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Lamm et al.

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(54) **METHOD AND APPARATUS OF CONTROLLING A SLIDING ROOF**

(75) Inventors: **Hubert Lamm**, Kappelrodeck; **Guenter Haderer**, Buehl, both of (DE)

(73) Assignee: **Robert Bosch GmbH**, Stuttgart (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(51) **Int. Cl.**[7] **H02H 7/085**; B60J 7/057
(52) **U.S. Cl.** **701/49**; 701/36
(58) **Field of Search** 701/36, 49; 324/468, 324/469, 283; 49/26, 28

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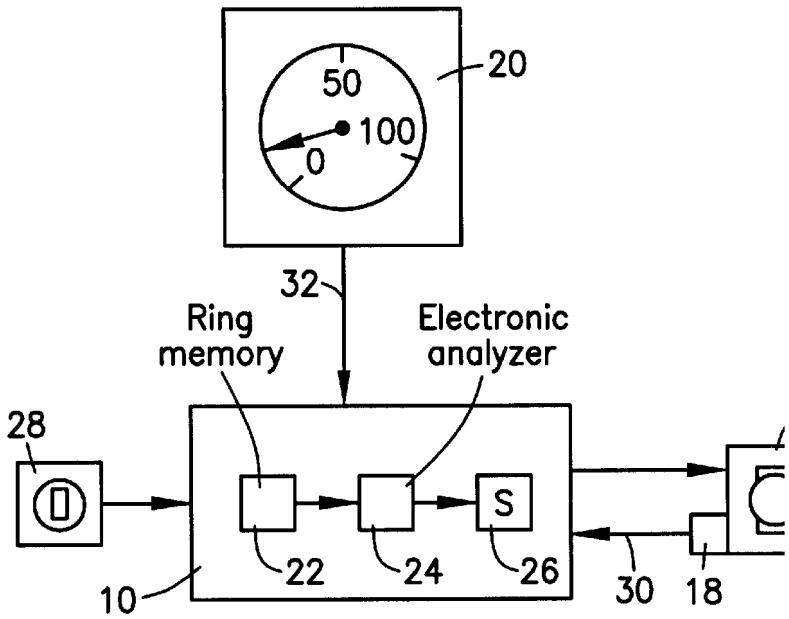
(57) **ABSTRACT**

A method of controlling a sliding roof, where braking of a vehicle is detected by a controller of the sliding roof device, and the pinch protection, i.e., the closing force limiter, is corrected so that faulty reversal of the sliding roof is suppressed when the vehicle is decelerating and the roof is being closed at the same time.

10 Claims, 2 Drawing Sheets



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A method of controlling a sliding roof, where braking of a vehicle is detected by a controller of the sliding roof device, and the pinch protection, i.e., the closing force limiter, is corrected so that faulty reversal of the sliding roof is suppressed when the vehicle is decelerating and the roof is being closed at the same time.

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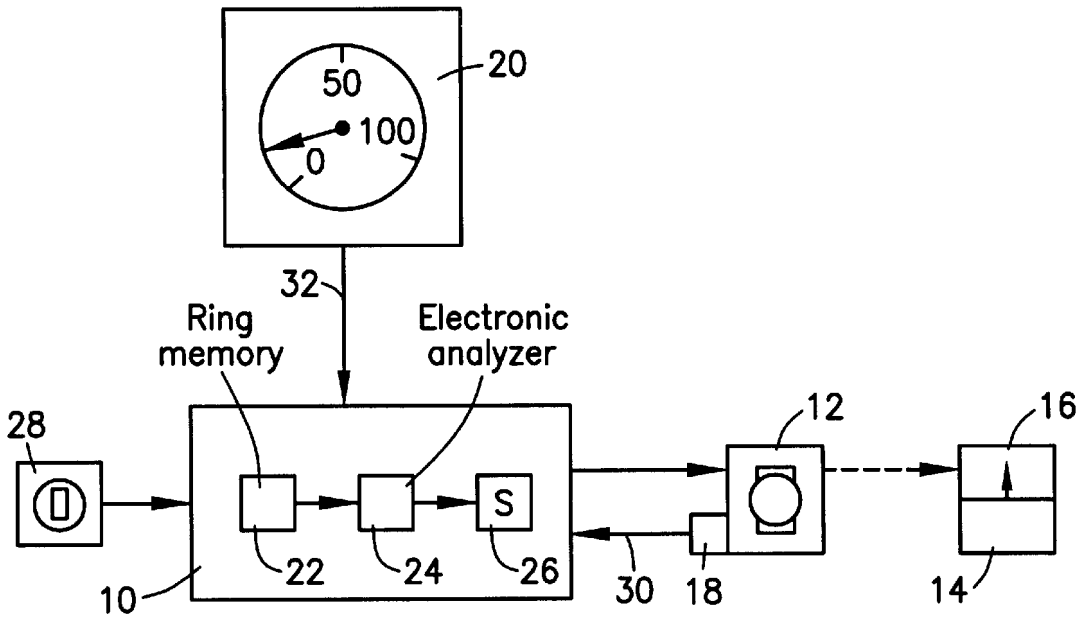

