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(71) Demandeurs/Applicants:
FOYLE, ROBERT GEORGE, NZ;
FOYLE, MATHEW WILLIAM JAMES, NZ

(72) Inventeurs/Inventors:
FOYLE, ROBERT GEORGE, NZ;
FOYLE, MATHEW WILLIAM JAMES, NZ

(74) Agent: OYEN WIGGS GREEN & MUTALA LLP

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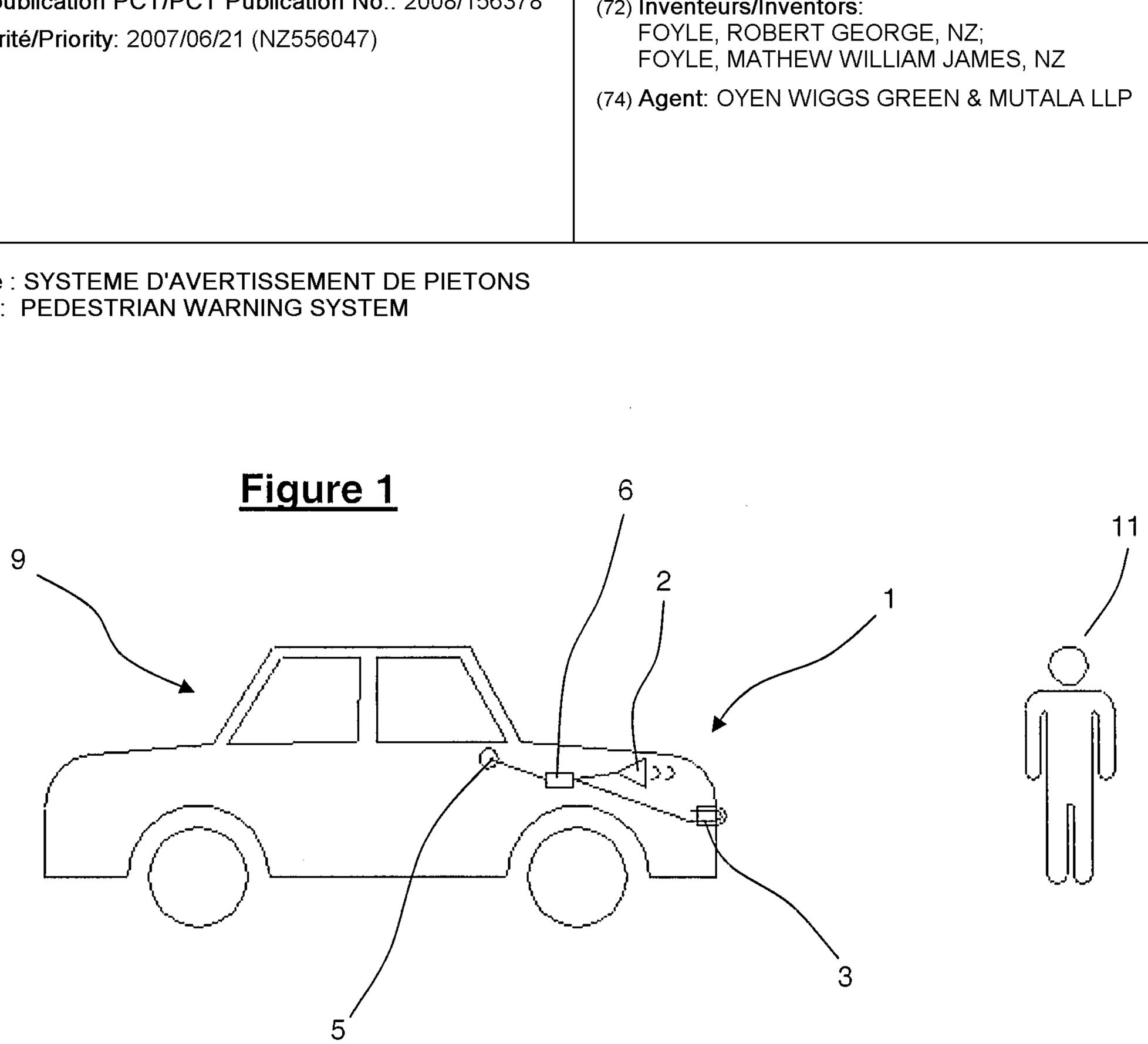
(54) Title: PEDESTRIAN WARNING SYSTEM

Figure 1



(57) Abrégé/Abstract:
According to a first aspect of the present invention there is provided a pedestrian warning system including an audible warning indicator for emitting a warning signal detectable externally of the vehicle. The warning system includes a sensor capable of detecting a speed, velocity and/or acceleration of the vehicle and capable of providing a signal indicative of the speed, velocity and/or acceleration to a controller configured to determine the acceleration of the vehicle from a the sensor signal and activate the warning indicator upon determining acceleration exceeding/deceeding a predetermined threshold limit.

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(71) Applicants and
(72) Inventors: **FOYLE, Robert George** [NZ/NZ]; 6 Millbrook Apartments, 21-23 Carlton Mill Road, Merivale, Christchurch, 8014 (NZ). **FOYLE, Mathew William James** [NZ/NZ]; 6 Millbrook Apartments, 21-23 Carlton Mill Road, Merivale, Christchurch, 8014 (NZ).

