Appeal decision

Appeal No. 2016-000382

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The case of appeal against the examiner's decision of refusal of Japanese Patent Application No. 2014-516241, entitled" RADAR SYSTEM FOR MOTOR VEHICLES, AND MOTOR VEHICLE HAVING A RADAR SYSTEM" (International Publication, WO2013/004418, on January 10, 2013, National Publication, National Publication of International Patent Application No. 2014-525031, on September 25, 2014) has resulted in the following appeal decision:

Conclusion

The appeal of the case was groundless.

Reason

No. 1 History of the procedures

The application was filed on May 8, 2012 (Priority claim under the Paris Convention: July 5, 2011 (hereinafter referred to as "the priority date"), Germany) as an international filing date, reason for refusal was notified on September 30, 2014, a written amendment was submitted on April 3, 2015, but the examiner's decision of refusal was issued on September 8, 2015, while on January 8, 2016, an appeal against the examiner's decision of refusal was requested, and at the same time a written amendment was submitted.

No. 2 On Decision to Dismiss Amendment of the written amendment submitted on January 8, 2016

[Conclusion of Decision to Dismiss Amendment]
The written amendment (hereinafter, referred to as "the Amendment") submitted on January 8, 2016 shall be dismissed.

[Reason]
1 Detail of Amendment
(1) The scope of claims after the Amendment

According to the Amendment, the description of Claim 1 of the scope of claims was amended as follows (underlined parts are amendments).

"Claim 1

A radar system (1) for a motor vehicle (2) for monitoring an environment of the motor vehicle (2) comprising at least two radar sensors (4a, 4b, 4c, 4d) for emitting and receiving radar radiation, wherein each of the at least two radar sensors (4a, 4b, 4c, 4d) is arranged at an angle (100) of between 40 degrees and 50 degrees to a common axis (3), and each of the at least two radar sensors (4a, 4b, 4c, 4d) comprises a plurality of phase-controlled antennas, and the at least two radar sensors (4a, 4b, 4c, 4d) are so configured that each of the plurality of phase-controlled antennas has pivotable fields of view (51, 52, 53) at an angle (101) of -60 degrees to +60 degrees relative to a main radiating direction (52a) of each of the radar sensors (4a, 4b, 4c, 4d) with the aid of amplitude modulation and/or phase modulation,

at least one of the radar sensors (4a, 4b, 4c, 4d) is so configured as to provide the plurality of phase-controlled antennas substantially at the same time with the at least two different fields of view in relation to directions of these radar sensors,

a control device (S) is disposed to control each of the field of view (51, 52, 53) of the plurality of phase controlled antennas included in the at least one of the radar sensors (4a, 4b, 4c, 4d),

the control device (S) is so configured as to adjust by pivoting each of the fields of view (51, 52, 53) of the plurality of phase controlled antennas included in the at least one of the radar sensors (4a, 4b, 4c, 4d) with the aid of amplitude modulation and/or phase modulation between +45 degrees to 0 degrees and 0 degrees to -45 degrees in relation to the main radiating direction (52a) of each of the radar sensors (4a, 4b, 4c, 4d),

and each of the plurality of phase controlled antennas included in the at least one of the radar sensors (4a, 4b, 4c, 4d) has a field of view so configured as to have the angle (101) relatively different from the main radiating direction (52a) of each of the radar sensors (4a, 4b, 4c, 4d)."

(2) Claims before the Amendment

The descriptions of Claim 1 and Claim 3 of the scope of claims amended by the written amendment dated on April 3, 2015 before the Amendment are as follows.

"Claim 1

A radar system (1) for a motor vehicle (2) for monitoring an environment of the motor vehicle (2) comprising at least two radar sensors (4a, 4b, 4c, 4d) for emitting and receiving radar radiation, wherein each of the at least two radar sensors (4a, 4b, 4c, 4d) is arranged at an angle (100) of between 40 degrees and 50 degrees to a common axis (3), and each of the at least two radar sensors (4a, 4b, 4c, 4d) comprises at least one antenna, and the at least two radar sensors (4a, 4b, 4c, 4d) are so configured that each of the antennas has pivotable fields of view (51, 52, 53) at an angle (101) of -60 degrees to +60 degrees relative to a main radiating direction (52a) of each of the radar sensors (4a, 4b, 4c, 4d), at least one of the radar sensors (4a, 4b, 4c, 4d) is so configured as to provide the at least one antennas substantially at the same time with the at least two different fields of view in relation to directions of these radar sensors, a control device (S) is disposed to control the fields of view (51, 52, 53) of the at least one antenna included in the at least one of the radar sensors (4a, 4b, 4c, 4d), the control device (S) is so configured as to adjust the fields of view (51, 52, 53) of the at least one antenna included in the at least one of the radar sensors (4a, 4b, 4c, 4d) between +45 degrees to 0 degrees and 0 degrees to -45 degrees in relation to the main radiating direction (52a) of at least one of the radar sensors (4a, 4b, 4c, 4d), and each of at least one of the antennas included in the at least one of the radar sensors (4a, 4b, 4c, 4d) has a field of view so differently configured as to have the angle (101) relatively different from the main radiating direction (52a) of each of the radar sensors (4a, 4b, 4c, 4d)."

"Claim 3

A radar system for a motor vehicle according to Claim 1 or Claim 2, wherein at least one of the radar sensors (4a, 4b, 4c, 4d) comprises a plurality of phase-controlled antennas the fields of view (51, 52, 53) of each of which are pivotable with the aid of amplitude modulation and/or phase modulation."

2 Propriety of amendment

Comparing the invention described in Claim 3 which cites Claim 1 before the Amendment with the invention described in Claim 1 after the Amendment, the Amendment has the following limitations.

