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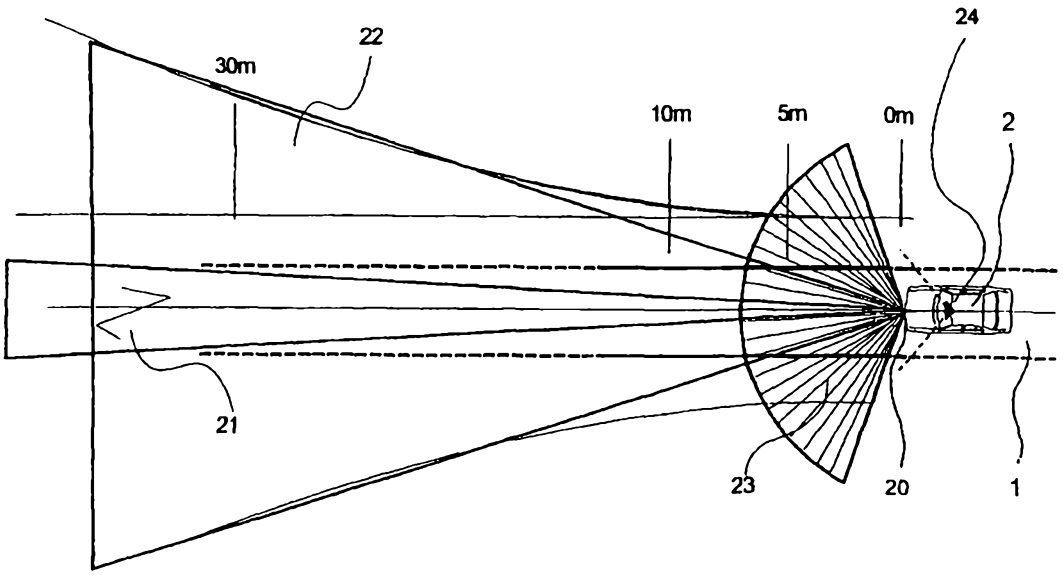
[Fortsetzung auf der nächsten Seite]

(54) Title: SYSTEM FOR DETECTING AN OBJECT

(54) Bezeichnung: OBJEKTDETEKTIONSSYSTEM



(57) Abstract: The invention relates to a system for detecting an object, especially for an automobile (2). The inventive object detection system (20) has several object detectors and/or operating modes allowing for different detection ranges and/or detection zones. An object detector is preferably a radar sensor. In a first operating mode, said radar sensor has a relatively large detection range (21) covering a relatively small angular detection zone. In a second operating mode, the radar sensor has a small detection range (22) in relation to the former, covering a larger angular detection zone.

(57) Zusammenfassung: Es wird ein Objektdetektionssystem, insbesondere für ein Kraftfahrzeug (2) vorgeschlagen, bei dem das Objektdetektionssystem (20) mehrere Objektdetektoren und/oder Betriebsmodi aufweist, mit denen unterschiedliche Detektionsreichweiten und/oder Detektionsbereiche erfasst werden. Hierbei ist bevorzugt ein Objektdetektor ein Radarsensor, der in einem ersten Betriebsmodus eine relativ große Detektionsreichweite (21) bei einem relativ kleinen Winkelerfassungsbereich und in einem zweiten Betriebsmodus eine relativ dazu geringe Detektionsreichweite (22) bei einem vergrößerten Winkelerfassungsbereich aufweist.

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(84) **Bestimmungsstaaten** *(regional)*: europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Veröffentlicht:

- *mit internationalem Recherchenbericht*
- *vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eintreffen*

Zur Erklärung der Zweibuchstaben-Codes, und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

System for Detecting an Object

Prior Art

The invention relates to an object detection system for a motor vehicle.

