AMENDMENT AND RESPONSE AND
EXAMINER INTERVIEW SUMMARY

Assistant Commissioner for Patents
Washington, D.C. 20231

Applicant has reviewed the Office Action with restriction requirement mailed September 15, 1999.

EXAMINER INTERVIEW

Applicant thanks Examiners Nguyen and Lefkowitz for the telephonic interview December 6, 1999. The Cho and Gobel references were discussed and it was agreed that the references show neither the calculation of the transverse location nor its display. Applicant agreed to add the limitation of calculating the transverse location to the claims.

AMENDMENT

In the Drawings

Enclosed is a copy of two sheets of the drawings, showing proposed amendments to Figures 3 and 5a in red ink.

In the Specification

On page 3, line 7, please delete “to date to not” and insert --to date do not--.

On page 4, line 8, please delete “of a the collision” and insert --of the collision--.

On page 5, lines 28-29, please delete “detection subsystem 34 ” and insert --proximity detector subsystem 34--.

On page 6, line 8, after “optional system features.” insert --In one embodiment optional system features include rear warning lights 98 and side warning lights 99--.

On page 7, line 14, please delete “tractor trailer right” and insert --tractor trailer rig--.
On page 9, lines 6-10, please delete "impact pad" and insert --impact bar--.

On page 13, line 28, please delete "the and electronics" and insert --and the electronics--.

On page 20, line 15, please delete "N our of M" and insert --N out of M--.

On page 22, line 23, please delete "control module 13" and insert --control module 12--.

On page 23, lines 14 and 19, please delete "operator interface 34" and insert --operator interface 32--.

On page 24, line 22, please delete "Display Modules (Figure 3)" and insert --Side Display Modules 36 (Figure 13)--.

**In the Claims**

Please cancel claims 10-23, 25-29 and 33-35 without prejudice.

Please amend claims 1, 5, 24, 30, 31, 36 and 37 as follows:

1. (Amended) A collision avoidance system, comprising:
   
   a control module;

   a plurality of transmitting devices connected to the control module, wherein the plurality of transmitting devices includes a first and a second transmitting device, wherein the first and second transmitting devices transmit a first signal and a second signal, respectively;

   a plurality of receiving devices connected to the control module, wherein the plurality of receiving devices includes a first and a second receiving device, wherein the first receiving device receives a return representative of the signal transmitted from the first transmitting device and transmits to the control [device] module a first return signal representative of the first return and wherein the second receiving device receives a return of the signal transmitted from the second transmitting device and transmits to the control device a second return signal representative of the return; and

   wherein the control module includes measurement circuitry used to measure the first and second return signals and calculate a transverse location of an object as a function of said first and second return signals and further wherein the control module includes a display means for displaying [a] the transverse location [of an object as a function of said first and second return signals].
5. (Amended) In a collision avoidance system having a plurality of sensors, including a first and a second sensor, a method of displaying a transverse location, comprising the steps of:
   placing the system proximate an object;
   transmitting a signal from the first sensor to said object;
   sensing a return from the object of the signal transmitted from the first sensor and generating a first return signal as a function of the sensed return of the signal transmitted from the first sensor;
   transmitting a signal from the second sensor to said object;
   sensing [the] a return from the object of the signal transmitted from the second sensor and generating a second return signal as a function of the sensed return of the signal transmitted from the second sensor;
   calculating a transverse location as a function of the first and second return signals; and displaying an indication of the calculated transverse location.

24. (Amended) A collision avoidance system, comprising:
   a control module;
   a first transmitting device connected to the control module, wherein the first transmitting device transmits a signal;
   a first receiving device connected to the control module, wherein the first receiving device receives a return of the signal transmitted from the first transmitting device and transmits a first return signal representative of the return to the control device;
   a second transmitting device connected to the control module, wherein the second transmitting device transmits a signal; and
   a second receiving device connected to the control module, wherein the second receiving device receives a return of the signal transmitted from the second transmitting device and transmits a second return signal representative of the return to the control device,
   wherein the control module includes measurement circuitry used to measure the first and second return signals and to calculate a transverse location as a function of the first and second return signals and further wherein the control module includes an interface between the control module and an on-board computer information system.
30. (Amended) A collision avoidance system for a vehicle comprising:
   a control module;
   a first transceiver connected to the control module, wherein the first transceiver produces a sensor antenna pattern; and
   a second transceiver connected to the control module, wherein the second transceiver produces a sensor antenna pattern;
   wherein the control module [senses] determines an angle to an object [in front of the vehicle] as a function of [an angular relationship of] the amplitude of signals received by the first and second transceivers and the sensor antenna pattern of each transceiver.