(Limitation 1): "<u>At least one antenna</u>" (Claim 1 before the Amendment) (the underline is provided by the body for emphasis, the same applies hereinafter), which is a necessary

matter for specifying the invention described in Claim 3 citing Claim 1 before the Amendment, is limited to be "a plurality of phase controlled antennas."
(Limitation 2): Concerning points, which are necessary matters for specifying the invention described in Claim 3 citing Claim 1 before the Amendment, that "each of the at least two radar sensors (4a, 4b, 4c, 4d) comprises at least one antenna, and the at least two radar sensors (4a, 4b, 4c, 4d) are so configured that each of the antennas has pivotable fields of view (51, 52, 53) at an angle (101) of -60 degrees to +60 degrees relative to a main radiating direction (52a) of each of the radar sensors (4a, 4b, 4c, 4d)" (Claim 1 before the Amendment)," and "at least one of the radar sensors (4a, 4b, 4c, 4d) comprises a plurality of phase-controlled antennas the fields of view (51, 52, 53) each of which is pivotable with the aid of amplitude modulation and/or phase modulation." (Claim 3 before the Amendment), it is limited to that "each of the at least two radar sensors (4a, 4b, 4c, 4d) comprises a plurality of phase-controlled antennas, and the at least two radar sensors (4a, 4b, 4c, 4d) are so configured that each of the plurality of phase-controlled antennas has pivotable fields of view (51, 52, 53) at an angle (101) of -60 degrees to +60 degrees relative to a main radiating direction (52a) of each of the radar sensors (4a, 4b, 4c, 4d) with the aid of amplitude modulation and/or phase modulation."
(Limitation 3): "each of at least one of the antennas included in the at least one of the radar sensors (4a, 4b, 4c, 4d) has a field of view so differently configured as to have the angle (101) relatively different from the main radiating direction (52a) of each of the radar sensors (4a, 4b, 4c, 4d)," which is a necessary matter for specifying the invention described in Claim 3 citing Claim 1 before the Amendment, is limited to "each of the plurality of phase controlled antennas included in the at least one of the radar sensors (4a, 4b, 4c, 4d) has a field of view so configured as to have the angle (101) relatively different from the main radiating direction (52a) of each of the radar sensors (4a, 4b, 4c, 4d)."

Therefore, the Amendment is to aim at matters (the restriction of the scope of claims) stipulated in Article 17-2(5)(ii) of the Patent Act.

Then, whether the appellant should be granted a patent for the invention (hereinafter, referred to as "the Amended Invention") described in Claim 1 after the Amendment independently at the time of patent application (whether it falls under the provisions of Article 126(7) of the Patent Act which is applied mutatis mutandis pursuant to the provisions of Article 17-2(6) of the Patent Act) will be examined below.

(1) Amended Invention

The Amended Invention is as described in 1 (1) above.

(2) Described matters in the Cited Document

International publication No. WO 2011/066993 (international publication on June 9, 2011, hereinafter referred to as "Cited Example 1"), which is a publication distributed before the priority date of the application, cited for reasons of refusal of the examiner's decision, describes the following matters along with the drawing (The translation by the body is based on the patent family of Cited Example 1, National Publication of International Patent Application No. 2013-513093, and the paragraph numbers in the translation are the paragraph numbers described in the publication (However, for a place in paragraph [0037] having a description of "an antenna array or antenna matrix," "Antennenmatrix (Array)" was translated as "antenna matrix (array)" to be consistent with the description of paragraph [0039]). In addition, "a," "o," and "u" with umlauts are described as "a," "o," "u," respectively, and Eszet is described as "ss"; the underline was provided by the body.)

(A)

[0027]

A motor vehicle according to the invention comprises a driver assistance device according to the invention. The motor vehicle is preferably a passenger motor vehicle.

[0028]

By way of example, the driver assistance device may be a monitoring system for a dead-angle range of the motor vehicle and/or an accident early-warning system, (in particular for accidents involving an impact from the rear) and/or an ACC (Additive Course Control) system.)" (Page 10, line 9 to 14)

(B)

"

Description of Embodiments

[0033]

A motor vehicle 1 as illustrated in FIG. 1 comprises a driver assistance device 2 which assists the driver in controlling the motor vehicle 1. In the exemplary embodiment, the motor vehicle 1 is a passenger motor vehicle. By way of example, the driver assistance device 2 may be a monitoring system for the dead-angle range and/or an accident early-warning system, and/or an ACC system. The driver assistance device 2 comprises a first radar 3 and a second radar 4. The first radar 3 is arranged in a left-hand corner of a rear bumper, and the second radar 4 is arranged in a right-hand corner of the same bumper. The first and the second radars 3, 4 are frequency-modulation continuous-wave radars (frequency modulated continuous wave radar, FMCW radar).

[0034]

The first and the second radars 3, 4 are coupled to a signal processing device 5. By way of example, said signal processing device 5 may comprise a microcontroller 6 which is shared by the first and second radars 3, 4, or a digital signal processor, which is not illustrated in the figures. Alternatively, there may be provided two microcontrollers 6 and/or two digital signal processors which communicate with one another, for example, via a communication bus which is provided in the motor vehicle 1.

[0035]

The first radar 3 has a first detection area 7. The detection area 7 is defined in the horizontal direction by an azimuth angle range α, which is bounded in FIG. 1 by two lines 7a, 7b. Correspondingly, the second radar 4 has a detection area 8 which is defined by a corresponding azimuth angle range α, specifically in the horizontal direction. The azimuth angle range α is bounded by two lines 8a, 8b. The azimuth angle ranges α are about 170° in the exemplary embodiment. The detection areas 7, 8 of the radars 3, 4 intersect, thus resulting in an overlap area 9. The overlap area 9 is bounded in angle by the lines 7b, 8b. In the exemplary embodiment, an opening angle β of the overlap area 9 is about 70°.

[0036] The radars 3, 4 can determine the position of the objects in their respective detection areas 7, 8. In particular, the radars 3, 4 can determine a distance to an object from the respective radars 3, 4, and also a relative velocity of an object with respect to the motor vehicle 1.