(74) Agent: **JAMES AND WELLS**; Private Bag 3140, 3240 Hamilton, Hamilton, 3240 (NZ).

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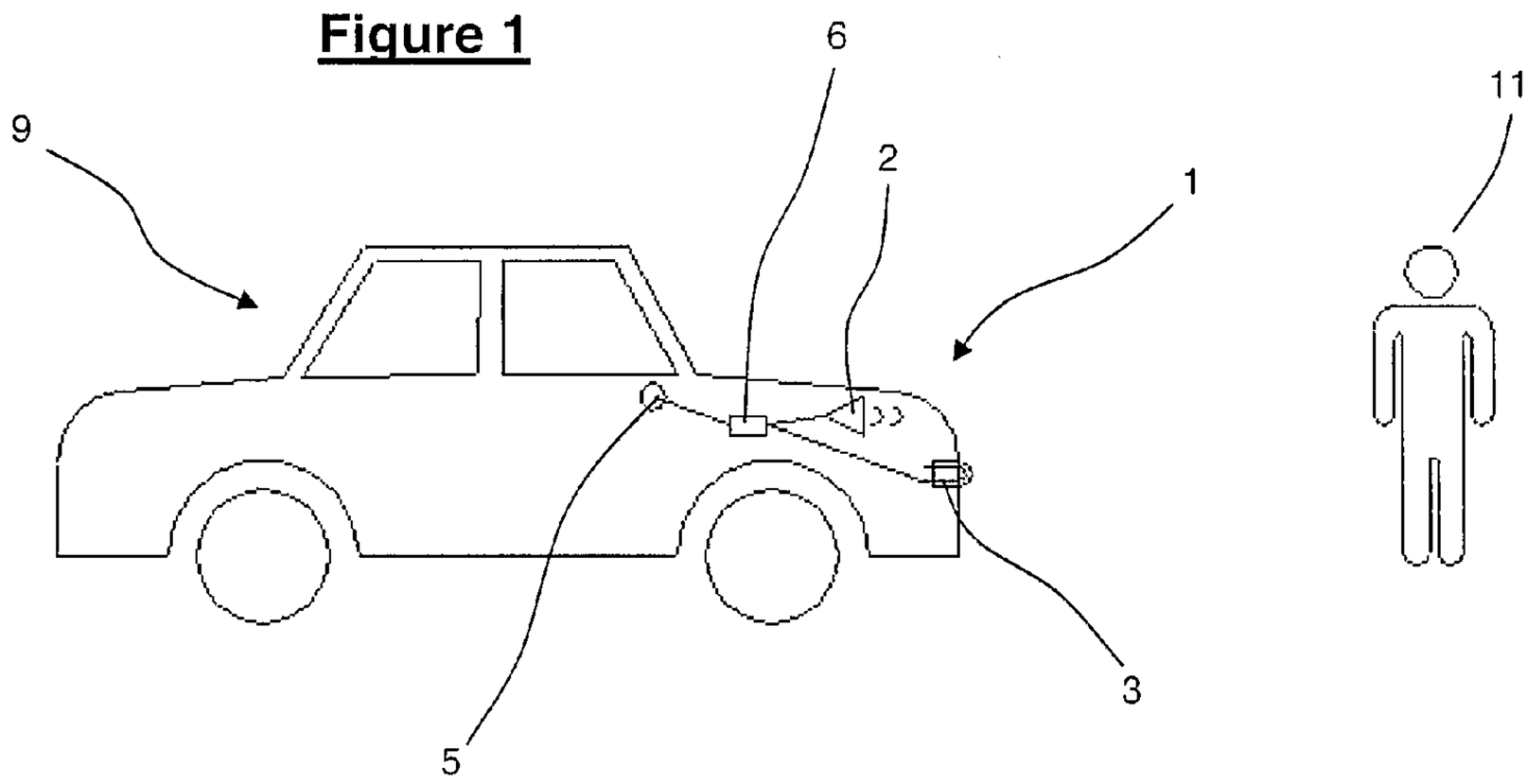
Figure 1



(57) Abstract: According to a first aspect of the present invention there is provided a pedestrian warning system including an audible warning indicator for emitting a warning signal detectable externally of the vehicle. The warning system includes a sensor capable of detecting a speed, velocity and/or acceleration of the vehicle and capable of providing a signal indicative of the speed, velocity and/or acceleration to a controller configured to determine the acceleration of the vehicle from a the sensor signal and activate the warning indicator upon determining acceleration exceeding/deceeding a predetermined threshold limit.

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PEDESTRIAN WARNING SYSTEM

Technical Field

The present invention relates to a pedestrian warning system.

In particular, the present invention relates to an automatic pedestrian warning system for warning pedestrians or other road users when a driver of a vehicle in which the warning system is installed reacts to a possible road hazard.

Background Art

Pedestrians and other road users at risk of being hit by vehicles typically stop, look and listen before moving onto a road. However, many pedestrians become complacent or may be inattentive and may move onto the road without being fully aware of hazards.