Such a system can be used within the framework of an adaptive cruise and/or range control of a motor vehicle. Such a control can control without intervention by the driver a previously set speed and/or a previously set distance to a vehicle travelling ahead of the vehicle or to objects located in the direction travelled and/or objects. This takes place with consideration of the environment of the vehicle and if necessary other parameters such as conditions such as weather or visibility. A control of this type is known as an Adaptive Cruise Control System (ACC system). The ACC system must, in view of the increasing traffic density of today, be flexible enough to react appropriately in all driving situations. This requires corresponding object detection sensors in order to provide the measurement data in every driving situation necessary for the control.

In fact, sensors for an AAC freeway system, as a rule with radar or lidar sensors, which have a range of approximately 100 to 150m with a coverage angle of approximately 10° are known. Furthermore, short-range distance sensors for parking systems are known, which are frequently equipped with ultrasound sensors.

From DE 196 22 777 a sensor system for the automatic relative determining of position between two objects is known. The sensor system consists of a combination of an angle-independent sensor and an angle dependent sensor. The non-angle-resolving and therefore angle independent sensor is designed as a sensor, which evaluates the distance to an object by means of a period measurement. RADAR, LIDAR or ultrasound sensors are suggested as possible sensors. The angle-dependent sensor consists of a geometric arrangement of optoelectronic transmitters and receivers, which are arranged in the form of photoelectric barriers. The sensors, which both cover a common detection area, are spatially arranged closely together. In order to determine a relative position to the object, the distance to the object is determined by means of the angle-independent sensor and by means of the angle-resolving sensor the angle to the object is determined. The relative position to the object is known on the basis of the distance and the angle to the sensor. As an alternative, the

named arrangement of optoelectronic transmitters and receivers, the use of two sensors is proposed, which determine the angle to the object according to the triangulation principle.

Moreover, from DE 196 16 038 A1 an object detective system is known, in which also an optical transmitter for a beam of light with changeable transmission angle and an angle-resolving optical receiver are present. The emitted beam of light is modulated here in such a way that from the phase difference of the transmitted and received beam of light to a certain distance, the position of the object within the angle range of the emitted beam of light can be determined.

In another object detection system known from DE 42 42 700 with a microwave-radar sensor on a vehicle, the detection of objects, in particular long-range objects is enabled. This radar sensor also is a component of the above vehicle security system, in which information on the distance and the relative speed of the vehicle to the vehicle travelling ahead of it in a given, however limited angle range is processed.

Summary of the Invention

According to the present invention there is provided an object detection system for a motor vehicle, for adaptive distance and speed control of the vehicle, wherein the object detection system includes a number of object-detectors with different detection-ranges and detection-regions, wherein one object-detector is a radar sensor, which, in one operating mode, has a relatively long detection-range with a relatively small angular coverage region, and wherein another object-detector is an ultra-close-range sensor, which, compared with the radar sensor, has a short detection range and a large angular coverage region.

An advantageous sensor concept for the ACC system mentioned at the outset can be realised with the invention, which permits the complete detection of vehicles in front of the vehicle equipped with the ACC system on its own carriageway and on those to the left and right of it at a predetermined maximal distance. In a preferred embodiment a second operating mode of the radar sensor with a relatively small detection range can cover, for example, a so-called local environment of up to approximately 30 to 40m to a minimal curve radius of approximately 100m.

The microwave field environment radar, known from prior art and mentioned at the outset operates, eg. in a frequency range of 77 GHz and is suited to the detection of objects in front of the ACC vehicle up to 150m with an angle detection area of approximately 10°. These radar sensors can be so extended that they, in the additional operating mode, enable the extended angle detection area with a shortened range for the detection of the local environment. Alternatively to this, these radar sensors can also be so designed that they have an extended angle detection range in the local environment as standard equipment.