31. (Amended) The system according to claim 30, wherein the control module reduces false alarms as a function of the [angular relationship of] amplitude of the signals received by the first and second transceivers and the sensor antenna pattern of each transceiver.

36. (Amended) A collision avoidance system for a vehicle comprising:
   a control module;
   a plurality of transmitting devices coupled to the control module;
   a plurality of receiving devices coupled to the control module,
   wherein [two or more of the transmitting devices are sequentially commanded to transmit a signal, and further wherein a plurality of returns from the transmitted signals are received by the receiving devices and sequentially sent to] the control module includes a built-in-test function which sequentially commands each transmitting device to transmit a signal, detects a return of the signal and sends a signal representative of said return signal to the control module for system verification.

37. (Amended) The collision avoidance system of claim 36, wherein the control module includes a display module, and further wherein the display module indicates a status as a function of the returns received by the plurality of receiving devices.
Please add the following new claims 40-50:

40. (New) A collision avoidance system, which provides object detection around the exterior of a vehicle, comprising:

   a control module;

   a plurality of transmitting devices connected to the control module, wherein each of the plurality of transmitting devices transmits a signal;

   a plurality of receiving devices connected to the control module, wherein each of the plurality of receiving devices receives a return representative of one of the plurality of transmitted signals and wherein each of the plurality of receiving devices transmits to the control module a return signal representative of the return received by that receiving device; and

   wherein the control module measures the return signals, detects an object as a function of the return signals, calculates a distance to and location of the object and displays the distance to and the location of the object.

41. (New) The system of claim 40, wherein the control module fuses data received from the plurality of sensors to detect objects within a 360° view surrounding the vehicle.

42. (New) The system of claim 40, wherein each of the plurality of transmitters produces a sensor antenna pattern and the control module determines an angle to the object as a function of the amplitude of the return signals and the sensor antenna pattern of each transmitter.

43. (New) The system of claim 40, wherein the control module includes a built-in-test function which sequentially commands each transmitting device to transmit a signal, detects a return of the signal and sends a signal representative of said return to the control module for system verification.

44. (New) The system of claim 40, wherein the control module determines whether it can triangulate and calculates an actual perpendicular distance to the object and location of the object with respect to the vehicle.
45. (New) The system of claim 40, wherein the control module includes a means for detecting a slow moving object.

46. (New) The system of claim 40, wherein the control module includes a means for detecting a stationary object proximate to the vehicle.

47. (New) The system of claim 40, wherein the control module includes a means for detecting a slow moving object.

48. (New) The system of claim 40, wherein the control module includes a means for detecting a stationary object proximate to the vehicle.

49. (New) The system according to claim 20, wherein the control module uses the amplitude of the received signals and the sensor antenna patterns to detect an object in an adjacent lane of traffic.

50. (New) The system of claim 40, wherein the control module fuses data received from the plurality of sensors and provides a single picture of all objects within a 360° view surrounding the vehicle.

REMARKS

Affirmation of Election

Applicant ratifies the election of Group I (claims 1-9, 24, 30-32, and 36-39) and the cancellation of remaining claims 10-23, 25-29 and 33-35 without prejudice.

Claims 40-50 have been added. Claim 49 has been added to claim the ability of the collision avoidance system to detect objects in front of but in adjacent lanes of traffic. This is especially useful during street cleaning, sanding and snowplow operations.
Allowed Claims
The Examiner indicated that claim 9 is allowed.

The Drawings
The Examiner noted that the drawings need to be corrected as numerals 50 and 52 are missing from Figure 5a. In addition, the Examiner objected to Figure 3 because “rear warning lights” and “side warning lights” were not mentioned in the specification. The specification and Figure 5a have been amended to correct this oversight. A copy of Figures 3 and 5a with proposed changes marked in red are enclosed for the review and approval of the Examiner. Formal drawings including these corrections will be provided once the Examiner indicates that proposed changes to the drawings are approved.

Rejections Under 35 U.S.C. § 103
The Examiner rejected claims 1-4 under 35 U.S.C. § 103(a) as being unpatentable over Cho et al. (U.S. Patent No. 5,635,922) and Gobel et al. (U.S. Patent No. 4,920,520). Applicant respectfully traverses this rejection.