A driver may warn pedestrians on the road by sounding the vehicle's horn or flashing the lights. However, in many circumstances the driver may not have time to sound the horn or lights and may instead brake or attempt to avoid the pedestrian. Even if the driver initiates braking and/or evasive steering there may be insufficient time to avoid colliding with the pedestrian. It will be appreciated that such dangers are faced not only by pedestrians but also other drivers and other road users.

It has thus become desirable to create a system to warn the pedestrian or other road user before a potential collision.

One attempt at solving this problem is described in United States Patent No. 6,081,188 by *Kutlucinar* et al. which forms the basis of the prior art and the entire contents of which is herein incorporated by reference.

Kutlucinar describes a number of prior art warning systems such as conventional brake and hazard lights or operator activated warning lights, horns or sirens. *Kutlucinar* describes how these systems may not always be activated in an emergency as they require user activation in some way, i.e. switching on the lights or horn. *Kutlucinar* eliminates the user-activation requirement by providing a warning system that automatically activates a visual or audible alarm when a detecting circuit detects activation of a "vehicle safety device" such as an Antilock Braking System (ABS), airbag, impact or proximity sensor, parking aid or the like. The automatic warning system described by *Kutlucinar* thus automatically activates in an emergency to warn other road users of an emergency situation.

The *Kutlucinar* system however relies on the activation of a vehicle safety device and is thus only activated when the vehicle is in an emergency situation, which may often be too late to warn other road users.

While the activation of the warning system on detecting ABS activation may pre-empt an emergency situation and provide more warning than airbag detecting systems, not all vehicles have ABS fitted. Moreover, ABS may not activate until the brakes begin to 'lock-up' which may not occur, or occur too late to provide effective warning time.

It would thus be advantageous to provide an improved pedestrian warning system that may be capable of automatically activating before a collision takes place. It would also be advantageous to provide a pedestrian warning system that may be retrofitted to existing vehicles.

A further hazard faced by road users is the risk of crashing out of sight of other road users and thus potentially not receiving help.

All references, including any patents or patent applications cited in this specification are hereby incorporated by reference. No admission is made that any

reference constitutes prior art. The discussion of the references states what their authors assert, and the applicants reserve the right to challenge the accuracy and pertinency of the cited documents. It will be clearly understood that, although a number of prior art publications are referred to herein; this reference does not constitute an admission that any of these documents form part of the common general knowledge in the art, in New Zealand or in any other country.

It is acknowledged that the term 'comprise' may, under varying jurisdictions, be attributed with either an exclusive or an inclusive meaning. For the purpose of this specification, and unless otherwise noted, the term 'comprise' shall have an inclusive meaning - i.e. that it will be taken to mean an inclusion of not only the listed components it directly references, but also other non-specified components or elements. This rationale will also be used when the term 'comprised' or 'comprising' is used in relation to one or more steps in a method or process.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

Disclosure of Invention

According to a first aspect of the present invention there is provided a pedestrian warning system, said warning system including:

- at least one warning indicator for emitting a warning signal detectable externally of said vehicle, said warning signal having at least one audible component;

- at least one sensor capable of detecting a speed, velocity and/or acceleration of said vehicle, the, or each sensor capable of providing a signal indicative of said speed, velocity and/or acceleration, and

said warning system characterised in the further inclusion of:

- a controller for receiving said sensor signal(s), the, or each, controller configured to determine the acceleration of said vehicle from a said sensor signal and activate said warning indicator upon determining acceleration exceeding/deceeding a predetermined threshold limit.

Preferably said predetermined threshold limit is a level of negative acceleration (i.e. deceleration) indicative of a hazard situation, said controller configured to activate the warning indicator if said sensor signal indicates the negative acceleration deceeding said threshold level. For example, sudden braking, impacts and/or a rapid change in acceleration may all indicate that the driver has either noticed a hazard and is attempting to stop, or the vehicle has collided with an object.

As used herein, the term "deceeding" refers to a parameter decreasing below a predetermined limit. For example, deceeding may be used herein to describe when a negative acceleration (i.e. deceleration) passes (deceeds) a predetermined level indicating rapid deceleration.

It will be appreciated that a vehicle's acceleration is not only dependant on the forward/backward moving speed but also changes in the direction, and therefore velocity of the vehicle. Thus, according to one preferred embodiment, said predetermined threshold limit is a level of acceleration defined with respect to the rate of change of direction of the vehicle, e.g. if a driver attempts to avoid a pedestrian by turning sharply. This rate of change of direction may be determined by input from inertia, gyro, steering wheel sensors, GPS or any other sensor capable of detecting a change of direction of the vehicle.

It will be appreciated that the present invention has particular application to land vehicles such as cars, motorbikes, trains, trucks, buses and other automobiles though this should not be seen to be limiting as the present invention may also have application to water vessels, snowmobiles, amusement rides, toys or any other vehicle.

The, or each, warning indicator is preferably a visual and/or audible indicator. For example, the indicator may include one or more of: a flashing or constant light, siren, horn, bell or the like. It will be appreciated that most vehicles are manufactured with suitable warning indicators fitted in the form of a horn, security alarm and/or lights.