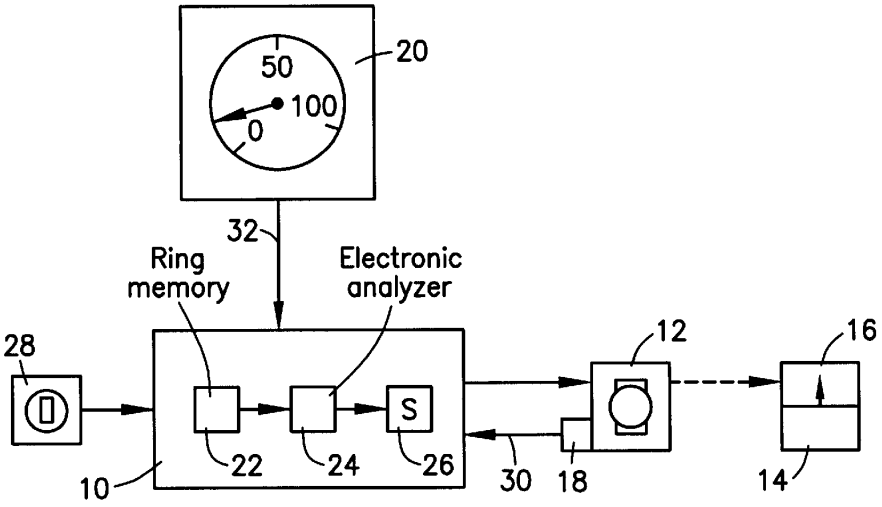

Fig. 1

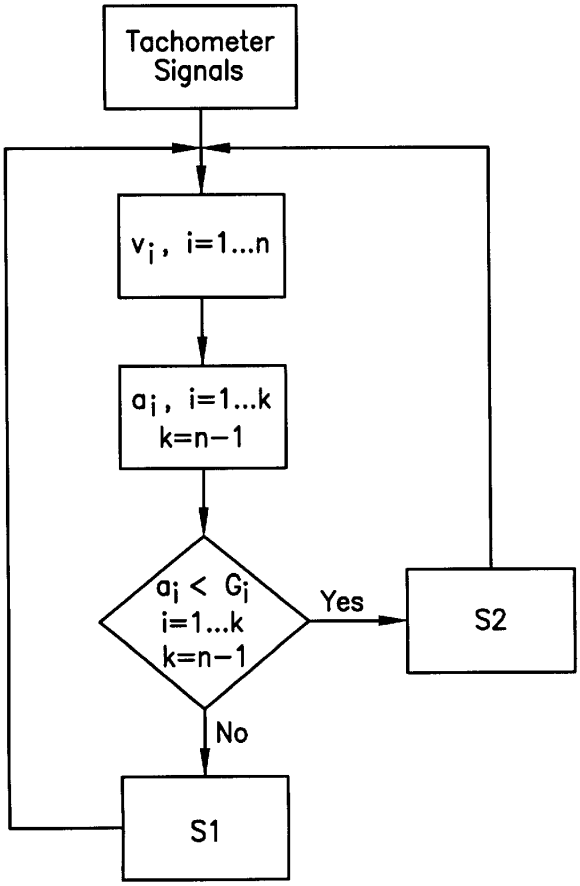

Fig. 2

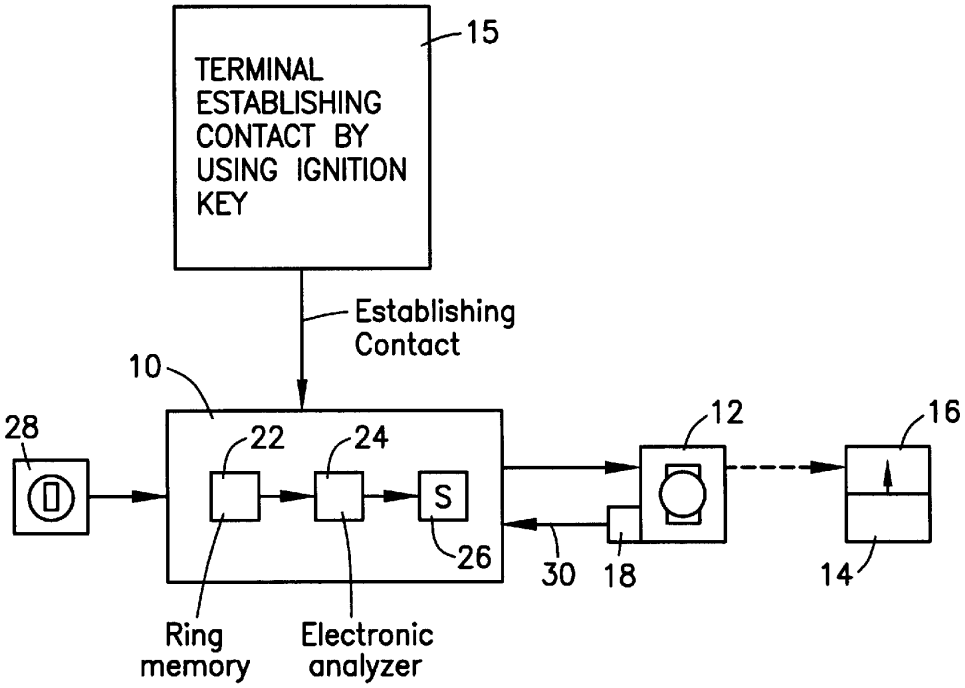

Fig. 3

METHOD AND APPARATUS OF CONTROLLING A SLIDING ROOF

BACKGROUND INFORMATION

The present invention is based on a method of controlling a sliding roof.

A method of electronic monitoring of an adjusting drive arranged in a motor vehicle, in particular a sliding roof drive, is known from German Published Patent Application No. 196 15 123, where a measured quantity detected by a sensor in closing the roof is compared with a threshold value for the closing force limiter for the purpose of guaranteeing, pinch protection, and when the threshold value is reached, the drive motor is turned off and/or reversed. Reaching, the threshold value thus represents a pinch criterion and leads to release of the object, such as an arm or neck, pinched between the adjusting part and a stop of the adjusting part.

In addition, the threshold value is adapted to the speed-dependent force and pressure conditions on the adjusting part, i.e., the sliding roof cover, in that the vehicle velocity is analyzed by using a tachometer signal sent to the adjusting drive. This prevents unwanted triggering of the closing, force limiter, i.e., the pinch protection, because of the forces occurring on the adjusting part at high speeds without there being an actual pinch situation. Consequently, threshold values can be adjusted as a function of speed.

However, this does not detect acceleration of the vehicle, e.g., full braking. The closing of a sliding, roof takes place more easily in negatively accelerated systems than in unaccelerated systems. This leads to the problem that the positive acceleration of the sliding roof cover in the closing direction caused by a negative acceleration of the vehicle during the closing operation of a sliding roof and consequently also the related increase in rotational speed of the drive motor are not detected. A subsequent reduction in acceleration, in particular due to stopping the vehicle, leads to a reduction in rotational speed of the sliding roof motor. This reduction in rotational speed is interpreted as a pinch criterion, so the pinch protection responds and the sliding roof is stopped and/or reversed in an unwanted manner.