[0037]

FIG. 2 shows a block diagram of single radars 3, 4, including the signal processing unit 5. Each of the radars 3, 4 comprises a transmitting antenna unit 13, which may be an antenna matrix (array), and may comprise a multiplicity of patch antennas. The transmitting antenna unit 13 is fed via a feed circuit 14. The transmitting antenna unit 13 is fed with the aid of a local oscillator 15 which produces a transmitted signal S0. This transmitted signal S0 is a frequency-modulated electromagnetic wave, whose frequency in its exemplary embodiment has a sawtooth-waveform profile. This will be explained in more detail further below with reference to FIG. 3. The transmitted signal S0 is therefore frequency-modulated; its frequency varies periodically between a first frequency value and a second frequency value. The mid-frequency of the transmitted signal S0 in the exemplary embodiment is 24 GHz.

[0038]

The local oscillator 15 is controlled by the signal processing unit 5. By way of example, the oscillator 15 is a voltage-controlled oscillator, which produces the transmitted signal S0 at a frequency which is dependent on the amplitude of a DC voltage, which is provided for the oscillator 15 by the signal processing unit 5.

[0039]

Each of the radars 3, 4 furthermore comprises a receiver 16. This receiver 16 comprises a receiver antenna unit 17 which, in the exemplary embodiment, may comprise a multiplicity of patch antennas. The receiving antenna unit 17 may likewise be a two-dimensional antenna matrix (array). The receiving antenna unit 17 is coupled to a feed circuit 18. The feed circuit 18 produces a signal SE, which is a received signal. The received signal SE is amplified with the aid of a low-noise amplifier 19, down-mixed with the aid of a mixer 20, low-pass-filtered with the aid of a low-pass filter 21, and converted from analogue to digital form by means of an analogue/digital converter 22. The transmitted signal S0 is used for down-mixing the received signal SE; the transmitted signal S0 is passed to the mixer 20, (specifically, for example, with the aid of a directional coupler.) The received digital signal SE is then processed with the aid of the signal processing device 5. By way of example, the signal processing device 5 uses the signal SE to determine the distance to the object, as well as a relative velocity.

[0040]

FIG. 2 shows an outline illustration of the radars 3, 4. By way of example, the radars 3, 4 may also include further receivers 16, each having the receiving antenna unit 17; the radars 3, 4 may likewise include a multiplicity of the transmitting antenna units 13. Therefore, the radars 3, 4 are illustrated only by way of example in FIG. 2.)" (page 11, line 5 to page 13, line 6)

(C)

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[0041]

The method of operation of the radars 3, 4 will be described in more detail in the following text:

[0042]

The transmitting antenna unit 13 and, to be more precise, the feed circuit 14, can be controlled such that it successively illuminates different subareas A, B, C, D, E, F, G, H of the detection area 7. By way of example, a transmission lobe of the transmitting antenna unit 13 can be steered electronically in the horizontal direction (based on the phased-array principle). In this case, the receiving antenna unit 17 may have a broad receiving characteristic in the horizontal direction, covering the entire detection area 7. Other refinements may alternatively or additionally provide narrow receiving angle ranges in conjunction with broad transmission lobes.

[0043]

For the sake of clarity, FIG. 1 shows only the subareas A to H of the detection area 7 of the first radar 3. In this case, the detection area 8 of the radar 4 is correspondingly also subdivided into a plurality of subareas, which are covered successively by the radar 4. Although the following description relates only to the radar 3, the method of operation of the radar 4 corresponds to that of the radar 3.

[0044]

The subareas A to H are covered successively by the radar 3 in a single measurement cycle. The radar 3 in each case separately transmits a predetermined sequence of frequency-modulated signal pulses (Chirps) for each subarea A to H (that is to say per beam) in a single measurement cycle. The radar 3 therefore in each case transmits a sequence of frequency-modulated signal pulses per measurement cycle and per subarea A to H. To be precise, the radar 3 in each case transmits a block of 16 to 64 frequency-modulated signal pulses. A block such as this or a sequence such as this of linearly frequency-modulated signal pulses 23 is illustrated in FIG. 3. The figure shows the function of a frequency f as a function of time t. The parameters for the sequence of signal pulses 23 are:

- a time duration TChirp of an individual frequency-modulated signal pulse,
- a time duration TPause of a pause between the individual signal pulses 23,
- a number NChirp of signal pulses within a block,
- a frequency shift fShift (a difference between an upper frequency fE and a lower frequency fA),
- a mid-frequency f0=24 GHz." (page 13, line 7 to page 14, line 6)

(D)

"[0056]

After each measurement cycle, the signal processing unit 5 in each case determines a number of measured values both for the range and for the relative velocity, because of the respective ambiguities. The final range and the final relative velocity are determined by the signal processing device 5 as follows:" (page 16, lines 13 to 16)

From the above description, the following technical matters can be read (The paragraph numbers are the paragraph numbers in the translation by the body.).

A From paragraphs [0027], [0028], and [0033], technical matters can be read that "a driver assistance device 2 provided in the motor vehicle 1, wherein the driver assistance device 2 may be a monitoring system for the dead angle range of the vehicle and/or an accident early-warning system (in particular, accidents involving an impact from the rear), and/or an ACC (Additive Course Control) system)."

B According to paragraphs [0033] and [0034], technical matters can be read that "the driver assistance device 2 includes the first radar 3 and the second radar 4. The first radar 3 is arranged at the left-hand corner of the rear bumper and the second radar 4 is arranged at the right-hand corner of the same bumper. The first and second radars 3, 4 are frequency-modulation continuous-wave radars (FMCW radars). The first and second radars 3, 4 are coupled to the signal processing device 5."

C From paragraphs [0035] and [0036], technical matters can be read that "The first radar 3 has a first detection area 7, and the detection area 7 is defined horizontally by the azimuth angle range α. Boundaries of the azimuth angle range α are determined by two lines 7a, 7b. Correspondingly, the second radar 4 has a detection area 8, which is specifically defined in the horizontal direction by a corresponding azimuth angle range α. Boundaries of the azimuth angle range α are determined by two lines 8a, 8b. The azimuthal range α is about 170° in the exemplary embodiment. The detection areas 7, 8 of the radars 3, 4 cross each other, so that an overlap area 9 occurs. Boundaries of angles of the overlap area 9 are determined by the lines 7b and 8b. In an exemplary embodiment, the opening angle β of the overlap area 9 is about 70°. The radars 3 and 4 can determine the position of the object in their own detection areas 7 and 8, respectively."