However, in preferred embodiments at least one said warning indicator is a speaker configured to emit a sound simulating the sound emitted by tyres skidding on a road surface, i.e. a 'screech'. This 'screeching' provokes a greater sense of danger in a pedestrian or other road users relative to typical vehicle horns.

Preferably, the warning indicator includes a security alarm siren. In many countries it is illegal to sound a car horn in residential areas between certain time periods, e.g. early morning, and thus a car alarm provides a convenient alternative.

In a further embodiment, the, or each warning indicator is configured to provide a signal with one or more variable parameters, dependant on said acceleration level. For example, the lights may flash with increased intensity or the speaker/horn may sound with a greater volume or varying audible pattern under high deceleration.

Preferably at least one said sensor is provided in the form of an interface connecting the vehicle's speedometer to the controller, the controller configured to obtain a signal from the speedometer indicative of the vehicle's speed and being capable of calculating the vehicle acceleration from changes in said speed.

It will be appreciated that the interface may be relatively easily configured for electronic speedometers by connecting a speedometer output from the Engine Control Unit (ECU) to the controller, the controller thus receiving the same speed signal passed to the speedometer.

However, to connect the controller of the present invention to typical mechanical rotation-based speedometers may require additional components and complexity. For example, in rotating sleeved cable and cup speedometer systems, one end of a cable may be connected to the speedometer shaft and at an opposing end to an electronic transducer configured to provide an output signal to the controller proportional to the degree of rotation of the speedometer shaft.

It will be appreciated by one skilled in the art that numerous other configurations, including mechanical, electrical, magnetic, and/or optical systems may act as the interface and be appropriately connected to a speedometer and configured to provide an output indicative of the vehicle speed and are considered within the scope of the present invention.

It will also be appreciated that numerous other speed, velocity or acceleration sensors or systems may be suitable for the present invention and may include: inertia-based transducers, GPS tracking systems, Doppler effect radar, Pitot tubes, or any other means for measuring speed, velocity and/or acceleration.

Preferably the, or each controller includes a microcontroller, microprocessor or computer system capable of:

- receiving and processing the signal from a said sensor to determine said vehicle acceleration, and

- activating a said warning indicator if said signal indicates acceleration exceeding/deceeding a predetermined threshold limit.

In an alternative embodiment said controller is a threshold switch or the like configured to activate said warning indicator upon receiving a said signal indicative of acceleration at, or exceeding/deceeding said predetermined threshold limit. For example, the sensor may be configured to provide a varying voltage signal proportional to vehicle acceleration, the threshold switch configured to activate the warning indicator if a predetermined voltage limit is exceeded/deceeded. Similarly, electrical current, frequency or other signal parameter may be utilised.

In an alternative embodiment the sensor may be capable of producing a digital signal to be processed by the controller.

It will be appreciated that in one embodiment the controller and sensor may be formed as a single device or as distinct capability of a single device.

Preferably the predetermined threshold limit is variable according to a user's requirements.

Preferably the controller is calibrated such that the predetermined threshold limit is outside levels of acceleration experienced in normal driving conditions.

Preferably the warning system includes a manual 'on/off' switch to allow a user to turn the warning system on or off. In an alternative embodiment one or more 'on/off' switches may be provided for turning the, or each, sensor, warning indicator and/or controller on or off.

In some hazard situations a vehicle may come to a rapid halt after crashing off a road out of sight of other road users. Thus, the vehicle occupants may be injured, trapped or at risk of being injured and without being visible to other road users may not receive help.

Thus, in one preferred embodiment the warning system may be configured to continue emitting a warning signal from the, or each, warning indicator after the predetermined acceleration threshold limit has been passed until:

- the warning system and/or indicator is manually switched off;
- a predetermined period of time passes.

In applications where the predetermined acceleration threshold limit is a level of negative acceleration, the warning system may be configured to continue emitting a warning signal from the, or each warning indicator after the predetermined acceleration threshold limit has been passed until the controller detects a positive acceleration.

Preferably, for vehicles including GPS navigation systems or the like, the warning system is configured to trigger a vehicle position logging and/or transmission when the warning system detects the predetermined acceleration threshold limit has been passed. Such a GPS logging system in the vehicle provides a means for accident investigators to garner more information about the vehicle's movements and speed preceding the accident.

Ina further embodiment, the GPS navigation system may be configured to wirelessly transmit a position and/or speed information when the warning system detects the predetermined acceleration threshold limit has been passed. The transmission may be sent to a central vehicle monitoring station which can thus monitor for vehicle accidents or acceleration events and notify emergency services if an accident occurs. Transmission of vehicle position information also allows emergency services to quickly locate the vehicle.

It will be appreciated that the, or each, warning indicator, sensor and/or controller may be powered by a vehicle power source such as a vehicle battery or alternatively by one or more auxiliary power sources.

In one embodiment the warning system may be configured to receive a signal from an ABS sensor indicating ABS activation to activate said warning indicator, thus providing a backup to the predetermined acceleration threshold activation. In icy, wet or other slippery conditions the vehicle may not exceed/deceed the predetermined acceleration threshold limit and thus not directly activate the warning indicator. However, as the ABS is likely to be activated on the user applying the vehicle brakes in such conditions, an ABS activated warning indicator will still activate.