The Examiner, in rejecting claim 1, states that Cho discloses an apparatus for and method of preventing car collision utilizing laser which comprises a control unit 40 and a display unit 80 and front sensor 52 adapted to monitor a situation in the front of the car and measure a distance between the car and an object running ahead. The Examiner states that Cho does not disclose a first and a second transmitting/receiving devices which transmit and receive signals respectively but that Gobel discloses the method of and a device for safeguarding a vehicle or machinery movable in space which includes a total of five ultrasonic sensors 4 mounted in the front of the vehicle.

Cho describes a car collision prevention apparatus which includes sensors respectively attached to a front surface, a rear surface and a bottom surface of a car. See, Col. 2, lines 3-4. In contrast to Applicant’s invention, Cho does not calculate a transverse location. Additionally, Cho’s invention, with only one sensor in the front, rear or bottom, is unable to calculate a transverse location as a function of a first and a second return signal as taught by Applicant’s invention.

Gobel describes a device for safeguarding a vehicle or machinery movable in space with five sensors on the front which trigger a response based on detection of an object within a predetermined distance. Gobel also does not calculate a transverse location as a function of a first and a second return signal as taught by Applicant’s invention. Gobel teaches initiating a speed reduction or an
emergency stop based on receiving a first echo signal which is less than the predetermined threshold value of the distance from an obstacle. See, Col. 3, lines 10-14. That echo signal can be received from any one of the transceivers. Gobel does not teach a system which makes decision based on two or more transceivers. As a result, claim 1 is not taught or suggested by Gobel and Cho and would not have been obvious at the time the invention was made to a person having ordinary skill in the art.

As discussed in the interview, claim 1 is amended to clarify Applicant’s claim to a system which calculates a transverse location as a function of a first and a second return signal. Claims 2-4 depend directly from claim 1 and, as such, include the patentable limitations of claim 1. Therefore claims 2-4 are also not obvious in view of Cho and Gobel. Furthermore, claims 6-8 include limitations which further distinguish Applicant’s invention over the cited patents.

The Examiner rejected claim 5 under 35 U.S.C. § 103(a) as being unpatentable over Gobel et al. (U.S. Patent No. 4,920,520) and Cho et al. (U.S. Patent No. 5,635,922).

The Examiner states that although Gobel does not disclose the method of displaying a transverse location Cho discloses a display unit 80 for displaying an emergency situation under a control of control unit 40. As discussed with reference to claim 1 above, Cho and Gobel do not teach calculating a transverse location as taught by Applicant’s invention. Since neither Cho nor Gobel teaches or suggests calculating a transverse location as a function of first and second return signals, these references are incapable of displaying the calculated transverse location as taught by Applicant’s invention. As a result claim 5 is not taught or suggested by Cho and would not be obvious to a person of ordinary skill in the art at the time the invention was made. Applicant requests that the rejection be removed and claim 5 be allowed.

Claims 6-8 depend directly or indirectly from claim 5 and thus include the patentable limitations of claim 5. Therefore, claims 6-8 are also not obvious in light of Gobel and Cho. Furthermore, claims 6-8 include limitations which further distinguish Applicant’s invention over the cited patents.

In addition to Gobel and Cho, the Examiner states that claims 6-8 are unpatentable over Qualizza (U.S. Patent No. 5,235,316). Like Gobel and Cho, Qualizza also does not teach or suggest calculating a transverse location and displaying the calculated transverse location. The Examiner points to LED 60 and 62 of Qualizza’s figure 2 which display the distance to objects detected. See, Col. 7, lines 17-25. LED 60 and 62 do not display an indication of the calculated transverse location as taught by claims 5-8. As discussed in the specification, page 6, line 29 the transverse location can
be displayed in addition to the digital display of the distance to an object. In contrast to Qualizza, the transverse location can be displayed graphically as discussed in the specification, page 7, lines 1-2, and page 7, lines 18-19. As a result claims 5-8 are not taught or suggested by Gobel, Cho and Qualizza and should be allowed.

The Examiner rejected claim 24 under 35 U.S.C. § 103(a) as being unpatentable over Cho et al. (U.S. Patent No. 5,635,922), Gobel et al. (U.S. Patent No. 4,920,520), and further in view of Qualizza (U.S. Patent No. 5,235,316).