D From paragraphs [0037], [0039], and [0049], technical matters can be read that "single radars 3, 4 comprising a signal processing unit 5 each comprise a transmitting antenna unit 13. The transmitting antenna unit 13 may be an antenna matrix (array) and may comprise a multiplicity of patch antennas. Each of the radars 3, 4 further comprises a receiver 16. The receiver 16 comprises a receiver antenna unit 17. The receiver antenna unit 17 may comprise a multiplicity of patch antennas. The receiver antenna unit 17 may likewise be a two-dimensional antenna matrix (array). The radars

3, 4 may also include a further receiver 16. Each receiver has a receiving antenna unit 17. Each of the radars 3, 4 may likewise comprise a plurality of transmitting antenna units 13."

E From paragraphs [0042], [0043], technical matters can be read that "The transmitting antenna unit 13 and the feed circuit 14 can be controlled to sequentially and continuously illuminate the different sub areas A, B, C, D, E, F, G, H of the detection area 7. The transmitting lobe of the transmitting antenna unit 13 can be steered electronically in the horizontal direction (based on the phased-array principle). The detection area 8 of the radar 4 is also subdivided into a plurality of subareas corresponding to (the subareas A to H of the detection area 7 of the first radar 3), which are covered continuously and successively by the radar 4."

F From paragraphs [0043], [0044], technical matters can be read that "The subareas A to H are covered successively by the radar 3 in a single measurement cycle. The radar 3 in each case separately transmits a predetermined sequence of frequency-modulated signal pulses (Chirps) for each subarea A to H (that is to say per beam) in a single measurement cycle. The radar 3 therefore in each case transmits a sequence of frequency-modulated signal pulses per measurement cycle and per subarea A to H. The method of operation of the radar 4 also corresponds to the method of operation of the radar 3."

G In paragraph [0056], technical matters are described that "After each measurement cycle, the signal processing unit 5 determines in each case multiple measurements for both distance and relative velocity."

Considering the above technical matters and the description of the drawings, it is recognized that the following invention (hereinafter referred to as "the Cited Invention 1") is described in Cited Document 1.

"A driver assistance device 2 provided in a motor vehicle 1, wherein the driver assistance device 2 may be a monitoring system for the dead-angle range of the vehicle and/or an accident early-warning system (in particular, an accident involving an impact from the rear) and/or ACC (Additive Course Control) system,

the driver assistance device 2 comprising a first radar 3 and a second radar 4, wherein the first radar 3 is arranged at the left-hand corner of the rear bumper, and the second radar 4 is arranged at the right-hand corner of the same bumper, the first and second radars 3, 4 are frequency-modulation continuous-wave radars (FMCW radars), and the first and second radars 3, 4 are coupled to a signal processing device 5,

the first radar 3 has a first detection area 7, the detection area 7 is horizontally defined by an azimuth angle range α, which is bounded by two lines 7a, 7b, correspondingly, the second radar 4 has a detection area 8, which is specifically defined in the horizontal direction by a corresponding azimuth angle range α, which is defined by two lines 8a, 8b, the azimuth angle range α is about 170° in the exemplary embodiment, the detection areas 7, 8 of the radars 3, 4 cross each other, accordingly, an overlap area 9 is generated, boundaries of angles of the overlap area 9 are determined by the lines 7b and 8b, in an exemplary embodiment, the opening angle β of the overlap area 9 is about 70°, the radars 3 and 4 may respectively determine the position of the object in their own detection areas 7 and 8,

single radars 3, 4 comprising a signal processing unit 5 each comprise a transmitting antenna unit 13, the transmitting antenna unit 13 may be an antenna matrix (array) and may comprise a multiplicity of patch antennas, each of the radars 3, 4 further comprises a receiver 16, which comprises a receiver antenna unit 17, the receiver antenna unit 17 may comprise a multiplicity of patch antennas and the receiving antenna unit 17 may likewise be a two dimensional antenna matrix (array), each of the radars 3, 4 may also include a further receiver 16, each receiver has a receiving antenna unit 17, the radars 3, 4 may likewise comprise a multiplicity of transmitting antenna units 13,

the transmitting antenna unit 13 and the feed circuit 14 may be controlled to sequentially and continuously illuminate the different subareas A, B, C, D, E, F, G, H of the detection area 7, the transmission lobe of the transmitting antenna unit 13 can be steered electronically in the horizontal direction (based on the phased array principle), the detection area 8 of the radar 4 is also divided into a plurality of subareas corresponding to (the subareas A to H of the detection area 7 of the first radar 3), these subareas are continuously covered sequentially by the radar 4,

the subareas A to H are continuously covered by the radar 3 in a single measurement cycle, in each case, the radar 3 individually transmits a predetermined sequence frequency of modulated signal pulses (Chirps) to each of the subareas A to H in a single measurement cycle (i.e., for each beam), so that the radar 3 transmits in each case one sequence of frequency modulated signal pulses for each measurement cycle and for each of the subareas A to H, the method of operation of the radar 4 also corresponds to the method of operation of the radar 3, and after each measurement cycle, the signal processing unit 5 in each case determines a plurality of measurement values for both range and relative velocity."

(3) Comparison

The Amended Invention and the Cited Invention 1 will be compared.

A As described in paragraph [0037] of Cited Document 1 that "the mid-frequency of the transmission signal S0 in the exemplary embodiment is 24 GHz," it is obvious that "the first radar 3 and the second radar 4" in Cited Invention 1 are each transmitting and receiving a radio wave having a strong rectilinearity like light; namely, a radar beam.