According to another aspect, the controller may be operatively connected to a vehicle safety device to automatically activate said vehicle safety device upon receiving said sensor signal indicating acceleration exceeding/deceeding said predetermined threshold limit. The vehicle safety device may be any safety device, e.g. airbags, ABS, ejector seats and fire extinguishers.

According to another aspect of the present invention there is provided a method of retrofitting a pedestrian warning system as aforementioned to a vehicle, said method including one or more of the following steps:

- attaching at least one warning indicator to the vehicle;
- attaching at least one acceleration sensor to the vehicle; and/or
- attaching at least one controller to the vehicle, said controller configured to activate a said warning indicator upon receiving a said sensor signal indicating acceleration exceeding/deceeding a predetermined threshold limit.

It will be appreciated that not all of the aforementioned retrofitting steps may be required depending on whether the vehicle:

- has existing warning indicators such as lights and/or horn;
- has existing acceleration sensors;
- has an existing controller or analogous system.

The present invention may thus provide significant advantages over the prior art including provision of a warning system capable of at least one or more of:

- being retrofitted to existing vehicles, regardless of the type of vehicle or whether the vehicle has airbags, ABS, or the like, and/or
- automatically providing a warning signal on detection of acceleration exceeding/deceeding predetermined limits indicating a hazard situation and/or change of vehicle direction, thereby potentially activating said warning indicator more rapidly than prior art systems relying solely on activation of a vehicle safety device such as ABS, airbags or the like.

Brief Description of Drawings

Further aspects and advantages of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

Figure 1 shows a pictorial diagram of a pedestrian warning system according to one preferred embodiment of the present invention;

Figure 2 shows a schematic system diagram of the functional components of one preferred embodiment of the present invention;

Figure 3 shows schematic system diagram of the functional components of another embodiment of the present invention

Best Modes for Carrying out the Invention

Figures 1 and 2 respectively show pictorial and schematic diagrams of one preferred embodiment of the present invention in the form of a pedestrian warning system generally indicated by arrow 1 installed in a vehicle (9). The warning system (1) has two warning indicators in the form of a security alarm siren (2) and lights (3) for respectively emitting audible and visual signals detectable externally of the vehicle. The siren (2) emits a loud sound to warn pedestrians (11) and other road users the vehicle (9) is in a hazard situation, e.g. rapidly decelerating.

The warning system (1) also has a sensor in the form of an interface (4) coupled to the vehicle's speedometer (5) to provide an output signal proportional to the vehicle speed. The interface (4) is connected to a controller in the form of microcontroller (6) which calculates the acceleration of the vehicle from changes in speed. If the microcontroller (6) calculates a level of acceleration that exceeds/deceeds a predetermined threshold limit, the microcontroller (6) will send a signal to activate the security alarm siren (2) and/or lights (3). The predetermined threshold limit is a level of negative acceleration (i.e. deceleration) indicative of a hazard situation experienced by a driver of the vehicle. For example, sudden braking, impacts and/or a rapid change in positive acceleration may all indicate that the driver has either noticed or encountered a hazard and is attempting to stop. Alternatively rapid negative acceleration may indicate the vehicle has collided with an object.

The microcontroller (6) is calibrated when installed to ensure that a threshold acceleration limit is set, such that normal driving conditions and acceleration will

not trigger activation of the siren (2) and lights (3) unless the vehicle is in a hazard situation.

All components of the warning system (1) are connected to a power supply in the form of vehicle battery (7)

Figure 3 shows an alternative embodiment with the sensor provided in the form of an inertia based transducer (8) capable of measuring both forward/backward and lateral acceleration of the vehicle. Thus, when the driver takes evasive action by braking and/or swerving to avoid collision, the transducer (8) will provide a signal to the microcontroller (6) indicative of the level of acceleration. If this level of acceleration exceeds (in the case of lateral positive acceleration) or deceeds (in the case of forward/backward negative acceleration) a predetermined threshold limit, the controller sends a signal to activate the siren (2) and lights (3).

A backup activation system is provided and composed of an ABS sensor (10) linked to the microcontroller (6) to provide a signal when the ABS sensor (10) is activated. This ABS backup system is useful in ensuring warning indicators (2 and 3) are activated even in icy, wet or other slippery conditions where the vehicle may not necessarily exceed/deceed the predetermined threshold limit.

Also shown in figure 2 is a vehicle safety device in the form of airbag (13) that is automatically activated when the microcontroller (6) calculates a predetermined acceleration threshold is exceeded/deceeded. This airbag threshold is set at a much higher level (i.e. requiring more rapid negative acceleration) than the warning indicator threshold, as an airbag (13) will only need to be deployed in violent deceleration such as in collisions or the like.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope of the appended claims.

AMENDED CLAIMS
received by the International Bureau on 04 December 2008 (04.12.08).

