundary line (L), to control operation of the prime mover (18) to make the vehicle (1) turn toward inside of the preferential working region (ARa),

characterized in that

a magnetic sensor (40) is installed on the vehicle (1) and configured to produce an output indicating a magnetic field strength (H) generated by electric current passing through the boundary wire (2); and

the travel controlling unit (44) is configured to discriminate (S4, S5) whether the vehicle (1) has not reached the imaginary boundary line (L) but has reached the boundary wire (2) based on the output (H) of the magnetic sensors (51), and to control operation of the prime mover (18) to make the vehicle (1) turn (S7) toward inside of the working region (AR) when it is discriminated that the vehicle (1) has not reached the imaginary boundary line (L) (S4: NO) but has reached the boundary wire (2) (S5: YES), and to control operation of the prime mover (18) by detecting (S8) travel direction of the vehicle (1) to make the vehicle (1) turn (S9, S10) toward inside of the preferential working region (ARa) when it is discriminated that the vehicle (1) has reached the imaginary boundary line (L) (S4: YES), such that the vehicle (1) travels autonomously only in the preferential working region (ARa)."

VII. Claim 1 of **auxiliary request III** comprises the following amendment to the final paragraph of claim 1 of auxiliary request II:

"... determining (S9) a desired turning direction of the vehicle (1), and determining (S10) a desired turning angle for making the vehicle (1) pass through, among cells (2a) surrounding the vehicle (1), to make the vehicle (1) turn toward inside of the preferential working region (ARa) when it is discriminated that the vehicle (1) has reached the imaginary boundary line (L) (S4: YES), such that the vehicle (1) travels autonomously only in the preferential working region (ARa)."

VIII. Claim 1 of **auxiliary request IV** differs from claim 1 of auxiliary request III by the following features which have been inserted into the last paragraph of the claim:

"the travel controlling unit (44) is configured to discriminate (S4, S5) whether the vehicle (1) has not reached the imaginary boundary line (L) but has reached the boundary wire (2) based on the output (H) of the magnetic sensors (51), and to control operation of the prime mover (18) to make the vehicle (1) (S7) turn toward inside of the working region (AR) when it is discriminated that the vehicle (1) has not reached the imaginary boundary line (L) (S4: NO) but has reached the boundary wire (2) (S5: YES), and to control operation of the prime mover (18) by detecting (S8) travel direction of the vehicle (1) from the output of a geomagnetic orientation sensor (54), determining (S9) a desired turning direction of the vehicle (1), and determining (S10) a desired turning angle for making the vehicle (1) pass through, among cells (2a) surrounding the vehicle (1), which are a block of cells (2a1, 2a2, 2a3) inside the preferential working region (ARa) and through which the vehicle (1) has not just passed, to make the vehicle (1) turn toward inside

of the preferential working region (ARa) when it is discriminated that the vehicle (1) has reached the imaginary boundary line (L) (S4: YES), such that the vehicle (1) travels autonomously only in the preferential working region (ARa)."

IX. Claim of **auxiliary request V** differs from claim 1 of auxiliary request III by the following features which have been inserted into the last paragraph of the claim:

"the travel controlling unit (44) is configured to discriminate (S4, S5) whether the vehicle (1) has not reached the imaginary boundary line (L) but has reached the boundary wire (2) based on the output (H) of the magnetic sensors (51), and to control operation of the prime mover (18) to make the vehicle (1) turn (S7) toward inside of the working region (AR) when it is discriminated that the vehicle (1) has not reached the imaginary boundary line (L) (S4: NO) but has reached the boundary wire (2) (S5: YES), and to control operation of the prime mover (18) by detecting (S8) travel direction of the vehicle (1) from the output of an 2-axis or 3-axis geomagnetic orientation sensor (54), determining (S9) a desired turning direction of the vehicle (1), and determining (S10) a desired turning angle for making the vehicle (1) pass through, among cells (2a) surrounding the vehicle (1) to make the vehicle (1) turn toward inside of the preferential working region (ARa) when it is discriminated that the vehicle (1) has reached the imaginary boundary line (L) (S4: YES), such that the vehicle (1) travels autonomously only in the preferential working region (ARa)."