Therefore, the "first radar 3 and the second radar 4" in Cited Invention 1, and the "signal processing device 5" (in Cited Invention 1, it is also expressed as "single radars 3, 4 including the signal processing unit 5") correspond to "at least two radar sensors (4a, 4b, 4c, 4d) transmitting and receiving the radar beam" in the Amended Invention.

B "The driver assistance device 2 provided in the motor vehicle 1" in Cited Invention 1 is "equipped with the first radar 3 and the second radar 4," " the driver assistance device 2 may be a monitoring system for the dead-angle range of the vehicle and/or an accident early-warning system (in particular, an accident involving an impact from the rear) and/or ACC (Additive Course Control) system," therefore, it corresponds to "the radar system (1) for the motor vehicle (2) for monitoring the environment of the motor vehicle (2)."

C In Cited Invention 1, since the axes before and after "motor vehicle 1" correspond to "the axis of the motor vehicle 1" in the Amended Invention, in Cited Invention 1, "the first radar 3 is arranged at the left-hand corner of the rear bumper, and the second radar 4 is arranged at the right-hand corner of the same bumper," "the first radar 3 has a first detection area 7, the detection area 7 is horizontally defined by an azimuth angle range α, which is bounded by two lines 7a, 7b, correspondingly, the second radar 4 has a detection area 8, which is specifically defined in the horizontal direction by a corresponding azimuth angle range α, which is bounded by two lines 8a, 8b, the azimuthal range α is about 170° in the exemplary embodiment, the detection areas 7, 8 of the radars 3, 4 cross each other, accordingly, an overlap area 9 is generated, boundaries of angles of the overlap area 9 are determined by lines 7b and 8b, in an exemplary embodiment, the opening angle β of the overlap area 9 is about 70°", and "each of the at least two radar sensors (4a, 4b, 4c, 4d) is arranged at an angle (100) of between 40 degrees and 50 degrees to a common axis (3)" are common in a point that "each of the at least two radar sensors (4a, 4b, 4c, 4d) is arranged at a predetermined angle to a common axis (3)."

D " single radars 3, 4 comprising a signal processing unit 5 each comprise a transmitting antenna unit 13, the transmitting antenna unit 13 may be an antenna matrix (array) and may comprise a multiplicity of patch antennas, each of the radars 3, 4 further comprises a receiver 16, which comprises a receiver antenna unit 17, the receiver antenna unit 17 may comprise a multiplicity of patch antennas and the receiving antenna unit 17 may likewise be a two dimensional antenna matrix (array), each of the radars 3, 4 may also include a further receiver 16, each receiver has a receiving antenna unit 17, the radars 3, 4 may likewise comprise a multiplicity of transmitting antenna units 13" and "the transmission lobe of the transmitting antenna unit 13 can be steered electronically in the horizontal direction (based on the phased array principle)" in the Cited Invention correspond to "each of the at least two radar sensors (4a, 4b, 4c, 4d) comprises a plurality of phase-controlled antennas" in the Amended Invention. (It should be noted that even if it is interpreted as the phrase "a plurality of phase-controlled antennas" does not mean a phased array antenna formed by arraying a plurality of antennas whose phases are controlled, but means having a "multiple" phased array antenna, since, in Cited Invention 1, "the radars 3 and 4 may likewise comprise a multiplicity of transmitting antenna units 13" and "the radars 3 and 4 may also include a further receiver 16," this point is not a different feature.)

E In "the single radars 3, 4 including the signal processing unit 5" in the Cited Invention 1, "different sub areas A, B, C, D, E, F, G, H" of "the first detection area 7" included in "the first radar 3," and "a plurality of sub areas" of "the detection area 8" included in "the second radar 4" correspond to "the fields of view (51, 52, 53)" included in "the at least two radar sensors (4a, 4b, 4c, 4d)" in the Amended Invention.

F The features of Cited Invention 1, "the single radars 3, 4 including the signal processing unit 5", wherein "The first radar 3 has a first detection area 7 and the detection area 7 is defined horizontally by the azimuth angle range α. Boundaries of the azimuth angle range α are determined by two lines 7a, 7b. Correspondingly, the second radar 4 has a detection area 8, which is specifically defined in the horizontal direction by a corresponding azimuth angle range α. Boundaries of the azimuth angle range α are determined by two lines 8a, 8b. The azimuth angle range α is about 170° in the exemplary embodiment" and "the transmitting antenna unit 13 and the feed circuit 14 may be controlled to sequentially and continuously illuminate the different subareas A, B, C, D, E, F, G, H of the detection area 7, the transmission lobe of the transmitting antenna unit 13 can be steered electronically in the horizontal direction (based on the phased array principle), the detection area 8 of the radar 4 is also divided into a plurality of subareas corresponding to them (the subareas A to H of the detection area 7 of the first radar 3), these subareas are continuously covered sequentially by the radar 4", and, the features of the Amended invention "the at least two radar sensors (4a, 4b, 4c, 4d) are so configured that each of the plurality of phase-controlled antennas has pivotable fields of view (51, 52, 53) at an angle (101) of -60 degrees to +60 degrees relative to a main radiating direction (52a) of each of the radar sensors (4a, 4b, 4c, 4d) with the aid of amplitude modulation and/or phase modulation" are common in a point that "the at least two radar sensors (4a, 4b, 4c, 4d) are so configured that each of the plurality of phase-controlled antennas has pivotable fields of view (51, 52, 53) at an angle greater than or equal to 120 degrees relative to a radiating direction of each of the radar sensors (4a, 4b, 4c, 4d) with the aid of amplitude modulation and/or phase modulation."

G It is common general technical knowledge that the antenna, shown in Cited Invention 1, capable of electronically steering the transmission lobe horizontally based on the phased array principle; namely, the phased array antenna, allows scanning in such a short time that it can be said to be substantially the same time, compared to a mechanical scanning antenna.

