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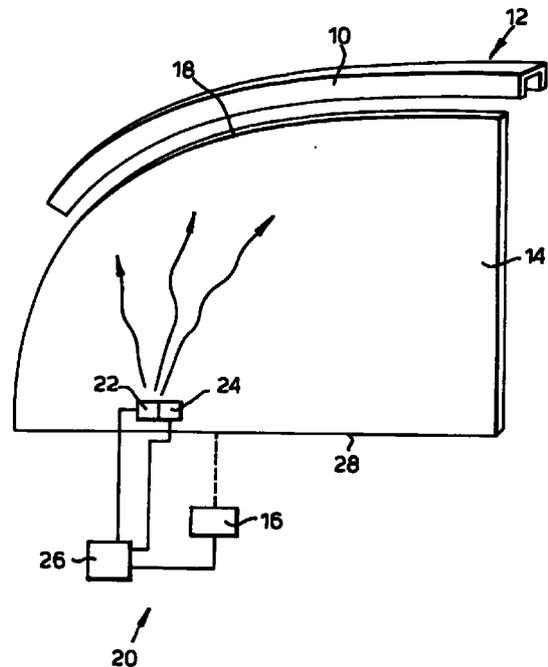
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(54) **Obstruction detection for a window**

(57) A system (20) for the detection of an obstruction in the path of a closing window (14) which is movable by an electric motor (16), the system comprising a FMCW radar transmitter (22) mountable on the window for transmitting a FMCW radar signal; a FMCW radar receiver (24) mountable on the window adjacent the transmitter for receiving the FMCW radar signal transmitted by the transmitter; and a control unit (26) for monitoring the FMCW radar signal received by the receiver, the control unit being connectable to the electric motor to control the operation of the motor dependent on the signal received by the receiver.

Fig.1.



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DescriptionTechnical Field

[0001] The present invention relates to a system for an electrically operated window which can detect the presence of an obstruction in the path of the window during closing, and which can stop the window. The present invention has particular application for use with an electrically operated window in a motor vehicle.

Background of the Invention

[0002] Electrically operated windows, especially in motor vehicles, are well known. During closing of the window, there is a risk that an object, such as a person's hand, may become trapped between the window and the frame. A known obstruction detection system monitors the torque developed by the electric motor which drives the window, and, on detection of increased torque, assumes that an obstruction is preventing closing of the window. The system then stops the electric motor, and, in some cases, reverses the electric motor to open the window.

Summary of the Invention

[0003] It is an object of the present invention to provide an alternative system for obstruction detection for a closing window.

[0004] A system in accordance with the present invention for the detection of an obstruction in the path of a closing window which is movable by an electric motor, comprises a FMCW radar transmitter mountable on the window for transmitting a FMCW radar signal; a FMCW radar receiver mountable on the window adjacent the transmitter for receiving the FMCW radar signal transmitted by the transmitter; and a control unit for monitoring the FMCW radar signal received by the receiver, the control unit being connectable to the electric motor to control the operation of the motor dependent on the signal received by the receiver.

[0005] The present invention also includes a method of detecting an obstruction in the path of a closing window.

Brief Description of the Drawings

[0006] The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a perspective view of a window and upper frame having an obstruction detection system in accordance with the present invention.

Description of the Preferred Embodiment

[0007] Referring to the drawing, the upper portion 10 of a window frame 12 is shown, along with a window 14 which is moved by an electric motor 16. In general, the upper portion 10 of the window frame 12 is substantially U-shaped in cross-section. The window 14 is mounted on a support system (not shown) and can be raised and lowered by the electric motor 16. In the fully closed position of the window 14, the upper edge 18 of the window is positioned inside the upper portion 10 of the window frame 12. Such an arrangement is well known (and has particular use in motor vehicles) to those skilled in the art, and will not be described in further detail.

[0008] The obstruction detection system 20 in accordance with the present invention comprises a frequency modulated continuous wave (FMCW) radar transmitter 22, an FMCW radar receiver 24, and a control unit 26. The transmitter 22 and the receiver 24 are positioned adjacent one another adjacent the lower edge 28 of the window 14. The transmitter 22 and the receiver 24 are connected to the control unit 26, which is also connected to the electric motor 16.

[0009] At least during closing of the window 14 by the electric motor 16, the transmitter 22 transmits an FMCW radar signal. The control unit 26 monitors the receiver 24. If an obstruction is present between the upper edge 18 of the window 14 and the upper part 10 of the window frame 12, the FMCW radar signal transmitted by the transmitter 22 is damped. If the receiver 24 indicates no damping of the FMCW radar signal, then the control unit 26 notes that there is no obstruction between the upper edge 18 of the window 14 and the upper part 10 of the window frame 12 and allows the window to close. If, however, the receiver 24 indicates that the FMCW radar signal has been damped, then the control unit 26 monitors that an obstruction is present, and stops operation of the electric motor 16 to prevent closing of the window 14. If required, in the latter case, the control unit 26 may cause the electric motor 16 to reverse to move the window 14 in an opening direction.