1. According to a first aspect of the present invention there is provided a vehicle warning system, said warning system including:

- a warning indicator for emitting a warning signal detectable externally of said vehicle;

- a sensor capable of detecting a speed, velocity and/or acceleration of said vehicle, the, or each sensor capable of providing a signal indicative of said speed, velocity and/or acceleration, and
said warning system characterised in the further inclusion of:

- a controller for receiving said sensor signal(s), the controller configured to determine the acceleration of said vehicle from a said sensor signal and activate said warning indicator upon determining acceleration exceeding/deceeding a predetermined threshold limit, wherein said predetermined threshold limit is a level of acceleration defined with respect to the rate of change of direction of the vehicle.

2. A vehicle warning system as claimed in claim 1, wherein said predetermined threshold limit is a level of negative acceleration indicative of a hazard situation, said controller configured to activate the warning indicator if said sensor signal indicates the negative acceleration deceeding said threshold level.

3. A vehicle warning system as claimed in any one of the preceding claims, wherein the warning indicator includes a speaker configured to emit a sound simulating the sound emitted by tyres skidding on a road surface.

4. A vehicle warning system as claimed in any one of the preceding claims, wherein the warning indicator includes a security alarm siren.

5. A vehicle warning system as claimed in any one of the preceding claims, wherein the warning indicator is configured to provide a signal with one or more variable parameters, dependant on said acceleration level.

6. A vehicle warning system as claimed in any one of the preceding claims, wherein said sensor includes an interface connecting the vehicle's speedometer to the controller, the controller configured to obtain a signal from the speedometer indicative of the vehicle's speed and being capable of calculating the vehicle acceleration from changes in said speed.

7. A vehicle warning system as claimed in any one of the preceding claims, wherein the controller includes a microcontroller, microprocessor or computer system capable of:

- receiving and processing the signal from a said sensor to determine said vehicle acceleration, and

- activating a said warning indicator if said signal indicates acceleration exceeding/deceeding a predetermined threshold limit.

8. A vehicle warning system as claimed in any one of claims 1-7, wherein the controller includes a threshold switch configured to activate said warning indicator upon receiving a said signal indicative of acceleration at, or exceeding/deceeding said predetermined threshold limit.

9. A vehicle warning system as claimed in any one of the preceding claims, wherein the sensor is capable of producing a digital signal indicative of said acceleration, said sensor configured to transmit the signal to the controller for processing.

10. A vehicle warning system as claimed in any one of the preceding claims, wherein the controller and sensor are formed as a single device.

11. A vehicle warning system as claimed in any one of the preceding claims, configured to continue emitting a warning signal from the warning indicator after the predetermined acceleration threshold limit has been exceeded/deceeded until:

- the warning system and/or indicator is manually switched off; and/or
- a predetermined period of time passes.

12. A vehicle warning system as claimed in any one of the preceding claims, wherein the predetermined acceleration threshold limit is a level of negative acceleration, the warning system configured to continue emitting a warning signal from the warning indicator after the predetermined acceleration threshold limit has been deceeded until the controller detects a positive acceleration.

13. A vehicle warning system as claimed in any one of the preceding claims, configured to receive a signal from an ABS sensor indicating ABS activation to activate the warning indicator.

14. A vehicle warning system as claimed in any one of the preceding claims, wherein the controller is operatively connected to a vehicle safety device to automatically activate said vehicle safety device upon receiving said sensor signal indicating acceleration exceeding/deceeding said predetermined threshold limit.

15. A method of retrofitting a vehicle warning system as claimed in any one of the preceding claims, said method including one or more of the following steps:

- attaching the warning indicator to the vehicle;
- attaching the acceleration sensor to the vehicle; and/or

– attaching the controller to the vehicle, said controller configured to activate a said warning indicator upon receiving a said sensor signal indicating acceleration exceeding/deceeding a predetermined threshold limit.