X. Claim 1 of **auxiliary request VI** combines the additional features of claim 1 of auxiliary requests IV and V.

XI. Claim 1 of **auxiliary request VII** is worded as follows (with a numbering of features corresponding to the one used in the examining division's communication of 6 April 2020, point 3):

"An apparatus for
a. controlling operation of
    1. an autonomously navigating utility vehicle (1) equipped with
        1. a prime mover (18) to travel
        2. about a working area (AR) delineated by
        3. a boundary wire (2) laid thereat in order to
        4. perform work autonomously, comprising:
b. a working region establishing unit (43) configured to
        1. divide the working area (AR) into multiple regions (ARn) with
        2. an imaginary boundary line (L1)
            1. designated by an operator on an input unit (25) and configured to
        3. establish a preferential working region (ARa) among the divided regions in the working area (AR) on
            1. a working area map (MP) comprised of
            2. an array of multiple cells (2a);
c. a position detector (55) configured to
        1. produce an output indicating a position of the vehicle (1); and
d. a travel controlling unit (44) configured to
        1. control operation of the prime mover (18) to make the vehicle (1) travel autonomously in the preferential working region (ARa) established by the working region establishing

unit (43),

e. the travel controlling unit (44) being configured to discriminate whether the vehicle (1) has reached the imaginary boundary line (L1) based on the output of the position detector (55), and

1. when it is discriminated that the vehicle (1) has reached the imaginary boundary line (L1), to control operation of the prime mover (18) to make the vehicle (1) turn toward inside of the preferential working region (ARa),

wherein

f. a magnetic sensor (40) is installed on the vehicle (1) and configured to produce an output indicating a magnetic field strength (H) generated by electric current passing through the boundary wire (2); and

g. the travel controlling unit (44) is configured to discriminate (S4, S5) whether the vehicle (1) has not reached the imaginary boundary line (L1) but has reached the boundary wire (2) based on the output (H) of the magnetic sensors (51), and to

h. control operation of the prime mover (18) to make the vehicle (1) turn toward inside of the working region (AR) when it is discriminated that the vehicle (1) has not reached the imaginary boundary line (L1) (S4:NO) but has reached the boundary wire (2) (S5: YES),

characterized in that the travel controlling unit (44) is further configured to control operation of the prime mover by

i. detecting (S8) travel direction of the vehicle (1) from the output of a geomagnetic orientation sensor (54),

j. determining (S9) a desired turning direction of the vehicle (1), and determining (S10) a desired turning angle for

k. making the vehicle (1) pass through, one of cells (2a1, 2a2, 2a3) inside the preferential working region (ARa) among cells (2a) surrounding the vehicle (1) and through which the vehicle (1) has not just passed, when it is discriminated that the vehicle (1) has reached the imaginary boundary line (L1) (S4: YES), to

l. make the vehicle (1) turn toward inside of the preferential working region (ARa) such that the vehicle (1) travels autonomously only in the preferential working region (ARa)."

XII. Claim 1 of **auxiliary request VIII** contains the following amendments to feature k of claim 1 of auxiliary request VII (board's numbering):

"k'. making the vehicle (1) pass through one of cells (2a1, 2a2, 2a3) inside the preferential working region (ARa) among a block of eight cells (2a) surrounding the vehicle (1) adjacently in forward, rearward, left, right and diagonal directions, and through which the vehicle (1) has not just passed, when it is discriminated that the vehicle (1) has reached the imaginary boundary line (L1) (S4: YES), to".

Reasons for the Decision

1. The application

The present application concerns a control apparatus for an autonomously navigating utility vehicle such as a lawn mower. It is known to delineate an area by a boundary wire, which may be folded back in some regions in order to exclude those regions from the working

area. In that way, the working area may be regarded as consisting of multiple regions (see page 1, lines 5 to 18 of the application as originally filed).

The control apparatus of the application contains a "working region establishing unit" that divides the working area into multiple regions. An operator may define a preferential working region delimited by the imaginary boundary line among the divided regions in the working area. Using a position detector such as a GPS sensor or a geomagnetic sensor to determine the position of the vehicle, a travel controlling unit makes the vehicle travel autonomously in the preferential working region. When the vehicle has reached the imaginary boundary line, the vehicle is turned towards the inside of the preferential working region such that it stays in that region (page 1, line 20 to page 2, line 4; page 5, lines 2 to 13 and page 6, line 21 to page 7, line 1; page 8, lines 21 to 29 and page 10, line 28 to page 11, line 8).

2. *Main request, auxiliary requests I to VI - admittance, Article 12(2), (4) and (6) RPBA 2020*

2.1 The claims of the **main request** and **auxiliary request I** were first submitted with the statement of grounds of appeal. According to the appellant, they are based on the claims of the application as originally filed with "some formal amendments to overcome the clarity objections of the search opinion (as far as reasonable)" (see statement of grounds of appeal, point 1.1).