Claim 24 is amended to clarify that the measurement circuitry calculates a transverse location as a function of the first and second return signals. As discussed in reference to claims 1-8 Cho, Gobel and Qualizza do not teach or suggest calculating a transverse location of an object as a function of a first and second return signal as taught by Applicant’s invention. As a result claim 24 is not obvious in light of Cho, Gobel and Qualizza and should be allowed.

The Examiner rejected claims 30-32 under 35 U.S.C. § 103(a) as being unpatentable over Cho et al. (U.S. Patent No. 5,635,922), Gobel et al. (U.S. Patent No. 4,920,520) and further in view of Noll et al. (U.S. Patent No. 5,455,557).

Claim 30 is amended to clarify the production of sensor antenna patterns by a first and a second transceiver and to determine an angle to an object as a function of received signals. As amended, claim 30 is directed to a collision avoidance system for a vehicle which includes a control module and a first and second transceiver each connected to the control module. The first and the second transceivers each produce sensor antenna patterns. The control module determines an angle to an object as a function of the amplitude of the signals received by the first and second transceivers and the sensor antenna patterns of each transceiver.

Gobel describes two ultrasonic sensors 40 which are each held in a spherical swivel head which in turn is received in a bore 44 of a housing secured to the vehicle 2 and is retained by a pressing plate 48. The pressing plate is joined to the housing via set screws at any desired angular position relative thereto. See, Col. 3, lines 32-37. However, Gobel does not teach or suggest determining an angle to an object as a function of the amplitude of the signals received by a first and a second transceiver and the sensor antenna patterns of each transceiver as taught by Applicant’s invention. See, page 19, lines 24-29 and page 20, lines 1-13. As a result, claim 30 is not obvious in view of Gobel and should be allowed.
Claims 31 and 32 depend directly from claim 30 and, as such, include the patentable limitations of claim 30. Therefore, claims 31 and 32 are also not obvious in view of Gobel and should be allowed.

The Examiner, in rejecting claim 31, refers to Cho’s use of handle angle detection carried out by the car collision prevention system of Figure 1. Further the Examiner states that based on the result of the analysis at step S10, an alarm is generated at an eleventh step S11 due to an emergency running condition [Col. 5, lines 25-31]. Cho describes determining whether the running condition of the car corresponds to an emergency running condition based on step S10. Step S10 comprises an analysis of a handle angle in the right or left direction and the car speed. An output signal indicative of the rotation angle of the handle which corresponds to the vehicle turning to the left or right is used to determine the running condition of the car. See, Col. 3, lines 20-45. In contrast to claim 30, Cho’s use of handle angle detection does not teach reducing false alarms as a function of the amplitude of the signals received by the first and second transceivers and the sensor antenna patterns of each transceiver. As a result claim 31 is not obvious in light of Cho and should be allowed.

The Examiner, in rejecting claim 32, refers to Noll’s auxiliary back-up and trailer coupling device for motor vehicle comprising three ultrasonic sensors S1, S2, and S3 which are coupled to a control unit. The Examiner states that it would have been obvious to a person of ordinary skill in the art at the time the invention was made to utilize the control unit 10 “uses” data from the ultrasonic sensors 4 as taught by Noll. Applicant respectfully notes that claim 32 teaches that the control module “fuses” data from the first and second transceivers not “uses” data as noted by the Examiner. Applicant refers the Examiner to the specification page 19, lines 24-29 and page 20, lines 14-18 for a discussion of data fusion as taught by Applicant. Noll does not teach or suggest the fusion of data by a control module as taught by Applicant’s invention. As a result claim 32 should be allowed.

The Examiner rejected claim 39 under 35 U.S.C. § 103(a) as being unpatentable over Noll et al. (U.S. Patent No. 5,455,557) and Cho et al. (U.S. Patent No. 5,635,922).

In rejecting claim 39, the Examiner states that Cho discloses a slope detecting unit 30 which operates to determine the gradient of the road surface slope [Col. 3, lines 51-65]. Further, the Examiner states that it would have been obvious to a person of ordinary skill in the art at the time the invention was made to utilize the ultrasonic sensors 52, 54 and the slope detecting unit 30 as taught by Cho in a system as disclosed by Noll in order to make the auxiliary back-up and trailer
coupling device for motor vehicle more effective to apply to the collision avoidance system. In contrast to Cho, Applicant’s invention teaches that signal returns are received from reflections from a road surface as part of a collision avoidance system with a built-in-test function, which sequentially commands each transmitting device to transmit a signal, detect a return of the signal and send a signal representative of said return signal to a control module for system verification. Noll and Cho do not teach a built-in-test function wherein return signals are received from reflections from a road surface as taught by Applicant’s invention. As a result claim 39 is not obvious in light of Noll and Cho and should be allowed.