SUMMARY OF THE INVENTION

The method according to the present invention has the advantage that braking of a vehicle is detected by a controller of the sliding roof device, and the pinch protection, i.e., the closing force limiter, is corrected so that faulty reversal of the sliding roof is suppressed when the vehicle is decelerating or stops in particular while the roof is closing.

It is especially advantageous that the controller determines from the input signals at least one acceleration value of the vehicle and compares this value with a limit value. Reaching the limit value is interpreted as full braking of the vehicle and leads to correction of the pinch protection. This correction of the pinch protection is reversed by the controller after braking.

The method is improved because not only one acceleration value is used but instead a plurality of acceleration values is used, preferably two, each of which is compared with a predetermined limit value. On reaching both limit values, full braking of the vehicle is then deduced and the pinch protection is corrected.

Preferably the acceleration values are obtained from a speed signal in particular a tachometer signal which is sent to the controller. The tachometer signals are stored temporarily in succession in a ring memory. The acceleration values are determined by forming the difference in an electronic analyzer.

The determination of a pinch situation is based, for example, on a determination of the rotational speed of a motor armature shaft and a comparison of the rotational speed with a threshold value for the closing force limiter, so that a correction of the pinch protection is performed by correcting the threshold value, preferably increasing it.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a block diagram of the device for controlling a sliding roof.

FIG. **2** shows a flow chart for one embodiment of the method according to the present invention for controlling a sliding roof.

FIG. **3** shows a flow chart for an alternative embodiment of the method according to the present invention for controlling a sliding roof.

DETAILED DESCRIPTION

FIG. **1** shows a schematic diagram of a device for controlling a sliding roof with a controller **10** which an electric drive motor **12** for moving a sliding roof **14** within an adjustment path. Sliding roof **14** closes or opens a sliding roof opening **16**. A sensor **18**, e.g., a Hall sensor or an incremental value pickup that delivers rpm-dependent pulses **30** to controller **10** for determination of the position and/or rotational speed of sliding roof **14** is arranged on motor **12**. These pulses are compared with a threshold value S in a comparator **26** to guarantee pinch protection.

In one embodiment, additional input signals **32** from a tachometer **20** are sent to controller **10** as a means for detecting the vehicle speed, are stored temporarily in a ring memory **22** of controller **10** and are analyzed in an electronic analyzer **24** of controller **10** to detect braking of the vehicle.

In addition, a setpoint position of sliding roof **14** is preselected by an operating element **28**, thus causing the roof to be opened or closed by the user. Determination of the rotational speed of motor **12** is usually used for regulating the position or rotational speed of sliding, roof **14** by controller **10** according to the setpoint preselected by the user.

The device of the present invention may also be used to control a sliding roof, preferably on a motor vehicle, having a reversible drive motor **(12)** and a controller **(10)** for controlling the motor **(12)** having a pinch protection **(18,30, 26)** and also having means **(20)** for detecting the vehicle speed and/or acceleration of the vehicle, where the means **(20)** deliver signals **(32)** to the controller **(10)**. According to one aspect of the present invention, a tachometer of the vehicle can be used as the means **(20)** for detecting the vehicle speed and/or acceleration of the vehicle. The controller **(10)** detects braking of the vehicle, in particular full braking, on the basis of the signals **(32)** and corrects the pinch protection on the basis thereof.

FIG. **2** shows a flow chart for detecting negative acceleration a of the vehicle from tachometer signals **32**.

The method according to the present invention will now be described on the basis of the device according to FIG. **1**. In the first step, the start of the method is initiated by establishing contact (terminal **15**) by using an ignition key in the ignition lock, for example, or controller **10** receives tachometer signals **32**. Input signals **32** are usually in the form of a pulse train which is assigned a time base in controller **10**, so that speed values v can be calculated from

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