The claims of **auxiliary requests II to VI** correspond to the claims of the main request and auxiliary requests I

to IV filed in the examination phase on 11 July 2019 and replaced with letter of 21 January 2020.

2.2 According to Article 12(2) RPBA 2020, in view of the primary object of the appeal proceedings to review the decision under appeal in a judicial manner, a party's appeal case shall be directed to the requests, facts, objections, arguments and evidence on which the decision under appeal was based. Furthermore, Article 12(4) RPBA 2020 states that any part of a party's appeal case which does not meet the requirements in paragraph 2 is to be regarded as an amendment, unless the party demonstrates that this part was admissibly raised and maintained in the proceedings leading to the decision under appeal. Any such amendment may be admitted only at the discretion of the board. The board shall exercise its discretion in view of, *inter alia*, the complexity of the amendment, the suitability of the amendment to address the issues which led to the decision under appeal, and the need for procedural economy. Further, according to Article 12(6), 2nd sentence, RPBA 2020, the board shall not admit requests, facts, objections or evidence which should have been submitted, or which were no longer maintained, in the proceedings leading to the decision under appeal, unless the circumstances of the appeal case justify their admittance.

2.3 In the present case, claims 1 of the **main request** and of **auxiliary request I** have been amended to exclude *inter alia* features relating to the "magnetic sensors" which were present in the corresponding claims underlying the decision under appeal.

2.4 The appellant argued in that respect that the omission of the feature relating to magnetic sensors "and

others" in the independent claims of these claim requests "was reasonable" since the feature was well known in the relevant prior art and thus this feature was not necessary to delimit the claims over the prior art. In addition, the omission of the feature relating to the magnetic sensor did not present problems under Article 123(2) EPC. Substantial delimitations of the claims during the examination proceedings only led to repeated novelty and inventive step objections by the examiner.

2.5 The board is not convinced by these arguments. The omission of features that are known from the prior art is typically not suitable to overcome objections concerning inventive step. Furthermore, admitting these claims would be contrary to the requirement of procedural economy, as it would possibly make it necessary to remit the case for further examination.

2.6 Regarding **auxiliary requests II to VI**, the appellant argued that these requests were dealt with in the examination proceedings and that the examining division had evaluated them in the proceedings leading to the decision under appeal. In addition, they had only been superseded and not been actively withdrawn.

2.7 According to Article 12(2) RPBA 2020, it is decisive on which requests the decision under appeal was based and not for which requests an *opinion* of the examining division was communicated to the applicant. Effectively, there is no difference between claims being superseded or claims being actively withdrawn, because in both cases no decision is taken on these sets of claims. In the present case, the appellant requested a *decision according to the state of the file* based on the claim requests for which the examining

division had given detailed reasons in its communication of 6 April 2020. By replacing previous versions of the claims, the applicant has thus renounced the possibility of obtaining a reasoned decision on these requests.

2.8 As a consequence, the board does not admit the main request and auxiliary requests I to VI into the appeal proceedings (Articles 12(2), (4) and (6) RPBA 2020).

3. *Auxiliary request VII – inventive step, Article 56 EPC*

3.1 It is common ground that document **D3** may be regarded as the closest prior art with respect to the subject-matter of claim 1 of auxiliary request VII.

3.2 Document D3 discloses an apparatus for controlling an autonomously navigating utility vehicle, which is equipped with a prime mover (see D3, paragraphs [0025] and [0038] together with figure 1). The apparatus controls the vehicle to travel autonomously about a working area 200 delineated by a boundary wire 206 (see paragraphs [0038] and [0039], figure 2). Furthermore, the apparatus comprises a working region establishing unit 112 according to the wording of claim 1 defining an imaginary boundary line and establishing a preferential working region (see paragraphs [0036], [0041] to [0043] together with figures 1 and 2). Finally, the apparatus comprises a position detector 110, a travel controlling unit 108 and a magnetic sensor 106 in the sense of claim 1 (see paragraphs [0027], [0029], [0030], [0039] and [0045] together with figure 1).

3.3 During the oral proceedings before the board, the appellant argued that D3 did not disclose an "imaginary boundary line".

The board agrees with the decision under appeal that an imaginary boundary line is implicitly disclosed in paragraphs [0042] and [0043] together with figure 2 of D3 either as designated by the operator or as a straight line connecting the different positions on which the vehicle is placed in the learning phase. Hence, D3 discloses all the features of the preamble of claim 1. However, **features i to l** are not disclosed by D3.