Therefore, it can be said that "the transmitting antenna unit 13 and the feed circuit 14 sequentially and continuously illuminate different subareas A, B, C, D, E, F, G, H of the detection area 7," "the subareas A to H are continuously covered by the radar 3 in a single measurement cycle," and "the method of operation of the radar 4 also corresponds to the method of operation of the radar 3" in Cited Invention 1 correspond to "at least one of the radar sensors (4a, 4b, 4c, 4d) is so configured as to provide the plurality of phase-controlled antennas substantially at the same time with the at least two different fields of view in relation to directions of these radar sensors."

H In Cited Invention 1, since "The transmitting antenna unit 13 and the feed circuit 14 can be controlled to sequentially and continuously illuminate the different sub areas A, B, C, D, E, F, G, H of the detection area 7" and "The detection area 8 of the radar 4 is also subdivided into a plurality of subareas corresponding to subareas A to H of the detection area 7 of the first radar 3, which are covered continuously and successively by the radar 4," it follows that "the single radars 3, 4 including the signal processing unit 5” of Cited Invention 1 include a device of performing such a "control" corresponds to "a control device (S) is disposed to control each of the fields of view (51, 52, 53) of the plurality of phase controlled antennas included in the at least one of the radar sensors (4a, 4b, 4c, 4d)" in the Amended Invention 1.

I In consideration of the comparison between F and H described above, that the device that performs "control" in Cited Invention 1 is so configured that "The transmitting antenna unit 13 and the feed circuit 14 can be controlled to sequentially and continuously illuminate the different sub areas A, B, C, D, E, F, G, H of the detection area 7" and "The detection area 8 of the radar 4 is also subdivided into a plurality of subareas corresponding to them (subareas A to H of the detection area 7 of the first radar 3), which are covered continuously and successively by the radar 4," and "the control device (S) is so configured as to adjust by pivoting each of the fields of view (51, 52, 53) of the plurality of phase controlled antennas included in the at least one of the radar sensors (4a, 4b, 4c, 4d) with the aid of amplitude modulation and/or phase modulation between +45 degrees to 0 degrees and 0 degrees to -45 degrees in relation to the main radiating direction (52a) of the at least one of the radar sensors (4a, 4b, 4c, 4d)" are common in a point that "the control device (S) is so configured as to adjust by pivoting each of the fields of view (51, 52, 53) of the plurality of phase controlled antennas included in the at least one of the radar sensors (4a, 4b, 4c, 4d) with the aid of amplitude modulation and/or phase modulation in a predetermined range in relation to the radiating direction of the at least one of the radar sensors (4a, 4b, 4c, 4d)."

J In consideration of the comparison among F, H, and I described above, that "a transmission lobe of the transmitting antenna unit 13" included in "the single radars 3, 4 including the signal processing unit 5" "can be steered electronically in the horizontal direction (based on the phased array principle)" and "the detection area 8 of the radar 4 is also divided into a plurality of subareas corresponding to them (the subareas A to H of the detection area 7 of the first radar 3), these subareas are continuously covered sequentially by the radar 4" in the Cited Invention 1 correspond to that "each of the plurality of phase controlled antennas included in the at least one of the radar sensors (4a, 4b, 4c, 4d) has a field of view so configured as to have the angle (101) relatively different from the radiating direction (52a) of each of the radar sensors (4a, 4b, 4c, 4d)".

K In consideration of the comparisons above, "driver assistance device 2 provided in the motor vehicle 1" "comprises the first radar 3 and the second radar 4", and "the driver assistance device may be a monitoring system for the dead-angle range of the vehicle and/or an accident early-warning system (in particular, an accident involving an impact from the rear) and/or ACC (Additive Course Control) system," it corresponds to "the radar system (1) for the motor vehicle (2)" in the Amended Invention except for the following different features.

From the above, corresponding features and different features of the Amended Invention and the Cited Invention 1 are as follows.

(Corresponding features)

"A radar system (1) for a motor vehicle (2) including at least two radar sensors (4a, 4b, 4c, 4d) for emitting and receiving radar beam for monitoring the environment of the motor vehicle (2), wherein the each of the at least two radar sensors (4a, 4b, 4c, 4d) is arranged at a predetermined angle to a common axis (3), the at least two radar sensors (4a, 4b, 4c, 4d) each have the plurality of phase-controlled antennas and are so configured that the at least two radar sensors (4a, 4b, 4c, 4d) have pivotable fields of view (51, 52, 53) at an angle greater than or equal to 120 degrees relative to a radiating direction of each of the radar sensors (4a, 4b, 4c, 4d) with the aid of amplitude modulation and/or phase modulation,

at least one of the radar sensors (4a, 4b, 4c, 4d) is so configured as to provide the plurality of phase-controlled antennas substantially at the same time with the at least two different fields of view in relation to directions of these radar sensors,

a control device (S) is disposed to control each of the fields of view (51, 52, 53) of the plurality of phase controlled antennas included in the at least one of the radar sensors (4a, 4b, 4c, 4d),

the control device (S) is so configured as to adjust by pivoting each of the fields of view (51, 52, 53) of the plurality of phase controlled antennas included in the at least one of the radar sensors (4a, 4b, 4c, 4d) with the aid of amplitude modulation and/or phase modulation in a predetermined range in relation to the radiating direction of the at least one of the radar sensors (4a, 4b, 4c, 4d), and

each of the plurality of phase controlled antennas included in the at least one of the radar sensors (4a, 4b, 4c, 4d) has a field of view so configured as to have the angle (101) different from the radiating direction of each of the radar sensors (4a, 4b, 4c, 4d)."

<The different feature A>

While, in the Amended Invention, the angles at which the radar sensors (4a, 4b, 4c, 4d) are disposed with respect to the common axis (3) are "between 40 degrees and

50 degrees", in the Cited Invention 1, it is not clear specifically at which angles "the single radars 3, 4 including the signal processing unit 5" are "disposed" with respect to the axes before and after the "motor vehicle 1."