Rejections Under 35 U.S.C. § 102

The Examiner rejected claims 36-38 under 35 U.S.C. § 102(b) as being anticipated by Noll et al. (U.S. Patent No. 5,455,557)

Claim 36 has been amended to clarify that the control module of the collision avoidance system of claim 30 includes a built-in-test function which sequentially commands each transmitting device to transmit a signal, detects a return of the signal and sends a signal representative of said return signal to the control module for system verification. In contrast, Noll describes an auxiliary back-up and trailer coupling device for motor vehicle which comprises three ultrasonic sensors S1, S2, and S3 which are adapted to transmit and receive sound waves. Noll does not teach or suggest a built-in-test function which sequentially commands each transmitting device to transmit a signal, detect a return of the signal and send a signal representative of said return signal to the control module for system verification as taught by Applicant’s invention. Applicant refers the Examiner to the Specification, page 13, lines 18-29 and page 14, lines 1-19 for a discussion of the built-in-test function. Claim 36 is not taught or suggest by Noll, therefore is not anticipated by Noll and should be allowed.

Claims 37-39 depend directly or indirectly from claim 36 and, as such, include the patentable limitations of claim 36.

The Examiner, in rejecting claim 38, states that Noll discloses the additional ultrasonic sensor SD, S4 and S5 which are similar to that of the ultrasonic sensors S1, S2 and S3. Additionally, he states that SD is likewise adapted to both transmit and receive sound waves [Col. 3, lines 7-41]. Applicant respectfully submits that the rejection is not on point as claim 38 claims a system having a built-in-test function which detects objects within a vicinity of the vehicle. Further, Applicant’s
request that the rejection be withdrawn in light of claim 36 since claim 38 depends indirectly from claim 36 and is not anticipated by Noll as discussed above.

CONCLUSION

Claims 1, 5, 24, 30, 31, 36 and 37 are amended and claims 40-50 have been added. The amendments have been made to further clarify the invention being claimed and not to overcome any art rejections. As a result, claims 1-9, 24, 30-32 and 36-50 are now pending in this application.

Applicant believes the claims are in condition for allowance and requests reconsideration of the application and allowance of the claims. The Examiner is invited to telephone the below-signed attorney at 612-373-6909 to discuss any questions which may remain with respect to the present application. If necessary, please charge any additional fees or credit over payment to Deposit Account No. 19-0743.

Respectfully submitted,

RICHARD A. GUNDERSON ET AL.
By their Representatives,

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 373-6909

Date December 15, 1999

By Thomas F. Brennan
Reg. No. 35,075

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Assistant Commissioner of Patents, Washington, D.C. 20231 on December 15, 1999.

Thomas F. Brennan
Signature
Figure 3 - System Block Diagram

Proximity Detector Subsystem

Rear Warning Lights

On-Board Computer

Forward-Looking Detector Subsystem

Control Module

Rear Guard Subsystem

Operator Interface

Vehicle Inputs

Side Displays

Side Warning Lights

G9

approved
12/27/99
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Richard A. Gunderson et al.
Title: SYSTEM AND METHOD OF AVOIDING COLLISIONS

Docket No.: 737.002US1
Filed: August 6, 1998
Examiner:

Serial No.: 09/130,279
Due Date: December 15, 1999
Group Art Unit: 2736

BOX NON-FEE AMENDMENT
Assistant Commissioner for Patents
Washington, D.C. 20231

We are transmitting herewith the following attached items (as indicated with an "X"):

X A return postcard.
X An Amendment and Response and Examiner Interview Summary (12 Pages), with 2 sheets of proposed corrected drawings (Figs. 3 and 5a).

Please consider this a PETITION FOR EXTENSION OF TIME for sufficient number of months to enter these papers and please charge any additional required fees or credit overpayment to Deposit Account No. 19-0743.

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this Transmittal Letter and the paper, as described above, are being deposited in the United States Postal Service, as first class mail, in an envelope addressed to: BOX NON-FEE AMENDMENT, Assistant Commissioner for Patents, Washington, D.C. 20231, on this 15th day of December, 1999.

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
P.O. Box 2938, Minneapolis, MN 55402 (612-373-6900)

Customer Number 21186

(GENERAL)