3.4 According to the decision under appeal, the objective technical problem emanating from these features was "to increase mowing efficiency". The appellant argued that the claimed subject-matter solved the technical problem of providing a utility vehicle with "improved behaviour in terms of accuracy and reliability". The board considers the appellant's formulation of the objective technical problem as being too broad. Improving a mower's behaviour in terms of accuracy and reliability, for example, includes increasing mechanical stability which is however not related to the effects brought about by the distinguishing features. However, the board accepts that when compared to the low-accuracy position sensor and the irregular mowing pattern of D3, the use of a geomagnetic orientation sensor according to feature i of claim 1, and the turning strategy according to features j to l may indeed contribute to an "increased mowing efficiency".

3.5 Document **D2**, which also concerns an apparatus for controlling operation of an autonomously navigating utility vehicle, discloses the use of a geomagnetic

orientation sensor (see paragraphs [0090] to [0098]). As regards the "turning behaviour", it is only specified in claim 1 that the vehicle turns towards a cell "through which the vehicle has not just passed" and that it turns towards the "inside of the preferential working region". Such turning behaviour also emanates from the rules described in D2, paragraphs [0103], [0105], [0111], [0168], which require the vehicle to stay inside the working area, prevent the vehicle from leaving the confinement and keep track of completed grid points such that it is steered away from completed grid points.

3.6 The appellant argued that D3 taught away from using more sophisticated sensor devices such as a geomagnetic orientation sensor. D2 did not contain a magnetic sensor or an imaginary boundary line. Moreover, D3 only disclosed low-accuracy positioning devices (referring to paragraphs [0003] and [0029]). The turning behaviour of the utility vehicle in D3 was only disclosed as "turning inside" when it encountered the boundary.

3.7 It is correct that D3 discloses the use of a "standard low-accuracy Global Positioning System (GPS)" (see paragraph [0029]). However, the trade-offs between costs and accuracy are well known to the skilled person, who would typically employ a positioning device according to the available budget and the required accuracy. Moreover, the use of off-the-shelf geomagnetic orientation sensors is common in autonomous vehicles. In addition, a magnetic sensor and an imaginary boundary line is already disclosed in D3. Thus, the skilled person would not have seen any need to adapt these features when incorporating the geomagnetic orientation sensor into the control apparatus of D3. Actually, an "imaginary boundary line"

is also disclosed in D2, paragraph [0161]. Finally, the board refers to the arguments above regarding the turning behaviour used in D2 (see point 3.5).

3.8 Hence, the board endorses the decision under appeal that the subject-matter of claim 1 of auxiliary request VII lacks an inventive step in view of D3 combined with D2 (Article 56 EPC).

4. *Auxiliary request VIII - inventive step, Article 56 EPC*

4.1 Claim 1 of auxiliary request VIII additionally specifies that the vehicle is supposed to pass through one of a block of eight cells surrounding the vehicle adjacently in forward, rearward, left, right and diagonal directions (i.e. feature k'; see point XII above).

4.2 The appellant argued that these amendments clarified the concept of neighbouring cells and specified the turning behaviour to a level of detail which was not disclosed or suggested in D3 or D2.

4.3 Document D2 discloses the use of grid points (see paragraphs [0103], [0105] and [0168]). It is common practice to use a cartesian grid with adjacent cells in forward, rearward, left, right and diagonal direction. The board also agrees with the examining division that it would have been obvious for the skilled person to choose square cells whose sizes match the vehicle's width to avoid leaving portions of the lawn unmowed. Considering such cells, it would have been immediately evident that, when the robot occupied one of the cells, *eight* neighbouring cells surrounded the robot: in front of the robot, behind, on the left, on the right and on the four diagonals. Thus, since eight cells surrounded

the robot, it would indeed have been obvious that, when the robot headed to the next cell, it had to travel through one of the eight neighbouring cells. Therefore, the skilled person would have arrived at the subject-matter of claim 1 of auxiliary request VIII by combining D3 with D2 and the skilled person's common general knowledge.

4.4 Hence, the subject-matter of claim 1 of auxiliary request VIII also lacks an inventive step in view of D3 combined with D2 and common general knowledge (Article 56 EPC).

5. It follows from the above that none of the appellant's requests is admissible or allowable and that therefore the appeal is to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chair:

B. Brückner K. Bengi-Akyürek

Decision electronically authenticated