<The different feature B>

While, in the Amended Invention, “the pivotable fields of view (51, 52, 53) of the radar sensors (4a, 4b, 4c, 4d) are angles (101) relatively at -60 degrees to + 60 degrees to the main radiating direction (52a)," in Cited Invention 1, "the transmission lobe" "can be steered electronically in the horizontal direction (based on the phased-array principle)", the azimuth angle range α" "in the horizontal direction" of "the detection area 7" and "the detection area 8" of "the single radars 3, 4 including the signal processing unit 5" “including the transmitting antenna unit 13" is "about 170 degrees" in the exemplary embodiment.

<The different feature C>

While, in the Amended Invention, a range in which the control device (S) pivotablly adjusts the fields of view (51, 52, 53) of the antenna is "between +45 degrees to 0 degrees and 0 degrees to -45 degrees with respect to the main radiating direction (52a) of the radar sensors (4a, 4b, 4c, 4d)", in Cited Invention 1, although, on the device "for controlling to sequentially and continuously illuminate the different sub areas A, B, C, D, E, F, G, H of the detection area 7," "the transmission lobe" of "the transmitting antenna unit 13" “is steered electronically in the horizontal direction" "(based on the phased-array principle)", the angle range in which "the transmitting antenna unit 13" “is steered electronically in the horizontal direction" is not shown.

<The different feature D>

While, in the Amended Invention, the configuration is made so that the fields of view that the plurality of phase-controlled antenna have are set at the angles (101) relatively different from "the main radiating direction (52a) of the radar sensors (4a, 4b, 4c, 4d)", in Cited Invention 1, although "the transmission lobe" of "the transmitting antenna unit 13" is "steered electronically in the horizontal direction" "(based on the phased-array principle)", the angle in the horizontal direction of the "transmission lobe" "that sequentially and continuously illuminates different subareas A, B, C, D, E, F, G, H of the detection area 7" is not specified as an angle relatively different from the main radiating direction (52a) of "the transmitting antenna unit 13."

(4) Judgment

Therefore, the above different features will be examined. In view of the mutual relationship, a judgment will be made first on <the different feature D>.

A On <the different feature D>

For instance, as it is described in Japanese Unexamined Patent Application Publication No. 1996-97758 (hereinafter, referred to as "the Well-Known Example") that

"[0001]

[Industrial Application Field] This invention relates to a phased array antenna having a function to transmit or receive an electric wave to the target object, and for example, used in fields such as a radar or communication.

[0002] [Conventional Art] FIG. 7 is a block diagram showing a conventional phased array antenna shown, for example, in 'Antenna Engineering Handbook' (Ohm Co.). In the figure, 1i (i = 1 to n) is an element antenna, 2i (i = 1 to n) is a phase shifter for changing the phase amount of a received signal from the element antenna 1i or a transmitted signal to be supplied to the element antenna 1i, 3 is a distribution synthesizing circuit for synthesizing signals received by the element antenna 1i and distributing signals to be supplied to the element antenna 1i, 4 is a phase control circuit for controlling the phase of the phase shifter 2i, and 5 is an angle command circuit for directing the beam of the phased array antenna in a predetermined direction."

"[0006] At this time, if the beam pointing direction S moves away from the beam center of the phased array antenna; that is, in the normal direction vector n of the phased array antenna, a decrease ΔG in gain occurs, which is approximated by the following equation (2), caused by the decrease in the projected area of the phased array antenna with respect to the beam pointing direction of the phased array antenna and the element pattern of the element antenna 1i.",

it is a well-known art that "the gain of the phased array antenna is highest at the beam center (the normal direction of the phased array antenna)" ("main radiating direction (52a)" in the Amended Invention) and the gain decreases when departing from the beam center (the normal direction of the phased array antenna) (in terms of the Amended Invention, when "the angle (101) relatively different from" "the main radiating direction (52a)" becomes large)."

Therefore, in an antenna which is steered electronically in the horizontal direction" "(based on the phased array principle)," that is, a phased array antenna in Cited Invention 1, it would have been easily done by a person skilled in the art to make the configuration of the Amended Invention related to the above-described <the

different feature D> by specifying the angle in the horizontal direction of "the transmission lobe" "that sequentially and continuously illuminates different subareas A, B, C, D, E, F, G, H of the detection area 7" as an angle relatively different from the beam center (the normal direction of the phased array antenna) of "the transmitting antenna unit 13."

B On <the different feature A> to <the different feature C>

Next, since the angle ranges indicated in <the different feature A> to <the different feature C> are mutually related, a judgment will be made collectively on <the different feature A> to <the different feature C>.

(A) As described in "A" above, the gain of the phased array antenna used in a radar is highest at the beam center (the normal direction of the phased array antenna) ("main radiating direction (52a)" in the Amended Invention) and the gain decreases when departing from the beam center (the normal direction of the phased array antenna).

Therefore, it is a matter to be considered by a person skilled in the art when designing the radar that, in view of the above characteristics of the phased array antenna, in order to reduce the decrease in the gain in the detection area, "the azimuth angle range α" in the "horizontal direction" of "the detection area 7" and "the detection area 8" of "the single radars 3, 4 including the signal processing unit 5" in the Cited Invention 1 should be made to be an angle range from $-\alpha/2$ to $+ \alpha/2$ to the beam center (the normal direction of the phased array antenna) of the single radars 3, 4.

(B) Likewise, it is also a matter to be considered by a person skilled in the art when designing the radar that an angle range in which "the transmission lobe" of "the transmitting antenna unit 13" is "steered electronically in the horizontal direction" " (based on the phased-array principle)" in the device "for controlling so as to be capable of sequentially and continuously illuminating different subareas A, B, C, D, E, F, G, H of the detection area 7" in the Cited Invention 1 should be made to be an angle range from $-\alpha/2$ to $+ \alpha/2$ to the beam center (the normal direction of the phased array antenna) of the single radars 3, 4 as a predetermined angle range in consideration of a spread and such of the detection area of "the transmission lobe."