The object detection system of the invention further contains a so-called ultra-close-range sensor, which, with respect to the previously described radar sensor, has another smaller detection range and a greater angle area. The radar sensor mentioned initially is combined with a distance sensor, which detect objects immediately in front of the vehicle equipped with the ACC system in the so-called ultra local environment of approximately 0 to 7m. The ultra-close-range sensor sensor features here a width of angle detection, which covers both the breadth of the vehicle and part of the right and left neighbouring carriageways of the road.

The ultra-close-range sensor is preferably an optical sensor known from prior art mentioned in the preamble above, an ultrasound sensor or a radar sensor, eg. in 24 GHz range, which, for example, is already being used as so-called parking helps in vehicles.

The object detection system of the invention can also contain a video device for certain carriageway allocation and classification of the detected objects on the carriageway. A video device can be designed as a stereoscopic camera or as a CMOS camera.

These and other characteristic features of preferred further developments of the invention proceed from the description and from the drawings, the individual characteristic features being able to be realised individually or together in the form of sub-combinations in the embodiment of the invention and in other areas and can represent advantageous and patentable designs.

Brief Description of the Drawing

The object detection system of the invention will be described on the basis of the figure of the drawing, which shows a schematic diagram of the detection areas of a vehicle equipped with an ACC system.

Detailed Description of the Preferred Embodiment

A sketch of a multi-carriageway road is shown schematically in Figure 1. A vehicle 2, which has an object detection system 20, which is a component of an ACC system mentioned at the outset of this application is located on the road.

The object detection system 20 contains a radar sensor, which, in a first operating mode (so-called ACC radar) detects a relatively wide-reaching detection area 21 of up to approximately 150m, which covers here an angle area of approximately 8° and is therefore suitable for a cruise control system. With this cruise control system a distance control of a vehicle not illustrated here, driving in front of the vehicle 2, can be realised. In a second operating mode (so-called local environment radar), a second detection area 22 is detected, which extends to approximately 30 to 40m and detects an angle area of approximately 35°.

Moreover, a so-called ultra-close-range sensor is present in the object detection system 20, which extends to a range 23 of approximately 7m and detects an angle area of up to 52°. In addition, a video device 24 is installed in the vehicle 2, which can carry out a lane allocation and, if necessary, an object classification in the road area but which must not be part of the core function of the basic system. A video device of this type can preferably be designed as a stereoscopic camera or as a CMOS camera.

An ACC system can therefore be realised with the object detection system 20 according to the embodiment shown in Figure 1, which allows all objects to be completely detected, which are in front of the vehicle on the same carriageway and on the left or the right carriageway up to a maximal distance.

With the embodiment of the invention mentioned, it is possible, alongside the distance and cruise control and parking help for the vehicle 2, also to undertake the so-called stop and

go functionality on the road 1 with the object detection system 20. It is possible here that the cruise control take place between the stationary condition and maximum speed.

The claims defining the invention are as follows:

1. An object detection system for a motor vehicle, for adaptive distance and speed control of the vehicle, wherein the object detection system includes a number of object-detectors with different detection-ranges and detection-regions, wherein one object-detector is a radar sensor, which, in one operating mode, has a relatively long detection-range with a relatively small angular coverage region, and wherein another object-detector is an ultra-close-range sensor, which, compared with the radar sensor, has a short detection range and a large angular coverage region.

2. The object detection system as claimed in claim 1, wherein the radar sensor has a second operating mode, which, compared with the first operating mode, has a shorter detection-range with a larger angular coverage region.

3. The object detection system as claimed in claim 1 or claim 2, wherein the ultra-close-range sensor is an optical sensor, an ultrasound sensor, or a radar sensor.

4. The object detection system as claimed in any one of the preceding claims, wherein the object detection system contains, as an additional object-detector, a video device for tracking and classifying the detected objects.

5. The object detection system as claimed in claim 4, wherein the video device is in the form of a stereoscopic camera or a CMOS camera.