Figure 1

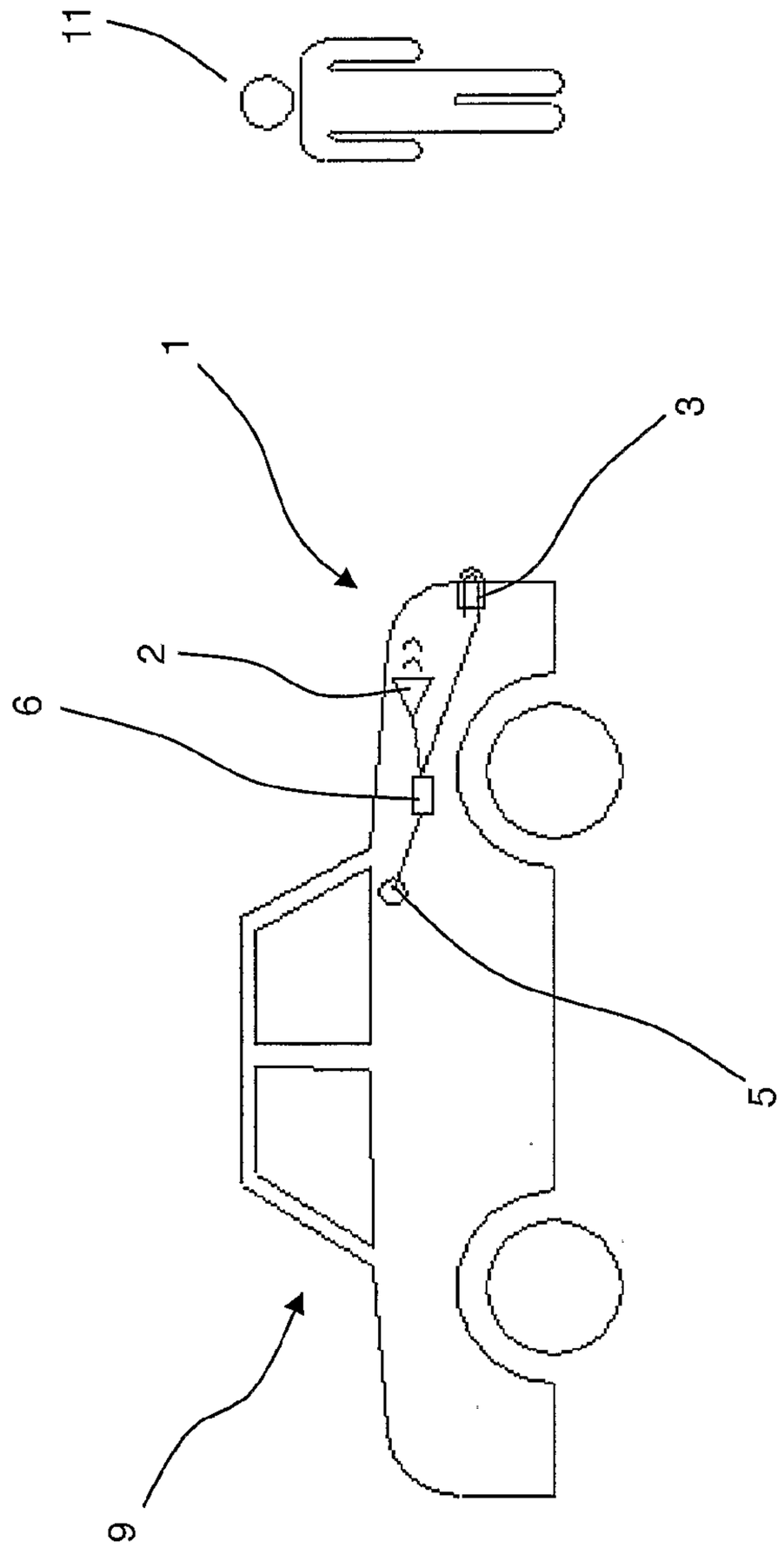

Figure 2