(C) Furthermore, it is also a matter to be considered by a person skilled in the art when designing the radar that, in the Cited Invention 1, in "arranging" "the first radar 3" at "the left-hand corner of the rear bumper" and arranging "the second radar 4" at "the right-hand corner of the rear bumper," the angle with respect to the axes before and after "the motor vehicle 1" of "the single radars 3, 4 including the signal processing unit 5" should be made to be an angle at which the detection areas 7, 8 of the radars 3, 4 mutually cross for monitoring the dead-angle range of the vehicle and an early warning related to an impact from the rear.

Therefore, it would have been easily conceived by a person skilled in the art, in designing the radar in the Cited Invention 1, in consideration of the matters described in (A) to (C) above,
(A') to make "the azimuth angle range α" ("about 170 degrees" in the exemplary embodiment) in "the horizontal direction" of "the detection area 7" and "the detection area 8" in the Cited Invention 1 to be α=120 degrees and to be the angle range from -60 degrees to +60 degrees to the beam center (the normal direction of the phased array antenna) of the single radars 3, 4, and therefore to make it the configuration of the Amended Invention related to the <the different feature B> described above,
(B') to make an angle range in which "the transmission lobe" of "the transmitting antenna unit 13" is "steered electronically in the horizontal direction" "(based on the phased-array principle)" in the device "for controlling so as to be capable of sequentially and continuously illuminating different subareas A, B, C, D, E, F, G, H of the detection area 7" to be an angle range from -45 degrees to + 45 degrees in consideration of a spread and such of the detection area of "the transmission lobe" and therefore to make it the configuration of the Amended Invention related to the <the different feature C> described above, and,
(C') furthermore, in the Cited Invention 1, in "arranging" "the first radar 3" at "the left-hand corner of the rear bumper" and arranging "the second radar 4" at "the right-hand corner of the rear bumper," to arrange "the single radars 3, 4 including the signal processing unit 5" at angles "between 40 degrees and 50 degrees" with respect to the axes before and after the "motor vehicle 1" so that the detection areas 7, 8 of the radars 3, 4 mutually cross, and therefore to make it the configuration of the Amended Invention related to the <the different feature A> described above.

In addition, even if the above different features are comprehensively taken into consideration, the working effect of the Amended Invention is only within the range predicted from the Cited Invention 1, well-known arts, and the design based on the well-known arts, and it cannot be said to be remarkable.

Although, with respect to "the plurality of phase-controlled antennas included in one radar sensor (4a, 4b, 4c, 4d)" in the Amended Invention, it is interpreted that "the phased array antenna" configured by arranging in a matrix (array) the plurality of antennas, each phase of which is controlled is included in one radar sensor (4a, 4b, 4c, 4d), and the case where it is interpreted that the description "the plurality of phase-controlled antennas included in one radar sensor (4a, 4b, 4c, 4d)" means that one radar sensor (4a, 4b, 4c, 4d) has a plurality of "phased array antennas" will be examined to be on the safe side.

As it is described in Cited Invention 1 that "each of the radars 3, 4 may also include the further receiver 16, each receiver has the receiver antenna unit 17, and each of the radars 3, 4 may likewise include the plurality of transmitting antenna units 13," it is well-known art, when using a combination of the plurality of phased array antennas, to select the phased array antenna having the highest gain therefrom and switch over as it is described, for instance, in paragraph [0009] of the above-described well-known example that "accordingly, in the case where it is necessary to scan the beam over a wide angle range, to make it a configuration in which a plurality of phased array antennas are arranged as shown in FIG. 8 and a switch-over circuit 10 for selecting the phased array antenna with the highest gain among them and switching over is provided," even if it is interpreted that the description in the Amended Invention, "the plurality of phase-controlled antennas included in one radar sensor (4a, 4b, 4c, 4d)" means that one radar sensor (4a, 4b, 4c, 4d) has a plurality of "phased array antennas," the Amended Invention would have been easily conceived by a person skilled in the art based on the Cited Invention 1 and the well-known arts.

Therefore, since the Amended Invention would have been easily conceived by a person skilled in the art based on the Cited Invention 1 and the well-known arts, the appellant cannot be granted a patent independently at the time of patent application under the provisions of Article 29(2) of the Patent Act.

(5) Closing on the Amendment

As described above, since the Amendment violates the provisions of Article 126(7) of the Patent Act which is applied mutatis mutandis pursuant to the provisions of Article 17-2(6) of the Patent Act, the Amendment shall be dismissed under the provisions of Article 53(1) of the Patent Act applied mutatis mutandis by replacing certain terms pursuant to Article 159(1) of the Patent Act.

No. 3 Regarding the invention of the case

1 The Invention

As the Amendment dated on January 8, 2016 was dismissed as above, the inventions according to Claims 1 to 6 of the application are specified by the matters described in Claims 1 to 6 of the scope of claims amended by the Amendment dated April 3, 2015, the invention according to Claim 3 citing Claim 1 (hereinafter, referred to as "the Invention") is as described in [Reasons] "1" "(2)" of No. 2 described above.

2 Cited Publications

Cited Document 1 cited in the reasons for refusal stated in the examiner's decision and the matters described therein are as described in [Reasons] "2" "(2)" of No. 2 described above.

3 Comparison/Judgment

The Invention was made by deleting the limitations associated with "(Limitation 1)" to "(Limitation 3)" of [Reasons] "2" of No. 2 from the Amended Invention examined in [Reasons] "2" of No. 2 described above.

That means that since the Amended Invention corresponding to what includes all the matters specifying the invention of the Invention and is added with other matters would have been easily invented by a person skilled in the art based on the Cited Invention 1 and the well-known arts as described in [Reasons] "2" "(3), (4)" of No. 2 described above, the Invention would have been easily invented by a person skilled in the art based on the Cited Invention 1 and the well-known arts because of the same reasons.

4 Closing

As described above, since the Invention cannot obtain a patent under the provision of Article 29, paragraph 2 of the Patent Law, the application shall be rejected even without examining the inventions associated with the other claims.

Therefore, the appeal decision shall be made as described in the conclusion.

November 11, 2016

Chief administrative judge: SAKAI, Nobuyoshi
Administrative judge: SHIMIZU, Minoru
Administrative judge: TAKAHASHI, Masaru