6. An object detection system, substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 20th day of December, 2004

ROBERT BOSCH GMBH

By Their Patent Attorneys

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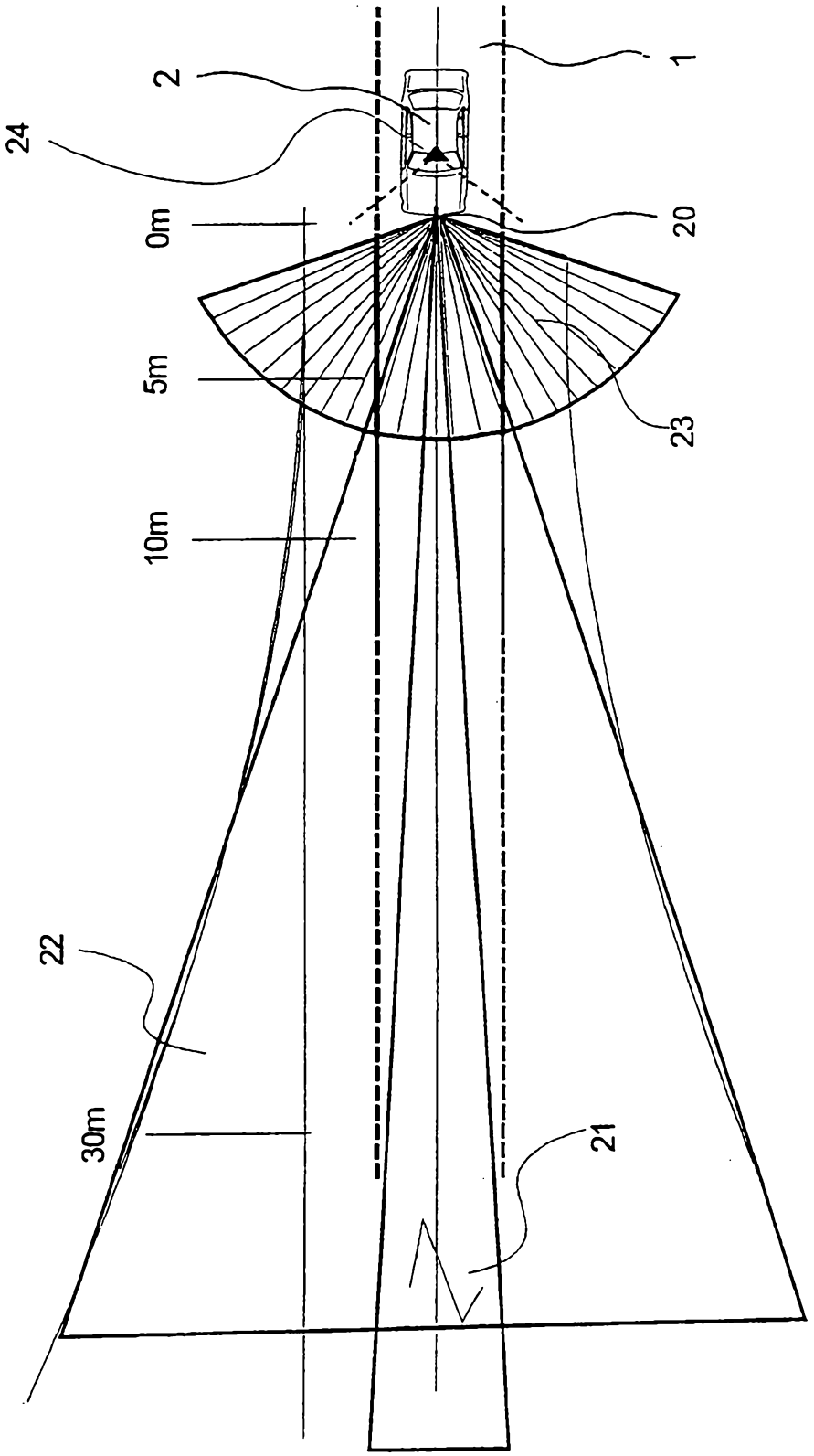
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