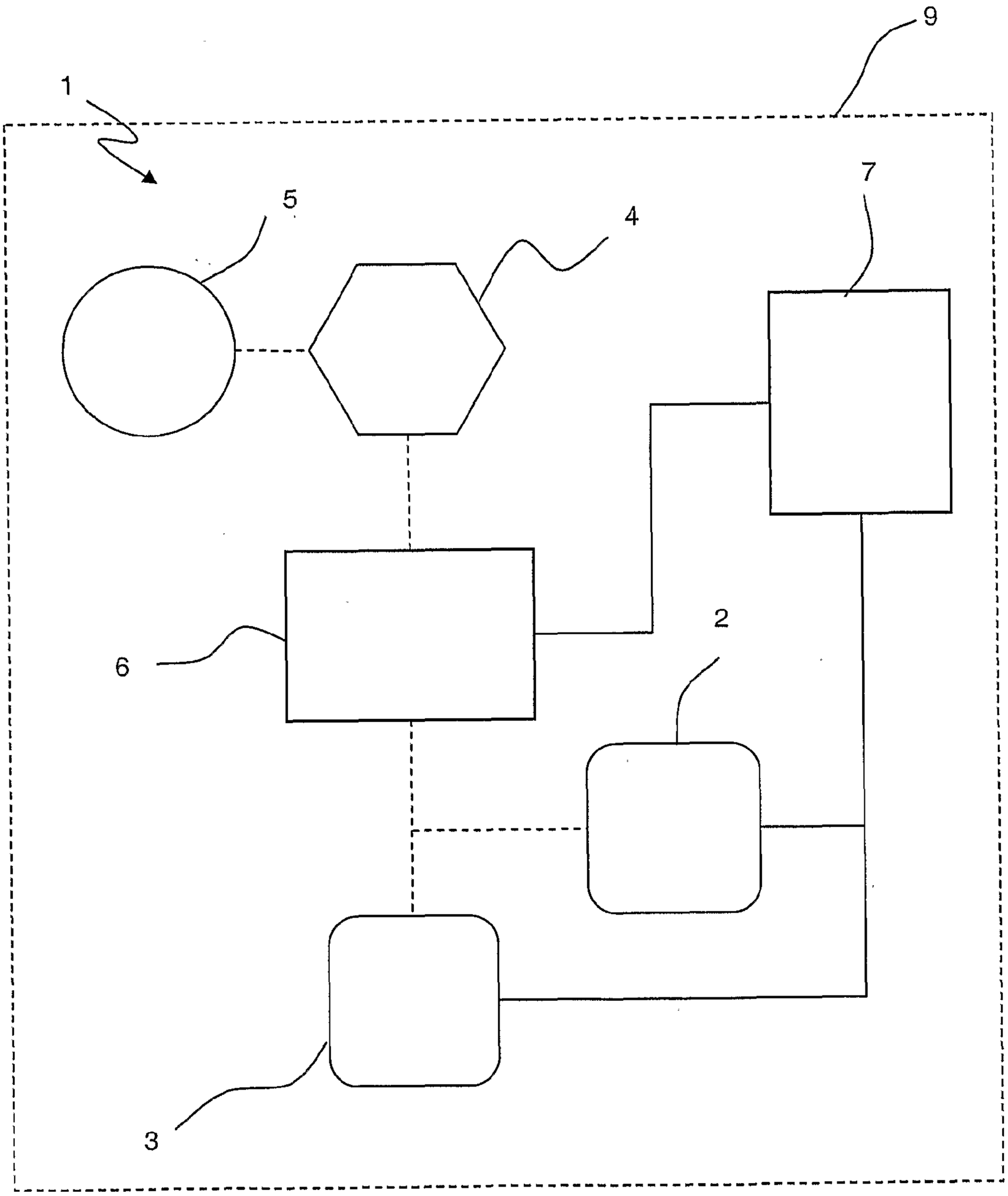

Figure 3

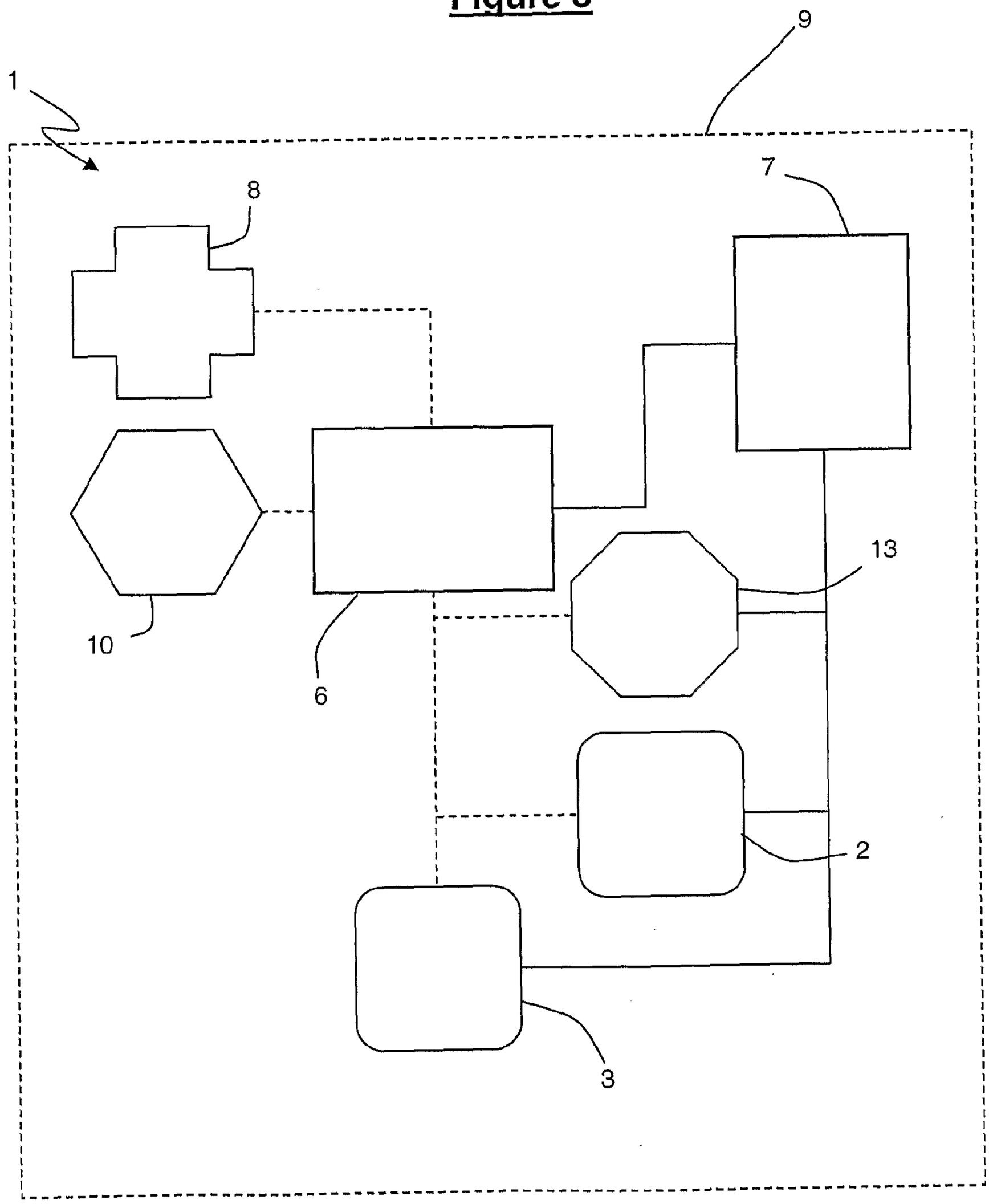

Figure 1