[0010] By FMCW radar signal is meant a signal in the range 2.45 to 25 GHz, and preferably of the order of 24 GHz.

[0011] The present invention provides a low cost obstruction detection system which has the benefits of easier installation when compared to previously known systems which monitor electric motor torque.

Claims

1. A system (20) for the detection of an obstruction in the path of a closing window (14) which is movable by an electric motor (16), the system comprising a FMCW radar transmitter (22) mountable on the window for transmitting a FMCW radar signal; a FMCW radar receiver (24) mountable on the window adja-

cent the transmitter for receiving the FMCW radar signal transmitted by the transmitter; and a control unit (26) for monitoring the FMCW radar signal received by the receiver, the control unit being connectable to the electric motor to control the operation of the motor dependent on the signal received by the receiver. 5

2. A system as claimed in Claim 1, wherein the transmitter (22) transmits the FMCW radar signal only during closing of the window (14). 10
3. A method of detecting an obstruction in the path of a closing window (14) comprising the steps of transmitting a FMCW radar signal adjacent the window on closing of the window; monitoring the FMCW radar signal transmitted adjacent the window; and stopping the closing of the window when the monitored FMCW radar signal is damped. 15
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4. A method as claimed in Claim 3, comprising the additional step of moving the window in an opening direction on monitoring damping of the FMCW radar signal. 25

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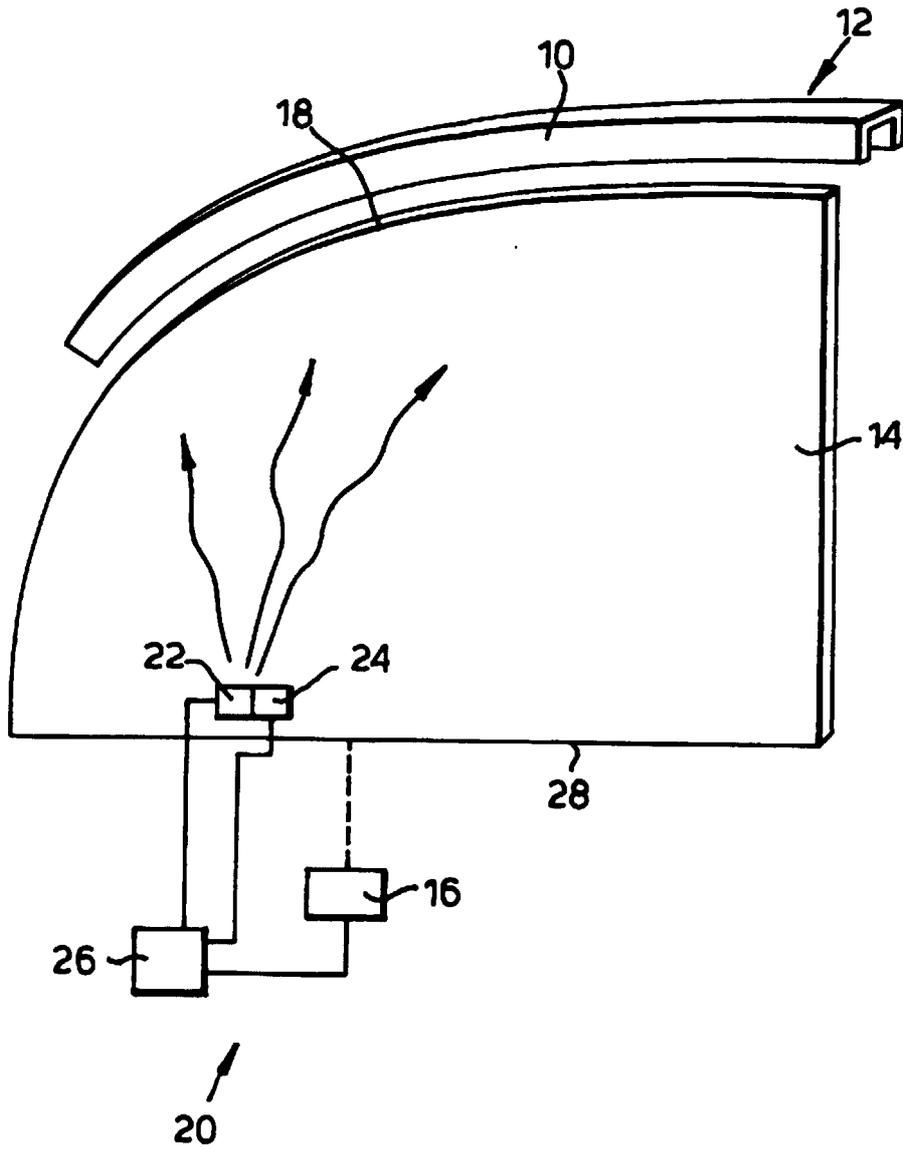
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Fig.1.





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		TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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Place of search	Date of completion of the search	Examiner
THE HAGUE	22 January 2001	Guillaume, G
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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